



Published in final edited form as:

*Addict Behav.* 2018 February ; 77: 152–159. doi:10.1016/j.addbeh.2017.09.019.

## Predictors of Short-Term Change after a Brief Alcohol Intervention for Mandated College Drinkers

Kate B. Carey, Ph.D.<sup>1,2</sup>, Jennifer E. Merrill, Ph.D.<sup>1,2</sup>, Jennifer L. Walsh, Ph.D.<sup>3</sup>, Sarah A. Lust, Ph.D.<sup>4</sup>, Seth C. Kalichman, Ph.D.<sup>5,6</sup>, and Michael P. Carey, Ph.D.<sup>2,7,8</sup>

<sup>1</sup>Center for Alcohol and Addiction Studies, Brown University School of Public Health, Providence, RI

<sup>2</sup>Department of Behavioral and Social Sciences, Brown University School of Public Health, Providence, RI

<sup>3</sup>Center for AIDS Intervention Research, Department of Psychiatry and Behavioral Medicine, Medical College of Wisconsin, Milwaukee, WI

<sup>4</sup>Department of Social Sciences, Maryville University, St. Louis, MO

<sup>5</sup>Department of Psychology, University of Connecticut, Storrs, CT

<sup>6</sup>Institute for Collaboration on Health, Intervention, and Policy, University of Connecticut, Storrs, CT

<sup>7</sup>Department of Psychiatry and Human Behavior, Alpert Medical School of Brown University, Providence, RI

<sup>8</sup>Centers for Preventive and Behavioral Medicine, The Miriam Hospital, Providence, RI

### Abstract

**Objective**—Brief motivational interventions (BMIs) reduce problematic drinking for some, but not all, college students. Identifying those students who are less responsive can help to guide intervention refinement. Therefore, we examined demographic, personality, and cognitive factors hypothesized to influence change after a BMI.

**Method**—Students mandated for intervention following a campus alcohol violation ( $N = 568$ ; 28% female, 38% freshmen) completed a baseline assessment, then received a BMI, and then

---

Correspondence should be addressed to Kate B. Carey, Center for Alcohol and Addiction Studies, Brown University School of Public Health, Box G-S121-5, Providence, RI 02912; 401-863-6558 (voice), 401-863-6647 (fax), Kate\_Carey@brown.edu.

**Publisher's Disclaimer:** This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

#### Contributors

Kate B. Carey and Michael P. Carey designed the study, and assisted by Seth C. Kalichman refined the protocol. Kate B. Carey drafted the Introduction and Discussion. Sarah A. Lust supervised data collection and data cleaning, and drafted the Methods. Jennifer L. Walsh and Jennifer E. Merrill conducted the statistical analyses and drafted the Results. All authors have contributed to and have approved the final manuscript.

#### Conflicts of Interest

All authors declare that they have no conflicts of interest.

completed a 1-month follow-up. At both assessments, alcohol use (i.e., drinks per week, typical BAC, binge frequency) and alcohol-related problems were measured.

**Results**—Latent change score analyses revealed significant decrease in both alcohol use and problems one month after the BMI. In the final model that predicted *change in alcohol use*, four factors (male sex, a “fun seeking” disposition, more perceived costs and fewer perceived benefits of change) predicted smaller decreases in alcohol use over time. In the final model that predicted *change in alcohol-related problems*, three factors (stronger beliefs about the centrality of alcohol to college life, more perceived costs and fewer perceived benefits of change) predicted smaller decreases in problems over time.

**Conclusions**—Participation in a BMI reduced alcohol use and problems among mandated college students at 1-month follow-up. We identified predictors of these outcomes, which suggest the need to tailor the BMI to improve its efficacy among males and those students expressing motives (pro and cons, and fun seeking) and beliefs about the centrality of drinking in college.

### Keywords

brief motivational intervention; college students; drinking; alcohol abuse prevention

---

College drinking is characterized by high volume consumption that undermines the health, safety, and academic performance of students (White & Hingson, 2014). Research shows that brief preventive interventions reduce alcohol misuse and problems in the general student population, especially those that use motivational interviewing and personalized feedback and those that target descriptive norms (Carey, Scott-Sheldon, Carey, & DeMartini, 2007; Huh et al., 2015; Samson & Tanner-Smith, 2015). A subgroup of students who require special attention are those who violate campus policies. These “mandated” students also respond well to brief alcohol interventions but effect sizes are often heterogeneous (Carey, Scott-Sheldon, Garey, Elliott, & Carey, 2016), such that not all students benefit from exposure to intervention equivalently. Research to clarify who benefits, and how to refine interventions to enhance efficacy, is needed.

One study identified trajectories of change after intervention using data from three samples (including mandated students) who received either a brief face-to-face or a computer-delivered intervention (Henson, Pearson, & Carey, 2015). Fully 82% of students demonstrated a strong initial intervention response, reflected in reductions in measures of alcohol consumption. Initial change was associated with characteristics of the recipients; that is, those who changed the most were female, upper-classmen, with later drinking onset, did not play drinking games, and reported lower peer drinking norms. Conversely, change after intervention was less for males, underclassmen, those reporting higher peer drinking norms and engaging in drinking games.

Building upon this work, we sought to identify predictors of change after a brief motivational intervention (BMI) for students mandated to an alcohol intervention. We drew from theoretical perspectives applied to college drinking interventions such as social cognitive theory (Bandura, 2011) and the transtheoretical model (Prochaska, DiClemente, & Norcross, 1992), and also drew upon the growing empirical literature documenting

determinants of young adult drinking. We hypothesized that factors that place students at greater alcohol-related risk may be barriers to change. However, correlates of drinking in the absence of an intervention may differ from predictors of change after intervention. Thus, based on theory, empirical literature, and our intervention experience, we selected promising demographic, personality, and cognitive candidate predictors of change after intervention.

*Demographic* characteristics have been consistently associated with heavier drinking including male sex, white race (Johnston, O'Malley, Bachman, Schulenberg, & Miech, 2014), affiliation with a Greek organization (A. Park, Sher, & Krull, 2008), and freshman status (Sher & Rutledge, 2007). In addition, both sex and class status have been linked to intervention response (Henson et al., 2015). Demographic variables are often correlated with social and psychological conditions related to establishing and modification of drinking patterns.

*Personality* constructs have also been linked to drinking. Among these, constructs related to reinforcement sensitivity (Gray, 1970) are promising predictors. Specifically, individuals with a strong Behavioral Activation System (BAS) tend to be impulsive sensation-seekers, reacting to reward-related cues (i.e., alcohol) with increases in positive affect and approach motivation (Hamilton, Sinha, & Potenza, 2012; Voigt et al., 2009). Conversely, the Behavioral Inhibition System (BIS) competes with approach behavior; high-BIS individuals show uncertainty and anxiety in response to mixed reward and punishment cues. It is unclear whether BIS is a risk factor for drinking because anxiety may promote drinking (Wardell, O'Connor, Read, & Colder, 2011) whereas dispositional avoidance of threat may discourage drinking (Keough & O'Connor, 2014). Strong orientations towards reward and/or avoidance of punishment may override the influence of a brief alcohol risk reduction intervention. We also explored multiple dimensions of impulsivity, which has been linked to heavy drinking among students (Diulio, Silvestri, & Correia, 2014; Kazemi, Flowers, Shou, Levine, & Van Horn, 2014). To the extent that impulsivity represents behavioral disinhibition or under-control, it may interfere with alcohol use self-management strategies.

*Mental health problems* have been associated with heavy episodic drinking (Cranford, Eisenberg, & Serras, 2009) and problems related to alcohol use (Dennhardt & Murphy, 2011; Kenney & LaBrie, 2013; Weitzman, 2004). Thus, the presence of mental health problems, and associated cognitive and motivational impairments, may undermine the ability of students to benefit from a BMI.

Social-cognitive variables also correlate with drinking. *Descriptive norms* (i.e., perceptions of how other students drink) and *injunctive norms* (i.e., perceptions of peer approval of drinking) uniquely influence drinking behavior (Larimer, Turner, Mallett, & Geisner, 2004; H. S. Park, Klein, Smith, & Martell, 2009). Henson et al. (2015) reported that stronger descriptive and injunctive norms predicted less change after alcohol interventions. We sought to replicate these findings with mandated students and with a BMI that emphasizes normative correction.

*Beliefs* about the central role that alcohol consumption plays in the college experience have been associated with both consumption and consequences (Osberg et al., 2010b; Osberg,

Insana, Eggert, & Billingsley, 2011), beyond positive alcohol expectancies, injunctive norms for friends, and descriptive norms (Osberg et al., 2011). Students holding stronger centrality beliefs reported less motivation to change drinking after an alcohol sanction (Qi, Pearson, & Hustad, 2014). Because these beliefs may conflict with risk reduction messages, we expect that strong beliefs about the centrality of alcohol to the college experience will predict less change.

According to the transtheoretical model, readiness to change a problem behavior is reflected in perceived *costs* and *benefits* of change (Prochaska et al., 1994); typically, individuals who are not ready to change perceive more costs than benefits. In the recovery context, costs of change predict increases in substance use over time, and benefits of change predict reductions (Cunningham, Sobell, Gavin, Sobel, & Breslin, 1997; Korcha, Polcin, Bond, Lapp, & Galloway, 2011). We predict that costs and benefits of changing drinking perceived by mandated students will predict change after a BMI.

To test these hypotheses, we used baseline and 1-month post-intervention data from an intervention trial. In a sample wherein all students receive a BMI, we predict smaller decreases for individuals with certain demographics (male sex, White race, Greek involvement, freshman status); lower behavioral inhibition; higher behavioral activation; higher impulsivity; more psychological distress; more permissive perceived norms (descriptive, injunctive); stronger beliefs about the centrality of alcohol to college life; and more perceived costs and fewer perceived benefits of change.

## Method

### Participants and Recruitment

Participants were 568 students enrolled in a public university in the northeastern U.S. who were mandated to participate in an alcohol education program following an alcohol-related violation. Students (N = 610) were screened for eligibility (i.e., enrolled in college, 18 years old, no previous participation in the study). Eligible students viewed a brief presentation outlining their options for satisfying the sanction: (a) pay a fee and participate in the standard sanction (a brief individualized alcohol intervention modeled after BASICS; Dimeff, Baer, Kivlahan, & Marlatt, 1999) or (b) participate in this study (i.e., baseline, BMI, and 1-month assessment). Completion of study activities through the 1-month follow-up was considered equivalent to the standard sanction, and therefore served to satisfy the sanction requirement. Students who selected the study option saved the standard sanction fee and gained the possibility of earning compensation for follow-up assessments after 1-month. Of the 610 mandated students screened, 13 were ineligible, 24 declined, and 5 did not attend the baseline session. Thus, 568 students (93%) consented and completed baseline.

### Procedures

The Institutional Review Board approved all procedures, and we obtained a Certificate of Confidentiality. Interested students scheduled an appointment, during which a research assistant (RA) explained the study, reviewed the consent, and answered questions. Consenting students completed the baseline survey and made a BMI appointment within 2

weeks. After the BMI, the RA scheduled a follow-up appointment 1 month later in the research office.

### Intervention

We used a BMI shown to be efficacious with mandated students (Carey, Carey, Henson, Maisto, & DeMartini, 2011; Carey, Carey, Maisto, & Henson, 2006; Carey, Henson, Carey, & Maisto, 2009). Nine interventionists (eight females, one male) were trained on the manualized protocol and received weekly supervision from the authors. The BMI used a collaborative, supportive, yet directive style, consistent with motivational interviewing (Miller & Rollnick, 2012). To structure the session, a personalized feedback sheet summarized (a) weekly consumption (compared to sex-specific national and local norms), (b) typical and peak blood alcohol concentration (BAC), and (c) alcohol-related consequences and associated risk behaviors; interventionists also (d) prompted goal setting and (e) provided tips for safer drinking. BMI sessions took 15 to 122 minutes ( $M = 67$ ;  $SD = 17$ ).

### Measures

All measures were collected at baseline, reflecting past month behavior; alcohol consumption and consequences were also collected at the 1-month follow-up.

**Descriptives**—Participants reported their sex, age, race/ethnicity, year in college, Greek status, and body weight (for calculation of BAC). A reliable and valid 13-item form of the Marlowe-Crowne Social Desirability scale (Reynolds, 1982) was used as a potential covariate in analyses; responses to the yes/no items are summed (sample  $\alpha = .67$ ).

**Alcohol consumption**—We defined a standard drink as 12 oz. of beer, 5 oz. of 12% table wine, 12 oz. of wine cooler, or 1.25 oz. of 80-proof liquor. The Daily Drinking Questionnaire (Collins, Parks, & Marlatt, 1985) was used to assess typical *drinks per week* (DPW) in the last month. Participants also reported the number of standard drinks consumed and the number of hours spent drinking on a typical day, from which we calculated *typical BAC*:  $[(\text{drinks}/2) * (\text{GC}/\text{weight})] - (0.016 * \text{hours})$ , where drinks = number of standard drinks consumed, hours = number of hours over which the drinks were consumed, weight = weight in pounds and GC = gender constant (9.0 for females, 7.5 for males) (Matthews & Miller, 1979). Participants also reported *heavy drinking frequency*, the number of times in the past month consuming 4+ (females)/5+ (males) drinks on one drinking occasion (Wechsler, Dowdall, Davenport, & Rimm, 1995).

**Alcohol-related consequences**—The 24-item Brief Young Adult Alcohol Consequences Questionnaire (B-YAACQ) (Kahler, Strong, & Read, 2005) is a checklist of *problems related to drinking* in the past month. The B-YAACQ items are summed, reliable ( $\alpha = .84$ ) and free of gender bias.

**Drinking norms**—*Descriptive norms* were assessed using 3 items ( $\alpha = .82$ ) that asked how many of the participant's friends (a) drink alcohol, (b) get drunk on a regular basis (at least once a month), and (c) drink primarily to get drunk. Response options ranged from 0

(none) to 4 (nearly all), and items are averaged. Perceived *injunctive norms* were assessed with 2 items ( $\alpha = .77$ ) that assessed how most friends' feel about (a) drinking and (b) getting drunk (Kahler, Read, Wood, & Palfai, 2003). Response options ranged from 0 (strongly disapprove) to 4 (strongly approve); items are averaged to obtain a summary score.

**Impulsivity**—Impulsivity was measured with the Urgency Premeditation Planning Sensation Seeking Impulsive Behavior Scale (UPPS) (Magid & Colder, 2007). Items, which use a 5-point Likert scale ranging from “not at all” to “very much,” are summed to form four subscales: negative urgency (10 items,  $\alpha = .82$ ), sensation seeking (12 items,  $\alpha = .87$ ), (lack of) Premeditation (10 items,  $\alpha = .85$ ), and (lack of) Perseverance (8 items,  $\alpha = .85$ ).

**Behavioral inhibition and activation**—The BIS/BAS Scales (Carver & White, 1994) consist of the 7-item behavioral inhibition scale (BIS;  $\alpha = .66$ ) and the 13-item behavioral activation (BAS;  $\alpha = .82$ ). The BAS consists of three sub-factors: Drive (4 items,  $\alpha = .84$ ), FunSeeking (4 items,  $\alpha = .84$ ), and Reward Responsiveness (5 items,  $\alpha = .74$ ). Participants respond on 4-point scales (1 = very false for me to 4 = very true for me); each item set was summed to obtain subscale scores.

**Decisional balance**—Participants rated the costs and benefits of quitting alcohol use using the Alcohol and Drug Consequences Questionnaire (ADCQ) (Cunningham et al., 1997). Responses ranged from 1 (not important) to 5 (extremely important), and are summarized as mean scores on costs (14 items;  $\alpha = .96$ ) and benefits (15 items;  $\alpha = .94$ ).

**Distress**—Distress was measured with the Patient Health Questionnaire-4 (PHQ-4) (Kroenke, Spitzer, Williams, & Löwe, 2009). Participants report how often (past two weeks) they have been bothered by depression and anxiety on a scale from 0 (not at all) to 3 (nearly every day); the four items are summed. In this sample,  $\alpha = .84$ .

**Centrality of alcohol**—The 15-item College Life Alcohol Salience Scale (CLASS; Osberg et al., 2010a) assesses the extent to which a student believes alcohol is central part of the college experience, from 1 (strongly disagree) to 5 (strongly agree); all items are summed. Alpha in this sample was .87.

## Data Analysis Plan

Missing cases were few, with 98% returning for the 1-month follow-up. We used multiple imputation to replace missing values (Schafer, 1999). Outliers were truncated to three times the interquartile range from the 75th percentile (Tabachnick & Fidell, 2007). Using *t*-tests, we examined differences between baseline and follow-up and sex differences in outcomes. Next, associations between baseline factors and changes in alcohol consumption and alcohol use consequences were examined using latent change score (LCS) analyses (McArdle & Nesselrode, 2013) in Mplus 7.1 (Muthén & Muthén, 1998–2015). LCS models include latent factors representing a construct at two time points as well as a third latent score representing the latent change between these two common-factor scores. Latent change scores are more reliable than simple difference scores (McArdle, 2009).



We created separate LCS models for alcohol consumption and alcohol-related consequences. *Consumption* was modeled with three indicators: drinks per week, typical BAC, and binge drinking frequency (all log transformed). *Consequences* were modeled with three parcels of items from the B-YAACQ as indicators (see Little, Cunningham, Shahar, & Widaman, 2002). We allowed correlations between identical indicators at baseline and 1 month to account for shared error variance (Duncan, Duncan, & Strycker, 2006).

Next, we tested for measurement invariance over time. Models were identified by constraining baseline means to 0 and variances to 1, putting scores on a standardized metric with regard to baseline consumption (consequences). Nested models were compared using the Satorra-Bentler scaled  $\chi^2$  difference test (Satorra & Bentler, 2010). Next, we used standard methods to estimate latent change scores (McArdle & Nesselrode, 2013). These scores represented the change in consumption (consequences) from baseline to 1 month for each participant in standard deviation (SD) units; thus, positive change scores indicate increases and negative change scores indicate decreases in consumption/consequences.

Finally, we regressed change scores on baseline predictors to determine characteristics associated with change following intervention. In preliminary models, predictors were tested in subsets to determine which would be included in final multivariate models. Controlling for significant demographic variables and social desirability, each of six sets (four BIS/BAS, four UPPS, two drinking norms, two decisional balance, CLASS, and PHQ scores) were entered separately into parallel models predicting consumption and consequences. We included paths from predictors associated with change scores ( $p < .10$ ) to both baseline and change scores. Additionally, change scores were regressed on baseline scores to control for the influence of starting values on change.

Models were fit with an estimator robust to non-normality (the MLR estimator; Muthén & Muthén, 1998–2015), and fit was assessed using the comparative fit index (CFI), TuckerLewis index (TLI), and the root-mean-square error of approximation (RMSEA). Good fit is indicated by CFI and TLI values  $> .95$  and RMSEA values  $< .05$  (Kline, 2011). For models using multiple imputation, we report the average fit across 100 imputed datasets. When discussing predictors of change scores, we report unstandardized coefficients and standard errors; these can be interpreted as the change in consumption or consequences in SD units for each unit change in a predictor variable.

## Results

### Preliminary Analyses

Participants were mostly male (72%) and freshmen (38%) or sophomores (35%). Mean age was 19.18 years ( $SD = 1.16$ ). Most identified as White (84%), with 9% multiracial, 4% Black, 6% Asian, and 6% other; 6% were Hispanic/Latino. The majority lived on campus (89%), 9% lived off-campus, and 2% with family. Thirteen percent were members of the Greek system and an additional 4% were pledging. Table 1 displays summary statistics for all predictors.

All but 8 of the 568 (99%) students who completed baseline received a BMI. Table 2 displays baseline and 1-month values on the outcomes, showing reductions from baseline on all outcomes ( $p < .001$ ).

### Measurement Models and Invariance Testing

The measurement models for both consumption and consequences showed full metric invariance and partial scalar invariance (with two of three items invariant across time), allowing interpretation of both associations of the latent change score with other variables and the mean of the change score (Byrne, Shavelson, & Muthn, 1989). The consumption model fit the data well,  $\chi^2(9, N = 568) = 26.74, p < .01, RMSEA = .059, CFI = .99, TLI = .98$ . The consequences model also fit the data well,  $\chi^2(8, N = 568) = 20.67, p < .01, RMSEA = .05, CFI = .99, TLI = .98$ . All factor loadings in both models were significant,  $p < .001$ . Consumption scores at baseline and follow-up were significantly correlated,  $r = .69, p < .001$ , as were consequence scores,  $r = .47, p < .001$ .

### Predictors of Changes in Alcohol Consumption

An initial latent change model without predictors (Figure 1) showed that, relative to baseline, participants decreased their alcohol consumption nearly half a SD ( $M_{\text{change}} = -0.42, SE = 0.04, p < .001$ ). The final model fit the data well,  $\chi^2(40, N = 568) = 121.55, RMSEA = .06, CFI = .97, TLI = .95$ . The predictors in Table 3 were retained because they predicted the latent change score in the models described earlier. As expected, male sex, white race, and Greek membership predicted baseline consumption, as did descriptive norms, costs of change, and beliefs about the centrality of drinking to college life (Table 3, top). However, after controlling for baseline consumption, a smaller set of predictors emerged for *change* in consumption (Table 3, bottom). Those who drank more at baseline reported greater decreases over 1 month,  $B = -0.43 (0.05), p < .001$ . Controlling for this effect, smaller decreases in consumption over time were observed for men,  $B = 0.32 (0.10), p = .001$ ; those higher in Fun Seeking,  $B = 0.05 (0.02), p < .01$ ; and those reporting more costs associated with stopping or cutting down alcohol use,  $B = 0.13 (0.05), p = .01$ . Those reporting more benefits associated with stopping or cutting down decreased their consumption more,  $B = -0.07 (0.04), p = .05$ .

### Predictors of Changes in Alcohol-Related Consequences

An initial latent change model without predictors (Figure 2) showed that relative to baseline, participants decreased their consequences significantly ( $M_{\text{change}} = -0.71, SE = 0.05, p < .001$ ). The final model fit the data well,  $\chi^2(48, N = 568) = 70.87, RMSEA = .03, CFI = .99, TLI = .98$ . As expected, many of the predictors were associated with baseline consequences (Table 4, top). Participants who reported more alcohol-related consequences at baseline decreased their consequences more over 1 month,  $B = -0.71 (0.06), p < .001$ . Controlling for this effect, those reporting more costs associated with stopping or cutting down alcohol use had smaller reductions in consequences,  $B = 0.16 (0.05), p < .01$ , while those reporting more benefits had larger reductions in consequences,  $B = -0.08 (0.04), p < .05$ . Participants with stronger beliefs about the centrality of alcohol to college life reported smaller decreases in consequences over time,  $B = 0.01 (0.01), p = .05$ .



## Discussion

We sought to identify characteristics of mandated students that predicted reductions in drinking and consequences after an empirically-supported alcohol intervention for college students. Consistent with prior research (Carey et al., 2011; Carey et al., 2009), participants reported less drinking and fewer consequences at the 1-month follow-up. The reductions in consumption and alcohol-related consequences of 0.42 to 0.71 SD units reflect medium-to-large effects, indicative of substantial risk reduction for these at-risk drinkers.

As expected, some participants reported more change than others. Specifically, male sex, Fun Seeking, and more costs and fewer benefits of reducing drinking predicted less change in consumption following the BMI. Similarly, more costs, fewer benefits, and a stronger belief in the centrality of drinking to college life predicted less change in consequences after the BMI. The predictor sets for both outcomes overlapped (costs and benefits of change), but also included unique predictors for changes in consumption (male sex, Fun Seeking) and consequences (beliefs about alcohol's centrality to college life). Thus, the BMI was less efficacious for fun-seeking individuals who (a) associate college life with drinking, (b) see fewer benefits of cutting down and (c) identify more costs of doing so, and (d) are male. These characteristics clarify the individuals for whom improved interventions are needed.

The current findings extend prior research that identified predictors of change after intervention in a *post hoc* manner (Henson et al., 2015), or that focused on one or two moderator variables such as sex (Carey et al., 2009) or race (Murphy, Dennhardt, Skidmore, Martens, & McDevitt-Murphy, 2010). Notably, only a subset of the variables identified for their crosssectional associations with outcomes provided unique information about the *magnitude of change* after participating in a BMI. For example, baseline consumption was predictably associated with being male, White, and a Greek member and having higher descriptive norms, costs of change, and centrality beliefs; once baseline consumption was controlled for, only sex and costs of change uniquely predicted how much participants decreased their drinking following a BMI. Although Fun Seeking and benefits of change were not associated with baseline drinking, they did predict post-intervention changes in drinking. Thus, it appears that person variables associated with concurrent drinking do not always predict the likelihood of change in drinking after intervention, and vice versa.

Our findings suggest ways of improving BMIs. First, because males reduced their drinking less than females after a BMI, it may be necessary to further tailor BMI content (beyond providing sex-specific personalized feedback) to make it more impactful for males. For example, it may be helpful to determine which consequences are evaluated more negatively by males, or identify which aspects of drinking are subject to more normative misperception by males, and provide feedback on those specifically. Because the use of protective behavioral strategies by men is underestimated (Lewis, Rees, & Lee, 2009), providing sex-specific feedback regarding the use of protective strategies may counteract male reluctance to engage in risk reduction. Psychosocial factors such as living in a fraternity house (McCabe, 2002) and endorsing certain masculine norms (e.g., risk taking, winning, being a playboy) raise the risk of heavy drinking among some college men (Iwamoto, Cheng, Lee, Takamatsu, & Gordon, 2011). Such findings are consistent with general observations that,

relative to women, men in the United States have more adverse health outcomes, more health risk behaviors and fewer health promotion behaviors (Courtenay, 2000). Thus, interventions might consider challenging the status that alcohol consumption enjoys in male peer groups, and potentially cultivating masculine norms inconsistent with risky drinking (e.g., work orientation; Iwamoto et al., 2011). Clearly, BMIs need to be better tailored to reduce heavy drinking by male students.

Second, fun-seeking individuals who associate college life with drinking changed less after intervention. The Fun Seeking scale describes individuals who do things spontaneously, for fun, excitement, and new sensations (Carver & White, 1994). Although there is overlap between Fun Seeking, as measured by the BAS subscale, and sensation seeking, as measured by the UPPS, the latter focuses more on engaging in risky activities whereas the former emphasizes approaching immediate reward. Interventions designed to make future goals more salient (Hall & Fong, 2003) warrant consideration as well as discussing alternative methods to achieve positive reinforcement (Murphy et al., 2012). Because college life is associated with drinking, partly as a function of advertising and media portrayals (Osberg, Billingsley, Eggert, & Insana, 2012), challenging this association with media literacy training might be fruitful.

Third, students who see fewer benefits to cutting down and more costs of doing so were less likely to change. Subjective utility theory (Bauman, Fisher, Bryan, & Chenoweth, 1985) suggests that they may perceive drinking less to carry social costs without benefits. Correcting exaggerated perceived drinking norms challenges these perceptions (Reid & Carey, 2015) but additional strategies are needed to challenge perceptions of social costs and/or enhance the value of the benefits of moderate drinking (cf LaBrie, Pedersen, Earleywine, & Olsen, 2006). Tailoring decisional balance exercises for male students who endorse drinking as a central part of college life may be warranted.

Strengths of this study include a large sample of mandated students, and delivery of an empirically-supported BMI with well-trained interventionists. The observed short-term reductions were strong, allowing us to identify characteristics associated with lower efficacy. We tested *a priori* predictions about factors that might affect change after receiving a BMI.

The primary limitation is that we did not include a comparison group, and so cannot address moderators of relative responsiveness to the BMI. We attempted to predict differential change after the BMI to focus attention on ways to improve BMI efficacy. However it is possible that the identified predictors of risk reduction would apply equally to other alcohol-related interventions. Second, the sample contained relatively few women and minority students, characteristic of mandated samples (Merrill, Carey, Lust, Kalichman, & Carey, 2014). Third, our sample consisted of mandated students so generalizability of findings to the broader population of student drinkers remains to be established. Fourth, the design of the parent study only allowed for testing predictors of short-term change associated with a mandated alcohol intervention, so we cannot determine predictors of outcomes later than 1-month post-intervention. Finally, the design of this study does not allow for disentangling the effect of being sanctioned per se versus the effect of receiving the BMI. Prior work has documented self-initiated change immediately after a sanctioned event and prior to

intervention (a sanction effect), particularly among women (Carey et al., 2011; Fromme & Corbin, 2004) and those experiencing referrals for more serious legal or medical events (Morgan, Mun, & White, 2008). Even so, exposure to a BMI has been associated with additional reductions in drinking (Carey et al., 2009), and so students who have not reduced their drinking either on their own or after a BMI deserve additional attention.

BMIs reliably produce risk reduction among college drinkers, but efforts to enhance efficacy must continue. We identified demographic, personality, and social cognitive factors associated with change after a BMI. Being male, valuing fun seeking, and perceiving fewer benefits and more costs to drinking less were associated with less change after the BMI. Similarly, associating college life with drinking and seeing fewer benefits and more costs to drinking less predicted smaller reductions in alcohol-related consequences. These predictors suggest psychosocial targets to be addressed in refined BMIs.

## Acknowledgments

The authors thank the University of Connecticut SURE team, Donna Korb, and Catherine Cocks for their assistance with this research.

### Role of Funding Sources

Funding for this study was provided by NIAAA Grants R01-AA12518 to Kate B. Carey, T32 AA007459 to Peter M. Monti, K01AA022938 to Jennifer E. Merrill, and NIMH Grant K01-MH099956 to Jennifer L. Walsh. Neither NIAAA or NIMH had any role in the study design, collection, analysis or interpretation of the data, writing the manuscript, or the decision to submit the paper for publication.

## References

- Bandura A. Social cognitive theory. *Handbook of social psychological theories*. 2011; 2012:349–373.
- Bauman KE, Fisher LA, Bryan ES, Chenoweth RL. Relationship between Subjective Expected Utility and Behavior - a Longitudinal-Study of Adolescent Drinking behavior. *Journal of Studies on Alcohol*. 1985; 46(1):32–38. [PubMed: 3974233]
- Byrne BM, Shavelson RJ, Muthen B. Testing for the Equivalence of Factor Covariance and Mean Structures - the Issue of Partial Measurement Invariance. *Psychological Bulletin*. 1989; 105(3):456–466. DOI: 10.1037/0033-2909.105.3.456
- Carey KB, Carey MP, Henson JM, Maisto SA, DeMartini KS. Brief alcohol interventions for mandated college students: comparison of face-to-face counseling and computer-delivered interventions. *Addiction*. 2011; 106(3):528–537. DOI: 10.1111/j.1360-0443.2010.03193.x [PubMed: 21059184]
- Carey KB, Carey MP, Maisto SA, Henson JM. Brief motivational interventions for heavy college drinkers: A randomized controlled trial. *Journal of Consulting and Clinical Psychology*. 2006; 74(5):943–954. doi:2006-13014-015 [pii] 10.1037/0022-006X.74.5.943. [PubMed: 17032098]
- Carey KB, Henson JM, Carey MP, Maisto SA. Computer versus in-person intervention for students violating campus alcohol policy. *Journal of Consulting and Clinical Psychology*. 2009; 77(1):74–87. doi:2009-00563-016 [pii] 10.1037/a0014281. [PubMed: 19170455]
- Carey KB, Scott-Sheldon LA, Carey MP, DeMartini KS. Individual-level interventions to reduce college student drinking: A meta-analytic review. *Addictive Behaviors*. 2007; 32(11):2469–2494. DOI: 10.1016/j.addbeh.2007.05.004 [PubMed: 17590277]
- Carey KB, Scott-Sheldon LA, Garey L, Elliott JC, Carey MP. Alcohol interventions for mandated college students: A meta-analytic review. *Journal of Consulting and Clinical Psychology*. 2016; 84(7):619–632. DOI: 10.1037/a0040275 [PubMed: 27100126]
- Carver CS, White TL. Behavioral-Inhibition, Behavioral Activation, and Affective Responses to Impending Reward and Punishment - the Bis Bas Scales. *Journal of Personality and Social Psychology*. 1994; 67(2):319–333. DOI: 10.1037/0022-3514.67.2.319

- Collins RL, Parks GA, Marlatt GA. Social determinants of alcohol consumption: The effects of social interaction and model status on the self-administration of alcohol. *Journal of Consulting and Clinical Psychology*. 1985; 53(2):189–200. DOI: 10.1037/0022-006x.53.2.189 [PubMed: 3998247]
- Courtenay WH. Constructions of masculinity and their influence on men's well-being: a theory of gender and health. *Social Science & Medicine*. 2000; 50(10):1385–1401. [PubMed: 10741575]
- Cranford JA, Eisenberg D, Serras AM. Substance use behaviors, mental health problems, and use of mental health services in a probability sample of college students. *Addictive Behaviors*. 2009; 34(2):134–145. DOI: 10.1016/J.Addbeh.2008.09.004 [PubMed: 18851897]
- Cunningham JA, Sobell LC, Gavin DR, Sobel MB, Breslin FC. Assessing motivation for change: Preliminary development and evaluation of a scale measuring the costs and benefits of changing alcohol or drug use. *Psychology of Addictive Behaviors*. 1997; 11:107–114.
- Dennhardt AA, Murphy JG. Associations Between Depression, Distress Tolerance, Delay Discounting, and Alcohol-Related Problems in European American and African American College Students. *Psychology of Addictive Behaviors*. 2011; 25(4):595–604. DOI: 10.1037/a0025807 [PubMed: 21988480]
- Dimeff, LA., Baer, JS., Kivlahan, DR., Marlatt, GA. *Brief Alcohol Screening and Intervention for College Students (BASICS): A harm reduction approach*. New York: Guilford; 1999.
- Diulio AR, Silvestri MM, Correia CJ. The role of personality variables in drinking game participation. *Addictive Behaviors*. 2014; 39(7):1159–1162. DOI: 10.1016/j.addbeh.2014.02.005 [PubMed: 24727112]
- Duncan, TE., Duncan, SC., Strycker, LA. *An introduction to latent variable growth curve modeling: Concepts, issues, and applications*. 2nd. Mahwah, NJ: Lawrence Erlbaum Associates; 2006.
- Fromme K, Corbin W. Prevention of heavy drinking and associated negative consequences among mandated and voluntary college students. *Journal of Consulting and Clinical Psychology*. 2004; 72(6):1038–1049. [PubMed: 15612850]
- Gray JA. The psychophysiological basis of introversion-extraversion. *Behaviour Research and Therapy*. 1970; 8(3):249–266. [PubMed: 5470377]
- Hall PA, Fong GT. The effects of a brief time perspective intervention for increasing physical activity among young adults. *Psychology & Health*. 2003; 18(6):685–706. DOI: 10.1080/0887044031000110447
- Hamilton KR, Sinha R, Potenza MN. Hazardous drinking and dimensions of impulsivity, behavioral approach, and inhibition in adult men and women. *Alcoholism, Clinical and Experimental Research*. 2012; 36(6):958–966. DOI: 10.1111/j.1530-0277.2011.01708.x
- Henson JM, Pearson MR, Carey KB. Defining and characterizing differences in college alcohol intervention efficacy: A growth mixture modeling application. *Journal of Consulting and Clinical Psychology*. 2015; 83(2):370–381. DOI: 10.1037/a0038897 [PubMed: 25730522]
- Huh D, Mun EY, Larimer ME, White HR, Ray AE, Rhew IC, Atkins DC. 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*. 2015; 39(5):919–931. DOI: 10.1111/acer.12714
- Iwamoto DK, Cheng A, Lee CS, Takamatsu S, Gordon D. “Man-ing” up and getting drunk: The role of masculine norms, alcohol intoxication and alcohol-related problems among college men. *Addictive Behaviors*. 2011; 36(9):906–911. DOI: 10.1016/J.Addbeh.2011.04.005 [PubMed: 21620570]
- Johnston LD, O'Malley PM, Bachman JG, Schulenberg JE, Miech RA. *Monitoring the Future national survey results on drug use, 1975–2013: Volume II, College students and adults ages 19–55*. 2014 Retrieved from Ann Arbor:
- Kahler CW, Read JP, Wood MD, Palfai TP. Social environmental selection as a mediator of gender, ethnic, and personality effects on college student drinking. *Psychology of Addictive Behaviors*. 2003; 17(3):226–234. DOI: 10.1037/0893-164x.17.3.226 [PubMed: 14498817]
- Kahler CW, Strong DR, Read JP. Toward efficient and comprehensive measurement of the alcohol problems continuum in college students: The Brief Young Adult Alcohol Consequences Questionnaire. *Alcoholism: Clinical and Experimental Research*. 2005; 29(7):1180–1189. DOI: 10.1097/01.alc.0000171940.95813.a5

- Kazemi DM, Flowers C, Shou Q, Levine MJ, Van Horn KR. Personality Risk for Alcohol Consequences Among College Freshmen. *Journal of Psychosocial Nursing and Mental Health Services*. 2014; 52(7):38–45. DOI: 10.3928/02793695-20140310-01
- Kenney SR, LaBrie JW. Use of Protective Behavioral Strategies and Reduced Alcohol Risk: Examining the Moderating Effects of Mental Health, Gender, and Race. *Psychology of Addictive Behaviors*. 2013; 27(4):997–1009. DOI: 10.1037/a0033262 [PubMed: 24079648]
- Keough MT, O'Connor RM. Clarifying the measurement and the role of the behavioral inhibition system in alcohol misuse. *Alcoholism, Clinical and Experimental Research*. 2014; 38(5):1470–1479. DOI: 10.1111/acer.12387
- Kline, RB. *Principles and practice of structural equation modeling*. Guilford press; 2011.
- Korcha RA, Polcin DL, Bond JC, Lapp WM, Galloway G. Substance use and motivation: a longitudinal perspective. *American Journal of Drug and Alcohol Abuse*. 2011; 37(1):48–53. DOI: 10.3109/00952990.2010.535583 [PubMed: 21090959]
- Kroenke K, Spitzer RL, Williams JBW, Lowe B. An ultra-brief screening scale for anxiety and depression: The PHQ-4. *Psychosomatics: Journal of Consultation and Liaison Psychiatry*. 2009; 50(6):613–621.
- LaBrie JW, Pedersen ER, Earleywine M, Olsen H. Reducing heavy drinking in college males with the decisional balance: Analyzing an element of Motivational Interviewing. *Addictive Behaviors*. 2006; 31(2):254–263. [PubMed: 15970393]
- Larimer ME, Turner AP, Mallett KA, Geisner IM. Predicting drinking behavior and alcohol-related problems among fraternity and sorority members: examining the role of descriptive and injunctive norms. *Psychology of Addictive Behaviors*. 2004; 18(3):203–212. [PubMed: 15482075]
- Lewis MA, Rees M, Lee CM. Gender-specific normative perceptions of alcohol-related protective behavioral strategies. *Psychology of Addictive Behaviors*. 2009; 23(3):539–545. DOI: 10.1037/a0015176 [PubMed: 19769438]
- Little TD, Cunningham WA, Shahar G, Widaman KF. To Parcel or Not to Parcel: Exploring the Question, Weighing the Merits. *Structural Equation Modeling: A Multidisciplinary Journal*. 2002; 9(2):151–173. DOI: 10.1207/s15328007sem0902\_1
- Magid V, Colder CR. The UPPS Impulsive Behavior Scale: Factor structure and associations with college drinking. *Personality and Individual Differences*. 2007; 43(7):1927–1937. DOI: 10.1016/j.paid.2007.06.013
- Matthews DB, Miller WR. Estimating blood alcohol concentration: Two computer programs and their applications in therapy and research. *Addictive Behaviors*. 1979; 4(1):55–60. DOI: 10.1016/0306-4603(79)90021-2 [PubMed: 420046]
- McArdle JJ. Latent variable modeling of differences and changes with longitudinal data. *Annual Review of Psychology*. 2009; 60:577–605. DOI: 10.1146/annurev.psych.60.110707.163612
- McArdle, JJ., Nesselroade, JR. An overview of latent curve and latent change score analyses. In: Schinka, JA, Velicer, WF., Weiner, IB., editors. *Handbook of Psychology*. 2. Vol. 2. Hoboken, NJ: John Wiley; 2013. p. 474-507. *Research Methods in Psychology*
- McCabe SE. Gender differences in collegiate risk factors for heavy episodic drinking. *Journal of Studies on Alcohol*. 2002; 63(1):49–56. [PubMed: 11925058]
- Merrill JE, Carey KB, Lust SA, Kalichman SC, Carey MP. Do Students Mandated to Intervention for Campus Alcohol-related Violations Drink More Than Nonmandated Students? *Psychology of Addictive Behaviors*. 2014; doi: 10.1037/a0037710
- Miller WR, Rollnick S. Meeting in the middle: motivational interviewing and selfdetermination theory. *Int J Behav Nutr Phys Act*. 2012; 9:25.doi: 10.1186/1479-5868-9-25 [PubMed: 22385872]
- Morgan TJ, White HR, Mun EY. Changes in drinking before a mandated brief intervention with college students. *Journal of Studies on Alcohol and Drugs*. 2008; 69(2):286–290. [PubMed: 18299770]
- Murphy JG, Dennhardt AA, Skidmore JR, Borsari B, Barnett NP, Colby SM, Martens MP. A randomized controlled trial of a behavioral economic supplement to brief motivational interventions for college drinking. *Journal of Consulting and Clinical Psychology*. 2012; 80(5): 876–886. DOI: 10.1037/a0028763 [PubMed: 22663899]



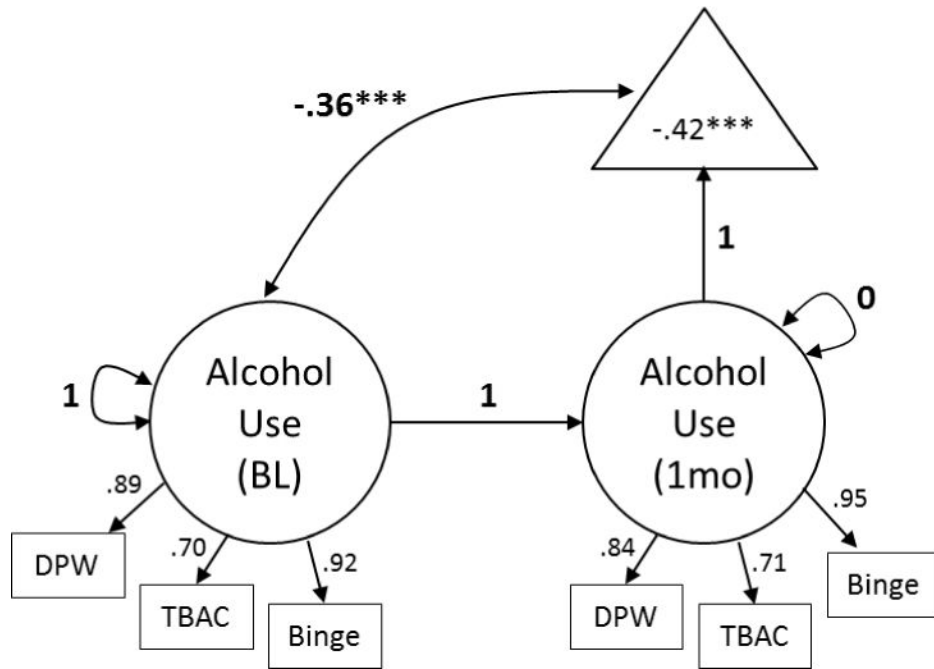
- Murphy JG, Dennhardt AA, Skidmore JR, Martens MP, McDevitt-Murphy ME. Computerized versus motivational interviewing alcohol interventions: impact on discrepancy, motivation, and drinking. *Psychol Addict Behav*. 2010; 24(4):628–639. DOI: 10.1037/a0021347 [PubMed: 21198224]
- Muthén, LK., Muthén, BO. *Mplus user's guide*. 7. Los Angeles: Muthén & Muthén; 1998–2015.
- Osberg TM, Atkins L, Buchholz L, Shirshova V, Swiantek A, Whitley J, Oquendo N. Development and validation of the college life alcohol salience scale: A measure of beliefs about the role of alcohol in college life. *Psychology of Addictive Behaviors*. 2010a; 24(1):1–12. DOI: 10.1037/a0018197 [PubMed: 20307107]
- Osberg TM, Atkins L, Buchholz L, Shirshova V, Swiantek A, Whitley J, Oquendo N. Development and validation of the College Life Alcohol Salience Scale: a measure of beliefs about the role of alcohol in college life. *Psychology of Addictive Behaviors*. 2010b; 24(1):1–12. DOI: 10.1037/a0018197 [PubMed: 20307107]
- Osberg TM, Billingsley K, Eggert M, Insana M. From Animal House to Old School: A multiple mediation analysis of the association between college drinking movie exposure and freshman drinking and its consequences. *Addictive Behaviors*. 2012; 37(8):922–930. DOI: 10.1016/j.addbeh.2012.03.030 [PubMed: 22507304]
- Osberg TM, Insana M, Eggert M, Billingsley K. Incremental validity of college alcohol beliefs in the prediction of freshman drinking and its consequences: a prospective study. *Addictive Behaviors*. 2011; 36(4):333–340. DOI: 10.1016/j.addbeh.2010.12.004 [PubMed: 21196082]
- Park A, Sher KJ, Krull JL. Risky drinking in college changes as fraternity/sorority affiliation changes: A person-environment perspective. *Psychology of Addictive Behaviors*. 2008; 22(2):219–229. DOI: 10.1037/0893-164x.22.2.219 [PubMed: 18540719]
- Park HS, Klein KA, Smith S, Martell D. Separating subjective norms, university descriptive and injunctive norms, and U.S. descriptive and injunctive norms for drinking behavior intentions. *Health Commun*. 2009; 24(8):746–751. DOI: 10.1080/10410230903265912 [PubMed: 20183383]
- Prochaska JO, DiClemente CC, Norcross JC. In search of how people change: Applications to addictive behaviors. *American Psychologist*. 1992; 47(9):1102–1114. [PubMed: 1329589]
- Prochaska JO, Velicer WF, Rossi JS, Goldstein MG, Marcus BH, Rakowski W, et al. Stages of change and decisional balance for 12 problem behaviors. *Health Psychology*. 1994; 13(1):39–46. [PubMed: 8168470]
- Qi D, Pearson MR, Hustad JT. Predictors of motivation to change in mandated college students following a referral incident. *Psychology of Addictive Behaviors*. 2014; 28(2):524–531. DOI: 10.1037/a0035910 [PubMed: 24750039]
- Reid AE, Carey KB. Interventions to reduce college student drinking: State of the evidence for mechanisms of behavior change. *Clinical Psychology Review*. 2015; 40:213–224. DOI: 10.1016/j.cpr.2015.06.006 [PubMed: 26164065]
- Reynolds WM. Development of reliable and valid short forms of the Marlowe-Crowne Social Desirability Scale. *Journal of Clinical Psychology*. 1982; 38(1):119–125. doi: 10.1002/1097-4679(198201)38:1<119::aid-jclp2270380118>3.0.co;2-i.
- Samson JE, Tanner-Smith EE. Single-Session Alcohol Interventions for Heavy Drinking College Students: A Systematic Review and Meta-Analysis. *J Stud Alcohol Drugs*. 2015; 76(4):530–543. [PubMed: 26098028]
- Satorra A, Bentler PM. Ensuring Positiveness of the Scaled Difference Chi-square Test Statistic. *Psychometrika*. 2010; 75(2):243–248. DOI: 10.1007/s11336-009-9135-y [PubMed: 20640194]
- Schafer JL. Multiple imputation: a primer. *Statistical Methods in Medical Research*. 1999; 8(1):3–15. [PubMed: 10347857]
- Sher KJ, Rutledge PC. Heavy drinking across the transition to college: predicting first-semester heavy drinking from precollege variables. *Addictive Behaviors*. 2007; 32(4):819–835. DOI: 10.1016/j.addbeh.2006.06.024 [PubMed: 16860940]
- Tabachnick, BG., Fidell, LS. *Using multivariate statistics*. 5. Bacon, PA., editor. Boston: 2007.
- Voigt DC, Dillard JP, Braddock KH, Anderson JW, Sopory P, Stephenson MT. Carver and White's (1994) BIS/BAS scales and their relationship to risky health behaviours. *Personality and Individual Differences*. 2009; 47(2):89–93. DOI: 10.1016/j.paid.2009.02.003



- Wardell JD, O'Connor RM, Read JP, Colder CR. Behavioral approach system moderates the prospective association between the behavioral inhibition system and alcohol outcomes in college students. *J Stud Alcohol Drugs*. 2011; 72(6):1028–1036. [PubMed: 22051217]
- Wechsler H, Dowdall GW, Davenport A, Rimm EB. A gender-specific measure of binge drinking among college students. *American Journal of Public Health*. 1995; 85(7):982–985. DOI: 10.2105/ajph.85.7.982 [PubMed: 7604925]
- Weitzman ER. Poor mental health, depression, and associations with alcohol consumption, harm, and abuse in a national sample of young adults in college. *Journal of Nervous and Mental Disease*. 2004; 192(4):269–277. [PubMed: 15060400]
- White A, Hingson R. New research findings since the 2007 Surgeon General's Call to Action to Prevent and Reduce Underage Drinking: a review. *Journal on Studies of Alcohol and Drugs*. 2014; 75(1):158–169.

**Highlights**

- College drinkers respond differently to brief motivational intervention
- We examined predictors of change after a mandated intervention
- Male sex, fun-seeking, more costs, fewer benefits predicted less change in drinking
- Alcohol beliefs, costs and benefits predicted less change in consequences
- We identify targets for intervention refinement



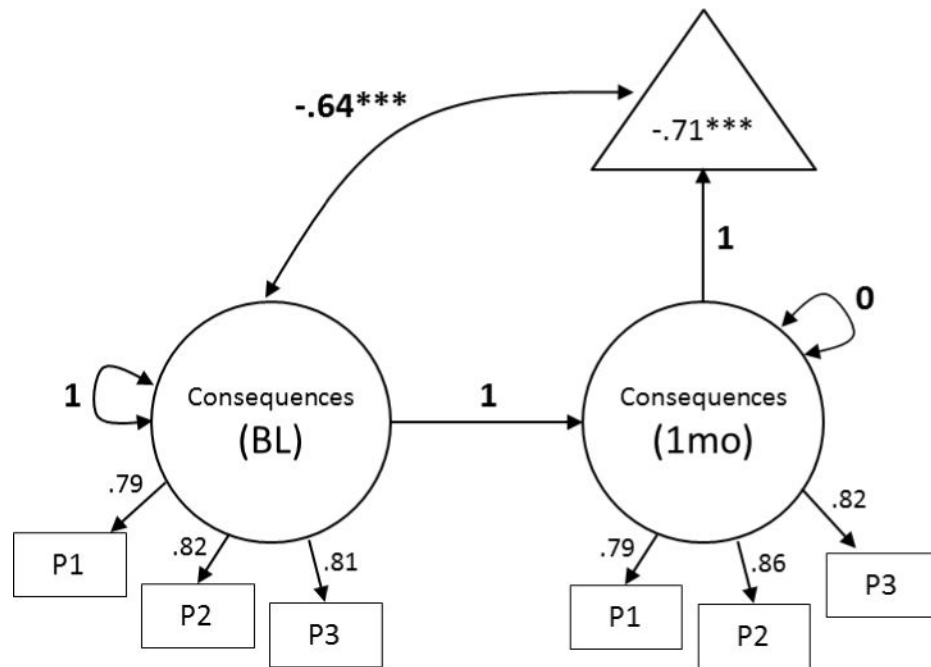
**Figure 1. Latent change score model for alcohol consumption at baseline and 1 month follow-up for mandated college drinkers ( $N = 568$ ) participating in a brief motivational intervention**  
*Notes.* Model fitted using a MLR estimator in Mplus. DPW = drinks per week (log transformed); TBAC = typical blood alcohol concentration (log transformed); Binge = binge drinking frequency (log transformed). Residual terms for identical indicators are allowed to correlate across time. Standardized factor loadings and correlations are reported.

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript



**Figure 2. Latent change score model for alcohol-related consequences at baseline and 1 month follow-up for mandated college drinkers ( $N = 568$ ) participating in a brief motivational intervention**

*Notes.* Model fitted using a MLR estimator in Mplus. Indicators are parcels of items from the Brief Young Adult Alcohol Consequences Questionnaire (B-YAACQ). Residual terms for identical indicators are allowed to correlate across time. Standardized factor loadings and correlations are reported.

**Table 1**

Baseline values on hypothesized predictors of change among mandated students participating in a brief motivational intervention (N = 568)

<b>Demographic Variables</b>	<b>%</b>		
Male sex	72%		
White race	84%		
Class Year			
Freshmen	38%		
Sophomore	35%		
Junior	18%		
Senior	9%		
Greek membership	17%		

<b>Psychological Variables</b>	<b>Mean</b>	<b>SD</b>	<b>Potential Range</b>
Social Desirability	6.95	2.76	0 – 13
Behavioral Inhibition Scale	20.36	3.35	7 – 28
Reward (BAS)	17.83	2.22	4 – 20
Drive (BAS)	11.27	2.51	4 – 16
Fun (BAS)	12.05	2.43	4 – 16
Sensation Seeking (UPPS)	29.63	9.27	0 – 48
Premeditation (UPPS)	23.12	6.95	0 – 40
Perseverance (UPPS)	20.91	5.48	0 – 32
Negative Urgency (UPPS)	12.61	6.99	0 – 40
Descriptive Norms	3.20	.77	0 – 4
Injunctive Norms	3.12	.64	0 – 4
Costs of Cutting Down	1.47	1.07	1 – 5
Benefits of Cutting Down	2.63	1.28	1 – 5
Psychological Distress (PHQ-4)	1.81	2.30	0 – 12
Centrality of Alcohol (CLASS)	44.26	9.19	15 – 75

*Note.* BAS=Behavioral Activation Scale; UPPS=Urgency Premeditation Planning Sensation Seeking Impulsive Behavior Scale; PHQ=Patient Health Questionnaire; CLASS=College Life Alcohol Salience Scale.

**Table 2**

Change in values for primary outcome variables from baseline to 1-month, for entire sample and separately by sex

	Entire Sample <i>N</i> = 568	Males <i>N</i> = 407	Females <i>N</i> = 161
	<i>M</i> ( <i>SD</i> )	<i>M</i> ( <i>SD</i> )	<i>M</i> ( <i>SD</i> )
Drinks per Week			
Baseline	12.57 (9.85)	14.22 (10.46)	8.33 (6.31)**
1-month	9.5 (7.82)	10.95 (8.13)	5.76 (5.43)**
Binge Drinking Frequency			
Baseline	4.15 (3.80)	4.49 (3.79)	3.31 (3.69)**
1-month	2.83 (2.89)	3.20 (3.0)	1.88 (2.33)**
Typical Blood Alcohol Concentration			
Baseline	0.08 (.06)	0.08 (.06)	0.09 (.07)*
1-month	0.06 (.06)	0.06 (.05)	0.05 (.06)
Alcohol Consequences			
Baseline	5.44 (4.25)	5.34 (4.04)	5.69 (4.74)
1-month	2.84 (3.51)	2.91 (3.52)	2.64 (3.48)

*Note.* All 1-month values differ significantly from baseline values ( $ps < .001$ ). Asterisks along a row indicate gender differences at that assessment point.

\*\* females differ from males at  $p < .001$

\* females differ from males at  $p < .05$



**Table 3**

Predictors of (a) Baseline Alcohol Consumption and (b) Latent Changes in Alcohol Consumption Following a Brief Motivational Intervention (N = 568)

<b>Predictors of Baseline Alcohol Consumption</b>				
	<b>B</b>	<b>SE</b>	<b>Est</b>	<b>P</b>
Male	0.26	0.11	2.24	0.03
White	0.43	0.12	3.46	0.001
Greek	0.24	0.11	2.08	0.04
Fun Seeking	0.05	0.02	2.25	0.02
Descriptive Norms	0.45	0.07	6.45	< 0.001
Costs of Cutting Down	0.17	0.06	3.18	0.001
Benefits of Cutting Down	-0.05	0.05	-1.06	0.29
CLASS	0.04	0.01	6.16	< 0.001
<b>Predictors of Changes in Alcohol Consumption</b>				
	<b>B</b>	<b>SE</b>	<b>Est</b>	<b>P</b>
Baseline Alcohol Consumption	-0.43	10.05	-8.51	< 0.001
Male	0.32	0.10	3.27	0.001
White	0.22	0.13	1.73	0.08
Greek	0.21	0.12	1.77	0.08
Fun Seeking	0.05	0.02	2.94	0.003
Descriptive Norms	0.07	0.07	0.99	0.32
Costs of Cutting Down	0.13	0.05	2.51	0.01
Benefits of Cutting Down	-0.07	0.04	-1.96	0.05
CLASS	0.01	0.01	1.10	0.27

*Note.* CLASS=College Life Alcohol Salience Scale.

**Table 4**

Predictors of (a) Baseline Alcohol Consequences and (b) Latent Changes in Alcohol-Related Consequences Following a Brief Motivational Intervention

<b>Predictors of Baseline Alcohol-Related Consequences</b>				
	<b>B</b>	<b>SE</b>	<b>Est</b>	<b>P</b>
Greek	0.07	0.13	0.52	0.60
Social Desirability	-0.10	0.02	-4.75	< 0.001
Behavioral Inhibition Scale	0.05	0.02	3.42	0.001
Fun Seeking	0.004	0.02	0.22	0.83
UPPS Premeditation	-0.01	0.01	-1.78	0.08
Descriptive Norms	0.20	0.07	2.76	0.006
Injunctive Norms	0.18	0.09	1.98	0.047
Costs of Cutting Down	0.08	0.07	1.19	0.24
Benefits of Cutting Down	0.22	0.05	4.49	< 0.001
CLASS	0.02	0.01	2.94	0.003
<b>Predictors of Changes in Alcohol-Related Consequences</b>				
	<b>B</b>	<b>SE</b>	<b>Est</b>	<b>P</b>
Baseline Alcohol-Related Consequences	-0.71	0.06	-11.46	< 0.001
Greek	0.20	0.13	1.61	0.11
Social Desirability	-0.01	0.02	-0.42	0.67
Behavioral Inhibition Scale	-0.02	0.01	-1.25	0.21
Fun Seeking	0.03	0.02	1.63	0.10
UPPS Premeditation	-0.01	0.01	-1.46	0.15
Descriptive Norms	0.07	0.06	1.23	0.22
Injunctive Norms	0.07	0.08	0.92	0.36
Costs of Cutting Down	0.16	0.05	3.04	0.002
Benefits of Cutting Down	-0.08	0.04	-2.09	0.04
CLASS	0.01	0.01	1.96	0.05

Note. UPPS=Urgency Premeditation Planning Sensation Seeking Impulsive Behavior Scale; CLASS=College Life Alcohol Salience Scale.