



## Prospective associations between attitudes toward alcohol advertisements and alcohol use behaviors among adolescent boys

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### ABSTRACT

**Objectives:** Earlier initiation of alcohol use and problematic drinking among adolescents are linked with adverse health outcomes. Exposure to alcohol advertisements is associated with drinking among adolescents, but the association between the attitudes toward alcohol advertisements and drinking behaviors is understudied. We evaluated the association between attitudes towards alcohol advertisements and initiation of alcohol use among adolescent boys.

**Methods:** Adolescent boys from urban and Appalachian Ohio enrolled in a prospective study and reported whether they had ever consumed alcohol or been drunk at baseline (N = 1220; ages 11–16 years) and at the 24-month follow up (N = 891). Attitudes toward alcohol advertisements were measured at baseline following a brief advertisement viewing activity. Adjusted logistic regression models were used to estimate associations between attitudes toward advertisements and initiating alcohol use or drunkenness at the 24-month follow-up.

**Results:** Adolescent boys reporting any positive attitudes toward alcohol advertisements had higher odds of initiating alcohol use (aOR = 2.00, 95% CI [1.16, 3.44]), and attitudes were marginally associated with incident drunkenness (aOR = 2.20, 95% CI [0.94, 5.12]). Increasing age, higher household income, ever use of tobacco, and frequency of visiting alcohol retailers were also associated with greater odds of incident alcohol use and/or drunkenness.

**Conclusions:** Attitudes toward alcohol advertisements at baseline were associated with alcohol drinking behaviors 24-months later among adolescent boys. Results highlight the importance of media literacy interventions targeted to adolescents.

### 1. Introduction

Alcohol is the most common substance used by adolescents in the United States (U.S.), and over half of high school seniors have tried alcohol (Miech, et al., 2018). Preventing alcohol use is important during adolescence, as earlier initiation is associated with problematic drinking (e.g., binge drinking, heavy drinking), which may lead to other alcohol-related issues like delayed educational progress, impaired decision making, altered brain development and function, and driving under the influence (Hingson, Heeren, Levenson, Jamanka, & Voas, 2002; Renna, 2008; Squeglia, Jacobus, & Tapert, 2014; O'Malley, Johnston, &

Bachman, 1998; Aiken, et al., 2018a).

Increased exposure to alcohol advertisements is associated with a higher risk of initiating alcohol use and engaging in binge drinking among adolescents (Anderson, de Bruijn, Angus, Gordon, & Hastings, 2009; Robinson, Chen, & Killen, 1998; Sargent, Wills, Stoolmiller, Gibson, & Gibbons, 2006; Wills, Sargent, Gibbons, Gerrard, & Stoolmiller, 2010; Grenard, Dent, & Stacy, 2013; Bery, Loparco, Leeman, & Grube, 2017; Jernigan, Noel, Landon, Thornton, & Lobstein, 2016; Morojele, et al., 2018; Snyder, Milici, Slater, Sun, & Strizhakova, 2006). Alcohol advertisements encourage alcohol consumption by using positive portrayals of events, actions, or themes involving alcohol (Chen,

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et al., 2016; Morgenstern, Li, Li, & Sargent, 2016). Among adolescents and young adults specifically, portrayals of sexuality, active lifestyles, confidence, and success among young models leads to positive attitudes toward alcohol (Siegel, et al., 2015; Weaver, Wright, Dietze, & Lim, 2016).

Despite the evidence describing associations between specific themes in alcohol advertisements and perceptions of alcohol among young people, only voluntary self-regulatory codes limit underage consumers from being targeted by alcohol advertisements in the U.S. (Federal Trade Commission, 2013). Adolescents can still be potential targets of alcohol advertisements, and it is therefore critical to understand the mechanisms underlying associations between exposures to alcohol advertisements and alcohol use outcomes among young people. Advertising researchers argue that positive attitudes to advertisements result in positive attitudes toward the brand advertised and increased intention to purchase or use the brand advertised (see Brown & Stayman, 1992; Shimp, 1981). Other research indicates that positive attitudinal responses to alcohol or tobacco brand advertising lead to more positive attitudes, not just about the brand, but about alcohol or tobacco overall (Kelly, Slater, & Karan, 2002), which is likely to impact alcohol or tobacco use, but use was not analyzed in that study.

We are aware of only two studies that have evaluated how attitudes towards alcohol advertisements are associated with alcohol use among adolescents. The first, a cross-sectional study of adolescents in South Africa identified that liking alcohol advertisements across multiple media types was positively associated with drinking (Morojele, et al., 2018). However, it is unclear whether liking of alcohol advertisements preceded drinking or if drinking led to a liking of advertisements. Second, a longitudinal study of adolescents in California, U.S., identified that exposure to alcohol advertisements and positive affective reactions towards recalled TV alcohol advertisements predicted increased alcohol use and alcohol-related problems (Grenard, Dent, & Stacy, 2013).

Our goal was to expand the results of these previous studies by focusing specifically on attitudes towards recently-viewed print alcohol advertisements and evaluating how attitudes predict behaviors longitudinally. Using a prospective cohort of adolescent boys, the objective of our study was to examine the association between attitudes towards alcohol advertisements and incident alcohol use and drunkenness. We hypothesized that positive attitudes toward alcohol advertisements would be prospectively associated with increased odds of incident alcohol use and drunkenness. Our study furthers previous findings by (1) directly measuring attitudes towards alcohol advertisements immediately after a brief viewing and (2) assessing alcohol-use behaviors 24 months later to clarify the associations between alcohol advertisement attitudes and incident alcohol use and binge drinking. Understanding the potential associations between attitudes toward alcohol advertisements and alcohol use would provide a useful target for media literacy interventions which can decrease positive responses to advertising through greater understanding of persuasive or manipulative strategies used in such advertising (Chang, et al., 2016; Vahedi, Sibalis, & Sutherland, 2018).

## 2. Material & methods

### 2.1. Setting

This study used baseline (January 2015 to June 2016) and 24-month follow-up (January 2017 to August 2018) data from a prospective cohort study of adolescent males (Friedman, et al., 2018). The parent study focused on determining predictors of single use and dual use of cigarettes and smokeless tobacco (SLT). Due to the high prevalence of SLT use in males relative to females (Wang, et al., 2018), the participants were only male. At baseline, participants (N = 1220) were between the ages of 11 and 16 (average age 14 years) and resided in an urban or Appalachian Ohio county. Participants were selected by probability address-based sampling (ABS; N = 991) and non-probability

convenience sampling (N = 229) methods. The ABS involved using the U.S. Postal Service's address list to randomly select households to recruit for the study. We sent the sampled addresses a pre-notification postcard, followed by a packet that briefly described the research study, a \$2 bill, and a screening survey to determine if an eligible participant might live in the household. We then called households that reported having at least one male youth between the ages of 11 and 16 years to describe the study, further screen for eligibility, and schedule the baseline visit. In cases where the household included more than one boy between the ages of 11 and 16 years, we selected the one with the most recent birthday. The convenience sampling recruitment strategies included attending community events, respondent-driven sampling, and advertising in local newspapers. Households identified through convenience sampling completed the same screening survey as households identified through ABS and were recruited using the same methods.

Participants with hearing or vision impairments that would prevent them from completing study activities (described below) or an inability to read or speak English were not eligible for the study. Two analytic samples were defined for the current study: 1) participants who reported never using alcohol at baseline (for alcohol incidence analyses) and participants who reported never being drunk at baseline (for drunkenness incidence analyses). Baseline and 24-month interviews were conducted in-person, and follow-up interviews occurred every 6 months via telephone. At baseline, an interviewer gained informed permission from a parent or legal guardian and informed assent from male youth before proceeding with interviews.

### 2.2. Procedures

The Ohio State University Institutional Review Board approved all study procedures. At both baseline and 24 months, trained interviewers administered non-sensitive items like demographic characteristics and attitudes towards advertisements. To maintain privacy and reduce response bias, audio computer-assisted self-interviewing (ACASI) was used at baseline for sensitive items including whether the respondent had ever consumed alcohol or been drunk. At the 24-month follow-up, most participants again reported on alcohol via ACASI (N = 778). However, some participants who were unavailable to complete the full session at the 24-month follow-up completed a brief telephone survey instead (N = 117).

For the advertisement viewing activity at baseline, participants were shown advertisements selected from popular magazines with high youth readership. Full-page advertisements were identified and laminated from print editions of *People Magazine*, *Sports Illustrated*, *Popular Science*, *ESPN Magazine*, and *Rolling Stone* published in 2014 and 2015. Advertisements were selected for five consumer products including alcohol (beer, wine, and hard liquor), soft drinks, cigarettes, electronic cigarettes, and SLT. Five recent advertisements, each for a different type of consumer product, were randomly selected and ordered (details in Friedman et al., 2018). Participants viewed each advertisement for eight seconds, well beyond the 0.1 s required to perceive the gist of an advertisement and about the length of time viewers spend determining whether they like an advertisement (Pieters, Wedel, & Smith, 2012; Rayner, Miller, & Rotello, 2008).

### 2.3. Measures

#### 2.3.1. Attitude toward the advertisement

After viewing each advertisement, participants were asked to what extent they found the advertisement to be appealing, enjoyable, and likeable (for each adjective, response options ranged from 0 = *not at all* to 10 = *very*). We calculated the mean of these items, separately for alcohol and soft drink advertisements, to derive a mean attitude toward the advertisement (both Cronbach's alphas = 0.95) (Friedman, et al., 2018). The attitude towards the soft drink advertisement was included in the current study to account for participants' attitudes toward

advertisements in general. Because mean attitudes were predominantly low and highly skewed (most overall attitudes were “not at all” or 0), a binary variable indicating whether the attitude score was zero or greater than zero was used in statistical models (Friedman, et al., 2018).

2.3.2. Point-of-Sale advertisement exposure

At baseline, participants reported the number of times within the past 7 days that they visited retailers permitted to sell and promote alcohol in Ohio, including convenience stores or gas stations, grocery stores or supermarkets, liquor stores, and pharmacies. The total number of visits was grouped by 0 visits to 1 visit (*none/some*) and 2 or more

visits (*many*), noting that about half adolescents visit a convenience store at least once a week (Sanders-Jackson, Parikh, Schleicher, Formann, & Henriksen, 2015). We used this summary measure as a proxy for point-of-sale advertisement exposure like the methods used by Burgoon et al. (2019).

2.3.3. Outcome variables

Incident alcohol consumption (“Have you ever used alcohol?”) and drunkenness (“Have you ever been drunk?”) at 24 months were the outcome variables in analyses. The item used to assess incident alcohol consumption also included the following text: “When we ask about

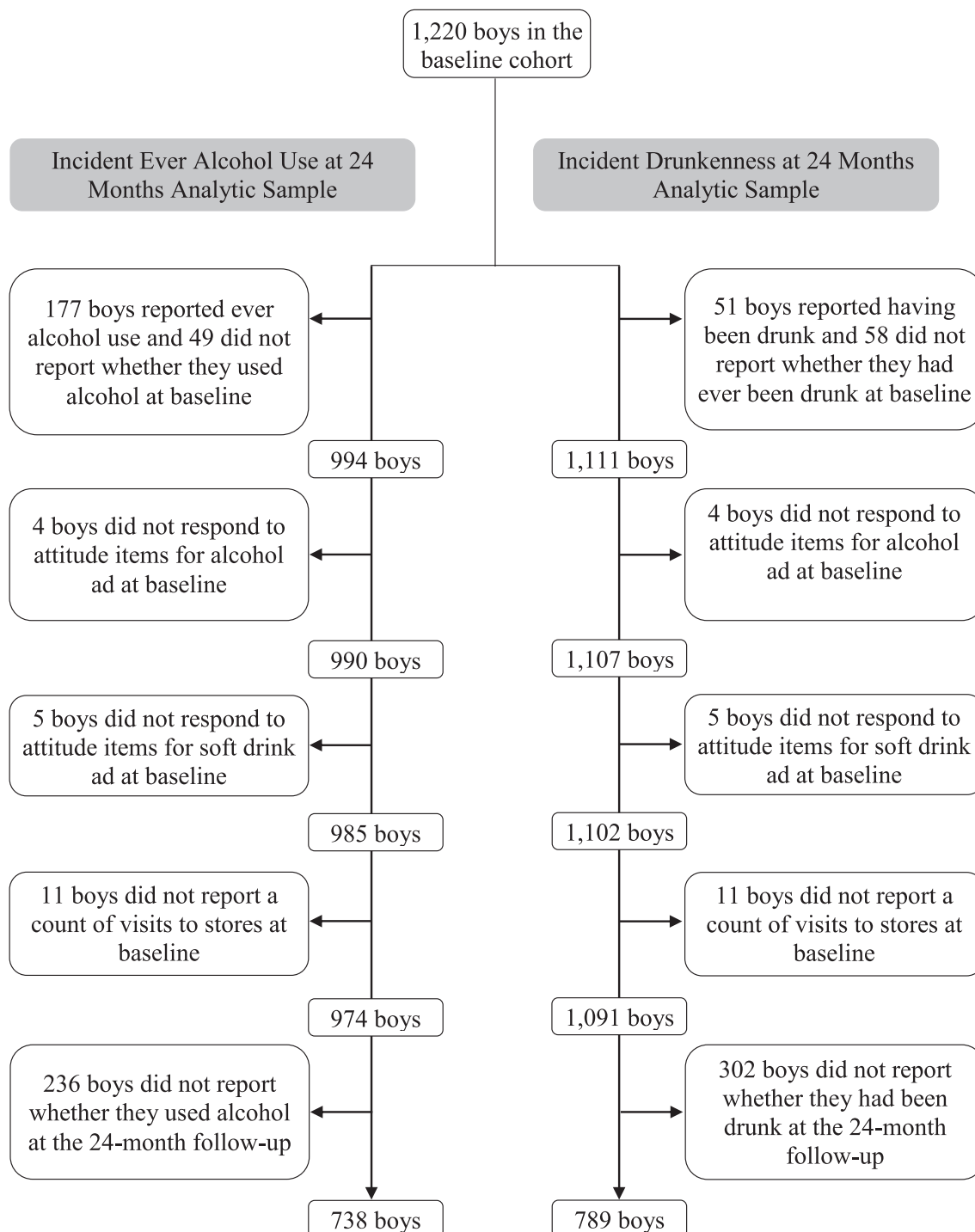


Fig. 1. Flow diagram for inclusion in the analytics samples for incident ever alcohol use (left) or incident drunkenness (right) at 24 months.

drinking alcohol, this includes drinking beer, wine, wine coolers, and liquor such as rum, gin, vodka, or whiskey. For these questions, drinking alcohol DOES NOT include drinking a few sips just to taste it or a few sips of wine for religious purposes.”

Participants were counted as incident alcohol users if they had never used alcohol at baseline and initiated alcohol use by follow-up (N = 120). Drunkenness incidence was similarly coded as “yes” for participants who had never been drunk at baseline but reported having been drunk by follow-up (N = 61).

#### 2.3.4. Covariates

Demographic characteristics included region of residence (urban vs. Appalachian), race/ethnicity (collapsed to non-Hispanic white vs other), socioeconomic status (household income more than or equal to \$50,000 versus less than \$50,000), and age. Ever use of any tobacco product at baseline (using any of the following products even once or twice: cigarettes, e-cigarettes, cigars, cigars, cigarillos, filtered cigars, pipes, hookah, SLT, or snus) was also included as a covariate.

#### 2.4. Analysis

Participants who had used alcohol (N = 177) or been drunk (N = 51) or did not report whether they had used alcohol (N = 49) or been drunk (N = 58) at baseline were excluded from the alcohol and drunkenness incidence analyses, respectively (i.e., separate analytic samples were used for each analysis; Fig. 1). Also, participants who did not respond to all three attitude items for both an alcoholic beverage (N = 4) and a soft drink (N = 5) advertisement, or did not report a count of visits to all store types (N = 11), were excluded (N = 20) (Fig. 1). Finally, participants who were missing alcohol (N = 236) or drunkenness (N = 302) data at 24 months due to study attrition or item nonresponse were excluded from alcohol incidence and drunkenness incidence analyses, respectively. There was a low proportion (<5%) of missing data for baseline household income and ever tobacco use that were imputed

using hot-deck single imputation prior to the current study; imputed values were used rather than excluding these participants. Missing data that were not imputed were handled by listwise deletion, yielding final analytic sample sizes of N = 738 and N = 789 for incident ever alcohol use and incident drunkenness at 24 months, respectively (Fig. 1).

We first computed descriptive statistics characterizing the overall sample of baseline participants who had never used alcohol or never been drunk compared to the analytic samples for alcohol incidence and drunkenness incidence at 24 months. We also compared distributions of attitudes and participant characteristics according to alcohol incidence and drunkenness incidence outcomes at 24 months. We used t-tests or chi-square tests to compare the distributions of each variable according to alcohol and drunkenness incidence outcomes, and we adjusted the alpha for multiple testing using the Holm-Bonferroni procedure. Next, multivariable logistic regression models were fit to examine the association between attitude toward the alcohol advertisement at baseline and alcohol and drunkenness incidence at 24-months. The models adjusted for attitude towards the soft drink advertisement, region, age, race/ethnicity, household income, use of any tobacco, and store visits (advertisement exposure proxy). All analyses were completed using R version 4.1.0 and RStudio version 1.4.1103.

### 3. Results

#### 3.1. Participant characteristics

In the analytic samples, overall, mean attitudes toward alcohol advertisements were low (M = 2.3 [SD = 2.5] and M = 2.4 [SD = 2.5] for alcohol use and drunkenness incidence analyses, respectively). Roughly half of participants were under 14-years-old, three-quarters were white non-Hispanic, and nearly two-thirds lived in urban Ohio; additional details about the sample are included in Table 1.

**Table 1**

Distributions of attitudes toward advertisements and participant characteristics within the baseline and 24-month analytic samples of adolescent males, Ohio, 2015–2018.

	Alcohol Use		Drunkenness	
	Baseline never alcohol use (N = 974)	Analytic sample for alcohol incidence at 24 months (N = 738)	Baseline never drunk (N = 1,091)	Analytic sample for drunkenness incidence at 24 months (N = 789)
Attitude toward alcohol advertisement <sup>a</sup> (mean [sd])	2.2 [2.5]	2.3 [2.5]	2.3 [2.6]	2.4 [2.5]
Attitude toward soft drink advertisement <sup>a</sup> (mean [sd])	4.9 [3.1]	4.7 [3.0]	4.9 [3.1]	4.7 [3.0]
Age (N (%))				
<14 years old	530 (54.4)	410 (55.6)	565 (51.8)	420 (53.2)
≥14 years old	444 (45.6)	328 (44.4)	526 (48.2)	369 (46.8)
Race/ethnicity (N (%))				
Non-Hispanic White	725 (74.4)	565 (76.6)	823 (75.4)	610 (77.3)
Other	249 (25.6)	173 (23.4)	268 (24.6)	179 (22.7)
Region (N (%))				
Urban	586 (60.2)	461 (62.5)	650 (59.6)	494 (62.6)
Appalachian	388 (39.8)	277 (37.5)	441 (40.4)	295 (37.4)
Household income (N (%))				
<\$50,000	325 (33.4)	213 (28.9)	374 (34.3)	223 (28.3)
≥\$50,000	649 (66.6)	525 (71.1)	717 (65.7)	566 (71.7)
Tobacco use (N (%))				
Never use	869 (89.2)	676 (91.6)	932 (85.4)	705 (89.4)
Ever use	105 (10.8)	62 (8.4)	159 (14.6)	84 (10.6)
Store visits (N (%)) <sup>b</sup>				
< 2 in past 7 days	236 (24.2)	193 (26.2)	254 (23.3)	200 (25.3)
≥ 2 in past 7 days	738 (75.8)	545 (73.8)	837 (76.7)	589 (74.7)

<sup>a</sup> Participants reported how appealing, enjoyable, and likable they found the alcohol advertisement on a scale from 0 (not at all) to 10 (very). Responses to these items were averaged.

<sup>b</sup> As a proxy for point-of-sale advertisement exposure, participants reported how many times they visited convenience stores or gas stations, grocery stores, liquor stores, and pharmacies in the past 7 days.

### 3.2. Attrition analyses

Descriptively, a greater proportion of boys included in the analytic samples (vs. their respective baseline samples) for incident alcohol use and drunkenness were from households with incomes greater than \$50,000 (incident alcohol use: 71.1% vs. 66.6%, respectively; incident drunkenness: 71.7% vs. 65.7%, respectively; Table 1). Ever use of tobacco was lower among boys included in the analytic samples for incident alcohol use and drunkenness (incident alcohol use: 8.4% vs. 10.8%, respectively; incident drunkenness: 10.6% vs. 14.6%, respectively). Distributions of attitudes towards the advertisements, age, race/ethnicity, region of residence, and number of store visits were similar for the baseline and analytic samples.

### 3.3. Unadjusted associations between participant characteristics and incident alcohol use and drunkenness

Boys who initiated alcohol use by the 24-month follow up had higher attitudes toward the alcohol advertisement at baseline ( $M = 3.3$  [ $SD = 2.5$ ] vs.  $M = 2.2$  [ $SD = 2.5$ ], respectively;  $p < 0.001$ ; Table 2). A similar association held for attitudes toward the soft drink advertisement ( $M = 5.6$  [ $SD = 2.7$ ] vs.  $M = 4.5$  [ $SD = 3.10$ ], respectively;  $p < 0.001$ ). Boys who reported incident drunkenness at the 24-month follow up also had higher attitudes toward the alcohol advertisement ( $M = 3.8$  [ $SD = 2.6$ ] vs.  $M = 2.3$  [ $SD = 2.5$ ], respectively;  $p < 0.001$ ), and attitudes were similar toward the soft drink advertisement ( $M = 5.4$  [ $SD = 2.5$ ] vs.  $M = 4.7$  [ $SD = 3.1$ ], respectively;  $p = 0.04$ ) at baseline after adjusting for multiple testing. A greater proportion of boys who initiated alcohol use or reported being drunk by follow-up were 14 or older (Table 2). A

smaller percentage of incident alcohol users or those who reported being drunk by follow-up were from households with income below \$50,000. Ever use of tobacco and number of store visits were higher among those who reported that they had been drunk by follow-up, but they were not associated with incident alcohol use. Incident alcohol use and drunkenness were not associated with race/ethnicity or region of residence.

### 3.4. Adjusted associations between participant characteristics and incident alcohol use and drunkenness

In adjusted models, participants with any positive attitude towards alcohol advertisements (i.e., a mean attitude greater than 0) had greater odds of initiating alcohol use (aOR = 2.00, 95% CI [1.16, 3.44],  $p = 0.012$ ; Table 3). Participants with any positive attitude towards alcohol advertisements also had increased odds of having been drunk (aOR = 2.20, 95% CI [0.94, 5.12]), but this association was marginally significant ( $p = 0.069$ ). Participants ages 14 and older had greater odds of initiating alcohol use (aOR = 2.37, 95% CI [1.56, 3.59],  $p < 0.001$ ) and drunkenness (aOR = 4.15, 95% CI [2.13, 8.05],  $p < 0.001$ ). Further, participants with a higher household income had greater odds of initiating alcohol use (aOR = 1.93, 95% CI [1.11, 3.34],  $p = 0.019$ ) and drunkenness (aOR = 2.79, 95% CI [1.22, 6.38],  $p = 0.015$ ). Ever use of tobacco was associated with incident drunkenness (aOR = 2.92, 95% CI [1.50, 5.70],  $p = 0.002$ ) but not with incident alcohol use. Many store visits (i.e., 2 or more in the past 7 days) was associated with incident drunkenness (aOR = 3.38, 95% CI [1.40, 8.19],  $p = 0.007$ ) but not with incident alcohol use. Attitude towards the soft drink advertisement, race/ethnicity, and region (Appalachian vs. urban) were not associated with initiating alcohol use or having been drunk.

**Table 2**

Characteristics of adolescent male participants at baseline, stratified by alcohol/drunkenness incidence at 24 months, Ohio, 2015–2018.

	Incident Ever Alcohol Use at 24-months (N = 738) <sup>a</sup>			Incident Drunkenness at 24-months (N = 789) <sup>a</sup>		
	Yes (N = 120)	No (N = 618)	p-value <sup>b</sup>	Yes (N = 61)	No (N = 728)	p-value <sup>b</sup>
Attitude toward alcohol advertisement score <sup>c</sup> (mean [sd])	3.3 [2.5]	2.2 [2.5]	<0.001	3.8 [2.6]	2.3 [2.5]	<0.001
Attitude toward soft drink advertisement <sup>c</sup> (mean [sd])	5.6 [2.7]	4.5 [3.1]	<0.001	5.4 [2.5]	4.7 [3.1]	0.04
Age (%)			<0.001			<0.001
<14 years old	10.5	89.5		2.9	97.1	
≥14 years old	23.5	76.5		13.3	86.7	
Race/ethnicity (%)			0.15			0.37
Non-Hispanic White	17.3	82.7		8.2	91.8	
Other	12.7	87.3		6.1	93.9	
Region (%)			0.41			0.29
Urban	17.1	82.9		8.5	91.5	
Appalachian	14.8	85.2		6.4	93.6	
Household income (%)			0.003			0.006
<\$50,000	9.9	90.1		3.6	96.4	
≥\$50,000	18.9	81.1		9.4	90.6	
Tobacco use (%)			0.08			<0.001
Never use	15.5	84.5		6.2	93.8	
Ever use	24.2	75.8		20.2	79.8	
Store visits (%) <sup>d</sup>			0.09			0.004
< 2 in past 7 days	12.4	87.6		3.0	97.0	
≥ 2 in past 7 days	17.6	82.4		9.3	90.7	

<sup>a</sup> Separate analytic samples were used for incident alcohol use (i.e., excluded participants who had ever used alcohol at baseline) and incident drunkenness analyses (i.e., excluded participants who had ever been drunk at baseline).

<sup>b</sup> P-values were calculated using t-tests or chi-square tests.

<sup>c</sup> Participants reported how appealing, enjoyable, and likable they found the alcohol advertisement on a scale from 0 (not at all) to 10 (very). Responses to these items were averaged.

<sup>d</sup> As a proxy for point-of-sale advertisement exposure, participants reported how many times they visited convenience stores or gas stations, grocery stores, liquor stores, and pharmacies in the past 7 days.

**Table 3**

Adjusted associations between attitudes toward alcohol advertisements at baseline and alcohol use outcomes at follow-up, Ohio, 2015–2018.

	Alcohol Incidence at 24 months (N = 738) <sup>a</sup>		Drunkenness Incidence at 24 months (N = 789) <sup>a</sup>	
	aOR (95% CI)	p-value	aOR (95% CI)	p-value
Alcohol Nonzero Attitude vs. Zero <sup>b</sup>	2.00 (1.16, 3.44)	0.012	2.20 (0.94, 5.12)	0.069
Soft Drink Nonzero Attitude vs. Zero <sup>b</sup>	1.66 (0.62, 4.44)	0.31	2.59 (0.33, 20.19)	0.36
Age ≥ 14 vs. < 14	2.37 (1.56, 3.59)	<0.001	4.15 (2.13, 8.05)	<0.001
White vs. Other race/ethnicity	1.32 (0.75, 2.31)	0.33	1.30 (0.60, 2.82)	0.50
Urban vs. Appalachian	1.15 (0.73, 1.81)	0.55	1.36 (0.72, 2.55)	0.35
Household Income ≥ \$50,000 vs. <\$50,000	1.93 (1.11, 3.34)	0.019	2.79 (1.22, 6.38)	0.015
Ever Tobacco Use vs. Never	1.55 (0.81, 2.99)	0.19	2.92 (1.50, 5.70)	0.002
2 or More Store Visits vs. Fewer <sup>c</sup>	1.60 (0.97, 2.64)	0.065	3.38 (1.40, 8.19)	0.007

Abbreviations: aOR = adjusted odds ratio; CI = confidence interval.

<sup>a</sup> Separate analytic samples were used for incident alcohol use (i.e., excluded participants who had ever used alcohol at baseline) and incident drunkenness analyses (i.e., excluded participants who had ever been drunk at baseline).

<sup>b</sup> Participants reported how appealing, enjoyable, and likable they found the alcohol advertisement on a scale from 0 (not at all) to 10 (very). Responses to these items were averaged, and then dichotomized to an average score of 0 vs. greater than 0 due to a strongly skewed distribution.

<sup>c</sup> As a proxy for point-of-sale advertisement exposure, participants reported how many times they visited convenience stores or gas stations, grocery stores, liquor stores, and pharmacies in the past 7 days.

#### 4. Discussion

Advertisements are designed to sell products, and thus they depict positive product attributes and highlight supposed benefits associated with product use. We found that adolescents who thought that alcohol advertisements were more enjoyable, likeable, and appealing were more likely to initiate alcohol use for the first time over a 24-month period. Our results add to the limited body of research that describes an association between positive attitudes towards alcohol advertisements and alcohol initiation among youth (Morojele, et al., 2018; Grenard, Dent, & Stacy, 2013).

Alcohol use during early adolescence increases the risk of problematic drinking later in adolescence, which is associated with other alcohol-related harms (Aiken, et al., 2018a). Thus, it is crucial to prevent adolescent alcohol use. Previous studies suggest that alcohol advertisement themes of sexuality, active lifestyles, confidence, and relatability affect whether adolescents like alcohol advertisements (Aiken et al., 2018; Siegel et al., 2015; Weaver, Wright, Dietze, & Lim, 2016). Moreover, our prior work suggests a trend towards a significant correlation between real-time point-of-sale exposure to alcohol advertisements and positive attitudes towards the advertisement (Roberts, et al., 2019). Now that alcohol companies have added digital media advertisements to their advertising campaigns, young people are also frequently exposed to alcohol advertisements from alcohol manufacturers and influencers, and these advertisements likewise use themes that appeal to youth (Lobstein, Landon, Thornton, & Jernigan, 2017).

To discourage underage alcohol use, many companies claim to follow voluntary codes to limit and prevent advertisements that target underage alcohol users in the U.S. (Federal Trade Commission, 2013), which we would define as those advertisements containing the previously mentioned themes. However, a study aimed at creating a measure of youth-appealing content in alcohol advertisements found that alcohol brands that were the most popular among adolescents had the most youth-appealing content in televised advertisements (Padon, Rimal, DeJong, Siegel, & Jernigan, 2018). There is also evidence of digital media advertisements ignoring the U.S. voluntary codes, and non-voluntary codes in other countries (Lobstein, Landon, Thornton, & Jernigan, 2017), clearly showing that stronger regulations and enforcement are necessary to make advertisements less appealing to adolescents.

Limiting exposure to advertisements with appealing themes may reduce the risk of alcohol incidence among adolescents, but our work also demonstrates that there is a need to address the attitudes adolescents have towards those advertisements. In the absence of stronger regulations, media literacy interventions that give adolescents the tools to reject messages in advertisements could break the associations between advertisement exposure and alcohol use (Chang, et al., 2016; Vahedi, Sibalis, & Sutherland, 2018). The association between positive attitudes towards advertisements and incident alcohol consumption and drunkenness emphasizes the need for more research into how media literacy interventions could help to prevent alcohol use among adolescents. Our findings further suggest that these interventions might be most impactful if targeted to adolescents who use tobacco and live in higher income households.

##### 4.1. Limitations & strengths

Because the sample was composed of only boys, we were unable to identify the effects of attitudes towards alcohol advertisements among girls. However, we suspect a similar association between positive attitudes and incident alcohol consumption and drunkenness as shown in other studies (Morojele, et al., 2018; Grenard, Dent, & Stacy, 2013). Our findings also might not generalize to adolescents with hearing or vision impairments, or those who cannot read or speak English, as they were excluded from the study. Moreover, we observed increased attrition among ever tobacco users and participants with lower household incomes, which could have biased our findings. Another limitation is related to our assessment of overall exposure to alcohol advertisements. Other studies have reported a positive relationship between total advertisement exposure and incident use (Grenard, Dent, & Stacy, 2013; Morojele, et al., 2018), but we did not have an equivalent measure of overall exposure to alcohol advertisements (e.g., across websites, television, and other media). We did measure store visits, in the event they might result in non-trivial degree of alcohol advertising exposure, as is the case for retailer visits and exposure to tobacco advertising as described by Burgoon, et al., (2019); however, this measure was not associated with alcohol or drunkenness incidence after controlling for attitudes. Additionally, we did not examine the impact of themes expressed in the advertisements, expecting that the single, brief 8-second viewing of an advertisement with any given theme would not be an adequate predictor of incident alcohol use 24-months later. Finally, although we have shown that a positive attitude towards advertisements is associated with incident alcohol use in adolescents, we could not control for other factors (e.g., baseline susceptibility to alcohol use, prior exposure to alcohol advertisements, and peer and family alcohol use) that likely left unmeasured confounding.

Despite the limitations, the current study had many strengths. Because the parent study gathered advertisements from current magazines with high youth readership, participants were asked to comment on advertisements in circulation that they might be exposed to routinely. During the advertisement viewing activity, five different product advertisements were shown to participants in a random order. This

ensured that effects of attitudes towards other advertisements viewed previously would be balanced in the measure of attitude towards the alcohol advertisement. The longitudinal aspect of our study allowed us to better understand the relationship between attitudes towards alcohol advertisements at baseline and later alcohol incidence.

## 5. Conclusions

We identified that adolescent boys' attitudes toward alcohol advertisements were associated with alcohol use outcomes two years later; future research should examine these associations among adolescent girls. These results, combined with the knowledge that increased exposure to advertisements influences drinking behavior, suggest the need for stronger advertisement regulations and interventions to improve media literacy among adolescents.

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## CRediT authorship contribution statement

**Danaye E. Nixon:** Conceptualization, Formal analysis, Writing – original draft. **Amy K. Ferketich:** Conceptualization, Methodology, Writing – review & editing, Supervision, Project administration, Funding acquisition. **Michael D. Slater:** Conceptualization, Methodology, Writing – review & editing. **Darren Mays:** Writing – review & editing. **Brittney Keller-Hamilton:** Conceptualization, Methodology, Supervision, Project administration, Writing – review & editing.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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