HHS Public Access

Author manuscript

J Consult Clin Psychol. Author manuscript; available in PMC 2019 December 01.

Published in final edited form as:

J Consult Clin Psychol. 2018 December ; 86(12): 1061–1075. doi:10.1037/ccp0000347.

A Randomized Control Trial of a Deviance Regulation Theory Intervention to Increase Alcohol Protective Strategies

Robert D. Dvorak[1], **Wendy Troop-Gordon**[2], **Brittany L. Stevenson**[1], **Matthew P. Kramer**[1], **Dexter Wilborn**[1], and **Angelina V. Leary**[1]

[1]The University of Central Florida

[2]Auburn University

Abstract

OBJECTIVE: Normative feedback remains an effective approach to reducing alcohol use among college students. However, this approach is difficult to extend to protective behavioral strategies (PBS), which are proximal to alcohol-related problems. Deviance Regulation Theory (DRT) is a social psychology theory that posits individuals choose engage in behaviors to standout out in positive ways or avoid standing out in negative ways. The current study tests a DRT-based randomized control trial.

METHOD: College student drinkers (n = 130) reported on PBS norm frequency, alcohol use, and PBS use. They were then randomly assigned to receive a positive message about PBS users, a negative message about non-PBS users, or a control. They reported on weekly PBS use, alcohol use, and alcohol problems for 10 weeks.

RESULTS: Consistent with DRT, there were immediate post-intervention effects on PBS use for individuals who believed PBS was uncommon and who also received a positive message. This remained stable across time. There was significant growth in PBS use among individuals who received a negative message and who believed PBS use was common. The intervention was not directly associated with alcohol use or problems. However, PBS use was associated with average alcohol use and lower weekly and global alcohol problems.

CONCLUSIONS: This study shows that a DRT intervention may increase PBS use. This may translate into lower alcohol use and fewer alcohol-related problems. The results also identify conditions under which positive and negative messages are indicated.

Keywords

Deviance Regulation Theory; Protective Behavioral Strategies; Alcohol; College Students

Corresponding Author: Robert D. Dvorak, PhD, Department of Psychology, The University of Central Florida, 4111 Pictor Ln, Orlando FL, 32816, robert.dvorak@ucf.edu.

3.This model was also examined by re-centering the Time variable at Week 11. There were no notable changes in any of the effects in this model at varying time points.

Introduction

Alcohol use among college students continues to be a significant public health issue in the United States (White & Hingson, 2013). The percentage of college students involved in heavy alcohol use is staggering, with some research reporting that approximately 20% of college students meet the diagnostic criteria for alcohol abuse or dependence (Dawson, Grant, Stinson, & Chou, 2004). In a seven-year longitudinal study, Hingson and colleagues (2009) found that college students with heavy alcohol use were more subject to problems such as unintentional injury, deaths, driving under the influence, and sexual assault. In their conclusion, they recommend the implementation of interventions aimed at reducing alcohol-related harm within the college student population. To date, the use of brief norm-based interventions to reduce alcohol use/problems has been shown effective with this population (Hingson, Berson, & Dowley, 1997; Reid & Carey, 2015), however, recent research suggests the effects may not be as robust as once thought (Huh et al., 2015). The current study tests an intervention aimed at reducing alcohol problems by increasing use of responsible drinking behaviors via a relatively novel social psychological theory.

Norm-Based Alcohol Interventions

Norm-based interventions targeting alcohol use have become an increasingly popular approach in attempts to curb college student drinking and subsequent problems (Carey, Scott-Sheldon, Carey, & DeMartini, 2007). Norm-based interventions work by focusing on an individual's pluralistic ignorance (Prentice & Miller, 1993), the discrepancy between what the individual believes is the norm, compared to the actual norm. Effective norm-based interventions focus on this discrepancy and highlight how the individual differs from the norm (Lewis & Neighbors, 2006), which usually involves the individual's perceived norm being drastically higher than the actual base-rate of behavior (Lewis, Neighbors, Oster-Aaland, Kirkeby, & Larimer, 2007; Neighbors et al., 2010). The result is that the heavy-drinking student realizes that his or her drinking rate is much further above the actual rate than they previously estimated.

Overall, norm-based interventions have been shown to be effective in many cases when applied to typical college-student drinking (Lewis & Neighbors, 2006; Lojewski, Rotunda, & Arruda, 2010). Previous studies have found that norm-based interventions can reduce the discrepancy between an individual's perceived norm rate and the actual normative rate (Neighbors, Larimer, & Lewis, 2004), as well as reduce alcohol consumption and problems (Bewick, Trusler, Mulhern, Barkham, & Hill, 2008; Lewis & Neighbors, 2007). However, in a recent meta-analysis, Huh and colleagues (2015) found that the effects of the interventions are not as robust as once thought. Furthermore, most of these studies have utilized pluralistic ignorance regarding alcohol consumption, but have not focused much on alcohol problems or mitigating factors aside from use. Thus, there is a need to expand norm-based interventions to target behaviors directly tied to alcohol problems, such as protective behavioral strategies.

Protective Behavioral Strategies

Protective Behavioral Strategies (PBS) are specific behaviors that individuals can use to reduce the deleterious consequences of alcohol consumption. These involve behaviors such as setting a limit on the number of drinks a person plans to consume, securing a designated driver before drinking, or avoiding drinking games - just to name a few. Research has shown that individuals who use PBS have a successful track record of mitigating alcohol-related problems (Pearson, 2013). Cross-sectional studies have consistently shown an inverse association between PBS use and alcohol-related problems (Pearson, 2013). Furthermore, longitudinal changes in the use of PBS are associated with decreases in alcohol use and problems in college students (Martens, Martin, Littlefield, Murphy, & Cimini, 2011). Like alcohol use, there is a link between perceived norms of PBS use and actual PBS use. In two large samples of college students, Benton and colleagues (2008) found that PBS descriptive norms predicted PBS use, and that there appears to be a discrepancy between perceptions of peers' use of PBS and the individual's own PBS norms (i.e., pluralistic ignorance). DeMartini and colleagues (2011) found high acceptance rates of PBS use (i.e., PBS injunctive norms) among college students as well as a perceived discrepancy in acceptability, with individuals endorsing higher personal acceptability of PBS than the perceived acceptability of PBS by their peers. These findings seem promising for interventions that rely on normative beliefs.

Although a number of brief interventions have demonstrated a significant relationship between increased PBS use and decreased alcohol consumption and/or problems (Barnett, Murphy, Colby, & Monti, 2007; Dvorak, Kramer, Stevenson, Sargent, & Kilwein, 2017; Dvorak, Pearson, Neighbors, Martens, & Stevenson, 2016; Dvorak, Pearson, Neighbors, & Martens, 2015; Larimer et al., 2007; Martens et al., 2007), the evidence is not monolithic; indeed, several stand-alone PBS interventions have had limited effects. Martens, Smith, and Murphy (2013) found a PBS norms feedback (PBSF) intervention to be less effective than a personalized alcohol norms feedback (PNF) intervention in reducing alcohol consumption, though PBSF was more effective at increasing PBS use. However, PBSF did show a stronger reduction in alcohol problems ($d = -0.64$), relative to PNF ($d = -0.32$), though the difference between these groups did not reach conventional levels of statistical significance. Recently, LaBrie and colleagues (2015) found evidence that a stand-alone PBS intervention, which utilized PBS skills training and personal PBS feedback (PBS-STPF), increased PBS use. However, this did not result in greater reductions in alcohol use. Similarly, Sugarman and Carey (2009) found that a simple intervention, instructing students to use more PBS, increased PBS use, but there was no change in alcohol use. In contrast, Kenney and colleagues (2014) found that a standalone PBS intervention, delivered in a group format, produced increased PBS use and subsequent decreases in both heavy alcohol use and alcohol-related problems. In addition, PBS use mediated intervention effects on alcohol problems post-intervention among participants with heightened levels of anxiety. Thus, while standalone PBS-based interventions appear to increase PBS consistently, the effects on alcohol consumption are less consistent. However, they may be effective at reducing alcohol-related problems, a more clinically relevant outcome. Though standalone PBS interventions show promise, the inconsistent findings suggest that new approaches are warranted.

Deviance Regulation Theory

Deviance Regulation Theory (DRT) is a relatively new social psychological theory of behavioral action motivated by social perception. Specifically, DRT posits that personal identity, in relation to reference groups, can influence behaviors (Blanton, Stuart, & Van den Eijnden, 2001). DRT offers a predictive model where an individual's motivation for engaging in a behavior is a product of the perceived normative frequency of the target behavior among a reference group and the social perceptions of people that engage in that behavior. The basic tenet of the theory rests on the assumption that counter-normative behavior is more salient than normative behavior (i.e., when you go against the grain, you stand out). Thus, information about counter-normative behavior influences motivation to engage in the behavior. If an individual believes that a behavior is uncommon, then information about engaging in that behavior will be especially pertinent. Importantly, it does not require pluralistic ignorance, or the manipulation of the descriptive norm. This means that any message can be tailored to highlight the counter-normative aspect of a behavior. For example, if a person believes that the majority of a population use PBS, then non-/infrequent PBS users are the minority. In this case, a negative message describing non-/infrequent PBS users should motivate individuals to engage in more PBS to avoid standing out in a negative way. In contrast, if an individual believes that the majority of a population *do not* use PBS, then PBS users are the minority. In this case, a positively framed message about frequent PBS users should motivate individuals to engage in more PBS to enhance standing out in a positive way. Previous research has supported the application of DRT to modify substance use behaviors.

In a series of recent pilot studies, Dvorak and colleagues utilized a DRT-based approach to modify PBS use norms, increase PBS use, strengthen the association between PBS use intentions and actual PBS use, decrease alcohol use, decrease alcohol-related problems, and decrease intentions to use marijuana (Dvorak, Kramer, & Stevenson, 2018; Dvorak et al., 2017; Dvorak et al., 2016; Dvorak et al., 2015; Dvorak, Raeder, et al., 2018; Sargent et al., 2018). In the alcohol PBS studies, college students are randomly assigned to receive positive messages about individuals who use PBS or negative messages about individuals who do not use PBS. Across several weeks (Dvorak et al., 2016; Dvorak et al., 2015) or across Spring Break (Dvorak et al., 2017; Sargent et al., 2018), consistent DRT effects were observed whereby a positive message about PBS users increased PBS use if those people believed PBS use was uncommon, or a negative message about PBS non-users increased PBS use among those that believed PBS use was common. However, these studies were not randomized control trials (RCTs), suffered from small sample sizes, did not include comprehensive measures of PBS norms, and did not examine effects across time. The current study addresses these shortcomings and is the first RCT of this approach.

Overview

The current study examines a RCT of Deviance Regulation Theory to increase the use of PBS among college student drinkers. It was hypothesized that, among individuals who believe PBS use is uncommon, a positive message about individuals who frequently use PBS would result in more PBS use. In contrast, among individuals who believe PBS use is common, a negative message about individuals who *do not* engage in PBS would result in

more PBS use. Consistent with previous research on DRT (Dvorak et al., 2015), we expected these effects to occur immediately after the intervention, and not grow or decay across time. In addition, these effects are expected to impact clinically relevant outcomes via PBS use. Specifically, we expect that PBS use will be negatively associated with alcohol use in a given week (a within-subjects association). Further, individuals who use more PBS, should also have lower global consumption rates (a between-subjects association) as more PBS use should result in less overall consumption. Finally, we expect that PBS use will be broadly protective against alcohol-related problems, both within a given week (a within-subjects association) as well as globally (a between-subjects association). As the intervention target is PBS use, we expect direct effects of PBS use on the alcohol outcomes, but do not anticipate direct intervention effects on either alcohol use or alcohol-related problems. The underlying theoretical model is depicted in Figure 1.

Methods

Participants

The participant flow chart is shown in Figure 2. The study screen was posted to the University research pool website. At the time, there were n = 1,163 registered participants. All research pool participants were eligible to register for the screening study; n = 532 registered and completed the screen. Of this sample, n = 259 (48.68%) reported drinking at least “2–3 times per month.” We randomly selected 60% of eligible participants (n = 155) and offered them the opportunity to participate in a study entitled “Longitudinal Use of Protective Strategies” in exchange for 1 research credit per week for the next 10 weeks. Of those contacted, 85.16% (n = 132) agreed to participate. These individuals were then randomized to receive a positive message about individuals who DO engage in protective strategies (n = 41), a negative message about individuals who DO NOT engage in protective strategies (n = 46), or a control condition (n = 45). After the initial intervention session, participants logged in weekly to report on activities the previous week. Nine individuals (control = 1, positive frame = 4, negative frame = 4) did not return to complete any post-intervention assessments. In addition, five individuals (control = 2, negative = 3) did not report any alcohol use in the post-intervention assessments; however, these individuals all provided some data and thus were retained in the analysis. Two individuals provided no drinking data in the pre-intervention assessment and did not return for any post-intervention assessments. These two individuals were removed from the analysis, resulting in a final analysis sample of n = 130. Participants in the analysis sample had a mean age of 19.26 (SD = 1.88). The sample was 70% female. The racial composition was fairly homogenous with 96.15% White, 1 participant endorsing Black/African American, 1 participant endorsing Asian, 5 individuals endorsing Hispanic/Latina/Latino, and 2 participants endorsing ‘Other.’ All participants were treated in accordance with American Psychological Association guidelines for ethical research (Sales & Folkman, 2000) and the University Institutional Review Board approved this study.

Procedure

Phase I.—This study was conducted in three phases. In phase I, participants completed a screen that asked about alcohol use, PBS use, and PBS norms. Participants received three

credits of research participation points (i.e., 30 minutes of participation credit) for completing the screen. Individuals who endorsed drinking "2–3 times per month" or more were identified as potential participants. A random sample of eligible individuals was then selected for participation in the intervention phase (phase II).

Phase II.—In phase II, participants reported their PBS use and alcohol use for each day of the previous week. They were then randomly assigned to receive a positively framed message about individuals who DO engage in PBS, a negatively framed message about individuals who DO NOT engage in PBS, or an attention control which asked opinions about PBS use in general (see intervention description below). Following the intervention, participants reported on intentions to use PBS the following week.

Phase III.—Phase III was the post-intervention monitoring phase. Each week, participants logged onto a secure server to report on current PBS use norms, alcohol use for each day of the previous week, alcohol-related problems experienced during the previous week, and PBS use for each day of the previous week. They then received a brief intervention reminder consistent with their original condition. Following this, they reported on intentions to use PBS in the coming week (not examined here). Participants were emailed every Tuesday morning to complete an assessment covering the last week. Participants had 72 hours to complete this assessment each week. Participants could complete 10 weeks of post-intervention surveys and received 1 research pool point (i.e., 10 minutes of credit) for each survey completed.

Intervention

The intervention used 12 positively framed messages about individuals who DO engage in PBS when drinking (sample positive item: "Did you know, that students who DO USE these strategies are seen as more competent by their peers?"), and 12 mirrored, negatively framed messages about individuals who DO NOT engage in PBS when drinking (sample negative item: "Did you know, that students who DO NOT USE these strategies are viewed by other students as more impulsive and having less self-control?"). Following each statement, individuals endorsed if they knew the statement or not. This was done simply to ensure they had read the intervention statement. After viewing all 12 statements, participants were told: "We're interested in your opinion of these statements. Why do you think people who…" (positive message: …"DO USE these strategies are viewed so much more positively?"; negative message: …"DO NOT USE these strategies are viewed so much more negatively?"). Participants responded in a free text box. This was used to reinforce the intervention message. The control condition asked about individual perceptions of others that do or do not use PBS (item: "We're interested in your perception of individuals who either DO or DO NOT use these strategies; what do think motivates people to use, or not use, these strategies when drinking?"). For a more detailed description of this intervention, see Dvorak and colleagues (2015).

Measures

Demographics.—Participants reported age, gender, sexual orientation, race, ethnicity, year in school, and grade point average. Gender and age were added as model covariates in

the final analyses as these are frequently associated with alcohol-related variables in college student samples.

Alcohol Use Disorder Identification Test (AUDIT).—In the initial screen, individuals completed the AUDIT as a measure of alcohol-related problems. The AUDIT is a 10-item questionnaire that assesses three aspects of alcohol-related outcomes: hazardous use, dependence symptoms, and serious harm (Saunders, Aasland, Babor, & de la Fuente, 1993). Summed scores range from 0 to 40, with scores of 8 and above indicating some intervention may be warranted (Saunders et al., 1993). Previous research supports the reliability and validity of the AUDIT with college student samples (DeMartini & Carey, 2009), and have indicated that scores of 5 for females and 7 for males may indicate intervention is warranted (DeMartini & Carey, 2012). The mean AUDIT score in this sample was 7.83 and there was acceptable internal consistency (α = .78). The AUDIT was not used in the analysis but is provided to compare this sample to other substance use samples.

Modified Daily Drinking Questionnaire (DDQ-M).—The DDQ-M is a measure of weekly alcohol consumption. Individuals report the number of drinks consumed on each day of the week. In the current study, the DDQ-M assessed weekly consumption over "a typical week in the last 6 months." This was used as a measure of individual differences in typical weekly alcohol consumption in the screening questionnaire. In the weekly post-intervention assessments, individuals used the same format to report the number of drinks consumed each day over the last week, starting with the previous Tuesday, and working up to the most recent Monday. The sum of this measure for each week was used as a measure of weekly alcohol consumption in the analysis. The DDQ-M has been used effectively as a measure of college student drinking (Dvorak et al., 2014; Dvorak, Simons, & Wray, 2011) as well as a weekly measure of consumption in the context of DRT-based interventions (Dvorak et al., 2017; Dvorak et al., 2015; Sargent et al., 2018).

Young Adult Alcohol Consequences Questionnaire (YAACQ).—The YAACQ is a measure of 48 alcohol-related problems. Participants were asked if they experienced each consequence over the last week (0 = *no*, 1 = *yes*; sample item: "*I have passed out from drinking*."). These items were summed to provide a measure of total alcohol-related problems experienced each week. The YAACQ showed good internal consistency across weeks (αs = .90-.98). Previous research has utilized the YAACQ as a measure of alcohol problems in both a daily and weekly format (see Dvorak et al., 2015; Pearson, D'Lima, & Kelley, 2013).

Protective Behavioral Strategies (PBS).—During the initial screen, participants were presented with a list of 36 different protective behavioral strategies (PBS; sample item: "*Use a designated driver*.") collected across a variety different measures (Benton et al., 2004; Martens et al., 2005; Sugarman & Carey, 2007; Treloar, Martens, & McCarthy, 2015). They were also presented with this list of strategies during each weekly post-intervention assessment. During the weekly post-intervention assessments, participants were asked to rate the extent to which they engaged in protective behavioral strategies for each day of the previous week (PBS daily scale: 1= *not at all*, 5 = *extremely*) using a Time Line Follow

Back (TLFB) like approach. At these sessions, participants reported only global PBS use to reduce the burden of completing a full PBS assessment for each day of the week. This approach has been used effectively to assess daily global PBS use during weekly diary assessments (Dvorak et al., 2017). Mean weekly PBS use from drinking days (as PBS use only occurs in the context of drinking) served as the primary intervention target.

PBS Norm Frequency.—The perceived frequency of PBS use was assessed by asking, "How often do you think students use these types of strategies?" This item was rated on a 5-point Likert-type scale (1= *never*, 5 = *always*). Consistent with DRT, the pre-intervention norm was used as a moderator of the intervention effects.

Analysis overview

At level 1 alcohol use, PBS use, and alcohol problems were nested within each week. The dataset had alcohol consumption and PBS use for each day over an 11-week period (1 pre-intervention week followed by 10 post-intervention weeks). There were also data on alcohol-related problems over the past week, though this variable was specific to the entire week, not day. Thus, we analyzed the level 1 data at the week level, with mean levels (i.e., intercept) of the outcome and slopes across time as the level 1 dependent variables of interest. Alcohol consumption was summed across the week to provide a measure of total drinks consumed that week. PBS use was the average use of PBS on drinking days that week (as PBS use only occurs during drinking episodes). Thus, each model had a level 1 equation comprised of a random intercept for the outcome and a slope across time:

$$\text{Level 1: Outcome}_{ij} = \beta_{0j} + \beta_{1j}(\text{Time in weeks}_{ij}) + r_{ij}$$

At level 2, we controlled for biological sex and age, and modeled message frame (condition), pre-intervention PBS use norms (grand mean centered), and the interaction of condition × PBS use norms were added to test the effects of the intervention on the intercept and the slope across time:

$$\text{Level 2: } \beta_{0j} = \gamma_{00} + \gamma_{01}(\text{Sex})_j + \gamma_{02}(\text{Age})_j + \gamma_{03}(\text{Condition 1})_j + \gamma_{04}(\text{Condition 2})_j + \gamma_{05}(\text{PBS Norm})_j + \gamma_{06}(\text{Condition 1} \times \text{PBS Norm})_j + \gamma_{07}(\text{Condition 2} \times \text{PBS Norm})_j + \text{U}_{0j}$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11}(\text{Sex})_j + \gamma_{12}(\text{Age})_j + \gamma_{13}(\text{Condition 1})_j + \gamma_{14}(\text{Condition 2})_j + \gamma_{15}(\text{PBS Norm})_j + \gamma_{16}(\text{Condition 1} \times \text{PBS Norm})_j + \gamma_{17}(\text{Condition 2} \times \text{PBS Norm})_j + \text{U}_{1j}$$

In addition, for the alcohol use and problems analyses weekly PBS use (centered at the subject mean) was added as a predictor of the level 1 intercept and average PBS use (centered at the grand mean) was added as a predictor of the level 2 intercept. For the alcohol problems analysis, we also added weekly alcohol use (centered at the subject mean) to the level 1 equation and average alcohol use (centered at the grand mean) predicting the intercept and time slope. These are depicted below.

The data were analyzed in Stata 15.0 (StataCorp, 2017). PBS data was treated as continuous and analyzed using the *mixed* command (StataCorp, 2013). Drinks consumed during

drinking weeks and frequency of alcohol-related problems during drinking weeks were treated as count variables and analyzed via multilevel negative binomial models using the *menbreg* command (Long & Freese, 2001). In the count models we report Incident Rate Ratios (IRR). Missing data within completed assessments were low (4.81%) and assumed to be missing at random. The analysis utilized maximum likelihood estimation, which is appropriate for nested data structures with data missing at random (Raykov, 2005).

The analysis was broken down into three multilevel regression models. In each model, Time (in weeks) was initially centered at the first post-intervention week (i.e., pre-intervention week = −1, first post-intervention week = 0, second post-intervention week = 1, third post-intervention week = 2… final post-intervention week = 9). This allows for the examination of intervention effects on the post-intervention intercept (β_{0j}) as well as on the time slope (β_{1j}). In the alcohol use and problems models, Time is re-centered to the study mid-point (i.e., week 6; pre-intervention week = −5… final post-intervention week = 5) to examine average effects across the study. The intervention effects are represented by the interaction of PBS norms with condition. Condition 1 is coded 0 = control/negative frame, 1 = positive frame. Condition 2 is coded 0 = control/positive frame, 1 = negative frame. Thus, condition 1 is the effect of the positive message, relative to control, and condition 2 is the effect of the negative message relative to control.

The underlying hypothesis of this study was that the DRT-based intervention would lead to DRT consistent increases in PBS use (i.e., more PBS use for those who receive a positive message about PBS users and believe PBS use is uncommon OR more PBS use for those who receive a negative message about PBS non-users and believe PBS use is common). Thus, we propose a basic mediation model whereby messaging (i.e., condition) leads to more PBS use as a function of PBS normative beliefs, PBS use is subsequently hypothesized to be inversely related to alcohol use and alcohol-related problems (see Figure 1). To examine this, we conduct three multilevel regression models. We initially examine the first step of the causal chain – the effects of the intervention on PBS use. In the next two models, we include condition, PBS norms, and Condition × PBS Norms. We then enter the outcome from the first step (PBS use) to examine the overall association between PBS use and both alcohol use and alcohol-related problems at the within-subject (i.e., weekly) and the between-subject levels. We conduct each analysis in a step-wise fashion, using likelihood ratio tests to examine the addition of parameters to each model.

In the first multilevel regression model, the outcome is average PBS use during weeks in which individuals consume any alcohol. The analysis uses a first-order autoregressive covariance structure (AR1) to account for serial autocorrelation across weeks. The multilevel equation is depicted below:

$$\text{Level 1: PBS use}_{ij} = \beta_{0j} + \beta_{1j}(\text{Time in weeks}_{ij}) + r_{ij}$$

$$\text{Level 2: } \beta_{0j} = \gamma_{00} + \gamma_{01}(\text{Sex})_j + \gamma_{02}(\text{Age})_j + \gamma_{03}(\text{Condition 1})_j + \gamma_{04}(\text{Condition 2})_j + \gamma_{05}(\text{PBS Norm})_j + \gamma_{06}(\text{Condition 1} \times \text{PBS Norm})_j + \gamma_{07}(\text{Condition 2} \times \text{PBS Norm})_j + \text{U}_{0j}$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11}(\text{Sex})_j + \gamma_{12}(\text{Age})_j + \gamma_{13}(\text{Condition 1})_j + \gamma_{14}(\text{Condition 2})_j + \gamma_{15}(\text{PBS Norm})_j + \gamma_{16}(\text{Condition 1} \times \text{PBS Norm})_j + \gamma_{17}(\text{Condition 2} \times \text{PBS Norm})_j + \text{U}_{1j}$$

Next, we examine the effects of the intervention on drinks consumed during drinking weeks. As drinks are a count variable with positive skew, we utilize a negative binomial count distribution to model weekly drinks consumed. This model also includes level 1 (person centered) and level 2 (grand-mean centered) PBS use, as the underlying hypothesis is that the intervention increases PBS use, which then predicts lower alcohol use and alcohol problems. The multilevel equation for alcohol use frequency is listed below:

$$\text{Level 1: Drinks Consumed(nb)}_{ij} = \beta_{0j} + \beta_{1j}(\text{Time in weeks}_{ij}) + \beta_{2j}(\text{Weekly PBS use}_{ij})$$

$$\text{Level 2: } \beta_{0j} = \gamma_{00} + \gamma_{01}(\text{Sex})_j + \gamma_{02}(\text{Age})_j + \gamma_{03}(\text{Condition 1})_j + \gamma_{04}(\text{Condition 2})_j + \gamma_{05}(\text{PBS Norm})_j + \gamma_{06}(\text{Condition 1} \times \text{PBS Norm})_j + \gamma_{07}(\text{Condition 2} \times \text{PBS Norm})_j + \gamma_{08}(\text{Average PBS Use})_j + \text{U}_{0j}$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11}(\text{Sex})_j + \gamma_{12}(\text{Age})_j + \gamma_{13}(\text{Condition 1})_j + \gamma_{14}(\text{Condition 2})_j + \gamma_{15}(\text{PBS Norm})_j + \gamma_{16}(\text{Condition 1} \times \text{PBS Norm})_j + \gamma_{17}(\text{Condition 2} \times \text{PBS Norm})_j + \text{U}_{1j}$$

Finally, we examine the effects of message framing on alcohol-related problems during weeks that individuals consumed alcohol, again using a negative binomial count outcome to model the frequency of alcohol-related problems experienced during drinking weeks. In this model, we add level 1 (person centered) and level 2 (grand-mean centered) PBS use as well as person-centered weekly alcohol use to the level 1 equation and grand-mean centered alcohol use to the level 2 intercept and time slope – thus controlling for weekly levels of PBS use and drinks consumed on drinking days as well as individual differences in PBS use and alcohol consumption rates.

$$\text{Level 1: Alcohol problems(nb)}_{ij} = \beta_{0j} + \beta_{1j}(\text{Time in weeks}_{ij}) + \beta_{2j}(\text{Weekly PBS use}_{ij}) + \beta_{3j}(\text{Weekly alcohol use}_{ij})$$

$$\text{Level 2: } \beta_{0j} = \gamma_{00} + \gamma_{01}(\text{Sex})_j + \gamma_{02}(\text{Age})_j + \gamma_{03}(\text{Condition 1})_j + \gamma_{04}(\text{Condition 2})_j + \gamma_{05}(\text{PBS Norm})_j + \gamma_{06}(\text{Condition 1} \times \text{PBS Norm})_j + \gamma_{07}(\text{Condition 2} \times \text{PBS Norm})_j + \gamma_{08}(\text{Average alcohol Use})_j + \gamma_{09}(\text{Average PBS Use})_j + \text{U}_{0j}$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11}(\text{Sex})_j + \gamma_{12}(\text{Age})_j + \gamma_{13}(\text{Condition 1})_j + \gamma_{14}(\text{Condition 2})_j + \gamma_{15}(\text{PBS Norm})_j + \gamma_{16}(\text{Condition 1} \times \text{PBS Norm})_j + \gamma_{17}(\text{Condition 2} \times \text{PBS Norm})_j + \text{U}_{1j}$$
$$\gamma_{18}(\text{Average alcohol Use})_j + \text{U}_{ij}$$

Across models, significant intervention effects (i.e., condition × norms interactions) are examined by (a) testing simple effects of condition on the intercept at high (+1*SD*) and low (−1*SD*) levels of PBS norms and (b) examining time slopes in each condition at high (+1*SD*) and low (−1*SD*) levels of PBS norms. Effects sizes utilize Cohen's conventions (Rosenthal, 1994) or Incident Risk Ratios (IRRs). For continuous outcomes, effect sizes of statistically significant slopes (Cohen's f^2: small = .02, medium = .15, large = .35) are calculated following the procedures outlined by Selya and colleagues (2012). Effect sizes on the intercepts (Cohen's *d*: small = 0.20, medium = 0.50, large = 0.80) are calculated by dividing the difference in intercepts between conditions by the pooled residual outcomes standard deviation (*SD*) at the intercept timepoint.

Results

Descriptive and compliance statistics

Descriptive statistics are listed in Table 1. Neither gender ($p = .371$) nor age ($p = .706$) was significantly different across conditions. Average AUDIT score was 7.82 ($SD = 4.42$) and did not vary across conditions ($F = 0.86$, $p = .428$). Participants completed an average of 7.66 ($SD = 1.85$) weeks of assessment and reported drinking during an average of 4.42 ($SD = 2.79$) weeks. There was a total of 856 person-weeks out of a total possible 1430 person-weeks (11 weeks × 130 participants) for a completion rate of weekly assessments of 60%. Participants could skip weeks during the study, resulting in varying participation rates across study weeks in phase III. Participation dropped dramatically in week 8, with only 43% of participants completing the weekly assessment. This continued to decline for the last two weeks, with only 19% of participants completing the assessment in the final week. Participants reported 1157 drinking day episodes across 621 drinking weeks (72.55% of the 856 measured weeks).

Pre-intervention associations

The week prior to the intervention, there were no differences in daily alcohol consumption ($p = .149$) or PBS norm frequency ($p = .651$) across conditions. To examine pre-intervention differences in PBS use, alcohol use, and alcohol problems, we tested three regression models using the pre-intervention TLFB data for the previous week. Each outcome was regressed onto biological sex (PBS use model: $p = .355$; Alcohol use model: $B = 0.41$, $p = .014$; Alcohol problems model: : $B = −0.50$, $p = .009$), age (PBS use model: $p = .327$; Alcohol use model: $p = .564$; Alcohol problems model: : $B = −0.12$, $p = .013$), alcohol use (PBS use model: $p = .952$; Alcohol problems model: : $B = 0.05$, $p < .001$), PBS norm (PBS use model: $p = .161$; Alcohol use model: $p = .272$; Alcohol problems model: $p = .953$), condition 1 (PBS use model: $p = .733$; Alcohol use model: $p = .167$; Alcohol problems model: $p = .673$), condition 2 (PBS use model: $p = ..573$; Alcohol use model: $p = .281$; Alcohol problems model: $p = .101$), condition 1 × PBS norm (PBS use model: $p = .824$; Alcohol use model: $p = .356$; Alcohol problems model: $p = .873$), and condition 2 × PBS norm (PBS use model: $p = .485$; Alcohol use model: $p = .181$; Alcohol problems model: $p = .466$). There were expected associations with age, gender, and consumption; however, there were no pre-intervention differences as a function of condition or condition × PBS norm.

PBS Use Analysis

The primary research questions concerned the effect of a DRT-based intervention on PBS use. It was hypothesized that at low PBS norms a positive message about PBS users would result in higher PBS use. It was also hypothesized that at high PBS norms a negative message would result in higher PBS use. Consistent with previous research, we expected these effects to occur immediately (i.e., predict the post-intervention intercept) and neither grow nor decay across time. In step 1, we specified an intercept-only multilevel model with average weekly PBS use from drinking weeks (as PBS use only occurs in the context of drinking) as the outcome variable (see Table 2, column 1). There was significant random variance in the intercept and the variance in PBS use was divided fairly evenly across levels (Intra-Class Correlation [ICC] = 0.50). In step 2, the time slope was added to the level 1 model.[1] We then added the main effects of age, biological sex, condition 1, condition 2, and PBS use norms to both the intercept and time slope (see Table 2, column 2). This resulted in a significant improvement over the intercept only model, $LR\chi^2(13) = 37.74$, $p < .001$. In step 3, we added the condition × PBS norm interactions, to the intercept and slope (see Table 2, column 3). The addition of these interactions resulted in significant improvement over the step 2 model, $LR\chi^2(4) = 9.99$, $p = .041$.

Consistent with hypothesis, the interaction of condition 1 × PBS norm predicted the PBS use intercept ($B = -0.74$, $p = .024$). This was examined at high and low PBS norms (see Figure 3). At high PBS norms (+1*SD*), there was no difference between the positive message condition and the control ($B = -0.28$, $p = .280$). At low PBS norms, the positive message resulted in higher PBS use immediately post-intervention ($B = 0.64$, $p = .038$; Cohen's $d = 0.50$). Contrary to hypothesis, the condition 2 × PBS norm interaction did not predict immediate post-intervention changes in PBS use ($B = -0.47$, $p = .133$).

Both the condition 1 × PBS norm ($B = 0.19$, $p = .016$) and condition 2 × PBS norm ($B = 0.18$, $p = .008$) interactions predicted the time slope. Figure 4 panel a, shows that at mean levels of PBS norms there was no change in PBS use across time in the control condition ($B = -0.04$, $p = .125$) or the positive message condition ($B = 0.02$, $p = .412$). However, there was a small increase in PBS use across time in the negative message condition ($B = 0.05$, $p = .029$; Cohen's $f^2 = 0.05$). Figure 4, panel b, shows that at low PBS norms there was no change in PBS use across time in the control ($B = 0.05$, $p = .150$), positive frame ($B = -0.01$, $p = .893$), or negative frame ($B = 0.03$, $p = .301$) conditions. Finally, Figure 4 panel c shows that at high levels of PBS norms there was a decline in PBS use across time in the control condition ($B = -0.14$, $p = .013$; Cohen's $f^2 = 0.06$), no change across time in the positive condition ($B = 0.04$, $p = .326$), and a small increase in PBS use across time in the negative condition ($B = 0.07$, $p = .015$; Cohen's $f^2 = 0.05$). Thus, although there was not an immediate DRT consistent effect on the PBS use intercept in the negative frame, there was a DRT consistent increase in PBS use across time for those receiving a negatively framed message and having an average or high PBS norm.

[1]We also tested a quadratic slope for PBS in Step 2. While there was evidence for a quadratic slope it was quite modest ($p = .024$). Further, there were no interactions between with the quadratic slope and the condition 1 and 2 intervention effects ($ps = .779$ and .298 respectively). Thus, we removed the quadratic slope from the model.

Drinks Consumed During Drinking Weeks Analysis

Next, we examined drinks consumed on drinking weeks. In step 1, we specified an intercept-only multilevel negative binomial count model with drinks consumed on drinking weeks (a count variable) as the outcome (see Table 3, column 1). There was significant random variance in the intercept, and it was allowed to vary randomly. In step 2, the time variable, centered at the first post-intervention week (i.e., week 2), was added to the level 1 equation. There was no random variance in the time slope; thus, the variance of the time slope was constrained to zero. We then added the main effects age, biological sex, condition 1, condition 2, and PBS use norms to both the intercept and time slope (see Table 3, column 2). A likelihood ratio test indicated this did not significantly improve the model, $LR\chi^2(11) = 17.03$, $p = .107$. In step 3, we added the condition × PBS norm interactions, to the intercept and time slope (see Table 3, column 3). The addition of these interactions resulted in significant improvement over the step 2 model, $LR\chi^2(4) = 14.12$, $p = .007$. Interestingly, there was a significant effect of condition 1 × PBS norm and condition 2 × PBS norm on the model intercept. In step 4, we added weekly PBS use (person centered) and average PBS use (grand-mean centered) to the model (see Table 3, column 4). The addition of PBS use did not result in a significant improvement over the step 3 model, $LR\chi^2(2) = 4.28$, $p = .118$. Furthermore, the interactions of condition 1 × PBS norm and condition 2 × PBS norm on the intercept remained significant. Next, we re-centered the time variable to the study midpoint (i.e., week 6). This allows for an examination of the mean effects of the intervention across the study (see Table 3, column 5). When centered at the study midpoint (i.e., week 6), the two interactions on the intercept remained significant. Weekly PBS use was not associated with drinks consumed on drinking weeks. However, at the between-subjects level, average PBS use was modestly inversely associated with drinking rate (IRR = 0.90, $p = .048$), suggesting that those who use more PBS consume fewer drinks in general; partially supporting hypothesis.

In the final step (centered at the study midpoint of week 6), both condition × PBS norm interactions on the intercept remained significant.[2] We examined the differences in drinking rate at mean, high (+1*SD*), and low (−1*SD*) levels of PBS norms. At mean PBS norms, there was no difference between the control condition and either the positively framed message (IRR = 1.22, $p = .101$) or the negatively framed message (IRR = 1.23, $p = .091$). Similarly, at low PBS norms there was no difference between the control condition and either the positively framed message (IRR = 0.77, $p = .181$) or the negatively framed message (IRR = 0.74, $p = .073$). However, at high levels of PBS norms, drinking rates were lower in the control condition than both the positively (IRR = 1.93, $p < .001$) and negatively (IRR = 2.04, $p < .001$) framed message conditions. Thus, at high PBS norms, individuals drank approximately 2 drinks more than the control condition on drinking weeks if they received any sort of messaging. A *posthoc* examination of these unanticipated findings showed that in the control condition PBS norms were inversely associated with mean drinking rate (IRR = 0.53, $p < .001$), while the association between PBS norms and mean drinking rate was

[2]We also examined these interactions at the final week of the study by re-centering the Time variable at Week 11 (final week). The interactions were relatively unchanged (and still statistically significant at this time point).

positive, though not statistically significant, in both the positively (IRR = 1.09, $p = .451$) and negatively (IRR = 1.18, $p = .120$) framed message conditions.

Alcohol Problems During Drinking Weeks Analysis

Lastly, we examined the effects of the intervention on the frequency of alcohol-related problems during drinking weeks across the study. In step 1, we specified an intercept-only multilevel negative binomial count model as the outcome variable. There was significant random variance in the intercept and it was allowed to vary randomly. In step 2, the time variable, centered at the first post-intervention week (i.e., week 2), was added to the model. There was no random variance in the time slope; thus, the variance of the time slope was constrained to zero. We then added the main effects of age, biological sex, condition 1, condition 2, PBS use norms, weekly alcohol use (person centered), and average alcohol use (grand-mean centered) to both the intercept and time slope (see Table 4, column 2). A likelihood ratio test indicated this significantly improved the model, $LR\chi^2(14) = 139.76$, $p < .001$. In step 3, we added the condition × PBS norm interactions, to the intercept and slope (see Table 4, column 3). The addition of these interactions did not significantly improve the model over the step 2 model, $LR\chi^2(4) = 2.84$, $p = .585$. In step 4, we added weekly PBS use (person centered) and average PBS use (grand-mean centered) to the model (see Table 4, column 4). The addition of PBS use resulted in a significant improvement over the step 3 model, $LR\chi^2(2) = 19.70$, $p < .001$. Finally, we re-centered the time variable to the study midpoint (i.e., week 6) to again allows for an examination of the mean effects of the intervention across the study (see Table 4, column 5). PBS use was broadly protective against alcohol-related problems with both weekly PBS use (IRR = 0.84, $p < .001$) and average PBS use (IRR = 0.75, $p = .004$) being inversely associated with alcohol-related problems. As might be expected, alcohol consumption was positively associated with alcohol-related problems at both the weekly level (IRR = 1.06, $p < .001$) and the between-subjects level (IRR = 1.17, $p < .001$).

In addition, average alcohol use moderated the trajectory of alcohol-related problems across time (IRR = 1.02, $p < .001$). At mean levels of alcohol consumption, there was a decline in alcohol problems across time in the study (IRR = 0.84, $p < .001$). However, at high (+1*SD*) levels of average alcohol consumption this decline was attenuated (IRR = 0.90, $p < .001$), while at low (−1*SD*) levels of average alcohol consumption the decline was potentiated (IRR = 0.80, $p < .001$). We explored this interaction in the context of the intervention. As this was done *posthoc*, we set the alpha level to $p \leq .001$ to guard against type I error. We first examined if this interaction varied by condition, PBS norm, and the condition × PBS norm interactions. None of these interactions were statistically significant. Next, we examined if this interaction varied by weekly PBS use (person centered) and average PBS use (grand-mean centered). None of these interactions were significant either. Thus, as might be expected, average alcohol use moderated the trajectory of alcohol-related problems across time, but this did not vary by the intervention or by PBS use.

Discussion

This study examined the effects of a brief Deviance Regulation Theory (DRT) intervention on PBS use among college student drinkers. Previous research has shown that PBS use may mitigate alcohol consumption and alcohol-related problems (Barnett et al., 2007; Dvorak et al., 2017; Dvorak et al., 2016; Dvorak et al., 2015; Larimer et al., 2007; Martens et al., 2007; Martens et al., 2011; Pearson, 2013). However, interventions specifically targeting PBS have had mixed results (see LaBrie et al., 2015; Martens et al., 2013; Sugarman & Carey, 2009). Thus, the development of efficacious interventions that can target PBS is warranted. The gold standard interventions for college student drinking utilize approaches that highlight drinking norms or normative discrepancies through personalized feedback (Reid & Carey, 2015). Similar to alcohol, PBS norms are also a significant predictor of actual PBS use (Benton et al., 2008; Dvorak et al., 2015). Thus, the current study sought to evaluate the association between PBS use, alcohol use, and alcohol-related problems as a function of perceived frequency of PBS use in the context of positive information about individuals that use PBS or negative information about individuals that do not. This approach is consistent with DRT, and has been shown to modify PBS use and subsequently substance use-related outcomes (Dvorak, Kramer, et al., 2018; Dvorak et al., 2017; Dvorak et al., 2015; Dvorak, Raeder, et al., 2018; Sargent et al., 2018). The results suggest that the intervention has DRT consistent effects on PBS use, though limited, if any, *direct* effects on alcohol use and related problems. However, PBS use, the primary target of the intervention, was associated with these outcomes, potentially supporting a mediation model. The primary findings are discussed by outcomes below.

Protective Behavioral Strategies

It was hypothesized that at low PBS norms, a positively framed message would lead to a post-intervention increase in PBS use. The data supported this hypothesis. Further, these immediate gains were sustained across time (i.e., no significant decline). This is consistent with previous work showing that at low PBS norms, a positive message leads to immediate increases in PBS use (Dvorak et al., 2015). Interestingly, due to gradual increases in PBS use by those with low norms in the control group, by the end of the study the advantages of the positive frame were no longer evident (see Figure 4, panel b). It is possible that having low perceived PBS norms has a negative effect on PBS use, but over time those individuals increase their PBS use, potentially because they were primed to notice it in others, or potentially due to their own self-monitoring across time (i.e., reactivity). Thus, rather than indicating a dissipation of the effects of the positive frame, the findings suggest that, at low levels of PBS norms, the positive frame condition may have elicited earlier PBS use than would be anticipated in the absence of an intervention.

The negative frame was hypothesized to lead to increased PBS use among those with high PBS norms. Although there were no immediate effects on PBS use, the negative frame was associated with a trajectory of increasing PBS use at high (and mean) levels of PBS norms. In other words, if participants believed that PBS use was common, they appear to increase their own PBS use in response to learning about the negative characteristics associated with individuals that do not engage in PBS use. Though different than predicted, this finding is

still consistent with DRT, as well as previous research showing that a negative frame can motivate healthy behaviors when individuals see that behavior as a function of their belief about the frequency that others engage in that behavior (Dvorak et al., 2017). Moreover, the findings provide evidence that the positive effects, although delayed, are maintained or even strengthened over time.

Alcohol Use

During drinking weeks, we found that the rate of drinking (i.e., the amount consumed when an individual drank) was inversely associated with between-subjects PBS use. Thus, individuals who use more PBS in general, also consume fewer drinks on average. It would appear that increasing individual levels of PBS use may result in lower rates of problematic alcohol use patterns. Perhaps most interesting was the observation that alcohol consumption rates (i.e., global levels of consumption across the study) were higher among individuals in both intervention frames if they also believed that PBS use was common. This finding is somewhat puzzling, especially in light of the effects on PBS. Perhaps individuals become overconfident in the effects of PBS, if they believe everyone is using PBS, and this leads to higher consumption rates. Or, perhaps DRT messages somehow change how PBS norms affect drinking. In fact, we also observed that PBS norms were inversely associated with the overall drinking in the control condition, but not the two intervention conditions. Alternatively, it may simply be a type I error due to the probing of four interactions across three different outcomes. Though, we have observed the same effect on PBS use in previous studies. Finally, this may be due to selection bias and/or reporting bias. In the current study, PBS is only recorded during drinking weeks. Thus, the primary outcome of the RCT is not reported if the individual decides not to drink; a potential (though unintended) effect of the intervention. Future research, with larger samples, is needed to fully understand these phenomena; though, it does warrant some caution, particularly for the negative message condition, as this is the message that should be effective among those with high PBS norms.

Alcohol-related Problems

Perhaps the most important finding is the observed effects on alcohol-related problems. Though there were no direct effects of the intervention on problems, there were direct effects of the intervention on PBS use. Further, PBS use was broadly protective against alcohol-related problems - both weekly PBS use and individual (between-subjects) levels of PBS use were inversely associated with alcohol-related problems. Thus, we can extrapolate that an intervention which increases PBS use may thereby protect against alcohol-related problems. Previous pilot research has shown that this intervention may indirectly affect alcohol-related problems via PBS use (Dvorak et al., 2015). However, there is also evidence that increasing PBS use via psychosocial interventions may not directly translate into reduced problematic alcohol use (LaBrie et al., 2015; Martens et al., 2013; Sugarman & Carey, 2009). However, we are hopeful that DRT may find a footing where these previous studies have come up short. All previous studies have focused on increasing PBS use via a normative process of some sort. In contrast, DRT encourages individuals to internalize beliefs about safe drinking, such that they may alter their social identity. In this way, DRT interventions for PBS encourage individuals to define themselves as “safe drinkers.” Though this is speculative at

present, future research should examine the ways in which individual drinking identities change as a function of DRT.

Clinical & Theoretical Implications

Previous research has shown that DRT can be used to modify PBS use. The current study is the first RCT of this approach. This study provides insight into a new, theory-driven, intervention that targets behaviors directly tied to alcohol-related problems, an outcome that has been difficult to change in college student samples. Consonant with this theme, we found that DRT can be used to increase PBS use, and PBS use was, in turn, broadly protective against alcohol-related problems. These findings offer a roadmap to begin stepped trials in which individuals can be placed into an appropriate condition based on their perceived PBS norms. Previous research has shown that PBS norms are directly tied to PBS use. Given this, the positive message seems particularly important, as it results in immediate and lasting effects for the most high-risk group, those with low PBS norms. That this appears to happen almost immediately after the intervention bodes well for the public health implications of this approach. The growth in PBS observed by those with high PBS norms who received a negatively framed message is also interesting. It is unclear why this growth occurs, but it may be linked to gain vs. loss framed messages. For example, in their classic experiment, Tversky and Kahneman (1981) found that gain (positive) messages are more effective if the outcome is certain, while loss (negative) messages are more effective if the outcome is uncertain. Perhaps the level of certainty or confidence in the social perception of PBS users, or the actual effects of PBS, slows the immediate effects in the negative frame, but also results in growth across time. Overall, more research is needed to flesh out the differential ways in which messages manifest to increase PBS use.

Limitations

The current results should be interpreted within the confines of study limitations. First, the study sample was very homogenous, limiting generalizability to other racial/ethnic groups. Second, this study focused on alcohol-related variables from a weekly perspective; but lacks a detailed assessment of alcohol-related outcomes at the daily level. However, assessing alcohol problems at the daily level using weekly TLFB is complicated by the fact that alcohol-related problems are quite diverse, making assessment taxing using a TLFB method, and problems may not manifest on a specific drinking day, making linking difficult. Future research using methods more amenable to complex daily assessment of problems (i.e., daily diary or ecological momentary assessment) is warranted. Further, as with all TLFB and self-report research, the reporting by participants is subject to potential recall and social desirability biases. Third, attrition was quite high for the weekly surveys and there is a likelihood that differential dropout may have resulted in greater attrition among heavier drinkers. Fourth, it is possible that individuals may believe that PBS is use rather low, depending on their perception of alcohol use. This may affect the robustness of the positive message. This issue could potentially be addressed through a stepped process in which normative feedback is used to correct misperceptions in PBS normative beliefs. However, this would also lead the intervention to favor a negative message, which may also increase reactance. These are issues for future research. Fifth, PBS use was assessed post-treatment. Using post-treatment variables as predictors can introduce bias due to hidden/unknown

confounds jointly associated with PBS use and the various outcomes. This is especially important here, given the missing PBS assessments on non-drinking weeks. Finally, due to a relatively small sample (especially within condition) we are unable to test for indirect effects from the conditions to alcohol-related problems via PBS use and alcohol use. Analyzing such a model would require the specification of latent growth parameters for PBS use, alcohol use, and alcohol-related problems, as well as associations among all of these parameters with each other and with intervention effects. This is further complicated by the different forms of outcomes (i.e., continuous, logistic, and count). However, we were able to show that the intervention increased PBS use, and that PBS was broadly protective against problems. A larger clinical trial to fully examine the effects of the intervention on slopes across time, as well as the effects of the slopes on each other, is warranted. In addition, due to the effects observed in our control group, future trials should include an inactive control group that is not exposed to descriptions of PBS, to differentiate between the effects of a DRT intervention for increasing PBS use and the effects that may be observed following repeated exposure to descriptions of PBS (i.e., monitoring reactivity).

Summary and Conclusions

In conclusion, the current study tested a DRT-based intervention to increase PBS use among college student drinkers. A positive message about individuals who use PBS resulted in immediate increases in PBS for those with low PBS norms. A negative message about individuals who *do not* use PBS resulted in a gradual increase in PBS use across time for those with high PBS norms. PBS use, both at the weekly level and the between-subjects level, was broadly protective against alcohol-related problems. The results suggest that this approach may offer a brief and effective way to increase responsible drinking behaviors. Research examining the distal effects of this intervention are needed.

References

Barnett NP, Murphy JG, Colby SM, & Monti PM (2007). Efficacy of counselor vs. computer-delivered intervention with mandated college students. Addictive Behaviors, 32(11), 2529–2548. doi:10.1016/j.addbeh.2007.06.017 [PubMed: 17707594]

Benton SL, Downey RG, Glider PJ, & Benton SA (2008). College students' norm perception predicts reported use of protective behavioral strategies for alcohol consumption. Journal of Studies on Alcohol and Drugs, 69(6), 859–865. doi:10.15288/jsad.2008.69.859 [PubMed: 18925344]

Benton SL, Schmidt JL, Newton FB, Shin K, Benton SA, & Newton DW (2004). College student protective strategies and drinking consequences. Journal of Studies on Alcohol, 65(1), 115–121. [PubMed: 15000510]

Bewick BM, Trusler K, Mulhern B, Barkham M, & Hill AJ (2008). The feasibility and effectiveness of a web-based personalised feedback and social norms alcohol intervention in UK university students: A randomised control trial. Addictive Behaviors, 33(9), 1192–1198. doi:10.1016/j.addbeh.2008.05.002 [PubMed: 18554819]

Blanton H, Stuart AE, & Van den Eijnden RJJM (2001). An introduction to deviance-regulation theory: The effect of behavioral norms on message framing. Personality and Social Psychology Bulletin, 27(7), 848–858.

Carey KB, Scott-Sheldon LAJ, Carey MP, & DeMartini KS (2007). Individual-level interventions to reduce college student drinking: A meta-analytic review. Addictive Behaviors, 32(11), 2469–2494. [PubMed: 17590277]

Dawson DA, Grant BF, Stinson FS, & Chou PS (2004). Another look at heavy episodic drinking and alcohol use disorders among college and noncollege youth. Journal of Studies on Alcohol, 65(4), 477–488. [PubMed: 15378804]

DeMartini KS, & Carey KB (2009). Correlates of AUDIT risk status for male and female college students. Journal of American College Health, 58(3), 233–239. doi:10.1080/07448480903295342 [PubMed: 19959437]

DeMartini KS, & Carey KB (2012). Optimizing the Use of the AUDIT for Alcohol Screening in College Students. Psychological Assessment. doi:10.1037/a0028519

DeMartini KS, Carey KB, Lao K, & Luciano M (2011). Injunctive norms for alcohol-related consequences and protective behavioral strategies: Effects of gender and year in school. Addictive Behaviors, 36(4), 347–353. doi:10.1016/j.addbeh.2010.12.009 [PubMed: 21236586]

Dvorak RD, Kramer MP, & Stevenson BL (2018). An initial examination of the effects of Deviance Regulation Theory on Normative Perceptions. Journal of Substance Use.

Dvorak RD, Kramer MP, Stevenson BL, Sargent EM, & Kilwein TM (2017). An Application of Deviance Regulation Theory to Reduce Alcohol-related Problems Among College Women During Spring Break. Psychology of Addictive Behaviors.

Dvorak RD, Pearson MR, Neighbors C, Martens M, & Stevenson BL (2016). A Road Paved with Safe Intentions: Increasing Intentions to Use Alcohol Protective Behavioral Strategies via Deviance Regulation Theory. Health Psychology, 35(6), 304–313.

Dvorak RD, Pearson MR, Neighbors C, & Martens MP (2015). Fitting in and standing out: Increasing the use of alcohol protective behavioral strategies with a deviance regulation intervention. Journal of Consulting and Clinical Psychology, 83(3), 482–493. doi:10.1037/a0038902 [PubMed: 25798727]

Dvorak RD, Raeder C, Kramer M, Sargent EM, Stevenson BL, & Helmy M (2018). Using Deviance Regulation Theory to Target Marijuana Use Intentions. Experimental and Clinical Psychopharmacology, 26(1), 29–35. [PubMed: 29389168]

Dvorak RD, Sargent EM, Kilwein TM, Stevenson BL, Kuvaas NJ, & Williams TJ (2014). Alcohol Use and Alcohol-related Consequences: Associations with Emotion Regulation Difficulties. American Journal of Drug and Alcohol Abuse, 40(2), 125–130. [PubMed: 24588419]

Dvorak RD, Simons JS, & Wray TB (2011). Alcohol use and problem severity: Associations with dual systems of self-control. Journal of Studies on Alcohol and Drugs, 72(4), 678–684. [PubMed: 21683050]

Hingson RW, Berson J, & Dowley K (1997). Interventions to reduce college student drinking and related health and social problems In Plant M, Single E, Stockwell T, Plant M, Single E, & Stockwell T (Eds.), Alcohol: Minimising the harm: What works?. (pp. 143–170). London, England: Free Association Books.

Hingson RW, Zha W, & Weitzman ER (2009). 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. Supplement(16), 12–20. [PubMed: 19538908]

Huh D, Mun E-Y, Larimer ME, White HR, Ray AE, Rhew IC, … Atkins DC (2015). Brief Motivational Interventions for College Student Drinking May Not Be as Powerful as We Think: An Individual Participant-Level Data Meta-Analysis. Alcoholism: Clinical and Experimental Research, 39(5), 919–931.

Kenney SR, Napper LE, LaBrie JW, & Martens MP (2014). Examining the efficacy of a brief group protective behavioral strategies skills training alcohol intervention with college women. Psychology of Addictive Behaviors, 28(4), 1041–1051. doi:10.1037/a0038173 [PubMed: 25347024]

LaBrie JW, Napper LE, Grimaldi EM, Kenney SR, & Lac A (2015). The efficacy of a standalone protective behavioral strategies intervention for students accessing mental health services. Prevention Science, 16(5), 663–673. doi:10.1007/s11121-015-0549-8 [PubMed: 25728042]

Larimer ME, Lee CM, Kilmer JR, Fabiano PM, Stark CB, Geisner IM, … Neighbors C (2007). Personalized mailed feedback for college drinking prevention: A randomized clinical trial. Journal of Consulting and Clinical Psychology, 75(2), 285–293. [PubMed: 17469886]

Lewis MA, & Neighbors C (2006). Social Norms Approaches Using Descriptive Drinking Norms Education: A Review of the Research on Personalized Normative Feedback. Journal of American College Health, 54(4), 213–218. doi:10.3200/JACH.54.4.213-218 [PubMed: 16450845]

Lewis MA, & Neighbors C (2007). Optimizing Personalized Normative Feedback: The Use of Gender-Specific Referents. Journal of Studies on Alcohol and Drugs, 68(2), 228–237. [PubMed: 17286341]

Lewis MA, Neighbors C, Oster-Aaland L, Kirkeby BS, & Larimer ME (2007). Indicated prevention for incoming freshmen: Personalized normative feedback and high-risk drinking. Addictive Behaviors, 32(11), 2495–2508. [PubMed: 17658695]

Lojewski R, Rotunda RJ, & Arruda JE (2010). Personalized normative feedback to reduce drinking among college students: A social norms intervention examining gender-based versus standard feedback. Journal of Alcohol and Drug Education, 54(3), 19–40.

Long SJ, & Freese J (2001). Regression models for categorical dependent variables using Stata. College Station, Texas: Stata Press Publications.

Martens MP, Cimini MD, Barr AR, Rivero EM, Vellis PA, Desemone GA, & Horner KJ (2007). Implementing a screening and brief intervention for high-risk drinking in university-based health and mental health care settings: Reductions in alcohol use and correlates of success. Addictive Behaviors, 32(11), 2563–2572. doi:10.1016/j.addbeh.2007.05.005 [PubMed: 17574769]

Martens MP, Ferrier AG, Sheehy MJ, Corbett K, Anderson DA, & Simmons A (2005). Development of the Protective Behavioral Strategies Survey. Journal of Studies on Alcohol, 66(5), 698–705. [PubMed: 16329461]

Martens MP, Martin JL, Littlefield AK, Murphy JG, & Cimini MD (2011). Changes in protective behavioral strategies and alcohol use among college students. Drug and Alcohol Dependence, 118(2–3), 504–507. doi:10.1016/j.drugalcdep.2011.04.020 [PubMed: 21612879]

Martens MP, Smith AE, & Murphy JG (2013). The efficacy of single-component brief motivational interventions among at-risk college drinkers. Journal of Consulting and Clinical Psychology, 81(4), 691–701. doi:10.1037/a0032235 [PubMed: 23506464]

Neighbors C, Larimer ME, & Lewis MA (2004). Targeting Misperceptions of Descriptive Drinking Norms: Efficacy of a Computer-Delivered Personalized Normative Feedback Intervention. Journal of Consulting and Clinical Psychology, 72(3), 434–447. doi:10.1037/0022-006X.72.3.434 [PubMed: 15279527]

Neighbors C, Lewis MA, Atkins DC, Jensen MM, Walter T, Fossos N, … Larimer ME (2010). Efficacy of web-based personalized normative feedback: A two-year randomized controlled trial. Journal of Consulting and Clinical Psychology, 78(6), 898–911. doi:10.1037/a0020766 [PubMed: 20873892]

Pearson MR (2013). Use of alcohol protective behavioral strategies among college students: A critical review. Clinical Psychology Review, 33(8), 1025–1040. doi:10.1016/j.cpr.2013.08.006 [PubMed: 24036089]

Pearson MR, D'Lima GM, & Kelley ML (2013). Daily use of protective behavioral strategies and alcohol-related outcomes among college students. Psychology of Addictive Behaviors, 27(3), 826–831. doi:10.1037/a0032516 [PubMed: 23647156]

Prentice DA, & Miller DT (1993). Pluralistic ignorance and alcohol use on campus: Some consequences of misperceiving the social norm. Journal of Personality and Social Psychology, 64(2), 243–256. [PubMed: 8433272]

Raykov T (2005). Analysis of Longitudinal Studies With Missing Data Using Covariance Structure Modeling With Full-Information Maximum Likelihood. Structural Equation Modeling, 12(3), 493–505.

Reid AE, & Carey KB (2015). Interventions to reduce college student drinking: State of the evidence for mechanisms of behavior change. Clinical Psychology Review, 40, 213–224. doi:10.1016/j.cpr.2015.06.006 [PubMed: 26164065]

Rosenthal R (1994). Parametric measures of effect size. In Cooper H, Hedges LV, Cooper H, & Hedges LV (Eds.), The handbook of research synthesis (pp. 231–244). New York, NY, US: Russell Sage Foundation.

Sales BD, & Folkman S (2000). Ethics in research with human participants. Washington D.C.: American Psychological Association.

Sargent EM, Kilwein TM, Dvorak RD, Looby A, Stevenson BL, & Kramer MP (2018). Deviance Regulation Theory and Drinking Outcomes among Greek-Life Students during Spring Break. Experimental and Clinical Psychopharmacology.

Saunders JB, Aasland OG, Babor TF, & de la Fuente JR (1993). Development of the Alcohol Use Disorders Identification Test (AUDIT): WHO collaborative project on early detection of persons with harmful alcohol consumption: II. Addiction, 88(6), 791–804. doi:10.1111/j.1360-0443.1993.tb02093.x [PubMed: 8329970]

Selya AS, Rose JS, Dierker LC, Hedeker D, & Mermelstein RJ (2012). A Practical Guide to Calculating Cohen's f2, a Measure of Local Effect Size, from PROC MIXED. Frontiers in Psychology, 3(11), 1–6. [PubMed: 22279440]

StataCorp. (2013). Stata Multilevel Mixed-Effects Reference Manusl: Release 13. College Station, TX: Stata Press.

StataCorp. (2017). Stata Statistical Software: Release 15. College Station, TX: Stata Corporation.

Sugarman DE, & Carey KB (2007). The relationship between drinking control strategies and college student alcohol use. Psychology of Addictive Behaviors, 21(3), 338–345. [PubMed: 17874884]

Sugarman DE, & Carey KB (2009). Drink less or drink slower: The effects of instruction on alcohol consumption and drinking control strategy use. Psychology of Addictive Behaviors, 23(4), 577–585. doi:10.1037/a0016580 [PubMed: 20025364]

Treloar H, Martens MP, & McCarthy DM (2015). The Protective Behavioral Strategies Scale-20: Improved content validity of the Serious Harm Reduction subscale. Psychological Assessment, 27(1), 340–346. doi:10.1037/pas0000071 [PubMed: 25558969]

Tversky A, & Kahneman D (1981). The framing of decisions and the psychology of choice. Science, 211(4481), 453–458. doi:10.1126/science.7455683 [PubMed: 7455683]

White A, & Hingson R (2013). The burden of alcohol use: Excessive alcohol consumption and related consequences among college students. Alcohol Research: Current Reviews, 35(2), 201–218. [PubMed: 24881329]

Public Health Relevance:

This study tested the use of Deviance Regulation Theory to increase alcohol protective behavioral strategies (PBS) in a randomized control trial. The results show that this approach can be used to modify PBS and potentially alcohol use and problems via changes in PBS use.

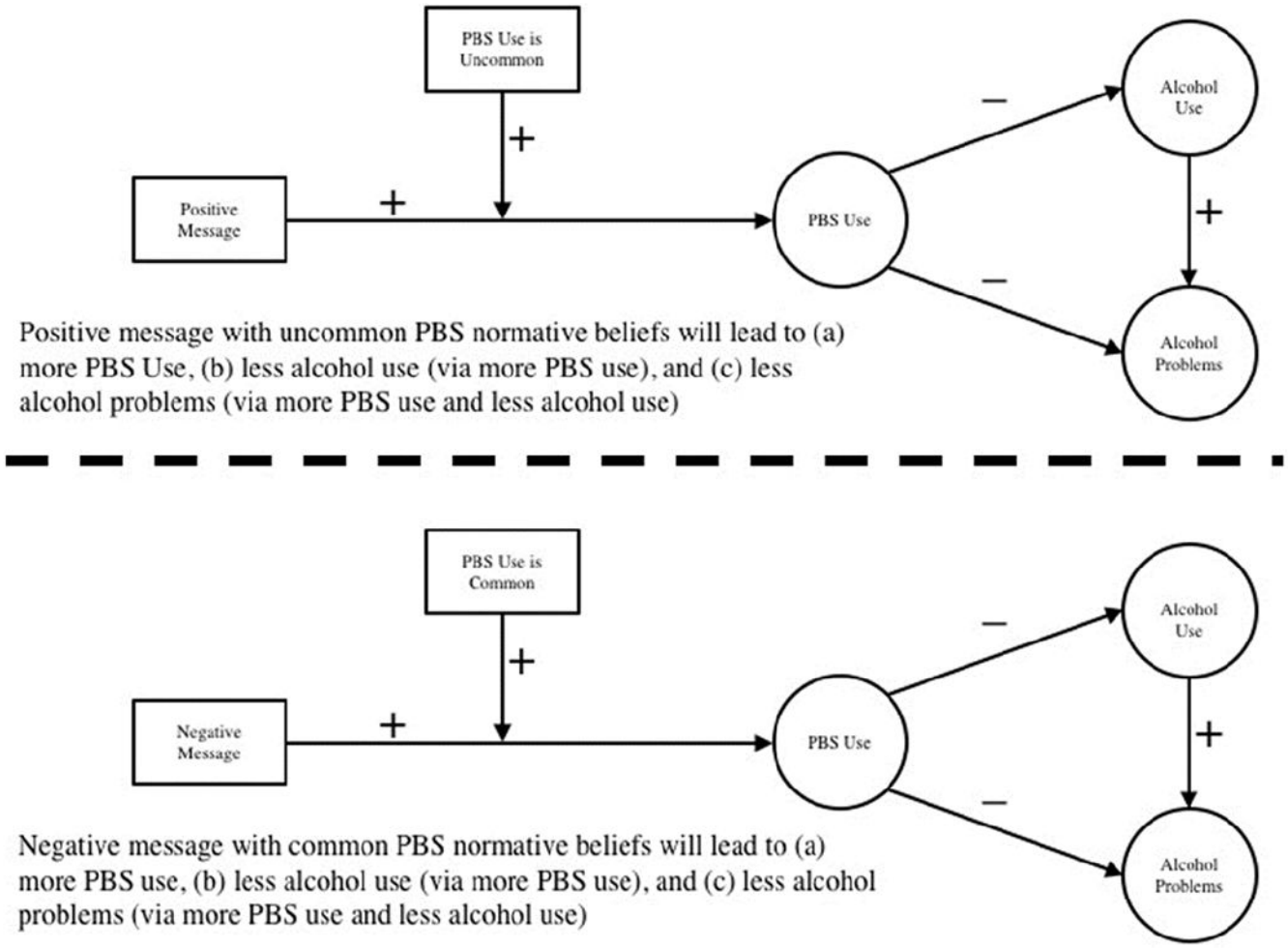

Figure 1.
Theoretical Model

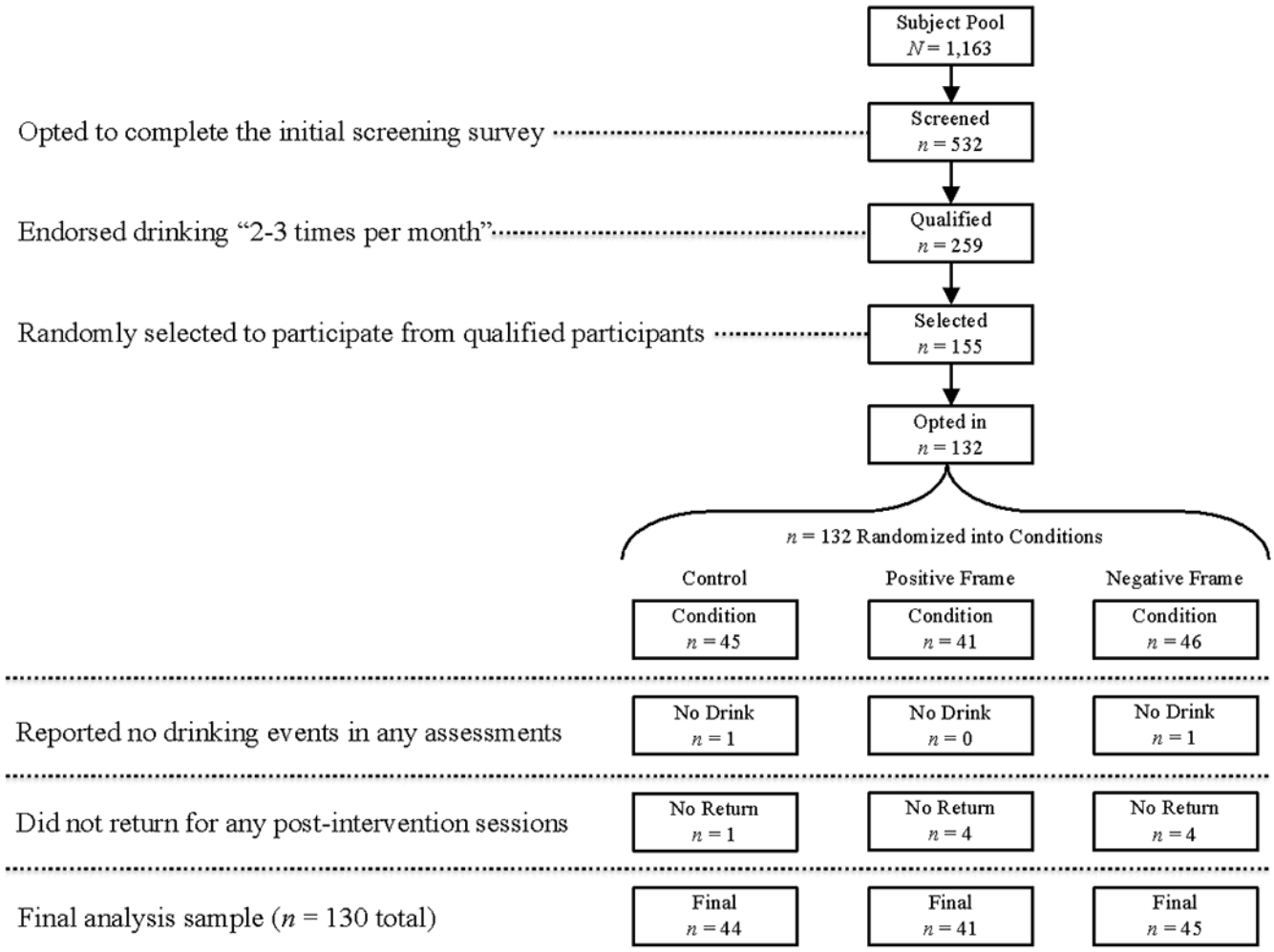

Figure 2.
CONSORT Diagram

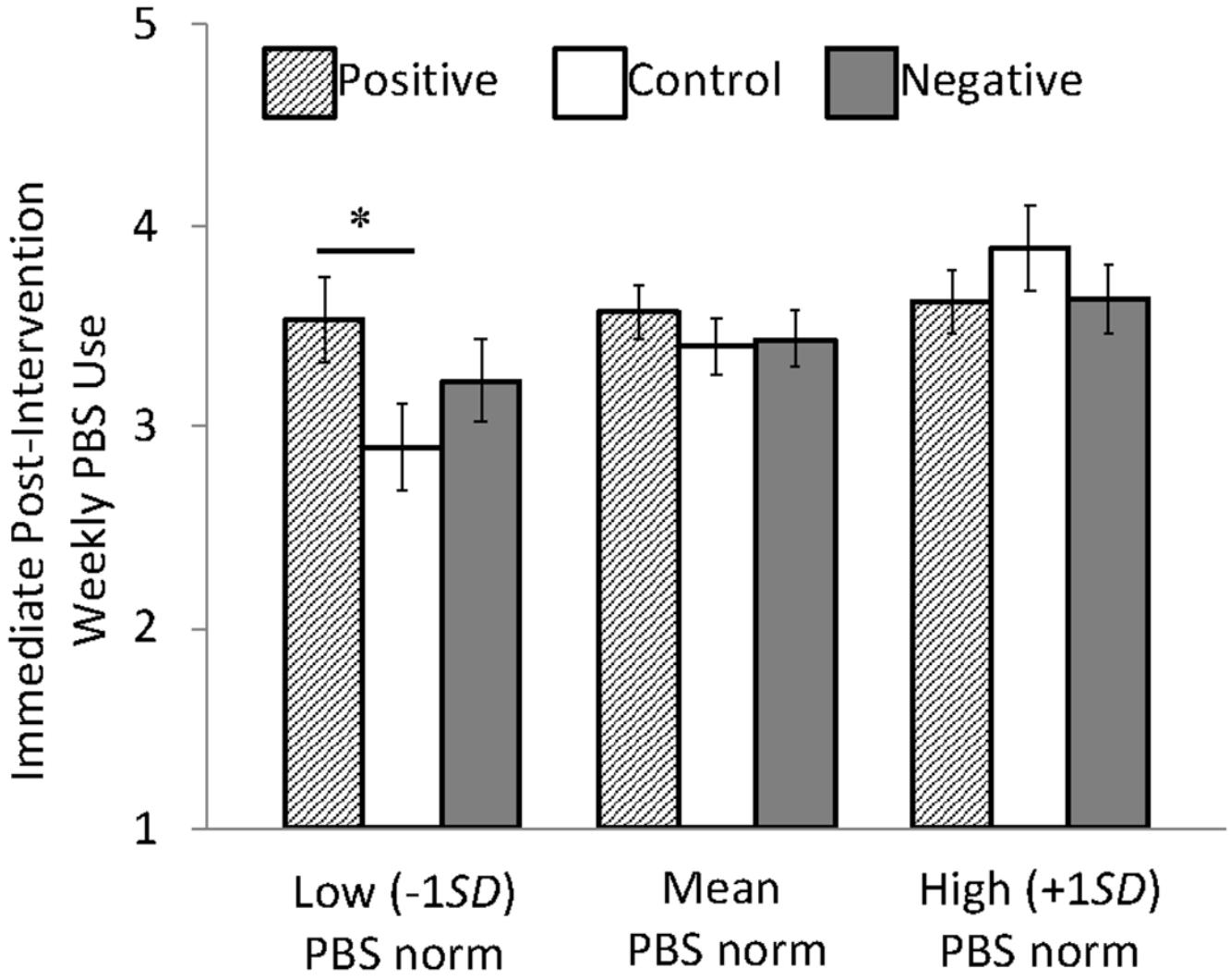

Figure 3.

Differences in mean weekly PBS use across conditions at mean, high (+1*SD*), and low (−1*SD*) levels of PBS Norms immediately post intervention.

Note. PBS = Protective Behavioral Strategies.

*$p < .05$

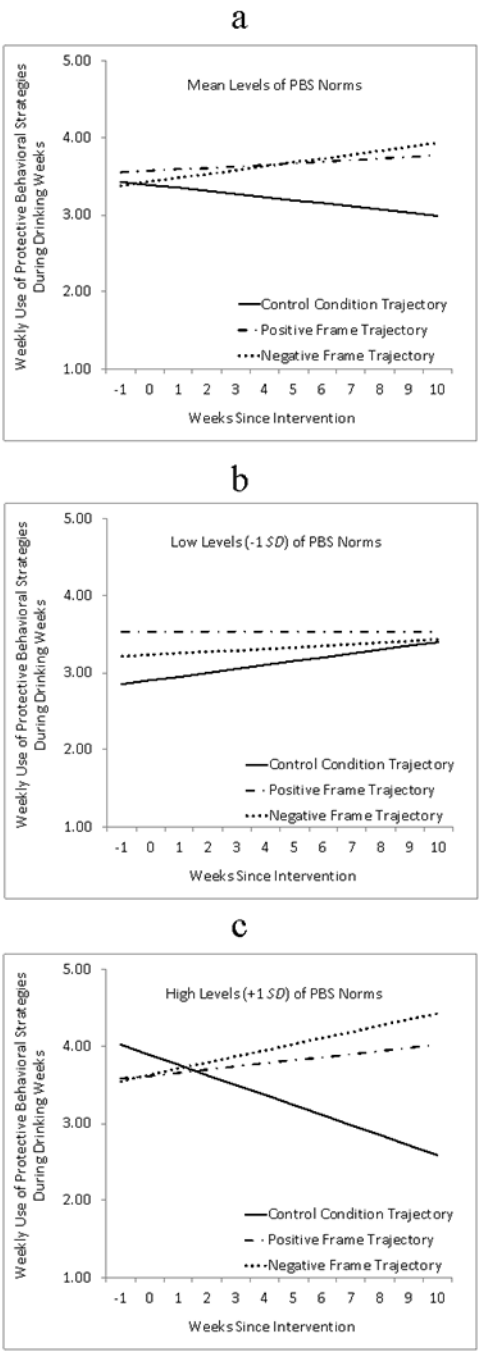

Figure 4.
Trajectories in each condition at varying levels of PBS norms

Table 1.

Descriptive statistics

Variables	Mean	*SD*	Skew	Range	
Pre-intervention Screen					
Age[1]	19.24	1.92	3.40	18	32
Gender[1]	0.28	0.45	0.99	0	1
DDQ-M[1]	9.61	7.43	1.65	0	44
AUDIT score[1]	7.83	4.42	1.47	2	30
PBS norm frequency[1]	3.40	0.63	0.08	1	5
Post-intervention Monitoring[2]					
Person weeks[2]	7.66	1.85	−1.08	1	11
Drinking weeks[2]	4.42	2.79	0.49	1	11
Drinks consumed/drinking week[3]	8.92	7.61	2.08	1	60
PBS use/drinking week[3]	3.52	1.27	−0.58	1	5
Alcohol problems/drinking week[3]	5.73	7.06	1.73	0	39

Note. DDQ-M = Daily Drinking Questionnaire – Modified; PBS = Protective Behavioral Strategies.

[1]Assessed at the between-subjects level (n = 130)

[2]Assessed weekly (n = 856 person-weeks)

[3]Assessed on drinking weeks (n = 621 person-weeks)

Table 2.

Parameter Estimates for multilevel model of weekly PBS use during drinking weeks

Model Parameters		Step 1 *B* (SE)	Step 2 *B* (SE)	Step 3 *B* (SE)
Effects on the Intercept				
Model Intercept	β_{0j}	3.49 *(0.09)	3.43 *(0.15)	3.40 *(0.15)
Age	γ_{01}	-----	−0.09 *(0.05)	−0.09 *(0.05)
Biological sex	γ_{02}	-----	−0.04 (0.19)	−0.01 (0.19)
Condition 1	γ_{03}	-----	0.16 (0.21)	0.18 (0.21)
Condition 2	γ_{04}	-----	−0.00 (0.21)	0.03 (0.21)
PBS Norm	γ_{05}	-----	0.38 *(0.14)	0.80 *(0.28)
Condition 1 × PBS norm	γ_{06}	-----	-----	−0.74 *(0.33)
Condition 2 × PBS norm	γ_{07}	-----	-----	−0.47 (0.31)
Effects on the Time Slope				
Time (in weeks)	β_{1j}	-----	−0.06 *(0.03)	−0.04 *(0.03)
Age	γ_{11}	-----	−0.01 (0.01)	−0.01 (0.01)
Biological sex	γ_{12}	-----	−0.03 (0.04)	−0.03 (0.04)
Condition 1	γ_{13}	-----	0.08 (0.04)	0.06 (0.04)
Condition 2	γ_{14}	-----	0.12 *(0.04)	0.09 *(0.04)
PBS Norm	γ_{15}	-----	−0.01 (0.03)	−0.15 *(0.06)
Condition 1 × PBS norm	γ_{16}	-----	-----	0.19 *(0.08)
Condition 2 × PBS norm	γ_{17}	-----	-----	0.18 *(0.07)
Variance Components				
Residual σ^2	r_{ij}	0.82 *(0.09)	0.76 *(0.06)	0.74 *(0.09)
Intercept random σ^2	U_{0j}	0.82 *(0.11)	0.62 *(0.11)	0.63 *(0.10)
Time slope random σ^2	U_{1j}	-----	0.01 *(0.00)	0.01 *(0.00)

Note. PBS = Protective Behavioral Strategies. Condition 1 coded: 0 = control/negative frame, 1 = positive frame. Condition 2 coded: 0 = control/positive frame, 1 = negative frame. Biological sex (0= female, 1 = male). Person-weeks in analyses were $n = 621$

* $p \leq .05$

Table 3.

Parameter Estimates for multilevel model of drinks consumed during drinking weeks

		Centered at Week 2 Immediately Post-Intervention				Centered at Study Midpoint
Model Parameter		**Step 1 IRR (SE)**	**Step 2 IRR (SE)**	**Step 3 IRR (SE)**	**Step 4 IRR (SE)**	**Step 4 IRR (SE)**
Effects on the Intercept						
Model Intercept	β_{0j}	7.39 *(0.42)	6.72 *(0.68)	6.92 *(0.64)	6.75 *(0.63)	6.59 *(0.63)
Age	γ_{01}	-----	0.99 (0.02)	0.99 (0.03)	0.99 (0.03)	0.99 (0.03)
Biological sex	γ_{02}	-----	1.48 *(0.20)	1.49 *(0.20)	1.44 *(0.20)	1.35 *(0.16)
Condition 1	γ_{03}	-----	1.13 (0.16)	1.11 (0.15)	1.16 (0.15)	1.22 (0.15)
Condition 2	γ_{04}	-----	1.22 (0.17)	1.19 (0.16)	1.17 (0.16)	1.23 (0.15)
PBS Norm	γ_{05}	-----	0.98 (0.08)	0.60 *(0.10)	0.62 *(0.10)	0.53 *(0.09)
Condition 1 × PBS norm	γ_{06}	-----	-----	1.72 *(0.41)	1.70 *(0.39)	2.07 *(0.42)
Condition 2 × PBS norm	γ_{07}	-----	-----	2.01 *(0.40)	1.89 *(0.38)	2.24 *(0.42)
Weekly PBS use	β_{2j}	-----	-----	-----	0.99 (0.04)	0.99 (0.04)
Average PBS use	γ_{08}	-----	-----	-----	0.90 *(0.05)	0.90 *(0.05)
Effects on the Time Slope						
Time (in weeks)	β_{1j}	-----	0.99 (0.02)	0.99 (0.02)	0.99 (0.02)	0.99 (0.02)
Age	γ_{11}	-----	0.99 (0.01)	0.99 (0.01)	0.99 (0.01)	0.99 (0.01)
Biological Sex	γ_{12}	-----	0.98 (0.02)	0.98 (0.02)	0.99 (0.02)	0.99 (0.02)
Condition 1	γ_{13}	-----	1.01 (0.02)	1.01 (0.02)	1.01 (0.02)	1.01 (0.02)
Condition 2	γ_{14}	-----	1.01 (0.02)	1.00 (0.02)	1.01 (0.02)	1.01 (0.02)
PBS Norm	γ_{15}	-----	1.00 (0.01)	0.98 (0.03)	0.96 (0.03)	0.96 (0.03)
Condition 1 × PBS norm	γ_{16}	-----	-----	1.04 (0.04)	1.05 (0.04)	1.05 (0.04)
Condition 2 × PBS norm	γ_{17}	-----	-----	1.02 (0.04)	1.04 (0.04)	1.04 (0.04)
Variance Component						
Intercept random σ^2	U_{0j}	0.31 *(0.05)	0.62 *(0.11)	0.63 *(0.10)	0.20 *(0.04)	0.20 *(0.04)

Note. PBS = Protective Behavioral Strategies. Condition 1 coded: 0 = control/negative frame, 1 = positive frame. Condition 2 coded: 0 = control/positive frame, 1 = negative frame. Biological sex (0= female, 1 = male). Person-weeks in analyses were $n = 621$

* $p \leq .05$

Table 4.

Parameter Estimates for multilevel model of alcohol problems during drinking weeks

		Centered at Week 1 Immediately Post-Intervention				Centered at Study Midpoint
Model Parameter		**Step 1 IRR (SE)**	**Step 2 IRR (SE)**	**Step 3 IRR (SE)**	**Step 4 IRR (SE)**	**Step 4 IRR (SE)**
Effects on the Intercept						
Model Intercept	β_{0j}	1.68 *(0.21)	2.93 *(0.53)	2.96 *(0.53)	2.82 *(0.50)	1.38 (0.25)
Age	γ_{01}	-----	0.95 (0.05)	0.95 (0.05)	0.93 (0.05)	0.93 (0.05)
Biological sex	γ_{02}	-----	0.56 *(0.13)	0.54 *(0.13)	0.54 *(0.13)	0.54 *(0.13)
Condition 1	γ_{03}	-----	1.27 (0.32)	1.26 (0.31)	1.36 (0.33)	1.36 (0.33)
Condition 2	γ_{04}	-----	1.18 (0.29)	1.16 (0.28)	1.22 (0.29)	1.22 (0.29)
PBS norm	γ_{05}	-----	0.91 (0.14)	0.66 (0.22)	0.81 (0.26)	0.81 (0.26)
Condition 1 × PBS norm	γ_{06}	-----	-----	1.90 (0.86)	1.64 (0.73)	1.64 (0.73)
Condition 2 × PBS norm	γ_{07}	-----	-----	1.36 (0.55)	1.26 (0.49)	1.26 (0.49)
Weekly alcohol use	β_{2j}	-----	1.05 *(0.01)	1.05 *(0.01)	1.06 *(0.01)	1.06 *(0.01)
Average alcohol use	γ_{08}	-----	1.10 *(0.03)	1.10 *(0.03)	1.10 *(0.03)	1.17 *(0.03)
Weekly PBS use	β_{3j}	-----	-----	-----	0.84 *(0.04)	0.84 *(0.04)
Average PBS use	γ_{09}	-----	-----	-----	0.75 *(0.08)	0.75 *(0.08)
Effects on the Time Slope						
Time (in weeks)	β_{1j}	-----	0.85 *(0.02)	0.84 *(0.02)	0.84 *(0.03)	0.84 *(0.03)
Age	γ_{11}	-----	1.00 (0.01)	1.00 (0.01)	1.00 (0.01)	1.00 (0.01)
Biological Sex	γ_{12}	-----	0.90 *(0.04)	0.89 *(0.04)	0.88 *(0.04)	0.88 *(0.04)
Condition 1	γ_{13}	-----	1.02 (0.04)	1.02 (0.04)	1.03 (0.04)	1.03 (0.04)
Condition 2	γ_{14}	-----	1.01 (0.04)	1.01 (0.04)	1.02 (0.04)	1.02 (0.04)
PBS Norm	γ_{15}	-----	1.01 (0.02)	1.02 (0.06)	0.98 (0.06)	0.98 (0.06)
Condition 1 × PBS norm	γ_{16}	-----	-----	1.01 (0.08)	1.06 (0.08)	1.06 (0.08)
Condition 2 × PBS norm	γ_{17}	-----	-----	0.97 (0.06)	1.02 (0.07)	1.02 (0.07)
Average alcohol use	γ_{18}		1.01 *(0.00)	1.01 *(0.00)	1.01 *(0.00)	1.01 *(0.00)
Variance Component						
Intercept Random σ^2	U_{0j}	1.18 *(0.26)	0.91 *(0.16)	0.90 *(0.16)	0.84 *(0.15)	0.84 *(0.15)

Note. PBS = Protective Behavioral Strategies. Condition 1 coded: 0 = control/negative frame, 1 = positive frame. Condition 2 coded: 0 = control/positive frame, 1 = negative frame. Biological sex (0= female, 1 = male). Person-weeks in analyses were $n = 621$

*$p \leq .05$