The dynamic nature of injunctive drinking norms and within-person associations with college student alcohol use

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Abstract

Objective: Perceptions of friends' approval of drinking behaviors (i.e., injunctive drinking norms) play a central role in shaping college students' alcohol use behaviors. However, we know little about the extent that students' perceptions of friends' approval fluctuate over time and whether there are within-person associations between these injunctive norms and alcohol use. To fill this knowledge gap, we estimated within-person variability in perceptions of friends' approval of alcohol use across a 12-month period and examined within-person associations between perceptions of friends' approval and three discrete drinking behaviors: Number of weekly drinks, hazardous drinking behaviors, and peak estimated blood-alcohol content (peak-eBAC).

Method: A sample of college students ($N = 433$, 54.82% female, $M_{age} = 20.06$) reported perceptions of friends' approval of alcohol use and indices of alcohol use behavior at four timepoints across a single year.

Results: Descriptive estimates of within-person variability of perceived friends' approval revealed that these perceptions fluctuated considerably across the four timepoints. After accounting for between-person effects, longitudinal multilevel modeling revealed significant within-person associations between perceptions of friends' approval and (a) number of weekly drinks, (b) hazardous drinking behaviors, and (c) peak-eBAC levels. Students reported heavier alcohol use at timepoints when they perceived their friends as being more approving than usual.

Conclusions: Alongside advancing theoretical understanding of social influences on students' alcohol use, the current findings hold important clinical implications for norms-based harm-reduction strategies. To optimize interventions, norms-based approaches may need to be adaptive over time (e.g., boosters) to map onto within-person fluctuations in perceived injunctive norms.

Alcohol misuse among college students remains a major public health concern (Hingson, Zha, & Smyth, 2017). Beyond the well-documented detrimental effects on physical and mental health, alcohol misuse during college is associated with other negative consequences such as regretted sexual experiences, decreased academic functioning, and post-graduation unemployment (Bamberger et al., 2017; Martinez, Sher, & Wood, 2014). With the majority of college student alcohol use occurring in highly social environments (Dumas, Davis, & Neighbors, 2019), influences from peers may be particularly salient in the formation of alcohol-related habits during emerging adulthood. Thus, it is critical to understand peer

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influences, such as perceptions of peer approval, and their relation to college student alcohol misuse to inform prevention and intervention efforts.

Perceptions regarding how approving or accepting others are of a given behavior are referred to as *injunctive norms* (Cialdini, Reno, & Kallgren, 1990). Injunctive norms serve as a behavioral compass that helps individuals discern which behaviors are socially acceptable and which are not. Deutsch and Gerard (1955) theorized that people are motivated to adhere to social norms in anticipation of social rewards (e.g., peer approval) and to avoid social repercussions of deviating from the norms (e.g., social exclusion). College students are particularly sensitive to these normative social influences as this developmental stage is marked by a strong drive for approval (Burnett, Sebastian, Cohen Kadosh, & Blakemore, 2011). Indeed, perceived social norms are widely considered to be among the most robust predictors of college student drinking (Borsari & Carey, 2003; Neighbors, Lee, Lewis, Fossos, & Larimer, 2007).

Although social norms research has often focused on descriptive norms regarding perceptions of others' actual drinking behaviors (e.g., Larimer et al., 2011), social learning theory (Bandura, 1977) highlights the importance of injunctive norms. This theory specifically suggests that believing others approve of a behavior instills implicit pressures for individuals to conform by engaging in that behavior themselves. There is increasing empirical evidence that injunctive norms regarding perceptions of others' approval may be a uniquely important determinant of health-risk behaviors (Krieger et al., 2016; Lac & Donaldson, 2018; Napper, Kenney, Hummer, Fiorot, & LaBrie, 2016).

Perceived Peer Approval of Alcohol Use

On college campuses, there are strong social pressures to drink as a means of fitting-in with peers and making friends (Balestrieri, Meisel, Clark, Ott, & Barnett, 2018). Indeed, a large literature indicates that peer approval can be a key motivating factor for student alcohol misuse (e.g., Halim, Hasking, & Allen, 2012; Lee, Geisner, Lewis, Neighbors, & Larimer, 2007). Tenets from social impact theory (Latane, 1981) and social comparison theory (Festinger, 1954) suggest that the attitudes and opinions of close friends are perceived as highly relevant and have a strong influence on behavior. From a practical perspective, obtaining peer approval is of major importance to college students as they navigate the development of new friendships and face hurdles associated with joining new social circles (Arnett, 2007). College is indeed described as a 'peer-intensive' environment where students are surrounded by peers and the social norms for alcohol misuse are quite salient (Perkins, 2002). Focusing on the drinking norms of close friends also aligns with the focus theory of normative conduct (Cialdini, Kallgren, & Reno, 2000), which holds that social norms are particularly powerful when they are salient or more readily observed. For college students, alcohol-related peer influences from close friends are highly visible. For example, students are able to surmise injunctive drinking norms by simply observing the social media posts of friends (Boyle, Smith, Earle, & LaBrie, 2018).

While the norms for distal referents, such as 'typical' university students, are indeed important (e.g., Krieger et al., 2016), several studies have reported that the norms for more

proximal peers are especially influential (Dumas, Davis, Maxwell-Smith, & Bell, 2018; Graupensperger, Benson, & Evans, 2018; Mallett, Bachrach, & Turrisi, 2009; Yanovitzky, Stewart, & Lederman, 2006). In particular, evidence indicates that the alcohol-related attitudes and opinions of close friends may be the strongest influence on students' alcohol use (Baer, Stacy, & Larimer, 1991; Thombs, Ray-Tomasek, Osborn, & Olds, 2005). Neighbors and colleagues (2008) found that perceived injunctive norms for close friends so strongly predicted alcohol use that the original significant effect of injunctive norms for 'typical' university students was nullified when entered into the regression model. In sum, although typical student norms are often the focus of research, friend-related norms can be especially influential, and are therefore worthy of further study.

Within-Person Variability in Perceived Injunctive Norms

Despite growing evidence that perceptions of friends' approval of alcohol use can shape students' drinking, it remains unclear whether these perceived injunctive norms vary over time. Interventions that target injunctive norms rely on the assumption that injunctive norms can change over time, but natural fluctuations without intervention are not well understood. There are indications that injunctive norms may be dynamic across college. For example, students may experience changes in friend groups due to participating in various extramural activities, changes in living arrangements, or peer group selection to match students' drinking preferences (Meisel & Barnett, 2017; Reifman, Watson, & McCourt, 2006). Changes in peer groups may correspond to changes in injunctive norms, and peer groups as a whole may also shift in drinking norms and patterns over time. Indeed, students' drinking behaviors increase around high-risk events (e.g., football games, spring break) and decrease during demanding academic periods (e.g., Lee et al., 2017; Neal & Fromme, 2007). Despite these indications, it remains unclear whether perceptions of injunctive norms of alcohol use fluctuate, and if so, whether this variability is associated with students' subsequent alcohol use. Such variability has recently been studied with regard to descriptive norms. Dumas and colleagues (2019) found that students engaged in more frequent heavy episodic drinking at timepoints in which they also perceived fellow group members (i.e., friends that drink together) to be engaged in more frequent heavy episodic drinking. Extending this work, an important next step in understanding the etiology of college alcohol use is to examine whether perceptions of injunctive norms vary across time, and whether these within-person changes relate to students' drinking. Determining whether injunctive norms are stable across time, or subject to more proximal influences and fluctuations, will have implications for both theory and intervention.

Current Study

The current study builds on recent evidence that fluctuations in perceptions of descriptive drinking norms have a within-person effect on students' alcohol use (Dumas et al., 2019) by examining within-person associations pertaining to perceived approval of students' close friends. Using a longitudinal approach with four waves of data collected across a single school year, the current study examined associations between injunctive norms and alcohol use at both the between-person level (i.e., aggregated person-means) and the within-person level (i.e., varying across timepoints). A descriptive aim of the current study was to estimate

the within-person variability in students' perceptions of injunctive norms over time. That is, we assessed the extent to which students' perceptions of friends' approval of alcohol use were dynamic across a single year of college. The primary aim was to examine whether within-person variability in perceptions of injunctive norms was associated with students' alcohol use over time, beyond the between-person association that has been demonstrated in cross-sectional studies. Based on recent findings regarding descriptive norms (Dumas et al., 2019), we anticipated that within-person fluctuations in perceptions of injunctive norms pertaining to friends' approval of alcohol use would be positively related to students' drinking behaviors. To provide a rich understanding of these associations we examined several discrete drinking behaviors in separate models: Number of weekly drinks, hazardous drinking behaviors (i.e., quantity or pattern of consumption that places an individual at risk for adverse health consequences), and peak estimated blood-alcohol content (i.e., peak-eBAC). As it pertains to the direction of the norms-behavior association, evidence from a longitudinal study of college sport clubs indicates that perceived injunctive norms prospectively predicted the frequency of students' alcohol use at later timepoints (i.e., conformity; Graupensperger, Turrisi, Jones, & Evans, 2020a). As such, the present study is grounded in the assumption that perceived injunctive norms are a likely precursor to alcohol use.

Method

Participants and Procedures

Participants for the present study were college students who had been randomly assigned to control conditions in two similar randomized controlled trials (RCT). Because the two RCT studies involved nearly identical recruitment, screening, and randomization procedures, and both surveyed participants using similar measures within the same timeframe, we have aggregated the two control samples for the sake of the current study (see Labrie et al., 2013; Larimer et al., 2020). In both RCTs, college students from two universities in the United States were randomly selected and invited via mail and e-mail to participate in initial screening procedures. Both universities are on the west coast; Campus 1 is a mid-sized private university (enrollment of ~6,000 undergraduates) and Campus 2 is a large public university (enrollment of ~30,000 undergraduates). Inclusion criteria included at least one heavy episodic drinking occasion in the past month (i.e., at least four (for female) or five (for males) drinks during a drinking occasion).

In the first RCT study (i.e., RCT-1; Labrie et al., 2013), 11,069 students were invited and 4,818 (43.5%) completed an online screening survey (Campus 1 $n = 1,784$; Campus 2 $n = 3,034$). Of those who completed screening, 2,034 (42%) met the inclusion criteria and were randomized to one of 11 conditions (i.e., $n = 184$ randomized into the control condition). Similarly, the second RCT (i.e., RCT-2; Larimer et al., 2020) invited 5,998 students to complete the screening survey, with 2,688 (44.8%) responding (Campus 1 $n = 1,212$; Campus 2 $n = 1,476$). Of those who completed screening, 1,494 (55.5%) met inclusion criteria and were randomized into six conditions (i.e., $n = 249$ randomized into the control condition). By aggregating the participants in the control groups of both RCTs, the

total sample for the present study was 433 students (54.82% female, M_{age} = 20.06 years at baseline).

Immediately following the screening survey, eligible participants were redirected to an online baseline survey that included questions on demographics, alcohol use, and additional constructs related to alcohol use (e.g., perceived norms). Participants in the current study were in the control conditions of the respective RCTs and did not receive any intervention components. Follow-up surveys were completed at three-, six-, and 12-months after baseline. RCT-1 also included a one-month follow-up survey, which was not currently included for consistency between the two studies. Of the 433 students who completed the baseline survey, there was attrition at each follow-up. Responses were received from 359 (82.9%) participants at three-month, 346 (79.9%) participants at six-month, and 340 (78.5%) participants at 12-month follow-ups, for a total of 1,478 unique responses.

Participation incentives included $15 for the screening survey and $25 for the baseline survey. RCT-1 offered $30 for completing follow-up waves at three and six months, and $40 for completing the 12-month follow-up. RCT-2 offered $25 for the three-month, $30 for the six-month, and $35 for the 12-month follow-ups. Participants also received a bonus incentive for completing all waves ($30 for RCT-1 and $25 for RCT-2). Institutional Review Board approval was obtained from both universities where participants were recruited.

Measures

Demographic items were asked during the screening/baseline survey (e.g., sex). All additional measures for the present study were assessed at each of the four timepoints, and measurement was consistent for all participants across the two campuses and the two RCTs. Participants were shown detailed descriptions of how much alcohol constitutes one standard drink for various types of alcohol (e.g., wine, beer, liquor).

Weekly number of drinks.—Using the Daily Drinking Questionnaire (Collins, Parks, & Marlatt, 1985), participants reported the number of drinks they typically consumed on each day of a typical week in the past month. Values from each day of the week were summed to create an index of how many drinks students consumed across a typical week. The DDQ is frequently employed with college student drinking and has shown consistently strong convergent validity and high test-re-test reliability (Borsari & Carey, 2001; Miller et al., 2002). We recoded extreme values to three standard deviations above the mean to reduce the effect of possibly spurious outliers (Tabachnick & Fidell, 2019).

Hazardous alcohol use.—The Alcohol Use Disorders Identification Test (AUDIT) is a 10-item questionnaire regarding hazardous alcohol use that is commonly used as an early indicator of alcohol use disorders (Saunders, Aasland, Babor, De La Fuente, & Grant, 1993). AUDIT items entail frequency/quantity of alcohol use, alcohol-dependent behaviors, and alcohol-related problems. Scores for each item range from 0 to 4 and are summed to create an index of hazardous drinking behavior (i.e., 0 to 40). The psychometric properties of the AUDIT have been extensively validated for use with college students (e.g., Reinert & Allen, 2007), and the reliability coefficients from the present sample ranged from α = .77 at screening/baseline to α = .82 at 12-month follow-up.

Peak estimated blood-alcohol content (eBAC).—Two items were used to calculate peak-eBAC: (a) the maximum number of drinks consumed on a single occasion within the past 30 days and (b) the number of hours spent drinking on that occasion (Dimeff, Baer, Kivlahan, & Marlatt, 1999). In line with Matthews and Miller (1979), these values were entered into the following formula: [(number of drinks/2) × (gender constant/ body weight)] — (.016 × hours). To reduce the influence of extreme values, scores above 0.40 were recoded to 0.40 (e.g., Martens, Kilmer, Beck, & Zamboanga, 2010).

Perceived Injunctive Norms.—We used Baer's (1994) 4-item measure to assesses perceptions of friends' approval of four specific behaviors: drinking every weekend, drinking every day, driving after drinking, and drinking enough to pass out. Response options ranged from 1 (strong disapproval) to 7 (strong approval). As noted by Neighbors et al. (2008), this operationalization of perceived approval is more comprehensive than single item scales (e.g., Perkins & Berkowitz, 1986) but less onerous than longer scales (e.g., Keefe, 1994). Reliability coefficients ranged from $\alpha = .68$ at screening/baseline to $\alpha = .71$ at three-month follow-up.

Analyses

Preliminary analyses entailed calculating descriptive statistics and examining the extent that attrition was related to alcohol use variables. Given the multilevel nature of these data where responses are nested within participants, zero-order correlations were calculated at both the within- and between-person levels.

Three analytic steps were taken to estimate the within-person variability of study variables across the four timepoints. First, intraclass correlation coefficients (ICC) were computed to estimate the extent that variance in study variables was attributed to between-person differences, relative to variance at the within-person level. One inherent limitation to interpreting ICCs as the sole indicator of within-person variability is that ICCs are study-population based such that the estimates of within-person variability are sensitive to between-person heterogeneity across the sample (Quan & Shih, 1996). The second approach involved calculating the within-subject coefficient of variation (WSCV) for each study variable, which is not sensitive to sample heterogeneity (see Quan & Shih, 1996). WSCV is often used as an index of measurement reproducibility or reliability, but can also be employed to estimate unreliability, or the amount of within-person variability across several measurement points. WSCVs are expressed as a percentage amount of variability around person-mean scores whereby larger values signify greater within-person variability. We specifically calculated WSCV with the recommended variance-stabilizing transformation (i.e., maximum log likelihood estimation; Shoukri, Elkum, & Walter, 2006). The third analytic step involved calculating average within-person standard deviation values for study variables. Note that all three of these approaches are analytically similar and are used descriptively in that they estimate the variability in study variables, but do not entail inferential tests of significance. ICCs were calculated using the 'performance' and 'reghelper' packages in R, while WSCV was calculated using the 'agRee' package (Feng, 2018; Hughes, 2020; Ludecke, Makowski, Waggoner, & Patil, 2020).

Multilevel modeling with maximum likelihood estimation was used to address the primary research question as this approach enabled us to examine the effects of perceived injunctive norms on participants' own alcohol use at both the between- and within-person levels. Although between-person effects are not the focus of this research, they are important to include within the models to disaggregate between-person effects from the within-person effects (Enders & Tofighi, 2007). That is, using person-mean-centering techniques, within-person variables represent deviations from an individual's average perceptions injunctive norms, which reveal how one's own alcohol use may vary with changes in perceived norms.

Separate multilevel models were fit for each of the three indices of alcohol use (i.e., typical weekly drinks, hazardous alcohol use, and peak eBAC) to gather a more nuanced understanding of this association. Multilevel models were fit using a two-step approach. In step one, we included covariates for cohort (i.e., RCT-1 or RCT-2), campus (i.e., private or public), sex, age, and time since baseline. Then in step two, we entered the main effects of perceived injunctive norms. Intercepts were allowed to vary across individuals.

Although there was attrition across the four timepoints, multilevel modeling is flexible when handling missing responses and should yield unbiased estimates assuming data are missing at random (Enders, 2011). Kwok and colleagues argue that even participants who only complete baseline surveys should be retained as their responses contribute to the between-person parameters (Kwok, Underhill, Berry, Elliott, & Yoon, 2008). Whereas peak-eBAC was normally distributed (i.e., skew = 0.59; kurtosis = 2.77), weekly drinks and AUDIT scores are non-negative integers with positively skewed distributions that should therefore be considered count variables (Atkins, Baldwin, Zheng, Gallop, & Neighbors, 2013). We therefore used multilevel Poisson regression in the models predicting weekly drinks and AUDIT scores. In multilevel count regression models, covariates are connected to outcomes via a log link and can be exponentiated to yield rate ratios describing the proportional change in the outcome variable associated with a one-unit increase in the independent variable conditional on random effects. Furthermore, because count variables are often over-dispersed (i.e., variance greatly exceeds the mean), we compared models with and without an over-dispersion term (i.e., using a likelihood ratio chi-square test) to identify the model that best fit our data (Atkins et al., 2013). Moreover, the distribution of AUDIT scores did not include any zeros, so this model was fit using a truncated-Poisson approach. Multilevel modeling was conducted in R using the 'glmmTMB' package (Brooks et al., 2017).

Results

As it pertains to attrition across the four waves, two-sample t-tests revealed that participants with missing waves did not differ from those with complete data on number of weekly drinks ($t = -1.43$, $p = .156$), AUDIT scores ($t = -1.68$, $p = .094$), or peak-eBAC ($t = -0.52$, $p = .605$). As such, missingness was assumed to be at random. Descriptive statistics are displayed in Table 1, and additional descriptive statistics broken down by campus (private/public) and cohort (RCT-1/RCT-2) are available in the online supplemental materials. Multilevel zero-order correlations revealed several notable associations. The three indices of alcohol use behaviors were strongly correlated at the between-person and moderately correlated at the within-person level. Despite these positive correlations, each indicator

of alcohol use holds unique relevance. Perceptions of injunctive norms were positively correlated with typical weekly number of drinks, peak eBAC, and hazardous alcohol use behavior (i.e., AUDIT scores). Between-person correlations indicated that those who typically perceived friends as more approving also typically reported more alcohol use behaviors, while within-person correlations indicated that participants reported engaging in relatively more alcohol use at timepoints in which they reported perceiving their friends as being relatively more approving. Older participants reported lower peak-eBAC but perceived their friends as being more approving of alcohol use. Similarly, age was negatively correlated with AUDIT scores and peak-eBAC. Being female was negatively related to AUDIT scores and number of weekly drinks. Females also perceived their friends as being less approving of alcohol use relative to males.

Within-person Variability

The ICC values displayed in Table 1 indicate that between 50.10% and 84.60% of the total variance in study variables is due to between-person differences. Given that ICCs are calculated by dividing the between-person variance by the total variance (i.e., the sum of between- and within-person variance), it follows that a substantial amount of the total variance in study variables is due to within-person variability. Notably, the ICC value for perceived injunctive norms (i.e., 64.05%) can be interpreted as showing that 35.95% of the total variance is due to within-person variability across the four waves.

We also estimated within-person variability by computing a within-subject coefficient of variation (WSCV) for each study variable. These values indicated that there was substantial variability in all three indices of alcohol use. Central to the present study, it was also revealed that there was substantial within-person variability in perceptions of injunctive norms (WSCV = 20.38%). This estimate indicates that perceptions of injunctive norms varied within-person by over 20% across participants' four responses. Finally, the average within-person standard deviation for perceived injunctive norms was 0.48 (scale ranged from 1 – 7). This indicates that there was fairly wide within-person spread. Taken together, the descriptive estimates of within-person variability revealed that participants fluctuated substantially on their perceptions of friends' approval across the four waves.

Multilevel Models

Estimates from the multilevel models are displayed in Table 2. Initial testing revealed that specifying an over-dispersion term improved model fit for the weekly drinks model ($\chi^2(1)$ = 380, $p < .001$), but not for the AUDIT model ($\chi^2(1) = 0.00$, $p = 1.00$), so we retained an over-dispersed Poisson approach for only the weekly drinks model. Regarding sampling control variables, there were no significant differences between the two study cohorts in any of the alcohol use variables. Participants from the mid-sized private university reported more weekly drinks and higher peak-eBAC values, relative to participants from the large public university. Relative to females, males reported more weekly drinks and higher AUDIT scores. Age was considered a time-varying variable, and older age was associated with lower peak-eBAC values. Similarly, time since baseline had an inverse effect on weekly drinks and peak-eBAC values.

As anticipated, perceptions that friends are generally more approving of alcohol use was positively related to participants' typical levels of weekly drinks, AUDIT scores, and peak-eBAC values (i.e., between-person effects). After accounting for these between-person associations, the models revealed several significant within-person associations. Relative to person-mean levels, participants reported consuming more weekly drinks, higher AUDIT scores, and higher peak-eBAC values at timepoints in which they perceived their friends as being relatively more approving of alcohol use. Interpreting the rate ratio values, this finding indicates that even after controlling for the between-person effect, every one-unit increase in perceived injunctive norms (conditional upon one's intercept) predicted an 8.8% increase in weekly drinks, an 8.9% increase in AUDIT scores, and a .05 increase in peak-eBAC. The pattern of these results held across all three clinically relevant indices of alcohol use.

Discussion

The alcohol-related attitudes of peers can play a central role in shaping college students' alcohol use behaviors. The current study extended our understanding of normative influences on college drinking by studying dynamic properties of perceived injunctive drinking norms. We examined the extent that students' perceptions of injunctive norms among their close friends varied at the within-person level across a single school year, and whether this within-person variability was associated with changes in students' alcohol use. In this sample of college student drinkers, we found descriptive evidence that perceptions of injunctive norms were indeed dynamic in that students' perceptions varied substantially across the four timepoints. Moreover, multilevel models revealed significant within-person associations between perceived injunctive norms and (a) number of weekly drinks, (b) hazardous drinking behavior, and (c) peak-eBAC levels. Students reported heavier alcohol use at timepoints when they perceived their friends as being more approving than usual.

Pertaining to the association between injunctive norms and alcohol use, the current study is the first to our knowledge to disaggregate within-person effects across time from between-person effects that could be ascertained cross-sectionally. While the reported findings are novel and advance the literature on the social etiology of college alcohol use, the results are complementary to a recent study that examined within-person effects of descriptive drinking norms. Dumas and colleagues (2019) specifically reported that students engaged in more frequent heavy episodic drinking at timepoints in which they perceived that their drinking group engaged in more frequent heavy episodic drinking. This is intuitive in that students most often drink alongside the members of their drinking groups, so corresponding fluctuations in descriptive norms would be inherent. However, by extending Dumas' findings to injunctive norms, we strengthen the inference that perceptions of drinking norms are dynamic and that students' drinking behaviors may map onto these within-person fluctuations in perceptions of peer drinking norms.

Although we found evidence that students' perceptions of injunctive drinking norms may be dynamic, the design did not enable us to reveal underlying reasons explaining *why* these perceptions may fluctuate. Alongside evidence that students engage in varying levels of alcohol use at different points across the school year (e.g., exam periods vs. spring break), perceptions of friends' approval may be responsive to certain seasonal effects. An

alternative point to consider is whether fluctuations in perceived injunctive norms may arise as students make new friends or join different social circles. Indeed, perceptions of friends' approval depends entirely on who the student considers to be a friend at that given moment. Members of one's social network are a major influence on an individual's alcohol use, and changes to one's friend group during college can have salient effects on alcohol use behaviors (Meisel & Barnett, 2017). Longitudinal network studies show that, across a single year of college, students' social networks are dynamic and the number of heavy drinking friends is highly variable across time (DeMartini, Prince, & Carey, 2013). That is, the addition of heavy drinkers into one's social network is predictive of increased alcohol use. In a similar study, researchers found that changes in students' drinking was driven more by adding and dropping new friends than behavioral changes among one's current set of friends (Reifman et al., 2006). Reifman and colleagues also noted that both selection and socialization processes appeared to occur, meaning that students chose friends who drank similar amounts but were also influenced by their friends' drinking.

Although the current study found that changes in perceived friends' approval may relate to student drinking behaviors, additional research is needed to further examine factors that contribute to fluctuations in perceived injunctive norms. It also follows that we need a deeper understanding of why students may adhere to injunctive norms more readily at certain timepoints. For example, researchers have reported that sport-playing college students demonstrated greater adherence to team injunctive drinking norms at timepoints in which they identified more strongly with their team (Graupensperger, Turrisi, Jones, Evans, et al., 2020). So, in addition to understanding why perceptions of injunctive norms may fluctuate, future studies should seek to examine why the influence of social norms may be more powerful at given timepoints. Lastly, it is important to consider the timing of how injunctive norms may influence individuals' behaviors. We currently examined contemporaneous associations between injunctive norms and behaviors, but more in-depth longitudinal approaches, such as daily- or weekly-diary designs, could enhance our understanding of nuanced fluctuations in normative perceptions and enable researchers to further disentangle the timing of these effects.

Clinical Implications

The finding that students' alcohol use behaviors may map onto fluctuations in perceptions of injunctive norms holds several implications for norms-based interventions. Notably, personalized normative feedback has had promising short term-effects on students' alcohol use, but reviews have noted that innovation is needed to extend these effects (Cronce & Larimer, 2012). If perceptions of injunctive norms vary across college, then it follows that norms-based approaches may need to be adaptive so that they can map onto these within-person fluctuations. For example, booster sessions may need to be integrated within existing norms-based interventions to account for the variability in students' perceptions of peer approval across college (e.g., Braitman & Lau-Barraco, 2020). If fluctuation in injunctive norms is related to changing friend groups, normative feedback with reference to each new friend group may help to maintain or strengthen intervention effects. For example, as students join new groups such as Greek organizations, group-specific normative feedback may be critical (Larimer, Turner, Mallett, & Geisner, 2004). Providing students

with adaptive normative feedback for multiple groups of close friends, across multiple timepoints, could potentially help students to generalize intervention content across contexts, and more broadly question the assumption that peers approve of heavy drinking. More research is needed to examine these possibilities.

Limitations

The reported findings and their implications should be considered alongside several limitations. Despite employing a longitudinal design to capture within-person effects between perceived injunctive norms and student drinking, causal claims are not warranted. Although there is both theoretical and empirical rationale for the expectation that perceived injunctive norms may be predictive of behavior (Bandura, 1977; Graupensperger, Turrisi, Jones, & Evans, 2020), we acknowledge that this association is complex and may be somewhat bidirectional. For example, researchers have previously reported that perceived injunctive drinking norms and alcohol use may be reciprocally related over time whereby individuals conform to perceptions of peers' approval as well as perceive their own level of alcohol use as being normative and accepted by peers (Lewis, Litt, & Neighbors, 2015). A second potential limitation is that the sample for this study comprised students who reported engaging in at least one occasion of heavy episodic drinking within 30 days before the baseline assessment. Although this subpopulation of college students is the most relevant for understanding social etiology of alcohol use, the findings may not be generalizable to students who do not engage in heavy alcohol use. A third limitation pertains to our current operationalization of injunctive norms. We note that while examining injunctive norms using Baer's (1994) 4-item instrument is justified, other researchers have noted that injunctive norms may be best captured using drink-specific indices of approval (Krieger et al., 2016). Specifically, Krieger and colleagues have argued that asking participants to report the exact number of drinks that peers' view as being acceptable is more closely related to students' alcohol use behaviors. As such, an important future direction is to examine whether drink-based injunctive norms fluctuate at the within-person level in a similar manner to the fluctuations in perceived friends' approval as currently operationalized. A related limitation is that we examined injunctive but not descriptive norms within our models as the primary focus was to examine perception of friends' approval to build on recent work by Dumas and colleagues (2019). There is nevertheless evidence that injunctive and descriptive norms may have complex interactive effects such that descriptive drinking norms are more strongly predictive of personal consumption for those who perceived their peers as being more approving of alcohol use (Lee et al., 2007). So, while integrating descriptive norms was beyond the scope of the current study, future studies should consider designs that can provide rich insights into the complex interactions between descriptive and injunctive norm, and whether these two constructs fluctuate together. Finally, the current study was limited to injunctive norms pertaining to close friends, and we were unable to capture *overestimations* of friends' actual approval of alcohol use. Doing so would require knowing who each participants' friends were and how approving each of these friends actually was. Future research would benefit from longitudinally sampling participants' proximal peers (i.e., social network designs) to accurately estimate how approving participants' friends are of alcohol use behaviors at different timepoints across the school year. By doing so, future studies can discern whether college students' friends *actually* fluctuate in alcohol

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use approval or if it is simply students' *perceptions* of peers' approval that fluctuates. This future step is important for informing translational strategies that employ friend-specific norms-based strategies within peer groups.

Conclusion

Findings from the current study provide descriptive evidence that students' perceptions of injunctive norms pertaining to friends' approval of alcohol use are dynamic in that they fluctuate across the school year. We also found evidence that within-person changes in students' drinking map onto fluctuations in perceptions of injunctive norms, even after accounting for between-person effects. Taken together, these results extend our theoretical understanding of normative influences on college alcohol use and may hold important implications for norms-based approaches to reducing alcohol-related harm.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgements:

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Table 1.

Zero-order correlations, descriptive statistics, intraclass correlation coefficients, and within-subject coefficients of variation.

	1	2	3	4	5
1. Weekly Drinks (DDQ)[1]	—	.39***	.38**	.11***	-.04
2. AUDIT	.71***	—	.29**	.18***	-.07*
3. Peak-eBAC[2]	.60***	.60***	—	.08**	-.10***
4. Friends Approval	.47***	.41***	.26***	—	-.02
5. Age	-.04	-.03	-.19***	.12*	—
6. Sex (M=0, F=1)	-.33***	-.26***	.03	-.25***	-.09
Mean	10.72	9.66	.15	2.83	20.59
Standard Deviation	9.63	4.78	.09	0.96	1.41
Range	0 - 45	2 - 34	.00 - .40	1 - 6.75	18 - 25
Between-Person Variability (ICC)	84.60%	58.20%	50.10%	64.05%	—
Within-Subject Coefficient of Variation	55.67%	25.65%	46.41%	20.38%	—
$CI_{95\%}$ LL	50.07%	23.13%	42.97%	19.27%	—
$CI_{95\%}$ UL	62.52%	28.63%	50.31%	21.57%	—
Within-Person Standard Deviation	3.86	2.03	0.06	0.48	

Note: Between-person level correlation coefficients are shown below the diagonal and within-person correlation coefficients are shown above the diagonal.

[1] Extreme values were recoded to three standard deviations above the mean (Tabachnick & Fidell, 2019).

[2] Calculated as: $[(\text{\# of drinks}/2) \times (\text{gender constant}/ \text{body weight})] - (.016 \times \text{hours})$ — and extreme values were recoded to 0.40. ICC = Intraclass correlation coefficients.

*
$p < .05$

**
$p < .01$

***
$p < .001$.

Table 2.

Multilevel models examining associations between perceived friends' approval and indices of alcohol use.

	Weekly Drinks (DDQ)[1]				AUDIT[1,2]				Peak-eBAC		
	Rate Ratio	CI$_{95\% \text{ LL}}$	CI$_{95\% \text{ UL}}$	p-value	Rate Ratio	CI$_{95\% \text{ LL}}$	CI$_{95\% \text{ UL}}$	p-value	β	SE	p-value
Step 1: Control Variables											
Cohort (RCT-1=0, RCT-2=1) γ^{01}	1.115	0.955	1.300	.168	1.007	0.928	1.093	.866	.00	.04	.999
Campus (Private=0, Public=1) γ^{02}	0.804	0.687	0.940	.007	0.926	0.852	1.007	.072	−.10	.04	.014
Sex (M=0, F=1) γ^{03}	0.598	0.513	0.697	<.001	0.784	0.722	0.851	<.001	.01	.04	.823
Age γ^{10}	0.990	0.941	1.042	.704	0.986	0.958	1.015	.341	−.11	.04	.005
Time (months since baseline) γ^{20}	0.992	0.985	0.999	.033	0.998	0.993	1.003	.396	−.06	.02	.009
			$R^2 = .087$				$R^2 = .096$				$R^2 = .033$
Step 2: Main Effects											
Friends Approval (*BW*) γ^{04}	1.547	1.423	1.666	<.001	1.235	1.180	1.292	<.001	.26	0.04	<.001
Friends Approval (*WI*) γ^{30}	1.088	1.034	1.144	.001	1.089	1.049	1.130	<.001	.05	0.02	.015
		$R^2 = .236$;	$R^2 = .149$		$R^2 = .275$;	$R^2 = .179$			$R^2 = .096$;	$R^2 = .063$	

Note: *BW* = Between-person level (i.e., aggregated person means). *WI* = Within-person level (i.e., person-mean centered).

[1] Because weekly drinks and AUDIT scores are skewed count variables, Poisson count regression was used to estimate rate ratios (i.e., RR) representing proportional change for each unit increase in the predictor (e.g., RR of 1.10 = 10% increase for each unit change in the independent variable).

[2] Because the distribution of AUDIT scores did not include any zeros, this model was fit using a truncated-Poisson approach.