Leveraging dynamic norms to reduce alcohol use among college students: A proof-of-concept experimental study

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Abstract

Background: Norm-correcting interventions are an effective alcohol harm-reduction approach, but innovation is needed to improve effect sizes. Recent social psychology research shows that individuals may be influenced by social norms that are increasing in prevalence. Contrary to *static norms* that reflect the current state of normative behavior, *dynamic norms* emphasize that a behavioral norm is shifting over time. This study tested proof-of-concept for utilizing dynamic norms messages within norm-correcting interventions.

Method: 461 undergraduate student drinkers (M_{age}=19.97; 64.43% female) were randomized to receive (a) dynamic norms messages highlighting that heavy drinking among college students has steadily decreased over the past six years; (b) static norms messaging stating only the current norms; or (c) a control condition without normative information. Proximal outcomes assessed immediately following the experimental paradigm entailed intentions for total weekly drinks and heavy episodic drinking. Self-reported alcohol use behavior was collected at 1-month follow-up.

Results: Following the experimental paradigm, participants in the dynamic norms condition estimated that future drinking norms would decrease, while those in the static norms and control groups estimated that future drinking norms would increase. Participants in the dynamic norms condition reported lower intentions for weekly drinks and heavy episodic drinking than those in the static norms and control conditions. No significant differences between conditions were found on alcohol use indices reported at the 1-month follow-up. However, dynamic norms messaging had a favorable indirect effect on heavy episodic drinking intentions mediated through lower perceived future drinking norms.

Conclusions: Findings provide proof-of-concept that dynamic norms messaging may be a prudent strategy for reducing alcohol use intentions that can be integrated into or alongside existing norm-correcting strategies.

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Alcohol use among young adults remains a significant public health concern despite decades of prevention and intervention efforts targeting this high-risk age group (Huh et al., 2015). Recent national estimates show the prevalence of alcohol use among college students is concerningly high; approximately 62.2% of college students report past month alcohol use and 32.7% report engaging in heavy drinking (i.e., 5+ drinks in a row) within the past two weeks (Schulenberg et al., 2020). Alongside the clear health implications of alcohol use during young adulthood, such as injury (Hingson et al., 2017) and increasing rates of liver disease (Tapper and Parikh, 2018), drinking during this age period increases likelihood of later alcohol dependence (Merrill et al., 2014). Because alcohol-related lifestyle habits are formed during young adulthood (Arria et al., 2016), it is a critical age period for behavioral intervention and is considered to be a top public health priority.

Peers are a central influence on young adults' health-risk behaviors such as alcohol use, especially because young adults have an increased drive for peer approval (Burnett et al., 2011) and are motivated to adhere to behaviors of others to gain social recognition (Helms et al., 2014). As such, young adults are powerfully influenced by perceptions of social norms regarding peers' alcohol use (Graupensperger et al., 2020b; Neighbors et al., 2007; Perkins, 2002). While perceptions of peers' *attitudes* towards alcohol use (i.e., injunctive norms) are a strong correlate of drinking behaviors (Graupensperger et al., 2020a; Krieger et al., 2016), studies have largely found that perceptions of peers' alcohol use *behaviors* (i.e., descriptive norms) are more strongly associated with use (Lac and Donaldson, 2018; Neighbors et al., 2008). This link between norms and behavior is central to many prominent behavioral theories such as theory of planned behavior (Ajzen, 1991) and social learning theory (Bandura, 1977), highlighting the salient role that norms can have on health behaviors. However, numerous studies have shown young adults tend to overestimate the social norms for peers' alcohol use (Borsari and Carey, 2001; Lewis and Neighbors, 2004), which is problematic in that young adults may be conforming to inflated norms (Cox et al., 2019).

In line with social norms theory (Berkowitz, 2004), misperceptions of drinking norms can facilitate increased engagement in alcohol use to match behavior that is believed to be normative and, as such, prevention strategies have found success in correcting misperceived norms as a means of reducing alcohol use and related harms (see reviews Dotson et al., 2015; Miller and Prentice, 2016). As an example of a norm-modifying strategy, personalized normative feedback highlights discrepancies between normative perceptions and actual peer behaviors, and has been widely utilized and recommended (Cronce et al., 2018). Similarly, social norms marketing campaigns are universal design strategies that present accurate norms without the individualized feedback (Su et al., 2018), and studies indicate that social norms marketing campaigns may be as effective as personalized normative feedback (Neighbors et al., 2011). Given the strong link between perceived norms and behavior, norms-based interventions can reduce alcohol use (and related behaviors/consequences) through reducing normative perceptions (i.e., intervention mechanism; Labrie et al., 2013; Neighbors et al., 2016). The effect sizes of norms-based strategies have been consistent, but are relatively small and can be further improved upon (Cole et al., 2018; Dotson et al., 2015). Innovation is thus needed to develop more effective strategies that can reduce and prevent risky alcohol use by shifting perceptions of drinking norms downward.

Dynamic Norms.

Current norms-based alcohol interventions provide participants with accurate norms derived from current or recent estimates of alcohol use behaviors. However, social psychology researchers have found emerging evidence that individuals align their behavior (i.e., conform) with social norms that they anticipate being prevalent in the future, even more so than the current state of a norm (Sparkman and Walton, 2017). Contrary to *static norms* that reflect the current state of normative behavior, *dynamic norms* emphasize information about collective change in normative behavior (Sparkman and Walton, 2019, 2017). Dynamic norms, and the closely related concept of trending norms (e.g., Mortensen et al., 2019), draw attention to changes in norms over time, often signaling collective progress (Sparkman and Walton, 2017). Such normative messages can highlight that the number of people engaging in a behavior is increasing (or decreasing) over time. For example, in a study by Mortensen and colleagues, participants were told "*Research from (previous year) has found that 48% of (University name) students engage in one or more of the following water conservation behaviors.*" However, participants randomly assigned to the trending norms condition were also told that "*This has increased from 37% in (2 years previous).*" Participants exposed to trending norms messages used significantly less water than participants exposed to static norms messages alone. Similar interventions have been successful at changing behaviors related to plastic cup use and meat consumption (Loschelder et al., 2019; Sparkman and Walton, 2017). For example, researchers approached patrons standing in a lunch line with one of two messages: (a) Static Norms indicating that 30% of Americans limit their meat consumption, or (b) Dynamic Norms highlighting that people are changing – stating that over the last 5 years, 30% of Americans have *started* to limit their meat consumption. Participants in the dynamic norms condition were more likely to order a meatless lunch (34%) compared to those in the static norms (17%) or control conditions (21%).

Whereas existing literature has primarily focused on environmentally sustainable behaviors, researchers recently extended dynamic norms as a strategy for smoking cessation (Sparkman and Walton, 2019). Participants in the dynamic norms condition read that "*Fewer and fewer people smoke. The number of people in the US who smoke continues to decrease. Now 81% of people do not smoke. Surveys find that most people who smoke change. Specifically, more than half of all people who smoke quit successfully.*" This study reported a strong main effect on intentions to quit smoking (d=0.42), but did not conduct a follow-up to examine actual behavior change. Ultimately, recent studies show that dynamic norms—information about collective change in behavioral norms—can facilitate constructive behavior change. Dynamic norms approaches thus have potential to be employed within alcohol reduction strategies by shifting perceptions of drinking norms among college students.

In addition to emerging evidence that dynamic norms may be employed as a constructive social influence on health behaviors and intentions, there is a need to better understand the mechanism through which this may unfold. Sparkman and Walton (2017) theorized that dynamic norms provide insight regarding behavioral norms in the near future, such as a trend continuing in a similar direction, and that perceived future norms may influence one's current behaviors and intentions in a process called preconformity. Indeed, these researchers found that perceived future norms for decreasing meat consumption mediated

the effect of dynamic norms messaging on personal interest in eating less meat. A follow-up experiment manipulated the future norms component by telling participants either (a) "This trend is expected to continue in the near future" or (b) "This trend is not expected to continue—instead, it's expected to slow and possibly reverse in the future." As hypothesized by Sparkman and Walton, those who were exposed to the future growth condition reported significantly greater interest in reducing meat consumption.

Current Study

The present study was designed to gather critical proof-of-concept evidence regarding the utility of integrating dynamic norms messages into norms-based alcohol interventions. Using a randomized experimental design, college student participants were shown either (a) a dynamic norms message highlighting decreasing trends in heavy alcohol use (i.e., 5+ drinks in a single occasion) among college students across the past six years (2014-2019); (b) a static norms message highlighting only the current norm for heavy drinking among college students (in 2019), or (c) a control condition with no normative information.

Using self-report data collected immediately following the experimental paradigm and again at a 1-month follow-up, this study tested several hypotheses. First, we hypothesized that participants in the dynamic norms condition would estimate a further decrease in alcohol use norms across subsequent years (i.e., perceived future norms). Second, compared to those in the static norms and control conditions, we hypothesized that those in the dynamic norms condition would have relatively lower intentions for weekly drinking and heavy episodic drinking in the next month (i.e., proximal outcomes) and report fewer past-month drinks per week and fewer past-month heavy episodic drinking occasions at the 1-month follow-up (i.e., distal outcomes).

Regarding the mechanism of behavior change, we tested indirect effects of perceived future norms for heavy episodic drinking as a mediator of the effects of dynamic norms on heavy episodic drinking intentions and behavior at 1-month follow-up, relative to those in the other two experimental conditions. In line with previous studies showing evidence of preconformity (Sparkman and Walton, 2019), we hypothesized that those in the dynamic norms group would perceive heavy episodic drinking behaviors to become less prevalent/normative in the near future, and that these perceived future norms would in-turn predict lower intentions to engage in heavy episodic drinking and less heavy episodic drinking reported at the 1-month follow-up. Given the normative messages pertained only to heavy episodic drinking norms (and their trends for those in the dynamic norms condition), mediation models were not fit for weekly drinks. Moreover, testing the theorized preconformity process for heavy episodic drinking and intentions was focused on the pathway through perceived future norms for that specific behavior, so we include only perceived future norms for heavy episodic drinking as the mediator variable.

Method

Participants

In November of 2020, 1400 undergraduate students at a large public university in the Pacific Northwest (United States) were randomly selected from the University Registrar list to receive an invitation into the current study. These 1400 students were e-mailed a brief description of the study, which was broadly described as a project examining college student health behaviors, to avoid biasing the sample based on interest in alcohol use.

Of the 1400 undergraduate students invited to participate, complete responses were received from 646 students at baseline (46.14% response rate) and 576 completed the follow-up survey (89.16% retention rate). Given the aims of the study, students who indicated they "had never had more than a few sips of alcohol" at both baseline and follow-up were removed (28.64%), leaving an analytic sample of 461 at baseline and 405 at follow-up (87.85% retention). The full sample (M_{age}= 19.97; SD = 1.33) comprised 64.43% females. Most reported being Caucasian (46.42%) or Asian/Asian American (36.44%), and race/ethnicity approximately matched the estimates provided on the university website. Nearly all participants (97.40%) were fulltime students, 20.82% were affiliated with a Greek organization, and 34.49% reported currently living at home with parents (data were collected during the COVID-19 pandemic).[1] Participants included 18.87% first-year, 22.78% second-year, 29.72% third-year, 24.30% fourth-year, and 4.34% reported being fifth-year students or beyond.

Study Procedures and Design

Interested students followed a custom URL link to the online survey platform where they were asked to read the informed consent material (URL links were tied to individual e-mail addresses to disable duplicate responding). If they indicated consent, participants were asked to complete demographic questions (e.g., age, birth sex) and then told they were randomly selected to answer questions about college student alcohol use. Prior to the experimental paradigm, participants self-reported past-month engagement in alcohol use behaviors (e.g., number of weekly drinks, heavy episodic drinking).

As an ostensible lead-in to the experimental paradigm, participants were told that the study team was developing a student health campaign that required students' input regarding college student health behaviors. At this point, students were discretely randomized into one of three study conditions: dynamic norms (n=152), static norms (n=167), or control (n=142). Following the paradigm, participants were asked to estimate the extent and direction that college student alcohol use norms may change over the next several years (i.e., perceived future norms) and then asked their intentions to engage in alcohol use over the next month (i.e., proximal outcomes).

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[1]Estimates from the university's website show that approximately 15% of students are affiliated with a Greek organization. In one study collected from students at this university at the beginning of the pandemic (April 2020), 63.7% reported living at home (Graupensperger et al., 2021c), whereas pre-pandemic studies from this same university reported 13.9% living with parents (Larimer et al., 2009).

One month after completing the baseline survey and experimental paradigm, participants were e-mailed an invitation to complete a brief follow-up survey. They were asked some of the demographic information assessed at baseline to enable identification of fraudulent responding, and then asked questions pertaining to the distal outcomes: self-reported alcohol use behaviors (i.e., since baseline).

Participation was incentivized with a $10 e-gift card at both baseline and follow-up. All data and responses were stored confidentially, and e-mail addresses were linked to a random PIN; a file linking PINs to e-mail addresses was stored in a separate encrypted file. Following the study, all participants were debriefed, and resources were provided should students seek additional information regarding alcohol use. All study procedures were approved by the Institutional Review Board at the authors' university and no adverse events were reported.

Dynamic Norms Condition.—The dynamic norms condition entailed a normative message regarding the national estimate for the percent of college students that refrain from heavy drinking behavior and highlighted the trend over the past six years. Specifically, participants in this condition were shown the following message: "*Research from 2019 has found that 75% of college students either do not engage in any alcohol use at all, or refrain from heavy drinking (i.e., 5 or more drinks in a single occasion). The percent has increased steadily over the past six years (see figure below). These trends indicate that more-and-more students are avoiding risky alcohol use behaviors.*" Participants in this condition were also shown this information in a figure to highlight the trend (see Figure 1A). Data informing this normative message were derived from the American College Health Association database years 2014 to 2019. To ensure that participants spent time reflecting on the normative information, they were asked to respond to an open-ended prompt: "*In the following space, please describe in detail why you think that 75% of students refrain from heavy alcohol use, and why this trend is increasing (at least 2 to 3 sentences).*"

Static Norms Condition.—The static norms condition was similar to the dynamic norms condition except the message only provided the most recent normative information available, from 2019 (i.e., no trends were shown): "*Research from 2019 has found that 75% of college students either do not engage in any alcohol use at all, or refrain from heavy drinking behaviors (i.e., 5 or more drinks in a single occasion).*" Participants in this condition were also shown a figure of this normative information (see Figure 1B). As with the dynamic norms condition, participants were prompted to reflect on this norm by responding to the following open-ended question: "*In the following space, please describe in detail why you think that 75% of students refrain from heavy alcohol use (at least 2 to 3 sentences).*"

Control Condition.—Participants randomized to the control condition were not shown any normative messages regarding college student alcohol use. Instead, control group participants responded to an open-ended prompt pertaining to college student exercise and physical activity: "*Maintaining a regular exercise routine can be difficult. In the space below, please provide your thoughts on some of the biggest hurdles for college students' exercise and physical activity (at least 2 to 3 sentences).*"

Measures

Prior to assessing any alcohol use behaviors, intentions, or norms, participants were shown a figure displaying standard drink estimates (i.e., 12 oz. beer, 10 oz. wine cooler, 4 oz. wine, 1 oz. 100 proof [1 ¼ oz. 80 proof] liquor).

Baseline.—We used the Daily Drinking Questionnaire (DDQ; Collins et al., 1985) to assess the number of total drinks consumed during a typical week in the past month. This questionnaire asked participants to report how many drinks they consumed on each day of the week in the past month and responses were summed across each of the seven days to form a weekly composite score. Frequency of heavy episodic drinking occasions in the past month (4+/5+ drinks in a 2-hour period for women/men) was assessed with a commonly-used single item: "During the past month, how often did you have 4 (women)/5 (men) or more drinks of alcohol within a two hour period?" (e.g., Rodriguez et al., 2020).[2]

Perceived Future Norms.—Several items were created to assess participants' estimates of forthcoming trends in college student drinking norms over the next several years. First, we asked participants the following: "Looking ahead to next year (2021), what percent of college students do you think will *refrain* from heavy alcohol use behaviors (i.e., 5+ drinks in a single sitting)?" Participants responded on a sliding scale ranging from 0% to 100% with higher percentages indicating perceptions that more students will refrain from heavy alcohol use. Three additional perceived future norms items were assessed using the following stem: "Compared to the current levels, how do you think that college student alcohol use behaviors will change over the next several years?" with items specifically asking about normative shifts pertaining to (a) alcohol use frequency, (b) quantity consumed per drinking occasion, and (c) heavy episodic drinking. Response options ranged from −5=*A lot less* to +5=*A lot more,* with a scale midpoint of 0=*Unchanged.*

Proximal Outcomes (Alcohol Use Intentions).—The next set of items asked participants to report their intentions for alcohol use behaviors over the next month. Baseline measures of alcohol use, described above, were modified to assess intentions. Specifically, we adapted the DDQ to estimate an index of intended weekly number of drinks and the single heavy episodic drinking item to assess intentions for heavy episodic drinking. Previous studies have modified these measures to assess alcohol use intentions (e.g., Lee et al., 2014).

Distal Outcomes.—The distal outcomes assessed within the one-month follow-up survey entailed indices of past month alcohol use. Weekly number of drinks and frequency of heavy episodic drinking were assessed using the same scales employed at baseline (described above) and referred specifically to the past month since baseline.

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[2]The normative messages included in the experimental paradigm operationalized 5+ drinks as a heavy episodic drinking occasion because this was how it was assessed and reported in the American College Health Association data. The NIAAA nevertheless encourages heavy drinking occasions to be operationalized as 4+ drinks for women and 5+ drinks for men when assessing this behavioral outcome.

Data Analyses

Perceived Future Norms.—To assess differences in perceived future norms (i.e., estimates of normative alcohol use in subsequent years) between the three experimental conditions, we conducted analysis of variance (ANOVA). Following a significant omnibus effect indicating differences between groups, we used Tukey's post-hoc test with Bonferroni adjustment for multiple comparisons to contrast each of the three conditions.

Proximal Outcomes (Intentions).—Intentions for total weekly drinks and heavy episodic drinking were positively skewed count variables, requiring negative binomial count regression models to account for overdispersion. In these models, experimental condition was dummy-coded with the dynamic norms condition as the referent group to enable comparisons with the static norms and control conditions. Models included participants' baseline score on the respective variable as a covariate, as well as a binary covariate for whether the participant was living with their parents during the study period.

In count regression, coefficients are exponentiated to yield incidence rate ratios (IRR). Like odds-ratios, IRRs larger than 1 indicate a percentage increase for each unit increase in the predictor and IRRs less than 1 are interpreted as percentage decreases in the outcome for each unit increase in the predictor. Models were estimated in R using the 'MASS' package (Venables and Ripley, 2002).

Distal Outcomes.—Similar negative binomial models estimated differences in weekly drinks and heavy episodic drinking occasions at 1-month follow-up between the experimental conditions. Models included baseline scores for these respective outcome variables to enable interpretation of intraindividual change from baseline, and whether the participant was living with their parents during the study period.

Intervention Mechanism: Preconformity.—The final set of analytic models sought to examine perceived future norms as a theorized mechanism of change (Sparkman and Walton, 2019). This entailed mediation models with an indirect effect of experimental condition on heavy drinking intentions and behavior reported at follow-up via perceptions of future norms for heavy episodic drinking. Note that mediation analyses are only warranted when the independent variable (i.e., condition) is significantly associated with the mediator (i.e., perceived future norms). Mediation analyses entailed decomposing the total effect into direct and indirect effects. For parsimony and interpretability, mediation models employed Helmert coding where the dynamic norms condition (coded as '2/3') was compared to both the static norms and control condition in combination (each coded as '−1/3'). Mediation models were conducted in R using the 'mediation' package (Tingley et al., 2014), and were generated using both non-parametric bootstrapping (with bias-corrected confidence intervals) and quasi-Bayesian Monte Carlo simulation, each with 1000 simulations. Given that estimates were approximately identical for these two methods, we report the estimates from the quasi-Bayesian Monte Carlo simulation that is the default for this statistical package.

Results

Preliminary Analyses

A priori power analyses with an estimated effect size (d=0.15) indicated we required at least 432 participants. Although this was satisfied for the analyses using baseline and post-paradigm analyses (i.e., $N = 461$), there was attrition at the 1-month follow-up, and analyses for alcohol use behavior at follow-up narrowly missed the planned level of power. Indeed, post-hoc power analysis with a sample size of 405 (the number of non-abstaining participants completing both waves) indicated that an effect size of d=.154 would be needed to meet the .80 power threshold; alternatively, with this sample size and an estimated effect size of d=.15, the level of power was 0.77. Therefore, we are sufficiently powered for aims testing the effect of dynamic norms messaging on perceived future norms and alcohol use intentions, and near to the arbitrary .80 power threshold for aims involving alcohol use behaviors reported at the 1-month follow-up, though we note that the a priori effect size of d=.15 used in these power analyses is a conservative estimate.

In a preliminary step, we examined the distribution of 'true abstainers' who reported never drinking alcohol (at both baseline and follow-up) by condition. Despite being dropped for analyses, it is worth noting that there were 56 (26.9%) true abstainers randomized to the dynamic norms condition. 46 (21.6%) true abstainers randomized to static norms, and 69 (32.7%) true abstainers randomized to the control condition. We then tested the extent to which participants in the three conditions differed on key study variables at baseline. ANOVA revealed no significant differences between groups in participant age ($p = .408$), and logistic regressions (experimental condition was dummy-coded with adjustment for planned multiple comparisons between three groups) revealed no differences in birth sex (p-values ranged from .510 to .999), or Greek affiliation (p-values ranged from .566 to .880). To examine baseline differences in alcohol use indices, negative binomial models were fit with experimental condition as the independent variable. There were no differences between conditions on baseline number of weekly drinks (p-values ranged from .261 to .800), or baseline heavy episodic drinking (p-values ranged from .136 to .980). Attrition was approximately the same across the three conditions, but several correlates of attrition were identified. Women, relative to men, were more likely to participate in the one-month follow-up survey ($\chi^2 = 4.58$, $p = .032$), and those who reported more heavy episodic drinking at baseline were significantly less likely to complete the follow-up ($t = 2.13$, $p = .037$).

Descriptive statistics for indices of alcohol use at both baseline and 1-month follow-up (stratified by condition) are displayed in Table 1 and shown in Figure 2. Notably, none of the experimental conditions reported an increase in alcohol use, indicating none of the conditions had an iatrogenic effect, on average. Pertaining to abstaining from alcohol use at the 1-month follow-up, the dynamic norms condition had the greatest proportion of abstinence (i.e., 28.24%), though this was not significantly higher than the other two conditions.

Perceived Future Norms

Immediately following the experimental paradigm, participants were asked to estimate future normative drinking behavior among college students in subsequent years (Table 2). Pertaining to estimates of the percent of college students who will refrain from heavy alcohol use, an ANOVA revealed significant differences by condition; those in the dynamic norms condition estimated that a significantly greater percentage of college students will refrain from heavy alcohol use relative to estimates of those in both the static norms and control conditions. Moreover, those in the static norms condition estimated *more* college students will refrain from heavy episodic drinking relative to those in the control condition.

Three additional items asked about estimated normative changes in specific drinking patterns: frequency, quantity per drinking occasion, and heavy episodic drinking. Across these three indices, a clear pattern emerged in which those in the dynamic norms condition estimated lower future drinking norms among college student drinking, relative to those in the static norms and control conditions. Indeed, those in the dynamic norms condition, on average, estimated these three drinking behaviors will *decrease* across the next several years, while participants in the static norms and control conditions estimated these drinking behaviors will *increase* over the next several years (on average).

Alcohol Use Intentions

Pertaining to intended weekly drinks, count regression models (see left half of Table 3) revealed participants in the dynamic norms condition intended to drink significantly fewer drinks per week than participants in the static norms and control conditions. The next model examined intentions to engage in heavy episodic drinking. Similarly, participants in the dynamic norms condition intended to engage in fewer heavy episodic drinking occasions when compared with participants in the static norms and control conditions.

Alcohol Use Behaviors at 1-Month Follow-Up

Models estimating differences between conditions in weekly number of drinks and heavy episodic drinking (in the month following the experimental paradigm) are shown in the right half of Table 3. Counter to hypotheses, there were no significant differences in either weekly drinks or heavy episodic drinking in the month following the experimental paradigm.

Mediation Models (Preconformity)

Building on the finding that dynamic norms messaging was associated with lower perceived future norms for heavy drinking, mediation models were specified to estimate the extent to which dynamic norms may have an indirect effect (i.e., mediation) on heavy drinking intentions and behaviors at follow-up through perceived future norms (i.e., preconformity). Contrasting the dynamic norms condition to the other two conditions, we found evidence that the significant direct effect of dynamic norms on heavy drinking intentions was mediated by participants' perceptions of future heavy drinking norms (Figure 3A). That is, participants in the dynamic norms condition perceived significantly lower future norms, which was in-turn significantly associated with heavy episodic drinking intentions. Indeed, this indirect effect explained 34.17% of the total effect – highlighting perceived future norms

may be a key mechanism through which dynamic norms messaging reduces intentions to engage in heavy drinking.

Despite not finding a significant main effect of dynamic norms on heavy episodic drinking at follow-up, compared to the two other experimental conditions, a similar mediation model was tested (Figure 3B). Counter to hypotheses, perceived future norms for heavy drinking were not associated with reported heavy episodic drinking at follow-up. The indirect effect explained only a small proportion of the total effect; thus, we did not find support for perceived future norms as a mediator of dynamic norms on heavy episodic drinking at follow-up.

Discussion

Norms-based alcohol interventions have been a promising strategy for reducing alcohol use and related harms among young adults, but there remains a need for innovation to further move the needle on this public health priority. Inspired by recent social psychology findings, the current proof-of-concept study tested whether dynamic norms messaging—highlighting that heavy drinking has been decreasing over the past several years among college students—may have utility within norms-based interventions for non-abstinent college students. Although the findings indicated no support for reducing alcohol use behaviors at a 1-month follow-up, results generally showed the potential value of dynamic norms as a strategy to reduce students' *intentions* to engage in alcohol use. Findings also indicated that dynamic norms may be a strategy to reduce normative perceptions of typical college student drinking behavior in the future. Regarding perceptions of future norms, participants in the dynamic norms condition estimated more college students will refrain from heavy drinking, relative to participants in the other experimental conditions. Those in the dynamic norms condition also estimated the norms for alcohol use behaviors will continue to decrease over the next several years, while those in the other conditions estimated that drinking norms will increase. It is intuitive that participants in the dynamic norms condition would anticipate increased percentages of young adults who will refrain from heavy alcohol use, given the clear trend shown in the figure displayed to those in this condition, but it also appears this trend was generalized by participants across several drinking patterns including frequency and quantity per occasion. Moreover, participants in the other two conditions estimated that drinking norms would *increase*, on average, over the next several years. This indicates that that the status-quo for student drinkers in our sample is the assumption that drinking behaviors are on the rise, or will increase in the future, though it is possible that this may be partially due to students' anticipation of increased drinking when students return to campus following the COVID-19 pandemic. These effects on perceived future norms are nevertheless promising given that normative messages showing future growth alongside dynamic norms are more influential than dynamic norms messages provided without future growth (Sparkman and Walton, 2017). As such, future norms-based interventions may benefit from providing not only trends of the previous years, but also highlighting that healthier drinking norms are likely to increase in the future as well (i.e., collective progress).

In support of our hypotheses, students in the dynamic norms condition intended to consume fewer weekly drinks and engage in fewer heavy episodic drinking occasions in the next

month, relative to those in the static norms and control conditions. Thus, dynamic norms may have a favorable *immediate* impact on students' alcohol-related cognitions. Given the brief nature of the current experimental paradigm, it is reasonable to expect stronger proximal effects relative to distal outcomes one month later. Nevertheless, intentions are a strong precursor to behavior (Ajzen, 1991) and are therefore a prudent proximal target for alcohol use interventions; however, there is evidence of an intentions-behavior gap, especially as it pertains to health behaviors (Sheeran and Webb, 2016). It follows that future studies on dynamic norms could look to strengthen the effect of intentions on downstream behaviors. Dynamic norms research on smoking cessation has specifically targeted individuals' self-efficacy toward quitting by providing messages that more-and-more people are successfully quitting (Sparkman and Walton, 2019). Similarly, alcohol-related dynamic norms marketing campaigns could highlight that drinking norms are decreasing, while additionally targeting individuals' self-efficacy and providing supplemental messages about behaviors students are engaging in that help them refrain from alcohol use (e.g., attending alcohol-free programs; Layland et al., 2019).

Despite having lower *intentions* for weekly drinking, the dynamic norms condition did not differ from the control condition on either number of weekly drinks or heavy episodic drinking at 1-month follow-up. In addition to the paradigm being brief, it is worth noting that this study took place during the COVID-19 pandemic when young adults' social and conformity motives may have decreased, relative to pre-pandemic (Graupensperger et al., 2021b). Given that norms-based interventions are grounded in these social processes, limited effects on self-reported drinking changes from baseline may stem from decreased opportunity to engage in social drinking and, similarly, during a time when students are not as likely to observe social drinking on campus. Taken together, the null effect on alcohol use behaviors at follow-up does not necessarily indicate a lack of utility for dynamic norms messaging but does warrant further exploration in non-pandemic contexts.

Finally, as it pertains to perceived future drinking norms as a theorized mechanism of behavior, mediation models indicated a significant indirect effect of dynamic norms on heavy episodic alcohol use intentions through perceived future norms. That is, dynamic norms messaging facilitated perceptions that heavy drinking norms will decrease, which subsequently predicted lower intentions to engage in heavy episodic drinking. This highlights that dynamic norms messages operate by reducing perceived future drinking norms, consistent with extant dynamic norms literature on intentions to reduce meat consumption (Sparkman and Walton, 2017). Despite this early indication, further studies are needed to examine additional mechanisms of dynamic norms messaging in relation to static norms that are commonly used within norms-based interventions.

Limitations and Future Directions

The current study represents a critical first step in establishing proof-of-concept for the utility of dynamic norms within brief norms-based alcohol interventions, but several limitations regarding the limited scope of this experimental paradigm warrant discussion. The foremost limitation is that the normative messages shown within the experimental paradigm were very brief and only highlighted norms for heavy drinking, so large effect

sizes may not be expected especially for distal outcomes one month following the paradigm. Indeed, further studies are needed to examine different normative messages regarding other patterns of use (e.g., frequency, quantity) to identify which types of messages may be most efficacious. Similarly, there is still much to be learned about the most effective way of presenting dynamic norms messages (i.e., optimization). For example, would it be more effective to present norms showing that heavy drinking is going *down* rather than showing that refraining from heavy drinking is going *up*? Additionally, future studies may identify an ideal period for which trends can be shown (e.g., across the past three years, instead of past six years as currently shown to participants in the dynamic norms group). Previous dynamic norms studies have found that specifically telling subjects that normative trends are expected to continue in this direction may motivate behavior change to a greater extent (i.e., future growth; Sparkman and Walton, 2017), but there are ethical considerations when presenting norms that may not be empirically based. Related to logistical concerns, dynamic norms may not be effectively employed for behaviors in which the norms are actually increasing, such as marijuana use (McCabe et al., 2020).

Limitations also pertained to the sample and timing of this study. Students were recruited from one public university in the United States, which limits generalizability. Follow-up surveys were administered near the end of the quarter, so students may have engaged in less alcohol use due to school demands. This study was also conducted during the COVID-19 pandemic and, though this would have impacted all participants who were randomized into experimental conditions, there is evidence that alcohol use patterns have changed among college students and young adults during the pandemic (Graupensperger et al., 2021b, 2021c). Although we controlled for participants' living with parents during the study period, alcohol use behaviors/intentions and responses to the experimental paradigm may be influenced by the timing of this study, such as COVID-19-related stressors (Graupensperger et al., 2021a). Thus, future studies should replicate and extend the current study in a broader geographical sample, as well as when college campuses return to normal after the pandemic subsides.

Conclusions

Norms-based alcohol interventions have been a promising harm-reduction strategy for young adults (e.g., Neighbors et al., 2011), but innovation is needed to increase effect sizes and further move the needle on this public health priority. The current study of non-abstaining college students provides initial proof-of-concept for the utility of dynamic norms messaging that highlights not only the current state of a behavioral norm, but also that the norm is trending in a favorable direction. The most salient effects of dynamic norms (relative to static norms and control conditions) were on non-abstaining students' intentions to engage in relatively less alcohol use and on students' perceptions of future drinking norms. There was also evidence that dynamic norms messaging may have an indirect effect on heavy drinking intentions mediated through perceived future norms. Taken together, the findings provide encouraging proof-of-concept that dynamic norms may be a prudent strategy within norms-based interventions, such as social norms marketing campaigns, but more research is needed to further clarify the effects and to optimize the specific elements that are employed within a dynamic norms messaging intervention.

Funding:

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Key Findings:

In this experimental study, we provide proof-of-concept evidence that dynamic norms (i.e., information highlighting that heavy drinking norms have steadily decreased among college students) facilitated lower intentions to engage in alcohol use behaviors, relative to a static norms condition (i.e., participants only shown current normative estimates) and control conditions. Although no significant differences were found on alcohol use indices at one-month follow-up, these data show the potential value of integrating dynamic norms messaging into or alongside existing norms-based prevention strategies.
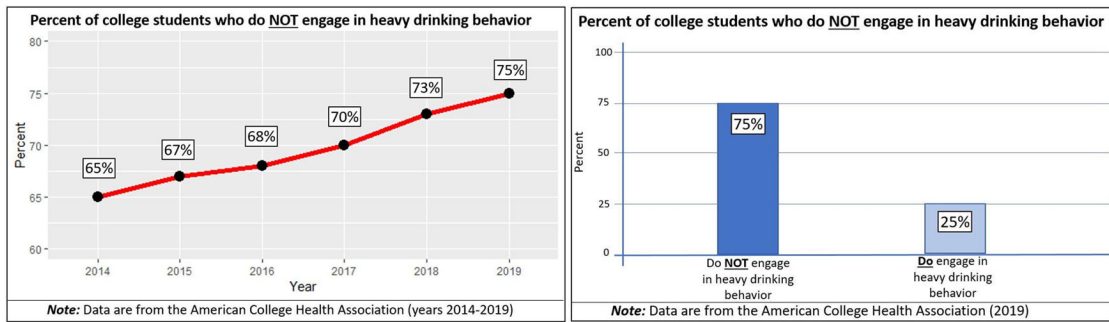
Figure 1.

The figures shown above were displayed as part of the experimental paradigm for participants randomly assigned to (A) the dynamic norms condition and (B) the static norms condition.
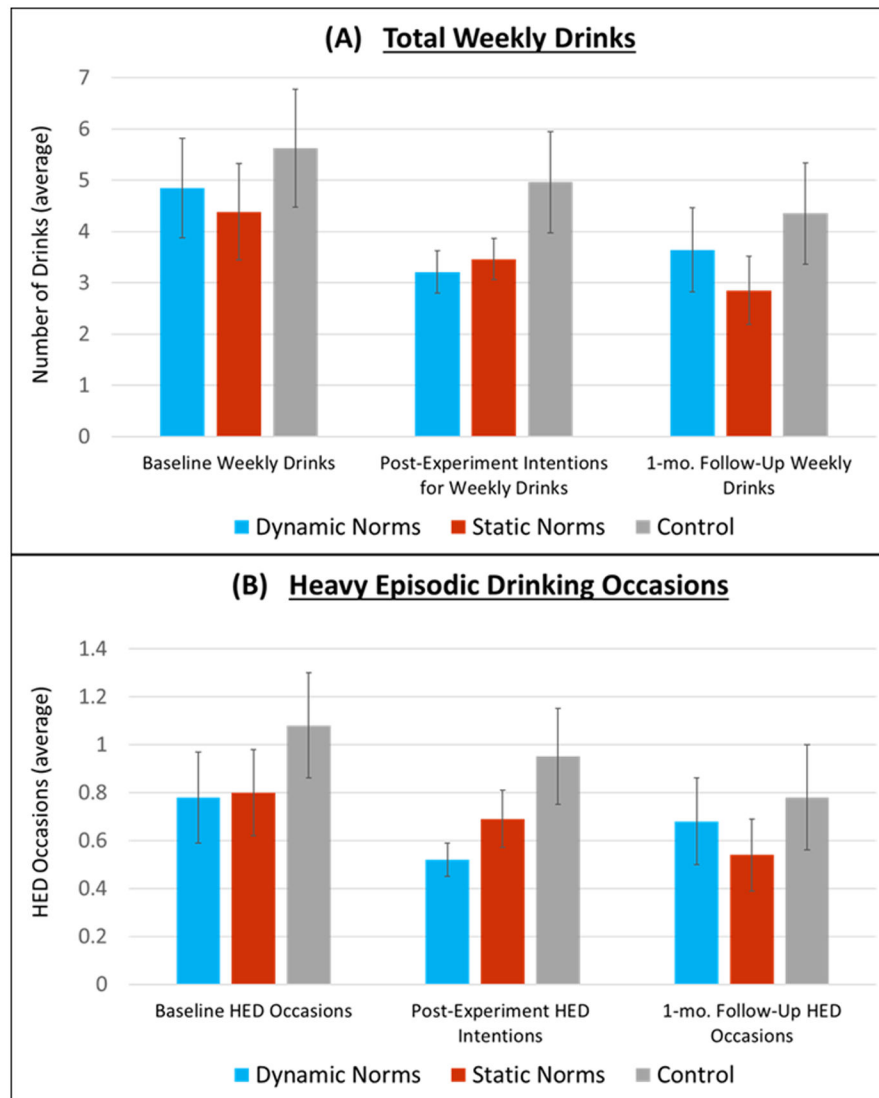
Figure 2.
Bar charts showing group means on past month weekly drinks (A) and heavy episodic drinking (B) at baseline, intentions for use in the month following the experimental paradigm, and reported use at the 1-month follow-up. Error bars represent 95% confidence intervals
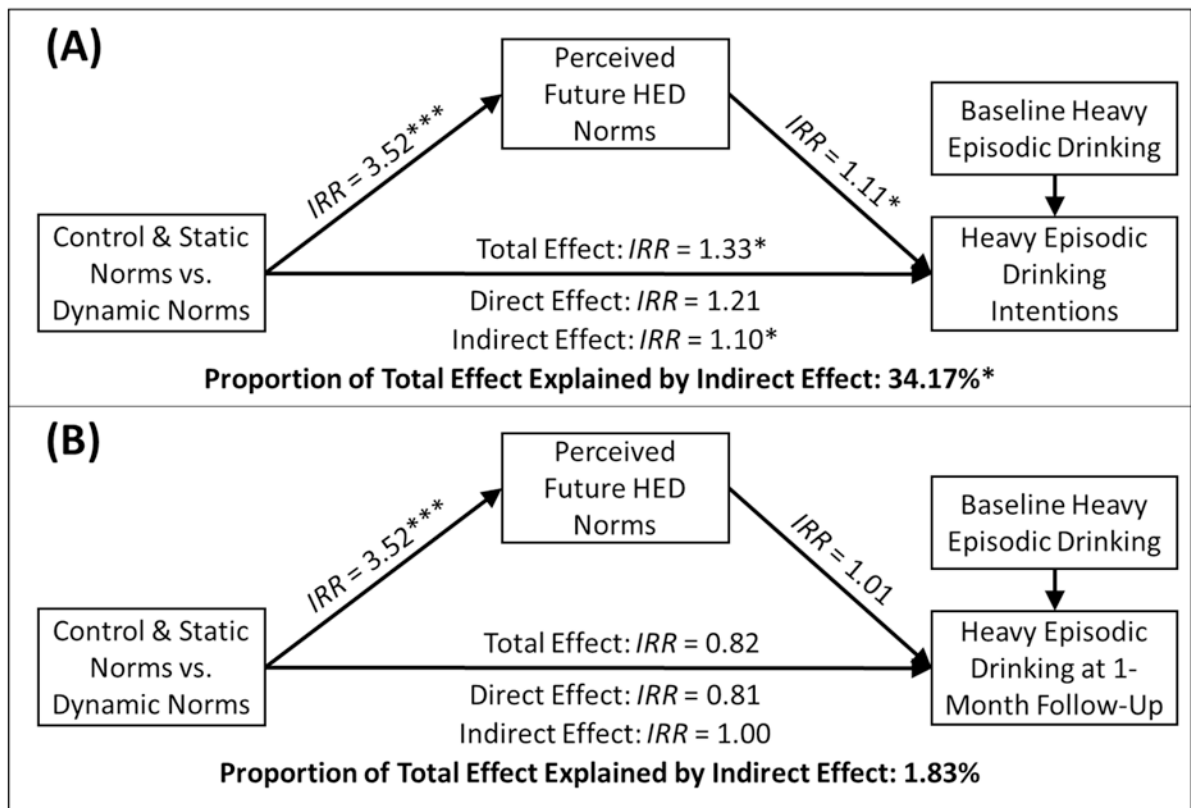
Figure 3.
Mediation models estimating the effect of dynamic norms on heavy episodic drinking
intentions (A) and heavy episodic drinking reported at 1-month follow-up (B) through
the indirect effect of perceived future heavy drinking norms. Mediation models employ
Helmert coding to contrast dynamic norms against both static norms and control conditions
combined, and models controlled for whether participant lived with parents during the study
period. IRR = Incidence rate ratios, which represent proportional differences in the outcome
variable between two conditions (e.g., a ratio of 1.15 = 15% increase in the outcome variable
for those in the reference group). *$p < .05$. **$p < .01$. ***$p < .001$.

Means by condition at baseline and one-month follow-up.

	Dynamic Norms Condition	Static Norms Condition	Control Condition
	M (SD)	M (SD)	M (SD)
Baseline: Weekly Drinks (DDQ) [a]	4.84 (6.09)	4.38 (6.13)	5.62 (6.89)
Baseline: HED Occasions [a]	0.78 (1.14)	0.80 (1.21)	1.08 (1.33)
Intentions: Weekly Drinks (DDQ) [a]	3.21 (4.81)	3.46 (5.00)	4.96 (6.22)
Intentions: HED Occasions [a]	0.52 (0.91)	0.69 (1.08)	0.95 (1.31)
Follow-Up: Weekly Drinks (DDQ) [b]	3.64 (4.71)	2.85 (4.04)	4.35 (5.57)
Follow-Up: HED Occasions [b]	0.68 (1.07)	0.54 (0.91)	0.78 (1.23)
Follow-Up: % Abstained from Drinking [b]	28.24%	19.33%	23.38%

Note: HED = Heavy Episodic Drinking.

[a] Values derived from all 461 participants that completed baseline.

[b] Values derived from the 405 participants that completed both baseline and one-month follow-up.

Table 2.

ANOVA models estimating differences in pre-conformity outcomes between experimental conditions. $N = 405$.

	Estimated Future Norm for % of College Students that will Refrain from Heavy Alcohol Use [a]	Estimated Change in Norms for Alcohol Use Frequency [b]	Estimated Change in Norms for Quantity of Alcohol Consumed per Drinking Occasion [b]	Estimated Change in Norms for Heavy Drinking Occasions [b]
Mean (SD) for Trending Norms Condition	71.0 (15.8)	−0.44 (1.67)	−0.10 (1.68)	−0.87 (1.82)
Mean (SD) for Static Norms Condition	62.7 (17.6)	0.64 (1.80)	0.73 (1.54)	0.29 (1.83)
Mean (SD) for Control Condition	49.7 (19.2)	0.75 (1.72)	0.71 (1.88)	0.48 (2.02)
ANOVA F-test	$F = 48.00$ ***	$F = 18.86$ ***	$F = 10.46$ ***	$F = 19.68$ ***
Post-Hoc Contrasts (t-tests)				
Static Norms vs. Dynamic Norms	$t = -3.98$ ***	$t = 5.19$ ***	$t = 4.11$ ***	$t = 5.13$ ***
Control vs. Dynamic Norms	$t = -9.73$ ***	$t = 5.47$ ***	$t = 3.82$ ***	$t = 5.73$ ***
Static Norms vs. Control	$t = 6.13$ ***	$t = -0.52$	$t = 0.12$	$t = -0.86$

Note:

[a] Responses ranged from 0% to 100%.

[b] Responses ranged from −5 (*A lot less*) to 5 (*A lot more*) with 0 (*Unchanged*) as a scale midpoint.

***
$p < .001$.

Table 3.

Negative binomial regression models contrasting drinking intentions (proximal outcome) and drinking behaviors at 1-month follow-up (distal outcome) by experimental condition.

	Proximal Outcomes (N = 461)				Distal Outcomes (N = 405)			
	Intentions for Total Weekly Drinks in Next Month		Intentions for Heavy Episodic Drinking in Next Month		Total Weekly Drinks in Past Month		Heavy Episodic Drinking Occasions in Past Month	
	IRR	[95% C.I.]	IRR	[95% C.I.]	IRR	[95% C.I.]	IRR	[95% C.I.]
Covariates								
Baseline Score of Outcome Variable	1.16 ***	[1.14, 1.19]	1.12 ***	[1.10, 1.15]	1.15 ***	[1.12, 1.18]	2.04 ***	[1.81, 2.31]
Living with Parents (0=*No*, 1=*Yes*)	0.56 ***	[0.46, 0.69]	0.44 ***	[0.31, 0.62]	0.57 ***	[0.45, 0.72]	0.60 **	[0.41, 0.86]
Experimental Condition								
Dynamic Norms (Referent Group)								
Static Norms	1.31 *	[1.05, 1.64]	1.55 *	[1.10, 2.20]	0.98	[0.76, 1.26]	0.86	[0.60, 1.23]
Control Group	1.38 **	[1.10, 1.74]	1.67 **	[1.18, 2.37]	0.93	[0.72, 1.21]	0.72	[0.50, 1.04]

Note. IRR = Incidence rate ratios, which represent proportional differences in the outcome variable between two conditions (e.g., a ratio of 1.15 = 15% increase in the outcome variable for those in the reference group, whereas a ratio of 0.85 = 15% decrease).

*
 $p < .05$.

**
 $p < .01$.

***
 $p < .001$.