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## Emergence and predictors of alcohol reference displays on Facebook during the first year of college

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## Abstract

The purpose of this study was to investigate the emergence of displayed alcohol references on Facebook for first-year students from two universities. Graduated high school seniors who were planning to attend one of the two targeted study universities were recruited. Participants' Facebook profiles were evaluated for displayed alcohol references at baseline and every four weeks throughout the first year of college. Profiles were categorized as Non-Displayers, Alcohol Displayers or Intoxication/Problem Drinking Displayers. Analyses included logistic regression, univariate and multivariate Cox proportional hazard analysis and multi-state Markov modeling. A total of 338 participants were recruited, 56.1% were female, 74.8% were Caucasian, and 58.8% were from University A. At baseline, 68 Facebook profiles (20.1%) included displayed alcohol references. During the first year of college, 135 (39.9%) profiles newly displayed alcohol. In multivariate Cox proportional hazard analysis, university (University B versus A, HR = 0.47, 95% CI: 0.28–0.77, *p* = 0.003), number of Facebook friends (HR = 1.19, 95% CI: 1.09–1.28, *p* < 0.001 for every 100 more friends), and average monthly status updates (HR = 1.03, 95% CI: 1.002–1.05, *p* = 0.033) were identified as independent predictors for new alcohol display. Findings contribute to understanding the patterns and predictors for displayed alcohol references on Facebook.

## Keywords

Facebook; College student; Alcohol

## 1. Introduction

Adolescents' transition from high school to college is often accompanied by escalation of alcohol behaviors. For some first-year students, experimentation with alcohol use begins with arrival at college and exposure to both new social settings and increased independence.

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Implications and contribution

Alcohol is frequently referenced on college students' Facebook profiles. Using content analysis, we found that university context and Facebook use were predictors in emergence of displayed alcohol references over the first year of college.

While alcohol use is readily visible in the corporal collegiate setting, it is also displayed in virtual collegiate contexts. Alcohol use and abuse is often displayed on college students' Facebook profiles; up to 83% of college students' profiles include displayed references to alcohol (Egan & Moreno, 2011; Moreno, Parks, Zimmerman, Brito, & Christakis, 2009) These displayed alcohol references on Facebook are likely to have broad reach, as the vast majority of college students maintain a Facebook profile, most report daily use and college students have large social networks within the website (Buffardi & Campbell, 2008; Lewis, Kaufman, & Christakis, 2008; Sachdev et al., 2012).

#### 1.1. Influence on alcohol behavior

Previous work, rooted in social learning theory, has established strong links between what adolescents see in daily life and how they act (Bandura, 1986). While there are many influences involved in a first-year college student's decision to initiate alcohol use, two salient ones that may be encountered on a daily basis are peers and media. Observation of peers is a major source of influence on adolescent health attitudes, intentions and behaviors (Keefe, 1994; Wood, Read, Mitchell, & Brand, 2004). Previous work has illustrated that both close peers and the larger social network influence alcohol behaviors (Mundt, 2011). Equally strong are links between adolescent health behaviors and exposure to media content (Dalton et al., 2009, 2003; Gidwani, Sobol, DeJong, Perrin, & Gortmaker, 2002; Titus-Ernstoff, Dalton, Adachi-Mejia, Longacre, & Beach, 2008). Studies have shown that exposure to substance use in traditional media such as television or movies is associated with initiation of these behaviors, leading some to describe television as a "superpeer" (Dalton et al., 2009; Gidwani et al., 2002; Klein et al., 1993; Robinson, Chen, & Killen, 1998; Strasburger, Wilson, & Jordan, 2008).

## 1.2. Social media combines peer and media influences

Social media sites such as Facebook allow adolescents to display information about their identities, communicate with peers and build an online social network. As social media combines peer and media effects, it thereby represents a powerful potential motivator of behavior. Adolescents are uniquely positioned to be vulnerable to the influence of what they see on social media: they are at once early adopters of technologies, nearly ubiquitous users and highly susceptible to peer influences (Ellison, Steinfield, & Lampe, 2007; Lenhart & Madden, 2007; Lenhart, Madden, & Hitlin, 2005; Lenhart, Purcell, Smith, & Zickuhr, 2010). A previous study found that younger teens viewed displayed references to alcohol on social networking site profiles by their peers as both influential and believable as representations of offline behaviors (Moreno, Briner, Williams, Walker, & Christakis, 2009). Further, adolescents who view alcohol content on Facebook profiles are more likely to perceive that alcohol use is a normative behavior, and are more likely to report interest in initiating alcohol use (Litt & Stock, 2011). Thus, social media likely has influence over those who view and interact with it, particularly regarding substance use.

#### 1.3. First year college students: seeking a new peer group

Incoming college students may be particularly influenced by peers' Facebook content as they learn to navigate social norms and expectations in their new college setting. An early task when entering college is establishing new friends. In this process it is likely that adolescents use Facebook to evaluate a new acquaintance's profile to learn more about a

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potential new friend (Chou & Edge, 2012). If displayed alcohol references are present on a new peer's Facebook profile, this may contribute to perceptions of social norms of students regarding alcohol behaviors. Social learning theory suggests that exposure to alcohol use in media may influence behavior through promoting positive attitudes and intentions towards the displayed behavior. (Bandura, 1977; Bandura, 2001; Glanz, Rimer, & Lewis, 2002) If an adolescent is exposed to displayed alcohol content prior to or upon arriving at college there are potential implications for that adolescents' attitudes, intentions and behaviors regarding alcohol.

## 1.4. Purpose

While it is well understood that the first year of college often leads to changes in alcohol behaviors in the offline world, little is understood regarding how these exposures or experiences change online displays on Facebook. A current gap in the literature involves understanding the emergence of alcohol references on Facebook among early college students. Previous work has evaluated displayed alcohol content on Facebook profiles; however, these evaluations have been limited by being observational only and by collecting cross sectional data at one time point (Egan & Moreno, 2011; Moreno, Parks et al., 2009). Thus, the purpose of this study was to investigate the emergence of displayed alcohol references on Facebook, and the emergence and predictors of displayed alcohol references on Facebook, and the emergence of displayed alcohol content over time. We sought to understand predictors in the emergence of displayed alcohol content, including the role of university context and time of year. This information may contribute to a deeper understanding regarding which students choose to display and those who view such content.

## 2. Materials and methods

## 2.1. Setting

This study was conducted between May 2011 and July 2012 and received approval from the two relevant university Institutional Review Boards.

## 2.2. Subjects

Graduated high school seniors who were planning to attend one of the two targeted study universities were recruited the summer prior to beginning college. Participants were eligible if they were between the ages of 17 and 19 years and enrolled as first-year full-time students for fall 2011 at one of these two universities. A subset of approximately 600 potential participants were randomly selected from the full registrar's lists of incoming first-year students from both universities for recruitment towards our goal of recruiting 320 participants.

## 2.3. Recruitment

Students were recruited through several steps, beginning with a pre-announcement postcard. Over a 4 week recruitment period potentially eligible students were recruited through up to 4 rounds of emails, phone calls and Facebook messages. Students were excluded if they were outside the age range for this study. Students were also excluded if they had already arrived on campus for summer early-enrollment programs, as baseline measures were intended to measure pre-college experiences.

## 2.4. Consent process and Facebook friending

During the consent process potential participants were informed that this was a longitudinal study involving a baseline phone interview as well as evaluation of Facebook profiles, and that friending our research team profile was a requirement of the study. Participants were informed that content would be viewed, but that no one on the research team would post any information to the participant's profile. Participants were asked to maintain open security settings with our research team during the study. Students who provided consent to enroll in the study were sent a Facebook friend request from one of our research assistant Facebook profiles designated for use in this study.

## 2.5. Codebook and variables

An existing codebook was used to evaluate displayed alcohol references. This codebook has been described in previous publications and studies (Egan & Moreno, 2011; Moreno, Egan, & Brockman, 2011). This research codebook was initially designed to evaluate displayed alcohol references on Facebook that represented alcohol behaviors. For the purposes of this study, the definition of displayed alcohol content was expanded applying the theory of planned behavior as a conceptual framework (Ajzen, 1985; Ajzen, 1991). This theory supports the importance of attitudes and intentions predicting behaviors. Thus, displayed alcohol content referred to attitudes, intentions or behaviors regarding alcohol were considered displayed alcohol references.

Profiles were categorized into one of three groups. Profiles without any alcohol references were considered "Non-Displayers." Profiles with one or more references to alcohol attitudes, intentions or behaviors but no references to intoxication or problem drinking were considered "Alcohol Displayers." Example references included personal photographs in which the profile owner was drinking from a beer bottle, or text references describing drinking vodka at a party. Only text references that explicitly mentioned the profile owner's attitudes, intentions or behaviors towards alcohol or photographs that included the profile owner with a clearly labeled alcoholic beverage were coded as an alcohol reference. The codebook was designed to be conservative in approach; thus, while a red solo cup may be indicative of alcohol beverages to some college students it would not be counted in our coding approach.

Profiles in which there were one or more references to attitudes, intentions or behaviors regarding intoxication or problem drinking behaviors were considered "Intoxication/ Problem Drinking (I/PD) Displayers." Examples of intoxication references included text describing the profile owner as "being wasted" or "getting drunk." Similar to previous work, problem drinking was defined using the CRAFFT problem drinking criteria which has been validated in adolescent populations (Knight et al., 1999; Wilson, Sherritt, Gates, & Knight, 2004). Criteria include driving or riding in a car while intoxicated (C = car), drinking to relax (R = relax), drinking alone (A = alone), forgetting what one did while drinking or blacking out (F = forget), having friends or family ask you to cut down on alcohol (F = friends/family) or getting into trouble because of alcohol use such as being arrested (T = trouble) (Knight et al., 1999; McGee & Begg, 2008; Wilson et al., 2004). Because of the concern regarding subjectivity of evaluating photographs as depictions of alcohol use versus intoxication, photographs were not considered in this category.

Other recorded data from Facebook profiles included the type of displayed alcohol reference (e.g. status update, photograph or group). We also recorded the total number of Facebook friends to assess the participants' Facebook social network, as well as the number of posted status updates by the profile owner in that four week period as a measure of interactive Facebook use.

## 2.6. Coding procedure

The Facebook profile of each participant was initially evaluated at the time of enrollment in the study by a trained coder. This baseline evaluation included a 3-month period of the participant's senior year of high school (March, April and May). Once the participant arrived at college, the profile was evaluated every four weeks for displayed content during that 4-week period. Each coding period began at the day after the last evaluation and included 28 days. The ninth and final coding period was at the conclusion of the academic year. At each Facebook profile evaluation, we recorded displayed alcohol reference data, including the coder's typewritten description of any image references or verbatim text from profiles, as well as Facebook use data. If present, identifiable information was removed from text references. Sections of the Facebook profile that were evaluated included the wall, photographs, groups and likes/interests.

A total of 7 coders evaluated profiles in this study, and all had undergone a minimum 3 month training period. A 20% random subsample of profiles were evaluated by all coders to test interrater reliability. Fleiss' Kappa statistic was used to evaluate the extent to which there was overall agreement in the coding of the presence or absence of alcohol references on a profile, as well as agreement among coders for the number of references on a profile. Fleiss' kappa was 0.82 for the presence or absence of alcohol references present on profiles indicating near-perfect agreement, and 0.74 for the agreement among all coders for the number of alcohol references indicating substantial agreement.

## 2.7. Interview variables

Interviews assessed demographic data including age, gender, ethnicity/race and university attending. At baseline, participants were asked whether they had ever consumed alcohol.

#### 2.8. Interview procedure

Phone interviews were conducted with all participants at the time of enrollment as a baseline evaluation. Phone interviews were used because many participants were more than an hour away from the primary research site, and because phone interviews have been used successfully in the past as a way to investigate stigmatizing topics such as risky health behaviors (Fortney et al., 2004; Meyer, Rossano, Ellis, & Bradford, 2002). Interviews were scheduled at a time of convenience for the participants. Interviews lasted approximately 30–40 min and included other questions relevant to the larger context of the study not reported here. Participants received \$30 as an incentive for completing the interview.

## 2.9. Analysis

Demographic variables and displayed alcohol references on Facebook were evaluated with descriptive statistics. All *P* values were 2-sided, and p < .05 was used to indicate statistical significance. Statistical analyses were performed using SAS software version 9.2 (SAS Institute, Cary, NC) and R software version 2.15.1 (www.cran.r-project.org).

2.9.1. Prevalence and types of displayed references to alcohol on Facebook—

To describe the prevalence and types of displayed alcohol content, demographic variables and displayed alcohol references on Facebook were summarized in frequency tables for categorical variables and in terms of means and standard deviations for continuous variables.

#### 2.9.2. Predictors of emergence of alcohol displays over the first year of

**college**—To evaluate predictors of displayed alcohol content on Facebook at baseline and over the first year of college we conducted logistic regression and Cox proportional hazard analysis. First, to determine predictors of baseline display of alcohol use on Facebook, we

Second, we used univariate and multivariate Cox proportional hazard analysis to evaluate predictors for time to emergence of displayed alcohol references on Facebook. In these analyses, a new alcohol display on Facebook was defined as an event. The follow-up durations of subjects who did not have an alcohol display were censored at the end of the academic year. Predictive variables were selected via forward stepwise selection with a *p*-value cutoff of <0.05 to identify a final parsimonious Cox proportional hazard model; a previously deleted variable was allowed to re-enter the final model if its p-value was <0.05. Standard model diagnostic tools were utilized to verify the proportional hazard assumption. Hazard ratios (HR) and the corresponding 95% confidence intervals were reported for each predictor.

**2.9.3. Patterns in displayed references over time**—Finally, to understand the emergence of alcohol displays over time we used a multi-state Markov modeling approach to describe the dynamics of moving through the three categories of Facebook alcohol display: Non-Displayer, Alcohol Displayer and I/PD Displayer (Welton & Ades, 2005). These three categories were defined as the states of the Markov model. In the context of this model, the transitions were assumed to be unidirectional and included transitions from a Non-Displayer to an Alcohol Displayer, or from a Non-Displayer to a I/PD Displayer, or from Alcohol Displayer to I/PD displayer. As Facebook profiles were evaluated every four weeks for displayed content, each coding period was considered one time period. The instantaneous risk or hazard of moving from one state to the next state for each time period was modeled using a log-linear model. Both univariate and multivariate analysis which incorporated gender, race, number of Facebook friends at baseline and university was conducted. Hazard ratios and the corresponding 95% confidence intervals for the probabilities of transitioning from one state to the next state were reported for the comparisons between groups.

## 3. Results

#### 3.1. Participants

A total of 338 participants were recruited, of these 56.1% were female, 74.8% were Caucasian, and 58.8% were from University A, average age was 18.4 years (SD = 0.6). Our initial response rate was 54.6%, and by the end of the yearlong study our retention rate was 93.1%. Table 1 illustrates demographic characteristics of the participants in this study.

## 3.2. Prevalence and types of displayed references to alcohol on Facebook

At baseline, prior to starting college, 68 Facebook profiles (20.1%) included references to alcohol. Among these initial displayers, 46 (13.6%) were Alcohol Displayers and 22 (6.5%) were Intoxication/Problem Drinking displayers. There were no significant differences in baseline distribution of alcohol references by gender, race or university.

During the first year of college, 135 profiles newly displayed alcohol references on Facebook; these included 105 new Alcohol Displayers and 30 new Intoxication/Problem Drinking displayers. Among those who already were Alcohol Displayers at baseline, 35 of the 46 Alcohol Displayer profiles (76%) newly displayed Intoxication/Problem Drinking references. Thus, a total of 257 participants' remained Non-Displayers before and throughout the first year of college. Table 2 illustrates these data.

Displayed alcohol references were present in a variety of formats on the Facebook profile including status updates, photographs, likes and joining groups. Displayed references included attitudes towards alcohol; examples included "liking" groups such as alcohol brands (i.e. Bud Light, Corona). References to drinking intentions were also present, often through planning future alcohol-related events. Examples of these types of references included comments such as "Can't wait for Friday beer pong night!" or "I've got a six pack of MGD and just waiting for the game to start." References to alcohol use also included displayed behaviors through photographs, and text describing drinking experiences, including problem drinking behaviors. Table 3 illustrates example references from both Alcohol Displayers and I/PD Displayers.

## 3.3. Predictors of emergence of alcohol displays over the first year of college

Multivariate logistic regression using baseline data showed that the odds of alcohol display prior to college among current drinkers was 2.68 times (95% CI: 1.44–4.99) that of nondrinkers (p = 0.002). Further, the odds of displaying alcohol at baseline increased by 10.5% (95% CI: 0–22.1%) for every 100 more Facebook friends.

The likelihood of displaying alcohol references on Facebook during the first year of college did not differ by gender or race. In the multivariate Cox proportional hazard analysis, university (University B versus A, HR = 0.47, 95% CI: 0.28–0.77, p = 0.003), number of Facebook friends (HR = 1.19, 95% CI: 1.09–1.28, p < 0.001) for every 100 more friends, and total average monthly status updates (HR = 1.03, 95% CI: 1.002–1.05, p = 0.033) were identified as independent predictors for new alcohol display.

#### 3.4. Facebook alcohol displays over time

Facebook alcohol displays varied in quantity over time and across university site. The univariate Cox proportional hazard analysis illustrates these temporal variations for each of the two university sites in Fig. 1. One noted difference is the increased display rates concomitant with the start of November at University A, which was associated with increased displays related to alcohol-themed Halloween parties. A second noted increase in displays at University A was seen in early May, which corresponds to increased displays related to a large alcohol-themed block party.

Multi-state Markov modeling revealed that while many profiles remained in the same Facebook alcohol display category in which they started for many coding periods, that there was often a progression from Non-Displayer to Alcohol Displayer to I/PD Displayer. Fig. 2 illustrates the path of these transitions. In any given month, the predicted transition probability for progressing from Non-Displayer to Alcohol Displayer was 5.4% (95% CI: 4.5-6.4%), for progressing from an Alcohol Displayer to an I/PD Displayer it was 5.0% (95% CI: 3.5–6.6%), and for progressing from an Non-Displayer to an I/PD Displayer it was 1.5% (95% CI: 1.1-2.1%) (Table 2). In the multivariate analysis, males demonstrated smaller risk for transitioning from Alcohol Displayers to I/PD Displayers compared to females (HR = 0.45, 95% CI: 0.23-0.86). Race was not significantly associated with transition between alcohol displayer categories. Participants with a large number of Facebook friends at baseline (>500) were at higher risk of transitioning from Non-Displayer to Alcohol Displayer (HR = 2.80, 95% CI: 1.89-4.18) when compared to participants with a smaller number of Facebook friends at baseline ( 500). Participants from University A were at greater risk (HR = 2.89, 95% CI: 1.75–4.75) of transitioning from Non-Displayer to Alcohol Displayer compared to University B (Table 2).

## 4. Discussion

This longitudinal study evaluated displayed content on Facebook over the first year of college from students at two universities, and assessed the emergence of displayed alcohol references during this critical transition time. We found that displays were uncommon prior to college, and similar prevalence of displays among students intending to attend both universities. Over the first year of college, alcohol displays on Facebook dramatically increased in a variety of multimedia formats. We assessed predictors of displayed alcohol use and found that university, number of Facebook friends and Facebook activity were predictors. Finally, we assessed patterns in display over time and found that displayed references to alcohol on Facebook often increased concomitant with campus drinking events.

## 4.1. Displays provide rich and contextual data

Findings illustrate that displayed alcohol content is featured across a variety of multimedia formats. Placing these findings in the context of previous work regarding peer and media influences on attitudes, intentions and behaviors illustrates several key points. First, previous work has illustrated that media can be a powerful source of influence on behavior. Social learning theory predicts that adolescents who observe media characters referencing or engaging in behaviors such as alcohol use without experiencing negative consequences will be more likely to adopt the behaviors portrayed (Bandura, 1977, 1986, 2001; Glanz et al., 2002). Previous work has shown that adolescents who are exposed to alcohol use in media such as television are more likely to drink alcohol and view this as a normative behavior (Robinson et al., 1998; Sargent, Wills, Stoolmiller, Gibson, & Gibbons, 2006). Second, displayed Facebook content is rooted in the daily and familiar lives of college students. Previous work has illustrated that when something experienced or seen through the media is similar to one's experiences in the social environment, the influential effects of the media can be much more powerful (Greene et al., 2012). Third, social media presents a form of media created by peers, who are also understood to have great influence over adolescent behavior. Personal sources of information are typically viewed with more credibility and persuasiveness than traditional media (Brook, Lee, Brown, Finch, & Brook, 2012; Du, Huang, Zhao, & Hser, 2013). As social media likely combines the influence of both peers and media, Facebook likely represents a new and influential source of influence for adolescents' attitudes, intentions and behaviors regarding alcohol use.

## 4.2. Differences between the two universities

Findings also suggest significant differences in the prevalence of displayed alcohol references on Facebook between the two universities in this study. At baseline, there were no significant differences in prevalence of displayed alcohol references on Facebook between the students from the two university settings. By the end of the first year of college, students attending University B were half as likely to display references to alcohol on Facebook compared to students at University A; these differences are also clearly visualized through Fig. 1. These differences only emerge after students have arrived at college and become immersed in the social norms of that school. These norms may impact both alcohol behaviors as well as what material is socially acceptable to display on Facebook at that school. It is well understood that different universities have different drinking rates, different drinking policies and consequences, as well as varying social norms regarding the role of alcohol use at a given university. The culture at University A may have placed increased importance on alcohol use behaviors, leading to an increased presence of alcohol content on students' Facebook profiles. It is also possible that findings reflect differences in the states in which these universities reside, such as variations in laws regarding underage alcohol use. Conversely, these two universities may have cultural differences regarding what is

acceptable to display on Facebook. Previous work evaluated differences in two countries' cultures in what level of personal information is acceptable or desirable to display on Facebook and found marked differences (Huang & Park, 2012). In contrast, findings in this study derive from similar populations of college students at large state universities who are displaced by location in the country. Thus, findings suggest the importance of local culture and context within a university impacting Facebook displays.

## 4.3. Links between behavior and display

Findings suggest that participants who displayed alcohol references on Facebook prior to college were also more likely to report lifetime alcohol use prior to college. This finding may be unsurprising given that previous work has suggested that display of alcohol on Facebook is associated with alcohol use (Moreno, Christakis, Egan, Brockman, & Becker, 2012). Students who displayed references to alcohol prior to college were highly likely to escalate Facebook displays to include references to intoxication or problem drinking during the first year of college. These potential links between behavior and display are further supported by our findings regarding the timing of displays. Displays were more common for University A participants during times in which large alcohol-themed events were taking place on campus. This suggests links between attending these events, drinking alcohol and displaying on Facebook. Further, the progression of transition between Facebook alcohol display categories from Non-Displayer to Alcohol Displayer to I/PD Displayer suggests a logical progression in display that mirrors a common progression in behavior.

## 4.4. Other factors that may contribute to Facebook alcohol displays

There are other reasons to consider for why Facebook displays regarding alcohol use may have increased during the first year of college. It may be that once they are in college, students perceive fewer risks in displaying these behaviors publicly on social media sites. As high school students may face suspension or other negative consequences from such displays, many college students who have engaged in drinking since prior to college may decide upon arrival to college that it is now safe to display these ongoing behaviors on Facebook.

## 4.5. Limitations

There are several limitations to our study. Content analysis coding can be considered subjective; in order to provide the most detailed and comprehensive coding possible we provided extensive training to every coder. Our interrater agreement suggests high reliability among our coders. Second, though we included two large universities in this study with varied locations and student profiles, there was limited racial diversity present at both schools. Thus, generalization to other colleges or non-college attending older adolescents should be approached with caution. Third, our study did not present results related to participants who lived on campus versus with parents which could have bearing on alcohol behaviors. Finally, our study provides rich description over time and assessments of associations, but no causality linking alcohol displays and behaviors can be inferred from these findings.

## 4.6. Conclusions

Despite these limitations, our findings have important implications. This study provides a detailed longitudinal assessment of similarities and differences across two universities first-year students' displayed alcohol content. Future research should consider why differences in disclosure may occur between universities, and further expand our understanding of how computer-mediated-communication may be influenced by both corporal and virtual contexts.

Practical implications for universities include the possibility of using these findings to enhance ongoing prevention efforts. The population of incoming students who already display references to alcohol prior to college may represent a unique population to target with prevention messages. Universities could provide prevention messages to these incoming students within Facebook by creating pop-up advertisements linked to alcoholrelated keywords and targeted to first-year students.

Further, universities may consider whether time periods in which Facebook alcohol displays escalate are associated with high risk times for student alcohol use or abuse. At University A, the increases in Facebook alcohol displays correspond with known high-risk times for alcohol abuse on campus, including a yearly Halloween party. However, the patterns in timing of emergent displayed alcohol references illustrate some patterns that may merit investigation, such as the rise in newly displayed alcohol references in early March for University B. While our findings highlight differences in timing of display between the two universities in this study, it is likely that patterns of high and low alcohol displays on Facebook occur across many universities. Universities could consider using Facebook alcohol displays as a barometer to predict time periods of heightened awareness for university health services or law enforcement. It is important to consider that these efforts could be limited by college student privacy settings on social media. However, colleges could also consider creating targeted Facebook alcohol advertisements featuring alcohol safety messages or health care services that pop-up in response to common alcohol-related terms displayed on Facebook. By applying an understanding of the emergence and patterns of displayed alcohol content on Facebook, colleges could enhance provision of relevant alcohol safety messages to first-year students linked to the messages that students themselves present on Facebook.

Finally, it is worth considering whether universities should play a role in discouraging displayed alcohol content on Facebook by their students. Students may underestimate the potential implications for employment or future educational opportunities that could be impacted by displayed alcohol content on Facebook. Further, the potential for legal repercussions from posting potential evidence of underage drinking remains an additional serious possible negative consequence.

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Fig. 1.

Changes in hazard rates for displayed alcohol references on Facebook over the first year of college for University A and B.

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## Fig. 2.

Estimated transition probabilities between Facebook alcohol display categories for each month of the first year of college predicted by Markov modeling.

## Table 1

Participant information for first-year students from two universities.

N = 338	Number (%)	
Gender		
Female	189 (56.08%)	
Male	148 (43.92%)	
University		
University A	198 (58.75%)	
University B	139 (41.25%)	
Ethnicity		
Caucasian/White	252 (74.8%)	
Asian	39 (11.6%)	
More than One	21 (6.2%)	
Hispanic	13 (3.9%)	
African American/Black	5 (1.5%)	
East Indian	3 (0.9%)	
Native American/Alaskan	2 (0.6%)	
Other	2 (0.6%)	
Number of Facebook friends at baseline	Median (range)	
	470 (46–2045)	

## Table 2

Prevalence of displayed alcohol references on Facebook profiles of 338 first-year college students from two universities at baseline and one year later.

Facebook alcohol display category	Time 1: Prior to entering college $N$ (%, 95% CI)	Time 2: By the end of the first year of college $N$ (%, 95% CI)
Any alcohol display on Facebook	68 (20.1%, 16–24.8%)	203 (60.1%, 54.6-65.3%)
Alcohol display on Facebook	46 (13.6%, 10.1–17.7%)	116 (34.3%, 29.3–39.7%)
I/PD display on Facebook <sup>a</sup>	22 (6.5%, 4.1–9.7%)	87 (25.7%, 21.2–30.8%)
Non-displayers	268 (79.3%, 74.6–83.5%)	135 (39.9%, 34.7–45.4%)

 $^{a}$ I/PD = Intoxication/Problem Drinking.

## Table 3

Examples of displayed alcohol references on first-year college students' Facebook profiles.

	Status update	Photograph	Group
Alcohol references	"Throwin' a few Buds back with my buds tonight"		"Beer Pong!"
	"save water, drink margaritas"		"Prague Pub Crawl"
Intoxication/Problem Drinking references	"Blacked out last night the question isgo to class or go to sleep" "sooooooooo druuuuuunnnkkkkk"		"Drunk people taking care of drunker people"