Association Between Adolescent Viewership and Alcohol Advertising on Cable Television

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Objectives. We examined whether alcohol advertising on cable television is associated with adolescent viewership.

Methods. Using Nielsen data for every national cable alcohol advertisement from 2001 to 2006 (608591 ads), we examined whether ad incidence in a given advertising time slot was associated with adolescent viewership (i.e., the percentage of the audience that was aged 12–20 years) after we controlled for other demographic variables.

Results. Almost all alcohol ads appeared in time slots with audiences made up of 30% or fewer underage viewers. In these time slots (standardized by duration and number of viewers), each 1-percentage-point increase in adolescent viewership was associated with more beer (7%), spirits (15%), and alcopop (or low-alcohol refresher; 22%) ads, but fewer wine (–8%) ads ($P<.001$ for all). For spirits and alcopops, associations were stronger among adolescent girls than among adolescent boys ($P<.001$ for each).

Conclusions. Ad placements for beer, spirits, and alcopops increased as adolescent viewership rose from 0% to 30%, especially for female viewers. Alcohol advertising practices should be modified to limit exposure of underage viewers. (*Am J Public Health.* 2010;100:555–562. doi:10.2105/AJPH.2008.146423)

Underage alcohol use is a national public health problem. In 2005, 36% of ninth graders and 51% of 12th graders reported drinking in the past 30 days; 33% of 12th graders reported binge drinking (i.e., having ≥5 drinks in 2 hours) during that time.[1] One study estimated that underage drinking accounts for 17.5% of total US consumer expenditures for alcohol.[2]

Each year, about 5000 US deaths of persons younger than 21 years are attributable to underage alcohol use (mostly through alcohol-impaired driving, homicide, suicide, and drowning).[3,4] Underage drinking is linked to sexual and other violence, unintentional injury, pregnancy, unprotected sexual intercourse, delinquent behaviors, other substance use, and academic problems.[5–10] Those who begin drinking at 14 years or younger have a 47% lifetime incidence of alcohol dependence compared with 9% for those who begin drinking at 21 or older.[11]

Evidence suggests that alcohol advertising influences underage drinking. A longitudinal study found that both regional alcohol advertising expenditures and individual exposure to alcohol ads were associated with subsequent underage drinking.[12] In a longitudinal study of seventh graders, watching television programs containing alcohol commercials was associated with drinking alcohol and consuming 3 or more drinks in a single setting.[13] A study of sixth and seventh graders found that exposure to alcohol advertising was associated with both drinking and intention to drink.[14] Other studies have shown that beer advertisements generate high levels of awareness among children and adolescents[15–17] and that awareness is associated with favorable beliefs about drinking and intention to drink.[15]

Television is the most heavily used form of media among adolescents.[18] The average child aged 8 to 18 years watches 3 hours of television per day. In particular, cable television has rapidly supplanted broadcast television as this age group's dominant medium.[18]

Similarly, alcohol advertising on cable has increased dramatically.[19] From 2001 to 2006, alcohol advertisements and expenditures on cable increased 176% (from 51019 to 140930 ads) and 137% (from $157 million to $372 million), respectively; cable now hosts 95% of all alcohol advertisements on national television networks. By comparison, total reported advertising expenditures for all product categories on cable television increased only 35% over the same period, and alcohol advertising on broadcast television has changed relatively little (unpublished data, Nielsen Monitor-Plus, Nielsen Media Research, Inc., 2002–2006). As both underage viewers and alcohol advertisers have turned toward cable, total exposure of underage viewers to alcohol ads has increased, with cable becoming the largest source of exposure of underage viewers.[19]

Policymakers have argued about how best to limit exposure of underage viewers. At the end of 2003, the beer and spirits industries strengthened their voluntary guidelines, shifting the maximum underage viewership threshold from 50% to 30% (a standard previously adopted by the wine industry in 2000).[20–22] The Institute of Medicine and 20 state attorneys general have countered that more-stringent measures are needed.[23,24]

One critical question is whether exposure of underage viewers to alcohol ads is an incidental by-product of advertising aimed purely at audiences 21 years and older. If so, then strong advertising restrictions to reduce the exposure of underage viewers might inadvertently prevent advertisers from reaching audiences 21 years and older as well. If exposure of underage viewers were incidental, ad incidence should, after the demographics of audiences 21 years and older are controlled for, demonstrate no association with underage viewership. Thus, we used Nielsen data from 2001 to 2006 to study whether the incidence of alcohol ads on national cable networks was associated with viewership by audiences aged 12 to 20 years.

METHODS

We obtained television viewership data from Nielsen Media Research (NMR) for each alcohol ad appearing on a national cable network from 2001 to 2006 (unpublished data, Nielsen Media Research, Inc., 2002–2006). NMR measures television audiences for national networks by using a representative sample of about 9000 households (>18 000 persons). We received aggregate viewership data broken down into NMR-defined categories for age, gender, race/ethnicity, and household income. Only product ads were considered, as opposed to advertiser-sponsored public service announcements (e.g., "Drink responsibly") or corporate or event messages (e.g., "We are proud to honor our Olympic athletes").

Ad and expenditure data were obtained from Nielsen Monitor-Plus (unpublished data, Nielsen Monitor-Plus, Nielsen Media Research, Inc., 2002–2006). This data set included the date, time, network, alcohol brand, and cost of each ad from 2001 to 2006. The time each ad appeared was classified by using a conventional television classification system of "dayparts" defined by time of day and weekday versus weekend (e.g., the 5 AM to 10 AM weekday daypart; Table 1).

TABLE 1—Dayparts of Weekly Cable Television

Weekdays	Weekend
5 AM to 10 AM	5 AM to 10 AM
10 AM to 4 PM	10 AM to 4 PM
4 PM to 6 PM	4 PM to 6 PM
6 PM to 7 PM	6 PM to 7 PM
7 PM to 8 PM (prime access)	7 PM to 8 PM (prime access)
8 PM to 11 PM (prime time)	8 PM to 11 PM (prime time)
11 PM to 11:30 PM	11 PM to 11:30 PM
11:30 PM to 5 AM (overnight)	11:30 PM to 5 AM (overnight)

Note. Dayparts are defined by time of day and weekday versus weekend, as shown. On Sunday, there is no prime access, and prime time is 7 PM to 11 PM.

Alcohol brands were classified as beer (including ale), spirits, alcopops, or wine by Impact Databank, a market research firm serving the alcohol industry.[25–27] Alcopops (e.g., Mike's Hard Lemonade, Smirnoff Ice) are commonly referred to as low-alcohol refreshers, malternatives, flavored malt beverages, or ready-to-drink flavored alcoholic beverages.[28]

Unit of Observation

On broadcast television, ads are purchased for individual programs. On cable, by contrast, advertisers generally contract with a network to place ads on dayparts rather than on specific programs.[29,30] The network then distributes the ads among programs within the selected dayparts (paying some attention to advertiser-expressed program preferences). There are two reasons for this difference (D. Zornow, Founder, TNG Research, and former Chairman, Cable Advertising Bureau's CONCAM Cable Research Committee, e-mail communication, April 2008). First, cable networks usually focus on a single genre (e.g., sports with ESPN) or demographic group (e.g., women with Lifetime). Thus, cable demographics tend to be narrower and more stable than broadcast demographics, which fluctuate substantially by program. As a result, cable advertisers can effectively target demographic groups by purchasing ad space at the daypart level. Second, cable programs that attract large audiences (e.g., ESPN's Monday Night Football) are still so rare that competition among advertisers for premium ad space is intense. To gain access to those few highly rated programs, advertisers routinely agree to purchase daypart-based bundles imposed on them by cable networks.

Thus, advertising decisions on cable are typically made at the level of a specific daypart on a specific network in a specific year (which we will call, for simplicity, an "advertising time slot"). We defined "ad counts" in our data set as the number of ads placed in a specific advertising time slot by a specific alcohol brand. Likewise, we reported the average viewership data for all alcohol ads placed within that time slot.

For each year, we were able to obtain average alcohol-ad viewership data only for the time slots that hosted at least 1 alcohol ad. On average, 37% of each year's time slots had no alcohol ads and so were necessarily omitted. To assess whether omitting these time slots might have biased our results, we examined an auxiliary Nielsen data set that provided limited summary data about both the included and omitted time slots. Whereas, on average, 5% of the audiences in the included time slots were aged 2 to 11 years, nearly 50% of the audiences in the omitted time slots were aged 2 to 11 years. Omitted time slots often included cartoons and other children's programming. Thus, most of the omitted time slots were those in which alcohol advertising would have been either prohibited by network policies or considered an unrealistic option by advertisers. Our goal was to model alcohol advertising within the universe of time slots in which advertisers could realistically place ads. Given the heavy preponderance of child viewers in the omitted time slots, omission of those slots likely brought us closer to that goal.

Analysis

Our outcome variable was a count of ads placed in a specific time slot by a specific alcohol brand. The Poisson distribution is most commonly used for modeling count data. Our ad counts, however, had variances substantially exceeding the mean (i.e., overdispersion relative to a Poisson distribution). Therefore, we used negative binomial regression (which accommodates overdispersion and fit better than do Poisson models by likelihood-ratio testing) for all analyses. Alternative types of generalized linear models (e.g., linear regression with log-transformed variables) failed diagnostic tests of model fit. We conducted 4 parallel regressions for beer, spirits, alcopop, and wine ads.

Our time slots differed in both number of hours and average audience size. In general, longer time slots provide more potential ad space, whereas larger audiences create more incentive to advertise. Thus, raw ad counts are inherently less comparable than ad counts scaled to reflect time-slot duration and audience size. To enhance comparability among time slots, we created a measure of each time slot's annual viewer hours (called an exposure or offset variable in negative binomial models), which was equal to each time slot's annual number of hours multiplied by its average number of viewers. This exposure

variable functioned as a denominator, so that we modeled the incidence of advertisements per viewer hour (hereafter referred to simply as "ad incidence"). Results were presented as incidence rate ratios (IRRs), the amount by which ad incidence was multiplied for each 1-unit increase in a given predictor, with control for other predictors. With respect to our variables of interest, our unit usually equaled 1 percentage point; for illustrative purposes, we occasionally reported results from regressions using 10 percentage points as our unit.

The main predictor variable was adolescent viewership, which was measured as the percentage of the total audience (aged 2 years and older) that was aged 12 to 20 years (the age range provided by Nielsen that best captured underage viewers other than children). Initially, we controlled for the viewership of 5 other age groups provided by NMR: 2 to 11 years (child), 21 to 24 years (young adult), 25 to 34 years, 35 to 49 years, and 50 years and older. Associations between ad incidence and adolescent viewership were consistent across various parameterizations, which allowed us to collapse the 3 oldest categories into a single 25 years and older (older adult) reference category in our final model. This older adult category allowed us to compare the ad exposure of younger populations with the exposure of a group that nearly approximated the adult general public. On average in our data set, 94% of the audience 21 years and older was 25 years and older. Thus, regressions estimated changes in ad incidence associated with increases in the proportion of child, adolescent, and young adult viewership compared with the incidence expected with older adult viewership.

Gender breakdowns were not available for children (ages 2–11 years), but the percentage of viewers within each age group who were female was calculated for adolescents, young adults, and older adults. Other predictors included the percentages of viewing households whose annual income was within a specific range (<$30 000, $30 000–$49 999, $50 000–$74 999, ≥$75 000) and whose head of household was a specific race (Black, White, and other—additional races and Hispanic ethnicity were not obtained) and indicators for each year, daypart, and alcohol brand.

Current industry guidelines to avoid audiences made up of more than 30% underage viewers were adopted near the end of 2003. Thus, we compared time slots with audiences less than or equal to 30% underage with time slots with audiences more than 30% underage by including in our analysis both an indicator for whether the time slot's percentage of underage viewership was less than or equal to 30% or greater than 30% and interaction terms to test whether age-related associations (child, adolescent, young adult) differed by underage viewership (less than or equal to 30% or greater than 30%). In secondary analyses, we conducted subanalyses for the 2001 to 2003 and 2004 to 2006 periods to detect any large-scale advertising shifts after adoption of the guidelines.

RESULTS

From 2001 to 2006, the alcohol industries placed 608 591 ads in 205 592 unique advertising time slots on national cable networks. In 2004 to 2006—the years following adoption of industry guidelines to avoid audiences made up of more than 30% underage viewers—beer and spirits ad placements increased compared with 2001 to 2003, both overall and in time slots with audiences composed of more than 30% underage viewers (Table 2). Alcopop ad placements decreased, but this shift coincided with a rise to dominance of a few brands that resulted in disinvestment by most alcopop advertisers.[31]

Cable Viewership

Average audience size and demographics varied widely across time slots, representing both niche and mainstream audiences (Table 3). Adolescent viewership averaged 8.6% (range: 0.0%–69.9%); within adolescent audiences, 45.5% (range: 0.0%–100.0%) were female.

Ad Incidence and Adolescent Viewership

Interactions testing whether associations between ad incidence and adolescent viewership varied by whether time slots had

TABLE 2—Alcohol-Ad Placements (and Estimated Expenditures) on National Cable Networks Before (2001–2003) and After (2004–2006) Voluntary Policies to Avoid Audiences Made up of More Than 30% Underage Viewers Were Pledged

	Ads Placed		Change in No. of Ads, %
	Before, No. ($ Million)	After, No. ($ Million)	
Beer ads			
Time slots with <15% underage viewers	36 815 ($145)	114 277 ($343)	210
Time slots with 15%–30% underage viewers	79 622 ($238)	87 660 ($333)	10
Time slots with >30% underage viewers	8707 ($16)	10 073 ($21.6)	16
Spirits ads			
Time slots with <15% underage viewers	13 041 ($24)	60 347 ($104)	363
Time slots with 15%–30% underage viewers	12 832 ($28)	67 308 ($205)	425
Time slots with >30% underage viewers	550 ($1.2)	9667 ($15.7)	1658
Alcopops ads			
Time slots with <15% underage viewers	5942 ($23)	5429 ($20.2)	–9
Time slots with 15%–30% underage viewers	15 262 ($44)	12 976 ($39.2)	–15
Time slots with >30% underage viewers	1961 ($3.9)	1070 ($1.9)	–45
Wine ads			
Time slots with <15% underage viewers	32 591 ($66)	21 821 ($38.4)	–33
Time slots with 15%–30% underage viewers	5305 ($17)	4794 ($8.6)	–10
Time slots with >30% underage viewers	125 ($0.04)	466 ($1.0)	273

Note. Data are from Nielsen Media Research, Inc (unpublished data, Nielsen Media Research, Inc., 2002-2006).

TABLE 3—Average Audience Demographics of Cable Television Advertising Time Slots, 2001–2006

Demographics	% (range)
% of audience aged	
2–11 y	5.0 (0.0–72.9)
12–20 y	8.6 (0.0–69.9)
21–24 y	4.8 (0.0–57.3)
≥25 y	81.7 (10.6–99.0)
% of audience that is females, by age group	
2–11 y	NA[a]
12–20 y	45.5 (0.0–100.0)
21–24 y	48.6 (0.0–100.0)
≥25 y	50.5 (13.7–100.0)
% of heads of household with the following ethnicity	
White	84.1 (12.6–99.6)
Black	15.9 (0.4–87.4)
Other	6.1 (0.0–19.7)
% of households with the following income	
<$30 000	30.2 (8.0–60.4)
$30 000–$49 999	22.2 (5.2–38.9)
$50 000–$74 999	20.5 (3.1–35.3)
≥$75 000	27.1 (5.9–59.7)

[a]Not available from Nielsen Media Research, Inc (unpublished data, Nielsen Media Research, Inc., 2002-2006).

audiences composed of more than 30% underage viewers were significant. For ease of interpretation, we do not report the interaction terms but instead translate them into separate associations for time slots with audiences composed of less than or equal to 30% or more than 30% underage viewers (see age category rows in Table 4).

In time slots with underage viewership of less than or equal to 30% (constituting 95% of the time slots in our sample), each 1-percentage-point increase in adolescent viewership was associated with an increase in ad incidence of 7% (IRR=1.07; $P<.001$) for beer, 15% (IRR=1.15; $P<.001$) for spirits, and 22% (IRR=1.22; $P<.001$) for alcopops, but a decrease in ad incidence of 8% (IRR=0.92; $P<.001$) for wine.

By contrast, there were positive associations between ad incidence and young adult viewership across all 4 industries as follows: beer (IRR=1.10; $P<.001$), spirits (IRR=1.09; $P=0.001$), alcopops (IRR=1.38; $P<.001$), and wine (IRR=1.12; $P<.001$).

Ad Incidence and Adolescent Viewer Gender

For spirits and alcopops, ad incidence was more strongly associated with adolescent-girl than adolescent-boy viewership (see gender distribution rows in Table 5). Each 1-point increase in the percentage of the adolescent audience that was female was associated with an increase in ad incidence of 4% for spirits (IRR=1.04; $P<.001$) and 5% for alcopops (IRR=1.05; $P<.001$). In other words, time slots where adolescent audiences were 55% female had, on average, 48% more spirits ads and 58% more alcopop ads than did time slots where adolescent audiences were 45% female. Programs that attracted both alcohol ads and female adolescent viewers were often reality shows such as "Dr. 90210," "Girls Next Door," "Project Runway," "Queer Eye for the Straight Guy," and "The Simple Life."

Other Associations

In time slots with audiences composed of more than 30% underage viewers (constituting 5% of the time slots in our sample), ad incidence and adolescent viewership were negatively associated (see age category rows in Table 5) for beer (IRR=0.83; $P<.001$), spirits (IRR=0.84; $P<.001$), alcopops (IRR=0.82; $P<.001$), and wine (IRR=0.90; $P<.001$); associations between ad incidence and young adult viewership remained positive for beer (IRR=1.16; $P<.001$) and spirits (IRR=1.81; $P<.001$), but not for alcopops (IRR=1.09; $P=0.32$) and wine (IRR=1.10; $P=.24$). In subanalyses of 2001 to 2003 and 2004 to 2006, age and gender associations persisted both before and after the policy change at the end of 2003 (data not shown).

DISCUSSION

This study was the first to document associations between alcohol-ad incidence on cable television and adolescent viewership. The vast majority (95%) of advertising time slots had a proportion of underage viewership of less than or equal to 30%, and in those time slots, adolescent viewers were exposed to more beer, spirits, and alcopop ads than would have been expected through incidental exposure to ads aimed at adults 21 years and older. Consider 2 time slots (A and B). Our results suggest that if A and B had identical young adult viewership, but adolescent viewership was 10 percentage points higher in B, then beer, spirits, and alcopops advertisers would have advertised, on average, 2.0, 4.0, and 7.3 times as frequently in B. This pattern existed before the industries strengthened their pledge to avoid underage audiences, and it persisted after.

Although associations between ad incidence and adolescent viewership were negative in the few (5%) time slots with a proportion of underage viewership of more than 30%, the scarcity of these time slots rendered the new 30% standard ineffective in reducing exposure of underage viewers to alcohol ads. In fact, total exposure of underage viewers continued to increase, driven by the large increase in the total number of ads (Table 2).[19]

For spirits and alcopops, ad placements were especially associated with viewership among adolescent girls. These findings correlate with relative trends in underage alcohol use among girls and boys. In annual nationally representative surveys of 8th, 10th, and 12th graders from 2001 to 2005, alcohol in general became more widely used by 8th- and 10th-grade girls than by 8th- and 10th-grade boys, with more drunkenness and binge drinking among 8th-grade girls than among 8th-grade boys. Binge drinking of spirits rose faster among girls than among boys. Drinking in the new alcopops category rapidly became common among adolescents, especially girls.[32] One trend (a smaller decrease in beer drinking among girls than among boys) unanticipated by our results suggests that, if anything, our analysis might have underpredicted the shift to girls. Whether these associations suggest the influence of ads on adolescent drinking, the sensitivity of advertisers to adolescent drinking trends, or neither is unknown. Because ad frequency analysis alone cannot easily answer such questions, future research should incorporate other modalities, including content analysis, to better examine how ads might influence adolescent drinking. Certain types of ads, for instance, may be particularly attractive to adolescents.[33–35] Maximal adolescent effect would require

TABLE 4—Multivariate Negative Binomial Associations Between Ad Incidence and Audience Age, by Percentage of Underage Viewers (≤30%, >30%), 2001–2006

	Beer		Spirits		Alcopops		Wine	
	≤30%, IRR (95% CI)	>30%, IRR (95% CI)	≤30%, IRR (95% CI)	>30%, IRR (95% CI)	≤30%, IRR (95% CI)	>30%, IRR (95% CI)	≤30%, IRR (95% CI)	>30%, IRR (95% CI)
% of audience aged								
2–11 y	0.94*** (0.93, 0.96)	0.90*** (0.87, 0.92)	0.92*** (0.89, 0.95)	0.87*** (0.82, 0.92)	1.04 (1.00, 1.08)	0.78*** (0.72, 0.85)	0.80*** (0.77, 0.83)	0.92** (0.88, 0.97)
12–20 y	1.07*** (1.06, 1.09)	0.83*** (0.81, 0.85)	1.15*** (1.11, 1.18)	0.84*** (0.78, 0.90)	1.22*** (1.18, 1.26)	0.82*** (0.79, 0.86)	0.92*** (0.89, 0.94)	0.90*** (0.85, 0.95)
21–24 y	1.10*** (1.07, 1.13)	1.16*** (1.07, 1.26)	1.09** (1.04, 1.14)	1.81*** (1.50, 2.19)	1.38*** (1.30, 1.46)	1.09 (0.92, 1.31)	1.12*** (1.06, 1.18)	1.10 (0.94, 1.28)
≥25 y (Ref)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Note. CI = confidence interval; IRR = incidence rate ratio. Multivariate regressions also included indicator variables for all 13 dayparts and all 167 alcohol brands (not shown). The ad IRR is the amount by which ad incidence per viewer-hour is multiplied for each 1-unit increase in a given predictor, with control for all other predictors. For example, a 1-point increase in percent of adolescent viewership corresponds with a 22% greater increase in the incidence of alcopop ads per viewer-hour than does a 1-point increase in percent of older adult viewership. For ease of interpretation, we do not report the interaction terms but instead translate them into separate associations for time slots with a percentage of underage viewers less than or equal to 30% or more than 30%.

*$P<.05$; **$P<.01$; ***$P<.001$.

a combination of both heavy exposure and high appeal among adolescents, which suggests the need for a multimodal research approach.

With respect to wine, ad incidence was negatively associated with adolescent viewership but positively associated with young adult viewership. Consider 2 time slots (A and B). Our results suggest that if A and B had identical young adult viewership, but adolescent viewership was 10 percentage points higher in B, then wine advertisers would have advertised, on average, 0.43 times as frequently in B. If, however, A and B had identical adolescent viewership, but young adult viewership was 10 percentage points higher in B, then wine advertisers would have advertised, on average, 3.1 times as frequently in B. Thus, the wine industry appears to have demonstrated that alcohol advertisers can target young adults while limiting exposure to adolescent viewers.

Strengths and Limitations

This study had unique strengths. We captured a census, rather than merely a sample, of alcohol advertising on cable. We focused on national cable, which accounts for almost all nationally televised alcohol ads, airs numerous ads from all 4 alcohol industries (versus national broadcast television, which is used mainly by beer advertisers), and is growing as an alcohol advertising venue much faster than other types of television (i.e., national broadcast, local broadcast). Our use of Nielsen data, which allowed us to examine many of the same viewership demographics used by alcohol advertisers, was an additional strength.

Our study also had limitations. By ignoring national broadcast, we excluded a small number of alcohol ads that, because of their higher cost, account for a disproportionate share of ad expenditures. Beer expenditures, in particular, remain greater on national broadcast than on national cable. Because the higher cost creates a higher barrier-to-entry, advertising decisions on national broadcast might be different than on national cable.

Our data set excluded time slots in which no alcohol ads were placed in that year. Thus, the data might have biased the association between

TABLE 5—Multivariate Negative Binomial Associations Between Ad Incidence and Other Audience Demographics, 2001–2006

	Beer, IRR (95% CI)	Spirits, IRR (95% CI)	Alcopops, IRR (95% CI)	Wine, IRR (95% CI)
% of audience that is female, by age				
2–11 y (child)			–[a]	
12–20 y (adolescent)	1.00 (1.00, 1.01)	1.04*** (1.03, 1.05)	1.05*** (1.04, 1.05)	1.00 (1.00, 1.01)
21–24 y (young adult)	0.99*** (0.98, 0.99)	1.03*** (1.03, 1.04)	1.01** (1.01, 1.02)	1.00 (0.99, 1.00)
≥25 y (older adult)	0.93*** (0.93, 0.94)	0.93*** (0.92, 0.94)	0.91*** (0.89, 0.92)	1.06*** (1.05, 1.06)
% of households with the following ethnicity				
White (Ref)	1.00	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)
Black	1.04*** (1.03, 1.04)	1.03*** (1.02, 1.03)	1.02*** (1.01, 1.03)	1.03*** (1.02, 1.04)
Other	0.97*** (0.95, 0.98)	0.94*** (0.91, 0.97)	0.86*** (0.83, 0.89)	1.29*** (1.25, 1.34)
% of households with the following income				
<$30 000 (Ref)	1.00	1.00	1.00	1.00
$30 000–$49 999	1.08*** (1.07, 1.09)	1.12*** (1.09, 1.15)	1.06*** (1.03, 1.09)	1.05*** (1.02, 1.08)
$50 000–$74 999	1.17*** (1.16, 1.19)	1.14*** (1.11, 1.17)	1.14*** (1.10, 1.17)	1.03 (1.00, 1.06)
≥$75 000	1.10*** (1.09, 1.11)	1.13*** (1.11, 1.14)	1.09*** (1.07, 1.10)	1.07*** (1.06, 1.09)
Year				
2001 (Ref)	1.00	1.00	1.00	1.00
2002	0.79*** (0.69, 0.90)	0.66 (0.41, 1.08)	0.93 (0.67, 1.28)	0.58*** (0.46, 0.74)
2003	1.17 (1.00, 1.37)	2.29** (1.38, 3.79)	0.50*** (0.35, 0.71)	0.22*** (0.16, 0.29)
2004	1.46*** (1.26, 1.69)	3.42*** (2.11, 5.57)	0.49*** (0.35, 0.69)	0.06*** (0.04, 0.09)
2005	2.18*** (1.89, 2.52)	4.96*** (3.07, 7.99)	0.62** (0.44, 0.88)	0.05*** (0.04, 0.08)
2006	1.23* (1.06, 1.43)	7.24*** (4.55, 11.54)	0.66* (0.45, 0.98)	0.06*** (0.04, 0.09)
Cost per ad ($ thousands)	0.86*** (0.85, 0.86)	0.82*** (0.81, 0.83)	0.89*** (0.87, 0.90)	0.83*** (0.82, 0.85)

Note. CI = confidence interval; IRR = incidence rate ratio. Multivariate regressions also included indicator variables for all 13 dayparts and all 167 alcohol brands (not shown). The ad IRR is the amount by which ad incidence per viewer-hour is multiplied for each 1-unit increase in a given predictor, with control for all other predictors. For example, a 1-point increase in percent of adolescent viewership corresponds with a 22% greater increase in the incidence of alcopop ads per viewer-hour than does a 1-point increase in percent of older adult viewership.
[a]Gender data for this age group were not available from Nielsen.
*$P < .05$; **$P < .01$; ***$P < .001$.

ad placements and adolescent viewership. However, a time slot was included if it had even 1 ad placed by any 1 of 167 alcohol brands; thus, 63% of all possible time slots were included. Moreover, because observations were at the brand level and all brands were included if even 1 brand advertised in a time slot, most observations still had no ads (e.g., if only 1 alcohol brand advertised in a time slot, then only 1 of 167 observations would have contained any ads, whereas the other 166 observations would have contained none). Finally, our data suggested that the omitted time slots were largely dominated by children's programming. By omitting time slots in which alcohol advertising would have been either prohibited by network policies or considered an unrealistic option by advertisers, we likely improved our ability to model advertising in a real-world context.

It is always possible that unmeasured confounders might account for observed associations. By including indicator variables for each of the 13 dayparts and 167 alcohol brands, we attempted to account for at least some of the unmeasured differences among dayparts and brands. With respect to differences among the time slots, we used the same Nielsen viewer demographics that were available to alcohol advertisers. Nevertheless, the demographics available from Nielsen were limited, as were the category breakdowns within the age, gender, race/ethnicity, and household income variables; it is possible that the industries' internal or alternative marketing research data or strategies influenced advertisers in ways our data could not capture. Future research examining other network, television show, and alcohol-ad characteristics would be useful. Also, stratifying analyses by networks (which would require more power than was available to us) could reveal how associations might differ across networks. Such research could help advertisers understand how certain strategies not explicitly involving age could still create associations between age and ad incidence that result in avoidable exposure of adolescents.

Correlation among predictor variables (multicollinearity) reduces the power to distinguish the independent effects of each variable, widening their confidence intervals. Multicollinearity inflated the variance of our age-related viewership variables (child, adolescent, and young adult) by factors of 1.4, 3.9, and 3.0, respectively. Nonsignificant associations involving these variables, therefore, should be interpreted with caution, because the power to detect weaker associations was limited. Our main findings, however—that ad incidences are

associated with adolescent viewership—were ones of significance rather than nonsignificance, making multicollinearity somewhat less concerning.

Finally, our findings did not address whether the association between ad incidence and adolescent viewership was intentional. From a health policy standpoint, however, establishing intent may be less important than demonstrating that (1) the association occurred, and (2) the association was not an unavoidable consequence of advertising to young adult audiences.

Conclusions

Our study showed that across the vast majority of time slots, adolescent viewers, especially girls, were exposed to more beer, spirits, and alcopop ads on cable television than would be expected through incidental exposure. This finding suggests that the underage viewership threshold of 30% adopted by the various industries has been ineffective in reducing adolescent exposure to ads. Moreover, the wine industry's relative success in reaching young adults while avoiding adolescents suggests that more-careful discrimination between the 2 groups may be possible. Which regulatory strategy would be most effective is unclear; one study suggests that a 15% threshold (recommended by the Institute of Medicine and 20 state attorneys general) might substantially reduce adolescent exposure.[36] Regardless, given the growing evidence of alcohol advertising's effect on underage drinking, underage drinking's public health impact, and the industry's current ineffectiveness in reducing exposure of underage viewers to alcohol ads, more-stringent guidelines may be indicated, and ongoing monitoring of industry self-regulation is warranted. ■

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Contributors

P.J. Chung originated and led the study, conducted all data analyses, led the writing and revision, and obtained funding support. C.F. Garfield co-originated and co-led the study. M.N. Elliott provided senior oversight of data analyses. J. Ostroff and C. Ross provided advertising and alcohol industry expertise and managed all data sets. D. Jernigan provided public policy expertise, obtained access to all data sets, and obtained funding support. K.D. Vestal provided key support for data analyses, writing, and revision. M.A. Schuster provided senior oversight of the study and obtained funding support. All authors participated in study design, interpretation of data analyses, writing, and revision.

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Human Participant Protection

Institutional review board approval was not obtained for this research because it used commercially available data and did not include identifying information for the participants.

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