

Exposure to Alcohol-Related Content on Social-Media

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Objective: Exposure to alcohol-related content is unavoidable on social media. In this study level of exposure to alcohol marketing content on Twitter and Instagram for those in recovery was examined, and the effectiveness of privacy settings to mitigate exposing content was assessed.

Methods: Four fictitious accounts were created on Instagram and Twitter in a case-control design in Spring 2022. All accounts followed 19 alcohol brands, with two accounts (1 male, 1 female) following only alcohol brand accounts while the other two (1 male, 1 female) additionally followed recovery resources. Four weeks of data collection were done with default privacy and advertisement settings, followed by two additional weeks of data collection with advertisement and privacy settings for blocking alcohol content.

Results: Privacy settings did not help with blocking the alcoholic brand-related photographic content on either platform, meaning that the accounts received the same amount of alcohol-related content from the accounts they were following with and without changing the privacy settings. However, Twitter algorithms were more effective in suppressing alcohol-related content for accounts following recovery resources and alcohol brands.

Conclusions: These results suggest that risks of exposure to triggering/cueing photographic alcohol content may outweigh the benefits of social media for social connection if an individual is considering seeking recovery.

Psych Res Clin Pract. 2023; 5:93–104; doi: 10.1176/appi.prcp.20230009

Alcohol, a substance widely used and normalized by many cultures, is also a commonplace and readily available substance in the United States and globally (1,2). The alcohol industry is highly profitable in multiple sectors, such as the legal and advertising industries. In the United States (U.S.) alcoholic drinks market in 2023, profits are projected to amount to 283.80 billion dollars with an expected annual growth rate of 5.5% until 2027 (3,4). Alcohol marketing is a fundamental pillar of the alcohol industry, fueling its growth and success in the U.S. and globally (5).

Alcohol misuse in the form of excessive heavy drinking or binge drinking could potentially lead to the development of alcohol use disorder (AUD), affecting men and women of all ages from any socioeconomic or cultural background (6). The DSM-V defines AUD as a disorder with moderate and severe diagnoses meeting two or more of the following criteria: hazardous drinking, drinking despite social consequences, not meeting role obligations due to alcohol intake, withdrawal and/or drinking to avoid withdrawal symptoms, tolerance, consumption of larger amounts of alcohol, drinking despite social consequences, unsuccessful attempts to reduce intake, significant amount of time spent on drinking or recovering from drinking, or alcohol craving (7). It takes tremendous courage and

strength to seek recovery from AUDs due to the stigma surrounding the disorder, the recovery process itself, and the omnipotence of alcohol in everyday society, among other factors.

HIGHLIGHTS

- Fictitious accounts were used on Twitter and Instagram to examine what potentially triggering and/or cueing content a social media user that is potentially seeking recovery from Alcohol Use Disorder is exposed to.
- Accounts that followed both Recovery Resource accounts and alcohol brand accounts received the same amount of alcohol brand-related content as the accounts that did not follow Recovery Resource accounts on Instagram. In contrast, the accounts that followed Recovery Resource accounts on Twitter received less alcohol brand-related content.
- Privacy setting changes made no difference in the amount of content received.
- There is a lack of policy surrounding alcohol and social media marketing and a lack of universal privacy laws, implementation of which could protect vulnerable populations.

When an individual is recovering from AUD, the social support network around that individual can be beneficial or detrimental to recovery (8). With adequate support, an individual who identifies as having AUD or as being in recovery from AUD can go on to live a fulfilling and productive life (9). It has also been shown that the social network an individual is part of can influence how quickly an individual with AUD seeks treatment and succeeds in recovery (10). In particular, the relationships that an individual with AUD have can aid in recovery from AUD and help prevent relapse (11).

However, problems with social support can abet prospective recovery and potentially cause relapse (12). In the era of social media, the definition of an individual's environment has extended to include online virtual spaces where they engage in and interact with other individuals or entities (13). Past research shows that a person who has AUD experiences cravings for alcohol, particularly when in an environment with alcohol-related stimuli, even while in recovery from AUD (14). It is known that alcohol photographs can trigger cravings to drink in a person with AUD, and those images can reduce coping mechanisms that individuals use to avoid alcohol consumption (15). Furthermore, multiple studies have shown that in young adults, increased interaction with alcohol brands' social media marketing was correlated with an increase in the AUDIT score, which is the scale used to screen for the presence of an AUD (16,17). In addition, a longitudinal review of 12 research articles worldwide found associations between engagement and awareness of alcohol-brand-related content on social media and increased alcohol consumption in youth and young adults (18). Moreover, individuals with a history of heavy alcohol use or alcohol dependence have been shown to be at increased risk of slipping when seeing alcohol-related social media images.

Alcohol advertisements on social media may be triggering for someone in recovery. Despite their attempt to block the content, past studies have shown that people in recovery were exposed to triggering content, meaning that "blocking" failed (19). This is particularly problematic because most alcohol marketing strategies seem to center around normalizing alcohol consumption and encouraging positive attitudes towards consumption (19). However, limited research exists on the impact of traditional alcohol marketing (e.g., television advertising, billboards, and more) and alcohol marketing on social media on recovery outcomes (20). Additionally, there is not a unified conclusion on the impact of alcohol advertising on people in recovery (20). Yet, in recent years there have been interesting studies on women in recovery as gender differences in alcohol drinking patterns and alcohol-related harms seem to have been diminishing (20). For instance, it has been shown that women who are in recovery from AUD have more awareness of alcohol advertising and its omnipotence in society and have complex emotions

toward it (21). Moreover, a more recent study suggests that not all women in sobriety from alcohol may disengage from alcohol-related content. Thus, research on the potential exposure to alcohol brand advertisements is of utmost importance (21). A recent study suggests that not all women in sobriety from alcohol may disengage from alcohol-related content. Therefore, research on the potential exposure to alcohol brand advertisements is of utmost importance.

Social media platforms are designed to engage individuals and keep them using the application for as long as possible (22). Alcohol brands design their content to be as appealing to viewers as possible (23). It is also known that when a user engages with some form of content, the algorithms are more likely to push that form of content to them (24). Studies have shown that when social media users are exposed to social media alcohol advertising, they are more likely to drink alcohol (25). Therefore, in this study, we aimed to examine the level of exposure to photographic alcohol marketing content to social media users in recovery (i.e., those who follow recovery pages on social media) on the Twitter and Instagram social media platforms. These platforms were chosen as they are two main contemporary social media platforms, with 822 million and 1.961 billion monthly consumers in Quarter 1 of 2022, on Twitter and Instagram respectively (26,27). We also aimed to determine the effectiveness of their algorithms in suppressing alcohol-related content and determine whether privacy settings protect social media users from such exposure.

MATERIALS AND METHODS

Setup

All data in this study was collected on an Apple iPhone 11 with a 15.4.1 operating system (O.S.) that was run on the iPhone at the start of the data collection and updated throughout data collection (final version: 15.5). The Instagram (I.G.) version at the beginning of the data collection was 228.0. The Twitter version started at 9.6. The end versions were 237.0 for Instagram and 9.12.3 for Twitter.

Data was collected from April 15, 2022, to June 3, 2022, in Greater Boston, Massachusetts, USA. All data were collected on the same phone manually by the same individual. No personal I.G. was used on the phone for the duration of data collection, and any personal accounts were logged out at the beginning of the study and not logged in until the end of the study. The iPhone used had a Virtual Private Network (VPN) enabled and was encrypted. I.G. was scrolled until it was noted that all posts had been seen. The data was collected at 5 pm every night on the same iPhone for 4 weeks, starting with I.G. and then Twitter. Accounts were scrolled in a random order each night. Twitter was scrolled for a timed 5 min. The 5-min duration was chosen based on the average time people

spend scrolling social media (3 min) and then adding 2 min to account for data input into a spreadsheet (28). The sufficiency of the 5-min scroll time was further confirmed throughout the study as it showed to be sufficient to capture everything on Twitter throughout data collection due to the repetitiveness of the posts (that were still counted) and the limited new content of the posts. Similarly, the allocated time was sufficient for Instagram throughout the study except for the last ~2 days. Data was collected for 4 weeks with the same default advertisement/application privacy settings (Phase 1). Then two more weeks of data collection were conducted with different ad and privacy settings (Phase 2).

Fictitious Accounts

We created four fictitious I.G. and Twitter accounts. We used fictitious email addresses for the Twitter accounts. However, I.G. made us use personal phone numbers for some I.G. accounts for identity verification, which was not an issue with Twitter. To select the first names of the accounts, we used the [SSA.gov](#) top 10 baby names and a random name generator to select the names for each account (29). We used [Namecensus.com](#) to choose the last names, took the top 12, used a random name generator to select the last names, and randomly assigned the names to each account (30). We selected the age by using [Statista.com](#) and looked at the predominant age range of an I.G. and Twitter user, 25 to 34 years (per data from October 2021 for I.G. and April 2021 for Twitter) and selected the midpoint of 30 years as the representative age of a user of both accounts.

Alcohol Brands

All four accounts followed alcohol account brands that were chosen based on the patterns of consumption by Millennials (31,32). Millennials mainly consume spirits, and the top 20 brands consumed by Millennials in Quarter 1, 2022 (28–30). Of those 20 brands, 19 had I.G. and Twitter accounts which all our fictitious accounts followed. The age group of millennials was chosen because they were an age group that has been exposed to social media for much of their lifetime (including Myspace, Facebook, Instagram, Twitter, Reddit, TikTok, and others) and have come of age with social media. Additionally, in 1996, the self-imposed embargo on alcohol advertising was lifted in the United States (33). Thus, for the fictitious accounts, they have been exposed to alcohol advertising and social media most of their entire lives. In addition, this generation encompasses the widest age range of 26–41 years that is statistically more likely to develop an AUD (34).

Recovery Resources

Two of the accounts (1 male, one female) followed only alcohol brand accounts (Alcohol Exposure group) while the other two (1 male, one female), in addition, followed

recovery resources (Alcohol and Recovery Exposure group). The latter group accounts were set up to follow local and nationwide AUD recovery resources with social media presence. Some recovery resources did not have an account on both I.G. or Twitter.

Data Collection

During the data collection, no tweets or I.G. posts were liked on any account, reposted, or interacted with in any way, as the study aimed only to examine the exposure per accounts followed. We collected the total number of alcoholic brand posts and recovery resource account posts. To count photo I.G. posts, if a brand posted multiple photos in one I.G. post, the data collector counted the photo post as one post. For Phase 1 of data collection, which lasted 4 weeks, privacy settings and advertisement settings on both I.G. and Twitter were set to the default settings of the applications with location tracking, personalized advertisements receiving, and application cross tracking set off. For Phase 2 of data collection, which lasted for 2 weeks, for privacy settings, I.G. had personalized advertisements and cross-application tracking shut off for all accounts. This was to see if the advertisement or privacy settings would have any impact on the total number of alcohol brand posts on the I.G. newsfeed and Twitter timeline. During this period, for ad settings, I.G. also had each account set preferences to see fewer advertisements in alcohol, pets, parenting, and politics/social issues. For Twitter privacy settings, each account had personalized advertisements based on inferred identity or places visited shut off. Information sharing with business partners was also shut off. These privacy settings were chosen because they were the settings in each application that might allow an average user to have some amount of control over their privacy or decrease the amount of alcohol-brand-related content they received.

Statistical Analysis

To compare the number of posts received between the accounts, the average number of posts over two of the 4 weeks of data collection during Phase 1 (last 2 weeks) was compared to the 2 weeks of data collected during Phase 2 using two-sided Student's *t*-tests while assuming equal variances among the samples. The analysis used SPSS (IBM SPSS Statistics, Version 28.0) with a significant level set at $p < 0.05$. The comparisons were made between alcohol only and recovery resource accounts for male and female fictitious accounts separately.

RESULTS

The list of alcohol brands followed by the fictitious accounts in this study is presented in Table 1. The list of recovery resources with I.G. or Twitter page is presented in Table 2. In Figure 1, the total number of alcohol-related photographic posts received by each of the fictitious

TABLE 1. Top 20 alcohol brands consumed by millennials in Q1 2022.

Alcohol brand	Has official Instagram page	Has official Twitter page	Number of Followers Instagram	Number of Followers Twitter
Smirnoff	Yes	Yes	235,000	13,300
Jack Daniel's	Yes	Yes	658,000	200,600
Mike's Hard Lemonade	Yes	Yes	50,700	36,000
Seagram's	Yes	Yes	74,500	26,600
Bailey's	Yes	Yes	180,000	9686
Patrón	Yes	Yes	341,000	214,300
Captain Morgan	Yes	Yes	128,000	25,800
Bacardi	Yes	Yes	212,000	100,600
Crown Royal	Yes	Yes	226,000	37,600
Maker's Mark	Yes	Yes	190,000	134,800
Grey Goose	Yes	Yes	364,000	88,900
Hennessy	Yes	Yes	730,000	73,500
Smirnoff Ice	No	No	n/a	n/a
Jim Beam	Yes	Yes	145,000	147,800
Skyy	Yes	Yes	43,600	52,000
Hornitos Tequila	Yes	Yes	23,600	13,200
Johnnie Walker	Yes	Yes	471,000	31,200
Casamigos	Yes	Yes	128,000	13,600
Malibu Rum	Yes	Yes	66,800	48,200
Tito's Vodka	Yes	Yes	197,000	63,000 [1]

TABLE 2. Recovery resource social media accounts.

Recovery resource	Has official Instagram page	Has official Twitter page	Number of Followers Instagram	Number of Followers Twitter
Alcoholics Anonymous	Yes	Yes	11,300	1904
Bureau of Substance Abuse (BSAS) (Mass.gov)	Yes	No	12,400	n/a
In the Rooms	Yes	Yes	4062	4967
Learn to Cope	Yes	No	438	n/a
National Institute on Alcohol Abuse and Alcoholism	Yes	Yes	2621	28,600
Network of Care Massachusetts	No	Yes	n/a	1673
Research Recovery Institute	Yes	Yes	309	34,500
SAMHSA	Yes	Yes	6658	127,500
The National Center on Addiction and Substance Abuse (CASA)	No	No	n/a	n/a
The Recovery Village	Yes	Yes	6991	8273
Wellbeing & Recovery Research Institute	n/a	Yes	n/a	12 [2]

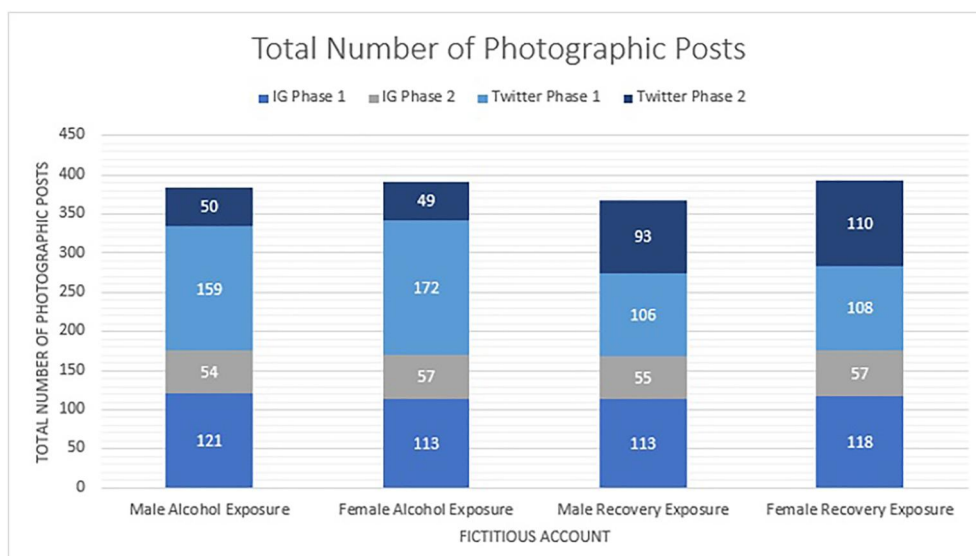
accounts is presented. Figure 2 shows the daily changes in the total number of ads received by each account during Phase 1 of the study. There was no statistically significant difference between the fictitious accounts for the Instagram (I.G.) posts, Figure 3. However, the alcohol content was significantly suppressed by Twitter for the accounts that followed recovery accounts for both men and women. We also found no difference between the accounts by changing the privacy settings on either platform. On both platforms, privacy and advertisements settings did not help to block alcohol brand photographic content if the user was following those brands, meaning that the accounts were receiving the same amount of content with and without using the privacy settings. We also found that male accounts would receive more photographic content than Female accounts on I.G. and Twitter (See Figures 1–2). It also should be noted that the recovery resources accounts

were also receiving posts from other recovery resource accounts they were not following, and we accounted for those separately. For example, the content was received from accounts named “alcoholism research” and “young minds.”

DISCUSSION

In this study, we examined the level of exposure to alcohol marketing content on Twitter and Instagram for those in recovery and assessed the effectiveness of privacy settings to mitigate exposing content was evaluated. We found that, unlike Instagram, Twitter was somewhat effective in suppressing alcohol-related content if an account/user followed recovery resources. We also found that privacy and advertisement settings did not significantly change the amount of alcohol brand photographic content received

FIGURE 1. Total photographic posts at the end of data collection for Twitter and I.G. Alcohol Exposure: accounts following alcohol brands only; Recovery Exposure: accounts following alcohol brands and recovery resources accounts.



across all four fictitious accounts, thus suggesting the settings may not have effectively blocked content on either platform. Several reasons may explain the observed patterns in our study, which we will discuss in detail in the following.

Algorithms Prioritization of the Content

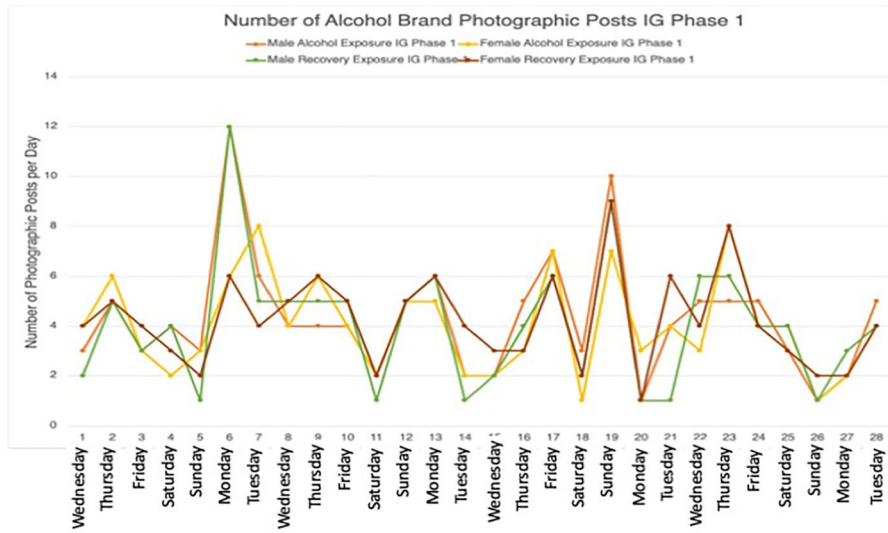
The I.G. newsfeed algorithm in Spring 2022 - when all the data was collected - was (and still is) dictated by the prioritization of reels, original content, figuring out how much the user scrolls the application when they scroll the application, and what they do when scrolling the application which then generates the content the application thinks is likely to be relevant (35). Twitter, on the other hand, does its algorithm differently. Their algorithm is divided into 3 Phases: Ranked Tweets, In Case You Missed It, and Remaining Tweets. They then have ranked signals for tweets to push tweets to the timeline, including Recency, Relevance, Engagement, and Rich Media (Gifs, Photos, Videos, and others) (36). This algorithm would prioritize photographic tweets and push them to the newsfeed.

The Instagram algorithm primarily prioritizes reels, figures out user habits, and has an algorithm that pushes content in chronological order (37). In contrast, Twitter pushes out any photographic content (36). In fact, Twitter has a more complex algorithm that ranks Tweets based on a few different factors and has a chronological and non-chronological order in which Tweets are seen by the user (36). Simultaneously, if an alcohol brand posts many I. G. reels and a user watches the reels, the I.G. algorithm is more likely to prioritize the alcohol brand account content. The differences between these platforms' algorithms make

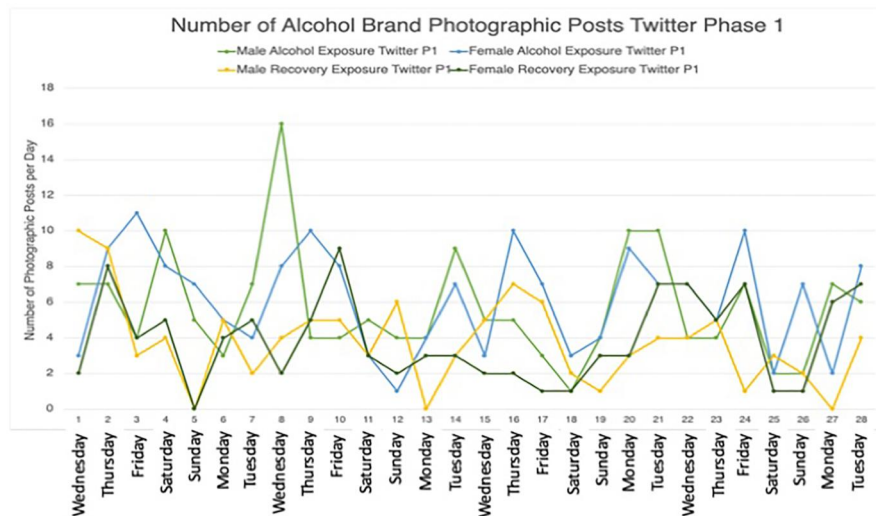
the observed differences between I.G. and Twitter in blocking alcohol-related photographic content even more interesting: Despite Twitter prioritizing photographic content, accounts following recovery resources were receiving less alcohol-related photographic content. These results suggest that somehow the Twitter algorithms may be more effective in determining 'relevance' concerning how an account/user is characterized per the other accounts it follows. In the case of our study, it may be that the Twitter algorithms, to some extent, determine (although not effectively) that alcohol-related photographic content may be irrelevant to a user who is following recovery resource accounts. However, we cannot determine this with complete certainty, and our results were based on the algorithm from April 2022. Thus, Twitter is better at suppressing alcohol-related content for social media users who follow recovery accounts than those who do not.

Another difference between the two platforms that may relate to how the algorithms prioritize content, concerns the randomness in the pattern of content received on Twitter that was not seen on I.G., as demonstrated in the graphs in Figure 2. One potential explanation for this relates to how the Twitter algorithm sets up and prioritizes tweets to appear on the feed based on the chronological order, user engagement, and user interest inferred by the algorithm (38). I.G., on the other hand, determines what a user sees on their newsfeed by the following: Interest, Frequency, Following, Recency, Relationship, and Usage (39). However, both are based on user interaction, which was not something tested in this study. Nevertheless, in general, the more recent a post, the more likely a user is to see it on their I.G. newsfeed when they are scrolling

FIGURE 2. Daily alcohol-related photographic posts from all four accounts with default privacy settings on. Note that the duration of data collection in Phase 1 was double (28 days) that of Phase 2 (14 days). Alcohol Exposure: accounts following alcohol brands only; Recovery Exposure: accounts following alcohol brands and recovery resources accounts.



(a)



(b)

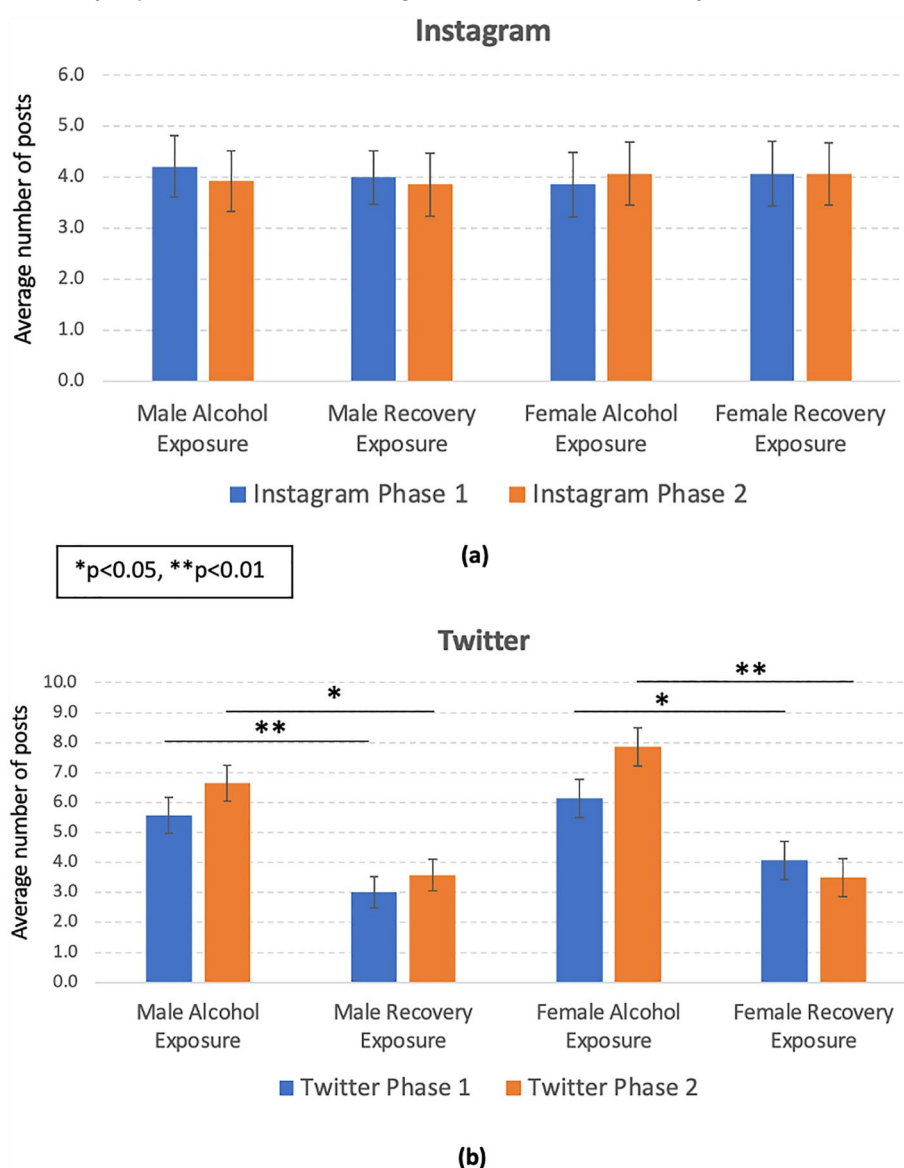
through it versus Twitter showing tweets from other dates. Another potential explanation for the randomness of the pattern of a daily number of tweets received by each account may be related to how on the Twitter timeline, the user gets both real-time tweets, as well as personalized tweets. This algorithm is unique to Twitter, meaning that the user could potentially see spikes at a random time during the week instead (40,41).

Sex-Differences in Contents Pushed

Similar to Barry et al. (42) we found that the female accounts would generally get more content pushed to them on both platforms, Figure 1. This result is interesting, as statistically,

men are more likely than women to develop an AUD (34,43). This data suggests that gender is a factor in determining how much content is pushed to the newsfeed. This is an interesting trend as alcohol use by women is also more stigmatized than men’s, especially if they are mothers. Cultural norms and religious constraints also may influence the bias in alcohol marketing, targeting men more than women. Nevertheless, despite all such influences, alcohol is a normalized substance in many cultures and a substance that is highly profitable as part of a legal industry. A recent study on women in sobriety with a history of problematic alcohol use suggests that these women may be particularly vulnerable to gendered marketing messages that try to associate

FIGURE 3. Comparison of the average number of posts on (A) Instagram and (B) Twitter. Alcohol Exposure: accounts following alcohol brands only; Recovery Exposure: accounts following alcohol brands and recovery resources accounts.



alcohol consumption with positive attributes such as stress relief for mothers, bonding with friends, and female empowerment (21).

Post Frequency and Account Popularity

Another potential reason for Twitter potentially being better at differentiating between an account following recovery resource accounts may be that on Twitter, the recovery resource accounts posted more frequently. Since both I.G. and Twitter algorithms rely on post and tweet engagement to push posts, this potentially may have contributed to how I.G. had a harder time profiling a user in recovery.

Tweets also get a ranking based on several factors, including factors surrounding account popularity, the time

the tweet was posted, the tweet’s popularity, and something called a “Blessed Account” (44). Tweets containing rich media (I.e., videos or photographs) hold a higher score (44). Our results also suggest that the number of alcohol brand posts peaks on Thursdays and Fridays, with random peaks corresponding to a holiday or significant event, as shown in Figure 2, correlating with prior reports on the trends of alcohol brand posts (45). This result is significant for social media users debating seeking recovery, as Friday is the end of the week for many individuals there is a prolonged period of free time. Additionally, there is more time to potentially view triggering and/or cueing content that I.G., and to a lesser extent Twitter, did not suppress. It is also important to note that recovery resource accounts were more likely to post on Twitter than on Instagram.

Thus, there was less alcohol brand content on the Twitter Timeline and more content from recovery resource content.

User Autonomy versus Algorithms

Another layer to consider in the context of exposure to alcohol-related content on social media is the misperceived notion of user autonomy in choosing what content they get exposed to (46). In reality, social media algorithms can and do interfere with a user's autonomy in that regard by controlling or manipulating a user's attention or focus based on their interactions with the content or other social media users using a platform or simply based on their demographic data. As a result, a user may be exposed to more of a specific type of content per the discretion of the algorithm and not completely content they chose (46).

In our study, we found no significant differences in the average number of alcohol brands' photographic content in both Phases of the study that had different privacy settings (Figure 2). One might argue that this may not be unexpected given that our fictitious accounts were deliberately following the alcohol brand accounts and that privacy settings will not supersede the social media users' choice in what they choose to follow. However, that is not precisely the case. We identified that the accounts were receiving alcohol-related content from other alcohol-brand accounts (e.g., all four accounts would receive posts from Budweiser on Twitter) other than the specific alcohol-brand accounts they were following. This suggests that the privacy settings may not effectively suppress alcohol-related content independent of the social media users' choice to follow certain alcohol-brand accounts.

Alcohol Marketing

There is evidence, based on industry data, that the alcohol industry utilizes marketing to encourage more consumption, whether it is through promoting more occasions for drinking or through simply recruiting more drinkers in general (47). While some marketers, unfortunately, target heavy drinkers (as they consume more alcohol) (47), some marketers do have a 'not-to-target' list to avoid targeting those who may be in recovery. However, that is not a common practice.

In the U.S., alcohol advertising is such a normalized and prominent part of American culture it is commonplace to see alcohol advertisements frequently on television, on billboards, played on the radio, on web pages, and in other places that people regularly frequent (5). Social media adds to the different forms of marketing people are typically exposed to via traditional means- T.V., retail displays, and more, so it is having a cumulative effect. The constant impact of alcohol advertising in digital media has been suggested to affect the increase in alcohol consumption, as the United States for many decades did not advertise alcohol on digital media up until 1996 (48). Wilcox et al.

(48) found that before the lifting of the ban, liquor sales were declining, but from 1996–2008, there was an 18% increase in liquor sales per capita. Moreover, on a policy level, social media platforms provide platforms for sophisticated, targeted, and data-driven marketing techniques connecting consumers and alcohol companies (producers, retailers, and others) in novel direct ways, increasing the effectiveness of the marketing strategies adopted by the companies (49). As well outlined by Carah and Brodmerkel (49), the complexity of social media platforms as a means for marketing is a multi-layered phenomenon, as consumers can be targeted in unprecedented ways through these platforms. Among such strategies, sponsored posts, utilization of social media influencers, location-, time-, and context-specific posts through algorithms that are primarily black boxes, increase the reach and impact of social media-based marketing in ways that a consumer may not even be aware of. The ease of access to such content and the ability to ease the logistics of purchasing an item being exposed to content on these platforms make them an effective marketing tool like no other (49).

In the U.S., alcohol advertisement rules and regulations are voluntary and self-imposed by the alcohol industry's self-regulated marketing codes to restrict alcohol marketing activity (48). These rules are mainly aimed at reducing the risk of underage drinking by minimizing youth exposure to any such advertisement (50). Massachusetts, USA, where our study was performed, has very few laws on alcohol advertising (51). The existing laws that would impact online alcohol advertisements consist of regulations mainly on the content, such as not making false or misleading statements and advertisements in an offensive or objectionable manner (51). But there are no regulations on the frequency of the posts, promotion/pushing of the posts, and anything that has to do with regulating the algorithms used to expose social media users to alcohol-related content.

Implications for Policy

Another area for managing the level of exposure social media users encounter is devising policies to regulate the marketing practices of alcohol brands on social media. However, one obstacle in regulating social media platforms regarding marketing practices is a lack of transparency in how social media algorithms work in marketing and targeting social media users (52). It is challenging to regulate a process mainly controlled by automated algorithms that are kept secret. Moreover, no international regulation is in place in the digital domain to regulate how consumer data is analyzed or sold for commercial purposes and product marketing. This also entails the promotion of alcoholic beverages on social media and the adoption of social media platforms by some of the multinational alcohol companies for digital marketing of their products (53), and in some cases may even entail partnerships and joint business

planning between alcohol companies and social media companies (49). This makes it nearly impossible to regulate these platforms and a challenge to harmonize policies on practices adopted by different platforms with not perfectly comparable functionalities. Another layer of complexity is the extent to which any such policy could or should interfere with a user's free will when they choose to be exposed to potentially harmful content by following an account, as was the case in our study.

Additionally, it has been shown that strengthening laws on alcohol advertising to make the laws more restrictive has decreased the amount of negative health-related impacts alcohol causes, for example, seen by the restrictive laws implemented in Finland (54). Moreover, as another example, Scotland has recommended stricter regulations for alcohol advertising for young adults that would restrict how alcoholic beverages are advertised in digital media and public places. Additionally, it would attempt to make alcohol less enticing and explain the risks of drinking.

On the other hand, due to how the federal government of the United States as well as some state governments, actively working to remove laws that protect vulnerable populations (see: the overturning of *Roe v. Wade*, laws about transgender healthcare, a lack of laws regulating gun control, no uniform law regulating data privacy except for fragmented laws broken up by sectors) (55,56) it is unlikely that any protections for vulnerable populations accessing social media applications will be put into law in the foreseeable future. However, providers can be aware of their patients' potential exposure when using social media. They may want to discuss the risks and benefits of using social media and possible coping mechanisms when faced with alcohol-related content on social media (5).

Limitations

Limitations of this study include using only 4 accounts, the accounts being on one phone and exclusively on an iPhone, the data collection performed in one-time zone, and that the impact of interactions was not studied. The data collection was also done exclusively on an iPhone. Additionally, the fictitious accounts did not follow individuals' or close relationships' social media accounts. It is known that alcohol brands encourage interaction on social media by having online events or games, posting content that encourages people to drink, and posting content that is not about drinking but is brand-related (57) to expose them to alcohol brand-related content. This type of peer-related exposure was not studied during this study. More broadly, our study was not designed to examine the interaction with alcohol marketing posts and the implications of engaging with the posts for the patterns observed, an important factor to consider in the context of exposure to alcohol marketing on social media. For instance, a survey of individuals between ages 15–29 years in Australia (17) has reported that interaction with alcohol marketing content on social media in the form of liking the alcohol

brands' posts is more common among males and those living outside of major cities. The same study also reports that interaction with alcohol marketing pages on social media is associated with riskier alcohol consumption patterns and an earlier age of first alcohol use.

Furthermore, we did not count the number of "likes" a post had, which has been shown to influence the feelings towards a post (the more "likes" a post has, the more positive sentiment). The intent to consume alcohol (also the greater the "likes," the greater the intent to consume alcohol) (58). Moreover, the second data collection phase was only 2 weeks long versus four. Thus, 2 weeks of the first data collection phase was not used for analysis.

Finally, for the accounts that followed recovery resources, we still had them follow alcohol brands for comparison purposes. This may seem contradictory as individuals attempting to recover from an AUD are often expected to disengage entirely from alcohol-related content. However, studies have shown that it is also likely that when an individual decides to start seeking recovery from AUD, they may have an account engaged with a significant amount of alcohol-related content (59). While there is the potential/option for the individual to "unfollow" those accounts, due to the nature of behavior change maintenance, this "unfollowing" is often hard to sustain (60). Indeed, sometimes people in recovery from AUD continue to engage with alcohol brand-related content (21). In addition, the ability to modify a previously rewarded behavior that requires effective decision-making may be challenging and compromised in individuals with AUD (61). However, it is also true that many in recovery do choose to unfollow alcohol brand account to sustain recovery and avoid exposure to material that may encourage them to drink.

CONCLUSION AND FUTURE DIRECTIONS

Exposure to alcohol-related triggering content on social media platforms may pose a significant risk to those recovering from AUDs. Privacy settings do not effectively block the photographic content on I.G. and Twitter platforms. Twitter algorithms, however, are more successful in profiling an account following recovery resource accounts differently, resulting in suppressing potentially triggering alcohol-related content, though not totally effective. These results seem to suggest that the risks of exposure to triggering/cueing photographic alcohol content may outweigh the benefits of using social media. These results also suggest that social media platforms could implement programs to help block potentially triggering and or cueing content. Social media platforms could possibly implement a setting to block any triggering or cueing content that does not force the user to have to block or unfollow specific accounts. Social media platforms could also implement a feature to allow social media users to pick what content they want to "blur out" so they would not see content such as alcohol brand-related content.

Suggestions and Considerations for the Future

One thing that the recovery resources accounts could consider doing is potentially posting more on Instagram. This is particularly important because about 30.3% of all Instagram users are between 26 and 34 years of age (62), and most are thought to develop an AUD around 30 years of age (34,63). Another factor to consider is that privacy is crucial when seeking recovery for AUD. Unfortunately, AUD carries a stigma that, while it should not, can affect many aspects of life, such as employment, relationships, and how one is perceived by society (64). This information, if not appropriately protected, could potentially put a user seeking recovery at risk for a multitude of problems such as loss of employment, loss of relationships, and potentially societal ostracization (64) if that data falls into the wrong hands, as the data is location specific. Even with privacy filters on, location filters are not that effective. Therefore, social media platforms must remain vigilant to protecting social media users' privacy while improving their algorithms to filter alcohol-related content effectively for social media users who may be harmed by exposure to such content.

Policy is lagging behind the fast-changing alcohol marketing strategies involving social media marketing (5). Perhaps devising policies that would monitor the advertisements in advance to ensure vulnerable populations (such as youth, heavy drinkers, or those in recovery) are not targeted or even indirectly persuaded about the positive impacts of drinking would be helpful. For instance, associating drinking advertisements with events such as Super Bowl, which has a large mixed audience, may inadvertently negatively impact vulnerable individuals, including the youth, by exposing them to alcohol-related content. It is also important to expand the definition of who should be considered as vulnerable in the policies around alcohol marketing as some other countries are also pursuing it. For instance, Scotland is currently running a consultation on more restrictions and state regulations needed to protect children and young people as a vulnerable group, but also people in recovery and with or at risk of alcohol problems as another group at risk as well as all people at the population level (65). The alcohol industry should also be encouraged to adopt more restrictive marketing regulations on social media and encourage marketers to have a 'not-to-target' list. If not that, at the very least, criteria for not targeting specific populations, particularly for digital marketing and work closely with big tech companies to realize such policies algorithmically on social media platforms. Unless marketers are onboard in making an effort to reduce the negative impact of alcohol marketing on public health, policies alone cannot be effective as marketers can always find ways to increase consumer engagement, the vulnerable consumers (66).

All in all, it seems reasonable to suggest that until there are better technical safeguards and appropriate policies to protect social media users exposed to a constantly evolving

digital alcohol marketing, it may be beneficial for providers to prioritize patients finding alternative ways for human connection, such as recovery groups, clubhouses, and others, rather than using social media platforms as a means to connect. Other directions to consider is expanding the same framework for safeguarding social media users to other platforms such as TikTok, YouTube, Reddit, and other social media platforms that may be emerging in the future.

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The writing of this paper was supported by a grant from the National Institute on Alcohol Abuse and Alcoholism (NIAAA) K01-AA027833.

Authors report no competing interests.

Data that support the findings of this study are available on request from the corresponding author.

Previous Presentation: Society for Neuroscience, San Diego, CA, November 12–16, 2022.

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Received February 8, 2023; revised May 1, 2023; accepted May 10, 2023.

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