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REVIEW

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Alcohol marketing and youth alcohol consumption: a systematic review of longitudinal studies published since 2008

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ABSTRACT

Background and Aims Youth alcohol consumption is a major global public health concern. Previous reviews have concluded that exposure to alcohol marketing was associated with earlier drinking initiation and higher alcohol consumption among youth. This review examined longitudinal studies published since those earlier reviews. **Methods** Peer-reviewed papers were identified in medical, scientific and social science databases, supplemented by examination of reference lists. Non-peer-reviewed papers were included if they were published by organizations deemed to be authoritative, were fully referenced and contained primary data not available elsewhere. Papers were restricted to those that included measures of marketing exposure and alcohol consumption for at least 500 underage people. Multiple authors reviewed studies for inclusion and assessed their quality using the National Heart, Lung and Blood Institute's Quality Assessment Tool for Observation Cohort and Cross-Sectional Studies. **Results** Twelve studies (ranging in duration from 9 months to 8 years), following nine unique cohorts not reported on previously involving 35 219 participants from Europe, Asia and North America, met inclusion criteria. All 12 found evidence of a positive association between level of marketing exposure and level of youth alcohol consumption. Some found significant associations between youth exposure to alcohol marketing and initiation of alcohol use (odds ratios ranging from 1.00 to 1.69), and there were clear associations between exposure and subsequent binge or hazardous drinking (odds ratios ranging from 1.38 to 2.15). Mediators included marketing receptivity, brand recognition and alcohol expectancies. Levels of marketing exposure among younger adolescents were similar to those found among older adolescents and young adults. **Conclusions** Young people who have greater exposure to alcohol marketing appear to be more likely subsequently to initiate alcohol use and engage in binge and hazardous drinking.

Keywords Adolescents, advertising, alcohol, marketing, self-regulation, youth.

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INTRODUCTION

Globally, alcohol consumption caused 7% of death and disability among young people aged 10–24 years in 2004, the most recent year for which estimates are available [1]. The World Health Organization (WHO) reported in 2010 that heavy episodic drinking (defined as at least monthly consumption of 60 g or more of alcohol on a single occasion) is more prevalent, on average, among 15–19-year-olds world-wide (11.7%) than among the general adult population (7.5%), although there are significant regional variations [2].

Given the high prevalence of risky drinking and alcohol-related harm among young populations, delaying alcohol initiation and preventing heavy use by young people is a public health priority. Alcohol producers agree, and the leading global producers have stated that: 'we strongly oppose marketing or sale of our products to underage youth' ([3], p. 36).

To accomplish this, alcohol marketers have detailed self-regulatory codes regarding placement and content of their advertising, including restrictions to prevent youth exposure and to prevent content that appeals to or targets youth [4], implying that alcohol marketing can affect youth decisions about drinking. There is, however, substantial

evidence of youth exposure to alcohol marketing, in some cases at rates higher than adults [5–7]. However, global producers have argued that existing evidence demonstrating associations between alcohol marketing exposure and alcohol consumption is: 'very weak and does not make a compelling case that advertising causes harmful drinking' [8].

The last published reviews of the evidence regarding alcohol marketing's effects on youth drinking were conducted in 2008 and published in 2009. Smith & Foxcroft examined seven cohort studies with more than 13 000 participants, all of which demonstrated significant effects of alcohol marketing on consumption across a range of different exposure variables and outcome measures. Anderson *et al.* [9] identified 13 longitudinal studies investigating the relationship between adolescent exposure to alcohol advertising and promotion and drinking. Twelve found evidence that such exposure predicts both onset of drinking among non-drinkers and increased levels of consumption among existing drinkers, while the 13th found increased intentions to use alcohol, although the authors concluded that participants were too young for drinking initiation to show an effect [10]. An expert Science Group, established in 2008 by the European Commission's European Alcohol and Health Forum and including industry representatives, also reviewed the literature and agreed, concluding: 'Based on the consistency of findings across the studies, the confounders controlled for, the dose–response relationships, as well as the theoretical plausibility and experimental findings regarding the impact of media exposure and commercial communications,… alcohol marketing increases the likelihood that adolescents will start to use alcohol, and to drink more if they are already using alcohol' ([11], p.2).

Since the publication of these reviews, there have been numerous industry innovations in reaching and engaging potential consumers through digital and traditional channels [12]. Subsequently, several additional studies have been conducted on the effects of alcohol marketing. Therefore, the purpose of this review was to review and summarize longitudinal research published since 2008 to inform current debates regarding regulation of commercial alcohol marketing activities. These studies have examined youth exposure to alcohol marketing in a wide range of venues and formats, including traditional print and broadcast channels as well as new (digital) media; outdoor advertisements; product placements within television shows, films and song lyrics; in-store and price promotions; branded merchandise; celebrity endorsements; and sporting and musical event sponsorship.

METHODS

Searches were conducted through MEDLINE (PubMed), Web of Science, CINAHL and PsycINFO in November 2014. The searches were repeated in January 2015 and March 2016. English-language papers published from 2008 to early 2016 were searched using the following terms: 'youth alcohol use' OR 'youth alcohol consumption' OR 'youth drinking' OR 'underage drinking' OR 'underage alcohol consumption' OR (youth* AND alcohol*) OR (youth* and drinking*) AND media exposure OR media OR TV OR radio OR advertising OR marketing OR film OR movie* OR lyrics OR event sponsorship OR sponsorship.

Papers returned for these search terms were assessed for relevance. Studies were not included if their abstracts or titles did not refer to the possibility of an association between alcohol advertising and youth alcohol consumption. Final review was conducted on full texts of papers meeting this criterion. The initial search was conducted by N.T.; abstracts and full papers were reviewed by D.J. and T.L. The second search and review were conducted by T.L., and the third by D.J. Reference lists of included articles were examined for additional citations, including non-peer-reviewed studies, not included in the search results.

Studies were included in the final review if they were based on original data and included at baseline measures of youth exposure to alcohol marketing. Exposure could consist of self-reported exposure, such as watching television content known to contain alcohol advertising, cued and un-cued recall of advertisements, liking of advertisements, recall of engagement with internet marketing and branded websites and brand allegiance, or population-level exposure as reported by designated market area by market research firms. Studies also needed to use, at baseline and follow-up, validated measures of self-reported drinking behaviour for at least 500 participants under the relevant minimum legal purchase age for alcohol. Drinking behaviour included initiation of alcohol use and/or binge drinking, past 30-day drinking, frequency and/or quantity of drinks consumed in the past 30 days and/or alcohol-related problems. Studies were included only if they used self-reported and observed actual alcohol use or alcohol-related behaviour such as binge drinking or drunkenness, as opposed to measures of intentions to consume, which are weak, indirect indicators of actual consumption behaviour [13], and may miss valuable information about patterns of drinking (e.g. binge drinking).

Because the purpose of the present study was to summarize and review evidence published since 2008, the papers cited in the systematic reviews by Smith & Foxcroft [14], Anderson *et al.* [9] and the Science Group of the European Alcohol and Health Forum [11] were excluded. Studies that examined the influence of social networking and digital media on drinking behaviour were also excluded unless they identified clearly that the social networking content originated from or was encouraged specifically by alcohol marketers. Studies of the influence

of alcohol use in media, such as actors drinking alcohol in films or TV shows, were excluded unless they specifically included advertising or commercial marketing practices.

Published versions of all studies were obtained and reviewed by T.S., D.J. and J.N.; data were extracted from these versions. From each study, we sought data on country and year of baseline data collection, number and age of participants at baseline, study duration, attrition at follow-up, marketing variables (principal independent variables) and drinking outcomes, including initiation of drinking or binge drinking, progression to binge or hazardous drinking and/or drinking consequences, including odds ratios of changes in drinking behaviour or consequences at follow-up.

Study quality was assessed using the National Heart, Lung, and Blood Institute's Quality Assessment Tool for Observation Cohort and Cross-Sectional Studies [15]. Each study was rated by two public health professionals. The sum of positive responses (= 1) from each rater was calculated for each paper, with potential values ranging from 0 to 14. Inter-rater reliability, measured using De Vries *et al.*'s [16] pooled kappa, was considered substantial ($\kappa_{pooled} = 0.845$). A study was determined to meet a study quality criterion if both raters agreed the criterion was present, and a study quality criterion was not met if at least one rater determined that the criterion was absent. Because of the diversity of outcomes studied, data were reported but not synthesized and a meta-analysis was not attempted.

RESULTS

The numbers of papers returned by the search and those that met the selection criteria are shown in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram in Fig. 1. Twelve longitudinal studies following nine cohorts not reported on previously were identified. These cohorts not reported on previously involved 35 219 unique participants from seven countries: Germany (four studies), Italy (three), the Netherlands (two), Poland (three), Scotland, UK (four), Taiwan (one) and the United States (four). One study [17] was a follow-up of a cohort reported on previously by Anderson *et al.* [9]. Two studies reported by De Bruijn *et al.* [18] examined exposure to different marketing media among the same cohort. Similarly, Gordon *et al.* [19] and Harris *et al.* [20] reported separate analyses of the same cohort, as did Tanski *et al.* [21] and McClure *et al.* [22]. Table 1 lists the studies, with details of the country in which the study took place, the year the baseline data were collected, the age range of the youth studied, the advertising form being assessed, the main results and the authors' summary conclusion.

Measures of marketing exposure differed across studies, as research groups explored a variety of different hypotheses for how alcohol marketing may influence youth drinking behaviour. These measures ranged from population-level exposures, as imputed from the participants' place of residence and market research studies

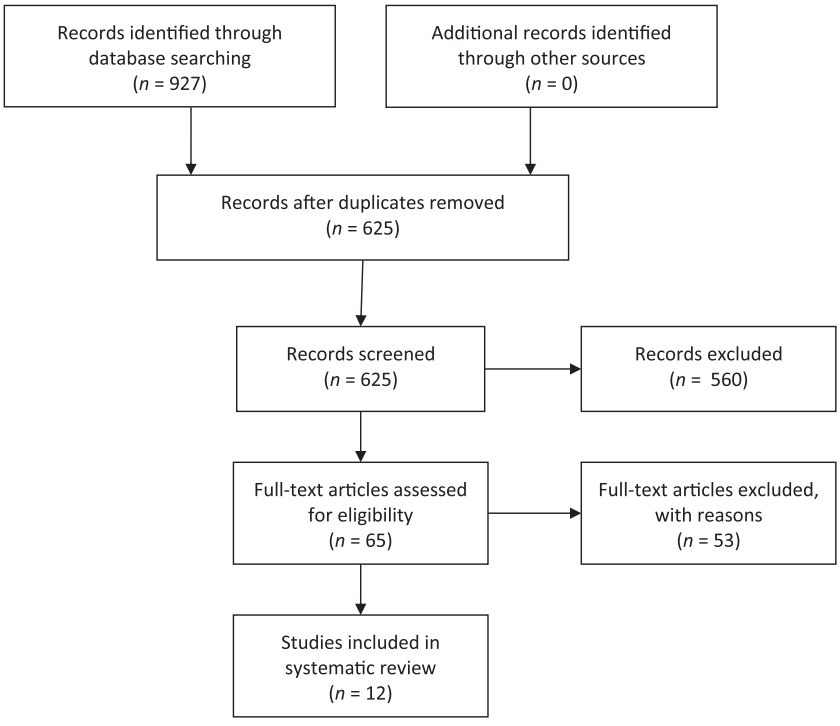

Figure 1 Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram of articles reviewed

Table 1 Summary of longitudinal studies published since 2009 investigating the relationship between alcohol marketing and youth alcohol consumption.

Source, reference, country and year of baseline data collection	*Number and age of participants at baseline*	*Study duration*	*Marketing variables*	*Summary*	*Authors' conclusion*
Chang *et al.* [42], Taiwan 2010	2315 youth aged 15–17 years	One year	Recall of exposure to branded and unbranded alcohol promotion in four media	Students from 26 high schools in Taipei, Taiwan were assessed in the 10th grade with follow-up conducted in the 11th grade. Self-administered questionnaires were collected in 2010 and 2011 to assess the patterns of change in youth alcohol drinking behaviours, media exposure to alcohol and risk and protective factors. Media exposure included questions on advertising on TV, print media and outdoor media, plus questions on the use of alcohol in TV shows and movies, and in internet social media discussions. Results: of 1712 non-drinking students in the 10th grade, 285 (16.6%) had initiated drinking by the 11th grade. Of the 590 drinkers in the 10th grade, 396 (67.1%) were drinking persistently by the 11th grade. When other potential confounders were accounted for, greater media exposure to alcohol advertising in the 10th grade was associated significantly with the initiation of alcohol use, and when combined with an increase in media exposure from 10th to 11th grades, this was significantly associated with the persistence of alcohol use	Exposure to alcohol advertising in the media was associated with both the initiation and the persistence of alcohol use by youth
De Bruijn *et al.* [18], Germany, Italy, the Netherlands, Poland 2010–11	6651 adolescents, with mean age 13.95 years	14–15 months	Recall of levels of engagement with on-line marketing activities	Youngsters in four European countries reported to be exposed frequently to on-line alcohol marketing. Results: adjusting for relevant confounders, higher reported exposure to on-line alcohol marketing was significantly associated with expecting to drink alcohol and actual drinking in the previous 30 days. This effect was found to be consistent in all four countries	The association between marketing exposure and adolescents' alcohol expectancies and drinking was robust and seems consistent in several national contexts
De Bruijn *et al.* [18], Germany, Italy, the Netherlands, Poland 2010–11	6652 adolescents, with mean age 13.9 years	14–15 months	Viewing of sports events (with known levels of alcohol sponsorship)	Youngsters in four European countries reported their viewing of TV sports events. Alcohol marketing in these events was calculated from known sponsorship ties. Results: higher exposure to alcohol-branded sports sponsorship was found to be associated significantly with alcohol drinking intentions and actual drinking in the previous 30 days. The association	Exposure to sports sponsorship can predict future drinking. Policymakers are recommended to take action on alcohol marketing via sports events

(*Continues*)

Table 1. (Continued)

Source, reference, country and year of baseline data collection	*Number and age of participants at baseline*	*Study duration*	*Marketing variables*	*Summary*	*Authors' conclusion*
				between this exposure and adolescents' alcohol expectancies and drinking was robust, even when controlling for national differences and demographics	
Gordon *et al.* [19], Scotland, UK 2006–07	552 youth aged 12–14 years, with mean age 13	Two years	Prompted recall of 15 marketing media formats	Data were gathered on exposure to multiple forms of alcohol marketing (advertisements and promotions from TV/cinema, posters/billboards, newspapers/ magazines, in-store price promotions; sports-related sponsorship and clothing; e-mail, websites, mobile phone/computer screensaver and social networking sites; music sponsorship, TV/film sponsorship, celebrity endorsements and product design) and measures of drinking initiation, frequency and consumption. Results: at follow-up, logistic regression demonstrated that, after controlling for confounding variables, involvement with alcohol marketing at baseline was predictive of both uptake of drinking and increased frequency of drinking. Awareness of marketing at baseline was associated with increased frequency of drinking at follow-up	The authors are concerned whether the current regulatory environment affords youth sufficient protection from alcohol marketing
Grenard *et al.* [17], USA Date not given	3890 students, beginning in 7th grade (aged 11–12 years) and continuing through 10th grade (aged 14–15 years)	Four years	TV exposure and TV advertisement prompted recall	Data collected 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 viewing, acculturation, parents' jobs and parents' education. Results: structural equation modelling of alcohol consumption showed that exposure to alcohol advertisements and/or liking of those advertisements in 7th grade were predictive of the latent growth factors for alcohol use (previous 30 days and previous 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 advertisements and liking of those advertisements in 7th grade through latent	Alcohol advertisement exposure and the affective reaction to those advertisements influence some youth to drink more and experience drinking-related problems later in adolescence

(*Continues*)

Table 1. (Continued)

Source, reference, country and year of baseline data collection	*Number and age of participants at baseline*	*Study duration*	*Marketing variables*	*Summary*	*Authors' conclusion*
				growth factors for alcohol use on alcohol-related problems in 10th grade. Measures of exposure at time 1 were also associated with the increasing use of alcohol over time and the development of alcohol-related problems at time 4	
Harris *et al.* [20], 2015, Scotland 2006–07	552 youth aged 12–14 at baseline	Two years	Unaided alcohol brand recognition, aided brand recognition, number of alcohol brands able to list unaided	In an extension of the findings of Gordon *et al.*, measures of consumer socialization to alcohol brands (in the form of aided and unaided brand recognition and brand saliency) were collected along with data on hazardous drinking, defined as 6 or more units on the last occasion in the past 30 days (for boys) or 5 or more for girls. Results: at wave 1, the more channels through which adolescents had seen alcohol marketing, the higher their level of consumer socialization. At wave 2, hazardous drinking at age 15 was predicted by two measures of consumer socialization at 13: unaided brand recognition and brand saliency	Marketing acts as a significant influencing agent in the consumer socialization of adolescents to alcohol. The current policy and regulatory environment is not protecting children adequately
McClure *et al.* [22], 2016, USA 2011–13	2012 youth aged 15–20 at baseline	Two years	Internet alcohol marketing receptivity, including recall, engagement, recognition of alcohol home page images, and being an on-line fan	Respondents were asked if they recalled web advertising for alcohol, had ever been to an alcohol company website, could recognize any of five alcohol brand home page images and had become an on-line fan of any alcoholic beverages; these were combined into an internet marketing receptivity score. Outcome measures were ever drinking and ever binge drinking (six or more drinks on one occasion). Results: higher receptivity to internet alcohol marketing was associated positively with transition to binge drinking even after controlling for sensation-seeking, peer alcohol use and age. Compared with non-receptive youth, those with higher receptivity scores were 1.77–2.15 times more likely to report binge drinking at follow-up; higher receptivity scores were not associated with drinking initation among baseline non-drinkers	Internet alcohol marketing receptivity was associated with underage binge drinking even after controlling for internet time. Internet marketing may be important in transitions to problematic outcomes in the subset of drinkers who are more highly engaged in and seek out on-line marketing
Morgenstern *et al.* [43], Germany 2008	2130 6th to 8th grade students,	Nine months	Prompted recall of TV commercials	Exposure to alcohol and non-alcohol advertising was measured at baseline with masked images of 17	More favourable attitudes about alcohol may be one path through which alcohol

(*Continues*)

Table 1. (Continued)

Source, reference, country and year of baseline data collection	*Number and age of participants at baseline*	*Study duration*	*Marketing variables*	*Summary*	*Authors' conclusion*
	non-drinking at baseline, aged 11–17 years, with mean age 12.2 years			commercial advertisements with all brand information digitally removed; students indicated contact frequency and brand names. Outcome measures were positive attitudes toward alcohol, current alcohol use and life-time binge drinking. Results: a total of 581 of the students (28%) started to drink alcohol during the observation period. Alcohol use initiation was related positively to baseline alcohol advertisement exposure. This effect of alcohol advertisement exposure on alcohol use was mediated by a change in alcohol-related attitudes, partially, which explained about 35% of the total effect. The analysis revealed similar results for binge drinking initiation	advertising exerts behavioural influence. The study supports policy measures to reduce exposure (e.g. through advertising bans) as well as intervention techniques that focus on the processing of advertising contents
Morgenstern *et al.* [25], Germany, Italy, Poland, Scotland 2009–10	7438 adolescents non-binge drinking at baseline, with mean age 13.5 years	12 months	Allegiance to a favourite brand	Pupils were asked the brand of their favourite alcohol advertisement at baseline. Multi-level mixed-effects logistic regressions assessed relationships between having a favourite alcohol advertisement ('alcohol marketing receptivity') and (a) binge drinking at baseline; and (b) initiating binge drinking during follow-up among never binge drinkers. Results: life-time binge drinking prevalence at baseline was 29.9%, and 25.9% initiated binge drinking during follow-up. Almost one-third of the baseline sample (32.1%) and 22.6% of the follow-up sample of never bingers named a branded favourite alcohol advertisement, with high between-country variation in brand named. Alcohol marketing receptivity was related significantly to both binge drinking at baseline [adjusted odds ratio (AOR) = 2.13] and binge drinking initiation in longitudinal analysis (AOR = 1.45). There was no evidence for effect heterogeneity across countries	Among European adolescents, naming a favourite alcohol advertisement was associated with increased likelihood of initiating binge drinking during 1-year follow-up, suggesting a relationship between alcohol marketing receptivity and adolescent binge drinking
Ross [23], USA 2004–05	3576 youth aged 10–14 years	One year	Relationship of population-level exposure to alcohol advertising based on	National sample of youth collected through random digit dialling was followed for 5 years. Study examined data from waves 2 and 3, using as proxy for exposure	Relatively small amounts of alcohol advertising are associated with increased

(*Continues*)

Table 1. (Continued)

Source, reference, country and year of baseline data collection	*Number and age of participants at baseline*	*Study duration*	*Marketing variables*	*Summary*	*Authors' conclusion*
			favourite TV channel and drinking initiation	extrapolation from favourite TV station and amount of time spent viewing television to develop, using Nielsen ratings data, a measure of the adstock (current and prior exposure to alcohol advertising, discounted retrospectively, for the past year) of each participant. Outcomes were alcohol expectancies ('If one of your friends offered you alcohol would you drink it?'; 'I think I would enjoy drinking alcohol'; 'Do you think you will drink alcohol in the next year?') and alcohol initiation ('Have you ever drunk alcohol that your parents did not know about?'). Results: among non-drinking participants, 303 initiated alcohol use between waves 2 and 3. Relationships between exposure and both expectancies and initiation were curvilinear and significant for the sample overall, and for boys but not girls	alcohol expectancies and with drinking initiation among early adolescent boys
Saffer *et al.* [24], 2015, USA 2002–09	8984 youth aged 18–22 at baseline	Eight years	Average number of advertisements per designated market area (DMA)	Annual, nationally representative sample of youth reports alcohol consumption. Advertising exposure and price effects were examined, with exposure derived from place of residence and the hours of alcohol advertisments per month on local and national TV shown in that media market as reported by commercial sources. Results: population-level elasticities increase as alcohol consumption increases, supportive of the behavioural economic theory that heavy drinkers are more responsive to alcohol advertising	Advertising-induced alcohol consumption may not be optimal (from a behavioural economics point of view), especially for heavy drinkers. Continued high levels of alcohol advertising on TV are not in the interests of public health
Tanski *et al.* [21], USA 2010–11	1596 youth aged 15–23 years	Two years	Prompted recall of TV commercials	Respondents were questioned about 20 randomly selected masked images from TV advertisements, and an alcohol advertising receptivity score was derived (one point each for having seen the advertisement and for liking it, and two points for correct brand identification). Fast-food advertisements that aired nationally in 2010–11 were queried similarly to evaluate message specificity. Alcohol consumption measures were (a) the onset of drinking among those who never drank; (b) the onset of binge drinking among those who were never binge drinkers;	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

(*Continues*)

Table 1. (Continued)

Source, reference, country and year of baseline data collection	*Number and age of participants at baseline*	*Study duration*	*Marketing variables*	*Summary*	*Authors' conclusion*
				and (c) the onset of hazardous drinking among those with an Alcohol Use Disorders Identification Test consumption subscore of less than 4. Results: underage participants were only slightly less likely than participants of legal drinking age to have seen alcohol advertisements (the mean percentages of advertisements seen were 23.4, 22.7 and 25.6%, respectively, for youth aged 15–17, 18–20 and 21–23 years). The transition to binge and hazardous drinking occurred for 29 and 18% of youth aged 15–17 years, and for 29 and 19% of youth aged 18–20 years, respectively. Among underage participants, the alcohol advertising receptivity score independently predicted the onset of drinking (AOR = 1.69), the onset of binge drinking (AOR = 1.38) and the onset of hazardous drinking (AOR = 1.49). Fast-food advertising receptivity was not associated with any drinking outcome	

documenting potential exposure from levels of advertising available in those geographic markets [23,24] to self-reported exposure imputed from television content viewed [17,18]. The remaining studies used various measures of receptivity to and/or engagement with alcohol marketing, including prompted or unprompted recall of branded and unbranded exposure, recognition of specific alcohol advertising content and/or allegiance to a favourite brand.

Significant associations between exposure to, awareness of, engagement with and/or receptivity to alcohol marketing at baseline and initiation of alcohol use, initiation of binge drinking, drinking in the previous 30 days and/or alcohol problems at follow-up were found in all studies. Periods of follow-up ranged from 9 months to 8 years. For example, Morgenstern *et al.*'s four-country study followed more than 12 000 children (average age below 13.5 years) for 1 year [25]. After controlling for differences in a wide range of possible confounding factors (age, gender, family affluence, school performance, TV screen time, personality characteristics and drinking behaviour of peers, parents and siblings), children who were familiar with alcohol branding and had a favourite brand at baseline were 45% more likely to have their first binge drinking experience at follow-up compared to those who did not meet these criteria. A 2-year study of more than 550 Scottish children aged approximately 13 years found at follow-up that awareness of advertising was not significantly predictive of subsequent drinking, but engagement—defined as taking free gifts, ownership of branded clothing or participation in alcohol websites or branded social networking sites—was [19]. Those engaged at baseline were 31% more likely to initiate drinking during the period and 43% more likely to have become frequent drinkers (at least fortnightly consumption), after controlling for a range of potential confounders.

Figure 2 is a forest plot of the odds ratios with 95% confidence intervals from the seven studies that reported them. Some studies found associations between exposure to alcohol marketing of various kinds and initiation of alcohol use, although several studies reported non-significant effects. Ross [22] found a significant association between exposure for boys but not for girls, using a curvilinear rather than a linear approach to assess the association, based on earlier literature suggesting that initiation effects are strongest at lower levels of exposure [25]. Evidence was stronger for the relationship between initiation of binge drinking or participation in binge or hazardous drinking at follow-up than for initiation of alcohol use. This is consistent with Saffer *et al.*'s theoretical and empirical argument that exposure to alcohol advertising will have the greatest effects on the heaviest drinkers over time [23].

Table 2 Results of study quality assessment.

Study	*Study quality score*
Chang *et al.* [42]	12
de Bruijn *et al.* [18]	11
de Bruijn *et al.* [18]	12
Gordon *et al.* [19]	11
Grenard *et al.* [17]	8
Harris *et al.* [20]	11
McClure *et al.* [22]	10
Morgenstern *et al.* [43]	12
Morgenstern *et al.* [25]	11
Ross [23]	11
Saffer *et al.* [24]	10
Tanski *et al.* [21]	9

Mean quality score (standard deviation) = 10.7 (1.2).

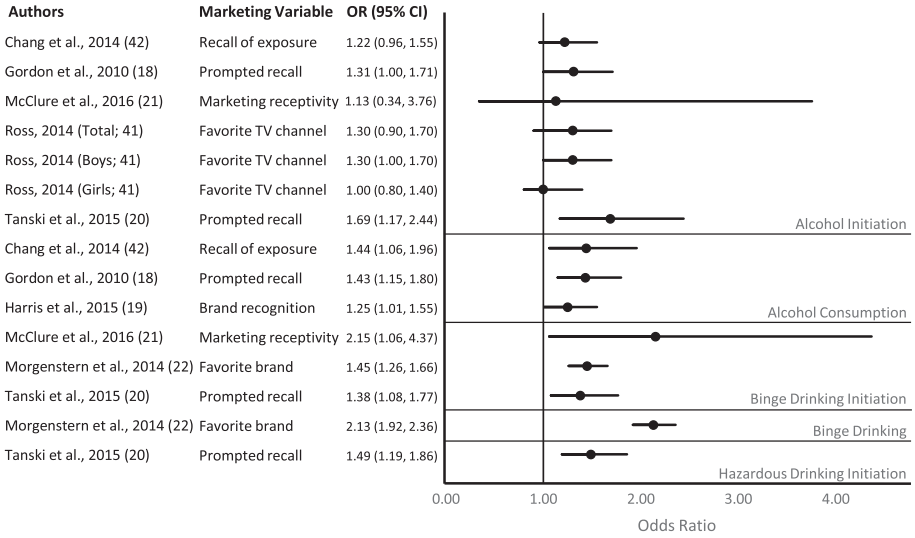

Figure 2 Forest plot of longitudinal cohort studies that supplied odds ratios and 95% confidence intervals

Table 3 Frequency of study quality criteria.

Question	*Frequency (%)*
Was the research question or objective in this paper clearly stated?	11 (91.7)
Was the study population clearly specified and defined?	12 (100)
Was the participation rate of eligible people at least 50%?	9 (75.0)
Were all the subjects selected or recruited from the same or similar populations (including the same time-period)? Were inclusion and exclusion criteria for being in the study pre-specified and applied uniformly to all participants?	12 (100)
Was a sample size justification, power description or variance and effect estimates provided?	0 (0)
For the analyses in this paper, were the exposure(s) of interest measured prior to the outcome(s) being measured?	7 (58.3)
Was the time-frame sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?	12 (100)
For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (e.g. categories of exposure, or exposure measured as continuous variable)?	10 (83.3)
Were the exposure measures (independent variables) clearly defined, valid, reliable and implemented consistently across all study participants?	12 (100)
Was the exposure(s) assessed more than once over time?	5 (41.7)
Were the outcome measures (dependent variables) clearly defined, valid, reliable and implemented consistently across all study participants?	12 (100)
Were the outcome assessors blinded to the exposure status of participants?	12 (100)
Was loss to follow-up after baseline 20% or less?	2 (16.7)
Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure(s) and outcome(s)?	12 (100)

Results of the study quality assessment are included in Table 2, and Table 3 shows the frequency of study quality criteria. Strengths of the studies included specification and definition of study populations; use of long enough follow-up periods to reasonably expect to see an association between exposure and outcome if it existed; clear definition and measurement of independent and dependent variables; and measurement and adjustment for key potential confounding variables. Weaknesses included higher than optimal attrition of participants at follow-up, failure to assess the relevant exposures more than once over time and measurement of the exposure(s) of interest after the outcomes being measured may have already occurred.

DISCUSSION

This review has identified 12 longitudinal studies published since 2008 containing original data from nine cohorts not reported on previously regarding children and young people's exposure to alcohol marketing and their consumption of alcohol. All found positive associations between exposure to marketing and some measure of subsequent drinking behaviour and/or negative consequences of drinking.

Regulation of alcohol marketing is a highly contested area in public health. As has been noted elsewhere [27], little work has been conducted on the actual effects of advertising restrictions or bans on alcohol consumption in adolescents or adults. Bosque-Prous *et al.* found that stricter marketing regulations were associated cross-sectionally with a low prevalence of hazardous drinking among 50–64-year-olds in 16 European countries [28]. Examining a range of alcohol control policies, including alcohol advertising restrictions, from the 1960s to the 2000s, Baccini & Carreras found a significant decrease in consumption following advertisement restrictions only in France and not in five other countries where restrictions were implemented during the study period [29]. Smith & Geller found 32.9% fewer youth traffic fatalities in US states with laws prohibiting alcohol advertising targeting minors compared with states lacking such laws. Based on this finding, they estimated that imposing regulations on alcohol marketing to youth in the 26 US states that currently do not have such restrictions could save 400 lives per year from youth drink-driving casualties alone [30].

The studies summarized in this review help to fill the gap in evidence regarding alcohol marketing's effects on young people. World-wide, the most common approach has been for government to rely on alcohol industry self-regulation [2]. Reviews of the literature on the effectiveness of self-regulation in reducing youth exposure or limiting problematic content have concluded that existing self-regulatory systems do not meet their intended goal of protecting vulnerable populations from alcohol marketing [31,32]. Given the ineffectiveness of current regulatory approaches, the implications of the current review are that more research is needed to understand and intervene more effectively in the relationship between alcohol marketing exposure and youth drinking behaviour. This is particularly true in light of the apparent effects of

exposure to alcohol marketing on youth binge drinking. In the United States, adult binge drinking accounted for more than 75% of economic costs associated with excessive drinking [33]. Underage binge drinking has been associated with a range of negative outcomes, including peer violence, dating violence, alcohol-related fighting, poor school performance, attempting suicide and using illicit drugs [34].

Mediating factors

Effective intervention requires understanding how alcohol marketing influences young people. The most obvious mediator between alcohol marketing and youth drinking behaviour is marketing exposure itself. Beyond this, however, several studies used measures of marketing receptivity, operationalized through such variables as liking an advertisement, the ability to recall alcohol advertisements correctly and participation in marketing. The latter may be particularly important with increasing youth exposure to alcohol marketing in social media, which seek to encourage user and viewer participation often and explicitly in marketing [35]. Other studies hypothesized and demonstrated that positive expectancies about alcohol use were significant mediators. Further insight into mediating factors may come from cross-sectional studies not included in this review. For instance, Jang & Frederick [36] found that interpersonal discussions about alcohol use and expectations about using alcohol were mediating factors that shaped the influence of advertising. This suggests that social media discourse may play a significant role in enhancing marketers' advertising impact, a point echoed by Hoffman *et al.* [37], who found that young people's use of social media related to alcohol marketing predicted alcohol consumption and engaging in risky behaviours, whereas the use of social media more generally did not.

Brand recognition, including identifying oneself as a 'brand drinker', was another significant mediator. Again, cross-sectional research has shed light on the importance of including brands of alcohol in both the independent (i.e. exposure to marketing for specific brands) and the dependent (i.e. consumption of specific brands) variables when studying the effects of youth exposure to alcohol marketing. Branded cross-sectional research has found larger effect sizes than the studies in this review [38,39], although they are limited in their ability to address causality. This suggests that future longitudinal research should measure branded exposure and consumption. Moreover, Ross and colleagues [23,29] have argued that the relationship between youth exposure to alcohol marketing and youth drinking initiation is non-linear, with saturation beginning to occur at higher levels of exposure. This also has implications for future research.

Strengths and limitations

The strengths of the studies included in this review include the diversity of national and cultural settings in which they have been conducted, as well as the diversity of measures of marketing exposure and mediators they have employed. This diversity is also a limitation, however, in that after more than two decades of longitudinal research in this area there is still no consensus on how marketing exposure should be measured or what outcomes are most important. While we selected 500 participants somewhat arbitrarily as a minimum for studies included in this review, it is another limitation of the research so far that none of the studies included any justification for the sample size selected. Studies also suffered from a high level of attrition at follow-up, and a quarter of the studies had participation rates of eligible people of less than 50%. Future research may need to explore greater use of incentives and more resources devoted to follow-up to address these weaknesses.

This review is limited to the English-language literature, and there may be studies that have been published in other languages that could have informed its findings. The types of studies reviewed here vary greatly in measures of marketing exposure, post-baseline follow-up periods in the longitudinal studies and measures of drinking behaviour. The latter suffer from the usual problems with self-reporting; however, these are somewhat mitigated by the assumption that if under-reporting occurs in a longitudinal design it may be expected to be consistent over time. The age of the subjects also varied, from children as young as 10 to college/university students aged 17 or 18 years to young adults (at follow-up) as old as 29 years. The failure of most of the studies to use the same methodology across different countries and cultures is particularly limiting in the case of countries with a lower baseline of both exposure and youth alcohol use (e.g. low-income countries), where changes are more rapid and effects might be expected to be stronger. The heterogeneity of the studies also means that they cannot be combined easily into a meta-analysis or other method for deriving an estimate of the true effect size. Publication bias may also be a factor in the studies we were able to identify for this review, in that it is possible that studies finding no association may not have been submitted for publication or included in published results of studies that examined advertising along with other possible influences on youth drinking behaviour.

One of the strengths of the present review is that it has found evidence of an association between marketing exposure and youth drinking behaviour in multiple population groups, cultures and nationalities among a range of younger age groups, and using an array of different measurement methods. To the 13 longitudinal cohorts reviewed by Anderson *et al.* [6] we add nine more, with a total of more than 35 000 participants, follow-up periods ranging

from 9 months to 8 years and including children aged as young as 10 years. All support the original review's findings of a significant association between exposure to marketing and increased consumption of alcohol or worsening of drinking patterns.

Gaps in the literature remain to be filled. Content of marketing has been largely ignored, and there is reason to believe that content such as associating drinking alcohol with parties, humour, sexual attractiveness and other rewarding outcomes may be more attractive to youth [40]. A longitudinal study published too late for inclusion in this review found that adolescents and young adults in the United States were more likely to initiate drinking and binge drinking if they had greater exposure to alcohol advertisements containing a 'party' theme, independent of their exposure to advertisements without such themes [41]. If such content areas could be documented and quantified more fully, they may add to the predictive power of simple exposure measures. This is an important area for future research.

The finding of several studies that levels of exposure appear to be as high or nearly as high among younger adolescents as they are among older adolescents and young adults represents a significant failure of current marketing codes to protect minors from marketing messages [21,31]. This is particularly important with digital marketing techniques that encourage interactive engagement with brand marketing and are difficult for parents to monitor and control.

CONCLUSIONS

This review has found further evidence of a close association between marketing and youth alcohol consumption. Recent longitudinal studies show additional evidence of a relationship between early marketing exposure and later alcohol consumption, and the results support the conclusions of the earlier reviews. These effects have now been found in a wider range of countries and among children as young as 10 years. Many of the studies found their effects after adjusting for differences in family and peer drinking behaviour and other cultural incentives to consume alcohol. Although it is acknowledged that additional external factors—including non-marketing pro-alcohol messages, family and cultural factors and individual personality types—may explain some of the associations shown, these studies add to the evidence suggesting that alcohol marketing affects youth drinking behaviour and that there is a need for public health-orientated policies that can prevent, reduce or mitigate that effect.

Declaration of interests

None.

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