The Effectiveness of Message Framing and Temporal Context on College Student Alcohol Use and Problems: A Selective E-Mail Intervention

Michael H. Bernstein*, Mark D. Wood†, and Lauren R. Erickson

Cancer Prevention Research Center, University of Rhode Island, 130 Flagg Road, Kingston, RI 02881, USA

*Corresponding author: Tel.: +1-401-875-5025; E-mail: mbernstein11@my.uri.edu

†Deceased on 26 April 2015.

Received 14 February 2015; Revised 6 July 2015; Accepted 7 July 2015

Abstract

Aims: Only one study has examined message framing on college drinking, but did so in a laboratory setting among a general sample of college students. The current study was designed to: (a) compare the efficacy of emailed interventions differing by message framing and temporal context on alcohol involvement among heavy drinking college students and (b) examine need for cognition (NFC), consideration of future consequences (CFC) and self-efficacy as putative moderators.

Methods: Hazardous drinking college students (N = 220) were randomly assigned to conditions in a 2 (Frame: gain vs. loss) × 2 (Temporal Context: long-term vs. short-term consequences) factorial design. Participants received four emails on heavy drinking consequences phrased in a manner consistent with their condition. After each message, participants were given a manipulation check. Participants were sent a 1-month follow-up assessment. Primary outcome measures were heavy episodic drinking (HED) and alcohol-related problems. We hypothesized two main effects (less alcohol consumption in the gain-frame and short-term condition), qualified by a Frame × Temporal Context interaction with substantially less alcohol involvement in the gain-frame/short-term condition.

Results: There was very little study attrition (96.4% completed follow-up survey, 93.2%–99.5% completed manipulation checks), and strong effects were observed for the manipulations. A 2 × 2 ANCOVA, controlling for baseline alcohol involvement, revealed no consistent main effects or interactions on either outcome. No moderation was observed for any putative moderator.

Conclusions: These results do not replicate prior laboratory-based research. The null findings may be attributed to the heavy drinking sample or electronic means of message delivery.

INTRODUCTION

Alcohol abuse among college students has long been recognized as a significant public health issue (Straus and Bacon, 1953; Kraft, 1976). An estimated 1825 alcohol-related fatalities occur annually among the college student population and alcohol is implicated in more than 796,000 violent and sexual assaults (Hingson et al., 2009). One of the major opportunities for significant advances in reducing heavy and problematic drinking is through widespread dissemination of effective brief interventions, particularly with technology-based methods that have the potential to significantly advance clinical practice in a cost-effective method. Furthermore, enhanced understanding of the individual-level moderators will maximize the efficacy of existing interventions.

Message framing and temporal context

Prospect theory (Tversky and Kahneman, 1981) proposes that the effectiveness of identical message content varies based on the extent to
which consequences of behavior are couched in terms of costs (e.g. loss frame) or benefits (e.g. gain frame) (Tversky and Kahneman, 1981; Rothman and Salovey, 1997). A loss-framed message focuses on the costs of not engaging in a health protective behavior or engaging in a risky behavior (e.g. heavy drinking leads to driving accidents) while a gain-framed message highlights the benefits of engaging in a health protective behavior or not engaging in a risky behavior (e.g. by not drinking heavily you can avoid driving accidents). Substantial research has supported message framing across a wide range of detection (e.g. HIV testing, mammography, skin cancer self-exams) and preventive (e.g. seat belt use, sun screen use) behaviors (Meyerowitz and Chaiken, 1987; Rothman et al., 1993; Detweiler et al., 1999; Schneider et al., 2001; Apanovitch et al., 2003; Kiene et al., 2005). A recent meta-analysis found a significant advantage for gain frame messages targeting preventive, behavioral outcomes (as opposed to attitudes or behavioral intention outcomes) (Gallagher and Updegraff, 2012). The authors concluded that attitudes and behavioral intentions constitute poor proxies for behavior and that the ‘practical benefit of health message framing can only be realized by examining behavior’ (p. 111).

To our knowledge, only one study has manipulated gain- vs. loss-frame messages in targeting alcohol consequences, although see Dvorak et al. (2015) for an experiment that compares gain- and loss-frame messages discussing protective behavioral strategies.

Gerend and Cullen (2008) asked 228 general college students not selected on the basis of drinking status to read alcohol information for 5 min. These researchers manipulated message frame (gain vs. loss) and temporal context (short- vs. long-term consequences) of the information. Among the 181 participants who returned for a 1-month follow-up, there was a significant main effect for temporal context on alcohol quantity, such that short-term consequences were associated with fewer drinks per occasion (d = 0.30). Main effects of the message frame were observed for frequency of alcohol consumption, with gain frames producing lower alcohol use frequency (d = 0.32). There was also a Frame x Temporal Context interaction for alcohol quantity and heavy episodic drinking frequency, with participants in the gain frame-short-term consequences condition reporting less alcohol involvement compared to the other three conditions (ds = 0.33 and 0.31, respectively). While this study constitutes an important first step, study limitations include the omission of measures of alcohol-related problems, and potential treatment moderators. Additionally, the study was conducted in a laboratory, which leaves questions about the feasibility of large scale dissemination (e.g. via computer delivery) unaddressed.

**Moderators of message frame effects**

Message frame theorists and attitude researchers have long recognized the importance of individual differences on persuasive message impact (Petty and Cacioppo, 1986; Rothman et al., 2008). Individual differences in future orientation have been shown to moderate both message frame and temporal context effects. O’Connor et al. (2009) observed a stronger effect for loss frame messages for those high on consideration of future consequences (CFC) and a gain frame advantage for those low on CFC on the dependent measure of time spent reading additional health information. Orbell et al. (2004) found that low CFC participants were more persuaded and generated more positive thoughts to a health communication that emphasized short-term consequences while high CFC participants were more persuaded and generated more positive thoughts in response to long-term consequences. Need for cognition (NFC), or the enjoyment of effortful cognitive processing (Cacioppo et al., 1996), and self-efficacy were identified as among the most consistent dispositional moderators of message frame effects in a recent meta-analysis (Covey, 2014). Some studies have shown that those participants low in NFC are more influenced by gain-frame messages (Steward et al., 2003), and people high in self-efficacy are more influenced by loss-frame messages (Van’t Riet et al., 2010). To date, none of these dispositional factors has been examined with respect to alcohol-related communications.

**The current study**

The current study replicates and extends Gerend and Cullen (2008) and prior message framing research in multiple ways. Consistent with theory (Rothman and Salovey, 1997) and results of a recent research synthesis (Gallagher and Updegraff, 2012) we hypothesized gain-framed messages would be more effective in reducing alcohol use and problems than loss-framed communications. We also anticipated that temporal context would affect outcomes. This is consistent with findings of Gerend and Cullen and a behavioral economic study that found monetary gains are discounted more strongly over a hypothetical 250 month period than monetary losses (Estle et al., 2006, experiments 1 and 3). Specifically, we hypothesized that short-term consequences would be more efficacious than long-term consequences and would increase the impact of gain-framed messages on alcohol use and problems. While prior research, including Gerend and Cullen (2008), has used message framing as a universal preventive intervention (applied at the population level; see Muñoz et al., 1996), the current study examines the efficacy of message framing as a selective intervention (applied to high-risk individuals). In doing so, our goal was to target college students who would benefit most from the intervention, and examine whether message framing is effective as a targeted means of communications. This study also advances prior work by using email as the means of dissemination, which can be more easily administered to most populations.

As noted above, dispositional characteristics of message recipients have been identified as important moderators of message frame and temporal context effects. Accordingly, for the first time with alcohol use and problems, we investigated whether consideration of future consequences (CFC), need for cognition (NFC), and self-efficacy would moderate message frame and temporal context effects. Although we recognize other moderators have been studied with respect to message framing, we chose CFC and NFC since they are two of the more widely studied variables. Self-efficacy was chosen because it is an important construct in the substance use literature (DiClemente et al., 1995). We anticipated that individuals high on CFC would be more responsive to loss-framed and long-term consequences messages and that individuals low on NFC would be more responsive to gain-framed messages. With respect to self-efficacy, we anticipated that those higher on self-efficacy would be more affected by loss-framed messages. We also examined whether CFC would moderate temporal context effects, such that high CFC individuals would be more affected by long-term consequence messages.

**METHOD**

**Recruitment and participants**

A recruitment message containing the Alcohol Use Disorders Identification Test (AUDIT; Saunders et al., 1993) and drug treatment history measure was emailed to all 10,016 18- to 24-year-old undergraduates at the study site. A total of 1617 students completed this survey, and
1023 (63.3%) were eligible. Participants were eligible if they: (a) were 18–24 years old, (b) met criteria for hazardous drinking, defined as AUDIT scores of 8+/6+ for men/women, and (c) had no past two year history of alcohol or drug treatment. We invited the first 160 men and 140 women who met eligibility criteria to participate. We sent these 300 participants the baseline survey, which was completed by 73.3% (N = 220), comprising the current sample.

Procedure
Upon completion of the 15–20 min baseline questionnaire administered on SurveyMonkey, participants were randomized to one of four conditions: gain frame/long term (GFLT), gain frame/short term (GFST), loss frame/long term (LFLT) and loss frame/short term (LFST). We used block-randomization to ensure that 55 participants would be assigned to each condition. Conditions were also balanced on gender. Within one week of completing the baseline survey, participants were emailed the first of four messages. Messages 2, 3, and 4, were sent 11, 28, and 37 days after the first message, respectively (See Appendix for messages). The long gap between messages 2 and 3 was due to the timing of Spring Break, which hindered our ability to space these out more evenly. After viewing each message, participants completed a brief manipulation check questionnaire. Non-responders received up to three reminders, (two emails and one text message). The manipulation check items for Messages 1, 2, 3, and 4 were completed by 99.5, 96.8, 93.2, and 93.6%, respectively, of all participants. One month after the final message, we emailed the follow-up survey which was completed by 96.4% of participants. Non-responders received up to four follow-ups (two emails, one text message and one phone call). Participants received $10 for completing the baseline survey and $25 for completing the follow-up survey. No incentives were offered for the four manipulation checks. All policies and procedures were approved by the study site IRB. Since the study was conducted online, we obtained a waiver of signed consent, and informed participants that by beginning the baseline survey they were consenting to study procedures described on page one of our SurveyMonkey questionnaire.

Materials
Demographics. At T2, participants indicated their age, gender, race and ethnicity.

Alcohol/drug involvement
Alcohol Use Disorders Identification Test (AUDIT). To determine eligibility, participants completed the 10-item AUDIT in the screener survey as a measure of hazardous drinking (Saunders et al., 1993).

Drug Treatment History. In the screener, participants were asked ‘Within the past 2 years, have you attended Alcoholics Anonymous, or received treatment for alcohol or drug use?’

Heavy Episodic Drinking (HED). At baseline and follow-up, participants were asked ‘Within the past month, how many times have you had 5 or more drinks on one occasion?’ (Midanik, 1999).

Brief Young Adult Alcohol Consequences Questionnaire (B-YAACQ). At baseline and follow-up, past-month alcohol-related problems were assessed with the 24-item B-YAACQ (Kahler et al., 2005). We observed a co-efficient alpha of 0.819 at baseline and 0.836 at follow-up.

Manipulation checks
Framing. After each message, participants were asked to respond to the stem: ‘In my view, this message focused on. . .’ on a six-point scale from ‘costs of drinking heavily’ to ‘benefits of not drinking heavy.’ (Gerend and Cullen, 2008).

Temporal Context. After each message, participants were asked to respond to the stem ‘In my view, this message focused on. . .’ on a six-point scale from ‘short-term consequences of heavy drinking’ to ‘long-term consequences of heavy drinking.’ (Gerend and Cullen, 2008).

Additional Manipulation Check Items. After each message, participants were asked the following items on a 6-point scale from ‘strongly disagree’ to ‘strongly agree’: ‘The message was interesting,’ ‘The message was clear,’ ‘The message was easy to understand,’ ‘Information in the message was important,’ and ‘The information in this message was of a high quality.’ Participants also indicated whether reading the messages made them feel: anxious, afraid, hopeful, or relieved on a 6-point scale from ‘not at all’ to ‘extremely.’ These items were based on Gerend and Cullen (2008).

Putative moderators
Need for Cognition (NFC). An 18-item short-form of Need for Cognition, developed by Cacioppo et al. (1984), was administered at baseline. We observed a coefficient alpha of 0.856.

Consideration for Future Consequences (CFC). Consideration of Future Consequences, which indicates the extent one thinks about and plans for the future, was assessed at baseline with 12 items (Strathman et al., 1994). We observed a coefficient alpha of 0.795.

Self-Efficacy. Self-efficacy was assessed at baseline with a modified version of the Brief Situational Confidence Questionnaire (BSCQ) (Breslin et al., 2000). This measure asks participants to ‘indicate how confident you are RIGHT NOW that you will be able to resist drinking heavily in each situation, from 0% ‘Not at all confident’ to 100% ‘Totally Confident.’ On the original survey, these included eight situations, although we removed ‘testing control over my use of alcohol’ since the item is likely inapplicable for this sample. We observed a coefficient alpha of 0.795 with the remaining seven items.

Messages. All messages were closely adapted from Gerend and Cullen (2008), and focused on one area of heavy drinking consequences. Message 1 discussed social consequences, Message 2 discussed psychological consequences, Message 3 discussed health consequences, and Message 4 discussed performance consequences. The subject line varied according to assigned temporal context condition and targeted consequence domain: ‘What are the [long/short]-term (social/psychological/health/performance) consequences of heavy drinking?’ Each message also included a figure illustrating that heavy drinking refers to 4+/5+ drinks in a 2-h period for women/men.

Regarding the framing manipulation, consequences were phrased as potentially occurring as a result of heavy drinking (loss-frame) (e.g. ‘Drinking heavily can lead to negative health consequences’) or likely not occurring if one abstains from heavy drinking (gain-frame) (e.g. ‘Not drinking heavily can help you avoid negative health consequences.’). Regarding the temporal context manipulation, messages differed in terms of whether they were phrased as long term (e.g. ‘Drinking heavily can lead to long-term social embarrassment’) or short term (e.g. ‘Drinking heavily can lead to immediate social embarrassment’) consequences. Other than framing and temporal context manipulations, all messages were identical.

Analytic plan
Prior to tests of our hypotheses, we ran descriptive statistics and correlations among study variables, examined assumptions underlying the general linear model, and conducted randomization and manipulation checks. Next, we tested our primary hypothesis by conducting
two 2 (Framing: gain vs. loss) by 2 (Temporal Context: short vs. long) ANCOVAs. In the first ANCOVA, follow-up HED was the outcome and baseline HED was the covariate. In the second ANCOVA, follow-up alcohol problems was the outcome and baseline alcohol problems was the covariate. We examined potential moderation by individual difference factors with three-step hierarchical multiple regression analyses.

RESULTS

Descriptive statistics

As shown in Table 1, participants were 50.9% male with an average age of 19.85 (SD = 1.38). The majority (90.1%) were White/Caucasian, not Hispanic or Latino (91.5%), and lived in a residence hall (51.9%). Compared to the University from which these data were collected, the present sample is over-represented with men (50.9 vs. 45.4%), and White/Caucasian (90.1 vs. 67.7%).

At baseline, participants reported a mean of 4.21 (SD = 3.11) past month heavy drinking episodes, and experienced an average of 7.92 (SD = 4.45) past month alcohol-related problems. At follow-up, participants reported a mean of 4.13 (SD = 3.44) past month heavy drinking episodes, and experienced an average of 7.22 (SD = 4.60) problems. Paired t-tests revealed that problems at baseline was greater than problems at follow-up, t(211) = 2.60, P = 0.010. There was no difference on heavy drinking, t(211) = 0.44, P = 0.661. Correlations among the primary study variables are presented in Table 2.

Assumptions

To determine if our outcomes (HED and problems) were normal, we calculated skewness and kurtosis values. All of these fell within an acceptable range (skewness < |2| kurtosis < |3|). Homoscedasticity was verified by conducting Levene’s test on each outcome across the four experimental conditions. Results indicated no violation of this assumption (Ps > 0.2).

Randomization check

We ran a one-way ANOVA to verify that participants were comparable at baseline with respect to heavy drinking and alcohol problems. None of these comparisons approached significance (for heavy drinking: F(3, 216) = 0.37, P = 0.777; for alcohol problems, F(3, 216) = 0.447, P = 0.720) indicating that all groups were equal on study outcomes at baseline.

Manipulation check

Results showed that our manipulations were robust, yielding large effects for framing: M1: t(217) = 7.77; M2: t(210) = 9.53; M3: t(202) = 7.25; M4: t(204) = 8.85 (all Ps < 0.001, average Cohen’s d = 1.57) and temporal context: M1: t(217) = 6.29, P < 0.001; M2: t(210) = 9.68, P < 0.001; M3: t(202) = 4.87; M4: t(204) = 2.93, P < 0.01 (average Cohen’s d = 0.76). Regarding the additional manipulation check items, the only consistent differences that emerged were gain-frame participants reporting that they felt more hopeful (M1: t[217] = 1.72, P = 0.087; M2: t[210] = 2.67, P = 0.008; M3: t[202] = 2.71, P = 0.007; **P < 0.01, two-tailed; ***P < 0.001, two-tailed.

Table 1. Sample demographics

<table>
<thead>
<tr>
<th>Demographic</th>
<th>Percent of sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>16.5</td>
</tr>
<tr>
<td>19</td>
<td>31.1</td>
</tr>
<tr>
<td>20</td>
<td>19.8</td>
</tr>
<tr>
<td>21</td>
<td>20.8</td>
</tr>
<tr>
<td>22</td>
<td>8.5</td>
</tr>
<tr>
<td>23</td>
<td>1.9</td>
</tr>
<tr>
<td>24</td>
<td>1.4</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>50.9</td>
</tr>
<tr>
<td>Female</td>
<td>40.1</td>
</tr>
<tr>
<td>Race</td>
<td></td>
</tr>
<tr>
<td>White/Caucasian</td>
<td>90.1</td>
</tr>
<tr>
<td>Black or African American</td>
<td>2.8</td>
</tr>
<tr>
<td>Multi-racial</td>
<td>2.8</td>
</tr>
<tr>
<td>Other</td>
<td>2.8</td>
</tr>
<tr>
<td>Asian</td>
<td>1.4</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
</tr>
<tr>
<td>Hispanic or Latino</td>
<td>91.5</td>
</tr>
<tr>
<td>Not Hispanic or Latino</td>
<td>8.5</td>
</tr>
<tr>
<td>Residence</td>
<td></td>
</tr>
<tr>
<td>Residence hall</td>
<td>51.9</td>
</tr>
<tr>
<td>Apartment, house or condo (not w/parents)</td>
<td>33.0</td>
</tr>
<tr>
<td>With parents</td>
<td>7.5</td>
</tr>
<tr>
<td>Fraternity/Sorority House</td>
<td>6.1</td>
</tr>
<tr>
<td>Other</td>
<td>1.4</td>
</tr>
</tbody>
</table>

Table 2. Bivariate correlations between study variables

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>–</td>
<td>–</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>0.005</td>
<td>–</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>–0.060</td>
<td>–0.327***</td>
<td></td>
<td>–</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>0.032</td>
<td>–0.336***</td>
<td>0.674***</td>
<td>–</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>–0.002</td>
<td>–0.055</td>
<td>0.457***</td>
<td>0.277***</td>
<td>–</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>0.081</td>
<td>–0.094</td>
<td>0.428***</td>
<td>0.473***</td>
<td>0.621***</td>
<td>–</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>–0.049</td>
<td>0.183**</td>
<td>–0.243***</td>
<td>–0.120*</td>
<td>–0.350***</td>
<td>–0.238***</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>0.047</td>
<td>–0.070</td>
<td>–0.121*</td>
<td>–0.001</td>
<td>–0.134*</td>
<td>–0.034</td>
<td>0.414***</td>
<td>–</td>
</tr>
<tr>
<td>9.</td>
<td>0.038</td>
<td>0.010</td>
<td>–0.269***</td>
<td>–0.155*</td>
<td>–0.399***</td>
<td>0.319***</td>
<td>0.319***</td>
<td>0.174*</td>
</tr>
</tbody>
</table>

BL, baseline; T2, Time 2; HED, heavy episodic drinking; Probs, alcohol-related problems; CFC, consideration of future consequences; NFC, need for cognition; SE, self-efficacy.

*P < 0.05, two-tailed; **P < 0.01, two-tailed; ***P < 0.001, two-tailed.
Tests of major study hypotheses
A 2 (Framing: gain vs. loss) by 2 (Temporal Context: short- vs. long-term) ANCOVA with follow-up HED as the outcome and baseline HED as the covariate revealed a marginal effect of framing, $F(1, 207) = 2.91, P = 0.089$. However, contrary to our hypothesis of a gain-frame advantage, participants reported fewer HED episodes in the loss-frame condition relative to the gain-frame condition. In partial support of our hypothesis regarding temporal context, there was a marginal effect of temporal context $F(1, 207) = 3.60, P = 0.059$, with fewer HED episodes reported among participants who received a short-term, vs. a long-term message. The Message Frame $\times$ Temporal context interaction was not significant $F(1, 207) = 0.125, P = 0.724$.

Next, we conducted a parallel ANCOVA with follow-up alcohol problems (computed as the sum of BYAACQ items) as our outcome, and baseline alcohol problems as our covariate. There was no effect of message framing, $F(1, 207) = 0.48, P = 0.489$, but there was a marginal effect of temporal context, $F(1, 207) = 3.59, P = 0.060$. In contrast to our findings for HED, slightly fewer alcohol problems were reported among participants who received a long-term message. The Message Frame $\times$ Temporal Context interaction was not significant, $F(1, 207) = 0.95, P = 0.331$.

Tests of moderation
A series of three-step hierarchical regression analyses were conducted to examine potential moderators on HED and alcohol problems. In the first step, the corresponding baseline assessment (e.g. Baseline HED) was entered. In the second step, message frame and temporal context manipulations were added, along with the hypothesized moderators. In the third step, three two-way interactions and a three-way interaction were added. Since the direct effect of message frame and temporal context are discussed in the above ANCOVAs, here we report results from the moderators, and their interactions with message frame and temporal context.

As shown in Table 3, baseline HED was strongly associated with HED at 1-month follow-up ($\beta = 0.67, P < 0.001$). For HED, we observed a main effect for NFC ($\beta = 0.10, P < 0.05$) such that higher scores were associated with greater frequency of HED during the follow-up period. Neither CFC nor Self-Efficacy was associated with HED. Moreover, as indicated by the lack of significant two- and three-way interactions, there was no evidence in support of a moderating role of any of the three individual difference variables we examined. As shown in Table 4, a largely similar pattern of results was observed for alcohol problems.

Table 3. Moderators of message framing and temporal context manipulations on heavy episodic drinking (HED)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Moderator</th>
<th>NFC</th>
<th>CFC</th>
<th>Self-efficacy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>B</td>
<td>β</td>
<td>ΔR²</td>
</tr>
<tr>
<td>Step 1</td>
<td>Baseline HED</td>
<td>0.75</td>
<td>0.67*</td>
<td>0.455***</td>
</tr>
<tr>
<td>Step 2</td>
<td>Frame</td>
<td>0.31</td>
<td>0.09</td>
<td>0.026*</td>
</tr>
<tr>
<td></td>
<td>Temporal context</td>
<td>0.35</td>
<td>0.10*</td>
<td>0.33</td>
</tr>
<tr>
<td></td>
<td>Moderator</td>
<td>0.60</td>
<td>0.10*</td>
<td>0.34</td>
</tr>
<tr>
<td>Step 3</td>
<td>Frame × Moderator</td>
<td>−0.27</td>
<td>−0.04</td>
<td>0.09</td>
</tr>
<tr>
<td></td>
<td>TC × Moderator</td>
<td>0.13</td>
<td>0.02</td>
<td>0.37</td>
</tr>
<tr>
<td></td>
<td>Frame × TC</td>
<td>−0.02</td>
<td>−0.01</td>
<td>−0.07</td>
</tr>
<tr>
<td></td>
<td>Frame × TC × Mod</td>
<td>−0.24</td>
<td>−0.04</td>
<td>−0.51</td>
</tr>
</tbody>
</table>

Note: Results shown above are taken from separate hierarchical regressions run for each putative moderator.

HED, heavy episodic drinking; TC, temporal context manipulation; NFC, need for cognition; CFC, consideration of future consequences.

* Coded as −1 = loss frame, +1 = gain frame.

** Coded as −1 = short term, +1 = long term.

* P < 0.10, * P < 0.05, ** P < 0.001.
Table 4. Moderators of message framing and temporal context manipulations on alcohol-related problems

<table>
<thead>
<tr>
<th>Variable</th>
<th>Moderator</th>
<th>B</th>
<th>β</th>
<th>ΔR²</th>
<th>B</th>
<th>β</th>
<th>ΔR²</th>
<th>B</th>
<th>β</th>
<th>ΔR²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NFC</td>
<td></td>
<td></td>
<td></td>
<td>CFC</td>
<td></td>
<td></td>
<td>Self-efficacy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline alcohol problems</td>
<td></td>
<td>0.64</td>
<td>0.62***</td>
<td>0.386***</td>
<td>0.64</td>
<td>0.62***</td>
<td>0.386***</td>
<td>0.64</td>
<td>0.62***</td>
<td>0.386***</td>
</tr>
<tr>
<td>Step 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frame</td>
<td></td>
<td>−0.16</td>
<td>−0.04</td>
<td>0.013</td>
<td></td>
<td>0.16</td>
<td>−0.04</td>
<td>0.012</td>
<td></td>
<td>0.19</td>
</tr>
<tr>
<td>Temporal context (TC)</td>
<td></td>
<td>−0.46</td>
<td>−0.10*</td>
<td>0.004</td>
<td>0.47</td>
<td>−0.10*</td>
<td>0.008</td>
<td>0.47</td>
<td>−0.10*</td>
<td>0.006</td>
</tr>
<tr>
<td>Moderator</td>
<td></td>
<td>0.29</td>
<td>0.04</td>
<td>0.004</td>
<td>0.11</td>
<td>−0.01</td>
<td></td>
<td>0.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frame × Moderator</td>
<td></td>
<td>−0.07</td>
<td>−0.01</td>
<td>0.004</td>
<td>0.44</td>
<td>0.05</td>
<td>0.008</td>
<td>0.01</td>
<td>0.03</td>
<td></td>
</tr>
<tr>
<td>TC × Moderator</td>
<td></td>
<td>0.27</td>
<td>0.03</td>
<td>0.004</td>
<td>0.36</td>
<td>−0.04</td>
<td></td>
<td>−0.01</td>
<td>−0.02</td>
<td></td>
</tr>
<tr>
<td>Frame × TC</td>
<td></td>
<td>−0.22</td>
<td>−0.05</td>
<td>0.004</td>
<td>0.24</td>
<td>−0.05</td>
<td></td>
<td>−0.26</td>
<td>−0.06</td>
<td></td>
</tr>
<tr>
<td>Frame × TC × Mod.</td>
<td></td>
<td>−0.15</td>
<td>−0.02</td>
<td>0.004</td>
<td>0.20</td>
<td>0.02</td>
<td></td>
<td>−0.01</td>
<td>−0.03</td>
<td></td>
</tr>
</tbody>
</table>

Note: Results shown above are taken from separate hierarchical regressions run for each putative moderator. TC, temporal context; NFC, need for cognition; CFC, consideration of future consequences.

aCoded as −1 = loss frame, +1 = gain frame.
bCoded as −1 = short term, +1 = long term.

Step 3 0.004 0.008 0.006

Study was to examine whether message framing impacts behavior when delivered via a highly disseminable mode of communication. This approach raises the possibility that participants were not reading the messages very carefully or thoughtfully, which is consistent with research showing that computer delivered Personalized Normative Feedback (PNF) is less effective than PNF delivered in a laboratory (Rodriguez et al., 2015), and that most college students are engaged in other activities while completing online PNF (Lewis and Neighbors, 2015). However, the robust effects of our manipulation check analyses indicate that participants clearly discerned the message frame and temporal context foci of the messages. Furthermore, the manipulation check for the message frame manipulation was comparable to Gerend and Cullen, who observed an effect of ΔR² = 1.44. This suggests participants were at least reasonably attentive to our messages. The current study sampled for hazardous drinkers only, while Gerend and Cullen did not have any eligibility criteria pertaining to drinking history. Thus, it is possible that message framing for college drinking is effective as a universal, but not an indicated preventive intervention. In a meta-analysis of 62 studies, Carey et al. (2007) found that interventions targeting high-risk college populations (as done here) were generally less effective at reducing alcohol problems than interventions targeting college students in general (as done in Gerend and Cullen, 2008).

Based on prior research, we had reason to believe that NFC or self-efficacy might moderate the effect of message framing (Covey, 2014), and CFC might moderate the effect of message framing or temporal context (Orbell et al., 2004; Orbell and Hagger, 2006; Orbell and Kyriakaki, 2008; O’Connor et al., 2009). However, no effects were observed in the present study. Although CFC has been the most widely replicated moderator, past work typically utilizes non-college samples, and it is possible these results do not extend to the current population.

Limitations and future directions
One limitation is the relatively long gap between messages, which were sent on average of 12.3 days apart. It may have been more effective to send them within three or four days, to increase dosage for an already subtle manipulation. An additional limitation is that we used a gender-adjusted definition of heavy drinking on the messages, while it was defined as 5 or more alcoholic drinks on the survey, regardless of gender. However, while this was an oversight in our design phase, it seems unlikely that results would be appreciably different if we used a consistent definition. A third limitation is that, in post-hoc analyses with G² power, it became apparent we were underpowered to detect results from our ANCOVA and regression analyses. Finally, the dosage of our intervention may have been too small to prompt behavior change in this hazardous drinking population. While Gerend and Cullen (2008) had participants read all messages in one laboratory session, we diffused the intervention over four emails because we thought this would be too much information to electronically convey at once. Future research could examine this question empirically.

Although we were unable to replicate theoretically consistent findings from a prior study (Gerend and Cullen, 2008) using email as the mode of message delivery, future message framing studies would benefit from examining whether the results of past work can be translated to outside the laboratory. Further research examining the utility of message framing and temporal context as a universal preventive intervention is also advisable. Aside from email, other options include bulletin boards in college residence halls, fliers, and text messages. While the vast majority of work with message framing applies Prospect Theory, as done here, future research may consider Deviance Regulation Theory (see Dvorak et al., 2015), to examine normative perceptions of alcohol use as a potential moderator.
ACKNOWLEDGEMENTS
The authors would like to thank Bing Chen, Dr L.A.R. Stein and Dr Katherine Branch for their contribution to this work. We also acknowledge the support of a University of Rhode Island Professional Development grant to Mark Wood.

FUNDING
This project was funded by a University of Rhode Island Professional Development grant awarded to M.D.W.

CONFLICT OF INTEREST STATEMENT
None declared.

APPENDIX
Gain Frame, Short-Term (GF-ST) Consequences

GF-ST Message #1
E-mail subject line: How to avoid immediate social consequences from heavy drinking
What are the immediate social consequences of heavy drinking?

- **Social situations and relationships**: Not drinking heavily can help you avoid immediate social embarrassment and damage to your relationships, such as:
  - Doing or saying something you will regret within days or even hours
  - Arguments or conflict with friends or family
  - Relationship problems due to heavy drinking
- By not drinking heavily, you will:
  - Increase the likelihood of avoiding social embarrassment and relationship difficulties

Please click below to provide a brief evaluation of your perceptions and reactions to this message. THANKS!

GF-ST Message #2
E-mail subject line: How to avoid immediate psychological consequences from heavy drinking
What are the immediate psychological consequences of heavy drinking?

- **Psychological**: Not drinking heavily can help you avoid immediate psychological consequences that can occur soon after drinking, such as:
  - Impaired judgment
  - Memory loss
  - Difficulty concentrating
- By not drinking heavily, you will:
  - Increase the chance of better psychological health in the near future

Please click below to provide a brief evaluation of your perceptions and reactions to this message. THANKS!

GF-ST Message #3
E-mail subject line: How to avoid immediate health consequences from heavy drinking
What are the immediate health consequences of heavy drinking?

- **Health**: Not drinking heavily can help you avoid immediate negative health consequences, such as:
  - Weight gain
  - Driving accidents
  - Unprotected sex and unwanted pregnancy
- By not drinking heavily, you will:
  - Decrease the likelihood of high-risk sex and having an unhealthy liver

Please click below to provide a brief evaluation of your perceptions and reactions to this message. THANKS!

GF-ST Message #4
E-mail subject line: How to avoid immediate performance consequences from heavy drinking
What are the immediate performance consequences of heavy drinking?

- **Performance**: Not drinking heavily can help you avoid immediate negative performance consequences, such as:
  - Missed classes
  - Poor job performance
  - Academic failure
By not drinking heavily, you will:
- Increase the likelihood of academic and career success

Please click below to provide a brief evaluation of your perceptions and reactions to this message. THANKS!
"Link"

Gain Frame Message, Long-Term (GF-LT)

GF-LT Message #1
E-mail subject line: How to avoid long-term social consequences from heavy drinking

What are the long-term social consequences of heavy drinking?
- Social situations and relationships: Not drinking heavily can help you avoid long-term social embarrassment and damage to your relationships, such as:
  - Doing or saying something you will regret years into the future
  - Arguments or conflict with friends or family
  - Relationship problems due to heavy drinking
- By not drinking heavily, you will:
  - Increase the likelihood of avoiding social embarrassment and relationship difficulties

Please click below to provide a brief evaluation of your perceptions and reactions to this message. THANKS!
"Link"

Sample Message #4
E-mail subject line: How to avoid long-term performance consequences from heavy drinking

What are the long-term performance consequences of heavy drinking?
- Performance: Not drinking heavily can help you avoid long-term negative performance consequences, such as:
  - Missed classes
  - Poor job performance
  - Academic failure
  - By not drinking heavily, you will:
    - Increase the likelihood of academic and career success

Please click below to provide a brief evaluation of your perceptions and reactions to this message. THANKS!
"Link"
Loss Frame Message, Short-Term (LF-ST) Consequences

LF-ST Message #1
E-mail subject line: Heavy drinking leads to immediate social consequences
What are the immediate social consequences of heavy drinking?

- **Social situations and relationships**: Drinking heavily can lead to immediate social embarrassment and damage to your relationships, such as:
  - Doing or saying something you will regret within days or even hours
  - Arguments or conflict with friends or family
  - Relationship problems due to heavy drinking
- By drinking heavily, you will:
  - Increase the likelihood of social embarrassment and relationship difficulties

Please click below to provide a brief evaluation of your perceptions and reactions to this message. THANKS!

*Link*

LF-ST Message #2
E-mail subject line: Heavy drinking leads to immediate psychological consequences
What are the immediate psychological consequences of heavy drinking?

- **Psychological**: Drinking heavily can lead to immediate psychological consequences that can occur soon after drinking such as:
  - Impaired judgment
  - Memory loss
  - Difficulty concentrating
- By drinking heavily, you will:
  - Increase the risk of poorer psychological health in the near future

Please click below to provide a brief evaluation of your perceptions and reactions to this message. THANKS!

*Link*

LF-ST Message #3
E-mail subject line: Heavy drinking leads to immediate health consequences
What are the immediate health consequences of heavy drinking?

- **Health**: Drinking heavily can lead to immediate negative health consequences, such as:
  - Weight gain
  - Driving accidents
  - Unprotected sex and unwanted pregnancy
- By drinking heavily, you will:
  - Increase the likelihood of high-risk sex and having an unhealthy liver

Please click below to provide a brief evaluation of your perceptions and reactions to this message. THANKS!

*Link*

Loss Frame, Long-Term (LF-LT) Consequences

LF-LT Message #1
E-mail subject line: Heavy drinking leads to long-term social consequences
What are the long-term social consequences of heavy drinking?

Please click below to provide a brief evaluation of your perceptions and reactions to this message. THANKS!

*Link*
• Social situations and relationships: Drinking heavily can lead to long-term social embarrassment and damage to your relationships, such as:
  • Doing or saying something you will regret years into the future
  • Arguments or conflict with friends or family
  • Relationship problems due to heavy drinking
• By drinking heavily, you will:
  • Increase the likelihood of social embarrassment and relationship difficulties

Please click below to provide a brief evaluation of your perceptions and reactions to this message. THANKS!
*Link*

**LF-LT Message #2**

E-mail subject line: Heavy drinking leads to long-term psychological consequences

*What are the long-term psychological consequences of heavy drinking?*

![Image of a thermometer with temperatures ranging from 0 to 45°C]

• Psychological: Drinking heavily can lead to long-term psychological consequences that can occur for years into the future, such as:
  • Impaired judgment
  • Memory loss
  • Difficulty concentrating
• By drinking heavily, you will:
  • Increase the risk of poorer psychological health years into the future

Please click below to provide a brief evaluation of your perceptions and reactions to this message. THANKS!
*Link*

**LF-LT Message #3**

E-mail subject line: Heavy drinking leads to long-term health consequences

*What are the long-term health consequences of heavy drinking?*

![Image of a person exercising]

• Health: Drinking heavily can lead to negative health consequences for years to come, such as:
  • Weight gain
  • Driving accidents
  • Unprotected sex and unwanted pregnancy
  • By drinking heavily, you will:
    • Increase the likelihood of high-risk sex and having an unhealthy liver

Please click below to provide a brief evaluation of your perceptions and reactions to this message. THANKS!
*Link*

**REFERENCES**


