# Text-based Alcohol Prevention for First Year College Students

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**Principal Investigator: Kate B. Carey**

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## 1. RESEARCH TEAM

| | |
|---|---|
| Kate B. Carey, PhD | Principal Investigator |
| Jennifer E. Merrill, PhD | Co-Investigator |
| Nancy Barnett, PhD | Co-Investigator |
| Holly Boyle, ScM | Project Coordinator |
| Miranda L. Lauher, ScM | Graduate Research Assistant |
| Oliver S. Fox, ScM | Graduate Research Assistant |

## 2. PROJECT SUMMARY

Using mobile technology that most students already have in their pockets, we propose a novel use of SMS text messages to change campus drinking norms. We aim to correct exaggerated perceptions of drinking norms, and thereby reduce excessive drinking, by delivering push notifications representing accurate, campus-specific, pro-moderation descriptive norms (what others do) and injunctive norms (what others approve of). We predict that with repeated exposure over time, this information will compete with other sources of normative information to which students are exposed during their first year of college. In this exploratory R21, we will develop and refine message content and pilot test the delivery methods. First, with input from student advisors, we will survey a representative sample of 300 students about personal behaviors and attitudes, and perceived descriptive and injunctive norms, for a wide range of alcohol-related behaviors and protective strategies. Extending the range of behaviors previously studied in the norms literature, these data will yield campus-specific norms and identify items with the largest self-other discrepancies as potential sources of corrective feedback. Second, we will translate the content into a pool of text messages and solicit feedback, iteratively, from approximately 40 first-year students. Third, we will conduct a pilot test of the SMS-delivered pro-moderation norms intervention to evaluate the effect of receiving these text messages on perceived peer norms, and high-volume drinking and consequences. First year students (*N*=120) who are underage but report risky drinking (>4/day or >14/week for men; >3/day or >7/week for women) will be randomly assigned to two conditions differing by text content: alcohol norms or control. All will receive 5-6 text messages per week over 12 weeks. Process measures, 3-month post-test, and 3-month follow-up assessments will yield feasibility, acceptability, and preliminary outcome data to inform future larger scale randomized trials. We predict that the experimental condition will be acceptable and interesting, will protect against increases in pro-drinking perceived norms, and will result in less risky drinking and fewer alcohol consequences, relative to control. This project has public health significance because high volume drinking has harmful consequences to self and others, and has proven to be hard to change on college campuses; individual-level interventions typically have limited reach, and environmental policy changes can be hard to implement. This mHealth intervention offers a novel approach to prevention during a period of transition, and this study will provide proof-of-concept that SMS text messages can be used over time to correct exaggerated alcohol norms, a mechanism known to reduce excessive drinking and its negative consequences.

## 3. STUDY RATIONALE

Freshman year in college is a time of transition as students learn how to make friends, and socialize in a new environment. The theory of emerging adulthood (ages 18-25) identifies key tasks of exploration and crafting an adult identity (Arnett, 2005). This period is associated with both onset of and increases in high risk drinking (Merrill & Carey, 2016). Because high-volume drinking, emergency transports, and

sexual assault occur at alarming levels in the first year, freshmen have been identified as a high-risk priority subgroup for college alcohol prevention (Perkins, 2002). During times of transition, social influence can be strong and social norms provide informative guideposts.

**Perceived norms predict drinking, both concurrently and prospectively**. One of the strongest predictors of high-risk drinking among young college-attending adults is perceived norms (Perkins, 2002). Descriptive norms (DN, what others do) and injunctive norms (IN, what others approve of) are positively associated with drinking (Borsari & Carey, 2003), accounting for more variance than other established cognitive predictors (Neighbors et al., 2007). Further, there is evidence that college student drinking conforms to perceived norms over time (Lewis et al., 2015).

**Perceived norms tend to be exaggerated relative to actual norms**. Ample evidence documents self-other discrepancies with regard to drinking behaviors; estimates of others' drinking (DN) usually exceed reports of one's own behavior, and estimates of others' approval of drinking behaviors (IN) are usually more permissive than one's own attitudes (Borsari & Carey, 2003). Self-other discrepancies in the perceived approval of campus drinking (Lewis et al., 2015) and drinking consequences (DeMartini et al., 2011) have been documented. In contrast, students endorse more personal approval of *protective behavioral strategies* than they ascribe to others (DeMartini et al., 2011). The observation that privately held attitudes tend to be more conservative than perceived peer attitudes is known as "pluralistic ignorance."

**Exaggerated perceived norms can have adverse effects on individuals and the community**. Self-other differences in DN predict increased drinking over time, suggesting that students conform to their (mis)perception that peers are engaging in heavier drinking than they really are (Carey et al., 2006). Perceptions of self-other differences in IN can also serve to perpetuate a permissive drinking environment, whereby individual students who do not share the perceived approval of excessive drinking feel in the minority, and those holding pro-moderation attitudes do not express their opinions for fear of social isolation (Prentice & Miller, 2006). Over time opinions perceived to be in the majority are expressed while those perceived to be in the minority are not (Matthes, 2015). Exaggerated perceived norms are thereby perpetuated and continue to influence drinking decisions. Ample evidence supports the efficacy of interventions designed to correct exaggerated DN, and a growing body of literature suggests that correcting exaggerated IN may also be a viable prevention strategy (both summarized next).

**Changing exaggerated descriptive norms reduces drinking behavior**. Several reviews and meta-analyses document that personalized normative feedback is included in many of the efficacious interventions designed to reduce college student drinking; this feedback typically is delivered via computer screen or in person (e.g., Carey et al., 2007). Nearly all of these have provided accurate descriptive norms to correct misperceptions of peer drinking behavior, in one or two exposures. Importantly, mediation analyses consistently support DN as a mechanism of change; reducing exaggerated DN leads to lower alcohol consumption (Reid & Carey, 2015).

**Correcting exaggerated perceived injunctive norms is promising but understudied**. Relatively few prevention interventions have employed IN feedback with the goal of reducing risky drinking. A recent review of college drinking interventions found weak evidence for mediation by IN (Reid & Carey, 2015). However, most of the reviewed interventions did not attempt to change IN, and those that included IN manipulations failed to successfully change IN (i.e., the "a" path in mediation); thus strong tests of the potential for a successful IN manipulation to facilitate change in drinking are missing. Recently, two studies from our group demonstrate the malleability of IN. Manipulating informational content embedded in a survey (Prince & Carey, 2010), we demonstrated that IN changed immediately following presentation of corrective information about college students' attitudes about drinking. Similarly, a recently completed RCT documents that IN feedback, when delivered face-to-face, reduced perceptions of IN and consumption and consequences at a 1-month follow-up, relative to an assessment-only control (Prince et al., 2015). Taken together, correcting inaccurate IN is a promising direction for college alcohol abuse prevention.

**Addressing both DN and IN within one intervention has high potential.** This innovative focus is grounded in theory. The focus theory of normative conduct (Cialdini et al., 1991) holds that norms are

likely to influence behavior when they are made a salient focus of attention, which we aim to do with repeated text messages. The notion of pluralistic ignorance asserts that even when engaging in behavior consistent with prevailing DN, individuals privately endorse more conservative attitudes and can experience discomfort with social pressures to drink (Prentice & Miller, 1996). Importantly, norms feedback is most persuasive when DN and IN align in presenting a consistent message (Reid et al., 2010). Thus, **correcting both exaggerated DN and IN** has a sound theoretical basis as a prevention strategy, but this combination strategy has been underutilized in alcohol abuse prevention interventions.

**Freshman year is an optimal time to deliver a corrective norms intervention**. The new college environment provides ample sources of information about the prevalence and acceptability of drinking, due to selective exposure to and sharing of pro-drinking norms (Merrill & Carey, 2016). Further, there is suggestive evidence of an evolution towards greater acceptance of excessive drinking as students spend time in college (DeMartini et al., 2011). Correcting exaggerated DN and IN during the formative first year may reduce the perceived peer expectations for high risk drinking, which may reduce future harms**.**

**New prevention strategies targeted to freshmen are needed**. Meta-analysis shows that existing alcohol prevention programs targeted to freshmen produce significant but small effects, but most rely on traditional in-person or computer-delivered formats (Scott-Sheldon et al., 2014). Therefore, we propose a novel approach to prevention: regular exposure via SMS text messages to accurate descriptions of peer behaviors and peer beliefs, including peer use and endorsement of protective behavioral strategies.

**Text messaging affords a cost-effective opportunity to promote health behavior change, with nearly universal reach**. Nearly all (98%) young adults ages 18-29 own cell phones, and 97% of cell phone users receive or send texts (Pew Research Internet Project, 2014). Also, 9/10 young adults own smartphones, and 100% of smartphone users aged 18-29 used text messaging on their phone in the last week (Smith, 2015) Reviews document the efficacy of text-based interventions on a variety of health outcomes (Cole-Lewis & Kershaw, 2010); there is limited but growing support for text interventions to reduce alcohol use (Suffoletto et al., 2014). In this context, text messaging has advantages over other digital media, as it is accessed daily and via one's mobile phone; and does not involve user-generated content, which may be contraindicated for a behavior driven by exaggerated perceptions of peer norms. Further, young adult drinkers say text messages are a preferred mode of intervention contact (Bendtsen & Bendtsen, 2014). Thus, a text-based intervention can reach students in the context of their daily lives with messages designed to compete with exposure to risky drinking and peer approval that maintains exaggerated unhealthy norms. A norms correction intervention delivered *via text during the first year* may be a welcome tool for campus educators, who must fit increasing amounts of prevention content into orientation sessions conducted at the beginning of the semester.

**Summary of Scientific Premise and Overall Impact.** The state of the science suggests that correcting exaggerated drinking norms is a sound strategy for reducing hazardous drinking, with strong support for DN feedback and promising preliminary evidence for supplementing it with IN feedback. To date, delivery format has been limited to one or two doses of computerized or in-person personalized normative feedback. We propose an alternate method of delivering corrective norms that is low threshold, offers multiple exposures to pro-moderation content, and is scalable. This project has *potential for impact* because of when and how it aims to modify hazardous drinking among underage college students. The "when" is targeting the first year of college, a high-risk period of time for excessive drinking and negative consequences. This is an opportune time to present accurate information about peer drinking behaviors and attitudes because beliefs about the norms of the new campus community are being formed. The "how" is text-delivered normative feedback to correct exaggerated DN and IN about alcohol use, consequences, and protective strategies. Such a preventive intervention requires few resources beyond the mobile phones that nearly all students already possess, does not require students attend a prevention program, consists of information about peers that is inherently interesting and relevant to emerging adults, and delivers pro-moderation messages repeatedly in the natural environment. This content and delivery system has potential to counteract unhealthy campus norms in a way that a one-shot prevention program cannot. Our intervention is designed to challenge and compete with perceptions of peer approval of excessive drinking, and support the private, typically more conservative beliefs of many first-year

students. The work described in this R21 proposal will lay the groundwork for a larger RCT with more participants (and power) and longer follow-ups to demonstrate the durability of effects.

## 4. AIMS AND ENDPOINTS

This protocol addresses Aim 3 of our R21 grant, namely: **To conduct a pilot test of the efficacy of an SMS-delivered pro-moderation drinking norms intervention for first-year students**. We will randomize ~120 students who meet inclusion criteria to either the norms text message condition or the attention-control condition. All will receive 7 texts per week throughout 10 weeks within the first semester of college (late September through early December). Assessments at baseline, post-test (December) and 3-month follow-up (March) will allow us to test the hypotheses that the corrective norms intervention will reduce (a) perceived descriptive and injunctive norms, (b) drinking behavior (including high-volume drinking and risky consumption practices), and (c) alcohol-related consequences, and increase (d) protective behavioral strategies, relative to the control condition.

## 5. STUDY DESIGN

The design is a randomized controlled design with two groups (attention control and experimental) and 3 assessment points. Random assignment within sex will be conducted using random numbers tables such that each male and each female recruit has equal chance of assignment to either condition; in past this approach has resulted in equivalent numbers of males and females across conditions. Participants in both conditions will complete a baseline survey; they will receive and respond to ten weeks of daily text messages; and complete follow-up surveys after the completion of ten weeks of text messages (post-test, 3 months after baseline), and again 3 months later (follow-up, 6 months after baseline). The only difference between conditions is the content of the texts received: Participants in the experimental group (n~60) will receive daily text messages that include campus-specific descriptive and injunctive norms information, whereas participants in the contact control group (n~60) will receive daily text messages that include facts on the "this day in history." Primary outcomes will be assessed at post-test; maintenance will be assessed at follow-up.

## 6. STUDY POPULATION

**6.1. Target Sample**. The target sample for analyses is *N*=100 college student drinkers from Brown University, a residential 4-year colleague with ~6,300 undergraduate students. Like many residential colleges in the Northeastern US, it has many characteristics associated with higher risk for alcohol misuse (e.g., Greek system, athletic tradition); indeed at Brown students report high rates of drinking: 85% of first-year students report drinking in the past 3 months, and 50% endorse risky drinking practices such as pre-gaming. We plan to randomize at least 120 first-year students to conditions, to account to attrition from participants who may withdraw from the study.

**6.2. Inclusion Criteria.** Eligibility criteria consist of being a male or female (a) first-year student who (b) meets NIAAA criteria for risky drinking (for men, >4 drinks in a day or >14 in a week; for women >3 drinks in a day or >7 in a week), (c) has a mobile phone with text messaging capacity, and (d) uses text messaging at least weekly. Participants must also be age 18-20.

**6.3. Exclusion Criteria.** Exclusion criteria are: (a) engagement in treatment or indication of others suggesting need for treatment for alcohol or drug disorders; and (b) plans to be without cellular service for more than 3 days during the fall semester.

## 7. ENROLLMENT

### 7.1 Recruitment and Enrollment Procedures

We will recruit female and male Brown University students through multiple methods including hanging and distributing flyers/table slips in first year dorms and other locations around campus, announcements in classrooms, advertisements on university listservs (e.g., Today@Brown, pending approval by university officials) and on social media (e.g., facebook advertisements), and distributions via email announcements on university listservs (e.g., pending approval, directly from us via a first year class list or facilitated by freshman dorm resident life advisors or VP for the Office of Campus Life or other designated administrator). Also we will conduct snowball recruitment including asking those who enroll in our study to share this research opportunity with those they think may be interested in participating. The flyer/table slips will include a URL to the online survey as well as a QR code and the online advertisements will include a link to access the online survey. Interested participants will complete an online screener, and eligible participants will be redirected to an online consent form. If a person consents to the study, they will be asked to provide their contact information and then study staff will email them a link to complete a baseline questionnaire.

### 7.2. Orientation

Participants will be asked to attend an in-person, group study orientation, which will take place within two weeks of the baseline survey. At this meeting, Research Assistants (RAs) will (a) orient participants to the experimental phase of the study, (b) send a welcome text to each participant, who will be asked to reply with a practice evaluation rating, (c) instruct participants to identify the study telephone/text numbers with the FACT22 Study name, and (d) distribute Clincards that are used to issue study payments. They will be reminded that responses to study-sent texts will not be actively monitored, and they can text STOP to discontinue at any time. The 10-week intervention period will begin once all participants have been consented, oriented, and randomized, allowing for a uniform 10-week intervention period.

### 7.3. Retention Plan

**Reimbursement.** Participants can earn a total of $90 for their participation. Participants will receive $25 for completing the baseline survey and $30 and $35 (respectively) for completing the post-intervention and 3-month follow-ups. In addition, all participants who rate at least 90% of the daily text messages will be entered to win one of four $50 bonus payments, to be raffled off at the end of the 10 weeks. We will reimburse participants using the ClinCard program provided by Brown University as a means of subject payment. Using this system will allow us to electronically pay our participants. We have added the approved language to our consent form, and will provide participants with the ClinCard FAQs provided by the IRB along with the consent form in person at the orientation session.

**Participant communication.** We plan to communication with participants primarily via email. We drafted an introductory invitation email to send to potentially interested individuals (e.g., identified in snowball sampling); this email will contain the link to the screening survey. After participants consent and provided contact information, we will email them with a link to the baseline assessment. We will send reminder emails to those who do not complete the baseline email in a timely manner. After completing the baseline assessment, they will indicate preference for a time slot to attend an orientation session. We plan to send an email reminder the day before their scheduled orientation session with information regarding the time and location. For anyone who does not show up to their assigned orientation session, we will send an email/text to have these participants reschedule an orientation time at their earliest convenience. We also plan to send emails to participants in order to invite them to complete the follow-up survey at the end of the 10-week texting period, and again 3 months later. This email will contain the link to the follow-up survey for the participants to access. Additionally, we have drafted a second email and text message to serve as reminders if participants have not completed the follow-up surveys. Upon completing each follow-up survey, participants will receive an email notification that we

have added payment to their Clincards. We have drafted an email to send to unresponsive participants who have not engaged with our text messages. We also have drafted emails to inform participants of the results of the study raffle. Finally, to keep participants engaged with the research team for the duration of the study, we have drafted an encouraging email to send at the half-way point (5-weeks into the text intervention), as well as an email half-way through the follow-up (~ Feb 1) to remind them of their participation in the study and to wish them a good spring semester.

## 8. INTERVENTIONS

**8.1. Experimental Group Message Content**. The text messages represent accurate and pro-moderation DN and IN based on data collected from a campus-wide normative survey collected in spring of 2017. These messages were created during previous phases of this R21 research, with the help of an undergraduate Student Advisory Group and additional feedback was provided from heavy drinking first year students via an online survey. See Appendix A for our experimental text message library.

**8.2. Control Group Message Content**. Based on suggestions from our Student Advisory Group, we assembled 70 "this day in history" facts, reproduced in Appendix B.

**8.3. Message delivery and process assessment**. We will send text messages once per day (between 4-8pm) for 10 weeks (70 messages) using Qualtrics, a program which will allow us to upload recipients' information and pre-program the content and timing of messages. Each day, participants in the experimental group will be sent an initial text with a piece of normative feedback information (e.g., "Be a part of the 92% of Brown students that use a sober designated driver while they are out drinking"). Participants in the control group will receive daily texts with a fact "in this day in history" (e.g., "Today in 1985 the first Blockbuster store opened") Participants in both groups will be asked to respond with a rating for each text message from 1 (not at all interesting) to 5 (very interesting). Ratings are used to prompt attention, to document receipt, and to gather feedback on interest in specific message content. Response rate, participant ratings, message status (sent, failed, delivered, undelivered) with any error messages will be stored in a database to evaluate intervention implementation (message delivery and exposure) and engagement (interest ratings).

## 9. STUDY ASSESSMENTS AND PROCEDURES

**9.1. Screening.** The screening questionnaire, to be administered online, will include demographic and eligibility criteria, as well as some filler items so that participants cannot readily determine eligibility criteria. Eligibility screening data will be anonymous and retained only to document which inclusion/exclusion criteria resulted in eligibility for the study. Eligible students will be directed to the consent form of the study and if they consent to participate they will be asked to provide contact information. Participants will then be emailed a link to the baseline survey.

**9.2. Baseline Assessment.** Assessments will be administered remotely via web-based survey software. Primary outcome measures (alcohol consumption and consequences) and secondary outcomes (e.g., injunctive and descriptive norms) as well as potential moderators (e.g., willingness to drink) will be repeated at both follow-ups. The baseline and follow-up surveys will take between 30-45 minutes to complete. Following emerging online survey best practices, we will insert up to 5 attention check questions into each of the 3 surveys. At each assessment point, participants will have the option to download a Resource Sheet with contact information for substance abuse and mental health services.

9.2.1. Descriptive measures

*Demographics* will include gender, sex, age, weight, race/ethnicity, class year, international student status, athlete status, and planned involvement in Greek system.

*Other substance use* questions will include items about cigarette use including (a) whether or not participants have ever tried cigarettes, (b) frequency of cigarette use in the past 30 days, (c) amount of cigarettes smoked in the past 30 days. We also ask about the frequency of use of electronic vapor products, and the frequency of use of other tobacco products (i.e., cigars, chewing tobacco). We also ask about marijuana. We ask whether people have ever used marijuana and if so the frequency of use in the past 30 days and how it was used. These items were adapted from the CDC Youth Risk Behavior Survey. *Intentions to use marijuana* over the next 3 months will be assessed using 1 item ("I will use marijuana" 1=definitely will to 7=definitely will not).

9.2.2. Primary and secondary outcomes

*Alcohol use* will be assessed with the daily drinking questionnaire (DDQ)(Collins, Parks, & Marlatt, 1985). For each of the seven days of a typical week in the past 30 days, participants record the number of standard drinks (12 oz beer, 5 oz wine, 1.5 oz liquor). They will also be asked (a) frequency of alcohol use, (b) frequency of binge drinking (4+/5+ drinks on a single occasion for women/men), (c) peak number of drinks on a single occasion in the past 30 days and hours over which they were consumed allowing calculation of estimated BACs. Additional *high-risk drinking behaviors* include frequency of and typical quantity consumed when: (a) pregaming, defined as drinking, typically in one's home or room, before going out for the night (Borsari, Merrill, Yurasek, Miller, & Carey, 2016) and (b) playing drinking games, defined as a high-risk, social drinking activity with certain rules (Zamboanga, Audley, Iwamoto, Martin, & Tomaso, 2013). *Intentions to drink* over the next 3 months will be assessed using 5 items representing intentions to engage in drinking behaviors during the fall semester (and then again from December to March).

In addition, we will administer the Timeline Follow Back (TLFB) assessment (Sobell & Sobell, 1992), adapted for online use, to get detailed daily information on *drinking patterns* in the past month. Participants see a calendar representing the past 30 days, and the indicate (a) on which days they drank alcohol, and for those days (b) how many standard drinks they consumed, and (c) time elapsed from first to last drink.

*Alcohol consequences* in the past month will be assessed with the 24-item Brief Young Adult Alcohol Consequences Questionnaire (B-YAACQ) (Kahler, Strong, & Read, 2005) which has been modified to include 3 additional items (25-27) adapted from the YAAPST (Hurlbut and Sher, 1992). One YAAPST item asks about unwanted sex, and another item was divided into two items separately asking about birth control and condom use.

*Drinking motives.* It is possible that the intervention will be more or less effective as a function of one's motivations for consuming alcohol. As such, we will assess drinking motives with the well-validated and reliable Drinking Motives Questionnaire-Revised (Cooper, 1994). Twenty items assess frequency of drinking for each reason, forming subscales for motives related to coping, conformity, enhancement, and social facilitation.

*Protective behavioral strategies* will be assessed with the modified Strategy Questionnaire (Sugarman & Carey, 2007).

*Alcohol-Induced Amnesia* will be assessed using the alcohol-induced amnesia severity scale (Miller et al., 2019).

*Descriptive norms* will be assessed using a 7-day grid (Baer, Stacy, & Larimer, 1991) to estimate drinks consumed per typical day for a typical Brown student of the same gender. Standard drinks are summed across days to yield the (a) perceived drinks per week for the group. We also ask participants to indicate their perception of (b) how often they think a typical Brown student consumes alcohol and the (c) maximum number of drinks a typical Brown student of one's gender drank on a given day. Also, to align the descriptive norms assessment with intervention content, we will also assessed descriptive norms for the (d) behaviors derived from the PBS strategy questionnaire and (e) consequences from the BYAACQ that were represented in the text messages (e.g., how many of your peers at Brown… spaced drinks over time: 1=all, 2=most, 3=over half, 4=about half, 5=under half, 6=very few, 7=none).

*Injunctive norms* and *personal attitudes* will be assessed by asking about participants own approval and their perception of Brown students' approval of (a) drinking as measured by number of drinks acceptable to consume each day of a typical week, (b) frequency of drinking, and (c) maximum number of drinks to consume on a given occasion (Krieger, Neighbors, Lewis, LaBrie, Foster, & Larimer, 2016). Also, to align the injunctive norms assessment with intervention content, we assess perceived peer approval toward the behaviors derived from the (d) PBS strategy questionnaire and the (e) BYAACQ that were represented in the text messages also will be assessed (e.g., To what extent to do your peers approve of the following experiences related to drinking ……Passing out from drinking: Strongly Disapprove =1, Moderately Disapprove =2, Slightly Disapprove =3, Slightly Approve =4, Moderately Approve =5, Strongly Approve =6. Additionally, we will assess *generalized attitudes* toward moderate and heavy (5+ for men/4+ for women) drinking ( Norman, 2011; DiBello, Miller, Neighbors, Reid, & Carey, 2018) using 5-point Likert scales for each of 5 items (e.g., enjoyable-unenjoyable, bad-good).

9.2.3. Potential moderators

*Drinker identity.* The influence of norms on drinking behavior may depend on degree to which alcohol use is integrated into a person's self-identity. We assess this using a validated 5-item measure (Lindgren et al., 2013) where participants will be asked to respond to statements (i.e., "drinking is a part of my self-image.") using a 7-point scale (1=Strongly Disagree, 4=Neutral, 7=Strongly Agree).

*Beliefs about the role of alcohol in college life* will be assessed using the College Life Alcohol Salience Scale (CLASS) (Osberg et al., 2010) consisting of 15 items (i.e., Parties with alcohol are an integral part of college life) where participants are asked to select how strongly they disagree or agree with each statement (1 = Strongly Disagree, 5 =Strongly Agree).

*Willingness to experience alcohol-related consequences & engage in particular drinking levels* may moderate the influence of norms on drinking behaviors. We adapted an assessment (Mallett et al., 2011) of 4 items related to willingness to experience consequences to also include 3 items related to level of drinking. Participants respond to each of the 7 items by selecting how willing they are to have each experience from 1=Not at all willing to 4 = Extremely willing.

*Group identification.* The influence of norms on behavior can depend on group identification (Reed, Lange, Ketchie, & Clapp, 2007), so participants will rate how much they identify with students at Brown. By indicating their level of agreement with the statement 'I identify with students at Brown" from 1 = Fully Disagree to 7=Fully Agree.

*Iowa-Netherlands Comparison Orientation Measure (INCOM).* According to social comparison theory (Festinger, 1954), individual behaviors are guided by how one compares him/herself to others, and greater orientation toward social comparison is related to higher salience of perceived peer behaviors. Therefore we plan to administer the validated 11-item Iowa-Netherlands Comparison Orientation (INCOM) Scale (Gibbons & Buunk, 1999). Participants will be asked to indicate how much they agreed with each statement (e.g., "I always pay a lot of attention to how I do things compared with how others do things," "I always like to know what others in a similar situation would do.") on a scale of 1 (strongly disagree) to 5 (strongly agree).

9.2.4. Exploratory measures

*Mental and Physical Health* measures include the 4-item perceived stress scale (Cohen, Williamson, 1988; Cohen, Kamarck, & Mermelstein, 1983) to measure one's level of stress, the PH-4, a 4-item measure for detecting anxiety and depressive symptoms (Kroenke, Spitzer, Williams, & Lowe, 2009). We also include measures on sleep including the 9-item Pittsburgh Sleep Quality Index (Buysse et al., 1989), and a set of items assessing sleep habits and situations where one had struggled to fall asleep and stay awake in the past 2 weeks (personal communication, Mary Carskadon).

**9.3. Follow-up Assessments**. At the end of the 10-week intervention, participants will complete an online post-intervention survey, repeating all or a subset of baseline measures except demographics in addition to a number of post-assessment questions about (a) percentage of text messages received and read, (b)

sharing of text message content between participants, and (c) acceptability of text-message-based norms intervention. A second online follow-up survey will be completed 3 months later, repeating all or a subset of the baseline measures except demographics.

## 10. STATISTICAL CONSIDERATIONS

**10.1. Sample Size**. We will recruit 120 students, and anticipating 15% study attrition we should have complete data on 100 students. 50 in each condition exceeds the recommended sample size for Stage IB development work (15 to 30 participants per cell) and should provide relevant information to demonstrate promise for the intervention.

**10.2. Analysis Plan**. To examine feasibility, we will consider the recruitment, consent, and retention rates, response rates to text messages, and reasons for study termination. To assess acceptability, we will examine qualitative and quantitative feedback from RCT participants.

To characterize intervention effects, we will calculate within-group effect sizes and 95% CIs for change in self-reported alcohol consumption and alcohol-related consequences at post-intervention. Cohen's d, adjusted for pre-test scores, will be calculated to examine the magnitude of between-group differences at the follow-up assessment. We will use ANCOVAs or regressions with baseline levels of the outcome as a covariate to compare conditions on post-test and follow-up means; we will include sex as a biological variable and will conduct exploratory analyses to determine if sex interacts with the experimental conditions. We expect that, relative to controls, participants assigned to the intervention will report lower mean levels of drinking and consequences and greater use of protective strategies. Analyses will be intent-to-treat, so we will examine (a) exposure (based on response rates), and (b) attrition bias. Variables associated with attrition will be included in the models.

Though underpowered for tests of mediation or moderation, exploratory analyses will determine if experimental condition is associated with change in measures of global DN and IN, the hypothesized mediating variables. If the experimental condition is lower on both types of norms and alcohol outcomes, ANCOVA can evaluate whether change in DN or IN statistically accounts for change in alcohol outcomes. Exploratory analyses can also address whether associations between DN or IN change and outcome are moderated by exposure, attitudes, and/or group identification.

## 11. RISK/BENEFIT ASSESSMENT

Overall, this is a low risk study. Both the attention control arm and the experimental arm consist of receiving daily (non-personalized) text messages for 10 weeks. Participants are young adults in college who regularly send and receive text messages. Thus, we anticipate that participants will incur minimal risks by participation in this study.

**11.1. Possible Risks**. The risks of this study are minimal and include:

Subjective discomfort/distress from answering questions. It is possible that a focus on one's drinking behavior and the consequences of one's drinking could produce some distress. The likelihood of experiencing distress from answering assessment questions is low, as none of the participants in comparable studies have reported discomfort nor been observed to be concerned about answering the questions contained in the study.

Breach of confidentiality. It is possible that data collection could result in breach of confidentiality. For participants under the legal drinking age, breach of confidentiality in self-report data could reveal that they have engaged in illegal behavior (i.e., breaking laws against underage possession of alcohol in Rhode Island). However, the risk of breach of confidentiality is also modest, given the safeguards protecting the participants' data.

**11.2. Protection against Possible Risks**

Any subjective discomfort from answering questions will be minimized by assurances that participants can refuse to answer any particular question that they do not feel comfortable addressing and that they may withdraw from the study at any time without penalty. It is also possible that some participants may experience distress from reading one of the text messages that suggests a behavior/attitude they hold is in the minority on campus. Some subjective sense of discrepancy is to be expected and is the reason why normative correction works to reduce risky behaviors. Participants can ignore or delete up to 10% of the daily text messages and still be eligible for the $50 incentive for rating ≥90% of the text messages. In the event that participation in this study triggers the desire for participants to further discuss their alcohol use or other issues with a professional, all participants will be provided with a referral list at the time of the online consent and at each assessment point, containing contact information for the Brown Counseling and Psychological Services Center and other student resources.

The risk of breach of confidentiality, including the possibility for this breach to reveal illegal behavior (i.e., underage possession of alcohol) will be handled by emphasizing that all information obtained during the screening, self-monitoring, and laboratory sessions is confidential, and will be used solely for research purposes. Eligibility screening data will be anonymous and aside from the inclusion/exclusion criteria determining eligibility for the study, screening data will be destroyed once eligibility is determined. The confidentiality of data provided after consent will be protected by: numerically coding all research data, separating all identifying information from data (only numerical codes will identify data collected via computer), and keeping the data in password-protected computer files. All passwords are only known to project personnel directly involved in the administration and oversight of the data collection. Information collected via online surveys and text-messaged responses will be hosted on a secure and password-protected server at Qualtrics. These data will be available for secure viewing and downloading on a specialized Qualtrics website. This information will be accessible only to the PIs or the RAs, who will complete Brown University human subjects training to ensure familiarity with rights of research participants and protection of confidentiality. No names, only identification codes, will be used in presenting data in lectures, seminars, and papers. Confidentiality will be protected to the extent allowable by law.

**11.3. Expected Benefits**. Participants in the experimental condition may benefit from reductions in perceived drinking norms on campus and potentially a reduction in drinking behavior, which could positively impact their well-being. Participants in the control condition may not directly benefit; however, it is possible that assessments completed will result in raised awareness of one's own drinking and its consequences, which has potential to lead to self-initiated change in problematic drinking (Walters, Vader, Harris, & Jouriles, 2009). This benefit in part can mitigate the impact of the above-mentioned risks. However, most benefits of the proposed research are to others and society in general in the form of the potential to inform future treatment.

The degree of risk to which study participants will be exposed in the proposed protocol is low. By contrast, the potential benefit for some participants and the benefits to science are substantial, Because of the minimal risks to participants, the risk-benefit ratio is favorable.

**11.4 Data Safety and Monitoring Plan**. The Data Safety and Monitoring Plan (DSMP) is commensurate with a Phase I survey and formative research, including a small clinical trial implemented with 120 participants, where risks to participants are expected to be minimal. PI Dr. Kate Carey and the IRB at Brown University will share primary responsibility for monitoring the trial. Plans have been established for both the monitoring of the trial and the reporting of adverse events.
Dr. Carey, whose office is located at CAAS where all data collection will occur, will provide daily monitoring of the formative research and the intervention pilot to ensure that study personnel are carefully supervised, participants are safe, data collection is progressing on time, study procedures and protocols

are being followed, and the data being collected are valid. Dr. Carey is trained as a clinical psychologist and has relevant experiences in clinical research, and staff training and supervision. Her presence provides high quality assurance and immediate availability in the event of any clinical or research concern. All project staff will be carefully trained to immediately report to Dr. Carey any deviations from protocol, concerns about patient safety, and concerns about study validity. In addition, Dr. Carey's presence at the data collection site will allow her to observe practices, procedures, and problems (if they arise). Dr. Carey will review collected data weekly, to ensure that there are no problems with data integrity, and will monitor weekly study progress. Dr. Carey will consult with the Co-Investigators as needed.

In addition, the Brown University IRB will initially approve the study and will provide ongoing monitoring throughout the study to ensure patient safety. After initial study approval, the IRB will annually review the study, including recruitment, protocols, preliminary data, and any new research relevant to the study, to determine whether study approval will continue. If the IRB takes any actions as a result of the annual review, Dr. Carey will report these actions to the NIH project officer within 72 hours.

**11.5. Adverse Events and Serious Adverse Events**. All research staff will be carefully trained by Dr. Carey to recognize and report any adverse events to her. In the proposed study we will use the FDA definition of adverse events. An adverse event is any untoward (unexpected and undesirable) physical or psychological harm, serious and non-serious, experience by a participant that has a temporal relationship with study participation. During participant interactions, research staff will be trained to observe and report any adverse reaction reported by participants to the PI. The PI will review the information and classify the relationship of the study protocol to the event as:

- *Not related*: The event is clearly related to the participant's clinical state, not with the study protocol
- *Remote*: Event was most likely related to the participant's clinical state, not with the study protocol
- *Possible:* Event follows a reasonable temporal sequence associated with participating in the study but is possibly related to the participant's clinical state.
- *Probable:* Event follows a reasonable temporal sequence associated with participating in the study and cannot be explained by the participant's clinical state.

Although deemed unlikely given the study procedures, if a study-related adverse event should occur, Dr. Carey will submit a written report describing the adverse event to the Brown University IRB, within 48 hours of the initial reporting of the event. An annual report will be submitted to the NIAAA project officer summarizing all adverse events. In addition, the consent form will include the contact phone numbers for Dr. Carey and the appropriate Brown University IRB personnel so that participants can directly report any complaints or potential adverse events. In our previous research in similar research projects at similar venues with over 2200 student participants, no adverse events occurred; therefore, in the proposed project, we anticipate the likelihood of an adverse event to be minimal.

**11.6. Monitoring of Study Progress**. The research team meet weekly to review study progress. The Project Coordinator (PC) reports on enrollment, participation, and assessment completion data. The PC will download data from the Qualtrics website, and upload it to the secure Brown servers, on a weekly basis; she will examine completeness, and spot check data quality, and summarize to investigators. Adjustments to survey administration will be made as needed. At the completion of each assessment, the PC conducts data cleaning and produces data summaries.

## 12. REGULATORY CONSIDERATIONS

**12.1. Consent.** Potential participants will complete an online screener that they can accessed by clicking on an emailed link or typing in the url or scanning a QR code. They will first be asked to complete a screener to determine their eligibility for the study. Ineligible participants will receive the automated message "Unfortunately, you are not eligible for this study. We thank you for your time spent taking this

survey." At the end of the screener, eligible participants will receive the message "We thank you for your time spent completing the screening questions. We have determined that you are eligible for the FACT22 study. Please read more about the study below and decide whether you consent to participate." They will then be directed to the consent form. If they consent, they will be asked to submit contact information, including both email (to deliver baseline survey and follow-up assessment reminders) and mobile phone number (for text delivery). The research team will then send an email with a link directing participants to the baseline survey to complete.

Informed consent will be obtained using an online consent form, which will be reviewed during in-person orientation sessions. Eligible participants interested in the study will be presented with an online informed consent document to read. After reading the document they will be asked to confirm their understanding of the study and their rights as study participants, as well as their interest in being in the study by clicking "Yes, I agree to participate in this study". If a prospective participant does not understand the study or the participant rights they would respond "No, I do not want to be in this study" and would be exited from the study. In the unlikely event that a participant may need professional support, the location and phone number of Counseling and Psychological Services at Brown University as well as other relevant resources will be provided. The essential elements of consent will be highlighted during the in-person orientation, including participants' rights to discontinue the study at any time.

A waiver of written consent was requested so that participants can complete the baseline measure prior to attending orientation. This study is minimal risk because (a) both the experimental manipulation and the control condition involves the receipt of informative text messages and there is no deception or collection of any information aside from self-report survey responses and text message interest ratings; and (b) all responses will be anonymized. Furthermore, (c) the online consent makes completion of the baseline assessment more convenient for the participants, as they complete the baseline at a time that works best for them and they can complete it in a private location of their choosing. The waiver should not adversely affect participants' rights and welfare because participants will still be offered all the same information they would have been offered in the consent processes with a signed consent form. They will not be required to answer any questions they do not want to and they can still stop participation at any time.

**12.2. Research Material Obtained from Human Subjects.** Participants will be the sole source of data for this study and all data will be obtained specifically and exclusively for research purposes. Data collection will take place remotely via online surveys or responses to text messages. All collected data will be held confidential. Survey software Qualtrics ensures protection of information through its firewall systems and regular scans for vulnerabilities. The confidential system component design restricts access to outside parties and Qualtrics' use of Transport Layer Security (TLS) encryption protects all transmitted data.

**12.3. Access to Individually Identifiable Information.** All participants will be assigned a unique ID. These IDs will be used to identify all participants on all research materials, surveys, tracking forms, as well as the database. Participants' names will never appear in any report resulting from the project. Separate from research records, an identifier key will be created that will link the participant ID to subject names and contact information, to facilitate follow-up with participants; contact information will have participant ID numbers but will not have any data. All data will be stored separately from identifying documents (e.g., participant tracking data base with names and phone numbers). Only the PIs and the research assistants will have access to project data until it is de-identified. Electronic data will be secured and accessible only through password protected computers. We will adopt the following measures to safeguard the data and participant confidentiality:

- All staff will be trained in procedures for maintaining confidentiality of participant information

- Electronic data collection forms will be identified by a unique identification number linked to an identifier list;
- The identifier key will be stored separately from the data collection forms and accessible by the only the research staff;
- Participants will be instructed to password protect their mobile phone to prevent viewing of study text messages.
- Data will be stored on our password-protected computers and backed up to a secure server. Access to this server is password protected and only known to the PIs and RAs and backed up daily.

**12.4. Programming Technology and Web Security.** Information submitted via web-based surveys at baseline and at the follow-up assessments will be stored in a secure server at Brown University. The technology for transmitting and storing data includes Transport Layer Security (TLS) encryption (also known as HTTPS) and firewalls to protect the data and to prevent unauthorized access. Information collected via text message will be hosted on a secure and password-protected server through Qualtrics. These data will be available for secure viewing and downloading on a specialized website created by Qualtrics. We will download data from the Qualtrics website, and upload it to the secure Brown servers, on a weekly basis. When the study is over, we will ensure that the data are all removed from Qualtrics servers.

**12.5. Protocol Amendment History**

| Version | Date | Description of Change | Brief Rationale |
|---|---|---|---|
| Original IRB approval | 8/14/2018 | Approval of Protocol Entitled: Correcting Exaggerated Drinking Norms with a Mobile Message Delivery System; Aim 3: Pilot Intervention (public name: FACT22 Study) (#1807002145) | |
| Modification 1 | 12/3/2018 | Varying attention check items on the post-test and follow-up assessments | So that participants would not see the same attention check questions and to preserve their ability to prompt careful attention to the surveys |
| | | Addition of a Participant Opinion Survey to be sent after the post-test survey | To gather additional open-ended on what participants liked and disliked about the text messages. |
| | | Addition of 3 questions to the post-test and follow-up surveys assessing use of campus support services | To determine if participants in the experimental condition sought out help at health or counseling services |
| Modification 2 | 3/8/2019 | Add a phone call reminder (in addition to email and text reminders) | To add the option for an additional prompt to complete the final follow-up, using a different communication modality |
| | | Minor wording changes to 6-month follow-up | To clarify the timeframe covered by the 6-month survey |
| | | Minor modifications to email/text follow-up reminders, adding participants' names to reminders | To enhance completion of the final assessment by personalizing the request |

## 13. REFERENCES


Arnett, J. J. (2005). The developmental context of substance use in emerging adulthood. *Journal of drug issues*, *35*(2), 235-254

Baer, J. S., Stacy, A., & Larimer, M. (1991). Biases in the perception of drinking norms among college students. *Journal of Studies on Alcohol, 52(6)*, 580-586.

Bendtsen, M., & Bendtsen, P. (2014). Feasibility and user perception of a fully automated push-based multiple-session alcohol intervention for university students: randomized controlled trial. *JMIR mHealth and uHealth*, *2*(2), e30.

Borsari, B., & Carey, K. B. (2003). Descriptive and injunctive norms in college drinking: a meta-analytic integration. *Journal of studies on alcohol*, *64*(3), 331-341.

Borsari, B., Merrill, J.E., Yurasek, A., Miller, M.B., & Carey, K.B. (2016). Does a Brief Motivational Intervention reduce frequency of pregaming in mandated students? *Substance Use and Misuse, 51*, 1056-1066.

Buysse, D. J., Reynolds, C. F., Monk, T. H., Berman, S. R., & Kupfer, D. J. (1989). The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry research*, *28*(2), 193-213.

Carey, K. B., Scott-Sheldon, L. A., Carey, M. P., & DeMartini, K. S. (2007). Individual-level interventions to reduce college student drinking: A meta-analytic review. *Addictive behaviors*, *32*(11), 2469-2494.

Cialdini, R. B., Reno, R. R., & Kallgren, C. A. (1990). A focus theory of normative conduct: recycling the concept of norms to reduce littering in public places. *Journal of personality and social psychology*, *58*(6), 1015.

Cohen, S. and Williamson, G. Perceived Stress in a Probability Sample of the United States. Spacapan, S. and Oskamp, S. (Eds.) The Social Psychology of Health. Newbury Park, CA: Sage, 1988.

Cohen, S., Kamarck, T., Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior, 24*, 385-396.

Cole-Lewis, H., & Kershaw, T. (2010). Text messaging as a tool for behavior change in disease prevention and management. *Epidemiologic reviews*, *32*(1), 56-69.

Cooper, M.L. (1994). Motivations for alcohol use among adolescents: development and validation of a four-factor model. *Psychological Assessment, 6*, 117-128.

Collins, R. L., Parks, G. A., & Marlatt, G. A. (1985). 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, 53(2)*, 189-200. doi: 10.1037/0022-006x.53.2.189

DeMartini, K. S., Carey, K. B., Lao, K., & Luciano, M. (2011). Injunctive norms for alcohol-related consequences and protective behavioral strategies: Effects of gender and year in school. *Addictive behaviors*, *36*(4), 347-353.

DiBello, A. M., Miller, M. B., Neighbors, C., Reid, A., & Carey, K. B. (2018). The relative strength of attitudes versus perceived drinking norms as predictors of alcohol use. *Addictive behaviors, 80*, 39-46.

Festinger, L. (1954). A theory of social comparison processes. *Human relations, 7*(2), 117-140.

Gibbons, F. X., & Buunk, B. P. (1999). Individual differences in social comparison: Development of a scale of social comparison orientation. *Journal of Personality and Social Psychology, 76*(1), 129-142. doi: 10.1037/0022-3514.76.1.129

Hurlbut, S. C., & Sher, K. J. (1992). Assessing alcohol problems in college students. *Journal of American College Health, 41*(2), 49-58.

Kahler, C. W., Strong, D. R., & Read, J. P. (2005). 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, 29*(7), 1180-1189. doi: 10.1097/01.alc.0000171940.95813.a5

Krieger, H., Neighbors, C., Lewis, M. A., LaBrie, J. W., Foster, D. W., & Larimer, M. E. (2016). Injunctive norms and alcohol consumption: A revised conceptualization. *Alcoholism: Clinical & Experimental Research, 40*(5), 1083-1092. doi:10.1111/acer.13037

Kroenke, K, Spitzer, R.L., Williams, J.B., & Löwe B. (2009). An ultra-brief screening scale for anxiety and depression: the PHQ-4. *Psychosomatics, 50*, 613.

Lewis, M. A., Litt, D. M., & Neighbors, C. (2015). The chicken or the egg: Examining temporal precedence among attitudes, injunctive norms, and college student drinking. *Journal of studies on alcohol and drugs*, *76*(4), 594-601.

Lindgren, K. P., Neighbors, C., Teachman, B. A., Wiers, R. W., Westgate, E., & Greenwald, A. G. (2013). I drink therefore I am: Validating alcohol-related implicit association tests. *Psychology of addictive behaviors*, *27*(1), 1-13.

Mallett, K. A., Varvil-Weld, L., Turrisi, R., & Read, A. (2011). An examination of college students' willingness to experience consequences as a unique predictor of alcohol problems. *Psychology of Addictive Behaviors, 25*(1), 41-47.

Matthes, J. (2015). Observing the "spiral" in the spiral of silence. *International Journal of Public Opinion Research*, *27*(2), 155-176.

Merrill, J. E., & Carey, K. B. (2016). Drinking over the lifespan: Focus on college ages. *Alcohol research: current reviews*.

Miller, M. B., DiBello, A. M., Merrill, J. E., & Carey, K. B. (2019). Development and initial validation of the alcohol-induced blackout measure. *Addictive behaviors*, *99*, 106079.

Neighbors, C., Lee, C. M., Lewis, M. A., Fossos, N., & Larimer, M. E. (2007). Are social norms the best predictor of outcomes among heavy-drinking college students?. *Journal of studies on alcohol and drugs*, *68*(4), 556-565.

Norman, P. (2011). The theory of planned behavior and binge drinking among undergraduate students: Assessing the impact of habit strength. *Addictive Behaviors, 36*(5), 502-507. doi: 10.1016/j.addbeh.2011.01.025

Osberg, T. M., Atkins, L., Buchholz, L., Shirshova, V., Swiantek, A., Whitley, J., ... & Oquendo, N. (2010). 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*, *24*(1), 1.

Perkins, H. W. (2002). Surveying the damage: a review of research on consequences of alcohol misuse in college populations. *Journal of Studies on Alcohol, supplement*, (14), 91-100.

Pew Research Internet Project. Cell Phone and Smartphone Ownership Demographics. 2014; http://www.pewinternet.org/data-trend/mobile/cell-phone-and-smartphone-ownershipdemographics/. Accessed 4/7/14.

Prentice, D. A., & Miller, D. T. (1996). Pluralistic ignorance and the perpetuation of social norms by unwitting actors. In *Advances in experimental social psychology* (Vol. 28, pp. 161-209). Academic Press.

Prince, M. A., & Carey, K. B. (2010). The malleability of injunctive norms among college students. *Addictive Behaviors*, *35*(11), 940-947.

Prince, M. A., Maisto, S. A., Rice, S. L., & Carey, K. B. (2015). Development of a face-to-face injunctive norms brief motivational intervention for college drinkers and preliminary outcomes. *Psychology of addictive behaviors*, *29*(4), 825.

Reed, M. B., Lange, J. E., Ketchie, J. M., & Clapp, J. D. (2007). The relationship between social identity, normative information, and college student drinking. *Social Influence, 2(4*), 269-294. doi: 10.1080/15534510701476617

Reid, A. E., & Carey, K. B. (2015). Interventions to reduce college student drinking: State of the evidence for mechanisms of behavior change. *Clinical psychology review*, *40*, 213-224.

Reid, A. E., Cialdini, R. B., & Aiken, L. S. (2010). Social norms and health behavior. In *Handbook of behavioral medicine* (pp. 263-274). Springer, New York, NY.

Scott-Sheldon, L. A., Carey, K. B., Elliott, J. C., Garey, L., & Carey, M. P. (2014). Efficacy of alcohol interventions for first-year college students: a meta-analytic review of randomized controlled trials. *Journal of consulting and clinical psychology*, *82*(2), 177.

Smith A. *http://www.pewinternet.org/2015/04/01/us-smartphone-use-in-2015/*

Sugarman, D. E., & Carey, K. B. (2007). The relationship between drinking control strategies and college student alcohol use. *Psychology of Addictive Behaviors, 21*(3), 338-345. doi:10.1037/0893-164X.21.3.338

Sobell, L. C., & Sobell, M. B. (1992). Timeline follow-back. In Litten R.Z., Allen J.P. (eds) Measuring alcohol consumption (pp. 41-72). Humana Press, Totowa, NJ.

Walters, S. T., Vader, A. M., Harris, T. R., & Jouriles, E. N. (2009). Reactivity to alcohol assessment measures: An experimental test. *Addiction, 104(8)*, 1305-1310. doi: 10.1111/j.1360 0443.2009.02632.x

Zamboanga, B. L., Pearce, M. W., Kenney, S. R., Ham, L. S., Woods, O. E., & Borsari, B. (2013). Are "extreme consumption games" drinking games? Sometimes it's a matter of perspective. The *American Journal of Drug and Alcohol Abuse, 39(5)*, 275-279. Doi: 10.3109/00952990.2013.827202

## APPENDIX A. Content of Alcohol Norms Text Messages Sent to Experimental Group

**Note**: This document conveys the final alcohol norms messages delivered in the experimental condition for the Aim 3 RCT supported by R21AA024771. These data were derived from the Aim 1 Campus Norms Survey, and translated to text message format by a Student Advisory Group. Text messages are organized by date of delivery, as described in Carey, K. B., Merrill, J. E., Boyle, H. K., & Barnett, N. P. (2020). Correcting exaggerated drinking norms with a mobile message delivery system: Selective prevention with heavy-drinking first-year college students. *Psychology of Addictive Behaviors, 34*(3), 454–464. https://doi.org/10.1037/adb0000566.

**Text messages organized by date of delivery, showing data source and norm type (DN=descriptive norms; IN= injunctive norms).**

| Date | Text | Norm Type |
|---|---|---|
| Friday, September 28, 2018 | Be one of the 98% of Brown students who respect other folks' decision to drink or not. | DN |
| Saturday, September 29, 2018 | Brown students who drink go for a buzz not a blackout. The average number of drinks students reported consuming on a night out was only around 3. | DN |
| Sunday, September 30, 2018 | Do you remember what you did last night? Most (>80%) of Brown students are opposed to getting black out drunk. | IN |
| Monday, October 1, 2018 | Don't feel guilty about grabbing a condom off your RPL's door, 85% of Brown students have never taken the risk of unprotected sex even while drunk. | DN |
| Tuesday, October 2, 2018 | 96% of Brown students say it is not a good idea to go further in a hookup than you wanted while intoxicated, let alone sober. | IN |
| Wednesday, October 3, 2018 | You can go to parties without drinking! The majority of Brown students have attended a party before and chosen not to drink. | DN |
| Thursday, October 4, 2018 | The majority of Brown students agree that it is a good idea to limit yourself to one drink an hour. | IN |
| Friday, October 5, 2018 | Drink responsibly and take care of yourself. Be a part of the 96% of Brown students that have not passed out from drinking in the past 30 days. | DN |
| Saturday, October 6, 2018 | Time management is key in college. Nearly 95% of Brown students would not recommend spending too much time drinking. | IN |
| Sunday, October 7, 2018 | Over 90% of Brown students report they can AND do have a good time with friends without consuming alcohol. | DN |
| Monday, October 8, 2018 | Do not let your perceptions persuade you into drinking more. The average Brown student believes their peers drink twice as much as they actually do. | DN |
| Tuesday, October 9, 2018 | About half of Brown students don't think it's acceptable to be seen drunk in public. | IN |
| Wednesday, October 10, 2018 | Over half of the drinkers have NEVER taken additional drugs when drinking -- don't feel pressured to do both. | DN |
| Thursday, October 11, 2018 | Nearly all (99%) of Brown students think it is unacceptable to try to force someone into unwanted sexual contact, drunk or sober. | IN |
| Friday, October 12, 2018 | Using condoms can prevent many STIs. Around 94 percent of Brown students have reported using protection with a sexual partner when they were drinking. | DN |
| Saturday, October 13, 2018 | 96% of Brown students believe it is a good idea to keep track of the number of drinks they consume in a night out. Count your caps! | IN |
| Sunday, October 14, 2018 | You're not just putting your life at risk. Don't be a part of the 6% of Brown students who have driven a car when they've had too much to drink to drive safely. | DN |
| Monday, October 15, 2018 | Be part of the 96% of Brown students who do not let their drinking habits affect the quality of their schoolwork. | IN |
| Tuesday, October 16, 2018 | Nearly 4 out of 5 Brown students believe that you should not drink alcohol when you are anxious, angry, or sad. | IN |
| Wednesday, October 17, 2018 | It's not every weekend, half of Brown students drink less than once a week. | DN |

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|---|---|---|
| Thursday, October 18, 2018 | Think wild nights, major cleanups, and broken items are the norm? 87% have never done something disruptive when drunk. | DN |
| Friday, October 19, 2018 | Use protection! 99% of Brown students believe it is important to have protected sex even when drinking. | IN |
| Saturday, October 20, 2018 | 8 out of 10 Brown students have at some point chosen to limit themselves to a set number of drinks for a night out. | DN |
| Sunday, October 21, 2018 | Plan ahead: 9 out of 10 Brown students think it's a good idea to set a limit on how many drinks they have before going out. | IN |
| Monday, October 22, 2018 | Academics are important. 7 out of 10 Brown students never miss classes because of drinking. | DN |
| Tuesday, October 23, 2018 | Who likes vomiting? Around 90% of Brown students do not think it is okay to drink to the point of getting sick or throwing up. | IN |
| Wednesday, October 24, 2018 | Can you have a good time at a party without getting wasted? 9 out of 10 of your peers think so. | IN |
| Thursday, October 25, 2018 | More than one third of Brown students did not drink heavily (4+/5+) in the last month. | DN |
| Friday, October 26, 2018 | 84% of Brown students reported never forcefully encouraging someone to drink more than they want. | DN |
| Saturday, October 27, 2018 | 98% of Brown students believe it is not ok to become verbally aggressive while intoxicated. | IN |
| Sunday, October 28, 2018 | Brunonians look out for each other: more than 9 in 10 students have made a plan with a friend to keep each other safe on a night out. | DN |
| Monday, October 29, 2018 | Stay hydrated! 96% of Brown students believe drinking water while drinking alcohol is a good idea. | IN |
| Tuesday, October 30, 2018 | Keep it chill. Only 17% of Brown students say they became rude, obnoxious, or insulting after drinking. | DN |
| Wednesday, October 31, 2018 | 99% of Brown students say it is unacceptable to neglect familial and academic obligations because of drinking. | IN |
| Thursday, November 1, 2018 | Go Bruno! 95% of Brown students agree that the academic experience outweighs the need to drink & party. | IN |
| Friday, November 2, 2018 | More than half of Brown students consumed 5 or fewer drinks on their HEAVIEST drinking day. It is the norm to drink safely and in moderation. | DN |
| Saturday, November 3, 2018 | Most (62%) of Brown students would not recommend hooking up with someone you just met while drunk. | IN |
| Sunday, November 4, 2018 | More than 8 out of 10 of Brown students eat before or while they drink at least half the time to avoid getting too intoxicated. | DN |
| Monday, November 5, 2018 | Don't be afraid to switch it up! More than 9 out of 10 Brown students suggest alternating alcoholic beverages with non-alcoholic ones. | IN |
| Tuesday, November 6, 2018 | 84% of your peers have not thrown up or felt sick to their stomach after drinking in the past month | DN |
| Wednesday, November 7, 2018 | 97% of Brown students would prefer not to drink to the point of getting into sexual situations they later regret. | IN |
| Thursday, November 8, 2018 | 97% of current Brown students choose ways to de-stress without alcohol. | DN |
| Friday, November 9, 2018 | Just because it is the weekend does not mean you have to drink. 30 percent of Brown students did not consume any alcohol on a Friday. | DN |
| Saturday, November 10, 2018 | Nearly all (98%) Brown students think damaging property while intoxicated is not okay. | IN |
| Sunday, November 11, 2018 | Be a part of the 92% of Brown students that use a sober designated driver while they are out drinking. | DN |
| Monday, November 12, 2018 | Over 3 out of 4 Brown students believe it is a good idea to stop drinking at a predetermined time. | IN |
| Tuesday, November 13, 2018 | Blackouts aren't the norm. Only 15% of Brown students report having blacked out in the last month. | DN |
| Wednesday, November 14, 2018 | Know your limit. Nearly 9 out of 10 Brown students agree that it is not ok to pass out from drinking. | IN |

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|---|---|---|
| Thursday, November 15, 2018 | 6 out of 10 Brown students who pregame reported consuming 3 or less drinks while pregaming. | DN |
| Friday, November 16, 2018 | Keep calm and carry on: 99% if Brown students think it is unacceptable to become physically aggressive when intoxicated. | IN |
| Saturday, November 17, 2018 | 9 out of 10 Brown students who drink go for the quality of the experience, rather than the quantity. | DN |
| Sunday, November 18, 2018 | Why waste your college years on nights you won't remember? 95% of Brown students place quality of experience over quantity of drinks. | IN |
| Monday, November 19, 2018 | 8 out of 10 Brown students don't think it's good to drink to the point of needing to be EMS'ed. | IN |
| Tuesday, November 20, 2018 | The majority of Brown students drink fewer than 7 drinks in one week. | DN |
| Wednesday, November 21, 2018 | Nearly all (96%) of Brown students think it is never okay to pressure someone into drinking more. | IN |
| Thursday, November 22, 2018 | Puking isn't fun, a great way to avoid it is by spacing out your drinks! Around 90 percent of Brown students have reported spacing out their drinks over time. | DN |
| Friday, November 23, 2018 | Don't want to pregame? Don't have to! 96% of Brown students think it's okay to choose not to pregame. | IN |
| Saturday, November 24, 2018 | Almost 9 out of 10 Brown students think it is not ok to drink to the point of blacking or browning out. | IN |
| Sunday, November 25, 2018 | 87% of Brown students think it is not a good idea to get so drunk that you have difficulty walking. | IN |
| Monday, November 26, 2018 | 98% of Brown students think it is wise to space out your drinks over time. Take it easy. | IN |
| Tuesday, November 27, 2018 | The more you drink, the more you build your tolerance. 3 out of 4 Brown students think it's a bad idea to need increasingly more drinks to feel a buzz. | IN |
| Wednesday, November 28, 2018 | Don't lower your own standards - around 9 out of 10 Brown students believe that you shouldn't hook up with someone while drunk if you wouldn't when sober. | IN |
| Thursday, November 29, 2018 | Let's hit up Jo's tonight! 100% of Brown students say it's a good idea to eat something before or during drinking. | IN |
| Friday, November 30, 2018 | Did you know that students who drink average less than 3 drinks on a Friday night? Binge drinking is the exception, not the norm. | DN |
| Saturday, December 1, 2018 | 68% of Brown students drink fewer than 4 drinks on a typical Saturday. | DN |
| Sunday, December 2, 2018 | The vast majority of us (98%) agree that drinking cannot excuse rude, obnoxious, or insulting behavior. | IN |
| Monday, December 3, 2018 | More than 96% of Brown students agree that it is not OK to damage valuable items when intoxicated. | IN |
| Tuesday, December 4, 2018 | Don't live with regrets. 88% of Brown students say it is not a good idea to hook up with someone you wouldn't if sober. | IN |
| Wednesday, December 5, 2018 | More than 8 out of 10 Brown students agree that it is not okay to cheat on a significant other when drunk or sober. | IN |
| Thursday, December 6, 2018 | 99% of Brown students agree that it is unacceptable to do something disruptive, even when drunk. | IN |

**APPENDIX B. Content of "This day in history" Text Messages Sent to Control Group**

**Note**: This document conveys the "This day in history" messages selected to be delivered in the control condition for the Aim 3 RCT supported by R21AA024771, as described in Carey, K. B., Merrill, J. E., Boyle, H. K., & Barnett, N. P. (2020). Correcting exaggerated drinking norms with a mobile message delivery system: Selective prevention with heavy-drinking first-year college students. *Psychology of Addictive Behaviors, 34*(3), 454–464. https://doi.org/10.1037/adb0000566.

| Date | Control Text |
|---|---|
| 1. September 10 | Today in 1991 Nirvana's "Smells Like Teen Spirit" was released as a single |
| 2. September 11 | Today in 1987 the film Fatal Attraction premiered |
| 3. September 12 | Today in 1988 Hurricane Gilbert slammed Jamaica |
| 4. September 13 | Today in 1996 Tupac Shakur died |
| 5. September 14 | Today in 1927 Dancer Isadora Duncan was killed in car accident |
| 6. September 15 | Today in 1954 the famous Marilyn Monroe "skirt" scene filmed |
| 7. September 16 | Today in 1993 The show Frasier debuted |
| 8. September 17 | Today in 1996 Oprah launched her influential book club |
| 9. September 18 | Today in 1973 President Carter files official report on UFO sighting |
| 10. September 19 | Today in 2000 Michael Chabon's Pulitzer Prize-winning novel "The Amazing Adventures of Kavalier & Clay" debuted |
| 11. September 20 | Today in 1975 The Bay City Rollers made their U.S. debut on Saturday Night Live with Howard Cosell |
| 12. September 21 | Today in 1904 The great Nez Perce leader Chief Joseph died in Washington |
| 13. September 22 | Today in 1598 Playwright Ben Jonson was indicted for manslaughter |
| 14. September 23 | Today in 1972 Mac Davis earned one of the 70s' most head-scratching #1 hits with "Baby Don't Get Hooked on Me" |
| 15. September 24 | Today in 1966 "Last Train to Clarksville" gave the made-for-TV Monkeys a real-life pop hit |
| 16. September 25 | Today in 1970 The Partridge Family premiered on ABC television |
| 17. September 26 | Today in 1969 The Brady Bunch premiered on TV |
| 18. September 27 | Today in 1930 Bobby Jones won the U.S. Amateur title |
| 19. September 28 | Today in 1918 British soldier allegedly spared the life of an injured Adolf Hitler |
| 20. September 29 | Today in 1913 "Message filmmaker" Stanley Kramer was born |
| 21. September 30 | Today in 1955 James Dean died in car accident |
| 22. October 1 | Today in 1890 Yosemite National Park was established |
| 23. October 2 | Today in 1971 Musician Rod Stewart earned his first #1 hit with "Maggie May" |
| 24. October 3 | Today in 1967 Writer, singer and folk icon Woody Guthrie died |
| 25. October 4 | Today in 1955 the so-called Brooklyn bums won their first World Series in baseball |
| 26. October 5 | Today in 2011 Apple founder Steve Jobs died |

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| 27. October 6 | Today in 1866 The Reno brothers carried out the first train robbery in U.S. history |
| 28. October 7 | Today in 1983 Sean Connery played Bond in the film “Never Say Never Again” |
| 29. October 8 | Today in 1957 Musician Jerry Lee Lewis recorded “Great Balls Of Fire” in Memphis, Tennessee |
| 30. October 9 | Today in 1976 Disco/Classical hybrid “A Fifth of Beethoven” was the #1 song on the U.S. pop charts |
| 31. October 10 | Today in 1957 Braves beat the Yanks and won the World Series in baseball |
| 32. October 11 | Today in 1975 Saturday Night Live debuted |
| 33. October 12 | Today in 2007 Al Gore won the Nobel Prize in the wake of his film “An Inconvenient Truth” |
| 34. October 13 | Today in 1975 Singer Charlie Rich protested John Denver’s big win at the CMA Awards |
| 35. October 14 | Today in 1957 “Wake Up Little Susie” became the Everly Brothers’ first #1 hit |
| 36. October 15 | Today in 1930 Duke Ellington recorded his first big hit, “Mood Indigo” |
| 37. October 16 | Today in 1976 “Disco Duck” hit the #1 spot on the U.S. pop chart |
| 38. October 17 | Today in 1960 R&B legends the Drifters earned #1 pop hit with "Save the Last Dance for Me" |
| 39. October 18 | Today in 1968 John Lennon and Yoko Ono were arrested for drug possession |
| 40. October 19 | Today in 1985 “Take on Me” music video helped Norway’s a-Ha reach the top the U.S. pop charts |
| 41. October 20 | Today in 1977 Three members of the southern rock band Lynyrd Skynyrd died in a Mississippi plane crash |
| 42. October 21 | Today in 1959 Guggenheim Museum opened in New York City |
| 43. October 22 | Today in 1952 Actor Jeff Goldblum was born |
| 44. October 23 | Today in 1976 Chicago had its first #1 hit with “If You Leave Me Now” |
| 45. October 24 | Today in 1962 James Brown recorded his breakthrough Live at the Apollo album |
| 46. October 25 | Today in 1881 Pablo Picasso was born in Malaga, Spain |
| 47. October 26 | Today in 1985 Whitney Houston earned her first #1 hit with “Saving All My Love For You” |
| 48. October 27 | Today in 1970 Tim Rice and Andrew Lloyd Webber released Jesus Christ Superstar |
| 49. October 28 | Today in 1998 President Bill Clinton signed the Digital Millennium Copyright Act into law |
| 50. October 29 | Today in 1966 The song “96 Tears” became a #1 hit for the band “? and the Mysterians” |
| 51. October 30 | Today in 1864 The city of Helena, Montana, was founded after miners discover gold |
| 52. October 31 | Today in 1963 Ed Sullivan witnessed Beatlemania firsthand, paving the way for the British Invasion |
| 53. November 1 | Today in 1512 Sistine Chapel ceiling opened to the public |
| 54. November 2 | Today in 1960 Lady Chatterley’s Lover obscenity trial ended |
| 55. November 3 | Today in 1962 The Crystals earned a #1 hit with “He’s A Rebel” |
| 56. November 4 | Today in 1978 Anne Murray earned a #1 pop hit with “You Needed Me” |
| 57. November 5 | Today in 1938 Samuel Barber’s Adagio For Strings received its world premiere on NBC radio |

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| 58. November 6 | Today in 1917 the Bolsheviks revolted in Russia |
| 59. November 7 | Today in 1980 “King of Cool” Steve McQueen died |
| 60. November 8 | Today in 1887 Doc Holliday died of tuberculosis |
| 61. November 9 | Today in 1990 Willie Nelson’s assets were seized by the IRS |
| 62. November 10 | Today in 1969 Sesame Street debuted |
| 63. November 11 | Today in 1942 The US Army draft age was lowered to 18 |
| 64. November 12 | Today in 1954 Ellis Island closed |
| 65. November 13 | Today in 1953 Indiana Textbook Commission member charged that Robin Hood was communistic |
| 66. November 14 | Today in 1941 Cary Grant starred in Hitchcock’s Suspicion |
| 67. November 15 | Today in 1965 Craig Breedlove set new land-speed record |
| 68. November 16 | Today in 1959 The Sound of Music premiered on Broadway |
| 69. November 17 | Today in 2003 “The Terminator” Arnold Schwarzenegger became “The Governator” of California |
| 70. November 18 | Today in 1996 High-profile expert on exotic birds was sentenced for smuggling parrots |
| 71. November 19 | Today in 1985 Reagan and Gorbachev held their first summit meeting |
| 72. November 20 | Today in 1955 Bo Diddley made his national television debut on The Ed Sullivan Show |
| 73. November 21 | Today in 1967 Westmoreland told the media the communists are losing |
| 74. November 22 | Today in 1975 KC and the Sunshine band toped the U.S. pop charts with “That’s The Way (I Like It)” |
| 75. November 23 | Today in 1936 Blues legend Robert Johnson made first-ever recording |
| 76. November 24 | Today in 1947 “Hollywood 10″ cited for contempt of Congress |
| 77. November 25 | Today in 1999 This day became the international day to eliminate violence against women |
| 78. November 26 | Today in 1941 Japanese task force left for Pearl Harbor |
| 79. November 27 | Today in 1942 Jimi Hendrix was born |
| 80. November 28 | Today in 1989 Czechoslovakian Communist Party gave up its monopoly on political power |
| 81. November 29 | Today in 1775 Congress created the Committee of Secret Correspondence |
| 82. November 30 | Today in 1974 Elton John’s "Greatest Hits" album became #1 in the US |
| 83. December 1 | Today in 1955 Rosa Parks ignited a bus boycott |
| 84. December 2 | Today in 1972 The Temptations earned their final #1 hit with “Papa Was A Rolling Stone” |
| 85. December 3 | Today in 1967 The first human heart transplant was done |
| 86. December 4 | Today in 1956 The “Million Dollar Quartet” convened at Sun Studios in Memphis, Tennessee |
| 87. December 5 | Today in 2000 The "O Brother, Where Art Thou?" soundtrack was released |
| 88. December 6 | Today in 1992 Jerry Rice scored a record-breaking touchdown |
| 89. December 7 | Today in 1941 Pearl Harbor was bombed |

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| 90. December 8 | Today in 1941 Roosevelt asked Congress to declare war on Japan |
| 91. December 9 | Today in 1854 “The Charge of the Light Brigade” by Alfred Lord Tennyson was published |
| 92. December 10 | Today in 1901 First Nobel Prizes were awarded |
| 93. December 11 | Today in 1944 Toronto endured a record snowstorm |
| 94. December 12 | Today in 627 The Byzantines, under Heraclius, crushed the Persians in the Battle of Nineveh |
| 95. December 13 | Today in 2000 Al Gore conceded the 2000 US presidential election |
| 96. December 14 | Today in 1977 Saturday Night Fever got its world premiere and launched a musical juggernaut |
| 97. December 15 | Today in 1944 Legendary bandleader Glenn Miller disappeared over the English Channel |
| 98. December 16 | Today in 1914 Germans bombarded the English ports of Hartlepool and Scarborough |
| 99. December 17 | Today in 1777 France formally recognized the United States |
| 100.December 18 | Today in 1946 Director Steven Spielberg was born |
| 101.December 19 | Today in 2005 Ahmadinejad banned all Western music in Iranian state television and radio broadcasts |
| 102.December 20 | Today in 1963 Berlin Wall opened for first time |