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Indicated Prevention for Incoming Freshmen: Personalized Normative Feedback and High-Risk Drinking

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Abstract

This research evaluated the efficacy of a computerized, freshmen-specific personalized normative feedback (PNF) intervention on reducing alcohol consumption among high-risk drinking freshmen. Students (N = 316; 53.8% female) completed measures of perceived drinking norms and drinking behavior. After completing the baseline assessment, students were randomly assigned to receive either freshmen-specific PNF that was gender-specific or gender-neutral, or to assessment only control. Findings demonstrated that students exhibited normative misperceptions for typical freshmen drinking behavior and that perceptions of typical same-sex freshmen drinking were positively associated with riskier drinking behavior. At follow-up, students randomly assigned to receive PNF reduced perceptions of typical freshmen drinking behavior and personal drinking behavior relative to those who did not receive PNF. Findings extend previous evaluations of computer-based PNF and suggest that computer-based PNF for incoming freshmen using utilizing freshmen-specific norms that are gender-specific may constitute a promising prevention strategy.

Keywords

personalized normative feedback; alcohol; social norms; freshmen

1. Introduction

Alcohol abuse and related negative consequences continue to be problematic for college students (Hingson, Heeren, Winter, & Wechsler, 2005; Hingson, Heeren, Zakocs, Kopstein, & Wechsler, 2002; O'Malley & Johnston, 2002), particularly for freshmen (Baer, Kivlahan, & Marlatt, 1995; Grekin & Sher, 2006; Ichiyama & Kruse, 1998; Thompson, Leinfelt, & Smyth, 2006; Turrisi, Padilla, & Wiermsa, 2000). Social norms approaches (i.e., social norms marketing and personalized normative feedback) that aim to reduce college student drinking rest on the premise that reduction in perceptions of peer drinking behavior will result in reductions in personal drinking behavior (Perkins, 2002). Prior research has demonstrated

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personalized normative feedback (PNF) to be effective at reducing drinking behavior among college students as a stand alone intervention (Lewis & Neighbors, 2007; Neighbors, Larimer, & Lewis, 2004; Neighbors, Lewis, Bergstrom, & Larimer, 2006). Research on PNF has recently begun to focus on the potential to increase efficacy of PNF by examining specificity of the normative referent employed (Lewis & Neighbors, 2007). The present study continues this line of research, as it evaluated the efficacy of freshmen-specific PNF for heavy drinking incoming freshmen.

1.1 Alcohol use among freshmen

Freshmen are a subgroup of the college student population that is particularly at risk for problematic drinking and its consequences (Baer et al., 1995; Grekin & Sher, 2006; Ichiyama & Kruse, 1998; Thompson et al., 2006; Turrisi et al., 2000). For example, Turrisi, Padilla, and Wiermsa (2000) found that freshmen consumed larger amounts of alcohol than their upperclass peers did. Moreover, Thompson, Leinfelt, and Smyth (2006) found that freshmen were more likely to be arrested for an alcohol-related offense than were upper-class students. In a sample of freshmen at a private university, Ichiyama and Kruse (1998) found that over half reported at least one episode of heavy drinking (defined as 5 drinks in one sitting) compared to the national average of 40–44%. In addition, Grekin and Sher (2006) found that freshmen showed alcohol dependence symptoms at higher rates than the general adult population.

Freshmen may be particularly at-risk for alcohol abuse and negative consequences due to the transition from high school to college (Baer et al., 1995; Schulenberg & Maggs, 2002). For instance, Schulenberg and Maggs (2002) found that drinking tends to escalate during transitions related to increased independence and decreased parental guidance and support. Furthermore, longitudinal research confirms that on average students who drank in high school increase their drinking quantities and frequencies upon entering college (Baer et al., 1995).

1.2 Freshmen-specific normative misperceptions

Perceptions of peer drinking norms have been associated with heavy drinking and experiencing negative consequences (Borsari & Carey, 2001). Moreover, research has found this to be especially true for gender-specific norms (Lewis & Neighbors, 2004). Gender-specific norms are comprised of same-sex norms and opposite-sex norms. Perceived same-sex norms are perceptions of typical drinking behavior by same-sex peers (i.e., men's perceptions of men's drinking quantity and frequency and women's perceptions of women's drinking quantity and frequency). Perceived opposite-sex norms are perceptions of typical drinking behavior by opposite-sex peers (i.e., men's perceptions of women's drinking quantity and frequency and women's perceptions of men's drinking quantity and frequency). Lewis and Neighbors (2004) found that perceived same-sex norms were more strongly related to personal drinking behavior when compared to opposite-sex norms. Social psychological theories suggest that normative comparisons should increase in importance as specificity or proximity of the normative referent increases (i.e., Social Comparison Theory, Festinger, 1954; Social Impact Theory, Latane, 1981). For freshmen, perceived peer drinking norms may be particularly salient because a large number of freshmen live together on campus in residence halls and are greatly exposed to peers' drinking behavior. Normative perceptions for freshmen should be especially important when evaluating drinking behavior, as it represents a more proximal referent; furthermore, this should be especially true if norms are also specific to one's gender.

1.3 Personalized Normative Feedback

Recent reviews on brief interventions for college student drinking identified personalized feedback as a common component (Larimer & Cronce, 2002; Walters & Neighbors, 2005; Walters & Bennett, 2000). Personalized feedback components varied in content, providing information on one's drinking, risk factors, and normative comparisons (Walters & Neighbors,

2005). Feedback on normative comparisons (i.e., PNF) has been shown to be effective at reducing heavy drinking behavior as part of a multi-component intervention (Marlatt et al., 1998; Murphy et al., 2001; Murphy et al., 2004) and as a stand alone intervention (Lewis & Neighbors, 2007; Neighbors et al., 2004; Neighbors et al., 2006).

Recent research has begun to explore methods by which efficacy of PNF can be enhanced, with a focus on increasing specificity of the normative referent employed (Lewis & Neighbors, 2007). Lewis and Neighbors (2007) evaluated specificity of the normative referent by comparing PNF that presented gender-neutral normative comparisons versus PNF that presented gender-specific normative comparisons. Their findings indicated that gender-specific PNF was more effective for women who more strongly identified with their gender. The present research was unique from previous research on PNF efficacy, in that freshmen-specific normative comparisons for freshmen or gender-specific normative comparisons for freshmen or gender-specific normative comparisons that is specific on two levels (i.e., freshmen and gender) compared to gender-neutral PNF, which only presents a normative comparison that is specific on one level (i.e., freshmen), we expected that gender-specific PNF would be more effective than gender-neutral PNF for freshmen.

1.4 Hypotheses

Based on the above considerations, we had two hypotheses related to normative misperceptions: 1) students would demonstrate normative misperceptions for both gender-neutral and gender-specific norms (i.e., same-sex and opposite-sex norms) for freshmen; 2) same-sex gender-specific norms for freshmen would be more strongly related to personal behavior in comparison to gender-neutral or opposite-sex gender-specific norms for freshmen. Related to the PNF intervention, we expected that freshmen gender-specific PNF would be more effective than freshmen gender-neutral PNF in terms of reducing drinking behavior and normative misperceptions for gender-neutral and gender-specific freshmen norms. Finally, we expected that changes in normative misperceptions for gender-neutral and gender-specific freshmen norms. Finally, we

2. Method

2.1 Participant screening, recruitment, attrition

Participants were freshmen enrolled in a first-year orientation course from a midsized Midwest university. Approximately half of the incoming freshmen class (46.9%) participated in the screening survey during the second month of the academic year. Not all students were present in class when the screening survey was offered. The total number of freshmen invited to complete the survey is unknown; thus, the 46.9% is a completion rate based the number of incoming freshmen rather than a response rate based on those invited to complete the survey. Students were provided a description of the study and their rights as participants in research (e.g., the voluntary nature of the research). The brief screening questionnaire consisted of demographics, peak number of drinks in the previous month, and typical weekly alcohol consumption. The screening was conducted to identify 1) freshmen drinking norms for the campus (which were used for the PNF) and 2) potential participants for the longitudinal study. Students reporting at least one heavy-drinking episode (4/5 drinks at one setting for women/men, respectively) in the previous month were recruited to participate. Similar criteria have been used to designate heavy drinkers in previous research (Lewis & Neighbors, 2007; Marlatt et al., 1998; Neighbors et al., 2004; Neighbors et al., 2006).

Of the 891 freshmen who completed the brief survey, 437 (48.9%) met screening criteria and 316 (53.8% female) were successfully recruited for the study and randomized into one of three

intervention conditions. Recruitment efforts were ceased when the target sample size based on power analyses was achieved. Due to ethical concerns and in compliance with human subjects requirements, all freshmen who reported drinking to a dangerous level (estimated peak BAC level of .26 or higher in the previous month) received a more intensive intervention that included personalized feedback regarding their BAC, information expressing concerns about their BAC, and referral information. Because students who reached a BAC of .26 or higher (n = 71) received this additional intervention regardless of which of the three PNF conditions to which they were randomly assigned, data from these students were excluded from analyses related to intervention efficacy. Excluded cases did not differ by gender (59.15% female). Additional details regarding these students are available from the first author. The resulting sample consisted of 245 students (52.24% female). The average age of the freshmen was 18.53 (SD = 2.04) and the sample was primarily Caucasian (99.6%). After baseline assessment, participants were contacted to complete both a three- and five-month follow-ups (time 2 and time 3, respectively). Of the 245 participants that completed the baseline and intervention phase of the experiment (control, n = 88; gender-neutral PNF, n = 82; and gender-specific PNF, n =75), 230 (93.9%) completed the three-month follow-up (control, n = 84; gender-neutral PNF, n = 76; and gender-specific PNF, n = 70), and 209 (85.3%) completed the five-month followup (control, n = 78; gender-neutral PNF, n = 67; and gender-specific PNF, n = 64). A fivemonth follow-up, rather than a six-month follow-up, was selected in order to complete the study prior to the end of the academic year.

2.2 Procedure

Students meeting screening criteria were invited to participate in a longitudinal study that consisted of three time points (baseline/intervention, three- and five-month follow-ups). Participants were recruited via telephone and E-mail and scheduled to complete a Web-based survey in a controlled laboratory setting on campus. Students received \$50 for their participation at each assessment for a possible total of \$150. After providing informed consent, participants completed the baseline survey, which took approximately one hour. Students were asked not to interact with each other when completing the survey.

Participants were assigned to one of three intervention conditions using simple random assignment. After completion of the baseline survey, participants in the two PNF conditions received and read the feedback on the computer screen and were given a printout of their feedback. All participants were thanked for their time and were informed they would be contacted in three and five months time to complete the longitudinal portions of the study. All procedures were approved by the university's institutional review board.

2.2.1 Personalized Normative Feedback intervention—PNF feedback includes three pieces of information pertaining to: 1) personal drinking behavior, 2) personal perceptions of typical student drinking behavior, and 3) information regarding actual norms for typical student drinking behavior. Actual norms for typical student drinking behavior creates two discrepancies for heavy drinking students when compared with personal drinking behavior (i.e., most students don't drink as much as you do) and personal perceptions of typical student drinking behavior (i.e., most students don't drink as much as you do) and personal perceptions of typical student drinking behavior (i.e., most students don't drink as much as you do). Unique to the current study was that in both PNF groups, feedback was freshmen-specific. Participants in the gender-neutral PNF were provided gender-neutral norms (e.g., the typical freshman consumes 9.23 drinks per week) whereas participants in the gender-specific PNF condition received gender-specific norms (e.g., the typical *female* freshman consumes 7.95 drinks per week). Norms provided were based on responses from the screening survey and this information was provided at the bottom of the feedback. Students receiving PNF were also provided with the percentile rank of their drinking in comparison to other students (Dimeff, Baer, Kivlahan, & Marlatt, 1999; Lewis & Neighbors, 2007; Neighbors et al., 2004; Neighbors

et al., 2006). For an example of gender-neutral PNF, please see the appendix of Neighbors et al. (2004).

2.3 Measures

2.3.1 Drinking—Drinks per week and drinking frequency were the primary outcomes. Drinks per week was assessed with a modified version of the Daily Drinking Questionnaire (DDQ; Collins, Parks, & Marlatt, 1985). Participants were asked: "Consider a typical week during the last month. How much alcohol, on average, (measured in number of drinks), do you drink on each day of a typical week?" A response table with each day of the week was presented and the participants filled in how much they typically drink on each day of the week. Scores were computed by summing the number of drinks the participants reported drinking on each day of the typical week the participant drank.

2.3.2 Perceived norms—Perceived drinking norms were measured using two modified versions of the Drinking Norms Rating Form (Baer, Stacy, & Larimer, 1991; Lewis & Neighbors, 2004). The format of the measure mirrors the DDQ. Gender-neutral norms for drinks per week and frequency were assessed by asking the participants how much they believed the typical freshmen on campus drinks. Gender-specific norms for drinks per week and frequency were assessed by asking the participants how much they believed the typical same-sex freshmen and typical opposite-sex freshmen on campus drinks.

3. Results

3.1 Normative misperceptions for freshmen drinking behavior

In order to determine if students perceived that other freshmen engaged in more drinking behavior than they did, a repeated measures multivariate analysis of variance (MANOVA) was conducted with baseline data. Drinks per week and drinking frequency were the dependent variables. Personal behavior and perceived behavior (i.e., perceived typical freshmen, perceived typical same-sex freshmen, perceived typical opposite-sex freshmen) were entered as within-subject factors. Gender of perceiver was entered as a between-subjects factor in order to examine interactions between gender and the main effects for perceived and personal behavior (i.e., repeated measures). Partial eta squared (η_p^2) describes the proportion of total variability of the dependent variable(s) attributable to an effect. According to Cohen's (1988) definitions of effect size, the values of η_p^2 for small, medium, and large effects are .01, .06, and .14, respectively.

Multivariate findings indicated, as expected, there was a main effect for perceived and personal behavior (i.e., repeated measures), such that men and women perceived others as engaging in more drinking behavior than they actually did, Wilks' $\Lambda = .26$, *F* (6, 307) = 147.78, *p* < .001, $\eta_p^2 = .74$. Univariate tests revealed similar results for drinks per week, *F* (3, 936) = 336.96, *p* < .001, $\eta_p^2 = .52$, and drinking frequency, *F* (3, 936) = 222.11, *p* < .001, $\eta_p^2 = .42$, such that men and women perceived typical freshmen, typical male freshmen, and typical female freshmen as having more drinking behavior than they actually reported. Additionally, multivariate findings indicated an interaction between repeated measures and gender indicating women displayed greater misperceptions than men, Wilks' $\Lambda = .84$, *F* (6, 307) = 10.10, *p* < .001, $\eta_p^2 = .71$. Univariate results (Table 1) indicated this relationship was present for drinks per week and drinking frequency. In summary, at baseline males and females perceived that typical freshmen, typical male freshmen, and typical females perceived that typical freshmen, them engaged in more drinking behavior than themselves.

3.2 Perceptions of same-sex typical freshmen drinking relate to personal drinking behavior

In order to determine if normative perceptions for same-sex typical freshmen were more strongly associated with personal drinking behavior compared to normative perceptions of opposite-sex typical freshmen or gender-neutral typical freshmen, hierarchical multiple regression analyses were conducted with baseline data. Drinks per week and drinking frequency were examined separately. Sex was entered at Step 1. At Step 2, perceptions of behavior for typical freshmen, typical same-sex freshmen, and typical opposite-sex freshmen

were entered. Effect sizes (Cohen's d) were calculated using the formula $d=2t/\sqrt{df}$ (Rosenthal & Rosnow, 1991). Small, medium, and large effects are generally considered to be in the .2, . 5, and .8 ranges respectively (Cohen, 1992).

Findings demonstrated that neither typical freshmen, t (309) = 0.90, ns, d = 0.10, nor typical opposite-sex freshmen norms t (309) = 0.95, ns, d = 0.11, were uniquely related to drinks per week. In contrast, typical same-sex freshmen norms were positively associated with more drinks per week, t (309) = 3.54, p < .001, d = 0.40. Similarly, results indicated that neither typical freshmen, t (311) = -0.24, ns, d = -0.03, nor typical opposite-sex freshmen norms t (311) = 0.35, ns, d = 0.04, were uniquely related to drinking frequency, whereas typical same-sex freshmen norms were associated with greater drinking frequency, t (311) = 2.24, p < .05, d = 0.25. In summary, same-sex gender-specific freshmen norms were associated with personal drinking behavior, whereas gender-neutral and opposite-sex freshmen norms were not.

3.3 Analysis strategy to determine intervention efficacy

Analyses were conducted to evaluate changes in perceived norms and drinking as a function of intervention group. Our central aims were to evaluate whether there were intervention effects on drinking, on perceived norms, and whether intervention effects on drinking were due to intervention effects on perceived norms. In accordance with a temporal mediation model we evaluated 1) changes in drinking at five month follow-up, 2) changes in perceived norms at three-month follow-up, and 3) whether intervention effects on drinking at five-month follow-up (Baron & Kenny, 1986; MacKinnon & Dwyer, 1993). Our primary analysis strategy utilized multivariate analysis of covariance (MANCOVA) to determine whether changes in outcomes at follow-up varied by intervention group controlling for baseline outcomes. Univariate follow-up analyses were examined in the presence of significant multivariate effects (Tabachnick & Fidell, 2001).

Preliminary analyses were conducted to evaluate whether attrition varied as a function of intervention group, baseline drinking, or baseline norms. We created a dichotomous variable indicating missingness at three-month follow-up and a dichotomous variable indicating missingness at five-month follow-up. Chi-square tests indicated that attrition rates did not vary by intervention group at three-month follow-up, χ^2 (df = 2, n = 245) = .66, p = ns, or five-month follow-up, χ^2 (df = 2, n = 245) = .291, p = ns. A logistic regression analysis was conducted to evaluate whether missingness at three-month follow-up varied as a function of baseline measures, where missingness was regressed on baseline drinks per week, drinking frequency, gender-neutral and gender-specific perceived freshmen norms for drinks per week and drinking frequency. Results indicated that the overall model was not significant, χ^2 (df = 6, n = 245) = 5.30, p = ns, nor was any individual predictor significantly associated with missingness. Similarly, logistic regression evaluating missingness at five-month follow-up as a function of baseline variables indicated no significant relationship between any predictor and missingness nor was the overall model significant, χ^2 (df = 6, n = 245) = 5.10, p = ns.

Additionally a MANOVA was conducted to evaluate potential baseline differences among intervention groups on all variables. Participants' own drinking (drinks per week, drinking frequency), perceived norms for typical freshmen (i.e., gender-neutral) drinking (drinks per

week, drinking frequency), and perceived norms for typical same-sex freshmen drinking (i.e., gender-specific; drinks per week, drinking frequency) were specified as dependent variables. Intervention group was specified as the independent variable. Results indicated no multivariate group differences on baseline variables, Wilks' $\Lambda = .95$, F(12, 470) = .93, p = ns. Univariate follow-up results further revealed no significant group differences at baseline on any single variable.

3.4 Intervention effects on drinking

A MANCOVA was conducted to evaluate intervention effects on drinking outcomes at five months (i.e., drinks per week and drinking frequency). Baseline measures of drinks per week and drinking frequency were included as covariates. Sex and intervention group were included as independent variables. Multivariate results revealed a significant main effect for group, Wilks' $\Lambda = .91$, F(4, 398) = 3.91, p < .01, $\eta_p^2 = .04$. Multivariate tests were not significant for either sex or the interaction between sex and intervention condition. Univariate follow-up analyses further revealed significant group differences in drinks per week, F(2, 200) = 4.33, $p = .01, \eta_p^2 = .04$, and drinking frequency, $F(2, 200) = 7.91, p < .001, \eta_p^2 = .07$. Follow-up Least Significant Difference (LSD) tests indicated that for drinks per week, participants in the gender-specific PNF reduced their drinking more than control participants but gender-neutral PNF was not significantly different from control or gender-specific PNF. LSD tests for frequency indicated that for frequency both intervention groups reported significantly less drinking at follow-up relative to the control group but were not significantly different from each other. Overall, with respect to drinking, results suggested both PNF conditions were associated with drinking reductions but results were stronger and more consistent for genderspecific PNF. Table 2 presents estimated marginal means and standard errors for participants drinking at five-month follow-up by intervention group.

3.5 Intervention effects on perceived norms

Table 3 presents estimated marginal means and standard errors for participants perceived gender-neutral and gender-specific freshmen drinking norms at three-month follow-up by intervention group.

3.5.1 Intervention effects on gender-neutral norms—Using the same analysis approach, a MANCOVA was conducted to evaluate intervention effects on perceived genderneutral norms for drinks per week and drinking frequency at three-month follow-up. Baseline measures of perceived gender-neutral norms for drinks per week and drinking frequency were included as covariates. Sex and intervention group were included as independent variables. Multivariate results revealed a significant main effect for group, Wilks' $\Lambda = .89$, F (4, 440) = 4.30, p < .01, $\eta_p^2 = .04$, and for sex, Wilks' $\Lambda = .96$, F(2, 220) = 4.88, p < .01, $\eta_p^2 = .04$. Multivariate effects were not significant for the interaction between sex and intervention condition. Univariate follow-up tests indicated significant group differences in perceived gender-neutral norms for drinks per week, F(2, 221) = 8.65, p = .001, $\eta_p^2 = .07$, and drinking frequency, F(1, 221) = 4.31, p < .01, $\eta_p^2 = .04$. LSD tests indicated that both intervention groups reduced perceived gender-neutral norms significantly more than control but did not differ between each other for both gender-neutral norms variables. Univariate tests for sex indicated that women perceived gender-neutral norms to be higher for frequency than men perceived, F(1, 221) = 9.75, p < .01, $\eta_p^2 = .04$, and marginally higher for drinks per week, F $(1, 221) = 3.18, p = .08, \eta_p^2 = .01.$

3.5.2 Intervention effects on same-sex gender-specific norms—Repeating the above analyses replacing perceived gender-neutral norms with same-sex gender-specific norms revealed similar multivariate findings with a significant multivariate main effect for group, Wilks' $\Lambda = .90$, F(4, 440) = 5.71, p < .001, $\eta_p^{2} = .05$, and for sex, Wilks' $\Lambda = .89$, F(2, 600), F(2, 60), F(

220) = 4.96, p < .01, $\eta_p^2 = .04$. Again, there was no multivariate sex by group interaction. Univariate results for intervention condition were consistent with those reported for genderneutral norms. Group differences were evident for gender-specific norms for drinking frequency, F(2, 221) = 7.25, p < .001, $\eta_p^2 = .06$, and drinks per week, F(2, 221) = 9.80, p < .001, $\eta_p^2 = .08$. LSD results again revealed that both intervention groups significantly reduced gender- specific norms relative to control for both norms variables but that intervention groups did not differ between each other. Univariate follow-up tests again indicated, when controlling for baseline norms, women reported higher gender-specific norms than men for drinking frequency, F(1, 221) = 4.44, p < .05, $\eta_p^2 = .02$, whereas gender-specific perceived norms for drinks per week did not differ between men and women, F < 1.

3.6 Mediation

Mediation analyses were conducted in a regression framework (Baron & Kenny, 1986; Cohen, Cohen, West, & Aiken, 2003; Kenny, Kashy, & Bolger, 1998; MacKinnon & Dwyer, 1993), where two dummy coded variables were entered for the intervention group, one representing the gender-neutral PNF group and the other representing the gender-specific PNF group. Four sets of mediation analyses were conducted: 1) examination of perceived gender-neutral norms for drinks per week as a mediator of intervention effects on changes in drinks per week; 2) examination of perceived gender-neutral norms for drinking frequency as a mediator of intervention effects on changes in drinking frequency; 3) examination of perceived same-sex gender-specific norms for drinks per week as a mediator of intervention effects on changes in drinks per week; and 4) examination of perceived same-sex gender-specific norms for drinking frequency as a mediator of intervention effects on changes in drinking frequency. For the present study, evidence of mediation was indicated when A) there was a significant intervention effect on drinking at five-month follow-up, B) there was a significant intervention effect on the perceived norm at three-month follow-up, C) perceived norm at three-month follow-up was significantly associated with the drinking outcome at five-month follow-up, and D) the intervention effect on drinking outcome at five-month follow-up was no longer significant or was significantly reduced when controlling for the perceived norm at three-month follow-up.

Results reported above document criteria A and B for all four mediation analyses. Correlation analysis revealed that perceived gender-neutral, r = .26, p < .001, and gender-specific, r = .29, p < .001, drinking norms for drinks per week at three-month follow-up were significantly associated with drinks per week at five-month follow-up (criteria C). In contrast, neither gender-neutral nor gender-specific perceived norms for drinking frequency at three-month follow-up were significantly associated with five-month drinking frequency, eliminating perceived frequency norms as a potential mediator of intervention effects on changes in drinking. Furthermore, when running regression analyses to evaluate criteria D, the only case in which perceived norms at three-month follow-up were a significant predictor of five-month drinking was in examining perceived gender-neutral norms for drinks per week as a mediator of intervention effects on changes in drinks per week. In this case, results revealed that genderneutral norms for drinks per week at three-months were a significant predictor of drinks per week at five months, t(203) = 1.97, p < .05, d = .28, and neither intervention was significantly associated with drinking reductions when controlling for this variable. In sum, mediation results provide support for perceived norms as a mediator of both interventions effects on drinking reductions at five-month follow-up, but only for perceived gender-neutral norms. Moreover, perceived norms for drinking frequency at three-month follow-up did not mediate intervention effects on drinking reductions at five-month follow-up.

4. Discussion

The current study evaluated the relationship between gender-neutral and gender-specific perceived descriptive norms for drinking and participants' own self-reported alcohol consumption. Further, we evaluated efficacy of two computer-delivered PNF interventions for reducing alcohol use in a sample of high-risk college freshmen. All normative feedback was freshmen-specific, and we compared gender-neutral and same-sex gender-specific feedback to each other and to an assessment control group.

As found with previous research (Lewis & Neighbors, 2004), our hypotheses were supported such that students demonstrated normative misperceptions for both gender-neutral referents and for same- and opposite-sex typical student referents. However, this is the first study to demonstrate gender-specific normative misperceptions for freshmen-specific referents. Furthermore, results indicated that although both typical student and same-sex gender-specific misperceptions for typical same-sex freshmen were uniquely positively associated with personal drinking behavior. Consistent with Social Comparison Theory (Festinger, 1954) and Social Impact Theory (Latane, 1981), these findings suggest that normative perceptions for more specific referents (i.e., typical same-sex freshmen) are more strongly associated with drinking behavior compared to less specific referents (i.e., typical freshmen).

4. Implications for Personalized Normative Feedback interventions

Findings from the present study extend previous research demonstrating the efficacy of PNF as a single component intervention for college student drinking (Lewis & Neighbors, 2007; Neighbors et al., 2004; Neighbors et al., 2006) by showing that PNF is effective for reducing drinking among incoming high-risk freshmen. Additionally, this research continues the exploration to find the optimal referent for PNF interventions via examining specificity of the normative referent. Results indicated that both gender-neutral and same-sex gender-specific PNF were efficacious in reducing drinking behavior in comparison to the control group. Although there were no significant differences between feedback conditions as expected, the same-sex gender specific PNF effects were noted on both outcome variables (drinking quantity and frequency) whereas gender-neutral feedback significantly impacted frequency but not quantity. For reducing drinking behavior, these findings suggest gender-specific feedback may be preferable to gender-neutral feedback, at least for freshmen students.

Interestingly, mediation analyses indicated reductions in drinking quantity at five-month follow-up were mediated through reductions in the perceived gender-neutral norm at threemonths, whereas gender-specific norms did not mediate outcomes as we expected they would. It appears that both gender-neutral and gender-specific PNF lead to comparable reductions in norms for both referent groups. Thus, the suggested advantage of same-sex gender-specific PNF in the current study may be due to increased believability or relevance of the normative information provided (Borsari & Carey, 2003; Festinger, 1954; Latane, 1981), rather than unique impact on gender-specific normative misperceptions per se. Moreover, exposure to a discrepancy between one's own behavior and the actual norm may be driving the intervention effect more so than the misperception between perceived norm and actual norm, and this discrepancy may be most likely to have influence when the feedback is related to a more relevant reference group (i.e., same gender peers). Further, the mediation analyses employed in the current study represent a very conservative test in that baseline drinking rate was included in the regression. Given the much stronger concurrent relationship of same-sex-gender specific norms to personal drinking behavior in comparison to gender-neutral norms, it is difficult to demonstrate a unique effect of gender-specific norms once variance associated with personal drinking behavior is removed. It is also possible that gender-specific norms do not mediate changes in drinking, but rather change in response to changes in drinking. Previous cross-

lagged research has found a reciprocal relationship between gender-neutral normative perceptions and drinking over time, with changes in normative perceptions leading to drinking reductions which in turn influence subsequent perceptions of the norm (Neighbors, Dillard, Lewis, Bergstrom, & Neil, 2006). However, this relationship has not been evaluated with gender-specific norms.

Based on results of the current study, future research is needed to evaluate aspects of believability or relevance of the norm, which might influence outcomes. In addition, research should evaluate various levels and/or combinations of specificity where normative misperceptions are present. For example, normative referents could be evaluated in regards to ethnicity alone or in addition to gender and class standing. Exploring the extent to which feedback regarding different normative referent groups differentially influences drinking behavior may yield both theoretical and practical advances regarding the use of social influence interventions to prevent college student drinking. Finally, future research should evaluate the timing of prevention interventions among incoming freshmen. College is a critical period in which drinking patterns are established. It would be beneficial to determine if prevention efforts are more effective when provided prior to the transition to university (i.e., prior to the establishment of heavy drinking patterns) or following this transition.

4.2 Limitations

The primary limitation of this research was the inclusion of the high BAC intervention. Because the high BAC intervention was provided to all students who reached a peak BAC of .26 or higher in the previous month, regardless of PNF condition, it confounds findings. As such, we were unable to determine if the high BAC intervention had an effect on drinking behavior, and because of this confound students who received the high BAC intervention could not be included in our primary analyses of PNF efficacy. Thus, efficacy of the PNF intervention was evaluated only with those individuals who did not exceed a BAC of .26, removing the top 25% of drinkers from our sample and reducing our ability to demonstrate effects. Previous research has demonstrated efficacy of PNF with students who drink above these levels, thus we believe results of the current trial would generalize to heavier-drinking freshmen.

An additional limitation is that all drinking measures were self-report. Prior research has demonstrated concern over self-reported drinking behavior regarding reliability and validity (Carey & Hustad, 2002; Clapp et al., 2006; Hustad & Carey, 2005). However, research suggests that in comparison to other methods of assessing alcohol use, self-report is preferable (Laforge, Borsari, & Baer, 2005). In the current study, we assured all students of the confidentiality of their responses, obtained a Federal Certificate of Confidentiality to further protect our participants' privacy, utilized standardized measures of alcohol use that have demonstrated good reliability and validity in past research with student populations, and provided information about standard drink content to help anchor responses. These steps have been found to increase reliability and validity of self-report in a variety of populations (Babor, Stephens, & Marlatt, 1987; Marlatt et al., 1998). Two final limitations of the present research are that the sample was primarily Caucasian and the number of students initially invited for the screening survey is unknown.

4.3 Conclusions

To conclude, this research replicates previous research documenting the efficacy of PNF as a single component intervention to reduce college student drinking; however, this is the first study to do so among heavy-drinking freshmen, using freshmen-specific norms. Results support the continuation of research aimed at enhancing effects of PNF through identifying optimal referent groups and assessing mediators of intervention efficacy.

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Table 1

Estimated Marginal Means, Standard Errors, and Univariate Results for Drinks per Week and Drinking Frequency

	Pers	onal	Perceived Typ	ical Freshmen	Perceived Ma	le Freshmen	Perceived Fem	ale Freshmen	Univariate]	Results
Variable	Μ	SE	М	SE	Μ	SE	W	SE	F(3, 936)	η_p^2
Drinks per Week									26.33 ^{***}	0.08
Men	17.12	0.91	23.21	0.95	29.59	1.26	15.74	0.71		
Women	11.84	0.84	24.37	0.88	33.92	1.17	18.92	0.66		
Drinking Frequency									13.86^{***}	0.04
Men	2.90	0.11	4.23	0.14	4.51	0.14	3.61	0.14		
Women	2.55	0.10	4.69	0.13	5.08	0.13	4.23	0.13		

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Table 2

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Estimated Marginal Means and Standard Errors for Drinking at Five Month Follow-Up by Intervention Condition

	Drinking]	Frequency	Drinks pe	er Week
Intervention Condition	Μ	SE	Μ	SE
Control	2.43	0.13	11.02	0.76
Gender-neutral PNF	1.86	0.14	8.41	0.82
Gender-specific PNF	1.74	0.14	T.97	0.83

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Table 3

Estimated Marginal Means and Standard Errors Perceived Norms at Three-Month Follow-up by Intervention Group

	Percei	ved Gender-	Neutral No	orms	Percei	ved Gender-	Specific No	orms
	Drinking]	Frequency	Drinks pe	er Week	Drinking]	Frequency	Drinks p	er Week
Intervention Condition	Μ	SE	Μ	SE	М	SE	М	SE
Control	3.88	0.14	18.35	0.73	3.79	0.14	18.67	0.75
Gender-neutral PNF	3.42	0.15	14.78	0.77	3.28	0.15	14.50	0.79
Gender-specific PNF	3.30	0.16	14.30	0.81	3.02	0.16	14.47	0.83