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Exposure to Alcohol Advertisements and Teenage Alcohol-Related Problems

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KEY WORDS
alcohol advertising, alcohol drinking, adolescent, statistical model

ABBREVIATIONS
CI—confidence interval
OR—odds ratio

Dr Grenard contributed to the conception of the statistical model, analyzed the data, and prepared the manuscript; Dr Dent contributed to the acquisition of data and analysis of the data, revised the methods and analysis sections of the document, and provided final approval of the manuscript; and Dr Stacy contributed to the conception and design of the study, revised the introduction and discussion sections for intellectual content, and approved the final version of the manuscript.

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WHAT'S KNOWN ON THIS SUBJECT: The influence of alcohol advertising on underage drinking has been demonstrated in both cross-sectional and prospective studies. What is not well known is whether this increase in drinking leads to more problems related to alcohol consumption.

WHAT THIS STUDY ADDS: Exposure to alcohol advertising and liking of those ads in grade 7 has a significant influence on the severity of alcohol-related problems in grade 10 and that influence is mediated by growth in alcohol use from grades 7 to 9.

abstract

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OBJECTIVE: This study used prospective data to test the hypothesis that exposure to alcohol advertising contributes to an increase in underage drinking and that an increase in underage drinking then leads to problems associated with drinking alcohol.

METHODS: A total of 3890 students were surveyed once per year across 4 years from the 7th through the 10th grades. Assessments included several measures of exposure to alcohol advertising, alcohol use, problems related to alcohol use, and a range of covariates, such as age, drinking by peers, drinking by close adults, playing sports, general TV watching, acculturation, parents' jobs, and parents' education.

RESULTS: Structural equation modeling of alcohol consumption showed that exposure to alcohol ads and/or liking of those ads in seventh grade were predictive of the latent growth factors for alcohol use (past 30 days and past 6 months) after controlling for covariates. In addition, there was a significant total effect for boys and a significant mediated effect for girls of exposure to alcohol ads and liking of those ads in 7th grade through latent growth factors for alcohol use on alcohol-related problems in 10th grade.

CONCLUSIONS: Younger adolescents appear to be susceptible to the persuasive messages contained in alcohol commercials broadcast on TV, which sometimes results in a positive affective reaction to the ads. Alcohol ad exposure and the affective reaction to those ads influence some youth to drink more and experience drinking-related problems later in adolescence. *Pediatrics* 2013;131:e369–e379

Alcohol use among adolescents and young adults is a major health concern in the United States. According to a Substance Abuse and Mental Health Services Administration report published in 2004,[1] ~10.9 million (29%) adolescents reported drinking alcohol in the past month, 16.6% reported problem behaviors related to alcohol use, and 6.2% met *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* criteria for substance abuse or dependence.[2] Because of the risks involved, considerable attention has been given to the influence of alcohol advertising on underage drinking. Cross-sectional studies have consistently shown a small but significant association between exposure to alcohol ads and alcohol use.[3–6] More importantly, prospective studies have shown similar findings providing support for a temporal relationship between exposure to ads and alcohol use,[7–13] which has been confirmed in a systematic review of 13 longitudinal studies.[14] Few studies, however, have successfully used prospective data to demonstrate the temporal relationship among exposure to alcohol ads, alcohol consumption, and problem behaviors associated with alcohol use.

The current study examined the effects of alcohol ad exposure on consumption and problem behaviors across 4 years of data collection to test 2 hypotheses. First, the influence of exposure to alcohol ads on underage drinking was hypothesized to interact with an effect modifier (or moderator): an affective reaction to alcohol ads, self-reported as a liking of alcohol ads.[5,15] It was anticipated that adolescents who like alcohol advertisements will be more likely to elaborate on the content of the ads (eg, imagine themselves in the scene), and as a result, they will be more likely to be persuaded to try the product.[16,17] Studies on copy testing by advertisers have shown that liking of advertisements is predictive of sales for consumer products.[18] In addition, drinking among adolescents and young adults is associated with desirability and identification with characters in alcohol ads[5] and with liking of alcohol ads.[10,19] Second, it was hypothesized that the growth in alcohol use over the first 3 years of the study would significantly mediate the relationship between exposure to alcohol ads in year 1 and alcohol-related problems in year 4 (see paths a and b in Fig 1). That is, effects of Year 1 alcohol ads on the growth in alcohol consumption over time (path a) was expected to translate into later (Year 4) levels of alcohol problems (path b). Figure 1 depicts a conceptual model that incorporates both key hypotheses within a moderated-mediation model.

METHODS

Participants

The current data were collected as part of a prospective study on the influence of alcohol advertising on underage drinking.[12,13] Participants recruited from public schools were surveyed during regular school hours from the 7th through 10th grades. Of the 4186 students recruited to participate in the study, 3890 (93% of consented) students completed the survey in at least 1 wave: 2986 (77%) were surveyed in 7th grade, 2849 (73%) in the 8th grade, 2093 (54%) in the 9th grade, and 1609 (41%) in the 10th grade. Dropout in the 9th and 10th grades was largely because of failure of entire schools to remain in the study after initial agreements by the schools to participate. Thus, most dropouts were not because of subject self-selection factors that could confound results. Further, the data analysis (outlined below) thoroughly addresses missing data. A total of 23 public middle schools, randomly selected from all middle schools in Los Angeles County, agreed to participate in the study. The goal was to recruit a sample representative of students attending Los Angeles County high schools.

Procedures

All seventh grade students in each school at the time of the study were invited to participate. Data collectors visited classrooms to distribute consent and assent forms to students about 2 weeks before administering the surveys. Parents of the students either signed a consent form brought home from school by the student or gave verbal consent to data collectors via telephone if the consent forms were not returned. Students signed assent forms before completing the surveys. The surveys and all procedures were approved by the University of Southern California Institutional Review Board. Students completed paper-and-pencil questionnaires during regular classroom hours at their school.

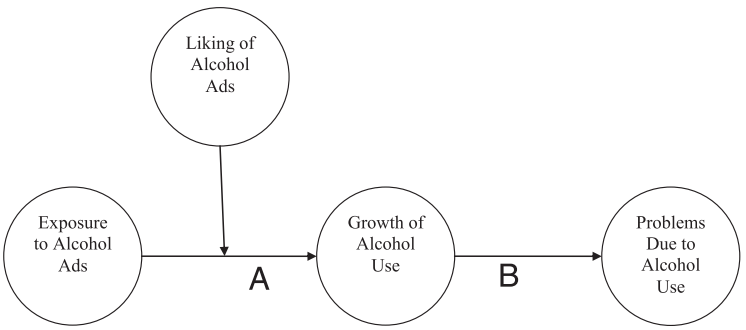

FIGURE 1
Conceptual model of primary hypothesized paths tested in the moderated-mediation models.

Outcome Measures

Current alcohol use was assessed with a total of 9 self-report items. Five items[20] assessed on how many days during the past 30 days the participant drank beer, wine, or liquor; drank 3 or more beers in a row; drank 3 or more glasses of wine or liquor; and drank enough to get drunk. An additional 4 items asked how often in the past 6 months participants drank beer, drank wine or wine coolers, drank liquor, or got drunk. An index was formed from all 9 items (coefficient α = 0.91). Problems due to alcohol use were assessed with 8 self-report items.[21] Participants indicated how often their alcohol use caused them problems, such as not being able to do their homework, getting into fights, neglecting responsibilities, or causing someone shame or embarrassment. An index score was formed from the 8 items (coefficient α = 0.93).

Independent Variables

Four measures of exposure to alcohol advertising were assessed: (1) Exposure to alcohol advertising on popular shows. Participants indicated how frequently they watched 20 popular TV shows during the past month on a 6-point scale ranging from 1 (never) to 6 (every day). The frequency of watching each show was multiplied by the average frequency of alcohol advertising broadcast on each show during the 10 months before the survey.[22] Data on televised alcohol advertising during the popular shows was purchased from Nielsen Media Research (New York, NY). The weighted items were summed to yield an index score for the number of alcohol ads each participant was exposed to during a typical day of watching popular shows (coefficient α = 0.79). This measure of exposure does not directly ask about exposure to alcohol ads, and it has been predictive of alcohol use in past studies.[13,22] (2) Exposure to alcohol advertising on sports programs. This measure was similar to the popular shows assessment except that it asked about the frequency of watching college and professional sports programs (coefficient α = 0.80), which often include a higher frequency of alcohol advertisements than other programming.[23] (3) Memory for alcohol ads: cued recall. Surveys included still pictures captured from TV advertisements including 2 example and 15 test ads.[24] The still pictures extracted from advertisements did not contain brand names or logos. An open-ended item asked participants to write down what product was being advertised. Independent judges coded the responses as being related to the advertisement or not (κ = 0.88). (4) Self-reported observation of alcohol advertising. Participants were asked 4 items[25] about how often they saw alcohol commercials on TV (coefficient α = 0.72).

The survey included 3 items assessing how much participants like alcohol ads on TV.[26] The items assessed whether participants thought that alcohol ads are funny or sexy, and whether they like the alcohol ads better than other ads (coefficient α = 0.78). These items measured an affective or emotional reaction to alcohol ads that has been useful in both the study of alcohol advertising[5,15,19] and by the advertising industry in general to estimate the potential effectiveness of advertising copy.[18] Additional covariates associated with adverting exposure, alcohol use, or alcohol-related problems included the amount of time watching television[27,28]; observing friends drinking[29]; observing well-known adults drinking[30]; participating in sports[31]; age, gender, ethnicity, language acculturation[32,33]; and parents' occupation and education (see Appendix for assessments).

Data Analyses

Construction of the structural equation models used to test the hypotheses involved 2 steps.[34] First, a measurement model established the simple structure of the model, measurement invariance across gender,[35] and acceptability of parcels as indicators.[36] The second step involved fitting of 4 latent growth-curve models, one for each measure of exposure to alcohol advertising. Goodness-of-fit statistics[37] included the χ^2 test, Comparative Fit Index, Tucker-Lewis Index, Root Mean Squared Error of Approximation, and the Standardized Root Mean Square Residual. The current analyses used full information maximum likelihood estimation[38] to adjust for uncertainty associated with missing data. Mediation effects (ie, specific and total indirect effects) were assessed using the multivariate δ method.[39] This method estimates significance for the product of 2 regression coefficients, the coefficient for the mediator regressed on the predictor and the coefficient for the outcome regressed on the mediator adjusted for the predictor and is consistent with criteria recommended by MacKinnon et al.[40] Mplus[41] was used to fit the measurement and the latent growth models. SEs were adjusted for clustering by school.[41]

RESULTS

Demographic characteristics for time 1 of the study, as shown in Table 1, indicated that the students in seventh grade were 12.51 (SD = 0.54) years old. Thirteen percent were non-Hispanic whites and 48% were Hispanic. Boys reported significantly more alcohol use than girls for past 30-day use of beer, lifetime binging with beer, and past 30 days binging with beer, and boys reported more negative consequences as a result of alcohol use. Participants more likely to have been lost to follow-up included those in wave 1 who knew peers (odds ratio [OR] = 1.30; 95% confidence interval [CI] = 1.16–1.44) or adults (OR = 1.13; 95% CI

= 1.05–1.21) who drank alcohol, were exposed to more alcohol commercials on popular shows (OR = 1.28; 95% CI = 1.01–1.61), or were Asian compared with whites (OR = 2.00; 95% CI = 1.30–3.08). There was no difference for those lost to follow-up based on gender, age acculturation, participation in sports, parents' education, lifetime or past 30-day alcohol use, alcohol-related problems, TV viewing, self-reported exposure to advertisements, or liking of alcohol advertisements.

Measurement Model

The measurement model examined the factor loading, simple structure, and measurement invariance of the latent variables proposed for the models. Indicators loaded well on their hypothesized latent variables in separate models for girls and boys. Examination of a priori hypothesized modification indices for cross-loadings among the alcohol use, alcohol-related problems, ad exposure, and liking of ads target latent factors provided support for a simple structure among the factors. The measurement model findings for the alcohol-related problems factor warranted the use of parcels of indicators in the structural model to provide more stable model estimation.[36,42] Tests for invariance of loadings and thresholds in a multigroup model by gender was adequate to compare structural models across gender.[43] Similar tests for invariance of loadings and thresholds in a multigroup model by grade provided evidence for invariance across time for items measuring alcohol use in the growth curves.

Latent Growth Models

The latent growth factors for alcohol use over times 1 through 3 and the latent factor for alcohol-related problems were regressed on each of the 4 alcohol ad exposure measures in 4 separate series of model evaluations.

TABLE 1 Demographic Information for Participants in Seventh Grade

Item	Total	Girls	Boys
Gender, *n* (%)	3890 (100)	1905 (50.14)	1894 (49.86)
Age, mean (SD)	12.51 (0.54)	12.51 (0.54)	12.51 (0.53)
Ethnicity, *n* (%)			
White/non-Hispanic	520 (13.37)	261 (13.78)	259 (13.60)
Hispanic	1862 (47.87)	937 (49.47)	923 (48.45)
Asian	662 (17.02)	324 (17.11)	338 (17.74)
Black/African American	120 (3.08)	56 (2.96)	64 (3.36)
Native Hawaiian or Pacific Islander	30 (0.77)	15 (0.79)	15 (0.79)
American Indian or American Native	37 (0.95)	17 (0.90)	20 (1.05)
Don't know	491 (12.62)	196 (10.35)	206 (10.81)
Mixed	168 (4.32)	88 (4.65)	80 (4.20)
Language acculturation, mean (SD)	4.22 (0.76)	4.14 (0.79)	4.28 (0.72)
At least 1 drink of beer in lifetime, *n* (%)			
0 d	1595 (56.94)	842 (59.21)	753 (54.60)
1 d	532 (18.99)	260 (18.28)	272 (19.72)
2 d	242 (8.64)	123 (8.65)	119 (8.63)
3 to 9 d	216 (7.71)	101 (7.10)	115 (8.34)
10 to 19 d	86 (3.07)	39 (2.74)	47 (3.41)
20 to 39 d	50 (1.79)	24 (1.69)	26 (1.89)
40 to 99 d	30 (1.07)	15 (1.05)	15 (1.09)
100 or more days	50 (1.79)	18 (1.27)	32 (2.32)
At least 1 drink of beer in past 30 days, *n* (%)[a]			
0 d	2414 (83.18)	1243 (84.44)	1171 (81.89)
1 d	281 (9.68)	140 (9.51)	141 (9.86)
2 d	90 (3.10)	40 (2.72)	50 (3.50)
3 to 5 d	55 (1.90)	20 (1.36)	35 (2.45)
6 to 9 d	27 (0.93)	16 (1.09)	11 (0.77)
10 to 19 d	9 (0.31)	6 (0.41)	3 (0.21)
20 to 29 d	6 (0.21)	3 (0.20)	3 (0.21)
All 30 d	20 (0.69)	4 (0.27)	16 (1.12)
At least 1 drink of wine or liquor in lifetime, *n* (%)			
0 d	1799 (64.67)	934 (66.15)	865 (63.14)
1 d	455 (16.36)	215 (15.23)	240 (17.52)
2 d	210 (7.55)	113 (8.00)	97 (7.08)
3 to 9 d	153 (5.50)	78 (5.52)	75 (5.47)
10 to 19 d	69 (2.48)	33 (2.34)	36 (2.63)
20 to 39 d	40 (1.44)	17 (1.20)	23 (1.68)
40 to 99 d	23 (0.83)	0 (0.64)	14 (1.02)
100 or more days	33 (1.19)	13 (0.92)	20 (1.46)
At least 1 drink of wine or liquor in past 30 days, *n* (%)			
0 d	2422 (83.81)	1246 (85.05)	1176 (82.53)
1 d	272 (9.41)	124 (8.46)	148 (10.39)
2 d	105 (3.63)	54 (3.69)	51 (3.58)
3 to 5 d	34 (1.18)	17 (1.16)	17 (1.19)
6 to 9 d	23 (0.80)	14 (0.96)	9 (0.63)
10 to 19 d	10 (0.35)	5 (0.34)	5 (0.35)
20 to 29 d	6 (0.21)	2 (0.14)	4 (0.28)
All 30 d	18 (0.62)	3 (0.20)	15 (1.05)
3 or more drinks of beer in a row in lifetime, *n* (%)[a]			
0 d	2432 (88.12)	1258 (89.92)	1174 (86.26)
1 d	134 (4.86)	61 (4.36)	73 (5.36)
2 d	70 (2.54)	33 (2.36)	37 (2.74)
3 to 9 d	45 (1.63)	13 (0.93)	32 (2.35)
10 to 19 d	26 (0.94)	13 (0.93)	13 (0.96)
20 to 39 d	25 (0.91)	14 (1.00)	11 (0.81)
40 to 99 d	8 (0.29)	2 (0.14)	6 (0.44)
100 or more days	20 (0.72)	5 (0.36)	15 (1.10)
3 or more drinks of beer in a row in past 30 days, *n* (%)[a]			
0 d	2688 (92.91)	1383 (94.40)	1305 (91.39)
1 d	105 (3.63)	47 (3.21)	58 (4.06)
2 d	34 (1.18)	14 (0.96)	20 (1.40)
3 to 5 d	25 (0.86)	9 (0.61)	16 (1.12)

TABLE 1 Continued

Item	Total	Girls	Boys
6 to 9 d	11 (0.38)	5 (0.34)	6 (0.42)
10 to 19 d	7 (0.24)	3 (0.20)	4 (0.28)
20 to 29 d	6 (0.21)	2 (0.14)	4 (0.28)
All 30 d	17 (0.59)	2 (0.14)	15 (1.05)
3 or more drinks of wine or liquor in lifetime, *n* (%)			
0 d	2448 (89.15)	1263 (90.67)	1185 (87.58)
1 d	135 (4.92)	55 (3.95)	80 (5.91)
2 d	58 (2.11)	31 (2.23)	27 (2.00)
3 to 9 d	43 (1.57)	20 (1.44)	23 (1.70)
10 to 19 d	20 (0.73)	9 (0.65)	11 (0.81)
20 to 39 d	17 (0.62)	7 (0.50)	10 (0.74)
40 to 99 d	6 (0.22)	2 (0.14)	4 (0.30)
100 or more days	19 (0.69)	6 (0.43)	13 (0.96)
3 or more drinks of wine or liquor in past 30 days, *n* (%)			
0 d	2707 (93.73)	1384 (94.60)	1323 (92.84)
1 d	92 (3.19)	43 (2.94)	49 (3.44)
2 d	30 (1.04)	16 (1.09)	14 (0.98)
3 to 5 d	18 (0.62)	10 (0.68)	8 (0.56)
6 to 9 d	13 (0.45)	4 (0.27)	9 (0.63)
10 to 19 d	7 (0.24)	2 (0.14)	5 (0.35)
20 to 29 d	6 (0.21)	2 (0.14)	4 (0.28)
All 30 d	15 (0.52)	2 (0.14)	13 (0.91)
Consequences of alcohol use, mean (SD)[b]	0.09 (0.41)	0.08 (0.38)	0.11 (0.44)

[a] Alcohol use by student gender was significant for past 30-days use of beer, lifetime binging with beer, and past 30- days binging with beer (all $\chi^2(7) > 14.07$, $P < .05$), but all other comparisons of alcohol use by student gender were nonsignificant (all $P > .05$).

[b] Consequences of alcohol use differed by gender ($t[2648] = -2.15$, $P < .05$); *P* = proportion.

The hypothesized moderator, liking of alcohol ads, was included in each of the 4 models. In addition, the growth factors were simultaneously regressed on covariates measured at time 1, including age, observing peers drink, observing adults drink, playing sports, general TV watching, language acculturation, and socioeconomic status (occupation and education of each participant's parents). All structural growth models differed by gender, so only those results for multigroup models by gender are presented here.

As shown in Table 2 and Fig 2, the coefficient for the intercept regressed on the interaction term was significant for boys and for girls. Figure 3 depicts this interaction illustrating that the level of exposure to ads was more predictive of alcohol use in seventh grade for those students who reported a greater liking of alcohol ads. There was no interaction in the prediction of the slope for the latent growth for alcohol use.

Significant mediation effects or indirect effects were observed among girls for the path from exposure to ads on popular shows at time 1 through the growth curve slopes to problems at time 4 (δ method indirect effect: ab = 0.091, P = .02) and for the path from liking of ads at time 1 through the growth curve intercepts to problems at time 4 (ab = 0.105, P = .03). Among boys, there was a significant total effect of the interaction term for popular shows and liking of ads at time 1 on problems at time 4, which included the direct effect on time 4 problems and indirect effects through the intercept and slope (δ method total effect: b = 0.164, P = .02). These effects among girls and boys were significant even after adjustment for time 1 problems, age, friends drinking, adults drinking, playing sports, general TV watching, acculturation, parents' jobs, parents' education, and clustering by school.

The covariates, alcohol-related problems at time 1 and friends and close adult drinking at time 1, were significant predictors of the intercept for girls. The same covariates plus language acculturation and parent jobs were significant predictors of the intercept for boys. For boys, drinking by friends and language acculturation were significant predictors of the slope, and the sign of the coefficients for these predictors changed between the intercept and the slope, suggesting that those higher in alcohol use at time 1 might have had lower growth rates than those lower in use at time 1. None of the time 1 variables were significant direct-effect (unmediated) predictors of alcohol-related problems at time 4 for boys or girls.

Mediation models for the other 3 exposure measures (frequency of watching sports show, cued recall of ads, and self-reported frequency of seeing alcohol ads) fit the data very well (results not shown). In all 3 models for girls, the intercept for the growth of alcohol use mediated the influence of liking of alcohol ads at time 1 on alcohol-related problems at time 4. No other indirect effects were significant for girls or boys. In these 3 mediation models for girls, both the intercept and slope for the growth of alcohol use were positive predictors of the level of alcohol-related problems at time 4, whereas this was not the case for boys.

DISCUSSION

This study provides evidence supporting the hypothesis that exposure to alcohol advertising and affective reactions to those advertisements on television influence underage drinking and the development of alcohol-related problems. The growth of alcohol use from the seventh through the ninth grades is predicted by the frequency of watching popular shows and self-reports on the liking of alcohol ads. In partial support of hypothesis 1, there

is a significant interaction between exposure to ads and liking of ads in the prediction of the intercept (but not the slope) for a growth curve modeled across these grade levels for both male and female students. The interaction shows that the level of exposure to ads is more predictive of a higher level of alcohol use in seventh grade for those students who report a greater liking of alcohol ads. In addition to this interaction observed at time 1, the frequency of watching popular shows at time 1 predicts the slope for the growth of alcohol use for girls, and the liking of alcohol ads at time 1 predicts the slope for boys.

In support of hypothesis 2, the mediation model shows that the influence of alcohol ads at time 1 on the occurrence of alcohol-related problems at time 4 is mediated by the growth of alcohol use. Among girls, there was a significant indirect effect of exposure to ads on popular shows in time 1 on problems in time 4 through the growth of alcohol use, and among boys, there was a significant total effect from the shows and liking interaction term in time 1 to problems in time 4. These relationships are significant even after adjusting for a range of other covariates measured at time 1 that are known to be associated with alcohol use. The other 3 measures of exposure to alcohol advertising show similar findings, although these measures are somewhat less predictive of the growth in alcohol use and alcohol-related problems.

Although causality cannot be verified in 1 observational study, the relevant theories and empirical evidence from the current prospective study and previous research are consistent with possible causal effects linking alcohol advertising to underage alcohol use and alcohol-related problems. In the current study, measures of exposure at time 1 are associated with the increasing use of alcohol over time and the

TABLE 2 Standardized Parameter Estimates for the Mediation Model

	Girls		Boys	
	Parameter Estimate	SE	Parameter Estimate	SE
Intercept on				
T1 alcohol use	0.759***	0.046	0.821***	0.038
T2 alcohol use	0.590***	0.060	0.643***	0.047
T3 alcohol use	0.466***	0.056	0.506***	0.030
Slope on				
T1 alcohol use	0.000	0.000	0.000	0.000
T2 alcohol use	0.404***	0.036	0.349***	0.057
T3 alcohol use	0.640***	0.056	0.549***	0.101
T4 alcohol-related problems on				
T4 problems 1	0.707***	0.029	0.720***	0.035
T4 problems 2	0.692***	0.039	0.721***	0.056
T4 problems 3	0.705***	0.038	0.736***	0.048
T4 problems 4	0.734***	0.050	0.780***	0.037
Intercept on T1 predictors				
Popular shows	−0.052	0.034	−0.027	0.031
Liking of ads	0.267***	0.047	0.171***	0.028
Shows x Liking	0.091*	0.042	0.093*	0.046
T1 problems	0.297*	0.123	0.264**	0.084
Age	0.030	0.031	0.040	0.030
Peer drinking	0.426***	0.060	0.539***	0.052
Playing sports	0.006	0.043	−0.009	0.024
Adult drinking	0.155***	0.036	0.138**	0.053
General TV viewing	0.012	0.034	0.012	0.037
Language acculturation	0.050	0.042	−0.098*	0.040
Parents' jobs	0.000	0.041	0.112*	0.046
Parents' education	−0.041	0.045	−0.002	0.030
Slope on T1 predictors				
Popular shows	0.190**	0.058	0.113	0.063
Liking of ads	−0.021	0.078	0.129*	0.060
Shows x Liking	−0.083	0.068	−0.112	0.081
T1 problems	−0.125	0.135	0.076	0.156
Age	0.031	0.039	−0.075	0.068
Peer drinking	0.057	0.075	−0.483***	0.128
Playing sports	−0.137	0.073	−0.015	0.074
Adult drinking	−0.029	0.067	−0.103	0.119
General TV viewing	−0.021	0.064	−0.059	0.062
Language acculturation	0.029	0.073	0.227*	0.097
Parents' jobs	0.130	0.075	−0.135	0.109
Parents' education	−0.085	0.064	0.009	0.090
T4 alcohol-related problems on				
Intercept	0.393*	0.166	0.177	0.303
Slope	0.478***	0.106	0.179	0.214
Popular shows	−0.054	0.065	−0.007	0.058
Liking of ads	−0.102	0.064	−0.095	0.062
Shows x Liking	0.040	0.072	0.167	0.094
T1 problems	0.050	0.070	0.014	0.090
Age	0.036	0.049	−0.004	0.034
Peer drinking	−0.022	0.085	0.234	0.214
Playing sports	0.050	0.059	0.027	0.044
Adult drinking	−0.027	0.041	0.021	0.074
General TV viewing	0.022	0.062	−0.021	0.063
Language acculturation	0.013	0.063	−0.048	0.086
Parents' jobs	−0.003	0.103	0.061	0.092
Parents' education	0.006	0.064	−0.018	0.100
Intercepts for latent factors				
Problems with alcohol at T4	0.000	0.000	0.232	0.184
Growth curve intercept	0.526***	0.032	0.496***	0.032
Growth curve slope	0.495***	0.059	0.441***	0.104
Residual variances				
T4 problems 1	0.500***	0.041	0.482***	0.050

TABLE 2 Continued

	Girls		Boys	
	Parameter Estimate	SE	Parameter Estimate	SE
T4 problems 2	0.522***	0.054	0.481***	0.080
T4 problems 3	0.502***	0.054	0.458***	0.071
T4 problems 4	0.462***	0.074	0.392***	0.058
T1 alcohol use	.0.424***	0.070	0.326***	0.063
T2 alcohol use	0.513***	0.049	0.631***	0.046
T3 alcohol use	0.404***	0.075	0.648***	0.067
Intercept	0.386***	0.096	.0.253**	0.077
Slope	0.921***	0.055	0.686***	0.087
T4 alcohol-related problems	0.661***	0.061	0.849***	0.054
Effects from Shows to Problems				
Total	0.017	0.051	0.008	0.046
Total indirect	0.070	0.042	0.015	0.028
Indirect Shows – I – Problems	–0.021	0.018	–0.005	0.009
Indirect Shows – S – Problems	0.091*	0.040	0.02	0.028
Direct Shows – Problems	–0.054	0.065	–0.007	0.058
Effects from Liking to Problems				
Total	–0.007	0.063	–0.042	0.041
Total indirect	0.095	0.057	0.053	0.058
Indirect Liking – I – Problems	0.105*	0.048	0.030	0.052
Indirect Liking – S – Problems	–0.010	0.038	0.023	0.030
Direct Liking – Problems	–0.102	0.064	–0.095	0.062
Effects from Interaction SxL to Problems				
Total	0.036	0.066	0.164*	0.069
Total indirect	–0.004	0.040	–0.004	0.045
Indirect from SxL – I – Problems	0.036	0.026	0.016	0.032
Indirect from SxL – S – Problems	–0.039	0.031	–0.020	0.029
Direct from SxL – Problems	0.040	0.072	0.167	0.094

I, intercept factor for growth curve; na, not available, slope variance fixed at 0; S, slope factor for growth curve; SxL, interaction term for popular shows and liking of alcohol ads; T1, time 1; T2, time 2; T3, time 3.
* $P < .05$.
** $P < .01$.
*** $< .001$.

development of alcohol-related problems at time 4, demonstrating a temporal ordering of predictors and outcomes. In addition, the models for this study control for a range of potentially confounding variables, including strong predictors, such as previous alcohol-related problems and peer influences. In previous studies, the indirect measure of exposure to alcohol ads on popular shows is predictive of alcohol use[22,26] and measures for liking of alcohol ads are predictive of alcohol use.[5,6,10,15]

The findings here are also consistent with well-established theories on vicarious learning, such as Social Learning Theory,[44] theories on persuasive messages in the media, such as the Elaboration Likelihood Model,[16] and with the more recent Message Interpretation Process model by Austin and colleagues.[5] Austin and colleagues[5] provide evidence for the influence of alcohol advertising on alcohol use through a number of affective mediators, including liking of advertisements.[5,45] Liking or desirability of alcohol advertisements predicts identification with

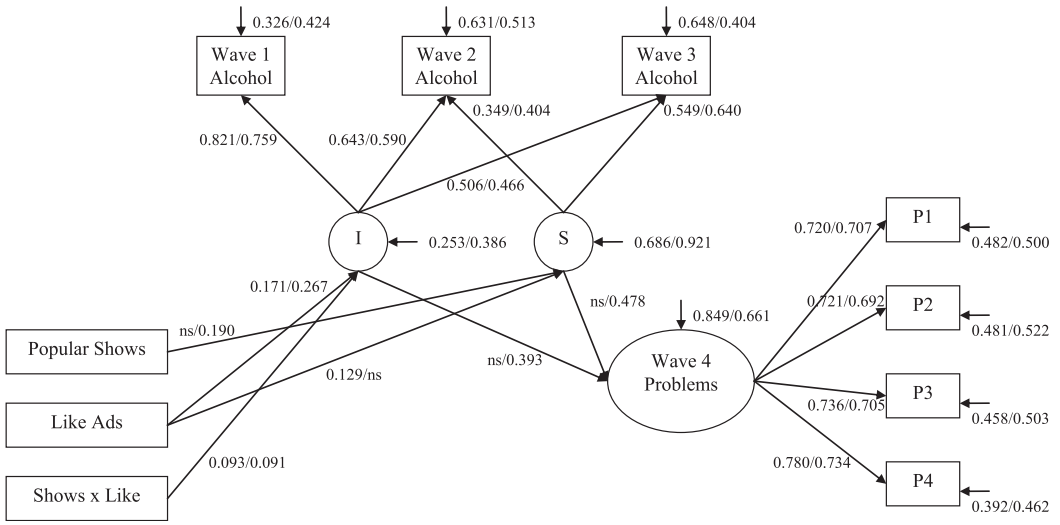

FIGURE 2
Mediation model for alcohol-related problems. Alcohol use = past 30 days + past 6 months. I, growth curve intercepts; S, growth curve slopes. Standardized parameter estimates: boys/girls ($P < .05$). Paths that were nonsignificant for both boys and girls are not included in the figure for clarity (eg, the direct effect of popular shows on wave 4 problems was not significant and is not shown). Adjusted for wave 1 problems, age, drinking peers, drinking adults, playing sports, general TV watching, acculturation, parents' jobs, parents' education, and clustering by school. Fit indices: $\chi^2(130) = 182.66$, $P = .002$; Comparative Fit Index = 0.98; Tucker-Lewis Index = 0.97; Root Mean Squared Error of Approximation = .015; Standardized Root Mean Square Residual = .026. ns = non-significant.

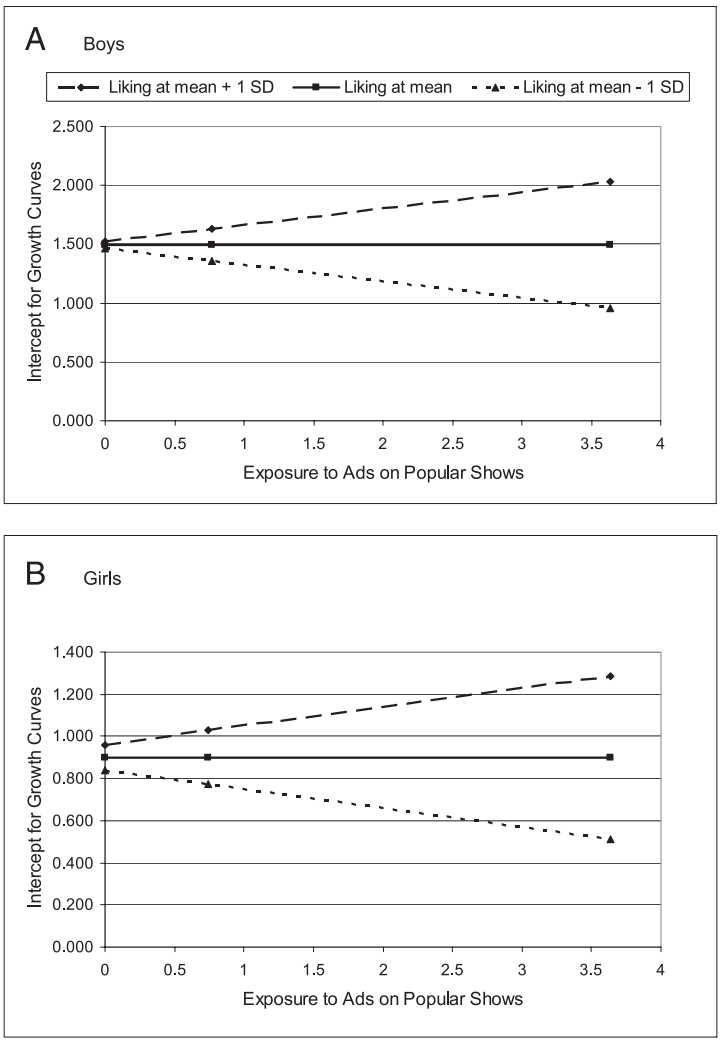

FIGURE 3
Interaction of exposure to ads with liking of ads. Liking of ads plotted at the mean, the mean plus 1 SD, and the mean minus 1 SD.

portrayals of alcohol use in advertisements, which, in turn, predicts liking of brands of beer and positive expectancies for alcohol use. The overall influence of liking of advertisements on alcohol use might be somewhat larger in the current model if these mediating pathways were taken into account. In another study of advertising, Austin et al[46] found that a media-literacy intervention increased skepticism (reduced liking) for advertising, as expected, but also increased recall of advertisement. This is consistent with the current study where memory and liking of advertisements interact. That is, a greater memory for alcohol advertisement does not necessarily mean an increase in alcohol use; it also depends on liking of the advertisements. This combination of theory and empirical evidence across research teams provides reasonably good support for the influence of exposure to alcohol advertisements on alcohol use and alcohol-related problems among adolescents.

A few limitations warrant discussion. First, the current results may be generalized only to public school students in the Los Angeles area. Second, alcohol use measures among young adolescents are often skewed toward 0, and this is true in the current sample. Seventh graders were actually recruited because of their low levels of alcohol use to examine the early development of alcohol use, but, unfortunately, these skewed measures may have contributed, in part, to some of the null findings in this study. Finally, not all results converge across multiple measures of exposure to advertising, but there is little literature available that indicates which exposure measures are optimal. However, it may not be surprising that cued recall of advertisements was not predictive of alcohol use. In the communication theory of Lang,[47] cued recall is thought to be a less effective measure of retrieval/accessibility of information than it is a measure of encoding/availability of information.[47] In encoding specificity[48] and transfer-appropriate processing[49] views, cued recall would reflect good accessibility and predictability at the time of drinking decisions only if the retrieval cues at test overlap well with retrieval cues during these later decisions; such overlap is unlikely, as the test cues were still pictures of commercials. However, the use of the indirect measure of exposure on popular shows and liking of ads are used successfully across a range of studies, and, in particular, liking of ads, although not strictly a measure of exposure, is used across product categories to predict the success of individual ads or ad campaigns.[18]

CONCLUSIONS

The accumulation of evidence for the influence of televised alcohol advertisements on underage drinking has important implications for prevention. First, children can be taught about the design of persuasive messages in the media early to help them avoid undue

influence by the media on their behaviors.[45,50] Second, it is important to have a comprehensive policy to limit the exposure of children to alcohol ads on television and on other media, such as the Internet, print media, and display ads. Although there are other influences on underage drinking, including those of peers and adults, prevention strategies should address the influence of alcohol ads as part of an overall strategy to prevent early initiation of alcohol use and the development of problems related to consumption.

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APPENDIX Assessments

Assessment	Items	α	Example Item	Response Option Anchors
Current frequency and quantity of alcohol use[20]	9	0.91	During the last 30 d, on how many days did you…have at least 1 drink of beer?	0 = 0 d 7 = all 30 d
Problems associated with alcohol use[21]	8	0.93	How many times have you ever…gone to school drunk?	1 = never 4 = more than 10 times
Exposure to alcohol advertising[a] on popular shows[22]	20	0.79	How frequently do you watch MTV?	1 = never 6 = every day
Exposure to alcohol advertising[a] on sports shows[22,23]	6	0.80	How often to you watch professional football?	1 = never 6 = every day
Cued recall memory for alcohol advertisements[24]	15	0.74	What product is being advertised in the photo?	Open-ended
Self-reported observation of alcohol advertisements[25]	4	0.72	In the past week, how many commercials have you seen for alcohol drinks like beer, wine, or liquor?	0 = none 6 = 6 or more
Liking of alcohol advertisements[26]	3	0.78	Of all the commercials you see on TV, how much do you like the TV commercials for alcohol?	1 = I like alcohol commercials the most 4 = I like the alcohol commercials the least
Propensity to watch TV[27,28]	7	0.79	On a typical weekday, how many hours a day do you watch TV…after school before dinner?	1 = I do not watch TV 5 = 5 h or more
Observed drinking by peers and friends[29]	4	0.86	About how often did you do the following things in the last 6 mo…saw someone your age drink beer or other alcohol?	0 = never 6 = every day
Observed drinking by known adults[30]	3	0.84	About how often did you do the following things in the last 6 mo…saw an adult you know well drink alcohol?	0 = never 6 = every day
Participation in sports[31]	5	0.73	About how often did you do the following things in the last 6 mo… played soccer?	0 = never 6 = every day
Language acculturation[32,33]	3	0.67	What language(s) do you usually speak at home?	1 = only English 5 = only another language
Socioeconomic status[51]	2	na	What is the highest grade completed by your mother?	1 = not completed elementary school 6 = Completed graduate school
Socioeconomic status[51]	2	na	What type of work does your father do?	Open-ended (coded)

na, not applicable.

[a] The frequency of watching popular shows or sports programs was weighted by the frequency of alcohol advertisements broadcast on those shows in the previous 10 mo, as reported by Nielsen Media Research (see text).

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