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Cued Recall of Alcohol Advertising on Television and Underage Drinking Behavior

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Abstract

IMPORTANCE—Alcohol is the most common drug among youth and a major contributor to morbidity and mortality worldwide. Billions of dollars are spent annually marketing alcohol.

OBJECTIVE—To examine the reach of television alcohol advertising and its effect on drinking among underage youth.

DESIGN, SETTING, AND PARTICIPANTS—Longitudinal telephone- and web-based surveys conducted in 2011 and 2013 involving 2541 US adolescents 15 to 23 years of age at baseline, with 1596 of these adolescents completing the follow-up survey. Cued recall of television advertising images for top beer and distilled spirits brands that aired nationally in 2010–2011 (n = 351). Images were digitally edited to remove branding, and the respondents were queried about 20 randomly selected images. An alcohol advertising receptivity score was derived (1 point each for

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Study concept and design: Tanski, McClure, Morgenstern, Sargent.

Acquisition, analysis, or interpretation of data: Tanski, McClure, Zhigang Li, Jackson, Zhongze Li, Sargent.

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having seen the ad and for liking it, and 2 points for correct brand identification). Fast-food ads that aired nationally in 2010–2011 (n = 535) were similarly queried to evaluate message specificity.

MAIN OUTCOMES AND MEASURES—Among the underage youth at baseline, we determined (1) the onset of drinking among those who never drank, (2) the onset of binge drinking among those who were never binge drinkers, and (3) the onset of hazardous drinking among those with an Alcohol Use Disorders Identification Test consumption subscore of less than 4. Multivariate regressions were used to predict each outcome, controlling for covariates (demographics, drinking among friends and parents, and sensation seeking), weighting to the US population, and using multiple imputation to address loss to follow-up.

RESULTS—Underage participants were only slightly less likely than participants of legal drinking age to have seen alcohol ads (the mean percentage of ads seen were 23.4%, 22.7%, and 25.6%, respectively, for youth 15–17, 18–20, and 21–23 years of age; $P < .005$). The transition to binge and hazardous drinking occurred for 29% and 18% of youth 15 to 17 years of age and for 29% and 19% of youth 18 to 20 years of age, respectively. Among underage participants, the alcohol advertising receptivity score independently predicted the onset of drinking (adjusted odds ratio [AOR], 1.69 [95% CI, 1.17–2.44]), the onset of binge drinking (AOR, 1.38 [95% CI, 1.08–1.77]), and the onset of hazardous drinking (AOR, 1.49 [95% CI, 1.19–1.86]). Fast-food advertising receptivity was not associated with any drinking outcome.

CONCLUSIONS AND RELEVANCE—Receptivity to television alcohol advertising predicted the transition to multiple drinking outcomes. The findings are consistent with the idea that marketing self-regulation has failed to keep television alcohol advertising from reaching large numbers of underage persons and affecting their drinking patterns.

Alcohol is the most common drug used by youth. In 2013, 66.2% of US high school students reported trying alcohol, 34.9% reported alcohol use in the past 30 days, and 20.8% reported recent binge drinking.¹ Among underage drinkers, alcohol use contributes to the 3 leading causes of death: unintentional injury, homicide, and suicide.^{2–6} Alcohol use also results in dependence, nonfatal injuries, job loss, and significant economic consequences for families, employers, and children.⁷

Alcohol producers spend billions of dollars annually marketing alcohol in the United States alone (just 14 companies spent \$3.45 billion in 2011).⁸ In contrast to cigarette companies, which voluntarily ended television advertising in 1969, alcohol continues to be actively marketed on television⁸ and subject only to self-regulatory restrictions on ad placement.^{9,10} Of longitudinal studies^{11,12} that have studied adolescent drinking and exposure to alcohol ads, relatively few have assessed television alcohol marketing, and the results are mixed. One longitudinal study by Ellickson et al¹³ measured exposure to television sports and late-night programming that contained alcohol advertising and found no relation between such exposure and drinking in multivariate models. Another study by Stacy et al,¹⁴ using a similar exposure assessment, did. Another study¹⁵ that used the same method as Stacy et al¹⁴ found that an affective response to television alcohol ads (ie, liking them) was associated longitudinally with alcohol use among boys only.

The study by Stacy et al¹⁴ assessed ad exposure in additional ways, using visual cues to improve recall reliability of specific television alcohol ads, but found no significant confounder-adjusted relationships with alcohol use. A subsequent study in Germany used this approach to assess alcohol advertising exposure generally and found both cross-sectional¹⁶ and longitudinal¹⁷ associations to drinking among youths there. Moreover, cued responses to ads for other products were not linked with drinking outcomes, suggesting association specificity to alcohol ad content. One limitation of cued-recall studies to date has been the use of small samples of ad images, making results less generalizable to the broader range of alcohol advertising.

We extend the cued-response method to more than 300 nationally televised alcohol ads and use random assignment¹⁸ to allow for the generalization to contemporary television advertising. In addition, we assess affective response¹⁵ and ability to decode brand, other components of marketing receptivity.^{19–21} To test for message specificity, we also assess cued responses to televised fast-food ads. Prospective analyses avoid confounders due to reverse-causal association (the idea that adolescents with drinking experience might be more attentive to alcohol ads) by emphasizing longitudinal associations with transitions to having ever had a whole drink of alcohol (ie, more than a sip or taste) (hereafter referred to as *ever drinking*), to binge drinking, and to hazardous drinking among US youths 15 to 23 years of age.

Methods

Sample Recruitment

Between October 25, 2010, and June 11, 2011, we recruited 3342 participants 15 to 23 years of age from all regions of the United States, via mixed-mode random-digit-dial landline and cell phone frames. The age range included participants of legal drinking age (21–23 years of age), underage young adults (18–20 years of age), and adolescents (15–17 years of age). Sample selection involved the numbers and stages depicted in the eFigure in the Supplement. Telephone surveys used a computer-assisted telephone interview after obtaining oral informed consent from a parent and the adolescent (if the adolescent was <18 years of age) or oral informed consent from the adolescent only (if the adolescent was ≥18 years of age). Participants younger than 18 years answered sensitive questions using the telephone touch pad to enhance protection of confidentiality. A second web (or paper) survey presenting the marketing images was completed by 2541 participants. The Committee for the Protection of Human Subjects at Dartmouth College in Lebanon, New Hampshire, approved all aspects of our study.

The American Association for Public Opinion Research response rates for the computer-assisted telephone interview were 56.3% for the landline sample and 43.8% for the cell phone sample (detailed information on response rates available on request). Weights were developed to adjust for recruitment sampling bias. The eTable 1 in the Supplement shows how unweighted and weighted percentages compare with percentages from the US Current Population Survey for sociodemographic factors, illustrating undercoverage of young adults, minorities, and participants from the southern United States and overcoverage of those from the Midwest. There were few differences by household income.

Participants completing the image-based survey were invited to complete a follow-up survey 2 years later, conducted between October 27, 2012, and March 31, 2013, with 1596 completions. The eTable 1 in the Supplement also shows that, compared with baseline, the follow-up sample had better retention for the younger and more affluent (household income more than \$100 000) and higher attrition among the very poor (household income less than \$20 000). There is little difference in mean values for the alcohol advertising receptivity scores by dropout status (weighted mean values were 1.72 and 1.70 in the dropout group and the retained group, respectively [$P = .71$]). Multiple imputation was used to account for loss to follow-up.

Advertising Exposure Measures

Ad Sample Selection—The method for assessing exposure to alcohol advertising extends prior studies of cigarettes²² and alcohol.^{14,16,17} Television ads were obtained for the top 21 beer and top 20 spirit brands (Table 1), based on 2007–2008 advertising expenditures²³ and corresponding with favorite brands listed by adolescents,²⁴ and brands with highest underage market share.²⁵ For each brand, we obtained an electronic copy of every nationally aired television advertisement from July 1, 2009, to June 30, 2010, from TNS Media Intelligence’s AdScope ($n = 351$). To test for specificity for alcohol ad effects, comparable ads for the top 20 fast-food restaurant companies were also purchased ($n = 535$).

Ad Receptivity Assessment—A still image representing a salient point in each advertisement was extracted from each ad video file and digitally modified to remove brand or logo imagery (Figure 1). From these 2 respective pools of images, 20 alcohol and 20 fast-food images were randomly selected for each participant in the baseline survey. The randomization stratified on brand of beer/malt or spirit and whether the ad included identifying features such as visual presence of the product or tag line. The randomization sampling process did not deliver images from all ads (some of the highly prevalent stratification groups [eg, Budweiser] contained so many ads that some did not get randomly assigned); data were obtained from 326 alcohol ads and 470 fast-food ads.

Based on a recently published alcohol marketing receptivity model,²⁶ respondents were asked about exposure, liking (affective response), and brand identification for each randomly selected ad (Figure 1 gives wording of each item). Responses were combined into composite alcohol and fast-food marketing receptivity scores, giving 1 point each for having seen the ad and for liking it and 2 points for correct brand identification. According to the model,²⁶ ad exposure and response are on a continuum that evolves from exposure to noticing, liking, and engaging in marketing. Consequently, greater weight was given for decoding the brand because this cognitive process is more distal in this continuum and more closely related to behavior.

Covariates

We adjusted for covariates that could affect marketing receptivity and drinking outcomes, including age, sex, race/ethnicity, personality, and social influences. Sensation seeking is associated with greater media exposure and substance use, determined based on a set of 6 items such as “I like to explore strange places” ($\alpha = 0.72$).²⁷ Communications among peer

drinkers could affect alcohol brand awareness; peer drinking was assessed by the question “How many of your friends drink alcohol?” (none, a few, more than a few, or most). Parental drinking affects household brand exposure, assessed by the question “Which of the following statements best describes how often your parents drink alcohol?” (never, occasionally, weekly, or daily).

Alcohol Use Measures

The primary outcome measures included ever drinking (“Have you ever had a whole drink of alcohol more than a sip or taste?” [yes or no]), binge drinking (“How often do you have six or more drinks on one occasion?” [never vs all other responses]), and hazardous drinking. The Alcohol Use Disorders Identification Test (AUDIT) 6-drink threshold for binge drinking²⁸ is higher and therefore indicates more problematic drinking than the customary 5-drink threshold for US surveys.²⁹ Hazardous drinking was defined as meeting or exceeding the threshold score of 4 on the consumption subscore (items listed at bottom of Table 2) of the AUDIT (ie, the AUDIT-C subscore) as defined by Dawson et al.³⁰

Statistical Analysis

Unadjusted cued-response outcomes were compared among the 3 different age groups (15–17, 18–20, and 21–23 years) using the Rao-Scott χ^2 test for categorical variables and *F* tests for continuous variables when sampling weights were incorporated. Associations between the alcohol outcomes and alcohol marketing receptivity scores were tested using weighted longitudinal analyses to examine whether baseline alcohol receptivity scores predicted future drinking transitions. The longitudinal analyses examined new onset of alcohol outcomes (at wave 2) in the underage group (baseline age of <21 years): ever drank alcohol (among those who never drank at baseline), ever binge drank (among those who never binge drank at baseline), and onset of hazardous drinking (among those with an AUDIT-C subscore of <4 at baseline).

Crude bivariate associations between alcohol outcomes and alcohol or fast-food marketing receptivity scores were fit using weighted lowess curves to illustrate dose response. Multivariate logistic regressions were used to model the relationships between alcohol outcomes and alcohol and fast-food marketing receptivity after accounting for covariates. In these analyses, multiple imputation (MICE package in R) was used to impute the wave 2 alcohol outcomes in those lost to follow-up. We created 5 imputed complete data sets. The log odds ratio (OR) estimates were averaged over the results from the 5 data sets, and then the baseline sampling weights were applied to account for survey selection bias, with standard errors also accounting for multiple imputation uncertainty.³¹ All analyses were completed using SAS version 9.3 (SAS Institute Inc), with variances and standard errors estimated using jack-knife replicate samples.³²

In a sensitivity analysis, we conducted weighted cross-sectional analyses involving the entire baseline sample to determine if the selection of lower-risk adolescents (eg, underage adolescents who never drank for the ever drink model) biased the results. In addition, we conducted a longitudinal complete case analysis (without multiple imputation).

Results

Sample Description

Of the participants completing both baseline survey stages, nearly half were younger than 18 years of age ($n = 1261$), with 751 participants being 18 to 20 years of age and 529 participants being 21 to 23 years of age. Given the potential importance of age in predicting drinking, we assessed the relation between age and other characteristics of the sample. There were no age differences by sex, race, or sensation seeking. The participants who were 15 to 17 years of age reported less often that they had friends who drank or that they had a parent who consumed alcohol weekly or daily.

As shown in Table 2, younger participants were slightly less likely to report having seen alcohol ads and were much less likely to report liking the ones they had seen or correctly decoding brands. These trends resulted in lower mean values on the alcohol receptivity scale for the younger participants. Compared with the percentage of alcohol ads seen and liked, the percentage of fast-food ads seen and liked were higher among all age groups, resulting in higher mean values on the fast-food receptivity scale, with little variation by age. The correlation between alcohol and fast-food ad receptivity was 0.42. As expected, older participants also had a higher prevalence for all drinking outcomes, with 91% of participants of legal drinking age having drunk alcohol compared with 46% of underage participants.

Alcohol and Fast-Food Marketing Receptivity and Their Relationships to Drinking

Unadjusted Relationship—Figure 2 illustrates unadjusted associations between alcohol and fast-food receptivity and problematic alcohol use (the results for ever drinking are similar but are not shown). The smoothed curves illustrate a linear dose response between alcohol ad receptivity and binge drinking, as well as hazardous drinking, for both cross-sectional and longitudinal samples. For example, whereas the prevalence and incidence of ever having binge drank among those with an alcohol marketing receptivity of 0 were approximately 35% and 20% (cross-sectional and longitudinal, respectively), they approached 80% in both analyses for individuals with a score of 5. In contrast, the relationship between fast-food receptivity and alcohol use is much weaker, illustrating the specificity of the relation between behavior and alcohol ad content.

Adjusted Relationship—In the longitudinal multivariate regression (Table 3), alcohol marketing receptivity was independently associated with the onset of each alcohol use outcome after controlling for a broad range of covariates. For example, the adjusted OR (AOR) for developing hazardous drinking over the study period was 1.49 (95% CI, 1.19–1.86) for each 1-point increase on the alcohol receptivity scale. Comparing adolescents with the highest receptivity score (a score of 5) with adolescents with the lowest receptivity score (a score of 1), we found that the AOR for onset of hazardous drinking was 4.54 (or 1.46 to the fourth power). The AORs overstate relative risk for common outcomes. Transforming the AORs resulted in the following estimated relative risks for the associations reported in Table 3: 1.27 (95% CI, 1.08–1.46) for onset of ever drinking, 1.25 (95% CI, 1.06–1.46) for onset of binge drinking, and 1.38 (95% CI, 1.15–1.64) for onset of hazardous drinking. There were no statistically significant interactions.

Sensitivity Analysis—The results for the alternative multivariate modeling strategies are shown in eTable 2 in the Supplement. The complete case analysis (not using imputation) gave the following AORs: 1.80 (95% CI, 1.15–2.81) for onset of ever drinking, 1.30 (95% CI, 1.00–1.68) for onset of binge drinking, and 1.34 (95% CI, 0.98–1.82) for onset of hazardous drinking, suggesting that attrition of high-risk participants biased the associations for binge and hazardous drinking downward and for ever-drinking upward. This is in line with the idea that the transition from never to ever drinking is less likely for higher-risk individuals (because most of them already drink) and that the transition from never to hazardous drinking is less likely for lower-risk individuals (many of whom are only beginning to drink). Significant associations for all 3 outcomes in the cross-sectional analysis further substantiate the robustness of the findings by extending them to higher-risk underage youth (who had been excluded from some of the longitudinal analyses) and participants of legal drinking age. For comparison, parental drinking was only associated with hazardous drinking in the longitudinal model and ever drinking in the cross-sectional model.

Discussion

In our study of underage US youth, higher receptivity to television alcohol advertising was associated, in a dose-response fashion, with the onset of trying alcohol, binge drinking, and hazardous drinking. This finding extends the findings of earlier work^{14–17} that tested cued response to limited samples of alcohol marketing images. By using random assignment of images from a comprehensive and contemporary sample of nationally televised alcohol ads, we found that the association estimates better generalize to televised alcohol advertising aired during the sampled time period. Null findings for fast-food ads suggest that the effects are specific to the messaging contained in alcohol marketing. The results were independent of alcohol use among friends and parents, suggesting that the findings are not simply a function of social learning in the peer or home environments; in contrast to industry propaganda on the topic,³³ parental drinking was less robustly associated with drinking than was marketing.

Importantly, the prospective associations reported here lend support to directional influences whereby alcohol ad receptivity precedes transition to increasingly severe alcohol involvement. The strength and consistency of the results add further validation to a marketing receptivity model, whereby adolescents are exposed to alcohol ads, notice them, and respond cognitively and affectively to them.²⁶ An assessment that captures multiple aspects of this process would be expected to correlate closely with behavior, as it does in this test of the model. Through cycles of repeated exposure and response, marketing is expected to have a reciprocal association with alcohol cognitions and a broad array of drinking outcomes, but further tests of the reciprocal association will require studies with more than 2 waves of data.

The results by age for recollection of having seen an ad shed doubt on self-regulatory standards to limit underage exposure. Specifically, there was little variation in the percentage of alcohol ads that participants had seen across age groups. This finding independently corroborates the serious questions already raised by others^{34,35} about the

effectiveness of voluntary self-regulation guidelines to limit ad placement on television.⁹ The industry standard directs the alcohol industry to aim for programs “where at least 71.6% of the audience is reasonably expected to be 21 years of age or older” based on Nielsen ratings,⁹ a standard that does not limit adolescents from seeing them. The methodology reported herein offers a direct way to determine if a more restrictive standard—a standard requiring 85% of the audience to be 21 years or older has been suggested³⁵—results in lower viewership.

The data for liking and decoding ads indicate that, while they have similar exposure, underage drinkers have less affective response to and more difficulty in decoding alcohol brands (lower receptivity) than drinkers of legal drinking age. These observations suggest that as adolescents age into young adulthood and become drinkers of legal drinking age, they become more engaged in alcohol advertising and may also be more responsive to it. The highest engagement was found among legal-age drinkers, an indication that concern about marketing influence on hazardous drinking should not be confined to underage youth.

We measured covariates hypothesized to confound a marketing association with behavior but cannot rule out the possibility that an unmeasured third variable could confound the reported associations. We did not measure other marketing channels, such as online alcohol advertising, and acknowledge that television ad receptivity may capture broader alcohol ad exposures. Finally, no study by itself can prove that an association is causal. We look forward to other prospective assessments of alcohol ad exposure and its relation with behavior.

Conclusions

Our study found that familiarity with and response to images of television alcohol marketing was associated with the subsequent onset of drinking across a range of outcomes of varying severity among adolescents and young adults, adding to studies suggesting that alcohol advertising is one cause of youth drinking. Current self-regulatory standards for televised alcohol advertising appear to inadequately protect underage youth from exposure to televised alcohol advertising and its probable effect on behavior.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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References

1. Kann L, Kinchen S, Shanklin SL, et al. Centers for Disease Control and Prevention (CDC). Youth risk behavior surveillance—United States, 2013 [published correction appears in *MMWR Morb Wkly Rep*. 2014;63(26):576]. *MMWR Surveill Summ*. 2014; 63(suppl 4):1–168. [PubMed: 24918634]
2. Hingson R, Heeren T, Zakocs R, Winter M, Wechsler H. Age of first intoxication, heavy drinking, driving after drinking and risk of unintentional injury among U.S. college students. *J Stud Alcohol*. 2003; 64(1):23–31. [PubMed: 12608480]
3. Hingson RW, Edwards EM, Heeren T, Rosenbloom D. Age of drinking onset and injuries, motor vehicle crashes, and physical fights after drinking and when not drinking. *Alcohol Clin Exp Res*. 2009; 33(5):783–790. [PubMed: 19298330]
4. Hingson R, Winter M. Epidemiology and consequences of drinking and driving. *Alcohol Res Health*. 2003; 27(1):63–78. [PubMed: 15301401]
5. Hingson RW, Heeren T, Jamanka A, Howland J. Age of drinking onset and unintentional injury involvement after drinking. *JAMA*. 2000; 284(12):1527–1533. [PubMed: 11000646]
6. Smith GS, Branas CC, Miller TR. Fatal nontraffic injuries involving alcohol: a metaanalysis. *Ann Emerg Med*. 1999; 33(6):659–668. [PubMed: 10339681]
7. Bouchery EE, Harwood HJ, Sacks JJ, Simon CJ, Brewer RD. Economic costs of excessive alcohol consumption in the U.S., 2006. *Am J Prev Med*. 2011; 41(5):516–524. [PubMed: 22011424]
8. Federal Trade Commission; Bureau of Consumer Protection; Bureau of Economics. Self-Regulation in the alcohol industry: report of the Federal Trade Commission. <http://www.ftc.gov/system/files/documents/reports/self-regulation-alcohol-industry-report-federal-trade-commission/140320alcoholreport.pdf>. Published March 2014. Accessed July 22, 2014
9. Distilled Spirits Council of the United States (DISCUS). Discus Code Media “Buying” Guidelines: Demographic Data/Advertisement Placement Guidelines. http://www.discus.org/assets/1/7/Enhanced-Expanded_Buying_Guidelines_Updated_5-26-11_to_reflect_new_demographic_standard.pdf. Effective May 26, 2011. Accessed July 22, 2014
10. Distilled Spirits Council of the United States. Code of Responsible Practices for Beverage Alcohol Advertising and Marketing. http://www.discus.org/assets/1/7/May_26_2011_DISCUS_Code_Word_Version1.pdf. Published May 26, 2011. Accessed July 22, 2014
11. Smith LA, Foxcroft DR. The effect of alcohol advertising, marketing and portrayal on drinking behaviour in young people: systematic review of prospective cohort studies. *BMC Public Health*. 2009; 9:51. [PubMed: 19200352]
12. Anderson P, de Bruijn A, Angus K, Gordon R, Hastings G. Impact of alcohol advertising and media exposure on adolescent alcohol use: a systematic review of longitudinal studies. *Alcohol Alcohol*. 2009; 44(3):229–243. [PubMed: 19144976]
13. Ellickson PL, Collins RL, Hambarsoomians K, McCaffrey DF. Does alcohol advertising promote adolescent drinking? results from a longitudinal assessment. *Addiction*. 2005; 100(2):235–246. [PubMed: 15679753]
14. Stacy AW, Zogg JB, Unger JB, Dent CW. Exposure to televised alcohol ads and subsequent adolescent alcohol use. *Am J Health Behav*. 2004; 28(6):498–509. [PubMed: 15569584]
15. Grenard JL, Dent CW, Stacy AW. Exposure to alcohol advertisements and teenage alcohol-related problems. *Pediatrics*. 2013; 131(2):e369–e379. [PubMed: 23359585]
16. Morgenstern M, Isensee B, Sargent JD, Hanewinkel R. Exposure to alcohol advertising and teen drinking. *Prev Med*. 2011; 52(2):146–151. [PubMed: 21130108]
17. Morgenstern M, Isensee B, Sargent JD, Hanewinkel R. Attitudes as mediators of the longitudinal association between alcohol advertising and youth drinking. *Arch Pediatr Adolesc Med*. 2011; 165(7):610–616. [PubMed: 21383258]
18. Sargent JD, Worth KA, Beach M, Gerrard M, Heatherton TF. Population-based assessment of exposure to risk behaviors in motion pictures. *Commun Methods Meas*. 2008; 2(1–2):134–151. [PubMed: 19122801]

19. Pierce JP, Choi WS, Gilpin EA, Farkas AJ, Berry CC. Tobacco industry promotion of cigarettes and adolescent smoking. *JAMA*. 1998; 279(7):511–515. [PubMed: 9480360]
20. Unger JB, Schuster D, Zogg J, Dent CW, Stacy AW. Alcohol advertising exposure and adolescent alcohol use: a comparison of exposure measures. *Addict Res Theory*. 2003; 11(3):177–193. [10.1080/1606635031000123292](https://doi.org/10.1080/1606635031000123292)
21. Henriksen L, Feighery EC, Schleicher NC, Fortmann SP. Receptivity to alcohol marketing predicts initiation of alcohol use. *J Adolesc Health*. 2008; 42(1):28–35. [PubMed: 18155027]
22. Klitzner M, Gruenewald PJ, Bamberger E. Cigarette advertising and adolescent experimentation with smoking. *Br J Addict*. 1991; 86(3):287–298. [PubMed: 2025691]
23. The Beverage Information Group. *Handbook Advance*. Norwalk, CT: Beverage Information Group; 2009.
24. Tanski SE, McClure AC, Jernigan DH, Sargent JD. Alcohol brand preference and binge drinking among adolescents. *Arch Pediatr Adolesc Med*. 2011; 165(7):675–676. [PubMed: 21727284]
25. Siegel M, DiLoreto J, Johnson A, Fortunato EK, DeJong W. Development and pilot testing of an Internet-based survey instrument to measure the alcohol brand preferences of U.S. youth. *Alcohol Clin Exp Res*. 2011; 35(4):765–772. [PubMed: 21223311]
26. McClure AC, Stoolmiller M, Tanski SE, Engels RC, Sargent JD. Alcohol marketing receptivity, marketing-specific cognitions, and underage binge drinking. *Alcohol Clin Exp Res*. 2013; 37(suppl 1):404–413.
27. Sargent JD, Tanski S, Stoolmiller M, Hanewinkel R. Using sensation seeking to target adolescents for substance use interventions. *Addiction*. 2010; 105(3):506–514. [PubMed: 20402995]
28. Babor, TF.; Higgins-Biddle, JC.; Saunders, JB.; Monteiro, MG.; World Health Organization; Dept of Mental Health and Substance Dependence. *AUDIT: the Alcohol Use Disorders Identification Test: guidelines for use in primary health care*. 2http://www.talkingalcohol.com/files/pdfs/WHO_audit.pdf. Accessed July 22, 2014
29. Wechsler H, Nelson TF. Relationship between level of consumption and harms in assessing drink cut-points for alcohol research: commentary on “Many college freshmen drink at levels far beyond the binge threshold” by White et al. *Alcohol Clin Exp Res*. 2006; 30(6):922–927. [PubMed: 16737449]
30. Dawson DA, Grant BF, Stinson FS, Zhou Y. Effectiveness of the derived Alcohol Use Disorders Identification Test (AUDIT-C) in screening for alcohol use disorders and risk drinking in the US general population. *Alcohol Clin Exp Res*. 2005; 29(5):844–854. [PubMed: 15897730]
31. Little, RJS.; Rubin, DB. *Statistical Analysis With Missing Data*. 2. Hoboken, NJ: Wiley-Interscience; 2002.
32. Rust K. Variance estimation for complex estimators in sample surveys. *J Off Stat*. 1985; 1(4):381–397. <http://www.jos.nu/Articles/article.asp>. Accessed December 4, 2014.
33. International Center for Alcohol Policies (ICAP). Key facts and issues. ICAP website. <http://www.icap.org/PolicyIssues/Marketing/KeyFactsandIssues/tabid/135/Default.aspx>. Accessed July 23, 2014
34. Chung PJ, Garfield CF, Elliott MN, et al. Association between adolescent viewership and alcohol advertising on cable television. *Am J Public Health*. 2010; 100(3):555–562. [PubMed: 19696391]
35. Jernigan DH, Ostroff J, Ross C. Alcohol advertising and youth: a measured approach. *J Public Health Policy*. 2005; 26(3):312–325. [PubMed: 16167559]

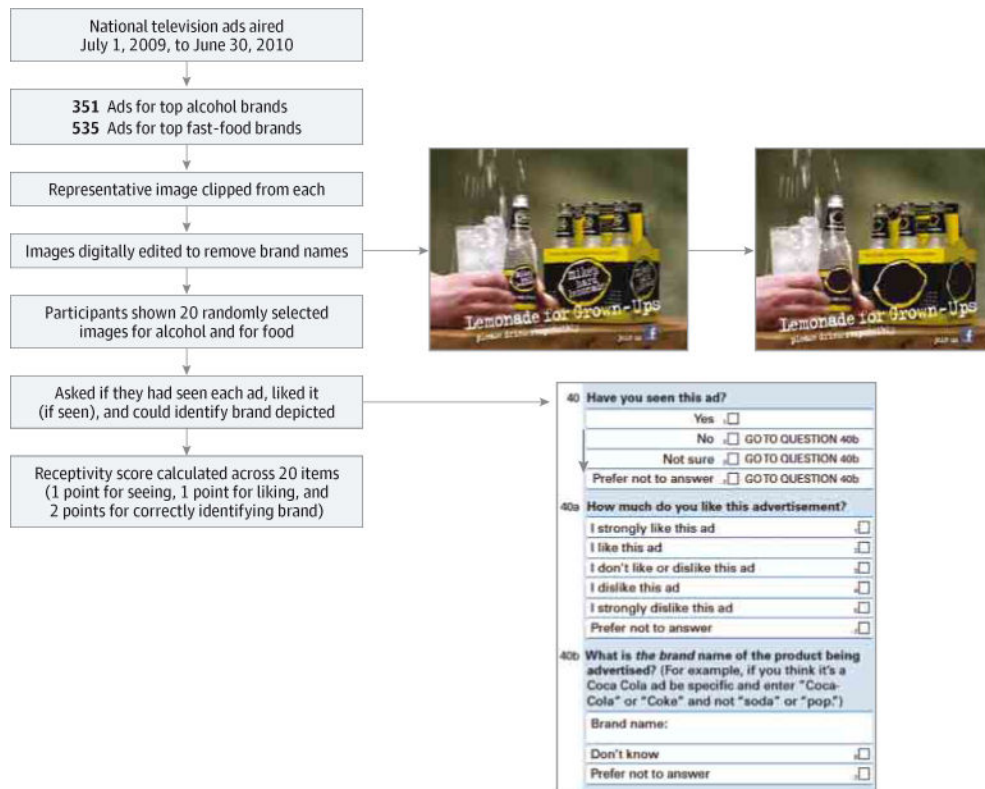


Figure 1.
Flow Diagram Illustrating Ascertainment of Receptivity to Cued Images of Contemporary
Television Alcohol Advertising

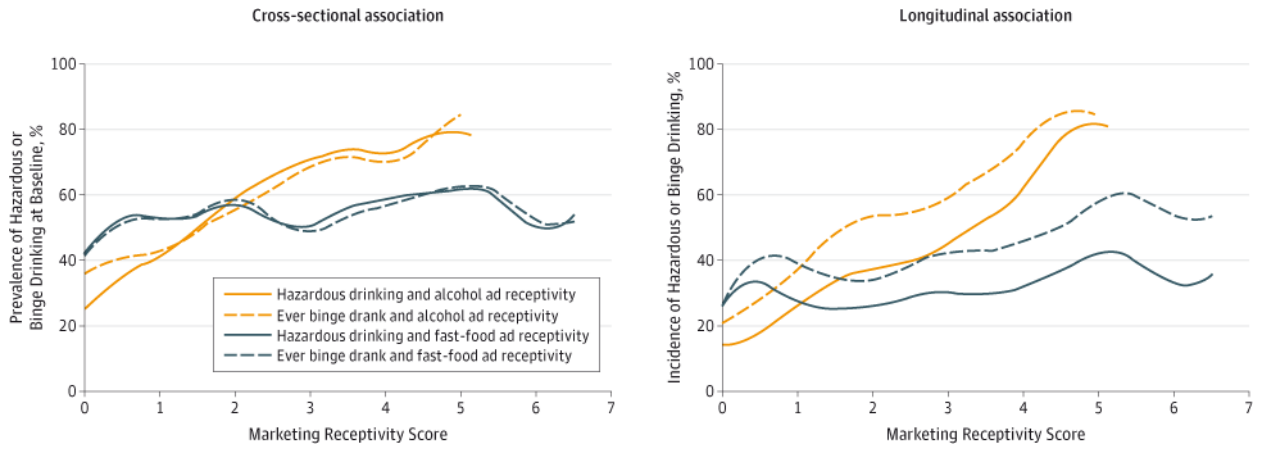


Figure 2. Unadjusted Associations Between Alcohol or Fast-Food Marketing and Drinking Outcomes

Cross-sectional associations pertain to alcohol users at baseline and include ever binge drinking (≥ 6 drinks) and hazardous drinking (as defined by the Alcohol Use Disorders Identification Test consumption subscore). Longitudinal associations include onset of binge drinking (≥ 6 drinks) during the follow-up period among those who never binge drank at baseline and onset of hazardous drinking during the follow-up period among those who did not meet criteria for hazardous drinking at baseline.

Table 1

Top 21 Beer and 20 Distilled Spirit Brands That Determined the Ads Included in the Study

Brand Rank	Beer/Malt	Distilled Spirits ^a
1	Bud Light	Absolut
2	Budweiser	Patron
3	Miller Lite	Jose Cuervo
4	Coors Light	Ketel One
5	Miller Chill	Bacardi
6	Heineken	Crown Royal
7	Corona Extra	Jack Daniel's
8	Bud Light Lime ^b	Grey Goose
9	Corona Light	Captain Morgan
10	Samuel Adams Boston Lager	Belvedere ^c
11	Michelob	Hennessy ^c
12	Coors Banquet (original)	Southern Comfort ^c
13	Heineken Premium Light	Jim Beam
14	Miller High Life	Stolichnaya ^c
15	Michelob Ultra	Skyy ^c
16	Bud Select	Grand Marnier ^c
17	Stella Artois	Smirnoff
18	Guinness Stout	Baileys
19	Dos Equis	Canadian Club ^c
20	Budweiser American Ale	Malibu
21	Mike's Hard Lemonade	

^aSeveral of the brands listed in the Distilled Spirits column have brand families that include popular malt beverages (Bacardi, Captain Morgan, Smirnoff, and Malibu), ads of which were included in our study.

^bBud Light Lime was categorized as a variant of Bud Light, allowing inclusion of Mike's Hard Lemonade in the "Beer/Malt" category.

^cBrand had no identified nationally televised advertising in the specified period.

Table 2

Weighted Percentages for Cued-Response Outcomes for Television Alcohol and Fast-Food Advertising

Sample, Measure	Age, y			P Value
	15–17	18–20	21–23	
All (N = 2541)				
% of Television alcohol ads seen	23.4	22.7	25.6	<.005
% of Television alcohol ads seen that were liked	23.8	30.5	35.2	<.005
% of Alcohol brands correctly identified	13.6	18.1	24.6	<.005
Mean television alcohol ad receptivity score	1.43	1.67	2.10	<.001
Mean television fast-food ad receptivity score	3.31	3.17	3.31	.27
Prevalence of ever drinking at baseline, %	46	72	91	<.001
Ever drinkers ^a (n = 1589), %				
Prevalence of binge drinking at baseline ^b	42	59	59	.002
Prevalence of hazardous drinking at baseline	39	54	63	<.001
New onset (at wave 2), %				
Ever drinking among those <21 y who never drank at baseline (n = 898)	47	51	0	.59
Binge drinking among those <21 y who never binge drank at baseline (n = 1451)	29	29	0	.92
Hazardous drinking among those <21 y who did not meet criteria for hazardous drinking at baseline ^c (n = 1503)	18	19	0	.94

^aThose having ever had a whole drink of alcohol (ie, more than a sip or taste).

^bBinge drinking query: “How often do you have six or more drinks in one occasion?” (never, less than monthly, monthly, weekly, daily, or almost daily), collapsed into never vs all other responses for this outcome.

^cCriteria for hazardous drinking: an Alcohol Use Disorders Identification Test consumption subscore of 4 or higher. In addition to binge drinking, queries include “In the past year, how often did you have a drink of alcohol (once a month or less, 2–4 times a month, 2–3 times a week, or 4 or more times a week)” and “How many drinks containing alcohol do you have on a typical day when you are drinking? (1 or 2; 3 or 4; 5 or 6; 7, 8, or 9; or 10 or more).

Table 3Multivariate Longitudinal Model for New Onset of 3 Drinking Outcomes^a

Marketing Risk Factor	Longitudinal Drinking Transitions, AOR (95% CI)		
	Drinking Onset	Binge Drinking Onset ^b	Hazardous Drinking Onset ^c
Receptivity score ^d			
TV alcohol ad	1.69 (1.17–2.44)	1.38 (1.08–1.77)	1.49 (1.19–1.86)
V fast-food ad	1.01 (0.82–1.25)	1.01 (0.83–1.23)	0.88 (0.72–1.08)

Abbreviations: AOR, adjusted odds ratio; TV, television.

^aThe model was adjusted for age, sex, race, sensation seeking, peer drinking, and parental drinking. The model uses multiple imputation to account for loss to follow-up and survey sample weights to account for sampling bias at baseline.

^bBinge drinking is defined as 6 or more drinks in a short time.

^cHazardous drinking is defined as having an Alcohol Use Disorders Identification Test consumption subscore of 4 or higher.

^dThe AOR reflects increased risk with each 1-point increase in the independent variable. A 1-point increase reflects correct responses to seeing, liking, and correct brand assessment for 2 ad images.