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Personalized Normative Feedback for Heavy Drinking: An Application of Deviance Regulation Theory

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Abstract

Deviance Regulation Theory (DRT) proposes that individuals regulate their behavior to be in line with the behaviors of others. Specifically, individuals desire to stand out in positive way and not stand out in a negative way. DRT has been successfully applied to encourage other health behaviors and offers a unique method to utilize both injunctive norms in combination with descriptive norms in brief alcohol interventions. This randomized controlled trial evaluated a computer-delivered, norms-based personalized feedback intervention which systematically varied the focus on whether specific drinking behaviors were described as common or uncommon (a descriptive norm), whether the drinking behaviors were healthy versus unhealthy, and whether the drinking behaviors were positively or negatively framed (an injunctive norm). Nine-hundred and fifty-nine college drinkers completed baseline, three-month, and six-month follow-up assessments. Results indicated messages focusing on unhealthy drinking behaviors, particularly when described as uncommon, were most effective in reducing drinking and alcohol-related problems over time. This research utilizes deviance regulation theory as a way of improving personalized normative feedback by elucidating how to construct messages for brief interventions based on descriptive characteristics associated with specific target drinking behaviors in combination with perceptions of prevalence and acceptability of such drinking behaviors (an injunctive norm).

Keywords

alcohol; personalized feedback; brief intervention; social norms; deviance regulation

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A Deviance Regulation Theory Application of Personalized Normative Feedback Intervention for Heavy Drinking College Students

College Drinking

Research suggests college student drinking continues to be widespread and problematic. Recent prevalence estimates suggest that 80% of college students reported drinking in the past year and 63% reported drinking in the past 30 days (Johnston, O'Malley, Bachman, Schulenberg, & Miech, 2016). Engaging in heavy drinking among college students is associated with a number of negative alcohol-related consequences, such as increased morbidity and mortality due to alcohol-impaired driving and unintentional injuries (Hingson, Zha, & Weitzman, 2009; Mundt, Zakletskaia, & Fleming, 2009; Turner & Shu, 2004), poor academic performance (Wechsler, Lee, Kuo, & Lee, 2000), problems with authorities and legal difficulties (Hingson, Heeren, Zakocs, Kopstein, & Wechsler, 2002; Thompson, 2007), risky sexual behavior (Goldstein et al., 2007; Scott-Sheldon et al., 2010), sexual assault (Abbey & McAuslan, 2004; Mouilso et al., 2012; Palmer et al., 2010), physical assault (Hingson et al., 2009; Saewyc et al., 2009), eating disorders (Dunn, Larimer, & Neighbors, 2002), and depression (Geisner, Larimer, & Neighbors, 2004). Given the substantial costs of heavy drinking, researchers have focused on developing, evaluating, and disseminating brief interventions.

Personalized Normative Feedback (PNF) Interventions for College Drinking

Personalized feedback interventions (PFIs) have been one of the most robust methods for reducing alcohol consumption among college students, particularly among heavier drinkers (Carey, Scott-Sheldon, Carey, & DeMartini, 2007; Larimer & Cronce, 2007; Walters & Neighbors, 2005). PFIs aim to reduce drinking by providing feedback to recipients that is personalized and often includes multiple components, including feedback comparing the recipients own drinking and perceived norms to actual norms (i.e, personalized normative feedback). Other commonly included components include feedback regarding alcohol-related consequences that the recipient has experienced; alcohol expectancies; personalized BAC charts; risk factors (e.g., tolerance, family history, personalized blood alcohol content information); readiness to change; and protective behavioral strategies, among others; Walters & Neighbors, 2005; Miller et al., 2012).

In 61 trials evaluating 22 intervention mechanisms for PFIs, changes in norms were the strongest and most consistently supported (Reid & Carey, 2015). Accordingly, a number of studies have evaluated PNF as a stand-alone intervention without including additional components that are often included in PFIs. PNF interventions function by asking participants to provide their own drinking and estimate the drinking behaviors of the "typical college student" (a descriptive norm); the participants' drinking and their perceived descriptive norms are then compared to actual campus drinking norms. Thus, PNF has been found to be successful in reducing the average amount of alcohol consumed by students (e.g., Cronce & Larimer, 2011; Dotson, Dunn, & Bowers, 2015; Larimer & Cronce, 2002, 2007; Larimer et al., 2007; Miller et al., 2013; Neighbors, Larimer, & Lewis, 2004; Walters & Neighbors, 2005) by drawing attention to the discrepancies between the individual's

perceived descriptive norms, which are invariably inflated, and actual drinking norms (Borsari & Carey, 2003; Lewis & Neighbors, 2004, 2006).

Although changes in perceived descriptive norms have been established as a mechanism of behavioral change in PNF interventions, for the most part, alcohol-researchers have yet to develop an unequivocal PNF intervention involving injunctive norms (e.g., perceptions regarding how peers perceive drinking; Prince, Maisto, Rice, S, & Carey, 2015; Schroeder & Prentice, 1998), even though injunctive norms in conjunction with descriptive norms have been found to be effective in addressing other behaviors (e.g., Cialdini et al., 2006; Mahler, Kulik, Butler, Gerrard, & Gibbons, 2008; Mollen, Rimal, Ruiter, & Kok, 2013; Panagopoulos, Larimer, & Condon 2014). As such, the current study proposes utilizing principles of deviance regulation theory as an innovative way of framing injunctive norms messages in conjunction with descriptive norms in order to improve current PNF interventions.

Deviance Regulation Theory

Theories of social influence have historically emphasized the desire to be similar to others and/or not be different from others as dominant factors underlying social behavior. Deviance regulation theory (DRT; Blanton & Christie, 2003), on the other hand, proposes a broader view of motivation, resting on the assumption that people make the decision on whether to engage in or refrain from engaging in distinctive behaviors based upon their perceptions about whether they will be viewed positively by others or avoid being viewed negatively by others. Specifically, DRT suggests that individuals' intentions, motivations, and behavior vary as a function of both perceived base rates of a given behavior (a descriptive norm), and evaluations of individuals who do (or do not) engage in that behavior (an injunctive norm). Individuals are motivated to engage in behaviors that are different from others when they believe that doing so should *increase* the likelihood of being *viewed positively*. Conversely, individuals are motivated to *avoid* engaging in distinctive behaviors that would cause them to be viewed as being different from others when they believe that doing so would *increase* the likelihood of being *viewed negatively*. Deviance Regulation Theory, which can be utilized to guide persuasive messages using both injunctive and descriptive norms in novel, personalized ways, has been demonstrated to be successful in motivating individuals to engage in a wide variety of health-related behaviors (Blanton & Burkley, 2008; Blanton & Christie, 2003; Hall & Blanton, 2009). Thus, the theory offers promise in terms of integration for brief-alcohol-related interventions aimed at reducing of drinking-related outcomes.

Moreover, DRT posits that persuasive messages aimed at influencing individuals to engage in or abstain from distinctive behaviors should be framed either positively or negatively based upon the descriptive norms/base rates of the action or perceived injunctive norms of the group surrounding the given behavior. When the perceived base rate is low and the group endorses this behavior, informing individuals that others who partake in that behavior (the minority) are judged more favorably should increase an individual's motivation to be unique in a way that would positively distinguish them from others. However, notifying individuals that those who do not engage in the behavior (the majority) are judged more negatively

should not automatically influence individuals' motivation to be unique. Conversely, when the perceived base rate is high and the group perceives those who do not engage in this behavior unfavorably, individuals should be motivated to refrain from engaging in the distinctive behavior, in an effort to avoid being negatively distinguished from others. On the other hand, alerting individuals that those who engage in the behavior (the majority) are judged more positively should not necessarily increase motivation to engage in the behavior.

DRT postulates are consistent with classic attribution perspectives (Jones & Davis, 1965; Kelley, 1973) by suggesting that distinctive actions (i.e., counter-normative alternatives) receive greater weight in impression formation and are therefore, more strongly considered in the regulation of social behaviors. Behaving the same way everyone else does has little impact on one's social identity. Conversely, distinctive behaviors, which prompt others to evaluate a person either positively or negatively, often directly impact the person's sense of identity and self-worth (Leary, Schreindorfer, & Haupt, 1995).

DRT has been found to predict behavioral intentions for engaging in several different types of health behaviors, including flu vaccinations, hand washing, condom use, and rejection of sexual advances (Blanton & Burkley, 2008; Blanton & Christie, 2003; Hall & Blanton, 2009). Specifically, Blanton et al. (2001) conducted several experiments testing hypotheses derived from DRT. One study randomly assigned participants to receive information that getting a flu shot was common (i.e., most students get flu shots) or uncommon (i.e., few students get flu shots). Some students received positively-framed, persuasive messages (i.e., getting a flu shot is good) whereas others received negatively-framed, persuasive messages (i.e., not getting a flu shot is bad). Although these studies did not explicitly study whether the behavior was portrayed as healthy versus unhealthy (getting a flu shot is healthy whereas not using a condom is unhealthy), this idea was implicitly conveyed; however, systematic manipulation of this dimension has not been thoroughly tested to date. Consistent with the DRT framework, the two conditions most strongly associated with intentions to get a flu shot were the common (normative), negatively-framed condition (i.e., most students get flu shots and not getting a flu shot is unhealthy and bad) and the uncommon (non-normative), positively-framed condition (i.e., few students get flu shots and getting a flu shot is healthy and good).

Recent studies have specifically linked DRT to drinking among college students (Dvorak, Pearson, Neighbors, & Martens, 2015; Dvorak et al., 2016; Ferrer, Dillard, & Klein, 2012; Lewis et al., 2010). Dvorak and colleagues have conducted a series of studies incorporating DRT in an alcohol intervention context (Dvorak et al, 2015; 2016; Sargent et al, 2018). In these studies participants were randomly assigned to receive either positively or negatively framed messages about protective behavior strategies (PBS). Findings have generally shown positively framed messages about protective behavior strategies (e.g., "those who use PBS are viewed favorably") result in better outcomes for participants who perceive PBS use as uncommon. Whereas, negatively framed strategies have more effective among those who believe PBS use is common. In these studies, prevalence or perceived prevalence of the behavior was not manipulated. Results provided good support for the theory in that better outcomes were obtained for participants in the framing condition that matched their norms. In terms of practical application however, the intervention also resulted in worse outcomes

for participants whose perceived norms were incongruent with in the framing condition they were assigned to.

Current Research

DRT is one of the most novel and innovative perspectives on social influence, offering straightforward and theoretically rich hypotheses about how to frame norms-based feedback for brief alcohol interventions. As such, the current study utilized DRT as a theoretical lens from which to integrate injunctive norms in combination with descriptive norms while simultaneously evaluating the framing of such personalized normative feedback messages as predictors of intervention efficacy. Specifically, we tested whether DRT, injunctive plus descriptive norms-based feedback would be more effective as a function of the (a) base rate of the drinking behavior (i.e., common vs. uncommon; a descriptive norm), (b) presentation of the behavior as healthy or unhealthy, and (c) message framing (i.e., where the distinctive behavior is perceived by others as being positive vs. negative; an injunctive norm). The DRT feedback also included standard descriptive PNF feedback for the drinking behavior referenced (e.g., moderate drinking, drinking shots, abstaining from drinking, and drinking more than 4 drinks in one sitting) in the given condition (e.g., students self-reported drinking is juxtaposed with what they think their peers drink and the actual campus-wide drinking norms).

In line with DRT, people should be motivated to engage in a distinctive behavior or resist engaging in the behavior based upon whether they believe it would make them appear favorably or unfavorably to others. Thus, we hypothesized that participants in the Common/ Healthy/ Negatively framed (CHN) and the Uncommon/Unhealthy/Positively framed (UUP) condition would reduce their drinking because the message conveyed was that engaging in heavy drinking would negatively distinguish them. Moreover, we expected that those in the Common/Unhealthy/Positively framed condition (CUP) and the Uncommon/Healthy/ Positively framed (UHP) condition would reduce their drinking because the message conveyed that they would be positively distinguishing themselves from others. The other four combinations: Common/Healthy/Positive; Common/Unhealthy/Negative; Uncommon/ Healthy/Negative; and Uncommon/Unhealthy/Positive were expected to be less effective in reducing drinking, since the resulting messages conveyed in these four conditions do not emphasize distinction from others.

Method

Participants

Participant flow through the study is presented in the CONSORT table in Figure 1. Participants included 959 undergraduates (54% female) who were between the ages of 18 and 26 and met heavy drinking criteria, defined as individuals who reported drinking 4/5 drinks on one occasion for women and men respectively in the last month. Students were recruited from a large southern university with a mean age of 21.47 years (*SD*=2.04). Participants reported the following racial and ethnic backgrounds: 27% White/Caucasian, 24% Asian, 18% Black/African American, and 31% Hispanic.

Participant recruitment and screening—Lists of all registered students during the summer, fall, spring, and summer semesters from 2013–2014 were obtained. A total random sample of 31,294 students were selected from the larger student population over a one year period and were recruited via email to participate in a brief, online screening survey. In order to be eligible for the longitudinal trial, participants had to be between 18 and 26 years old and report drinking at least 4/5 drinks on one occasion for women/men in the past month. Of the invited students, 12,471 (40%) completed the screening assessment, and 2,970 (24%) met screening criteria and were invited to participate in the longitudinal study. Of those who were eligible, 959 (32%) completed the baseline assessment and intervention procedure. There were 774 participants (81%) who completed the three-month follow-up and 758 participants (79%) who completed the six-month follow-up. A Federal Certificate of Confidentiality (CC-AA-12–33) was obtained for this research. The current project was approved by the university's institutional review board.

Attrition—Attrition was examined as a function of baseline drinking and group assignment. For each assessment participants were counted as completers only if they completed at least one outcome measure. In the follow-up assessments, of the 959 respondents, 789 (82.2%) participants complete the three-month follow-up and 766 (79.9%) completed the six-month follow-up. Differential attrition, defined by missing either the 3-month or 6 month follow ups or both follow-up assessments (n=256; 26.7%), was examined using logistic regression. Attrition was examined as a function of baseline drinking, alcohol-related problems, treatment group, and demographic variables (age, race/ethnicity, and sex). Higher baseline alcohol problems were associated with a greater likelihood of dropping out, $Z = 2.32$, $p = .02$, $OR = 1.024$. Marginal proportions of dropout for RAPI scores of 0, 5, 10, and 20 were 22.2%, 24.36%, 26.6%, and 31.5%, respectively. Attrition was not significantly associated with drinking, condition, age, race/ethnicity, or sex.

Design, randomization, and power—The design was a 2 (Common vs. Uncommon) × 2 (Healthy vs. Unhealthy) × 2 (Positive vs. Negative frame) + 1 (Attention control feedback). After completing the baseline survey, participants were automatically randomized to one of nine conditions: Common/Healthy/ Negative (n=105; CHN); Common/Unhealthy/ Positive (n=108; CUP); Uncommon/Healthy/Positive (n=105; UHP); Uncommon/ Unhealthy/Negative (n=106; UUN); Common/ Healthy/Positive (n=108; CHP); Common/ Unhealthy/Negative (n=107; CHN); Uncommon/Healthy/Negative (n=106; UHN); Uncommon/Unhealthy/Positive (n=107; UUP); and Attention Control (n=107; Control). The DRT feedback also included standard descriptive PNF feedback for the drinking behavior referenced in the given condition. For instance, in the uncommon, healthy conditions where abstinence was the focus, participants received feedback comparing their own drinking, their perception of the proportion of abstainers on campus, and the actual proportion of abstainers on campus. Sampling was stratified by gender and drinking (10 or more drinks per week versus 9 or less drinks as calculated by the Daily Drinking Questionnaire; See measures section).

Power analyses were conducted using the G-power software application (Faul, Erdfelder, Buchner, & Lang, 2009; Faul, Erdfelder, Lang, & Buchner, 2007) and were based on the

ability to detect univariate intervention effects on primary outcomes at three- and six-month follow-ups. Based on our previous intervention studies utilizing PNF among heavy drinking college students, we estimated that a sample of 1000 with maximum attrition of 20% (N=800) would yield adequate power to detect differences between the conditions with small to medium effect sizes (Cohen, 1992).

Procedures

Screening was conducted by sending emails to randomly selected students based on campus registrar's lists. Students who were eligible to participate in the longitudinal study were invited to schedule an in-person lab visit for baseline and intervention at the end of their screening survey. Trained research assistants met the participants in the lab and assisted them on the baseline and intervention procedures. Once oriented, participants completed the baseline survey on a computer and then they received either: CHN, CUP, UHP, UUN, CHP, CHN, UHN, UUP, or Control. After reviewing their feedback, participants completed a post-intervention survey and were debriefed by the research assistants. Participants also received a printed copy of their feedback to take with them.

Following completion of the baseline assessment and feedback, students were contacted three- and six-months later to complete follow-up surveys online. Participants who provided approval were contacted via phone calls, text messages, and emails to remind them to complete the assessments. Participants were paid $25 for completing each of the baseline, three-month, and six-month follow-up assessments. Participants completed consent procedures prior to the baseline assessment and were instructed that the baseline assessment would take approximately 60 minutes and both follow-up assessments would each take 60 minutes.

Intervention Feedback

Participants received one of eight feedback messages, four of which were consistent with DRT and four of which were inconsistent with the theory.

Consistent with DRT

Common/Healthy/Negative (CHN): Participants in the CHN condition received norms-based, personalized normative feedback that was consistent with DRT. Specifically, this feedback emphasized that most students at their university drink in moderation, demonstrating a common, healthy behavior. The feedback further presented information suggesting that students who do not drink in moderation and those who drink heavily are viewed negatively by most students at their university (i.e., careless, immature, and not very smart). The feedback suggests that those who drink more than moderate drinkers are viewed negatively by their fellow students; thus, the implicit message is that, in order to avoid negative evaluations by their peers, they should refrain from negatively distinguishing themselves from others

Common/Unhealthy/Positive (CUP): Participants in the CUP condition received feedback emphasizing that most students at their university report drinking shots and drinking shots is a common and unhealthy behavior. The feedback also reported that students who drink in

moderation are viewed more positively by most students at their university (i.e., smarter, more popular, and more mature). Thus, drinking in moderation is found to be acceptable by most other students whereas not drinking is moderation (e.g., drinking shots) is viewed as less acceptable by one's peers; the implicit message was that participants should refrain from the distinctive behavior of drinking shots/heavy drinking so that they would be positively distinguishing themselves from others.

Uncommon/Healthy/Positive (UHP): Participants in the UHP condition received feedback stating abstaining from alcohol is an uncommon, healthy behavior. The feedback suggested that drinking in moderation (e.g., students who are moderate drinkers are smarter, more popular, and more mature) is viewed more positively by most students at their university. The implicit message was that heavier drinkers should engage in the distinctive behavior of abstaining or reducing their drinking so that they would be positively distinguishing themselves from others.

Uncommon/Unhealthy/Negative (UUN): Participants in the UUN condition received feedback suggesting that few students drink 4 or more drinks in one sitting; therefore, heavy drinking is an uncommon and unhealthy behavior. The feedback further suggested that students who drink heavily are viewed negatively by most students at their university (e.g., not very mature, smart, or popular). Thus, the implicit message was that participants should refrain from engaging in heavy drinking because doing so would negatively distinguish them from their peers.

Not consistent with DRT

Common/Healthy/Positive (CHP): Feedback in the CHP condition stated that most students at their university drink in moderation. Thus, drinking in moderation is a common, healthy behavior. For the positive frame piece, feedback also included most students at their university think that other students who drink in moderation are viewed positively (i.e., smarter, more popular, and more mature). The implicit message was that students should engage in moderate drinking because it would make them similar to everyone else.

Common/Unhealthy/Negative (CUN): Participants who received feedback in the CUN condition were presented information suggesting that drinking shots is a common, unhealthy behavior that most students at their university have engaged in occasionally. Feedback also stated that most students at their university think others who drink heavily are not very smart, not very mature, and are careless. The implicit message was that the participants should refrain from heavy drinking because it would make them similar to everyone else.

Uncommon/Healthy/Negative (UHN): The UHN condition contained feedback suggesting that few students at their university report never drinking, or abstaining from alcohol use. Thus, abstinence from drinking is an uncommon and healthy behavior. Feedback also suggested that the peers at their university think others who drink heavily are careless, not very smart, and not very mature. Thus, the implicit message was that participants should refrain from heavier drinking/or engage in moderate drinking because it would make them similar to everyone else.

Uncommon/Unhealthy/Positive (UUP): For the UUP condition, participants received feedback illustrating that few students at their university drink four or more drinks per occasion, (an uncommon and unhealthy behavior). Feedback further detailed that most students at their university think others who drink in moderation are smart, popular, and mature. Thus, the implicit message was that participants should engage in moderate drinking because it would make them similar to everyone else.

Attention Control—Participants in the attention control condition received feedback about technology usage. This feedback depicted pictures and text about college students' texting and use of social networking sites. In particular, the feedback stated that most students at their university text and use Facebook, and that students at their university believe that being technologically sound is good.

Measures

Alcohol consumption—Participants' drinking was evaluated using a 30-day Timeline Follow-Back Questionnaire (TLFB) which was presented as a calendar of the 30 days prior to the day they in which they were completing the assessment (Pedersen, Grow, Duncan, Neighbors, & Larimer, 2012; Sobell & Sobell, 2000). The calendar included Federal, State, and other holidays as well as common religious observances. Within the calendar, participants indicated the number of drinks they consumed on each day in which they consumed alcohol. Additional alcohol consumption measures included the Daily Drinking Questionnaire (Collins, Parks, & Marlatt, 1985; Dimeff, Baer, Kivlahan, & Marlatt, 1999) which measures typical number of drinks per week in the past three months and the Quantity/Frequency scale (Dimeff et al., 1999), which includes items assessing peak number of drinks in the past month and frequency of drinking in the past month.

Alcohol-related problems—A modified version of the Rutgers Alcohol Problems Index (RAPI; White & Labouvie, 1989) was used to assess how often participants experienced 25 alcohol-related problems over the previous three months. The RAPI was modified to include two items related to driving after drinking (e.g., "drove after having two drinks" and "drove after having four drinks"). Participants responded to each of the statements using a 5-point scale (0 = *never*; 1 = *1 to 2 times*; 2 = *3 to 5 times*; 3 = *6 to 10 times*; 4 = *more than 10 times*). A sum score was created to reflect participants' experience of alcohol-related problems over the past three months (αs ranged from .89-.93 across the three time points).

Analyses

Analyses were conducted in STATA15. Drinks in the past month as assessed by the TLFB and alcohol problems as assessed by the RAPI were examined as primary outcomes. Both outcomes were positively skewed with a lower bound of zero and were treated as count outcomes (Cameron & Trivedi, 2013; Hilbe, 2011). Selection of negative binomial distributions were determined through comparison of Deviance/df, AIC, and BIC for normal, Poisson, and negative binomial models (Hilbe, 2011). Negative binomial distributions provided the best fit for both outcomes.

The design of the study was a 2 X 2 X 2 +1 unbalanced design, which was operationalized by 4 independent variables, corresponding to nine conditions. The three intervention framing variables (common, healthy, and positive) were designed as a 2 X 2 X2 factorial design, making up 8 of the 9 conditions with the non-intervention attention control group making up the final condition. Eight orthogonal contrasts were constructed to evaluate the three main effects, three two-way interactions, and one three-way interaction for the factorial conditions as well as a contrast between the control condition and all other conditions, and one four-way interaction which included time (see Table 1 for contrast codes and summary of conditions). Hypotheses were tested with generalized linear mixed models (GLMM; Hilbe, 2011). This is a person-centered approach analogous to standard multilevel models (i.e., linear mixed models) although unlike standard models, the person-centered approach has the ability to model counts or are non-normal distributions. Specifically, analyses were conducted for multilevel mixed effects of negative binomial outcomes using the MENBREG procedure. Sex was dummy coded (men=1) and included as a covariate. Models included random intercepts and random slopes for time. Random effects are not specifically presented below but both models indicated significant variances and covariance for the random intercept and slope. Time was coded as −1, 0, and 1 for baseline, three-month, and six-month assessments, respectively. Intervention effects were evaluated by tests of interactions between orthogonal contrasts and time.

Results

Descriptive Information and Correlations

Participants reported drinking an average of 26.6 drinks per month. See Figure 2 and Figure 3 for bar graph illustrations of the means and standard errors of drinks per month and alcohol-related problems by condition across all time points respectively.

Intervention effects on alcohol consumption

Results for the model evaluating condition effects on drinking in past month are presented in Table 2. Effect sizes (d) were calculated by adapting the formula $d = 2t/\sqrt{df}$ (Rosenthal & Rosnow, 1991) to $d2Z/\sqrt{df_{approx}}$. Parameter estimates for negative binomial models are log-linked. Exponentiated coefficients (e^B) are interpretable as rate ratios (Atkins, Baldwin, Zheng, Gallop, & Neighbors, 2013; Atkins & Gallop, 2007). Thus, with respect to main effects, there was a significant main effect for Sex such that the exponentiated parameter estimate (e^B=1.46, p<0.001) indicated that men, on average, consumed 46% more drinks in the last 30 days than women. There was also a significant effect of Time, such that drinks in the past 30 days decreased over the course of the trial. All other main effects (e.g., C, H, P) were nonsignificant. There was a two-way significant C X H interaction in predicting drinks in the past 30 days, which was qualified by the three-way interaction with time described below. Neither the C X P nor H X P interactions were significant. There was also a single significant group by time (e.g., H X Time) interaction in predicting drinks for the last 30 days suggesting that reductions in drinking were more evident among participants whose feedback focused on unhealthy drinking (i.e., shots and heavy drinking versus abstinence and moderation). This was also qualified by the three-way interaction mentioned below. All other groups by time two-way interactions were nonsignificant. A three-way interaction was

evident for the Common X Healthy X Time effect in predicting drinking over the past 30 days but none of the other three-way interactions were significant. As presented in Figure 4, feedback focusing on unhealthy drinking versus healthy drinking was more strongly associated with reduced drinking when the behavior was presented as uncommon (i.e., few students consume large quantities of alcohol) than when it was presented as common (i.e., most students engage in unhealthy drinking practices such as consuming shots). No other interactions were significant.

Next, analyses evaluated group differences with respect to alcohol-related problems across the three- and six-month follow-ups (See Table 3). Time and Sex were again included as a covariates. With respect to main effects there was a significant effect of Time, such that alcohol-related problems decreased over the duration of the trial. All other main effects were non-significant. There was a significant two-way interaction between Common X Healthy with no other significant two-way interactions. There was a significant three-way interaction representing the Common X Healthy X Time effect but none of the other three-way interactions were significant. The pattern of estimated means was similar to the corresponding interaction with consumption. As shown in Figure 5, students whose feedback focused on unhealthy drinking had greater reductions in alcohol-related problems when unhealthy drinking was described as uncommon. Contrary to our predictions, valence of the message framing (positive versus negative) did not appear to be a factor in reducing drinking or alcohol-related problems.

Discussion

The present research is of the few studies to provide some evidence that injunctive norms in combination with descriptive norms can be successfully integrated into personalized feedback interventions via a novel application of Deviance Regulation Theory (DRT). There were main effects of sex and time. Overall, men drank more than women but did not differ from women with respect to alcohol-related problems. In addition, both drinking and alcohol-related problems reduced over time. Results also revealed drinking reductions were more evident among participants who received feedback focusing on unhealthy drinking behaviors but that this was particularly true when unhealthy behaviors were described as uncommon. A similar pattern of results emerged in predicting alcohol-related problems such that the largest reduction in alcohol-related problems were demonstrated for participants in the uncommon, unhealthy conditions. Effect sizes for these interactions were relatively small. Overall, we did not find support for our hypotheses regarding the influence of positive versus negative framing on drinking or alcohol-related problems.

Given that the unhealthy-uncommon feedback included specific and relevant information directly related to the sample (e.g., few students who drink 4 or more drinks in one sitting and drinking excessively is bad or drinking moderately is viewed as good), these results are consistent with a large body of literature (Dotson et al., 2015; Reid & Carey, 2015) which suggests that providing feedback highlighting the discrepancies between heavier drinking college students' perceived drinking norms and actual campus drinking norms (albeit in this case participants were provided with injunctive norms – how others feel about drinking – rather than only descriptive norms – the overall prevalence of drinking) is effective in

reducing their consumption and alcohol-related problems. Moreover, the effect sizes associated with stronger effects for feedback presenting unhealthy drinking as uncommon on reduced drinking (d = .26) and alcohol-related problems (d = .20), while modest, were comparable to existing PNF trials which have demonstrated average effect sizes of (d = .28-.29) for reductions in drinking and (d = .15) for alcohol-related problems (Dotson et al., 2015).

Relatedly, these results are also somewhat consistent with DRT in that the most effective conditions were ones in which the norms were most salient to the given population. Our population was recruited on the basis that they met heavy drinking criteria (e.g., individuals who reported drinking 4/5 drinks on one occasion for women and men respectively in the last month). Thus, the uncommon, unhealthy conditions might have been the most effective because they provided injunctive norms information related to specific drinking behaviors that the heavier drinkers had personally engaged in (e.g., drinking more than 4 drinks in one occasion is sitting); however, the valence of the message was less important. That is, it may have been important that the students were explicitly (e.g., those who drink excessively are seen in a negative light) or implicitly (i.e., people who drink in moderation are viewed more favorably than heavier drinkers) viewed negatively by their peers.

In contrast to DRT, which suggests that uncommon, unhealthy behaviors should be negatively framed, our findings indicate that uncommon, unhealthy feedback messages were also effective in the reduction of drinking and alcohol-related problems, irrespective of framing. Thus, we did not find support for differences related to whether messages were positively or negatively framed. These results contrast with previous studies which have manipulated the positive/negative framing, but not the description of the prevalence of the behavior in question (Dvorak et al, 2015; 2016; Sargent et al, 2018). Furthermore, in those studies, which focused on protective behavior strategies, the healthy versus unhealthy dimension was represented by whether people were described as using (healthy) or not using (unhealthy) PBS. In the present study, distinct drinking behaviors were selected to represent common, healthy (drinking in moderation); common, unhealthy (drinking shots); uncommon, unhealthy (drinking large quantities of alcohol) and uncommon, healthy (abstaining) conditions. In contrast, the positive frame always indicated that moderate drinkers were viewed favorably whereas the negative frame always indicated that heavy drinkers were viewed negatively. This may have contributed to the absence of any effects related to positive versus negative framing, particularly for the uncommon, healthy conditions, where the behavior of focus was abstinence. In these conditions participants received descriptive norms feedback about abstinence and abstinence was described as a healthy behavior but the positive frame encouraged moderation and the negative frame discouraged heavy drinking. As this was a clear mismatch, it did not appear to provide a good test for DRT predictions for framing of uncommon, healthy behaviors. We may have inadvertently reinforced less favorable perceptions of abstainers relative to social or moderate drinkers (Nezlek, Pilkington, & Bilbro, 1994; Young et al., 2016).

Among the difficulties encountered in applying DRT to a drinking intervention context is that salient drinking norms already exist. From the conceptualization of this project, we constrained the feedback to be constructed in such a way that all of the information

presented in every condition would be truthful and based on actual data collected on campus. This constraint was based on ethical considerations and on the presumption that using misleading or exaggerated information as a means of persuasion would, in the long run, undermine the credibility of the intervention (Cermak & Banys, 2016). Within these bounds attempting to test all combinations of DRT dimensions experimentally invariably presented logical inconsistencies. For example, on average most students do not view a student who engages in uncommon, healthy drinking behaviors (e.g., abstinence) favorably, and, conversely, students do not view non-abstainers unfavorably. We elected to address this issue by keeping the positive and negative framing constant across the Common/Uncommon and Healthy/Unhealthy conditions, but, as noted, that also created problems in interpretation. That is, it may not make sense to test the full DRT model experimentally as an intervention for college drinking because some of the cells simply do not fit the climate and existing norms. However, it may be possible to evaluate specific contrasting conditions within targeted populations. For example, one might very well focus on abstinence as an uncommon, healthy behavior among existing abstainers as a means of preventing initiation and in the process, evaluate whether positive or negative framing would work better in this condition.

In conclusion, the present results highlight the importance of how to effectively frame content in norms-based interventions. Specifically, selecting relatively low-prevalence, unhealthy drinking behaviors is likely to produce the best effects. Consistent with DRT, it seems likely that these conditions were most effective because engaging in uncommon, unhealthy behaviors would result in negative distinction. Conversely, some of the other conditions appeared to be ineffective because they advocated refraining from drinking behaviors in order to fit in rather than providing participants with a way in which to positively distinguish them from others.

Although this intervention was applied to college students, it could be tailored to target other at-risk populations who view the group they belong to as equally important (e.g., veterans from different military branches or current active duty military members from specific branches). We believe that this intervention represents the first step in instigating drinking behavioral change. However, due to the modest effect sizes of this and other alcohol-related norms interventions, other steps might be taken to solidify this behavioral change depending on the severity of alcohol abuse in the given population. For instance, clinicians might consider implementing the intervention and using the content as a springboard for discussion. That is, in their sessions, clinicians could talk to their clients about their reactions to the feedback. If the clients are experiencing negative emotions such as embarrassment, reactance, or ambivalence over the feedback, clinicians might be able to use techniques, such as motivational interviewing, in combination with the intervention in order to assist their clients in resolving these emotions in order to enact long-lasting reductions in drinking and/or alcohol-related problems.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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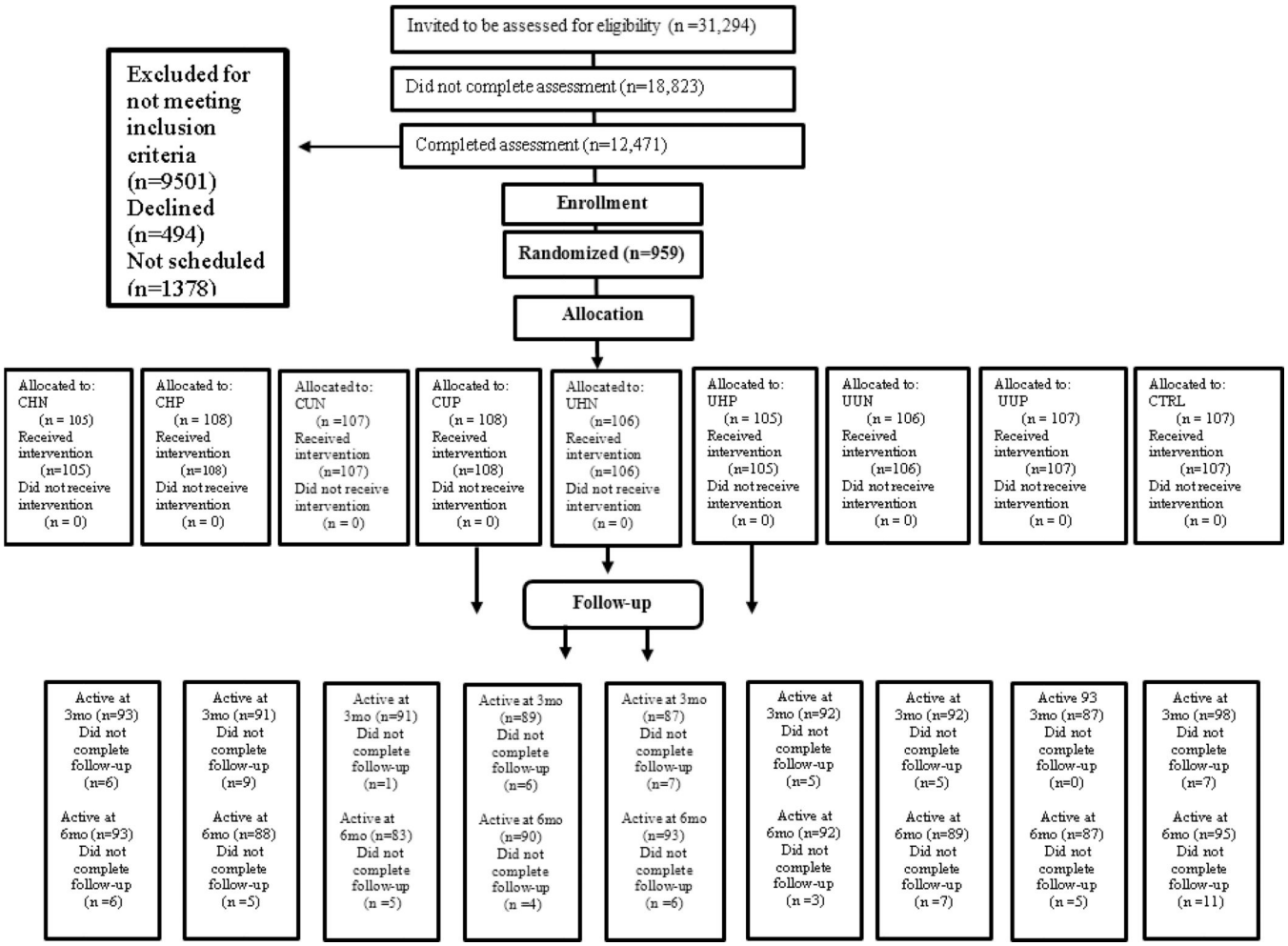

Figure 1.
Participant flow.

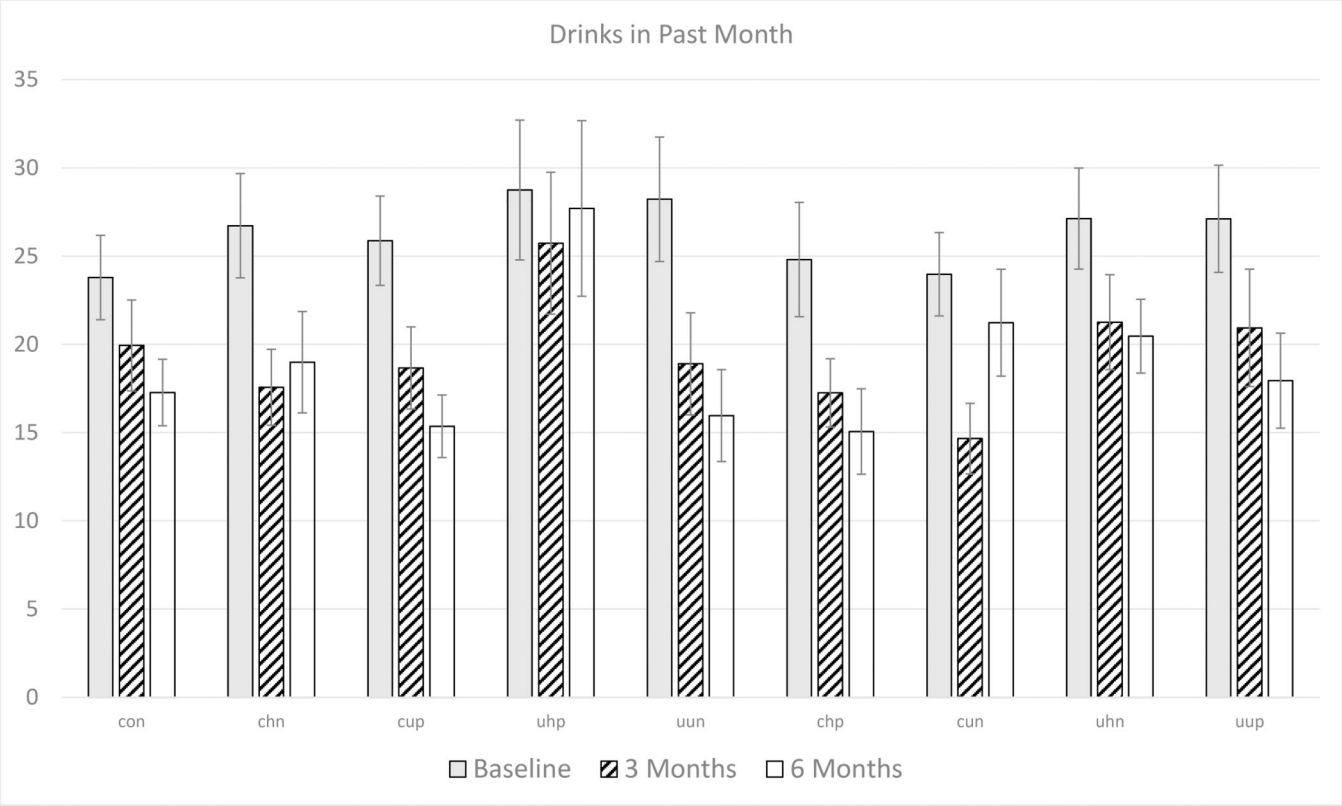

Figure 2.
Drinks in Past Month as a function of Condition & Time point

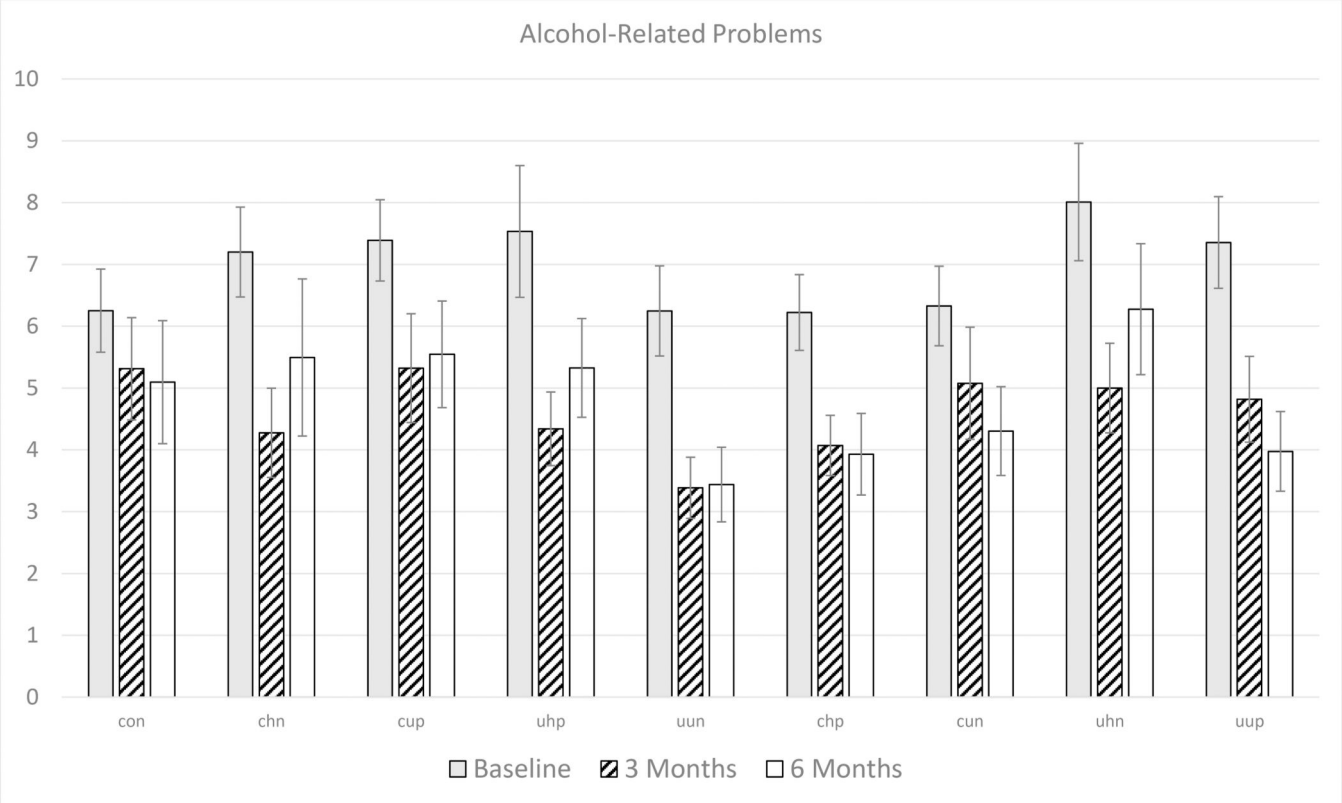

Figure 3.
Alcohol-related Problems as a function of Condition & Time point

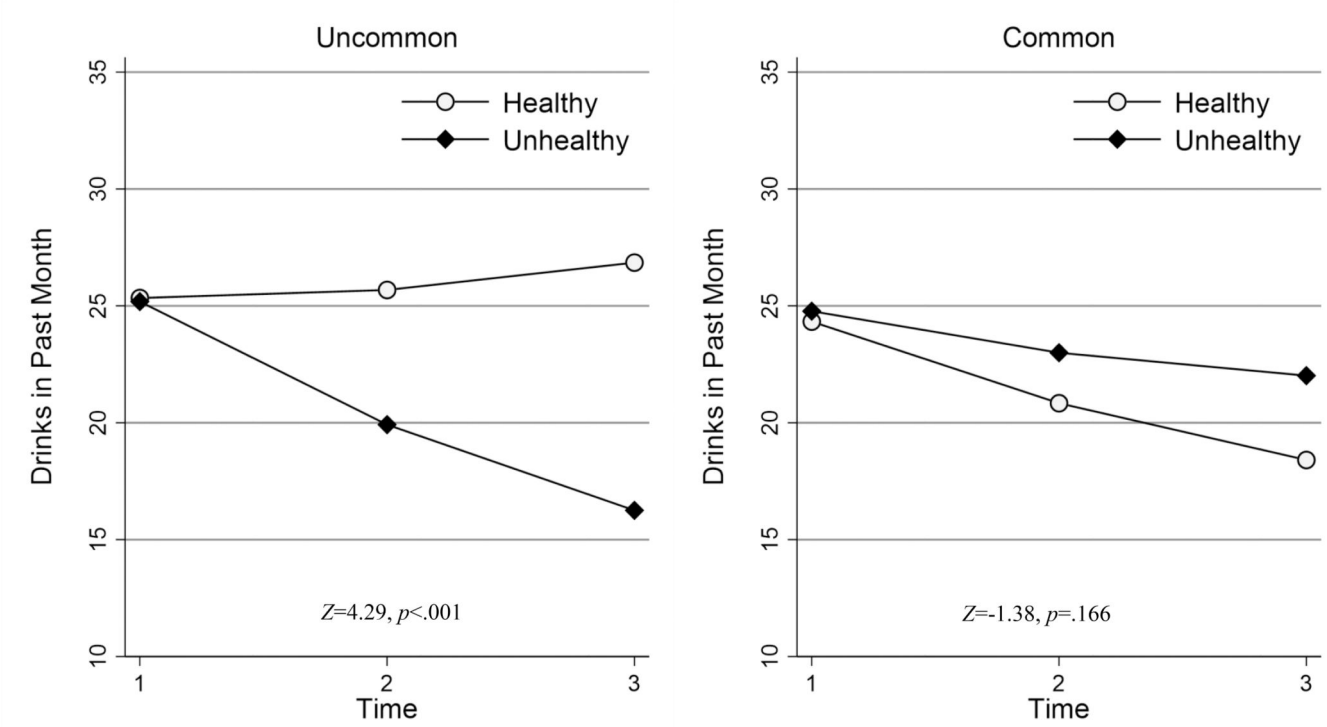

Figure 4.

A three-way interaction between Common X Healthy X Time in predicting drinks in the past 30 days

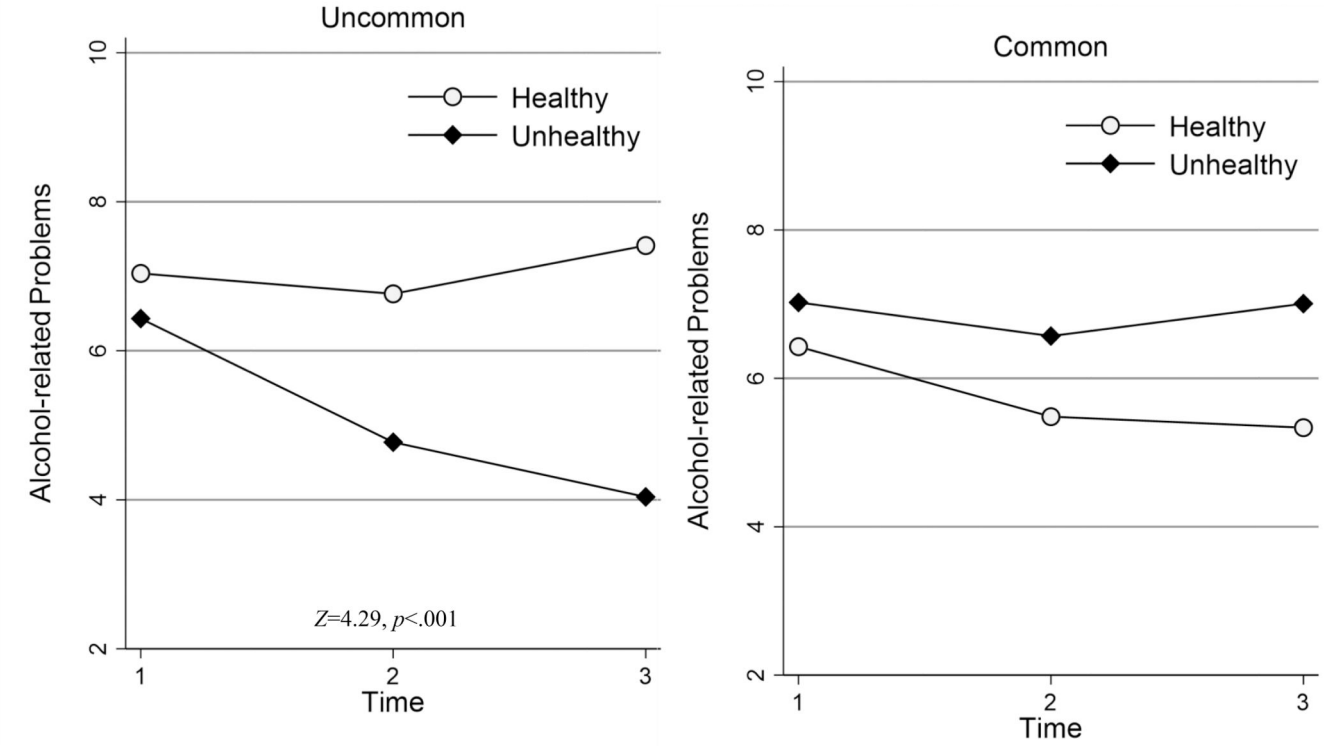

Figure 5.
A three-way interaction between Common X Healthy X Time in predicting alcohol-related problems.

Table 1.

Summary of Conditions and Orthogonal Contrasts

	Condition	Distinguish behavior or like everyone else?	Viewed by others positively or negatively?	Orthogonal Contrast Codes							
				C	H	P	CH	CP	HP	CHP	Control
DRT Consistent	CHN	Distinguished behavior	Negatively	1	1	−1	1	−1	−1	−1	1
	CUP	Distinguished behavior	Positively	1	−1	1	−1	1	−1	−1	1
	UHP	Distinguished behavior	Positively	−1	1	1	−1	−1	1	−1	1
	UUN	Distinguished behavior	Negatively	−1	−1	−1	1	1	1	−1	1
DRT Inconsistent	CHP	Like everyone else	Positively	1	1	1	1	1	1	1	1
	CUN	Like everyone else	Negatively	1	−1	−1	−1	−1	1	1	1
	UHN	Like everyone else	Negatively	−1	1	−1	−1	1	−1	1	1
	UUP	Like everyone else	Positively	−1	−1	1	1	−1	−1	1	1
Control	Control	N/A	N/A	0	0	0	0	0	0	0	−8

Note. Conditions are CHN = Common/Healthy/Negative; CUP = Common/Unhealthy/ Positive; UHP = Uncommon/Unhealthy/Positive; UUN = Uncommon/Unhealthy/Negative; CHP = Common/Healthy/ Positive; CUN = Common/Unhealthy/Negative; UHN = Uncommon/ Healthy/Negative; UUP = Uncommon/Unhealthy/Negative.

Table 2.

Results for number of drinks consumed in past 30 days.

	b	SE b	Z	p	e^b	e^b 95% CI	d
Intercept	**2.500**	**0.045**	**55.79**	**<0.001**	**12.18**	**11.16–13.30**	**3.62**
Sex	**0.380**	**0.063**	**6.00**	**<0.001**	**1.46**	**1.29–1.66**	**0.39**
Time	**−0.260**	**0.019**	**−13.49**	**<0.001**	**0.77**	**0.74–0.80**	**0.88**
Common (C)	−0.016	0.036	−0.45	0.652	0.98	0.92–1.06	0.03
Healthy (H)	0.039	0.036	1.08	0.280	1.04	0.97–1.12	0.07
Positive (P)	−0.007	0.036	−0.20	0.840	0.99	0.93–1.07	0.01
Control	−0.007	0.012	−0.62	0.535	0.99	0.97–1.02	0.04
C X H	**−0.088**	**0.036**	**−2.44**	**0.015**	**0.92**	**0.85–0.98**	**0.16**
C X P	−0.021	0.036	−0.58	0.559	0.98	0.91–1.05	0.04
H X P	−0.034	0.036	−0.95	0.341	0.97	0.90–1.04	0.06
C X Time	−0.002	0.020	−0.10	0.923	1.00	0.96–1.04	0.01
H X Time	**0.042**	**0.020**	**2.05**	**0.041**	**1.04**	**1.00–1.09**	**0.13**
P X Time	−0.012	0.020	−0.61	0.542	0.99	0.95–1.03	0.04
Control X Time	−0.010	0.007	−1.51	0.132	0.99	0.98–1.00	0.10
C X H X Time	**−0.082**	**0.020**	**−4.01**	**<0.001**	**0.92**	**0.89–0.96**	**0.26**
C X P X Time	−0.036	0.020	−1.77	0.077	0.96	0.93–1.00	0.11
H X P X Time	−0.006	0.020	−0.28	0.778	0.99	0.96–1.04	0.02
C X H X P	−0.026	0.036	−0.73	0.465	0.97	0.91–1.05	0.05
C X H X P X Time	0.005	0.020	0.23	0.818	1.01	0.97–1.05	0.01

Note. Bolded text represents significant differences.

Table 3.

Results for Alcohol-related problems.

	b	SE b	Z	p	e^b	e^b 95% CI	d
Intercept	**1.140**	**0.051**	**22.24**	**<0.001**	**3.13**	**2.83–3.46**	**1.44**
Sex	0.115	0.067	1.71	0.088	1.12	0.98–1.28	0.11
Time	**−0.464**	**0.027**	**−17.49**	**<0.001**	**0.63**	**0.60–0.66**	**1.14**
Common (C)	0.027	0.043	0.63	0.526	1.03	0.94–1.12	0.04
Healthy (H)	0.042	0.043	0.98	0.328	1.04	0.96–1.14	0.06
Positive (P)	0.046	0.043	1.07	0.283	1.05	0.96–1.14	0.07
Control	−0.007	0.014	−0.50	0.614	0.99	0.97–1.02	0.03
C X H	**−0.133**	**0.043**	**−3.06**	**0.002**	**0.88**	**0.81–0.95**	**0.20**
C X P	0.004	0.043	0.09	0.927	1.00	0.92–1.09	0.01
H X P	−0.055	0.043	−1.28	0.202	0.95	0.87–1.03	0.08
C X Time	0.028	0.028	1.00	0.317	1.03	0.97–1.09	0.06
H X Time	0.042	0.028	1.48	0.138	1.04	0.99–1.10	0.10
P X Time	0.013	0.028	0.46	0.648	1.01	0.96–1.07	0.03
Control X Time	−0.014	0.009	−1.49	0.135	0.99	0.97–1.00	0.10
C X H X Time	**−0.088**	**0.028**	**−3.12**	**0.002**	**0.92**	**0.87–0.97**	**0.20**
C X P X Time	0.021	0.028	0.73	0.465	1.02	0.97–1.08	0.05
H X P X Time	−0.002	0.028	−0.06	0.950	1.00	0.95–1.06	0.00
C X H X P	0.011	0.043	0.26	0.793	1.01	0.93–1.10	0.02
C X H X P X Time	0.012	0.028	0.41	0.680	1.01	0.96–1.07	0.03

Note. Bolded text represents significant differences.