Amount of Televised Alcohol Advertising Exposure and the Quantity of Alcohol Consumed by Youth

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ABSTRACT. Objective: Although studies demonstrate that exposure to brand-specific alcohol advertising is associated with an increased likelihood of youth consuming particular brands, the relationship between quantity of brand-specific advertising exposure and quantity of brand-specific consumption has not been firmly established. **Method:** Using the Alcohol Brand Research Among Underage Drinkers (ABRAND) national sample of 1,031 young drinkers (ages 13–20), this study examined the relationship between their aggregated past-year exposure to advertising (in adstock units, a measure based on gross rating points) for 61 alcohol brands that advertised on the 20 most popular nonsports television programs viewed by underage youth and their aggregated total consumption of those same brands during the past 30 days. Predictive models adjusted for other media exposure, predictors of youth's alcohol consumption, and the consumption of brands not advertised on the 20 shows. **Results:** For the fully adjusted models, each 100 adstock unit increase in exposure (about 1 *SD*) was associated with an increase of 5.9 drinks (95% CI [0.9, 11.0 drinks]) consumed during the past 30 days among those with less than 300 units of advertising exposure, and an increase of 55.7 drinks (95% CI [13.9, 97.4 drinks]) among those with 300 or more adstock units of exposure. **Conclusions:** Among underage youth, the quantity of brand-specific advertising exposure is positively associated with the total quantity of consumption of those advertised brands, even after controlling for the consumption of non-advertised brands. Future research should examine exposure–consumption relationships longitudinally and in other media. (*J. Stud. Alcohol Drugs, 77,* 723–729, 2016)

ALCOHOL CONSUMPTION CONTRIBUTES to the three leading causes of death (motor vehicle crash fatalities, suicide, and homicide) among underage youth ages 12–20 years (Donovan, 2013). Alcohol advertising exposure has been positively associated with youth's alcohol consumption, and restrictions on alcohol marketing are recommended as preventive interventions by the Institute of Medicine and the World Health Organization (Bonnie & O'Connell, 2004; World Health Organization, 2010).

Alcohol companies, through self-regulatory guidelines, tacitly acknowledge the importance of alcohol marketing by restricting advertising on television programs where the audience is disproportionately composed of underage persons, and by limiting the content of such advertising so that it does not primarily appeal to underage youth (Beer Institute, 2011; Distilled Spirits Council of the United States, 2011; Wine Institute, 2012). Even so, the role that advertising plays in drinking behaviors is still an area of scientific controversy (Nelson, 2010).

An important limitation of previous studies is that they have examined the relationship between total advertising exposure and total consumption across all types of alcohol or for broad categories of alcohol (e.g., beer, wine, distilled spirits). This approach does not permit an examination of the more specific relationship between brand-specific exposure and brand-specific consumption. This is important because advertising is brand specific, some brands advertise more than others, and different brands advertise to different populations.

Our research team has addressed this limitation by combining data about brand-specific advertising exposure with data on brand-specific alcohol consumption. After accounting for a variety of factors, including overall adult market share, we found a strong positive relationship between brand-specific exposure to television advertising and the likelihood of youth consuming a particular brand, at both the individual level (Ross et al., 2014) and the population level (Ross et al., 2014, 2015).

This finding is consistent with the Heuristic Marketing Receptivity Model, which posits that marketing-specific cognitions and attitudes in four domains mediate the association between alcohol advertising and consumption: alcohol expectancies, perceptions of alcohol norms, identifying one-

self as a drinker, and brand loyalty (McClure et al., 2013). This result might also be understood as a "mere exposure" effect, by which consumers develop a preference for certain products simply because of their greater familiarity, and is an effect that can occur outside conscious awareness (Bornstein, 1989; Zajonc, 2001).

Our earlier study corroborated other studies indicating that advertising exposure is associated with brand selection by underage drinkers, but the question remains whether advertising affects how much of those brands a person drinks (Anderson et al., 2009; Smith & Foxcroft, 2009). A previous study by our research team found that increased brand-specific advertising exposure was significantly associated with increased brand-specific consumption (Ross et al., 2015). However, even if advertising has an effect on the quantity of consumption of a particular brand, another important question is whether this might lead to decreased consumption of other brands (i.e., brand substitution) and therefore have no impact or a minimal impact on total consumption.

The present study was designed to address the relationship between aggregate brand-specific advertising and total brand-specific consumption, overall and among various demographic groups and at different levels of advertising exposure. We hypothesized that increased aggregated exposure to brand-specific advertising would be associated with increased total consumption of those same brands.

Method

Study population used to assess alcohol consumption among underage youth

The Alcohol Brand Research Among Underage Drinkers (ABRAND) survey was the source of data for alcohol consumption among underage youth (Siegel et al., 2013). The national sample comprised 1,032 persons ages 13–20 who reported drinking alcohol in the past 30 days. Those ages 18–20 years were recruited directly from the KnowledgePanel® maintained by Knowledge Networks (GfK Custom Research, Palo Alto, CA), a pre-recruited panel of approximately 50,000 adults (including young adults ages 18–20) who agreed to be invited periodically to participate in Internet-based surveys. The company recruits households to the panel through a combination of random-digit dialing and address-based sampling from a sampling frame that includes 97% of U.S. households (Knowledge Networks, 2012). To ensure adequate representation across race/ethnicity, telephone numbers from phone banks with higher concentrations of Blacks and Hispanics are oversampled. To ensure adequate participation across levels of socioeconomic status, persons agreeing to participate in the panel who do not have Internet access are given WebTV and Internet access and training for free.

Participants ages 13–17 were recruited by asking adult KnowledgePanel® members if they had children in this age range in their household whom they would permit to be surveyed. If so, one child was randomly selected for participation. These younger participants were screened and consented separately from their parents to ensure the confidentiality of their responses. For participants ages 13–17, the response rate was 44.4%, and it was 43.4% for those ages 18–20. The survey was conducted from December 2011 through May 2012. One participant reported drinking more than 15 drinks a day for each of 20-plus brands of alcohol; removing this participant left an analytic sample consisting of 1,031 participants.

Boston University Medical Center's institutional review board approved the study protocol.

Measures of advertising exposure and other covariates

The primary exposure was aggregated brand-specific television advertising. The survey provided participants with a list of the 20 most popular nonsports television shows among underage youth (by total viewership) that contained alcohol advertising and asked them to identify which programs they had watched in the past 30 days. Under a license agreement with Nielsen (2015 © The Nielsen Company, New York, NY, data from 2011–2012 used under license, all rights reserved), we had access to audience data and brand-specific advertising data for each of those shows for the year before the ABRAND survey, which allowed us to calculate a past-year cumulative advertising exposure (adstock) measure for each survey respondent.

Advertising exposure is measured in gross rating points (GRPs), which are per capita advertising exposure measures calculated by dividing the advertising exposures seen by a demographic group by the population size of the demographic group and multiplying by 100. Adstock is the past-year cumulative advertising exposure for each participant based on GRPs. Advertising effects are not just driven by the most recent advertising exposure, but rather are the result of cumulative advertising exposure over time (Broadbent, 1997; Wind & Sharp, 2009). Past advertising exposures are discounted by a decay rate with a specified half-life, which is typically 3 to 4 weeks for frequently purchased consumer goods (Broadbent, 1997).

In this analysis, we used a decay rate half-life of 4 weeks, which discounts prior exposure by 50% per month. Thus, our adstock calculation is as follows:

$$\text{Adstock} = \text{Exposure}_{Dec} + \text{Exposure}_{Nov}{}^{0.5} + \text{Exposure}_{Oct}{}^{0.25} + \ldots + \text{Exposure}_{Jan}{}^{0.000488}$$

where Exposure is the sum of the participants' total monthly exposure (in GRPs) to alcohol advertising across all brands on the 20 television programs. To make full use of the available data, we calculated adstock units using the full

12 months of data. Adstock may be accumulated over any period, but with a half-life of 4 weeks, exposure more than a few months in the past contributes a very negligible amount to the total adstock value.

We stratified our analyses on the basis of lower (<300 adstock units) versus higher (≥300 adstock units) cumulative advertising exposure from the 20 television shows. This bifurcation was based on an unadjusted Loess curve that demonstrated a steeper slope starting at approximately 300 adstock units of exposure. Because of the overall nonlinear relationship, only results from stratified analyses are presented. Of the sample, only 41 participants (3%) were exposed to 300 or more adstock units of advertising, yet they accounted for 10.1% of the weighted consumption of the 61 brands. Across the 61 brands, 1 *SD* in total advertising exposure was equivalent to 96.57 adstock units.

The outcome measure was the survey participants' aggregated consumption of the 61 alcohol brands that advertised during the past year on one or more of the 20 television programs. To assess consumption of those brands, the ABRAND study had provided the participants with a list of 898 major brands of alcohol, grouped into alcohol types (e.g., beer, bourbon, vodka). Participants indicated the number of days in the past 30 days that they had consumed a specific brand of alcohol and how many drinks, on average, they consumed on a typical drinking day. For each brand, the total number of brand-specific drinks consumed in the past 30 days was the product of the number of drinks times the number of drinking days.

Covariates included age, which was calculated from the participants' date of birth. We classified self-reported race/ethnicity into four categories: non-Hispanic White, Black/African American, Hispanic, and other. We divided household income—as reported by adult participants in the KnowledgePanel®—into four categories: under $15,000; $15,000–$39,999; $40,000–$99,999; and $100,000 or higher. We assessed smoking with the question, "During the past 30 days, on how many days did you smoke cigarettes?" The responses options were *0 days, 1 or 2 days, 3–5 days, 6–9 days, 10–19 days, 20–29 days,* and *all 30 days.* We dichotomized the data as "reported smoking" versus "no reported smoking." We assessed risk-taking propensity by asking about seatbelt use as follows: "How often do you wear a seatbelt when you are riding in or driving a car?" The response options were *never, rarely, sometimes, most of the time, always, I don't know,* which we dichotomized as "always" versus any other answer. To assess parental drinking we asked, "Do you have a parent, guardian, or other adult caretaker who now or previously lived in your household who drinks alcohol at least once a month?" The respondents answered yes or no.

We controlled for other media use by assessing average daily television viewing hours (a weighted average of self-reported weekday and weekend television viewing time) and Internet use (typical daily usage in hours). To control for the consumption of additional alcohol brands, we calculated each participant's consumption of alcohol brands that were not advertised on the 20 television programs, which we refer to here as "non-advertised" brands, although they might have been advertised on other programs or in other media. We also calculated the proportion of non-advertised brands consumed relative to all brands.

Brand-specific covariates included the (a) alcoholic beverage type (malts, including beer and flavored alcoholic beverages; spirits, including bourbon, cordials and liqueurs, cognac, rum, scotch, tequila, vodka, and whiskey; and wine); (b) the average brand price (above or below the median price of a U.S. standard drink); and (c) brand consumption prevalence among persons ages 13–20.

We acquired brand prices from the ABRAND project's Minimum Financial Outlay database (www.youthalcohol-brands.com/outlay.html), which reports the average price per ounce of ethanol for 951 alcohol brands in 2011 (DiLoreto et al., 2012). We stratified brands based on the median price for the 61 brands that advertised on the 20 television shows into higher priced brands (those >$1.94 per ounce of alcohol in off-premise outlets) versus lower priced brands.

We determined the prevalence of brand-level consumption among underage youth (to assess "popularity") by examining the ABRAND Brand Preference Database, which reports the proportion of persons ages 13–20 who had consumed each of several brands in the past 30 days (www.youthalcohol-brands.com/brand-pref-database.html). Using a median split, we stratified the 61 brands that advertised on the 20 television shows into more popular brands (>2.6% consumption prevalence) versus less popular brands.

Analysis

Participant data were weighted to account for selection probability and nonresponse to panel recruitment and attrition and were adjusted for sex, age, race/ethnicity, census region, household income, home ownership status, metropolitan area, and household size based on the Current Population Survey from the United States Census Bureau. We conducted the analyses using SAS Version 9.3 (SAS Institute Inc., Cary, NC).

First, we examined the crude association between each participant's aggregated past-year alcohol advertising exposure (based on the 61 brand-specific exposures) and total alcohol consumption (based on the past-30-day consumption of those 61 brands) by graphing a locally estimated scatter plot smoothing (Loess) curve (Cleveland & Devlin, 1988).

Next, we assessed the association between aggregated alcohol advertising exposure and aggregated alcohol consumption using linear regression. We first calculated the unadjusted association and then added covariates in four blocks: (a) demographics, including age, sex, race/ethnicity,
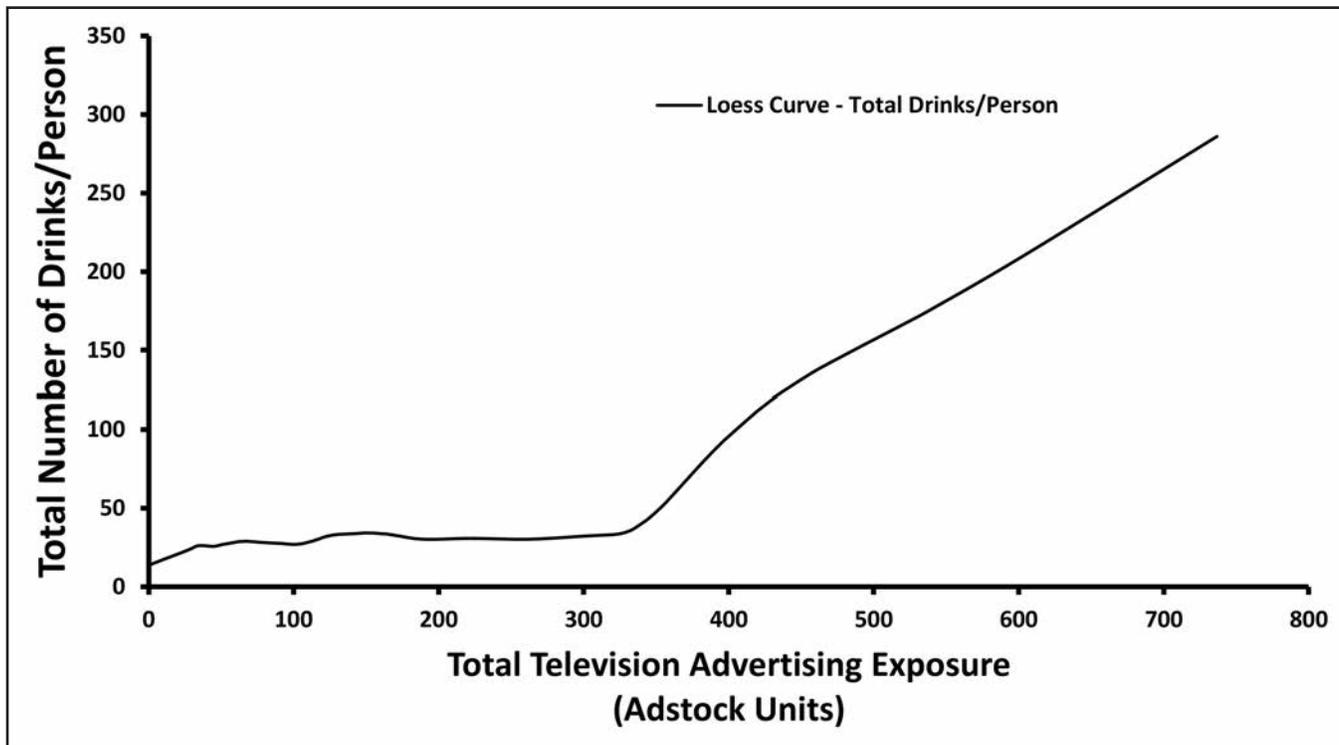
FIGURE 1.   Unadjusted association between past-year advertising exposure and average number of drinks consumed in the past 30 days, aggregated across 61 alcohol brands advertised on 20 television shows popular with youth: Loess curve—total drinks per person. The data are based on the entire sample (i.e., ages 13–20 years)

and household income; (b) media consumption, including television and Internet use; (c) parental drinking and other risk behaviors (e.g., cigarette smoking); and (d) consumption of brands not advertised on the 20 television programs. We included all covariates in the full model.

Finally, we conducted stratified analyses that examined separately the results for males versus females, participants ages 13–17 years of age versus 18–20 years of age, beer versus distilled spirits versus wine brands, higher priced versus lower priced brands, and more popular versus less popular brands.

Results

Among the sample of young drinkers, the median number of drinks consumed in the past 30 days was 5 drinks, with an interquartile range of 24 drinks. After weighting, the 61 brands advertised on those programs accounted for 46.9% of all alcohol consumption reported by the sample of underage drinkers.

Figure 1 shows the unadjusted association between past-year advertising exposure and the total number of drinks consumed in the past 30 days, aggregated across the 61 alcohol brands advertised on 20 television shows popular with youth. The average number of drinks consumed per underage youth during the past 30 days increased from 14 to 33 drinks

per month as advertising exposure increased from 0 to 300 adstock units. For participants in the entire sample exposed to 300 or more adstock units of advertising, per-person consumption increased from 33 drinks to more than 200 drinks consumed during the past 30 days. Because of the nonlinear relationship demonstrated by the Loess curve, in the tables we present results stratified on the basis of advertising exposure.

Results of the linear regression models are presented in Table 1. In unadjusted models, among participants with less than 300 adstock units of cumulative exposure, each 100 adstock unit increase in advertising exposure (approximately 1 SD) was associated with a mean increase of 6.5 drinks (95% CI [1.4, 11.5]) consumed during the past 30 days, whereas for those with exposure of 300 or more adstock units the increase was 74.6 drinks (95% CI [34.6, 114.6]). Adjustment for different sets of covariates made relatively small changes in these estimates. After adjustment for all covariates, among participants with less than 300 adstock units of exposure the increase was 5.9 drinks (95% CI [0.9, 11.0]), and for those with 300 or more adstock units of exposure the increase was 55.7 drinks (95% CI [13.9, 97.4]).

In fully adjusted analyses restricted to those with less than 300 units of adstock exposure and stratified by demographic and brand characteristics (Table 2), each 100-unit increase in past-year adstock exposure was associated with a nonsig-

TABLE 1. Unadjusted and adjusted associations between change in past-year alcohol advertising exposure (per 100 adstock units)[a] and number of drinks consumed during the past 30 days, aggregated across 61 alcohol brands advertised on 20 television shows popular with youth and stratified by participants at higher and lower levels of advertising exposure

Model	Change in number of drinks per 100 unit change in advertising exposure[a] (adstock) [95% CI][b]	
	Ad exposure <300 adstock units	Ad exposure ≥300 adstock units
Unadjusted	6.5 [1.4, 11.5]	74.6 [34.6, 114.6]
Adjusted for		
Age, sex, race, income only	6.6 [1.6, 11.7]	69.5 [27.9, 111.1]
TV and Internet use only	6.5 [1.4, 11.5]	65.2 [29.1, 101.4]
Parental drinking, other risk behaviors[c] only	6.4 [1.4, 11.4]	70.0 [26.7, 113.3]
Non-advertised brands[d] only	5.9 [0.8, 10.9]	77.8 [35.9, 119.7]
Fully adjusted (all covariates)	5.9 [0.9, 11.0]	55.7 [13.9, 97.4]

Notes: CI = confidence interval. [a]1 *SD* in advertising exposure = 96.57 adstock units. Results are stratified by exposure because of the nonlinear association between advertising exposure and consumption across all levels of advertising exposure; [b]confidence intervals > 0 indicate a significant positive association between advertising and the number of drinks consumed in the past 30 days (i.e., a significantly positive association between more advertising exposure and an increase in the number of drinks consumed); [c]other risk behaviors included smoking and not wearing seatbelts; [d]total consumption of all brands not advertised on the 20 television programs.

TABLE 2. Fully adjusted[a] association between change in past-year alcohol advertising exposure (per 100 adstock units)[b] and change in mean number of drinks consumed during the past 30 days among those with <300 adstock units[c] of exposure, stratified by sex, age, alcoholic beverage type, brand price, and brand popularity

Sample composition	Change in number of drinks, past 30 days [95% CI][d]
Entire sample	5.9 [0.9, 11.0]
Sex	
Male	6.1 [-2.5, 14.8]
Female	8.1 [2.5, 13.6]
Age	
13–17 years	4.7 [-4.5, 14.0]
18–20 years	6.5 [0.5, 12.6]
Alcohol type	
Beer (includes flavored alcoholic beverages)	4.1 [-3.0, 11.1]
Distilled spirits	4.6 [0.1, 9.0]
Wine	1.9 [-0.4, 4.2]
Alcohol price per standard drink	
Higher priced (above median price)	3.6 [-1.4, 8.6]
Lower priced (at or below median price)	7.2 [1.4, 13.1]
Brand youth popularity[e]	
More popular brands	10.4 [2.8, 18.1]
Less popular brands	-0.7 [-3.3, 1.8]

Notes: CI = confidence interval. [a]Adjusted for all covariates included in Table 1; [b]1 *SD* in past-year advertising exposure = 96.57 adstock units; [c]because of the smaller number of participants exposed to advertising levels ≥300 adstock units, stratified analyses were not performed for this group; [d]confidence intervals >0.0 indicate a significant positive association between advertising and the number of drinks consumed in the past 30 days (i.e., a significantly positive association between more advertising exposure and an increase in the number of drinks consumed); [e]brand popularity was determined by its weighted consumption prevalence among the underage youth sample; brands with consumption prevalence above the median were considered more popular.

nificant increase of 6.1 drinks among males, but a significant increase of 8.1 drinks (95% CI [2.5, 13.6]) among females. By age, 18- to 20-year-olds had a significant increase in the number of drinks consumed (6.5, 95% CI [0.5, 12.6]). In analyses stratified on the basis of alcohol brand characteristics, there was a significant positive association between exposure and number of drinks consumed for spirits brands (4.6, 95% CI [0.1, 9.0] drinks), lower priced brands (7.2, 95% CI [1.4, 13.1] drinks), and more popular brands (10.4, 95% CI [2.8, 18.1] drinks).

Discussion

Among this national sample of underage youth, there was a significant positive relationship between their aggregated past-year exposure to advertising and the total quantity of alcohol consumed in the past 30 days, even after controlling for consumption of non-advertised brands. Although exposure to alcohol advertising is related to which brands underage youth drink (Ross et al., 2014), few studies have assessed whether the quantity of advertising exposure is positively associated with the total quantity of alcohol consumed by underage youth (Snyder et al., 2006).

We believe that this is the first study to examine this relationship using brand-specific advertising data and corresponding brand-specific consumption, which greatly increases the specificity of the exposure–consumption relationship and therefore makes it more plausible that advertising is in fact related to consumption. Furthermore, controlling for the consumption of non-advertised brands serves to address the

question of whether advertising might affect the consumption of particular brands without affecting the overall amount of alcohol consumed. Our findings suggest that the increased consumption of advertised brands is not being cancelled out by the decreased consumption of other brands (brand substitution).

Although there was a temporal relationship between past-year advertising exposure (with a decay factor built in for the decreased effect of advertising over time) and current consumption, this study is largely cross-sectional in nature, so there is the possibility of reverse causation. Note, however, that there was a dose-response relationship: although the findings were significant among underage youth with less than 300 adstock units of advertising exposure, the exposure–consumption relationship was particularly strong among those with 300 or more adstock units of exposure. There were fewer youth with these higher levels of advertising exposure, but they consumed a disproportionately large amount of the alcohol consumed by the entire youth sample. Of note, youth who drink most heavily experience the majority of alcohol-related harms (Roberts et al., 2015).

Our finding of a stronger exposure–consumption relationship among participants with high levels of aggregate

brand-specific advertising exposure differs from the traditional diminishing marginal product curve associated with advertising effects on brand selection and brand-specific consumption (Ross et al., 2015). Our results could be attributable to cross-brand advertising effects, where advertising for one alcohol brand is associated with increased consumption of other advertised brands (Hanssens et al., 2005; Vakratsas & Ambler, 1999). Alternatively, there may be differences in confounding factors or nonresponse biases among those with different levels of advertising exposure, or an artifact from measurement error amplification that arises from aggregating consumption and exposure measures across brands.

This study is subject to several caveats and limitations. Logistically, the study could not assess the participants' exposure to all television shows, and therefore the number of advertised brands we could examine was limited. Our strategy was to focus on the 20 most popular television shows among underage youth, and we found that the alcohol brands advertised on those programs during the past year accounted for nearly half of all alcohol consumed by the youth sample in the past 30 days.

Although we controlled for total television and Internet viewing hours, we could not fully account for the participant's exposure to other sources of alcohol advertising. However, controlling for the consumption of non-advertised brands and several other relevant covariates mitigated this potential limitation. In addition, we could only control for a limited number of other potential confounders that could be associated with both television viewing and alcohol consumption (e.g., psychological factors).

Finally, this study is subject to possible nonresponse bias. Because the sample of 18- to 20-year-olds drew from existing Knowledge Networks panelists, we compared 18- to 20-year-old respondents to nonrespondents based on demographic factors to help assess the nature of potential nonresponse bias, using a chi-square test to assess the significance of observed differences. The nonrespondents were slightly older ($p < .05$) but similar in gender ($p = .41$) and region of the country ($p = .11$). However, nonrespondents were more likely to be Black ($p < .0001$), be from lower income households ($p < .01$), and not have Internet access before being enrolled in the panel ($p < .0001$). This type of analysis was not possible for the 13- to 17-year-old nonrespondents, nor do we know how these factors associate with advertising exposure or alcohol consumption.

Conclusions

Our findings indicate that the amount of exposure to television alcohol advertising is associated with the quantity of alcohol consumed by underage youth, not just which brands they consume. In addition, there was a stronger association between advertising and consumption at higher levels of exposure. This study should prompt a reevaluation of the industry's self-regulatory framework (Federal Trade Commission, 2014) in order to reduce advertising exposure among underage youth, particularly at higher levels. Future research should examine exposure–consumption relationships longitudinally and in other media and should assess larger numbers of youth with higher levels of advertising exposure.

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