Factors Associated with Younger Adolescents' Exposure to Online Alcohol Advertising

Elizabeth J. D'Amico[1], **Steven C. Martino**[2], **Rebecca L. Collins**[1], **William G. Shadel**[2], **Anagha Tolpadi**[1], **Stephanie Kovalchik**[3], and **Kirsten M. Becker**[1]

[1]RAND Corporation; 1776 Main Street; Santa Monica, CA 90407-2138

[2]RAND Corporation, 4570 Fifth Ave #600, Pittsburgh, PA 15213

[3]Institute of Sport, Exercise, and Active Living, Victoria University, Melbourne, Australia

Abstract

Little is known about the extent and nature of youth exposure to online alcohol advertising, or factors that may be associated with exposure. The current study recruited middle school students who completed a paper survey and then logged each alcohol advertisement that they encountered over a two-week period using cell phones as part of an ecological momentary assessment (EMA) design. We examined the percentage of youth who reported exposure to online alcohol advertising in the past two weeks, average weekly rate of exposure, types of online alcohol advertisements youth reported seeing, and factors that increased youths' risk of exposure to online alcohol advertising. Analyses are based on 485 participants (47% female; 25% Hispanic, 25% white, 27% black; 6% Asian, 16% other). Youth logged exposures to a total of 3,966 (16,018 weighted for under-reporting) alcohol advertisements across the monitoring period; 154 (568 weighted) or 3.6% were online ads. Seventeen percent of youth reported seeing any online alcohol ad; the majority of online ads seen were video commercials (44.8%) and banner/side ads (26.6%). Factors associated with greater ad exposure were being older, rebellious, and Black race; greater parental monitoring and more hours spent on social media were associated with less exposure. Findings provide important information about adolescents' exposure to online alcohol advertising and what might contribute to a greater likelihood of exposure. Given that online ad exposure is linked to drinking behavior, prevention programming for younger adolescents should continue to address this issue to help youth make healthy choices regarding alcohol use.

Keywords

adolescents; advertising; alcohol; ecological momentary assessment

Underage drinking continues to be prevalent in the United States. Over 20% of current U.S. high school students report drinking alcohol for the first time before age 13 (Eaton et al., 2012). Furthermore, regular drinking increases as youth age, with 10% of 8th graders and 22% of 10th graders reporting drinking in the past month (Johnston, O'Malley, Bachman, & Schulenberg, 2015). Underage drinkers are more likely to drop out of school (El Ansari,

Corresponding author: Elizabeth D'Amico, PhD, RAND Corporation, 1776 Main Street, Santa Monica, CA 90407-2138.

Stock, & Mills, 2013; Kelly et al., 2014), engage in delinquent behavior (D'Amico et al., in press), use other drugs (LaBrie, Rodrigues, Schiffman, & Tawalbeh, 2008; Stueve & O'Donnell, 2005), and develop alcohol use disorders in the future (Hingson, Heeren, & Edwards, 2008). Underage drinkers who drink alcohol regularly may also experience subtle neurological deficits, such as decreased ability in planning, executive functioning, memory, spatial operations, and attention (Squeglia, Jacobus, & Tapert, 2009) that may have life-long effects on overall functioning.

One factor that may be involved in initiation and escalation of underage drinking is alcohol advertising (e.g., Collins, Ellickson, McCaffrey, & Hambarsoomians, 2007; Grenard, Dent, & Stacy, 2013; Jones & Magee, 2011; McClure, Stoolmiller, Tanski, Engels, & Sargent, 2013). Youth are exposed to more than three alcohol ads per day, with most exposures occurring via outdoor ads and television (Collins et al., 2016). In recent years, the alcohol industry has begun to shift its emphasis from traditional advertising channels to a variety of forms of digital and online marketing (Chester, Montgomery, & Dorfman, 2010; Griffiths & Casswell, 2010; Mart, 2011; Mosher, 2012; Nicholls, 2012). In 2011, 27 of 40 leading alcohol brands had a dedicated website (Gordon, 2011), and a 2012 review of Facebook found 1,017 company sponsored alcohol-brand related sites (Siphannay et al., 2014). Online marketing is designed to be particularly engaging encouraging potential consumers to interact with and "befriend" the brand or product and integrate it into their personal relationships (Chester et al., 2010) and engaging marketing is known to have an especially powerful influence on adolescents (Wilcox et al., 2004).

Youth have tremendous potential for exposure to online alcohol marketing given how much time they spend online. A recent national survey found that 92% of adolescents aged 13–17 report going online daily, with nearly a quarter of survey respondents saying that they are online "almost constantly" (Lenhart, 2015). The three most popular online activities among youth aged 11–14 years are social networking on sites such as Facebook and Instagram, playing online video games, and watching videos on outlets such as YouTube (Rideout, 2016). The contemporary alcohol marketing landscape encompasses these new media platforms (Meier, 2011), and new marketing strategies are constantly being developed and refined to reach users (Chester et al., 2010; Mart, 2011). The highly engaging and social nature of interactive online media (e.g., photos, games, ability to share with friends) is likely to enhance the effects of alcohol advertising and promotion on youth drinking. There is, in fact, evidence that investment in online marketing is "paying off": a recent study showed that youth who are more receptive to online alcohol marketing are more likely to transition to heavy drinking one year later (McClure et al., 2016).

Although little is known about the extent and nature of youth exposure to online alcohol advertising or the factors that may be associated with exposure, there is evidence that youth have at least some exposure to these types of ads (Collins et al., 2016; McClure et al., 2016). Although alcohol companies subscribe to a self-regulatory code of ethics that include provisions for limiting youth exposure, the mechanisms that they use are known to be inadequate (Jones, Thom, Davoren, & Barrie, 2014). For example, in a recent study, researchers created fictitious email accounts linked to YouTube user profiles and found that each of the underage profiles that they created was able to access alcohol industry content

(Barry et al., 2015). Online and social media are also particularly challenging to study because content can change within minutes and popular platforms within months, and the boundaries of Internet content are limitlessly broad and diverse (Bull, 2010). Yet this information is sorely needed to guide regulatory policy on alcohol advertising and promotion.

The Tracking and Recording Alcohol Communications Study (TRAC; Martino et al., in press) provides the kind of detailed data that is needed to inform the policy debate about online alcohol advertising. In this study, middle school-aged youth logged each alcohol advertisement that they encountered over a two-week period using cell phones as part of an ecological momentary assessment (EMA) design. EMA has significant advantages over retrospective recall in that it minimizes recall biases and allows researchers to obtain detailed information about events of interest (Shiffman, Stone, & Hufford, 2008), including advertising (Martino, Scharf, Setodji, & Shadel, 2012). Because TRAC study participants logged exposures to online ads at the moment those exposures occurred, we can be confident that our estimates of total exposure are minimally affected by recall biases and distortions. Our data thus provide a unique look at online exposure among younger adolescents and allow us to address several important questions: (1) What percentage of younger adolescents report any type of exposure to online alcohol advertising in the past two weeks, (2) what is the average weekly rate of exposure among this population, (3) what types of online alcohol advertisements do youth report seeing, and (4) what individual, peer, parent, and social media factors may increase youths' risk of exposure to online alcohol advertising?

Method

Participants

We recruited 606 middle school students from two large school districts, after school clubs, and community organizations in Southern California with flyers and other notices. Enrollment occurred on a rolling basis over 10 months (September 2013 June 2014). We talked with parents by phone to determine children's eligibility. Youth were eligible to participate if they were 11–14 years old at baseline, could speak and write English, and did not have a mental or psychological condition that would preclude participation. More than one youth per family was eligible provided that each youth met all eligibility criteria. All study procedures were reviewed and approved by our institution's IRB.

Procedures

TRAC is a longitudinal study. At baseline and every eight months thereafter, students completed a paper survey assessing demographics, social context (e.g., parental and peer characteristics), and drinking behavior. Each paper assessment was followed by a two-week EMA period during which students report any alcohol advertising they observe via handheld computers. Of the three waves at which EMA data were collected, this article focuses primarily on the second (Wave 2). Data collection for Wave 2 occurred from July 2014 to February 2015.

Each participant and a parent/guardian came to a neighborhood study center for baseline assessment and training immediately prior to the start of the first EMA assessment. After parental consent and youth assent procedures, participants completed a one-day training session for the handheld devices and on the study definition of an alcohol advertisement. Participants were instructed to keep their device turned on at all times, charge the device at night while they slept, respond to random prompts issued by the device, and initiate data entry each time they encountered an alcohol advertisement. Participants were told that they should only record advertisements that they naturally encountered and should not deviate from their normal activities to "find" advertisements. They were trained to report exposure to a broad range of advertising types in a variety of venues and media, including various forms of online advertising. The range of online advertising that participants were trained to distinguish included alcohol company websites, banner ads, streaming video ads, online magazines, Google search ads, email ads, and ads appearing on social networking sites or mobile applications such as YouTube, Facebook, Instagram, and Twitter.

Before leaving the study center, participants practiced recording an advertisement (excluded from analysis). Participants then carried the device with them at all times for 14 days, but were instructed to leave the device in their locker or backpack while at school. All device functions besides the EMA software were disabled. At the end of the assessment, participants returned the device to the study center where data were uploaded. Participants earned $20 for completing the baseline questionnaire and attending training, and $40 each time they carried the device to track exposures to alcohol ads. To incentivize compliance, we paid an additional $25 to participants who responded to 76%-84% of the random prompts and an additional $60 to participants who responded to 85% of them.

Alcohol Advertising Exposure Measures (EMA data)

For each alcohol advertisement that participants logged during EMA, youth were asked first to broadly categorize the advertising venue or medium where it appeared, using a dropdown menu: "television, print, radio, outdoor, indoor, item with a brand name, online ad, product placement, or other?" For online alcohol ads, participants were asked to further specify the type of online ad that they encountered: alcohol company website, banner ad, video ad, online magazine, an ad appearing on a social networking site or mobile application, or other type of online ad. Ad reports were time and date stamped electronically.

Predictor Variables (Paper Survey)

Given that a great deal of research has shown that certain individual (e.g., rebelliousness), parent (e.g., monitoring) and peer (e.g., approval) factors are associated with drinking behavior, we examined whether these types of factors might also be associated with exposure to online alcohol advertising. For example, parental monitoring is typically associated with less drinking behavior (e.g., Clark, Shamblen, Ringwalt, & Hanley, 2012), so we might expect that it would be associated with less exposure to online alcohol advertising. In addition, peer approval and rebelliousness are often associated with greater alcohol consumption (Tucker, Ellickson, & Klein, 2008; Voelkl & Frone, 2000); thus we hypothesized that peer approval and rebelliousness would be associated with greater exposure to online alcohol advertising.

Information on relatively stable participant characteristics, including demographics, parental monitoring, and rebelliousness came from the baseline paper survey collected 8 months prior to the advertising exposure measures; all other predictor variables are drawn from the most recent (wave 2) paper survey. Demographic information included participant age, race/ ethnicity, and parent education (the highest level of education attained by the participants' more highly educated parent: less than a high school diploma, high school diploma, some college, or Bachelor's degree or more). Individual factors included drinking behavior and rebelliousness. We used "ever tried alcohol" (e.g., ever had a sip or more of alcohol vs. never had even a sip of alcohol) as our measure of drinking behavior as research has shown that even a sip of alcohol among younger youth can affect attitudes and behavior; for example, sipping alcohol before middle school is associated with subsequent adverse outcomes (Jackson, Colby, Barnett, & Abar, 2015). Rebelliousness consisted of six items [e.g., I get in trouble at school; (Sargent et al., 2004)] that were answered using a 4-point response scale (1=not at all like me to 4=just like me). Because responses greater than 2 (a little like me) were rare, we dichotomized these items (0=not at all like me, 1=any other response), summed the dichotomous indicators (α=0.66) and log-transformed the sum to create the index used in our analyses.

Peer factors included contact with peers who drink (D'Amico, Miles, Stern, & Meredith, 2008) and perceived peer approval of drinking (Orlando, Tucker, Ellickson, & Klein, 2005) *Contact with peers who drink* was assessed with three items: How often are you with kids who are drinking alcohol (1=never to 4=often), how often do you think your best friend drinks alcohol (1=never to 4=often), and how often were you offered alcohol by kids your age or older in the past 30 days (1=never to 7=20 or more times). We created a composite measure from these three items that was equal to the average of the first two items plus 1 minus the integer value for the response to the third item (α = 0.76). Because responses greater than 1 were rare, we created a dichotomous index of contact with peers who drink that was equal to 1 if the composite measure was greater than 1 and 0 otherwise. We averaged responses to four items to create a measure of *peer approval of drinking*: how would your friends react if they found out that you . . . drank alcohol once, drank alcohol more than once, drank alcohol every weekend, and drank enough to get drunk (1=strongly disapprove to 5=strongly approve; α = 0.89). Because responses greater than 1 were rare, we created a dichotomous index of peer approval that was equal to 0 if all four items were rated 1 (strongly disapprove) and 1 if any item was rated greater than 1.

Parent factors included *parental monitoring* (Stattin & Kerr, 2000) *and parental approval of drinking* (Nash, McQueen, & Bray, 2005). Parental monitoring was equal to the mean of seven items (e.g., my parents or guardians know what I do during my free time [1=never to 4=always]; α = 0.82;). *Parental approval of drinking* was measured in the same way as peer approval of drinking except that participants were asked to judge how their parent would react to the four scenarios listed above. Because responses greater than 1 were rare, we created a dichotomous index of parental approval that was equal to 0 if all four items were rated 1 (strongly disapprove) and 1 if any item was rated greater than 1.

Social media use was measured as the number of hours spent on a typical day using Facebook, Twitter, Instagram, or other social networking sites (<1 hour, 1–4 hours, >4

hours) and *other online activity* was measured as the number of hours spent on a typical day visiting other websites (besides social networking sites and not including hours spent online for school work; <1 hour, 1–4 hours, >4 hours).

Random Prompts

Participants were also prompted by their device, three times a day, to complete brief assessments of their alcohol-related beliefs. Prompts were audible and spread throughout the waking day. Responses to prompts were used to test hypotheses that are not the focus of the current report; they factor into this report only as a direct measure of compliance with study procedures. Compliance with random prompts is a key feature of EMA studies and a widely accepted index of index of adherence with EMA (Shiffman et al., 2008).

Non-Response Weighting

Best practices for survey research include correction for nonresponse, which can bias estimates if left unaddressed (Rubin, 1996). It was not possible to directly observe failure to report ad exposures (a form of nonresponse), but we could do so with regard to random prompts. On average, random prompt compliance at Wave 2 was 71%, which is similar to compliance rates observed in other EMA studies of youth (Scharf, Martino, Setodji, Staplefoote, & Shadel, 2013). Hispanics and Blacks exhibited lower compliance than whites; having a sibling in the sample and getting good grades were positively associated with compliance. Examination of ad reports revealed a very large drop in reported exposures on the 14th (final) day of monitoring, suggesting that most participants were not aware they should report exposures on this day. We therefore only examine reporting on the first 13 days of event-sampling. Finally, detailed analyses of the ad exposure data provided evidence of a fatigue effect (Courvoisier, Eid, & Lischetzke, 2012). Respondents reported fewer ads as the 13-day period progressed. To more accurately represent the level of ad exposure throughout the data collection period, we derived nonresponse weights to correct for participant differences in compliance and reporting fatigue (technical notes available on request).

Analysis Strategy

Analyses consisted of weighted estimates (means and percentages) of exposure to online alcohol advertisements as well as bivariate and multivariable regression models. Descriptive statistics revealed that a significant proportion of the sample reported zero exposure to online alcohol advertising. Zero-inflated Poisson (ZIP) regression is a method suitable to handling data in which the outcome variable has a distribution with a high zero count (Coxe, West, & Aiken, 2009). Zero-inflated models involve a combination of binary logistic and Poisson regression. The logistic portion of the model separates participants who solely produce zero observations (i.e., true zeros; in this case, those with no opportunity for exposure to online alcohol advertising) from those who produce observations in a certain range including zero (sampling zeros). The count portion of the model, which is our focus in this report, uses Poisson regression to predict the amount of exposure to online alcohol advertising among those with the opportunity for exposure. We began by fitting bivariate models of the association between exposure to online alcohol advertising and each of our predictor variables. We then fit a multivariable regression model with all predictors.

The most common way of interpreting ZIP models is to exponentiate the coefficients, leading to values that may be interpreted as incidence rate ratios (IRRs). In our models, the exponentiated coefficients indicate the factor by which the expected number of online alcohol ad exposures changes for each one unit change in the corresponding predictor (given the other variables in the model are held constant). Thus, IRRs greater than 1 indicate that increased levels of exposure to online alcohol ads are associated with a predictor; IRRs less than 1 indicate that a variable is associated with decreased levels of exposure. Two-sided Wald tests were used to test the significance, $p < 0.05$, of each model coefficient.

Results

Analyses are based on 485 participants (from a total of 400 households). Youth were approximately evenly distributed across ages 12 to 15; 47% were female, 65% from intact nuclear family households, 34% of youth reported ever having a sip of alcohol in their life, and 5% reported having a full drink of alcohol in their life. We recruited a diverse sample (25% Hispanic, 25% non-Hispanic white, and 27% Black, 6% Asian, and 16% "other"). Youth logged exposures to a total of 3966 (16018.12 weighted) alcohol advertisements across the 13-day monitoring period; 154 (568.21 weighted) or 3.55% were online ads. The percentage of youth that reported seeing any online alcohol ad in the past two weeks was 17%. This means that those who were exposed to ads saw an average of about one ad every two days (485 X 0.17 = 82.45; 568.21/82.45 = 6.89/13 = 0.53 ads per day). Of the online alcohol ads that youth reported seeing, 44.81% (N=69 ads) were video commercials, 26.62% (N=41 ads) were banner/side ads, 16.88% (N=26 ads) were encountered on social media , 7.79% (N=12 ads) were encountered on alcohol company websites, 0.65% (N=1 ad) was encountered via an online magazine or newspaper, and 3.25% (N=5 ads) were other online ads.

Table 1 shows bivariate associations between exposure to online alcohol advertising and each of the predictor variables examined in this study. The strongest association observed was between rebelliousness and exposure to online alcohol advertising. A one-unit increase on our measure of rebelliousness was associated with a six-fold increase in exposure to online alcohol advertising. Among the demographic characteristics examined, age and race/ethnicity were associated with exposure to online alcohol advertising. Specifically, being older and being Black were associated with increased exposure to online alcohol advertising, whereas specifying "other" as one's racial/ethnic background (i.e., not Hispanic, White, or Asian) was associated with less exposure to online advertising. As expected, greater parental monitoring was associated with decreased exposure to online alcohol advertising. Parental education was also a significant predictor of exposure, whereby youth with more highly educated parents reported more exposure to online alcohol advertising. Greater peer approval of alcohol was associated with increased exposure to online alcohol advertising, but greater contact with friends who drink was associated with decreased exposure to online alcohol advertising. Surprisingly, greater hours spent on social media was associated with less exposure to online alcohol advertising. Results from the multivariate ZIP model are presented in Table 2. In this model all of the statistically significant associations observed at the bivariate level remained except for the two peer variables.

Discussion

The current study is an important first step in understanding younger adolescents' exposure to online advertising, quantifying both amount of exposure and the types of ads that youth are likely to see when they are online. In comparison to alcohol advertising in other media and venues, the average youth in this age group sees relatively few online ads for alcohol. This is partly because only a small number of youth see any online alcohol ads less than one in five are exposed. When we focus within the exposed subgroup; however, exposure is not at all infrequent. The average number of exposures for these youth is about one ad every two days, or about 182 online alcohol ads each year. This is roughly half the average number of television alcohol ads that youth as a whole see each year (Center on Alcohol Marketing and Youth, 2012; Collins et al., 2016), enough to raise concern.

Given these very big differences between youth in their likelihood of exposure, it becomes particularly important to understand factors associated with exposure. We find that several demographic, individual, and parental factors contributed to seeing online advertising. Specifically, Black youth and youth with parents with higher education reported seeing more online advertising. In contrast, youth that reported "other" ethnicity were less exposed to online advertising. The finding that Black youth are more exposed is consistent with prior studies documenting greater media use in this group (Rideout, 2016) as well as greater alcohol advertising exposure (Collins et al., 2016; Ringel, Collins, & Ellickson, 2006). Regarding education, youth of parents with greater education/income tend to have greater access to multiple online opportunities, including some combination of computers, laptops and smart phones; research has shown, for example that lower income and lower education households are still somewhat less likely to use the internet in any capacity (Madden, Lenhart, Duggan, & Cortesi, 2013). Given this increased access to technology, it may be more difficult for these parents to monitor all of their teen's online activity, thus these youth may see more online alcohol advertising. Of note, we did not find gender differences in exposure to online alcohol advertising. Studies have shown that although boys and girls do tend to engage in different online activities (e.g., girls more likely to use instant messaging and social networking and boys more likely to do gaming) (Lenhart, 2015; Park, 2009; Pujazon-Zazik & Park, 2010), they appear to use the Internet in nearly equal amounts overall (Lenhart, 2015; Pujazon-Zazik & Park, 2010).

As technology continues to become more accessible to all youth, parents must recognize that alcohol advertising is among the various types of age-inappropriate online content to which youth may be exposed. Thus, monitoring is important, as was shown in this study: Youth who reported less exposure to online alcohol ads also reported greater parental monitoring. Helping parents to monitor their son or daughter's online access is important as it could decrease the chances that they are exposed to alcohol advertising and thus decrease the chance that they initiate drinking. It is well known that when parents are more involved in their teens' lives, teens are less likely to use substances (Britt, Toomey, Dunsmuir, & Wagenaar, 2006; Scribner et al., 2008). Although it can be challenging to effectively monitor online behavior, a recent report indicated that the majority of parents do take several steps to do this, including checking up on what their teen is posting on social media and limiting the amount of time their teen spends in front of various screens (Anderson, 2016).

We also found that rebelliousness was strongly associated with more exposure to online alcohol advertising. This is concerning for a number of reasons. Rebelliousness is also associated with adolescent drinking (Voelkl & Frone, 2000), which suggests that online ads may be reaching a group of adolescents particularly vulnerable to marketers' messages. In addition, alcohol marketing often portrays drinking as a rebellious activity, a message likely to resonate with rebellious youth (Jackson, Hastings, Wheeler, Eadie, & Mackintosh, 2000). Although, to our knowledge, there is not a drinking prevention approach that is specific to those who are rebellious, strategies that have been shown to work well with higher risk youth include helping these youth better think through influences on their beliefs and their choices regarding drinking behavior, for example, by providing media literacy training (Gordon, Jones, & Kervin, 2015), discussing alcohol use norms for their age group (D'Amico et al., 2012; Pedersen et al., 2013), or helping them think about the pros and cons of use (D'Amico et al., 2015; Feldstein Ewing, Walters, & Baer, 2012).

Of note, we found that youth who reported more hours on social medial were *less* likely to see online alcohol ads. Although this might seem counterintuitive, other research in this area has shown that hours of media exposure is often a poor indicator of exposure to different types of content [e.g., hours of television viewing is not strongly associated with exposure to sexual content; (Chandra et al., 2008)]. Thus, the diversity of content available on the internet may make it possible to spend a lot of time on social media but little time on webpages or social networking sites that contain or feed youth alcohol advertising. Similarly, in this study, these younger youth are likely utilizing social media platforms that market to them based on a psychographic profile generated from their web browsing. Some may also have a user-generated profile on social media sites [any site that gathers data about users is required to limit participation to those 13 and older by the Children's Online Privacy Protection Act, but many adolescents lie about their ages in their profiles (Jones et al., 2014). Nonetheless, the kinds of activities youth engage in online may not fit the psychographic profile that marketers specify when they target their ads. As a result, they may spend a great deal of time on social media but their "feed" may not show them alcohol advertising. Further research that addresses adolescents' specific online activities and how they fit with alcohol marketing algorithms is needed to more fully understand when and why youth encounter online advertising for alcohol.

Some limitations of our study include the representativeness of our sample. One issue with EMA is that it is requires the user to be technologically sophisticated and motivated to carry the device for a prolonged period of time (Piasecki, Richardson, & Smith, 2007). Thus, our sample may be biased perhaps due to both the burden of EMA procedures and the characteristics of youth who have sufficient time and energy to comply with these procedures. In addition, our sample reported lower rates of lifetime drinking (5%) than rates reported for national samples of a similar age and racial mix (11.5%; Center for Behavioral Health Statistics and Quality, 2015); however, the percent of youth that reported ever having tried even a sip of alcohol (34%) is similar to other studies that have examined sipping among this age group (37%; Jackson et al., 2015).

Despite limitations, our findings provide an important first look at the percent of younger adolescents that are exposed to online alcohol advertising over a two week period, the types

of ads that they see during this time, and demographic, individual, peer and parental factors that may be associated with their viewing of online alcohol ads. Results indicate a subgroup of youth is fairly heavily exposed to such ads. These youth are rebellious in nature and may also be more vulnerable to alcohol ads and their messages. We also found; however, evidence of a key protective factor, the important role that parents can play by monitoring their son or daughter's behavior to decrease the chances that he/she may access these types of ads. Given that online ad exposure is associated with drinking behavior (Jones & Magee, 2011) and that some youth may be more receptive to this type of marketing (McClure et al., 2016), prevention programming for younger adolescents should continue to address this issue to help youth make healthy choices regarding drinking behavior.

Acknowledgments

References

Anderson, M. Parents, teens and digital monitoring. Pew Research Center; 2016. http://www.pewinternet.org/2016/01/07/how-parents-monitor-their-teens-digital-behavior/

Barry AE, Johnson E, Rabre A, Darville G, Donovan KM, Efunbumi O. Underage access to online marketing content: A YouTube case study. Alcohol and Alcoholism. 2015; 50(1):89–94. [PubMed: 25411395]

Britt H, Toomey TL, Dunsmuir W, Wagenaar AC. Propensity for and correlates of alcohol sales to underage youth. Journal of Alcohol and Drug Education. 2006; 50:25–42.

Bull, S. Technology-based health promotion. London: Sage; 2010.

Center for Behavioral Health Statistics and Quality. Behavioral health trends in the United States: Results from the 2014 National Survey on Drug Use and Health. 2015. HHS Publication No. SMA 15-4927, NSDUH Series H-50: http://www.samhsa.gov

Center on Alcohol Marketing and Youth. Youth exposure to alcohol advertising on television, 2001–2009. John Hopkins University; 2012. http://www.camy.org/_docs/resources/reports/youth-exposure-alcohol-advertising-tv-01-09-full-report.pdf

Chandra A, Martino SC, Collins RL, Elliott MN, Berry SH, Kanouse DE, Angela M. Does watching sex on television predict teen pregnancy? Findings from a national longitudinal survey of youth. Pediatrics. 2008; 122(5):1047–1054. [PubMed: 18977986]

Chester, J., Montgomery, K., Dorfman, L. Alcohol marketing in the digital age. Berkeley, CA: Berkeley Media Studies Group; 2010.

Clark HK, Shamblen SR, Ringwalt CL, Hanley S. Predicting high risk adolescents' substance use over time: The role of parental monitoring. The Journal of Primary Prevention. 2012; 33(2–3):67–77. [PubMed: 22370765]

Collins RL, Ellickson PL, McCaffrey D, Hambarsoomians K. Early adolescent exposure to alcohol advertising and its relationship to underage drinking. Journal of Adolescent Health. 2007; 40:527–534. [PubMed: 17531759]

Collins RL, Martino SC, Kovalchik S, Becker K, Shadel W, D'Amico E. Alcohol advertising exposure among middle-school age youth: An assessment across all media and venues. Journal of Studies on Alcohol & Drugs. 2016; 77(3):384–392. [PubMed: 27172570]

Courvoisier DS, Eid M, Lischetzke T. Compliance to a cell phone-based ecological momentary assessment study: The effect of time and personality characteristics. Psychological Assessment. 2012; 24(3):713–720. [PubMed: 22250597]

Coxe S, West SG, Aiken LS. The analysis of count data: A gentle introduction to Poisson regression and its alternatives. Journal of Personality Assessment. 2009; 91:121–136. [PubMed: 19205933]

D'Amico EJ, Houck JM, Hunter SB, Miles JNV, Osilla KC, Ewing BA. Group motivational interviewing for adolescents: Change talk and alcohol and marijuana outcomes. Journal of Consulting and Clinical Psychology. 2015; 83(1):68–80. [PubMed: 25365779]

D'Amico EJ, Miles JNV, Stern SA, Meredith LS. Brief motivational interviewing for teens at risk of substance use consequences: A randomized pilot study in a primary care clinic. Journal of Substance Abuse Treatment. 2008; 35:53–61. [PubMed: 18037603]

D'Amico EJ, Tucker JS, Miles JNV, Ewing BA, Shih RA, Pedersen ER. Alcohol and marijuana use trajectories in a diverse longitudinal sample of adolescents: Examining use patterns from age 11 to 17. Addiction. in press.

D'Amico EJ, Tucker JS, Miles JNV, Zhou AJ, Shih RA, Green HDJ. Preventing alcohol use with a voluntary after school program for middle school students: Results from a cluster randomized controlled trial of CHOICE. Prevention Science. 2012; 13(4):415–425. [PubMed: 22311178]

Eaton DK, Kann L, Kinchen S, Shanklin S, Flint KH, Hawkins J, … Wechsler H. Youth risk behavior surveillance - United States, 2011. Surveillance Summaries. 2012; 61(4)

El Ansari W, Stock C, Mills C. Is alcohol consumption associated with poor academic achievement in university students? International Journal of Preventive Medicine. 2013; 4(10):1175–1188. [PubMed: 24319558]

Feldstein Ewing, SW., Walters, S., Baer, JS. Approaching group MI with adolescents and young adults: Strengthening the developmental fit. In: Wagner, CCI., Ingersoll, KS., editors. Motivational Interviewing in Groups. New York, NY: The Guilford Press; 2012. p. 387-406.

Gordon CS, Jones SC, Kervin L. Effectiveness of alcohol media literacy programmes: A systematic literature review. Health Education Research. 2015; 30(3):449–465. [PubMed: 25840435]

Gordon R. An audit of alcohol brand websites. Drug & Alcohol Review. 2011; 30:638–644. [PubMed: 21355900]

Grenard JL, Dent CW, Stacy AW. Exposure to alcohol advertisements and teenage alcohol-related problems. Pediatrics. 2013; 131(2):e369–e379. [PubMed: 23359585]

Griffiths R, Casswell S. Intoxigenic digital spaces? Youth, social networking sites and alcohol marketing. Drug and Alcohol Review. 2010; 29(5):525–530. [PubMed: 20887576]

Hingson RW, Heeren T, Edwards EM. Age at drinking onset, alcohol dependence, and their relation to drug use and dependence, driving under the influence of drugs, and motor-vehicle crash involvement because of drugs. J Stud Alcohol Drugs. 2008; 69(2):192–201. [PubMed: 18299759]

Jackson KM, Colby SM, Barnett NP, Abar CC. Prevalence and correlates of sipping alcohol in a prospective middle school sample. Psychology of Addictive Behaviors. 2015; 29:766–778. [PubMed: 25938631]

Jackson M, Hastings G, Wheeler C, Eadie D, Mackintosh A. Marketing alcohol to young people: Implications for industry regulation and research policy. Addiction. 2000; 95(Suppl 4):S597–S608. [PubMed: 11218354]

Johnston, LD., O'Malley, PM., Bachman, JG., Schulenberg, JE. Monitoring the Future national survey results on drug use, 1975–2014. Volume I: Secondary school students. Ann Arbor, Michigan: Institute for Social Research, The University of Michigan; 2015.

Jones SC, Magee CA. Exposure to alcohol advertising and alcohol consumption among Australian adolescents. Alcohol and Alcoholism. 2011; 46(5):630–637. [PubMed: 21733835]

Jones SC, Thom JA, Davoren S, Barrie L. Internet filters and entry pages do not protect children alcohol marketing. Journal of Public Health Policy. 2014; 35(1):75–90. [PubMed: 24257629]

Kelly AB, Evans-Whipp TJ, Smith R, Chan GC, Toumbourou JW, Patton GC, Catalano RF. A longitudinal study of the association of adolescent polydrug use, alcohol use, and high school non-completion. Addiction, Online First. 2014; doi: 10.1111/add.12829

LaBrie JW, Rodrigues A, Schiffman J, Tawalbeh S. Early alcohol initiation increases risk related to drinking among college students. Journal of Child & Adolescent Substance Abuse. 2008; 17(2): 125–141.

Lenhart, A. Teens, social media and technology overview 2015. Pew Research Center; 2015. http://www.pewinternet.org/2015/04/09/teens-social-media-technology-2015/

Madden, M., Lenhart, A., Duggan, M., Cortesi, S. Teens and technology 2013. Pew Research Center; 2013. http://www.pewinternet.org/files/old-media/Files/Reports/2013/PIP_TeensandTechnology2013.pdf

Mart SM. Alcohol marketing in the 21st century: New methods, old problems. Substance Use and Misuse. 2011; 46(7):889–892. [PubMed: 21599504]

Martino SC, Kovalchik SA, Collins RL, Becker KM, Shadel WG, D'Amico EJ. Ecological momentary assessment of the association between exposure to alcohol advertising and early adolescents' beliefs about alcohol. Journal of Adolescent Health. in press.

Martino SC, Scharf D, Setodji C, Shadel WG. Measuring exposure to pro-tobacco marketing and media: A field study using ecological momentary assessment. Nicotine & Tobacco Research. 2012; 14(4):398–406. [PubMed: 22039076]

McClure AC, Stoolmiller M, Tanski SE, Engels RCME, Sargent JD. Alcohol marketing receptivity, marketing-specific cognitions, and underage binge drinking. Alcoholism: Clinical and Experimental Research. 2013; 37(1):E404–E413.

McClure AC, Tanski SE, Li Z, Jackson K, Morgenstern M, Li Z, Sargent JD. Internet marketing and underage alcohol use. Pediatrics. 2016; 137(2):1–9.

Meier P. Alcohol marketing research: The need for a new agenda. Addiction. 2011; 106(3):466–471. [PubMed: 21299664]

Mosher JF. Joe Camel in a bottle: Diageo, the Smirnoff brand, and the transformation of the youth alcohol market. American Journal of Public Health. 2012; 102(1):56–63. [PubMed: 22095339]

Nash SG, McQueen A, Bray JH. Pathways to adolescent alcohol use: family environment, peer influence, and parental expectations. Journal of adolescent health : official publication of the Society for Adolescent Medicine. 2005; 37(1):10.

Nicholls J. Everyday, everywhere: Alcohol marketing and social media Current Trends. Alcohol and Alcoholism. 2012; 47(4):486–493. [PubMed: 22532575]

Orlando M, Tucker JS, Ellickson PL, Klein DJ. Concurrent use of alcohol and cigarettes from adolescence to young adulthood: An examination of developmental trajectories and outcomes. Substance Use and Misuse. 2005; 40:1051–1069. [PubMed: 16040368]

Park S. Concentration of internet usage and is't relation to exposure to negative content: Does the gender gap differ among adults and adolescents? Women's Studies International Forum. 2009; 32:98–107.

Pedersen ER, Miles JNV, Ewing BA, Tucker JS, Shih RA, D'Amico EJ. A longitudinal examination of alcohol, marijuana, and cigarette perceived norms among middle school adolescents. Drug and Alcohol Dependence. 2013; 133(2):647–653. [PubMed: 24012070]

Piasecki T, Richardson A, Smith S. Self-monitored motives for smoking among college students. Psychology of Addictive Behaviors. 2007; 21(3):328–337. [PubMed: 17874883]

Pujazon-Zazik M, Park MJ. To tweet or not to tweet: Gender differences and potential positive and negative health outcomes on adolescents' social internet use. American Journal of Men's Health. 2010; 4(1):77–85.

Rideout, V. The Common Sense Census: Media use by tweens and teens. Common Sense Media, Inc; 2016. https://www.commonsensemedia.org/sites/default/files/uploads/research/census_researchreport.pdf

Ringel JS, Collins RL, Ellickson PL. Time trends and demographic differences in youth exposure to alcohol advertising on television. Journal of Adolescent Health. 2006; 39(4):473–480. [PubMed: 16982380]

Rubin DB. Multiple imputation after 18+ years. Journal of the American Statistical Association. 1996; 91(434):473–489.

Sargent JD, Beach ML, Dalton MA, Ernstoff LT, Gibson JJ, Tickle JJ, Heatherton TF. Effect of parental R-rated movie restriction on adolescent smoking initiation. Pediatrics. 2004; 114(1):149–156. [PubMed: 15231921]

Scharf DM, Martino SC, Setodji CM, Staplefoote L, Shadel WG. Middle and high school students' exposure to alcohol- and smoking-related media: a pilot study using ecological momentary assessment. Psychology of Addictive Behaviors. 2013; 27(4)doi: 10.1037/a0032555

Scribner R, Mason K, Theall K, Simonsen N, Schneider SK, Towvim LG, DeJong W. The contextual role of alcohol outlet density in college drinking. Journal of Studies on Alcohol and Drugs. 2008; 69(1):112–120. [PubMed: 18080071]

Shiffman S, Stone AA, Hufford MR. Ecological momentary assessment. Annual Review of Clinical Psychology. 2008; 1:1–32.

Siphannay N, Nyborn J, Hinchey D, Valerio H, Kinzel K, Siegel M, Jernigan DH. The frequenty of company-sponsored alcohol brand-related sites on Facebook-2012. Substance Use and Misuse. 2014; 49:779–782. [PubMed: 24499464]

Squeglia LM, Jacobus J, Tapert SF. The influence of substance use on adolescent brain development. Clinical EEG Neuroscience. 2009; 40(1):31–38. [PubMed: 19278130]

Stattin H, Kerr M. Parental monitoring: A reinterpretation. Child Development. 2000; 71(4):1072–1085. [PubMed: 11016567]

Stueve A, O'Donnell LN. Early alcohol initiation and subsequent sexual and alcohol risk behaviors among urban youths. American Journal of Public Health. 2005; 95:887–893. [PubMed: 15855470]

Tucker JS, Ellickson PL, Klein DJ. Growing up in a permissive household: what deters at-risk adolescents from heavy drinking? Journal of Studies on Alcohol and Drugs. 2008; 69(4):528–534. [PubMed: 18612568]

Voelkl K, Frone M. Predictors of substance use at school among high school students. Journal of Educational Psychology. 2000; 92:583–592.

Wilcox, B., Cantor, J., Dowrick, P., Kunkel, D., Linn, S., Palmer, E. Report of the APA task force on advertising and children: Recommendations. 2004. http://www.apa.org/releases/childrenads_recommendations.pdf

Table 1

Bivariate associations with online alcohol advertising

	Estimate (IRR)	Pr(>|z|)
Age	1.136	0.001
Rebelliousness	6.000	<0.001
Ever tried alcohol (sip)	0.999	0.987
Parental monitoring	0.739	<0.001
Parental approval of drinking	1.079	0.351
Peer approval of drinking	1.334	0.001
Contact with peers who drink	0.748	0.009
Sex		
Male [ref]	1.000	
Female	0.955	0.570
Race		
Hispanic [ref]	1.000	
Asian/Native Hawaiian/	1.026	0.896
Pacific Islander		
Black, Non-Hispanic	1.844	<0.001
Other	0.704	0.009
White , Non-Hispanic	1.163	0.278
Education		
Parent education: < high school [ref]	1.000	
Parent education: high school	1.075	0.816
Parent education: some college	2.364	0.002
Parent education: college	1.480	0.158
Number of hours typically spent per day on social media		
<1 hours on social media [ref]	1.000	
1–4 hours on social media	0.786	0.004
>4 hours on social media	0.540	0.001
Number of hours typically spent per day online		
<1 hours online [ref]	1.000	
1–4 hours online	0.919	0.312
>4 hours online	0.495	0.061

Note: Incidence rate ratios (IRRs) greater than 1 indicate that increased levels of exposure to online alcohol ads are associated with a predictor; IRRs less than 1 indicate that a variable is associated with decreased levels of exposure. Two-sided Wald tests were used to test the significance, $p < 0.05$, of each model coefficient.

Table 2

Multivariate zero-inflated Poisson (ZIP) regression model of individual, parent and peer factors associated with exposure to online alcohol advertising

	Estimate (IRR)	Pr(>|z|)
Age	1.099	0.045
Rebelliousness	7.413	<0.001
Ever tried alcohol (sip)	0.808	0.060
Parental monitoring	0.813	0.006
Parental approval of drinking	1.112	0.298
Peer approval of drinking	1.050	0.662
Contact with peers who drink	0.805	0.117
Sex		
Male [ref]	1.000	
Female (yes)	1.199	0.082
Race		
Hispanic [ref]	1.000	
Asian/Native Hawaiian/	0.793	0.306
Pacific Islander		
Black	1.817	<0.001
Other	0.688	0.010
White	1.031	0.851
Education		
Parent education: < high school [ref]	1.000	
Parent education: high school	1.782	0.099
Parent education: some college	2.479	0.004
Parent education: college	2.310	0.008
Number of hours typically spent per day on social media		
<1 hours on social media [ref]	1.000	
1–4 hours on social media	0.566	<0.001
>4 hours on social media	0.516	0.008
Number of hours typically spent per day online		
<1 hours online [ref]	1.000	
1–4 hours online	0.935	0.490
>4 hours online	0.437	0.097

Note: Incidence rate ratios (IRRs) greater than 1 indicate that increased levels of exposure to online alcohol ads are associated with a predictor; IRRs less than 1 indicate that a variable is associated with decreased levels of exposure. Two-sided Wald tests were used to test the significance, $p < 0.05$, of each model coefficient.