



Immediate reductions in misperceived social norms among high-risk college student groups

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ABSTRACT

The current quasi-experimental design evaluated whether a brief, live, interactive, normative group (BLING) intervention produced immediate reductions in group-specific normative perceptions and whether the magnitude of these misperceptions differed among three at risk undergraduate populations: first-year students ($N = 767$), Greek-affiliated students ($N = 555$), and student-athletes ($N = 524$). In a live group setting, participants used wireless keypads to enter in normative perceptions of their group's drinking levels, followed by their own actual drinking behaviors. Feedback data illustrating the discrepancies between perceived and actual norms were then presented graphically on a large screen. Across all groups at pre-intervention, respondents reported significantly higher perceived group-specific norms than actual alcohol use, with magnitude of initial misperceptions varying by group. The BLING intervention was equally effective in immediately correcting normative misperceptions among all three groups regardless of gender or the magnitude of initial misperception. These data further validate the ability of live normative group-specific data-collection and feedback to overcome saliency and credibility issues exhibited by many existing social norms interventions.

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1. Introduction

Alcohol use continues to be a risk factor for American college students, resulting in a host of negative consequences (Hingson, Zha, & Weitzman, 2009; Wechsler, Lee, Kuo, & Lee, 2000). Among undergraduate populations, three subgroups have been particularly identified as at risk for problematic drinking: first-year students, Greek-affiliated students, and student-athletes. First-year students consume higher quantities of alcohol than upperclassmen, display more alcohol dependence symptoms than the general adult population, and experience an increasing amount of problems due to heavy drinking during the transition to college (Grekin & Sher, 2006; Schulenberg & Maggs, 2002; Turrissi, Padilla, & Wiersma, 2000). Greek-affiliated students drink higher quantities, drink more frequently, and incur more alcohol-related consequences than do non-Greek students (Barry, 2007; Sher, Bartholow, & Nanda, 2001). And student-athletes drink higher quantities per occasion, engage more frequently in heavy episodic drinking, and experience more negative alcohol-related consequences compared with non-athletes (Borsari & Carey, 2001; Leichliter, Meilman, Presley, & Cashin, 1998; Perkins, 2002; Perkins, Haines, & Rice, 2005; Yusko, Buckman, White, & Pandina, 2008a).

More research is needed in order to effectively combat the increased alcohol-related risk that exists for students in these three subgroups. The present project sought to advance such research by describing a novel intervention technique that utilizes the specific characteristics of these subgroups (saliency and proximity) to reduce alcohol risk within these cohorts.

To address undergraduate alcohol use, researchers and student-affairs professionals have designed interventions and preventative initiatives targeting individual predictors and theoretical constructs that have been shown to be strongly related to levels of college drinking. A construct receiving notable research attention is normative beliefs. Social norms theory posits that inaccurate perceptions of what constitutes typical actions of one's peer group, also known as descriptive norms, influence behavior (Berkowitz, 2004). When applied to college drinking, college students consistently overestimate the quantity and frequency of peer drinking (Borsari & Carey, 2001, 2003). These misperceptions tend to form when individuals observe and remember the highly-visible problem drinking of a salient minority better than the more common, but less striking, responsible behavior of the majority (Perkins, 1997). Individuals then assume these misperceptions to be normative (Perkins, 1997) and may spread them through public conversation (Berkowitz, 2004). The magnitude of these misperceptions has been shown to be important when evaluating the influence of norms on an individual's drinking, for students may alter their drinking behaviors to a manner that's characteristic of the perceived group norm (Berkowitz, 2004; Borsari & Carey, 2001).

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To decrease problematic drinking, social norms interventions seek to change inaccurate normative misperceptions by exposing and augmenting existing healthy norms among one's referent group (Berkowitz, 2004; Lewis & Neighbors, 2006). Social norms theory posits that correcting these misperceptions by revealing the actual, more modest norm will reduce alcohol risk as students will then drink to match the new, accurate, normative perception. Therefore, an important precursor and catalyst to reducing these risk behaviors is decreasing estimated misperceptions of normative behavior. However, little research has investigated the time-lapse between the intervention and at what point, post-intervention, participants qualify their normative perceptions.

Social norms interventions take on various forms and are now ubiquitous on American college campuses. The current quasi-experimental study utilized a novel methodology known as the brief, live, interactive, normative group (BLING) intervention. This technique seeks to provide a new and effective way to immediately correct normative misperceptions and reduce problem drinking with credible feedback from salient data. Participants actively engage in the assessment of group-specific normative perceptions in a live group setting by using wireless keypad technology to enter in perceptions of the group's drinking and the individual's actual drinking behaviors. Feedback data on the discrepancies between the perceived and actual norms derived from their inputs are then immediately presented to the group. The presence of misperceptions held by the group is authenticated and exposed homogeneously across all members of the group present, a technique believed to foster trust in the accuracy of the displayed data (LaBrie, Hummer, Neighbors, & Pedersen, 2008). This interactive methodology seeks to ensure that the data are adequately observed, believed, and reflected upon.

A strength of the BLING intervention is that it seeks to address limitations of other normative intervention approaches. Although some interventions have shown effectiveness in changing normative misperceptions and subsequent drinking (for review, see Perkins, 2002), others have been less successful due to certain identifiable barriers to change (e.g. Granfield, 2002; Werch et al., 2000). One common obstacle that these interventions face is the salience of the referent group data to participants. Personal behaviors tend to be mostly influenced by proximal individuals who share an important group membership (Borsari & Carey, 2003; Miller & Prentice, 1996). Students may be more likely to disregard data derived from distal referent groups unimportant to them (such as "all students"), while misperceptions of salient and proximal reference group behaviors may be more likely to influence drinking (Borsari & Carey, 2003; Cialdini, 2003; Lewis & Neighbors, 2006). Indeed, several studies have suggested that in light of strong associations between normative group-specific misperceptions and individual behavior, social norms interventions should incorporate proximal group-specific normative feedback targeting first-year students (Hummer, LaBrie, & Pedersen, *in press*), student-athletes (Yusko, Buckman, White, & Pandina, 2008b), and Greek-affiliated students (LaBrie et al., 2008). Such feedback would likely be salient and important to the individual and therefore potentially effective in reducing problematic drinking. The BLING intervention utilizes such normative feedback and has demonstrated preliminary longitudinal efficacy in reducing within-subject normative misperceptions and drinking behavioral outcomes among Greek-affiliated students and student-athletes at one and two-month follow-ups (LaBrie, Hummer, Huchting, & Neighbors, 2009; Labrie et al., 2008). Yet studies on the BLING intervention have not compared the levels of misperceptions among high-risk groups nor investigated whether reductions in misperceptions are actually achieved in 'real time'. Because of the consistent methodological assessment procedure across targeted groups, such data would provide unique insight into the relative nuances of group-specific misperceptions between three traditionally high-risk student groups on college campuses, while also extending research on the reliability and potential of the BLING approach.

Another obstacle to the efficacy of social norms interventions is the credibility of the normative data presented. Social norms interventions are intended to create a measurable level of cognitive dissonance in students by providing normative feedback that contradicts widely held beliefs about drinking behaviors (Berkowitz, 2004). As might be predicted by the theory of cognitive dissonance (Festinger, 1957), heavy drinking students may be motivated to prevent the dissonance elicited by the normative feedback (i.e., that they are deviating from the prevailing norm) by discounting the believability of the intervention data. In addition, theories on motivated reasoning posit that subjects motivated to disbelieve evidence may attempt to recruit beliefs and inferential rules (e.g., the use of statistical heuristics) in order to criticize and consequently demerit disagreeable conclusions rather than to proffer legitimate scientific criticism (Kunda, 1990). Such counter-argumentation would allow heavy drinking students to continue their level of drinking without experiencing a sense of conflict. Participants may discount the credibility of the intervention if they receive normative feedback that they misinterpret, find confusing, or deem suspect (Granfield, 2002; Thombs, Dotterer, Olds, Sharp, & Raub, 2004). Several studies have noted that such lack of believability and credibility of social norms messages may have accounted for negligible results observed in social norms interventions (Clapp, Russell, & DeJong, 2001; Granfield, 2002; Werch et al., 2000). The present project sought to enhance the believability of the normative feedback by having group participants provide the data themselves in 'real time' and by having the facilitator interactively present such data to them in an engaging, comprehensible format.

The current project combined data from three separate studies targeting three different high-risk groups for two new purposes: to assess whether the magnitude of normative misperceptions differed among first-year students, Greeks, and student-athletes; and whether the normative feedback utilized in the BLING intervention produced *immediate* reductions in perceived norms. This research also provides a conceptual framework for how and why the BLING technique may be an initial catalyst for behavior change, particularly among high-risk subgroups. We hypothesized that each group initially would significantly overestimate its own group-specific descriptive norms, but Greeks would have lower levels of misperception due to the heavily proximal and salient nature of this group. We also anticipated that the BLING intervention would be effective in immediately reducing overestimated normative misperceptions concerning group-specific drinking behaviors for each high-risk group, regardless of the magnitude of misperception for each group.

2. Materials and methods

2.1. Participants

The current project utilized samples from three separate, institutional review board-approved studies. Each study examined a distinct sample entirely comprised of one of the following subsets: first-year students ($N=767$), student-athletes ($N=524$), or Greek-affiliated students ($N=555$). In each study, demographic data were collected prior to the intervention via an online survey sent individually to each participant. All interventions for a particular study occurred within three weeks of each other.

The first-year student sample had a recruitment rate of 64% (767 out of 1203; 375 males and 392 females). These participants were recruited from first-year residence halls at a midsize private university on the west coast during the Fall 2007 and Fall 2008 semesters. With the help of Student Housing staff, facilitators arranged and implemented 10 BLING interventions comprised of same-gender students from randomly selected residence hall floors for participation. As an incentive to participate, three gift cards (valuing \$50, \$100, and \$150, respectively) were raffled off at each

intervention. Intervention group sizes ranged from 30 to 70 students. Participants averaged 18.19 ($SD = 0.54$) years of age. The ethnicity of the sample was 44.5% Caucasian, 13.8% Hispanic, 9.4% Asian/Pacific Islander, 3.9% African American, 3.0% Other, and 25.4% declined to state.

The student-athlete sample had a recruitment rate of 74% (524 out of 705; 219 males and 305 females). These participants were recruited from all Division I varsity athletic teams at two private, midsized universities (from the west and east coasts of the United States) in the Spring 2007 semester. The Athletic Departments at each school assisted project personnel in recruitment and in setting up intervention meetings that fit academic and practice schedules. Intervention groups (and thus reference groups) were constructed as a function of gender, school attended, and season status (“In-season” or “Out-of-season”). Thus, a total of eight athlete interventions were conducted. Overall, 61.2% of the sample participated in an in-season sport. Intervention group sizes ranged from 50 to 80 students and were comprised of 4–7 complete athletic teams, combining both individual and team oriented sports. Participants averaged 19.51 ($SD = 1.25$) years of age. The ethnicity of the sample was 72.5% Caucasian, 5.9% Hispanic, 3.1% Asian/Pacific Islander, 4.0% African American, 3.2% Mixed Ethnicity, 1.9% Other, and 9.4% declined to state.

The Greek-affiliated student sample had a recruitment rate of 64% (555 out of 861; 116 males and 439 females). Participants were recruited from fraternities, sororities, and service organizations at a midsized western university in the Spring 2006 semester. Service organizations, similar to Greek organizations, utilize a selective initiation process to recruit members, who meet primarily to perform service together but also share many other social activities. The facilitator organized meetings with the Greek Advisor and presidents of each organization to encourage members' participation and to help arrange meeting times. As an additional incentive to participate, the Greek Advisor allowed these interventions to fulfill alcohol programming requirements for each organization if a quorum of the organization's members was met. Organizations also received a nominal monetary stipend for participation. Reference groups were constructed as a function of organization (gender and group-specific), and interventions took place during a regularly scheduled meeting of each group. Intervention group sizes ranged from 40 to 120 students. A total of 12 Greek interventions were conducted. Participants averaged 19.81 ($SD = 0.95$) years of age. The ethnicity of the sample was 50.1% Caucasian, 13.2% Hispanic, 4.5% Asian/Pacific Islander, 2.7% African American, 4.7% Mixed Ethnicity, 2.5% Other, and 22.3% declined to state.

2.2. Design and procedure

The recruitment procedures were homogenous across studies. Every participant received an electronic invitation via e-mail to participate in a study about undergraduate alcohol use and social norms. If they agreed to participate, students were asked to electronically consent to the study. They were informed in the e-mail and during the intervention that all responses were confidential and would not be released to any university official or administrator. First-year students were informed by their resident advisors, student-athletes were informed by their team's coach, and Greek-affiliated students were informed by their organization's president of the time and place of the respective interventions. The Greek interventions were held at each of the organizations' meeting place, which due to shared space, resulted in 6 different locations on campus. All athlete interventions were held at the same location, at each institution. The first-year interventions were conducted in the common area for each residence hall. All interventions were facilitated by the same graduate-level research staff person, who was the project coordinator of the main study.

2.3. Measures

Participant perceived descriptive norms and actual alcohol use were assessed in parallel by sets of five items measuring the frequency of consumption, average number of drinks consumed during a typical drinking occasion, number of drinks consumed per week, maximum number of drinks consumed during one occasion in the past month, and number of times a student engaged in heavy, episodic drinking (five or more drinks in a row for men; four or more drinks in a row for women) during the past two-week period.

Questions first prompted individuals to report on their perceptions regarding the five descriptive normative behaviors by a typical member of their reference group. The reference groups were phrased differently, depending on the sample, using the following formats: “typical [gender] [dorm] [floor] resident” for first-year students, “typical [gender] [school] [season-status] athlete” for student-athletes, and “typical [gender] [Greek organization] member” for Greek-affiliated students. For example, a first-year student may be asked: “How many drinks, on average, does a typical male resident living on your floor in 'Dorm X' consume during a typical drinking occasion?” To assess actual alcohol use, the same five behavioral questions were then asked with the individual as the referent for the drinking behaviors. For example: “How many drinks, on average, do you consume during a typical drinking occasion?”

All items were measured on 9-point Likert type scales varying from 1 (lowest risk; e.g., 0 drinks per occasion, 0 drinks per week) to 9 (highest risk; e.g., 13 or more drinks per occasion, 22 or more drinks per week), with higher numbers indicating higher risk behaviors. Anchor descriptions varied by item (see Appendix A for the list of questions and response options).

2.4. Brief live interactive normative group (BLING) intervention

The interactive polling system known as OptionFinder was used in all group interventions. This technology combines PowerPoint-based software and an electronic system using wireless, handheld, single-response keypads that are given to group members during the intervention. Each participant received a keypad upon arrival to the intervention. The facilitator began the intervention with a statement of purpose and full review of the informed consent and confidentiality agreement. In order to introduce the OptionFinder technology to participants, the facilitator asked a series of questions regarding age, gender, and class year. Participants gave their personal responses using the wireless keypads. After all participants had entered their responses for a given question, a frequency chart that displayed the group's responses in percentages was projected on a large screen. The facilitator then explained how to interpret the graph.

This immediate visual presentation of responses was expected to increase participants' interest in and believability of subsequent data by showing participants that the system instantly and accurately reports the group's own responses, without manipulation. The OptionFinder system has already been shown to produce equivalent data on demographic and drinking questions to traditional confidential surveys (LaBrie, Earleywine, Lamb, & Shelesky, 2006).

After this preliminary demonstration, the immediate visual feedback option was disabled. Participants proceeded to answer the items that measured both descriptive normative perceptions concerning the drinking behaviors of a typical member of their relevant, salient reference group and the individuals' actual behaviors. The OptionFinder system saved participant responses for feedback. After participants had completed all questions, the graphical response pattern technology was re-enabled. But before presenting the normative feedback, the facilitator briefly explained the basic components of social norm theory to the group and its application to college drinking behaviors. Then, the facilitator led the group through an examination of the participants' responses. The facilitator

discussed each item separately, first examining the question measuring normative perceptions for that item, followed by the question measuring participants' actual behavior. For each question, the facilitator graphically presented the group's frequencies for each response option in a non-confrontational and non-judgmental style. The facilitator drew attention to the discrepancy between the perceived group norm and the group's actual drinking behaviors by encouraging participants to compare their personal perceptions and behaviors to the actual norms. By using the graphical display of response frequencies to make this comparison, participants could see how their perceived group norm and their individual drinking behaviors diverged from the actual group norm. This feedback portion of the intervention took approximately 15–20 min. During this time, the facilitator repeatedly asked for any questions and took care to ensure that the discrepancies were clearly presented and well-understood by the group.

In order to assess whether changes occurred immediately following the comparative feedback, the facilitator disabled the immediate visual feedback option and repeated the five questions assessing only the descriptive, group-specific normative perceptions. After this final assessment, the intervention was concluded.

2.5. Analytic plan

Variables representing normative misperceptions were constructed for each of the five alcohol use items by taking each individual's perception of descriptive norm for the reference group and subtracting the averaged actual level of alcohol use for the group. As such, positive scores reflect overestimation, scores of zero reflect accurate estimation, and negative scores reflect underestimation of the actual alcohol use of in-group members.

For the sake of parsimoniously analyzing the data, overall composites were calculated as the mean of the five alcohol use items. Specifically within each group, composite scores were formed for pre-intervention actual alcohol use ($\alpha=0.94$), pre-intervention perceived descriptive norms ($\alpha=0.86$), post-intervention perceived descriptive norms ($\alpha=0.92$); as well as the derived pre-intervention normative misperceptions ($\alpha=0.79$) and post-intervention normative misperceptions ($\alpha=0.83$).

Two primary sets of analyses were undertaken to address the central research questions. The first set involved only the pre-intervention assessment to investigate the degree of discrepancy between perceived descriptive norms and actual alcohol use prior to any form of normative intervention. Within a particular group status

(first-year students, athletes, and Greeks), paired *t*-tests were performed to determine mean differences between perceived descriptive norms and actual individual alcohol use at pre-intervention. One-way ANOVAs were also used to examine differences in drinking behaviors as a function of whether individuals overestimated or underestimated group norms. Next, the derived pre-intervention misperception variables were contrasted across the three status groups using a series of one-way ANOVAs. Significant omnibus group-based differences in misperceptions were subsequently decomposed with (LSD) contrasts. These analyses were conducted separately for males and females.

In the second analysis set, we evaluated the efficacy of the BLING intervention in correcting normative misperceptions, in addition to assessing the extent in which group status and gender statistically moderated the effectiveness of the intervention. Using a repeated measures ANOVA design, the intervention (pre-intervention and post-intervention) served as the within-subjects factor, whereas group status (first-year students, athletes, and Greek students) and gender (males and females) served as the between-subjects moderating factors. The derived normative misperception composites from both pre- and post-intervention acted as the dependent measures.

3. Results

3.1. Pre-intervention within- and between-group differences

First, within-group analyses assessed whether respondents' perceptions of descriptive norms for the group were discrepant from their actual individual level of alcohol use. Paired *t*-tests showed that respondents reported significantly higher perceived norms than their actual self-reported level of alcohol use, regardless of group status or gender (Table 1). The only notable exception is that male Greek students did not significantly misperceive the level of reference group alcohol use, though the difference in means between perceived norms and actual use tended to be in the direction anticipated. Additional descriptive analyses of within-group misperceptions revealed that 13.4% of first-year students, 12.0% of athletes, and 30.3% of Greek-affiliated students underestimated group norms at pre-intervention. One-way ANOVA tests revealed that all participants who reported underestimations reported significantly less alcohol use compared with participants reporting overestimations; this was true for first-year students $F(1, 762)=30.43, p<0.001$, student-athletes $F(1, 521)=22.19, p<0.001$, and Greek-affiliated students $F(1, 551)=41.96, p<0.001$.

Table 1

Mean differences in pre-intervention perceived norms and actual alcohol use as a function of group status by gender.

Group drinking variable	First-year		Athletes		Greek students	
	Perceived norm M (SD)	Actual use M (SD)	Perceived norm M (SD)	Actual use M (SD)	Perceived norm M (SD)	Actual use M (SD)
<i>Males</i>						
Overall composite	5.64 (1.62)	4.13 (2.34)**	6.15 (1.14)	5.09 (2.03)**	5.63 (1.72)	5.12 (2.25)**
1. Frequency of consumption	5.71 (1.91)	3.92 (2.30)**	5.31 (1.25)	4.29 (1.85)**	5.04 (1.79)	4.68 (2.09)
2. Avg. drinks per occasion	5.61 (1.82)	4.71 (2.58)**	6.91 (1.51)	6.24 (2.44)**	6.02 (2.12)	5.61 (2.41)**
3. Drinks per week	6.23 (2.25)	4.52 (2.95)**	7.13 (1.82)	5.65 (2.83)**	6.41 (2.44)	5.68 (2.97)**
4. Maximum drinks	5.83 (2.11)	4.24 (2.53)**	6.47 (1.58)	5.62 (2.24)**	5.81 (1.80)	5.31 (2.26)*
5. Heavy episodic drinking in past 2 weeks	4.87 (2.33)	3.28 (2.58)**	4.94 (1.92)	3.63 (2.30)**	4.89 (2.23)	4.35 (2.62)*
<i>Females</i>						
Overall composite	4.31 (1.37)	2.94 (1.82)**	4.88 (0.95)	3.77 (1.58)**	4.18 (1.00)	3.62 (1.58)**
1. Frequency of consumption	4.93 (1.66)	3.15 (2.06)**	4.78 (1.05)	3.78 (1.50)**	4.54 (1.12)	3.95 (1.75)**
2. Avg. drinks per occasion	4.18 (1.42)	3.35 (2.01)**	5.32 (1.20)	4.56 (1.85)**	4.25 (1.14)	4.00 (1.64)**
3. Drinks per week	4.48 (1.92)	2.94 (2.24)**	5.42 (1.68)	3.90 (2.10)**	4.32 (1.44)	3.74 (2.12)**
4. Maximum drinks	4.27 (1.60)	2.99 (1.84)**	4.98 (1.31)	3.95 (1.77)**	4.19 (1.15)	3.57 (1.55)**
5. Heavy episodic drinking in past 2 weeks	3.73 (2.02)	2.26 (1.92)**	3.93 (1.45)	2.67 (1.82)**	3.66 (1.57)	2.89 (2.02)**

Note. Response option ranges for each item were as follows: item 1 (1 = never to 6 × a year; 9 = everyday), item 2 (1 = none; 9 = 13 or more), item 3 (1 = none; 9 = 22 or more), item 4 (1 = none; 9 = 22 or more), and item 5 (1 = none; 9 = 10 or more times). See Appendix A for a full list of descriptive normative questions and response options for each question. * $p<0.01$. ** $p<0.001$: Difference between perceived norm and actual drinking behavior.

Next, between-group analyses assessed mean differences in normative misperceptions prior to the intervention across first-year students, student-athletes, and Greek-affiliated students (Table 2). All normative misperception scores were discovered to be positive in valence, supporting that each of the three status groups consistently overestimated the alcohol use levels of their reference group, regardless of gender. Typically, overestimation of reference group alcohol use tended to be highest among first-year students, followed by student-athletes, and lowest among Greek-affiliated students. These results also tended to vary depending on group membership, with first-year students being most at risk for normative overestimation.

3.2. Effectiveness of the intervention as moderated by group status and gender

The 2 (intervention) × 3 (group status) × 2 (gender) repeated measures ANOVA model predicting the normative misperception composite revealed several statistically significant main effects and interactions. The intervention main effect supported that the intervention was efficacious in correcting normative misperception, $F(1, 1834) = 1120.94, p < 0.001$, such that the level of misperception evidenced at pre-intervention ($M = 1.03, SD = 1.19$) was subsequently reduced at post-intervention ($M = -0.16, SD = 1.09$). Collapsed across both time points, results additionally show an overall group status main effect, $F(2, 1834) = 47.06, p < 0.001$, with follow-up contrasts disclosing that first-year students ($M = 0.61, SD = 0.98$) and athletes ($M = 0.58, SD = 0.80$) were not significantly different on the degree of normative misperception, but both of these groups held significantly higher misperception scores than Greek students ($M = 0.11, SD = 0.71$). A gender main effect was also demonstrated, $F(1, 1834) = 15.54, p < 0.001$, such that the level of normative misperception typically was higher in males ($M = 0.52, SD = 1.10$) than females ($M = 0.35, SD = 0.76$).

Furthermore, the moderating factors were shown to be statistically significant. Specifically, the effect of the intervention was statistically moderated by group status, $F(2, 1834) = 57.00, p < 0.001$. As illustrat-

Table 2
Mean differences in pre-intervention normative misperceptions as a function of group status by gender.

Normative misperception	Group status						F-test
	First-year		Athletes		Greek students		
	M	(SD)	M	(SD)	M	(SD)	
<i>Males</i>							
Overall composite	1.51 _a	(1.38)	1.09 _b	(1.09)	0.52 _c	(1.09)	29.2**
1. Frequency of consumption	1.78 _a	(1.76)	1.02 _b	(1.26)	0.34 _c	(1.64)	40.71**
2. Average drinks per occasion	0.90 _a	(1.66)	0.71 _{ab}	(1.47)	0.43 _b	(1.34)	4.14*
3. Drinks per week	1.71 _a	(1.96)	1.51 _a	(1.72)	0.69 _b	(1.53)	13.89**
4. Maximum drinks	1.59 _a	(2.05)	0.89 _b	(1.55)	0.50 _b	(1.63)	19.94**
5. Heavy episodic drinking	1.57 _a	(2.04)	1.34 _a	(1.89)	0.63 _b	(1.66)	10.18**
<i>Females</i>							
Overall composite	1.38 _a	(1.26)	1.10 _b	(0.91)	0.56 _c	(0.94)	65.98**
1. Frequency of consumption	1.78 _a	(1.56)	1.01 _b	(1.06)	0.60 _c	(1.08)	90.55**
2. Average drinks per occasion	0.83 _a	(1.41)	0.74 _a	(1.16)	0.24 _b	(1.08)	26.71**
3. Drinks per week	1.53 _a	(1.77)	1.49 _a	(1.64)	0.60 _b	(1.35)	44.05**
4. Maximum drinks	1.28 _a	(1.54)	1.00 _b	(1.30)	0.63 _c	(1.16)	23.99**
5. Heavy episodic drinking	1.45 _a	(1.90)	1.24 _a	(1.39)	0.73 _b	(1.47)	21.37**

Note. Means in the same row not sharing a subscript differ significantly in LSD contrasts, $p < 0.05$.

** $p < 0.001$.

* $p < 0.05$.

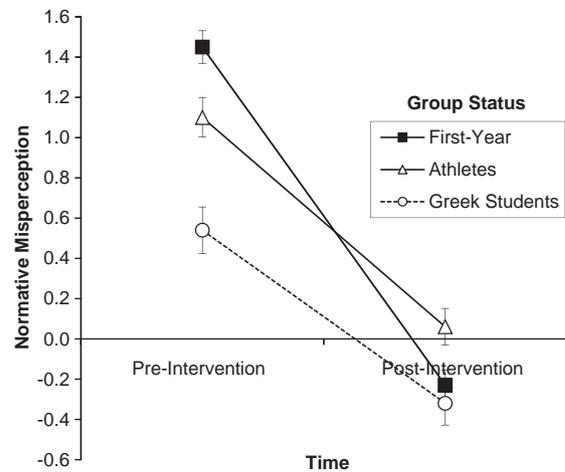


Fig. 1. Intervention effect on average misperception as moderated by group status. Note. Means with 95% confidence intervals. Means are estimated marginal means, controlling for all other factors.

ed in Fig. 1, even though first-year students started with the highest level of normative overestimation of in-group alcohol use among the three groups, post-intervention results show that their reduction in overestimation was most substantial. In fact, first-year and Greek-affiliated students slightly underestimated in-group alcohol consumption after receiving the intervention. Descriptives additionally reveal that 86.6% of first-year students, 88.0% of athletes, and 69.7% of Greek-Affiliated students overestimated at pre-intervention; whereas only 36.6% of first-year, 44.2% of athletes, and 27.8% of Greek-affiliated students overestimated at post-intervention.

The effect of the intervention was also moderated by gender, $F(1, 1834) = 15.99, p < 0.001$. Upon closer inspection in Fig. 2, males paralleled that of females in level of normative overestimation prior to the intervention, but shortly after the intervention, males accurately estimated, whereas females slightly underestimated, group-specific actual alcohol use. Furthermore, we discovered a group × gender interaction, $F(2, 1834) = 4.41, p < 0.05$. Descriptive results detail that 84.7% of males and 80.5% of females and overestimated at pre-intervention; whereas only 46.8% of males and 29.4% of females and overestimated at post-intervention. Finally, the three-way interaction of

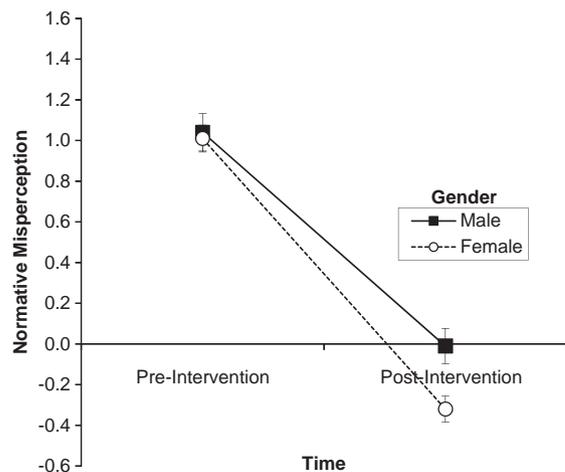


Fig. 2. Intervention effect on average misperception as moderated by gender. Note. Means with 95% confidence intervals. Means are estimated marginal means, controlling for all other factors.

intervention \times group status \times gender did not emerge as statistically significant, $F(2, 1834) = 0.899, p = 0.41$.

4. Discussion

The present research extends previous work applying social norms theory to group-specific interventions aimed at reducing risky undergraduate alcohol use (LaBrie et al., 2008, 2009; Lewis & Neighbors, 2006). This study used a novel, technologically advanced intervention (BLING) technique that utilizes immediate group-specific normative feedback in order to document differences and provide comparisons of group-specific misperceptions across three high-risk student groups: first-year students, student-athletes, and Greek-affiliated students. Results showed that all three groups overestimated their group's alcohol consumption prior to the intervention, with males having greater misperceptions than females.

In line with Social Norm Theory (Berkowitz, 2004), our data showed that prior to the intervention, the small subset of participants that underestimated their group-specific norms also reported less overall alcohol use compared with those who overestimated. As might be predicted by the false consensus effect, college drinkers prior to the BLING intervention may have been motivated to rationally justify beliefs that their own drinking patterns are typical (Sus, Wan, & Sanders, 1988). This in turn could be a cognitive factor influencing them to unconsciously access a biased subset of beliefs, memories, and processes that support this conclusion (Kunda, 1990). However at post-intervention, after participants had learned that inaccurate normative perceptions are associated with increases in health-risk behaviors, they may have been motivated to hold more accurate perceptions that better facilitate adaptive behavior. This would then result in participants more carefully attending to information relevant to forming more accurate perceptions and processing this information more deeply (see Kunda, 1990).

Overall, the strong proximal and salient nature of Greek students, relative to the other two groups, provides a potential explanation for why this group initially had the most accurate group-specific normative perceptions. Greek organizations are close social networks strongly focusing on unity and house identification, which may lead to a greater awareness of other members' drinking behaviors (Terry & Hogg, 1996; Trafimow & Finlay, 1996). However, the current study demonstrates that despite the relative accuracy of their normative perceptions for their Greek organization compared with groups of first-year students and student-athletes, Greek students still overestimate their group-specific norms.

Although longitudinal reductions in misperceptions via BLING have been shown to mediate actual changes in drinking up to two months post-intervention (LaBrie et al., 2008, 2009), the ability of this intervention technique to lead to immediate reductions in misperceptions had not yet been examined prior to this study. The present findings revealed that normative feedback via the BLING intervention appears to be equally effective in correcting normative misperceptions among all three groups regardless of gender or the magnitude of initial misperception. In addition, reductions in normative misperceptions were present immediately post-intervention. An interesting and unexpected finding was that first-year and Greek students, as well as the overall sample of females (who paralleled males in level of misperception prior to the intervention), slightly underestimated group-specific descriptive norms post-intervention. Thus, these findings help to validate the utilization of an interactive, real-time assessment of perceptions and behavior in social norms interventions. This is particularly important because, under the tenets of social norms theory, reducing the magnitude of normative misperceptions is thought to be the primary mechanism for the initiation of drinking behavior change. That these reductions are significant and present immediately following the intervention provides further evidence that BLING may be an efficient and effective tool to reduce risky

drinking behavior among various college subgroups. Further, the fact that the intervention takes place and is experienced in a group in which the students naturally congregate allows for the students to continue engaging each other about the data/experience after the intervention in their natural settings. This may lead to solidifying healthier, more accurate group norms.

This novel approach seeks to overcome challenges related to existing social norms feedback interventions by confirming the existence of normative misperceptions via the live collection of data and immediate feedback to a salient group of students. The strength of BLING lies in its live assessment and exposure of normative information regarding a salient reference group. This live component, along with the specificity of the normative feedback, is thought to create an environment through which the theoretical foundation of the research design can be realized. Specifically, this novel technique may overcome challenges faced by traditional normative interventions in providing students with credible peer group norms of a group they care about. The BLING intervention is in large part based on the belief that better assessment of normative data will lead to greater efficacy of social norms interventions. The manner in which such social network information is assessed directly affects how much faith students have in the data that are later presented to them as feedback. Given that students interactively create the data used in feedback themselves in real time and almost instantaneously see a graphical display, students may be more likely to believe the data are accurate because they know concretely the source of the data and recognize they are current. To date, most normative feedback samples have used data from prior campus-wide data collections and many of the students receiving the feedback were not directly part of the original survey. This may undermine credibility and salience of these standard feedback interventions when compared with BLING. Thus, with BLING, students may be more likely to be affected by the normative feedback, thereby increasing the potential for positively changing perceptions as well as actual alcohol consumption. Given that this enhanced believability component remains speculative, future research should include measures of credibility/believability in any application of the BLING method to better determine how and for whom this technique best operates.

These results have practical implications for college health personnel. BLING is an innovative and novel improvement to existing methodology, using an emerging technology (wireless keypads) to collect, tabulate, and present data from a group in real time. The technology's ability to collect data during group interventions, aggregate the data, and instantly generate a feedback presentation can help to reduce the cost and time commitment needed for large scale social norms interventions. Moreover, the benefits of utilizing this wireless keypad system include respondent anonymity, active involvement, immediate visual feedback, and ease of use. These features are thought to foster improved participant ownership of group data and create more dynamic discussions of group results. The technology utilized by the approach is already well-known among students and is currently available on many campuses for classroom quizzes and presentations.

Despite the strengths previously discussed, limitations exist in the current study. First, the technology used only allowed feedback for response frequencies and did not allow presentation of summary statistics (e.g., in your group, the average number of drinks consumed per week is X). Such statistics may be easier for students to comprehend than a range of frequencies and thus serve as more effective feedback. Also, it is not clear whether or how the presence of others may have differentially influenced reporting of perceived norms or drinking behavior. Similarly, the accuracy of electronic keypad assessment is unclear. Future research should rigorously test this BLING method against other traditional assessment methods (e.g., online surveys) to help determine the effect that the reference group

presence has on self-reports and to examine differences between electronic keypad assessment and traditional methods of assessment. Furthermore, the current study and other studies on BLING lack a long-term follow-up examining the lasting impact of the intervention on perceptions, drinking behaviors, and alcohol-related consequences. Though previous studies incorporated a one and two-month follow-up, future studies could extend the follow-up period to discover the endurance of the intervention's effects.

Future research can also seek to extend the BLING intervention to other health attitudes and behaviors. The ability to correct misperceptions of what constitutes typical behavior by a peer group has the potential to be applied to other types of risky behaviors, such as tobacco use, illicit substance abuse, eating disorders, and sexual violence. In addition, because the high-risk groups in this study showed differences in the magnitudes of their misperceptions, future research utilizing BLING should incorporate other salient and at-risk social networks in order to compare the impact of various reference groups on behavioral and cognitive outcomes. Such comparisons could determine what groups BLING is most effective for and whether it is in fact effective due to the proximal nature of the reference group. This type of research could also be expanded to other populations outside of the college setting, such as adolescents and high school students.

Lastly, future directions should include an evaluation of other possible moderators of intervention efficacy (e.g., level of conformity, reference group level of specificity, salience of reference group, identification with group). The potential effects of BLING might vary as a function of other variables, such as how important the group is to the individual when the intervention is being implemented. Recent research indicates that the relationship between perceived group-specific drinking norms and one's own drinking is moderated by identification with the reference group (Neighbors et al., in press). Most individuals are members of multiple groups, and their level of investment and identification may vary across groups and over time. Even within the current targeted samples of high-risk groups, individuals may identify more or less with a particular referent depending on the level of specificity (e.g. athletic team referent vs. athletic in/out-season referent). Thus, future research should experiment with social norms interventions targeting different reference groups of varying salience to an individual, while simultaneously evaluating changes in misperceptions as a function of identification level with each group. Such research would help to validate underlying premises of group-specific normative feedback by explicating the theoretical conditions under which the interventions best work and for whom.

5. Conclusion

Overall, this research provides further evidence that BLING is an effective assessment method for capturing believable social network health information as well as an effective intervention technique in immediately reducing normative misperceptions among intact, high-risk groups. Findings demonstrate that various reference groups have different magnitudes of normative misperceptions, and, thus, normative feedback may be indicated more for groups with higher misperceptions. However, even among Greek students who had the lowest levels of misperceptions, BLING did change perceptions to closely match their actual norms. Lastly, this study provides further validation for social norms interventions that assess and provide group-specific normative data derived interactively in vivo by participants.

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Contributors

Joseph LaBrie, Justin Hummer, Sean Grant, and Andrew Lac have each contributed significantly to this manuscript. Specifically, Dr. LaBrie generated the idea for the study, performed the major analyses, contributed to writing all sections of the manuscript, and oversaw its production. Justin Hummer and Sean Grant performed the literature review, drafted the Introduction, Materials and methods, and Discussion sections, contributed to the Results section, and created the tables. Andrew Lac wrote the Results section and created the figures.

Conflict of interest

All authors declare that they have no conflicts of interest.

Appendix A. Perceived normative drinking and actual alcohol use

Series 1	
Questions	Responses
a. How often does a <i>typical [Reference Group]</i> consume alcohol?	1) Never – Six times a year 2) Once a month 3) Twice a month 4) Once a week
b. How often do <i>you</i> consume alcohol?	5) Twice a week 6) Three times a week 7) Four times a week 8) Five to six times a week 9) Everyday

Series 2	
Questions	Responses
a. How many drinks, on average, does a <i>typical [Reference Group]</i> consume during a typical drinking occasion?	1) None 2) 1 – 2 3) 3 4) 4 5) 5 – 6
b. How many drinks, on average, do <i>you</i> consume during a typical drinking occasion?	6) 7 – 8 7) 9 – 10 8) 11 – 12 9) 13 or more

Series 3	
Questions	Responses
a. How many drinks does a <i>typical [Reference Group]</i> drink each week?	1) None 2) 1 – 2 3) 3 – 5 4) 6 – 8
b. How many drinks do <i>you</i> drink each week?	5) 9 – 10 6) 11 – 14 7) 15 – 18 8) 19 – 21 9) 22 or more

Series 4	
Questions	Responses
a. Within the past 30 days, what is the maximum number of drinks the <i>typical [Reference Group]</i> consumed during one occasion?	1) None 2) 1 – 3 3) 4 – 6 4) 7 – 9 5) 10 – 12 6) 13 – 15
b. Within the past 30 days, consider the one occasion where you drank the most. How much did <i>you</i> drink?	7) 16 – 18 8) 19 – 21 9) 22 or more

Appendix A (continued)

Series 5	
Questions	Responses
a. Over the past two weeks, how many times has a <i>typical</i> [Reference Group] had 4/5 or more drinks in a two hour period?	1) None 2) 1 time 3) 2 times 4) 3 times 5) 4 times
b. Over the past two weeks, how many times have <i>you</i> had 4/5 or more drinks in a two hour period?	6) 5 times 7) 6 times 8) 7–9 times 9) 10 or more times

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