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## Different digital paths to the keg? How exposure to peers' alcohol-related social media content influences drinking among male and female first-year college students

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### Abstract

Despite speculation that peers' alcohol-related content on social media sites (SMS) may influence the alcohol use behaviors of SMS frequenting college students, this relationship has not been investigated longitudinally. The current prospective study assesses the relationship between exposure to peers' alcohol-related SMS content and later-drinking among first-year college students. Among 408 first-year students, total exposure to peers' alcohol-related content on Facebook, Instagram, and Snapchat during the initial 6 weeks of college predicted alcohol consumption 6 months later. The rather robust relationship persisted even after students' and close friends drinking were accounted for, indicating that alcohol references on SMS do *not* simply reflect alcohol use behaviors that would otherwise be observed in the absence of SMS and be predictive of later alcohol use. Findings also illuminate important gender differences in the degree to which peers' alcohol-related SMS content influenced later drinking behavior as well as psychological mediators of this relationship. Among females, enhancement drinking motives and beliefs about the role of alcohol in the college experience fully mediated the relationship between SMS alcohol exposure and later drinking. Males, however, evidenced a much stronger predictive relationship between SMS alcohol exposure and second semester drinking, with this relationship only partially explained by perceptions of drinking norms, enhancement drinking motives, and beliefs about the role of alcohol in the college experience. Implications of these findings for college drinking prevention efforts and directions for future research are discussed.

### Keywords

College student drinking; Social media; Social influence; Gender differences; Mediation analysis

## 1. Introduction

Recent research confirms that social media sites (SMS) have become important mediums for college students to showcase their risky drinking behaviors, align themselves with the college drinking culture, and establish an online culture that normalizes and glamorizes binge drinking (Griffith & Casswell, 2010; Ridout, Campbell, & Ellis, 2011; Hebden, Lyons, Goodwin, & McCreanor, 2015). In fact, a content analysis of 225 undergraduate males'

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Facebook profiles found alcohol references to be present in 85% of the profiles (Egan & Moreno, 2011) and as many as one-third of undergraduates self-report having posted a picture depicting alcohol use on a SMS (Morgan, Snelson, & Elison-Bowers, 2010). These displayed alcohol references are likely to have a wide reach to students' peers as more than 94% of first-year college students in the U.S. use at least one SMS (Sponcil & Gitimu, 2012). The vast majority of first-year students report daily use of multiple SMS platforms (Lenhart, 2015) and boast peer networks far exceeding numbers of off-line friends (Moreno et al., 2014). Although researchers have just begun to tackle questions at the intersections of college, SMS, and alcohol use, two questions continue to merit attention: Do peers' references to alcohol on SMS influence college students' own alcohol-related cognitions and decisions? And, if the answer is yes, how does this occur?

### 1.1. Traditional Media influences on college drinking

A large body of research has demonstrated that media can be a powerful source of influence on behavior, particularly among adolescents and young adults (for a review see Fischer, Greitemeyer, Kastenmüller, Vogrincic, & Sauer, 2011). Social Learning Theory (Bandura, 1977) and Expectancy-Value Models (Ajzen & Fishbein, 1972; Stacy, Widaman, & Marlatt, 1990) similarly predict that those who observe media characters engaging in behaviors such as alcohol use without experiencing negative consequences will be more likely to adopt these same behaviors. Indeed, studies have shown that exposure to substance use in traditional media, such as television and movies, is associated with initiation of these behaviors.

(Dal Cin et al., 2009; Gibbons et al., 2010). Researchers have also identified various psychological mediators that explain the relationship between exposure to alcohol in traditional media and alcohol consumption. Most germane to the discussion of college drinking culture, Osberg, Billingsley, Eggert, and Insana (2012) demonstrated that exposure to popular college-alcohol-themed movies (e.g., *Old School*, *Animal House*) prior to college influenced alcohol use during the freshman year. Importantly, researchers identified perceptions of descriptive and injunctive drinking norms, beliefs about the role and salience of alcohol in the college experience, and alcohol expectancies, to be the mechanisms by which alcohol-themed movie exposure influenced students' alcohol use.

### 1.2. Social Media influences on college drinking

Similar to its depiction in movies like *Animal House* and *Old School*, risky drinking is often glorified and glamorized by college students on SMS (Niland, Lyons, Goodwin, & Hutton, 2014; Hebden et al., 2015; Lyons, Goodwin, McCreanor, & Griffin, 2015; Beullens & Schepers, 2013). The most recent studies confirm that college students use SMS to reconstruct negative and risky drinking practices into positive and highly valued outcomes (Hebden et al., 2015; Lyons et al., 2015), in essence, "air-brushing" away any notion of negative consequences associated with risky drinking (Niland et al., 2014). Unfortunately, research suggests that young adult viewers are likely to buy into these misrepresentations; viewing peers' air-brushed SMS posts as accurate representations of their offline experiences (Moreno, Briner, Williams, Walker, & Christakis, 2009). However, to date, no longitudinal studies have definitively linked SMS alcohol exposure to later drinking among

college students and only a few studies have explored psychological mechanisms by which SMS alcohol depictions by peers may influence alcohol consumption. In experimental studies, manipulated exposure to alcohol-related content on fabricated peer Facebook profiles has predicted inflated perceptions of descriptive drinking norms for adolescents peers (Litt & Stock, 2011) and typical students at the same university (Fournier, Hall, Ricke, & Storey, 2013). Given the importance of social norms-based interventions in efforts to reduce alcohol-related risks among college students (Reid & Carey, 2015; Borsari & Carey, 2003), these findings suggest that a richer understanding of the connection between SMS and college drinking and how this connection operates could prove fruitful to improving existing prevention efforts. Shifting focus to unanswered questions and gaps in the literature may lead to a more complete understanding of the role of SMS in college drinking.

**1.2.1. Would the same alcohol influence occur in the absence of SMS?**—Given the ubiquity of alcohol on college campuses, a variable portion of college students' total exposure to alcohol references on SMS may simply reflect offline drinking behaviors within a student's close peer group. As such, it may be necessary to make a distinction between offline-redundant exposure to alcohol-related SMS and the more meaningful portion of SMS alcohol exposure, which is unique to the SMS environment in that it would *not* otherwise be encountered in daily life, such as alcohol depictions from extended network peers.

**1.2.2. SMS beyond Facebook?**—Researchers have almost exclusively focused on Facebook in studying how SMS may reflect and perpetuate college drinking culture. However, although Facebook remains the most widely owned SMS among college students, mobile photo and video sharing applications Instagram and Snapchat have become increasingly popular among college students, with many students checking, posting, and using these platforms to interact with peers more frequently than Facebook (Lenhart, 2015). Studies have yet to investigate Instagram and Snapchat despite unique features (e.g., disappearing posts on Snapchat, photographic enhancement filters on Instagram) that may make these platforms especially attractive SMS for posts depicting alcohol misuse and other risk behaviors. Determining the total and relative influences of peers' alcohol-related content on Facebook, Instagram, and Snapchat will best inform college drinking prevention efforts.

**1.2.3. Additional mediators of SMS influence?**—Although perceptions of drinking norms are well-established predictors of drinking among college students (Borsari & Carey, 2003), it seems unlikely that perceptions of descriptive norms are the sole mediators of SMS alcohol influence. The college movie-alcohol mediators identified by Osberg et al. (2012) are suggestive of additional variables that may explain how peers' alcohol depictions on SMS influence college student's alcohol-related cognitions and decisions.

**1.2.4. Gender differences in SMS influence?**—Studies indicate that females use SMS more frequently than do males (Duggan, 2013) but males are more likely than females to post risky photos and text containing references to sex and alcohol (Peluchette & Karl, 2008). Further, females typically use SMS to communicate with friends and maintain close relationships established off-line while males primarily use SMS for information-seeking, entertainment, and making new social connections (Barker, 2009; Muscanell & Guadagno,

2012). In light of these gender differences, it seems likely that college men and women may also differ in the frequencies with which alcohol-related SMS posts by peers are observed, the degree to which observations influence drinking behaviors, and the mediators of such influence.

### 1.3. The current study

The current research aims to advance the understanding of alcohol-related SMS influence among college students by addressing these remaining questions. This prospective study examines how exposure to alcohol-related SMS content by peers (i.e., Facebook + Instagram + Snapchat) during the initial six weeks of college (T1) may influence viewers' alcohol consumption during the second semester of college (T2). In order to hone in on the unique component of SMS alcohol exposure associated with the behavior of extended network peers, we control for the variability in second semester drinking (T2) that can be predicted by students' own drinking as well as the alcohol use of close friends during the first six weeks of college (T1). Further, seeking to test psychological mediators that may explain any potential SMS alcohol exposure-alcohol consumption link, we focus on two of the college movie-alcohol mediators identified by Osberg et al. (2012), perceptions of descriptive drinking norms and beliefs about the role of alcohol in college life. Also, examined in this study are enhancement drinking motives (Cooper, 1994), a mediator closely related to positive alcohol expectancies (Scott-Sheldon, Terry, Carey, Garey, & Carey, 2012; O'Hara, Armeli, & Tennen, 2014) and widely speculated to play a role in alcohol influences associated with both traditional media (Osberg et al., 2012) and SMS (Westgate, Neighbors, Heppner, Jahn, & Lindgren, 2014).

Finally, in recognition of documented gender differences in SMS use, gender is tested as a potential moderator of both the overall relationship between exposure to peers' SMS content and later alcohol use (i.e., direct effect), as well as potential mediators of this relationship (i.e., indirect effects). Table 1 presents an overview of the four exploratory research questions investigated in this study.

## 2. Method

### 2.1. Participants

Participants were 412 first-year students at a private, mid-sized university on the west coast of the United States. Students in this sample were initially recruited during the summer prior to matriculation to take part in a larger study about the transition to college. The primary goal of the larger study was to evaluate the efficacy of a brief alcohol communication intervention session delivered to parents at summer orientation sessions. The majority of participants in the current sample had parents assigned to control arms of the intervention study while roughly 30% of student participants had parents who received the intervention session. No significant associations were found between parental condition assignment in the larger study and any of the student social media or alcohol-related variables at the data points utilized in the present investigation. As such, the current study focuses exclusively on the social media and alcohol-related perceptions and behaviors reported by all students in the larger parent study completing online surveys 25–50 days into their first semester (T1;

September–October) and 55–80 days into their second semester of college (T2; February–March). Of the original pre-matriculation sample of 534 students, 514 students went on to attend both fall and spring semesters at the university. Of these participants, 82.6% completed the T1 survey (N = 441) and 80.1% completed both T1 and T2 surveys (N = 412). The sample was representative of the freshman class. The mean age at T1 was 18.10 years (SD = .43), 64% were female, 54% were Caucasian, 11% were Asian, 9% were African American, 22% were Hispanic, and 4% were multi-racial or other.

## 2.2. Procedure

The university's registrar initially provided contact information for all incoming students, which, along with all other procedures and measures were approved by the university's Institutional Review Board. Potential participants were initially contacted via email and mailed invitation letters during May prior to their scheduled matriculation on campus. Based on the criteria for the larger parent intervention study, students had to be single (i.e., not married), under the age of 21, residing with at least one parent or guardian, and planning to attend summer orientation with a parent to be eligible for inclusion in the study. Students who completed the pre-matriculation assessments were emailed links to complete follow-up surveys approximately one month into their fall semester (T1) and approximately 6 weeks into their second semester (T2). Participants received nominal compensation for completing each online survey.

## 2.3. Measures

**2.3.1. Frequency of checking Facebook, Instagram, and Snapchat**—Parallel items asked participants to report the frequency with which they typically “check” Facebook, Instagram, and Snapchat. Participants selected from 7 frequency of use response options: “Do not have an Account”, “Once a month or less”, “2–3 times per month”, “1–3 times per week”, “4–6 times per week”, “1–3 times per day”, “4–6 times per day”, “7 or more times per day”. In order to create more meaningful frequency of use variables, for each SMS students who did not have an account were coded “0” those who checked respective accounts at least monthly were coded 1 to represent sporadic use, those who checked weekly were coded 2 to represent regular weekly use, 1–3 times per day were coded 3 to represent daily use, and 4+ times per day were coded 4 to represent heavy daily use.

**2.3.2. Frequency of Seeing Alcohol-Related Content on Facebook, Instagram, and Snapchat**—Participants using each SMS platform were asked to report the frequency with which they see text or pictures posted by peers related to alcohol, drinking, being drunk or hung-over when they check that specific platform. Instructions encouraged students' to check their SMS accounts to aid them in answering these questions. Response options for each item were *Never* (0), *Rarely* (1), *Occasionally* (2), *Often* (3), *Always* (4).

**2.3.3. Exposure to Peers' Alcohol-Related SMS Content**—Participants' frequencies of seeing alcohol-related content on each SMS were weighted by their frequency of checking that specific SMS so that platform-specific alcohol exposure scores ranged from 0 to 16. A total exposure to peers alcohol-related SMS variable was computed by summing individual platform exposure scores.

**2.3.4. Close college friends' alcohol use**—A previously published three-item scale (Abar & Turrisi, 2008) assessed alcohol use among students' close college friends at T1. Participants approximated numbers of close friends that drink alcohol, get drunk on a regular basis, and drink primarily to get drunk, using a 5-point scale from 0 (*None*) to 4 (*All*). Internal consistency was high ( $\alpha = .85$ ) and summing across items created composite scores ranging from 0 (*No Friend Alcohol Use*) to 12 (*High Friend Alcohol Use*).

**2.3.5. College Alcohol Beliefs**—Beliefs about the role and salience of alcohol in the college experience were assessed at T1 by the College Life Alcohol Salience Scale (CLASS; Osberg, Insana, Eggert, & Billingsley, 2011). Participants were asked to rate their level of agreement from 1 (*Strongly Disagree*) to 5 (*Strongly Agree*) with fifteen beliefs about the role of alcohol in college life. Example items include: “A college party is not a true college party without alcohol”, and “missing class due to a hangover is part of being a true college student”. Internal consistency was high ( $\alpha = .85$ ) and responses were averaged to determine the extent that participants believed alcohol to be a significant aspect of college life.

**2.3.6. Enhancement Drinking Motives**—Reasons for drinking to enhance positive affect, such as, to have fun, were measured by the Enhancement Motives subscale from the Drinking Motives Questionnaire-Revised (DMQ-R; Cooper, 1994). In light of college students' tendency to cast alcohol use in a positive light on SMS, enhancement drinking motives were assessed as a mediator given their close relationship to positive alcohol expectancies (O'Hara et al., 2014). Students reported the frequency with which they drank for enhancement purposes on a scale ranging from 1 (*Almost never/Never*) to 5 (*Almost always/Always*). Items demonstrated high internal consistency ( $\alpha = .89$ ) and were summed to compute an enhancement drinking motives score.

**2.3.7. Perception of Typical Student Peak Drinks on One Occasion**—Perceptions of how much other students at the same university drink was assessed by asking participants to estimate the maximum number of drinks a typical first-year student, of their same-sex, drinks during any one drinking occasion.

**2.3.8. Weekly Drinks**—Weekly drinking quantity was assessed at both T1 and T2 using a modified version of the Daily Drinking Questionnaire (DDQ; Collins, Parks, & Marlatt, 1985; Dimeff, Baer, Kivlahan, & Marlatt, 1999). Participants were asked to think about a typical week during the last 30 days and estimate the number of drinks they consumed on each day. Responses were aggregated across drinking days to create an overall weekly drinks score.

## 3. Results

### 3.1. Analytic plan & missing data

Table 1 provides an overview of the exploratory research questions and indicates the analytic strategies employed to test each question. To prepare data for analysis, all variables were initially inspected for both missing data and normality. Missing data were minimal as only 1.2% of cases (4 of 412) evidenced any missing data across the T1 and T2 variables of focus. Listwise deletion resulted in a final sample of 408 across analyses. While the majority



of variables did not diverge from normality, skew in drinks per week at both T1 and T2 were reduced by setting extreme values at two standard deviations from the mean (Wilcox, 2005).

### 3.2. Univariate analyses

First, t-tests examined gender differences in the frequency of checking each SMS platform and exposure to peers' alcohol-related content (RQ1). As shown in Table 2, compared to males, females reported both checking Instagram and Snapchat more frequently and seeing content from peers' related to alcohol on these platforms more frequently. Combining across SMS platforms, females ( $M = 12.48$ ;  $SD = 8.37$ ) greatly exceeded males ( $M = 8.93$ ;  $SD = 7.25$ ) in their overall exposure to peers' alcohol-related SMS content. Additionally, within gender groups, there were similar patterns in the frequencies with which males and females both checked and encountered alcohol-related content comparing across Facebook (least frequently) Instagram (slightly more frequently), and Snapchat (most frequently). Further, an examination of bivariate relationships (Table 3) between T2 drinking and exposure to alcohol across the individual SMS platforms evidenced Snapchat alcohol exposure to be most strongly related to T2 drinking, followed by Instagram then Facebook. However, Snapchat alcohol exposure was also most closely related to own and close friends drinking at T1, potentially reflecting the fact students reported much smaller peer networks on Snapchat, than they did on Instagram and Facebook. Multivariate analyses focused on total alcohol exposure across the three platforms and controlling for the variability in T1 SMS alcohol exposure associated with drinking among close friends that would be otherwise encountered in the absence of SMS.

### 3.3. Multivariate analyses

An initial hierarchical multiple regression model tested RQ2, whether SMS alcohol exposure at T1 (RQ2a, entered in model step 2), or the SMS alcohol-exposure \* gender interaction (RQ2b, entered in model step 3) predicted drinks per week at T2, after controlling for participants' T1 drinks per week and close friends alcohol use (covariates entered in model step 1). As shown in the top of Table 4, there was a significant main effect as well as a significant exposure \* gender interaction. Plotting T2 alcohol use as a function of T1 SMS alcohol-exposure and gender revealed that the strength of the association was enhanced among males, relative to females (Fig. 1). However, tests of the simple slopes (Aiken & West, 1991) indicated that the slopes of both lines significantly differed from zero, meaning that there were significant relationships between T1 SMS alcohol exposure and T2 drinking for both genders; the relationship was just notably stronger among male students.

Next, parallel regression models featuring the same predictors in each model step examined the three theorized mediators, perceptions of descriptive drinking norms, college alcohol beliefs, and enhancement drinking motives, as individual outcome variables (RQ3a and RQ3b). After controlling for own and close friends alcohol use at T1, SMS alcohol exposure predicted significant variability in all three theorized mediators (Table 4). There was also a significant SMS alcohol exposure exposure \* gender interaction in the model predicting perceptions of the peak drinking descriptive norm whereby the relationship between SMS alcohol exposure and perceptions of the descriptive drinking norm was only significant among male students (Fig. 2).

### 3.4. Tests of moderated multiple mediation

Bootstrap tests of moderated multiple mediation were performed using the PROCESS macro in SPSS (Preacher & Hayes, 2008; Hayes, 2009). The specific model tested (PROCESS Model 8), known as a First Stage and Direct Effect Moderated Mediation Model (Edwards & Lambert, 2007; Fig. 3), was informed by the gender-moderated relationships between T1 SMS alcohol exposure and both T1 perceptions of the peak drinking descriptive norm (first stage) and T2 drinks per week (total effect) evidenced through the individual regression models. Appropriately, the model estimated conditional direct and indirect effects among male and female students. Recommended guidelines for testing mediation using the Preacher and Hayes method were followed (e.g., 5000 bootstrap samples and bias corrected confidence intervals; Hayes, 2009; Preacher & Hayes, 2008). Bootstrapped point estimates, standard errors, and confidence intervals for conditional direct and indirect effects among male and female students are presented in Table 5. Among female students, college alcohol beliefs and enhancement motives fully mediated the relationship between SMS alcohol exposure at T1 and drinks per week at T2. In contrast, among males, although significant indirect effects were observed for all three mediators, perceptions of the peak drinking descriptive norm, college alcohol beliefs, and enhancement drinking motives, only partially mediated the (compared to females significantly stronger) relationship between SMS alcohol exposure at T1 and drinks per week at T2. Indices of moderated mediation (Hayes, 2014) indicated that only the indirect effects for perceptions of the peak drinking descriptive norm differed by gender, as it was only a significant explanatory variable among males. Fig. 3 depicts the supported moderated mediation model, and provides separate unstandardized coefficients for males (normal font) and females (italicized) for the moderated first stage and direct effect paths.

## 4. Discussion

Among both male and female college freshman, exposure to alcohol-related SMS content during the initial 6 weeks of college predicted alcohol consumption 6 months later. Moreover, the rather robust relationship persisted even after students' and close friends drinking were accounted for, indicating that alcohol references on SMS do *not* simply reflect alcohol use behaviors that would otherwise be observed in the absence of SMS and be predictive of later alcohol use. In contrast, our findings demonstrate that exposure to alcohol references on SMS exceed these offline interpersonal influences in predicting first to second semester drinking patterns among underage college freshman.

Beyond this overall effect, findings also illuminate important gender differences in the degree to which peers' alcohol-related SMS content influenced later drinking behavior as well as mediators of this relationship. Compared to females, males evidenced a much stronger predictive relationship between first semester SMS alcohol exposure and second semester drinking. The direction of the gender difference was unexpected given that female students reported checking SMS significantly more frequently than males, and as a result of this more frequent use, had significantly greater exposure to peers' alcohol-related SMS content. Findings may reflect previous research suggesting that women's online behavior is more interpersonally oriented (e.g. maintaining established relationships), while men's



behavior is more task and information oriented (e.g. reading the news, seeking information; Barker, 2009; Muscanell & Guadagno, 2012). Because a considerable task for a college freshman during the first weeks on campus is to become knowledgeable about the social environment and make new friends (Moreno et al., 2009) male students may use SMS to gather social information about extended network peers and learn about campus culture to a greater degree than do females, subsequently reading further into glorified alcohol depictions. In contrast, females may pay little attention to the same images in their newsfeeds as they engage in relationship maintenance behaviors with close SMS friends. Alternatively, SMS alcohol posts may be particularly salient for heavier drinking males or males who think alcohol is important to their college experience as these posts may reinforce their own drinking, attitudes and beliefs.

Among female students, the comparatively weaker SMS alcohol exposure-alcohol use link was fully explained by college alcohol beliefs and enhancement drinking motives, while the third mediator tested, perceptions of the peak drinking descriptive norm, was not related to SMS alcohol exposure. Although students' own frequencies of posting alcohol-related SMS content were not assessed in this study, previous research suggests that males are more likely to reference risk behaviors and model alcohol use on SMS than are females (Peluchette & Karl, 2008). Consistent with this notion, perceptions of the peak drinking descriptive norm, college alcohol beliefs, and enhancement drinking motives were all significant mediators of the comparatively stronger relationship among male students. However, after accounting for these mediators, a sizeable SMS alcohol exposure-alcohol use association persisted. The sizeable leftover effect suggests additional explanatory variables not identified in this study may be unique to the male SMS experience.

#### 4.1. Implications

As the first 6 weeks of college have been identified as a critical period particularly influential to college students' alcohol use trajectories (NIAAA, 2002), the overall relationship between alcohol-related SMS content observed during this time and later alcohol use is particularly concerning and may carry important implications for prevention and intervention efforts. If universities fail to confront students' glamorized portrayals of alcohol use on SMS, these images may undermine the efficacy of popular university alcohol education programs which aim to deter risky drinking by emphasizing negative alcohol-related consequences (Mallett et al., 2012) teaching protective behavioral strategies to avoid harm (Kenney, Napper, LaBrie, & Martens, 2014) and correcting misperceptions of alcohol use norms on campus (Borsari & Carey, 2003).

In the context of this study's findings, strategic interventionists might attempt to decrease students' exposure to positive alcohol portrayals on SMS through innovative SMS campaigns that simply reward students for posting non-alcohol-related content. For example, college health interventionists could borrow from the user-generated content challenges employed by big name consumer brands on SMS where loyal consumers are prompted to post images of themselves engaging in particular behaviors accompanied by brand relevant "hashtags" for chances to win prizes. To the extent that a similar University-sponsored SMS challenge could diminish the salience of peers' alcohol-related SMS content by motivating

students to flood SMS newsfeeds with photos of themselves engaging in non-alcohol related behaviors our findings suggest that perceptions of how much other students drink, beliefs about the role of alcohol in college, and enhancement motives for drinking may also be diminished, subsequently reducing alcohol-related risk among first-year students.

This is also the first study to explore alcohol-related content on Instagram and Snapchat in relation to alcohol use. Compared to Facebook, Snapchat and Instagram were more frequently home to alcohol-related posts, and exposure to alcohol-related content on these emerging platforms were more strongly related to viewers' current and future alcohol consumption. Examining the features of these networks, Instagram's attractive photographic filters and effects may make it particularly easy to "air-brush" (Niland et al., 2014) and glamourize alcohol-use. Likewise, Snapchat's unique disappearing post feature may assure students that there will be no lasting proof of their alcohol misuse. Thus, while a number of researchers have explored the feasibility of Facebook-based alcohol interventions for college students (Ridout & Campbell, 2014; Moreno et al., 2014), data from this study suggest that college students may be better reached through Instagram and Snapchat, and if ignored, alcohol depictions on Snapchat and Instagram may even thwart Facebook-based prevention efforts.

#### 4.2. Limitations and directions for future research

This study is not without limitations. Findings are specific to incoming students from a single university and suggest the need for further studies employing more diverse cohorts of college students. Additionally, this prospective study was limited in that both exposure to peers' alcohol-related SMS content and theorized mediators were assessed concurrently at T1 and were jointly examined as predictors of alcohol consumption at T2. A stronger design would include an additional data-point for the assessment of theorized mediators between the assessment of SMS alcohol exposure at T1 and alcohol consumption at T2. Limited to concurrent assessment of the predictor and mediator, mediational analyses (Preacher & Hayes, 2008) require the assumption that exposure to alcohol-related SMS content during the first weeks of college informed students' perceptions of drinking norms, college alcohol beliefs, and drinking motives, all which then influenced later drinking (i.e, SMS alcohol exposure → psychological mediators → alcohol consumption). This logical ordering is consistent with previous findings pertaining to SMS alcohol exposure and perceptions of drinking norms (Litt & Stock, 2011; Fournier et al., 2013). It is possible, however, that students' perceptions of drinking norms, college alcohol beliefs, and enhancement drinking motives at T1 actually occurred first in time and influenced how much alcohol-content they perceived their peers to post on SMS at T1. Directionality should be clarified by future prospective studies that assess variables across 3 time-points. In addition, due to concerns for students' privacy, exposure to peers' SMS alcohol content and students' own alcohol consumption were assessed via self-report. Limitations associated with self-report assessments should be remedied by future research which uses more sophisticated methods to capture and code students' actual social media newsfeeds, and objectively assess students' alcohol use behaviors (e.g., transdermal alcohol monitoring, etc.)

Identification of additional psychological mediators unique to the SMS experiences of male students remains an important direction for future research as they may provide important additional implications for prevention efforts. As previous studies have found that males post alcohol-related content more frequently than do females, observing positive female feedback in response to males' alcohol images (e.g. "Likes", positive comments) may contribute to reflective norms, or perceptions of how much female students desire male students to drink. Observed positive female feedback could also be related to positive alcohol expectancies associated with social and sexual enhancement among male students. Neither reflective drinking norms nor alcohol expectancies were assessed in this study and remain interesting potential mediators for future investigations. Additionally, following studies documenting the unique contribution of implicit alcohol associations to the prediction of college drinking (Lindgren et al., 2015; Houben & Wiers, 2008), it will be important for future research to examine implicit alcohol cognitions, in addition to explicit cognitions, as they relate to exposure to peers' alcohol references and images on SMS.

### 4.3. Conclusions

This prospective study advances efforts to understand if and how peers' alcohol-related content on social media contributes to college student drinking. Consistent with previous research documenting college students' frequently recording their risky drinking behaviors on SMS (Moreno et al., 2014) first-year students in this study reported observing alcohol-related content posted by peers on Facebook, Instagram, and Snapchat. Exposure to this content during the first 6 weeks of college predicted their own alcohol consumption 6 months later, even after controlling for students' and close friends initial drinking. Male students evidenced a much stronger predictive relationship between first semester SMS alcohol exposure and second semester drinking than did females. Further, perceptions of descriptive drinking norms, college alcohol beliefs and enhancement drinking motives, only partially explained the stronger relationship among male students. Findings are suggestive of a number of important new directions for future research and encourage interventionists to incorporate popular SMS platforms, especially Instagram and Snapchat, into college drinking prevention efforts as a means of mitigating the influence of peers' alcohol-related SMS content.

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**HIGHLIGHTS**

- Alcohol on Instagram and Snapchat may be more influential than that on Facebook.
- Exposure to peers' alcohol-related posts predicted students' drinking 6 months later.
- The relationship was stronger among male students.
- College alcohol beliefs, drinking norms and motives were partial mediators.



**Fig. 1.** Drinks per week at T2 as a function of exposure to others' alcohol-related SMS posts at T1 and gender.



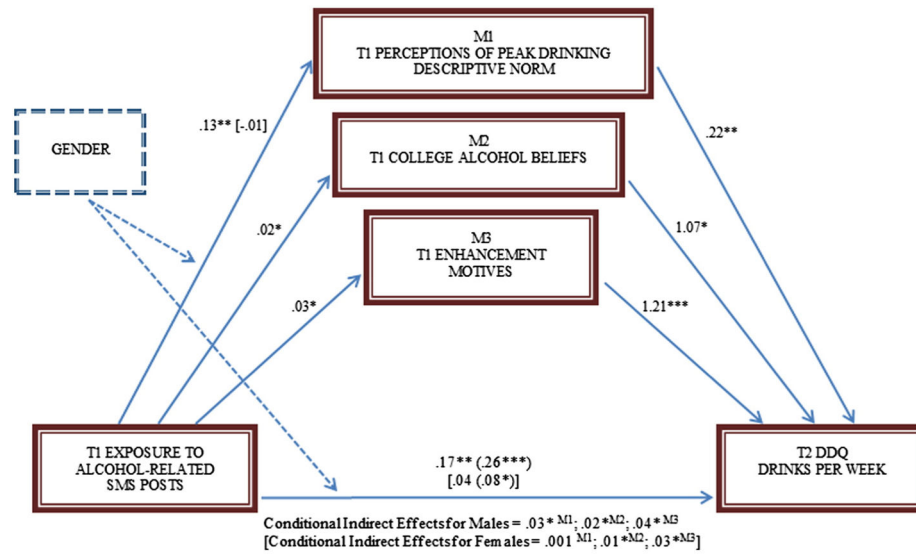
**Fig. 2.** Perception of the peak drinking norm at T1 as a function of exposure to others' alcohol-related SMS posts at T1 and gender.

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**Fig. 3.** Supported moderated multiple mediation model (N = 408). All paths control for drinks per week and close friends' alcohol use at T1.

**Table 1**

Data analytic plan: Research questions investigated via univariate t-tests (1), hierarchical regression models with tests of simple slopes (2), and bootstrap tests of moderated multiple mediation (3).

	<b>Research question</b>	<b>Analytic strategy</b>
RQ1	Are there gender differences in students' T1 exposure to peers' alcohol-related content on FB, IG, or SC?	1
RQ2	A) Does overall exposure to peers' alcohol-related SMS content at T1 significantly predict alcohol consumption at T2, after controlling for participants own alcohol use and that of close college friends?	2
	B) Is the strength of the association the same for male and female students?	
RQ3	A) Does overall exposure to peers' alcohol-related SMS content at T1 significantly predict theorized mediators, descriptive norm perceptions, college alcohol beliefs, and enhancement motives after controlling for participants own alcohol use and that of close college friends?	2
	B) Are relationships moderated by gender?	
RQ4	A) Do the theorized mediators partially or fully explain the relationships between male and female students overall exposure to peers' alcohol-related SMS content at T1 and alcohol consumption at T2?	3
	B) Do the direct and indirect effects differ by gender?	

**Table 2**

Descriptive Statistics for study variables assessed 1 month (T1) and 6 months (T2) into college.

	<b>Overall (N = 408)</b>	<b>Males (N = 148)</b>	<b>Females (N = 260)</b>
	<b>M (SD)</b>	<b>M (SD)</b>	<b>M (SD)</b>
T1: 1 month into college			
Frequency of checking social media			
Facebook	1.67 (0.88)	1.63 (0.89)	1.69 (0.88)
Instagram	1.63 (1.05)**	1.28 (1.06)	1.82 (0.99)
Snapchat	2.30 (1.47)**	1.70 (1.06)	2.09 (0.99)
Frequency of seeing others' alcohol-related posts			
Facebook	1.34 (1.16)	1.26 (1.11)	1.39 (1.13)
Instagram	1.66 (1.35)*	1.33 (1.33)	1.85 (1.34)
Snapchat	2.30 (1.47)**	2.00 (1.51)	2.47 (1.43)
Exposure to alcohol-related posts (checking * seeing)			
Facebook	2.50 (2.51)	2.30 (2.47)	2.62 (2.55)
Instagram	3.45 (3.25)***	2.74 (2.99)	4.00 (3.39)
Snapchat	5.23 (3.99)***	4.15 (3.84)	5.85 (4.02)
Total SMS	11.18 (8.10)***	8.93 (7.25)	12.48 (8.37)
Close friends' alcohol use	4.76 (3.27)	5.01 (3.38)	4.61 (3.24)
Perception of peak drinks typical student	5.41 (2.61)***	8.90 (4.87)	5.98 (2.39)
College alcohol beliefs	2.39 (.71)*	2.49 (.75)	2.32 (.65)
Enhancement drinking motives	2.07 (1.29)	2.22 (1.39)	1.98 (1.22)
Drinks consumed per week	3.92 (5.78)***	5.50 (6.10)	3.01 (5.02)
T2: 6 months into college			
Number of social media connections			
Facebook	597.15 (425.22)	596.40 (487.71)	597.60 (387.79)
Instagram	293.45 (273.00)**	200.97 (220.77)	344.71 (285.92)
Snapchat	64.34 (58.77)	62.30 (69.00)	65.47 (52.45)
Drinks consumed per week	4.52 (6.11)**	5.95 (8.17)	3.70 (4.41)

Note. Significant gender differences determined by Student's t-tests are flagged in the overall column.

\*  $p < .05$ .

\*\*  $p < .01$ .

\*\*\*  $p < .001$ .



Zero-order correlations between study variables among males (N = 148; above the diagonal) and females (N = 260; below the diagonal).

**Table 3**

	1	2	3	4	5	6	7	8	9	10
1. T1 Facebook alc exposure	1	.519**	.349**	.720**	.244**	.138	.186*	.153	.084	.191*
2. T1 Instagram alc exposure	.592***	1	.534***	.842**	.383**	.253**	.294***	.269**	.172*	.248**
3. T1 Snapchat alc exposure	.387***	.595**	1	.836**	.500**	.388**	.479***	.479***	.284***	.407***
4. T1 total SM alc exposure	.728**	.877**	.852**	1	.487**	.351**	.462***	.457***	.221**	.368***
5. T1 close friends alc use	.183**	.316**	.392**	.374**	1	.525**	.493***	.444***	.382***	.387**
6. T1 typical student peak drinks	.018	.185**	.210**	.200**	.271***	1	.525***	.538***	.313***	.410**
7. T1 college alcohol beliefs	.163*	.309**	.369**	.347**	.512***	.260***	1	.670***	.320***	.453**
8. T1 enhancement motives	.144*	.330***	.466***	.399***	.577***	.303***	.606***	1	.510***	.593**
9. T1 drinks per week	.187**	.289***	.352***	.332***	.440***	.297***	.432***	.631***	1	.655**
10. T2 drinks per week	.139*	.227**	.413***	.364***	.410***	.320***	.502***	.557***	.469***	1

\*  $p < .05$ .

\*\*  $p < .01$ .

\*\*\*  $p < .001$ .

Table 4

Hierarchical regression results for gender and T1 SMS alcohol exposure predicting hypothesized mediators and T2 drinks per week.

Step	Predictors	B	SE	$\beta$	R <sup>2</sup> change	F change	df
T2 drinks per week (Y)							
1	T1 college friends' alcohol use	.41***	.09	.23***	.30***	69.32***	2, 405
	T1 drinks per week	.58***	.07	.42***			
2	Participant sex	-1.65**	.60	-.13**	.03**	7.01**	2, 403
	T1 SNS alcohol exposure	.13**	.04	.17**			
3	T1 SNS alcohol exposure * sex	-.19*	.08	-.27*	.01*	5.99*	1, 402
T1 perception of peak drinking descriptive norm (M1)							
1	T1 college friends' alcohol use	.14*	.05	.16**	.18***	35.96***	2, 405
	T1 drinks per week	.38*	.06	.33***			
2	Participant sex	-2.78**	.38	-.36**	.12***	27.25**	2, 403
	T1 SNS alcohol exposure	.03	.03	.07			
3	T1 SNS alcohol exposure * sex	-.13**	.05	-.31**	.02***	7.39***	1, 402
T1 college alcohol beliefs (M2)							
1	T1 college friends' alcohol use	.04***	.01	.20***	.36***	90.60***	2, 405
	T1 drinks per week	.09***	.01	.42***			
2	Participant sex	-.05	.06	-.03	.03*	5.96*	2, 403
	T1 SNS alcohol exposure	.01**	.01	.13**			
3	T1 SNS alcohol exposure * sex	-.01	.01	-.10	.00	1.23	1, 402
T1 Enhancement drinking motives (M3)							
1	T1 college friends' alcohol use	.10***	.01	.38***	.45***	135.33***	2, 405
	T1 drinks per week	.18***	.02	.45***			
2	Participant sex	-.17*	.07	-.11*	.02*	6.17**	2, 403
	T1 SNS alcohol exposure	.02**	.01	.15**			
3	T1 SNS alcohol exposure * sex	-.01	.01	-.09	.00	0.75	1, 402
T2 Drinks per week also controlling for M1, M2, M3							

Step	Predictors	B	SE	$\beta$	$R^2$ change	F change	df
1	T1 college friends' alcohol use	.41***	.09	.22***	.30***	68.97	2, 405
	T1 drinks for weeks	.58***	.07	.42***			
2	Participant sex	.64	.10	.05			
	T1 peak drinking D-norm	.22**	.09	.14**	.12***	13.06	5, 400
	T1 college alcohol beliefs	1.10*	.52	.13*			
	T1 enhancement motives	1.21***	.31	.26***			
3	T1 SNS alcohol exposure	.07	.04	.10			
	T1 SNS alcohol exposure* sex	-.13	.07	-.09	.01	3.38	1, 399

Note. Coefficients are presented for the model step in which predictors were first entered.

\*  $p < .05$ .

\*\*  $p < .01$ .

\*\*\*  $p < .001$ .

Table 5

Total and specific conditional effects of T1 exposure to alcohol-related SMS on T2 drinks per week through T1 mediators.

	Value of the moderator					
	Male = 0			Female = 1		
	Point Estimate	SE	Bias corrected 95% CI	Point estimate	SE	Bias corrected 95% CI
Conditional direct effect (c')	.17*	.07	.042-.299	.04	.04	-.045-.121
Specific conditional indirect effects						
M1 typical student peak drinks	.03*	.02	.001-.092	.00	.01	-.016-.010
M2 college alcohol beliefs	.02*	.01	.003-.057	.01*	.01	.001-.033
M3 enhancement motives	.04*	.02	.009-.102	.03*	.01	.007-.065
Total conditional effect (c) (Conditional direct + indirect effects)	.26*			.08*		

\*  $p < .05$ .