

SPECIAL ISSUE: THE MESSAGE AND THE MEDIA

Impact of Alcohol Advertising and Media Exposure on Adolescent Alcohol Use: A Systematic Review of Longitudinal Studies

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Abstract — Aims: To assess the impact of alcohol advertising and media exposure on future adolescent alcohol use. **Methods:** We searched MEDLINE, the Cochrane Library, Sociological Abstracts, and PsycLIT, from 1990 to September 2008, supplemented with searches of Google scholar, hand searches of key journals and reference lists of identified papers and key publications for more recent publications. We selected longitudinal studies that assessed individuals' exposure to commercial communications and media and alcohol drinking behaviour at baseline, and assessed alcohol drinking behaviour at follow-up. Participants were adolescents aged 18 years or younger or below the legal drinking age of the country of origin of the study, whichever was the higher. **Results:** Thirteen longitudinal studies that followed up a total of over 38,000 young people met inclusion criteria. The studies measured exposure to advertising and promotion in a variety of ways, including estimates of the volume of media and advertising exposure, ownership of branded merchandise, recall and receptivity, and one study on expenditure on advertisements. Follow-up ranged from 8 to 96 months. One study reported outcomes at multiple time-points, 3, 5, and 8 years. Seven studies provided data on initiation of alcohol use amongst non-drinkers, three studies on maintenance and frequency of drinking amongst baseline drinkers, and seven studies on alcohol use of the total sample of non-drinkers and drinkers at baseline. Twelve of the thirteen studies concluded an impact of exposure on subsequent alcohol use, including initiation of drinking and heavier drinking amongst existing drinkers, with a dose response relationship in all studies that reported such exposure and analysis. There was variation in the strength of association, and the degree to which potential confounders were controlled for. The thirteenth study, which tested the impact of outdoor advertising placed near schools failed to detect an impact on alcohol use, but found an impact on intentions to use. **Conclusions:** Longitudinal studies consistently suggest that exposure to media and commercial communications on alcohol is associated with the likelihood that adolescents will start to drink alcohol, and with increased drinking amongst baseline drinkers. Based on the strength of this association, the consistency of findings across numerous observational studies, temporality of exposure and drinking behaviours observed, dose-response relationships, as well as the theoretical plausibility regarding the impact of media exposure and commercial communications, we conclude that alcohol advertising and promotion increases the likelihood that adolescents will start to use alcohol, and to drink more if they are already using alcohol.

INTRODUCTION

Adolescents are frequent users of alcohol and increasingly consume it in a risky fashion. For example, in Europe, nearly all (over 9 in 10) 15- to 16-year-old students have drunk alcohol at some point in their life (Currie *et al.*, 2004), starting on average just after 12½ years of age. Data from the 2003 European School Survey Project on Alcohol and Other Drugs (ESPAD) found that the average amount of alcohol drunk by 15- to 16-year olds on the last drinking occasion was 60 g (six drinks) (Hibell *et al.*, 2004). Over one in eight (13%) of 15- to 16-year-old students reported being drunk more than 20 times in their life, and over one in six (18%) reported binge drinking (5+ drinks on a single occasion) three times or more in the last month. Binge drinking in young people has increased across much of Europe in the last 10 years, although more so in the early part of this period (Anderson and Baumberg, 2006).

Children and adolescents have greater vulnerability to alcohol than adults. As well as usually being physically smaller, they lack experience of drinking and its effects. They have no context or reference point for assessing or regulating their drinking, and, furthermore, they have built up no tolerance to alcohol. From mid-adolescence to early adulthood, there are major increases in the amount and frequency of alcohol consumption and alcohol-related problems (Bonomo *et al.*, 2004; Wells *et al.*, 2004). Those with heavier consumption in their

mid-teens tend to be the ones with heavier consumption, alcohol dependence and alcohol-related harm, including poorer mental health, poorer education outcome and increased risk of crime in early adulthood (Jefferis *et al.*, 2005, Englund *et al.*, 2008; Pitkänen *et al.*, 2008). During adolescence, alcohol can lead to structural changes in the hippocampus (a part of the brain involved in the learning process) (De Bellis *et al.*, 2000) and at high levels can permanently impair brain development (Spear, 2002). Drinking by adolescents and young adults is associated with automobile crash injury and death, suicide and depression, missed classes and decreased academic performance, loss of memory, blackouts, fighting, property damage, peer criticism and broken friendships, date rape, and unprotected sexual intercourse that places people at risk for sexually transmitted diseases, HIV infection and unplanned pregnancy (Bonomo *et al.*, 2001). Adolescents aged 14–17 years with alcohol use disorders show substantially greater brain activation to alcoholic beverage pictures than control youths, predominantly in brain areas linked to reward, desire and positive affect (Tapert *et al.*, 2003). The degree of brain response to the alcohol pictures is highest in youths who consume more drinks per month and report greater desires to drink.

Alcohol advertising is one of the many factors that have the potential to encourage youth drinking. For young people who have not started to drink, expectancies are influenced by normative assumptions about teenage drinking as well as through

the observation of drinking by parents, peers and models in the mass media. Research has linked exposure to portrayals of alcohol use in the mass media with the development of positive drinking expectancies by children and adolescents (Austin and Knaus, 2000; Austin *et al.*, 2000). Young people with more positive affective responses to alcohol advertising hold more favourable drinking expectancies, perceive greater social approval for drinking, believe drinking is more common among peers and adults, and intend to drink more as adults (Chen and Grube, 2002). Fourteen-year olds with greater exposure to advertisements in magazines, at sporting and music events and on television are more advertisement-aware than those with less exposure, as are teens who watch more TV, pay attention to beer advertisements and know adults who drink (Collins *et al.*, 2003). Amongst 10- to 17-year olds, the perceived likeability of beer advertisements is a function of the positive affective responses evoked by the specific elements featured in the advertisements. Liking of specific elements featured in beer advertisements, such as humour, animation and popular music, significantly contribute to the overall likeability of these advertisements and subsequently to advertising effectiveness indicated by an intent to purchase the product and brand promoted by the advertisements (Chen *et al.*, 2005).

These studies, however, do not establish whether alcohol advertising actually influences young people's drinking behaviour. Answering this question requires either experimental studies, which are not possible for ethical reasons, or systematic observation of real world effects.

One approach to observation is to look for correlations between the amount of alcohol advertising and the amount of drinking taking place in a particular jurisdiction using econometric methods. It is hypothesized that, if advertising has an effect, drinking rates should shadow temporal variations in the amount of advertising. Establishing such a link, however, is problematic for a number of reasons. First, measures of the amount of advertising, which typically use expenditure on advertising, vary in the accuracy and inclusiveness. For example, in the UK, whilst mass media advertising expenditure has been estimated to be £202.2 million (UK Cabinet Office, 2003), expenditure on promotion more generally (taking in point of sale promotion, electronic communications and other 'below the line' activity) is thought to approach £800 million (Drink Pocket Book, 2006). Second, the analysis depends on the construction of a complex model that ascribes values for all the different variables—including price, drinking restrictions and disposable income—as well as advertising (Harrison and Godfrey, 1989; Casswell, 1995; Saffer, 1996) that might be implicated. Third, the duration of advertising effects need to be taken into account: a powerful campaign may continue to have an effect years after it was first deployed. Indeed, advertisers deliberately try to enhance these long-term effects as part of their effort to build brands. Fourth, variations in the amount of advertising tend to be minor (few comprehensive bans have been introduced) so researchers are looking for potentially very small changes in drinking patterns. Finally, and most importantly given our focus on adolescents, measures of the overall amount of advertising do not necessarily give an accurate picture of youth exposure.

To obtain this focus on young people, it is necessary to do research directly with them. Such investigations come in two forms: cross-sectional and longitudinal. Cross-sectional studies

take a snapshot of advertising exposure (awareness and/or appreciation) and levels of drinking, and look for correlations between the two. However, because they cannot show whether exposure preceded drinking uptake, they leave open the possibility that any correlation is as likely to reflect drinking encouraging young people to take an interest in advertising, as vice versa.

As Aitken *et al.* (1988) point out, however, paying attention to advertising presupposes that the viewer is getting some benefit or reward from it—most fundamentally that they are doing the right thing by consuming the advertised product—and advertisers deliberately design their work to provide such rewards (Aitken, 1988). Thus, cross-sectional data can shed a useful light on the role of alcohol advertising in young people's drinking.

Longitudinal studies take the debate a step further by measuring exposure at time *A*, and how this relates to drinking at time *B*. Provided potential confounders (such as peer and parental drinking) are controlled for, any correlation indicates a causative relationship. This review therefore focuses on longitudinal studies with young people. It builds on and extends reviews conducted by Jernigan (2006), Smith and Foxcroft (2007) and Booth *et al.* (2008).

METHODS OF THE REVIEW

Types of studies

We considered studies that examined the association between alcohol advertising and promotion, the portrayal of alcohol in mass media, and adolescent drinking. We included only longitudinal studies in which individuals' drinking behaviour and exposure to advertising, receptivity or attitudes to alcohol advertising, or brand awareness were measured at baseline and individuals' drinking behaviours were then measured in one or more follow-ups. Experimental, cross-sectional and time-series or econometric studies were excluded from this review.

Types of participants

Studies that included adolescents 18 years of age or younger were reviewed with the exception of US-based studies, where the legal drinking age of 21 years was taken as the cut-off.

Types of intervention

The 'intervention' is alcohol mass media advertising by the industry, including portrayal of alcohol in the mass media, alcohol promotion and media exposure that contained alcohol advertisements. Mass media channels of communication include advertising delivered through television, radio, newspapers, outdoor advertising, posters, etc. Alcohol promotion includes give-aways and items bearing alcohol industry logos. In practice, the measure of exposure to the intervention may not discriminate between specific types of advertising, since adolescents are exposed to many sources.

Types of outcome measures

Self-reported drinking status.

Search strategy

We searched MEDLINE, the Cochrane Library, Sociological Abstracts, and PsycLIT, from 1990 to September 2008, supplemented with searches of Google scholar, hand searches of

key journals and reference lists of identified papers and key publications for more recent publications. The search strategy combined the following four sets of terms. *Child Search Strategy*: Child(MeSH) OR Child* OR Schoolchild* OR School age* OR Kid OR Kids OR Adolescent(MeSH) OR Adoles* OR Teen* OR Boy* OR Girl* OR Minors(MeSH) OR Minors OR Schools(MeSH) OR Primary school* OR Secondary school* OR Elementary school* OR High school* OR Highschool* OR College* OR Universit* OR Young OR Youth*. *Alcohol Search Strategy*: Alcohol drinking(MeSH) OR Alcohol* drink* OR Alcoholic beverages(MeSH) OR Alcohol* beverage* OR Beer(MeSH) OR Beer* OR Wine(MeSH) OR Wine* OR Liquor* OR Spirits OR Alcohol*. *Marketing Search Strategy*: Marketing(MeSH:NoExp) OR Marketing OR Advertising as Topic(MeSH) OR Advert* OR Promot* OR Sponsor* OR Television(MeSH) OR Televis* OR TV* OR Radio(MeSH) OR Radio OR Radios OR Motion picture* OR Movie* OR Film* OR Display* OR Billboard* OR Poster OR Posters OR Newspapers(MeSH) OR Newspaper* OR Magazine* OR Mass media(MeSH) OR Internet(MeSH) OR Internet. *Longitudinal Studies Search Strategy*: Longitudinal Studies(MeSH) OR Longitud* OR Cohort* OR Follow-up* OR Prospectiv* OR Subsequ* OR Wave*.

There were four stages in the review process:

1. Studies identified in the electronic search were pre-screened for relevance by a reviewer. Articles were rejected if the title and abstract did not focus on the impact of alcohol advertising or promotion on adolescent drinking behaviour. If the article could not be rejected with certainty, the full text was obtained and screened by two reviewers.
2. Two reviewers independently assessed relevant studies for inclusion.
3. One reviewer extracted data from included studies using a form and a second reviewer checked these data.
4. Studies were combined using qualitative narrative synthesis because there was heterogeneity among study designs, type of 'intervention' and outcomes measured.

RESULTS

The search strategy resulted in 810 titles, reduced to 729 following deletion of duplicates. Initial assessment of the titles and abstracts reduced the number of papers to 131, further reduced to 29 on closer assessment of the abstract and full text. Sixteen publications reporting on 13 studies met the inclusion criteria. One longitudinal study was excluded, because the use of alcohol at baseline was not accounted for (Wingood *et al.*, 2003). No additional methodological quality criteria were used in selecting papers for inclusion. Table 1 summarizes the studies, describing the alcohol marketing and media exposures, the drinking behaviour outcome measures, the sample and study designs, the survey methods, the baseline sample sizes and follow-up rates, the methods of analyses, the confounders analysed and the outcome at follow-up. The individual studies were not ranked for methodological quality.

The 13 studies included a variety of different age groupings that ranged between 10 and 21 years of age at baseline. Ten studies were conducted in the United States, one in Belgium,

one in Germany and one in New Zealand. The years during which data were collected ranged between 1985 and 2005. Baseline sample sizes ranged from 630 to 6522, with a total of over 38,000 at follow-up across the 13 studies.

Two studies investigated the impact of media exposure (television and music videos) on the use of alcohol; three studies, alcohol use in motion pictures; two studies, a range of marketing exposure (including TV, magazines, concession stands at sports or music events, and in store advertisements); two studies, ownership of alcohol branded merchandise; one study, TV alcohol commercials alone; one study, recall and liking of advertisements; one study, outdoor advertising; one study, brand recognition, recall and receptivity to alcohol marketing; and one study, volume of and expenditure on advertisements.

In 10 studies, participants were followed up once after baseline. The duration of the follow-up was 12 months, 18 months, 24 months, 30 months and 12–26 months. One study followed up participants at 8, 16 and 24 months. The New Zealand study reported outcomes at multiple time points, 3 years, 5 years and 8 years. One study evaluated participants at four time points and presents results for follow-up after 21 months taking the multiple time points into account in the analysis (Snyder *et al.*, 2006). Attrition rates varied from 31% to 100% (the sample with 100% follow-up included and analysed all students with alcohol consumption measurements at baseline and follow-up (Casswell and Zhang, 1998). Three studies used imputation for missing data (Ellickson *et al.*, 2005; Collins *et al.*, 2007; Wills *et al.*, 2008); all other studies excluded participants with missing data from the analyses.

All studies measured alcohol use at follow-up. Eight studies provided data on initiation of alcohol use amongst non-drinkers (Robinson *et al.*, 1998; Ellickson *et al.*, 2005; Sargent *et al.*, 2006; Fisher *et al.*, 2007; Henriksen *et al.*, 2008; Hanewinkel and Sargent, 2008; McClure *et al.*, 2008; Wills *et al.*, 2008), three studies on maintenance and frequency of drinking amongst baseline drinkers (Robinson *et al.*, 1998; Casswell and Zhang, 1998; Casswell *et al.*, 2002; Ellickson *et al.*, 2005) and six studies on alcohol use of the total sample of non-drinkers and drinkers at baseline (Connolly *et al.*, 1994; Stacy *et al.*, 2004; Van den Bulck and Beullens, 2005; Snyder *et al.*, 2006; Collins *et al.*, 2007; Pasch *et al.*, 2007).

Study samples included random samples of youth (Snyder *et al.*, 2006; McClure *et al.*, 2008; Wills *et al.*, 2008), randomly selected schools with all participants invited to participate (Stacy *et al.*, 2004; Van den Bulck and Beullens, 2005; Sargent *et al.*, 2006), all elementary schools in a State (Collins *et al.*, 2007; Hanewinkel and Sargent, 2008), all middle and high schools in a city (Henriksen *et al.*, 2008), all participants at six schools, with no information given on how the schools were selected (Robinson *et al.*, 1998), the original sample of participants selected for participation in an RCT (Ellickson *et al.*, 2005; Pasch *et al.*, 2007), all participants of a longitudinal cohort study (Fisher *et al.*, 2007) and a sub-sample of a longitudinal cohort study who had exposure and outcome data available at all follow-up periods (Connolly *et al.*, 1994; Casswell and Zhang, 1998; Casswell *et al.*, 2002).

Measurement of exposure and alcohol use were by self-reported questionnaires in seven studies (Robinson *et al.*, 1998; Stacy *et al.*, 2004; Ellickson *et al.*, 2005; Collins *et al.*, 2007; Henriksen *et al.*, 2008; Hanewinkel and Sargent, 2008), by both face-to-face interview and computer interview in one (Connolly

Table 1. Summary of included studies

Study [reference] Country Baseline survey date Age group (years)	Study objective Alcohol marketing and media exposure Drinking behaviour outcome measure ^a	Sample/study design	Survey method	Baseline sample size	Follow-up (months) Follow-up rate	Analysis	Covariates/ confounders analysed	Outcome at follow-up
Connolly <i>et al.</i> (1994) New Zealand 1985 13 and again at 15	Impact of recall of alcohol-related mass media material on subsequent alcohol consumption Alcohol portrayals in mass media (e.g. TV, radio) including commercial advertising (product advertising, sponsorship) and entertainment media Average amount of alcohol consumed on an occasion during a year; maximum of typical amounts consumed across all drinking locations; total frequencies of beer and other drinks (wine and spirits) consumed	Participants in a multi-disciplinary longitudinal study of growth and development	Face-to-face interview at 13 and 15 years; computer survey at 18 years	667 who were present for alcohol interviews at ages 13, 15 and 18 years	60 and 36 435/667 (65%) (analysed sample)	Multiple regression analyses; only <i>P</i> values reported	Gender Socio-economic status Living situation Occupation Peer approval of people who drink Number of moderation messages recalled Number of hours of TV watched	Impact of number of commercial advertisements recalled at ages 13 and 15 on average and maximum amounts of alcohol consumed on an occasion and on frequency of drinking. There was no significant relationship with wine and spirit consumption. For males, number of commercial advertisements recalled at age 15, but not 13, predicted average (<i>P</i> = 0.047) and maximum amounts of beer (<i>P</i> = 0.008) consumed on an occasion. For females, the number of commercial advertisements recalled at age 13, but not 15, predicted frequency of beer consumption (<i>P</i> = 0.029)
Robinson <i>et al.</i> (1998) USA (California) 1994 Mean age (SD) 14.6 (0.5)	Impact of media exposure on initiation of alcohol use and maintenance of drinking among existing drinkers Exposure to TV, music videos (on music channels and rental videotapes); videotape viewing; computer and video game use on typical school and weekend days Frequency of lifetime alcohol drinking (a typical single serving); frequency of drinking in past 30 days	Non-randomized prospective survey across six public high schools	Paper survey	2609	18 1583/2609 (61%)	Analysis included 1533 students with complete data on both alcohol use and media exposure Logistic regression to calculate odds ratios adjusted for main confounders	Age Gender Ethnicity Hours of other media watched	During the 18-month follow-up, 325 (36%) non-drinkers began drinking. Controlling for the effects of age, gender, ethnicity and the exposure to other media, each 1-h increase per day in TV viewing associated with a 9% increased risk for initiating drinking [OR=1.09 (1.01–1.18)]. Each 1-h increase per day in watching music videos associated with a 31% increased risk for initiating drinking [OR=1.31 (1.17–1.47)]. During the 18-month follow-up, 322 (51%) drinkers continued drinking. There were no significant associations between media exposure and maintenance of drinking

Casswell and Zhang (1998). Same sample as Connolly <i>et al.</i> (1994) above New Zealand 1990/199118	Impact of liking for alcohol advertising and brand allegiance at age 18 years on drinking and alcohol-related aggression at age 21 years Exposure to alcohol advertising (e.g. TV, radio, cinema advertising and sponsorship) Combined average volume of beer drunk at own home, someone else's home, hotel, tavern or bar, sports clubs and nightclubs over previous year; whether ever experienced problems with aggression associated with drinking alcohol	Participants in a multi-disciplinary longitudinal study of growth and development	Computer-based questionnaire and face-to-face supplementary interview	Sample restricted to 630 of those who drank beer at age 18 years	36 Sample restricted to those who provided information at baseline and follow-up	Structural equation modelling analysis	Gender	The measure of liking of alcohol advertising was based on responses to three items: 'alcohol advertisements have plenty of action'; 'alcohol advertisements show the type of people I admire'; 'Comparing alcohol adverts generally with other ads, which of the following you most agree with?' Liking of alcohol advertisements at age 18 predicted beer consumption at age 21 [standardized coefficient 0.36 (SE = 0.06, $T = 6.6$)]
Casswell <i>et al.</i> (2002). Same sample as Connolly <i>et al.</i> (1994) and Casswell and Zhang (1998) above New Zealand 1990/1991 18	To identify developmental trajectories of drinking between the ages of 18 and 26 years and to identify variables at age 18, including liking of alcohol advertisements, which predict these trajectories Exposure to alcohol advertising (undefined/no examples given) Frequency of drinking over past year and typical quantity consumed per drinking occasion at own home, someone else's home, hotel, tavern or bar, sports clubs and nightclubs	Participants in a multi-disciplinary longitudinal study of growth and development	Computer-based questionnaire and face-to-face supplementary interview	Sample restricted to 714 participants who were drinkers of alcohol at ages 18, 21 and 26 years	Trajectories of drinking over 96 months Sample restricted to 714 participants who were drinkers of alcohol at ages 18, 21 and 26 years	Trajectory analysis using method of Jones <i>et al.</i> (2001)	Gender Ease of access to alcohol Access to licensed premises Living arrangement Parental consumption Level of education Age of onset of regular drinking	The measure of liking of alcohol advertising was based on responses to three items: 'alcohol advertisements have plenty of action'; 'alcohol advertisements show the type of people I admire'; 'Comparing alcohol adverts generally with other ads, which of the following you most agree with?' Liking of alcohol advertisements at age 18 did not project trajectories of quantities of alcohol consumed per occasion for both men and women over the age 18–26 years. Liking of alcohol advertisements at age 18 marginally predicted being in a higher trajectory for frequency of drinking for men (OR = 1.6, $P = 0.0706$) but not for women over the age 18–26 years
Stacy <i>et al.</i> (2004) USA (California) 2000 US seventh grade (normally 12–13 years)	Impact of TV alcohol commercials on alcohol use Exposure to TV adverts for alcohol aired during 20 popular TV series; and during professional baseball, college and professional basketball, professional soccer and hockey, and on subscription sports channel in previous months Frequency of drinking alcohol in last 30 days; frequency of '3-drink episodes' (≥ 3 drinks of typical serving size in a row over couple of hours) in past 30 days	Randomized prospective survey across 20 middle schools	Paper survey	2998	12 2250/2998 (75%)	Logistic regression to calculate odds ratios adjusted for main confounders	Gender Ethnicity School Participation in team sports Perception of friends' alcohol use Perceived peer approval of alcohol use Intentions to use alcohol Perceptions of adults' alcohol use General TV viewing frequency Ad memorability (cued-recall and drawing)	Each 1 standard deviation increase in alcohol advertising exposure associated with 44% increase in odds of beer drinking (95% CI: 27%–61%), 34% increase in odds of wine/liquor drinking (95% CI: 17%–52%) and 26% increase in odds of consuming three or more drinks on one occasion (95% CI: 8%–48%) during previous 30 days

(Continued)

Table 1. Continued

Study [reference] Country Baseline survey date Age group (years)	Study objective Alcohol marketing and media exposure Drinking behaviour outcome measure ^a	Sample/study design	Survey method	Baseline sample size	Follow-up (months) Follow-up rate	Analysis	Covariates/ confounders analysed	Outcome at follow-up
Van den Bulck and Beullens (2005) Belgium 2003 13 and 16 years of age	Impact of TV and music video exposure on the use of alcohol whilst going out Exposure to music video TV programmes and normal TV viewing between 7 am and 1 am Number of alcoholic drinks usually drank when going out (to a bar, party, disco, etc.) ranging from never to ≥9; frequency of going out	Randomized prospective survey across 15 secondary schools	Paper survey	2546	12 1648/2546 (65%)	Multiple regression analyses accounting for covariates	Age School year Gender Pubertal development status Smoking status Drinking at baseline	Quantity of alcohol consumed while going out at the follow-up period related to overall TV viewing ($\beta =$ 0.068, $t = 3.46$, $P = 0.001$) and music video exposure ($\beta = 0.073$, $t = 3.05$, $P = 0.004$)
Ellickson <i>et al.</i> (2005) USA (South Dakota) 1997 Seventh grade (age 12–13 years)	Impact of exposure to different forms of alcohol advertising on the initiation of alcohol use and the frequency of drinking amongst existing drinkers, and whether exposure to a prevention programme mitigates any such relationship Exposure to TV beer advertisements (aired during professional football and basketball and during four late-night shows popular with age group), magazines with alcohol advertisements, beer concession stands and in-store advertisement displays Frequency of drinking alcohol in the past year (five options ranging from 0 to +20 times)	Randomized controlled trial of an alcohol use prevention programme involving 41 middle schools in South Dakota	Paper survey	3780	30 3111/3780 (82%)	Regression models accounting for covariates	Gender Ethnicity TV viewing Adult drinking Adult approval of drinking Peer drinking Peer approval of drinking School grades Religiosity Parental monitoring Alcohol beliefs Deviance Impulsivity Playing sports Exposure to prevention programme	48% of 1206 grade 7 non-drinkers consumed alcohol in previous year at grade 9. Controlled for main confounders, including exposure to all different types of advertisement and the impact of the prevention programme, exposure to beer concession stands at sports or music events predicted drinking onset for non-drinkers in previous 12 months (OR = 1.42, $P < 0.05$), whereas exposure to TV beer adverts (OR = 1.05, $P > 0.05$), magazines with alcohol advertisements (OR = 1.12, $P > 0.05$) and exposure to in-store advertisements (OR = 1.06, $P >$ 0.05) did not. Weekly TV viewing, controlled for alcohol advertisement exposure, was inversely related to the onset of drinking, explained as a 'babysitter' effect, whereby youth who watch more TV have fewer opportunities to drink. 77% of 1905 grade 7 drinkers consumed alcohol in the previous year at grade 9. Exposure to beer concession stands at sports or music events predicted the frequency of drinking amongst existing drinkers in previous 12 months (coefficient = 0.09, $P <$ 0.05), as did exposure to magazines with alcohol advertisements (coefficient = 0.10, $P < 0.05$), whereas exposure to TV beer adverts (coefficient = -0.01, $P >$ 0.05) and exposure to in-store advertisements (coefficient = 0.02, $P > 0.05$) did not

Snyder <i>et al.</i> (2006) USA 1999 15–26 (52% <21)	Impact of alcohol advertising expenditures and the degree of exposure to alcohol advertisements on alcohol use Exposure to beer, liquor and premixed drink advertising on TV, radio, magazines and billboards in the past month. Industry data on amount spent on alcohol advertisements Number of alcoholic drinks in the past months calculated from the frequency of drinking alcohol (past 4 weeks); average quantity of drinks per day and maximum quantity of drinks on one occasion	Randomized survey sample from 24 Nielsen media markets	Telephone interviews	1872	21 588/1872 (31%)	Multi-level linear modelling to calculate event rate ratio	Gender Age Ethnicity School status Alcohol sales per capita	For those aged <21 years, each additional alcohol advertisement seen increased the number of drinks consumed in the previous month by 1% (event rate ratio = 1.01, 95% CI: 1.001–1.021). Each additional dollar spent on alcohol advertisements increased the number of drinks consumed in the previous month by 2.8% (event rate ratio = 1.028, 95% CI: 1.002–1.056). Seeing more or fewer advertisements in a particular month than he or she typically saw is a predictor of drinking (event rate ratio = 1.002, 95% CI: 1.001–1.003)
Sargent <i>et al.</i> (2006) USA (New Hampshire and Vermont) 1999 10–14	Impact of exposure of alcohol use in motion pictures on the initiation of alcohol use Exposure to US box-office hit movies content-coded for on-screen alcohol use (consumption, implied possession and purchase of alcohol) Initiation of alcohol drinking (unknown to parents)	Randomized cross sectional survey with longitudinal follow-up on non-drinkers at baseline in 15 middle schools	Paper survey, with follow-up telephone interview	3577 non-drinkers	12–26 (average 17 months) 2406/3577 (67%)	Multi-level logistic regression to calculate ORs adjusted for covariates	Grade Gender Parental education School performance Self-esteem Maternal support Maternal control Rebelliousness Sensation seeking Smoking status	357/2406 (15%) initiated drinking alcohol. Exposure predicted use of alcohol during the follow-up period (OR = 1.15, 95% CI: 1.06–1.25). Analysis with quadratic exposure effect (OR = 0.996, 95% CI: 0.992–0.999) showed that the relationship between exposure of alcohol use in motion pictures and the initiation of alcohol use was stronger among adolescents in lower exposure categories
Collins <i>et al.</i> (2007) USA (South Dakota) 2000 Grade 6 (11–12)	Impact of exposure to alcohol marketing on beer use Exposure to beer ads on TV (on subscription sports channel, other sports programmes, other TV programmes), in magazines, on radio, at concessions stands and on in-store displays Ownership of alcohol promotional items (hats, posters or T-shirts) Beer drinking over the past year	Longitudinal survey across 39 schools	Paper survey	1786	12 1699/1786 (95%) and 1740/1786 (97%)	Multivariate with logit and logistic regression	Gender Ethnicity Parental monitoring Adult drinking Peer drinking Parent approval Friend approval School grades Depressed mood Deviance Impulsivity Religiosity Sports participation Weekly TV viewing Parental education Grade 6 beer drinking	17% reported past year beer drinking at grade 7. OR (95% CI) for beer drinking were: ESPN cable network (an American cable TV network dedicated to broadcasting and producing sports-related programming 24 h a day) 1.08 (0.83–1.42); other sports beer ads 1.19 (1.01–1.40); other TV beer ads 1.13 (0.95–1.34); magazine reading 0.96 (0.87–1.06); radio listening 1.17 (1.00–1.37); beer concessions 1.01 (0.91–1.13); in-store beer displays 1.03 (0.92–1.14); beer promotional items 1.76 (1.23–2.52). Joint effect of exposure to ads from all sources: $F(8, 28) = 8.36, P < 0.0001$; and from three TV sources: $F(3, 33) = 3.35, P < 0.05$. Twenty percent of youth in 75th percentile of alcohol marketing exposure at grade 6 reported past year beer drinking at grade 7, compared with 13% in 25th percentile

(Continued)

Table 1. Continued

Study [reference] Country Baseline survey date Age group (years)	Study objective Alcohol marketing and media exposure Drinking behaviour outcome measure ^a	Sample/study design	Survey method	Baseline sample size	Follow-up (months) Follow-up rate	Analysis	Covariates/ confounders analysed	Outcome at follow-up
Fisher <i>et al.</i> (2007) USA 1998–1999 11–18	Impact of ownership of or willing to use alcohol promotional item on the initiation of alcohol use and subsequent binge drinking Exposure to alcohol advertisements or TV commercials; alcohol promotional item (e.g. hat, T-shirt, bag) ownership and willingness to use Initiation of alcohol drinking (ever sipped or had whole serving of alcoholic drink); ever binge drinking (≥ 5 drinks in few hours) in past year	Non-random prospective cohort study of never drinking children of mothers in Nurses' Health Study II	Postal survey	16,882 recruited in 1996; 11,834 completed follow-up in 1998 and 1999. Sample comprised 5511 non-drinkers who completed alcohol questions in 1998 and 1999	12 11,834/16,882 (70%) Analysis confined to the 511 non-drinkers	Multivariate logistic regression	Age Pubertal status Race Geographical area Social self-esteem Athletic self-esteem Global self-esteem Scholastic self-esteem Cigarette smoking Family composition Family dinner at home Adults drink at home Siblings <21 drinking Peer drinking Attitudes and beliefs about alcohol consumption	611/3283 girls (19%) and 384/2228 boys (17%) initiated alcohol use. The odds ratio of alcohol initiation during the 12-month period was 1.74 (1.37–2.19) for girls and 1.78 (1.36–2.33) for boys for those who owned or were willing to use an alcohol promotion item compared with those who did or would not. 149/611 drinking girls (24%) and 112/384 drinking boys (29%) engaged in binge drinking. The odds ratio of binge drinking amongst drinkers was 1.79 (1.16–2.77) for girls and 0.87 (0.51–1.48) for boys for those who owned or were willing to use an alcohol promotion item compared with those who did or would not
Pasch <i>et al.</i> (2007) USA (Chicago) 2003 Mean age 12.2 years	Impact of exposure of outdoor alcohol advertisements within 1500 feet (457 m) of 63 Chicago schools on alcohol use Outdoor alcohol advertisements, including at bus shelters/benches, on billboards, outside liquor, grocery, or convenience stores or outside bars. Content-coded on a 22-item system for theme(s) Drinking behaviour measures include the frequency of drinking alcohol over past 30 days; frequency of drinking ≥ 5 drinks over past 2 weeks	Sixth grade students in project Northland Chicago, a randomized controlled trial of an alcohol use prevention programme involving 61 public schools in Chicago	Digital camera and GPS positioning of alcohol advertisements; paper survey of alcohol use and intentions	4137	24 2586/4137 (62.5%)	Mixed-effect regression models	Gender Ethnicity School socio-economic status Exposure to other forms of alcohol advertising Awareness of outdoor advertising Prevention programme	On average, each school site had 14.8 alcohol advertisements within 1500 feet (457 m). 2027/2586 (78%) students followed up were non-users of alcohol at baseline, but the initiation of alcohol use was not reported. Exposure to alcohol advertisements at sixth grade did not predict alcohol behaviour amongst sixth grade alcohol users and non-users at eighth grade, but, amongst sixth grade non-users, did predict at eighth grade intentions to use (e.g. 'do you think you will be drinking alcohol in the next month'), $f = 6.29$, $P = 0.01$ and outcome expectancies, $f = 4.62$, $P = 0.03$

Henriksen <i>et al.</i> (2008) USA (California) 2003 10–15	Influence of alcohol advertising and promotions on the initiation of alcohol use Exposure to alcohol advertising (beer and vodka mix products) and to alcohol branded items (e.g. T-shirt, lighter, matches, hat or sunglasses) Initiation of alcohol use (either finished a serving of alcoholic drink ever, in last 30 days or last 7 days) and transition to current drinker (finished ≥ 1 –2 servings of alcoholic drink in last 30 days)	Non-random longitudinal survey of adolescents from three middle and two high schools in Tracy California (pop 56,929) in the Survey of Teen Opinions about Retail Environments, a longitudinal study primarily of smoking initiation	Paper survey	1527 non-drinking students	12 1080/1527 (71%)	Logistic regression to calculate odds ratios	Grade Gender Ethnicity Parental drinking Peer drinking Perceived peer drinking Perceived peer approval of drinking Risk taking Unsupervised hours after school Self-reported grades	29% of never drinkers at baseline had initiated alcohol use at follow-up. Brand recognition, OR = 1.15 (1.02–1.29); brand recall, OR = 1.16 (1.05–1.29) and high receptivity to alcohol marketing, OR = 1.77 (1.27–1.48) predicted initiation. When receptivity to alcohol marketing was controlled, recall and recognition no longer statistically significantly predicted alcohol initiation
Hanewinkel and Sargent (2008) Germany 2005 10–16 (mean age 12.4)	Influence of exposure to alcohol use in movies on the initiation of alcohol use Exposure to Germany's box-office hit movies content-coded for on-screen alcohol use (consumption, implied possession and purchase of alcohol) including viewing on TV, DVD and video Initiation of alcohol drinking (unknown to parents); ever binge drinking (≥ 5 drinks in a row within 2 h)	Random selection of 42 secondary schools participated in Schleswig–Holstein, a State of Germany; 85% of all fifth–ninth grade students surveyed	Paper survey	3432 never drinkers	12–13 months 2708/3432 (79%)	Generalized linear models using log link, adjusted for clustering	Age Gender School socio-economic status Parental drinking pattern Parenting style Friend drinking School performance TV in bedroom TV watching time Sensation seeking/rebelliousness	The estimated mean movie alcohol exposure was 3.2 h, subsequently divided into four quartiles. Thirty-three percent of students initiated drinking without parental knowledge and 14% binge drinking (five or more drinks within 2 h). Compared with quartile 1, the adjusted RRs (95% CI) for drinking without parental knowledge were 1.42 (1.16–1.74) for Q2, 1.94 (1.65–2.28) for Q3 and 2.0 (1.69–2.37) for Q4; and for binge drinking 1.44 (0.96–2.17) for Q2, 1.95 (1.27–3.0) for Q3 and 2.23 (1.48–3.37) for Q4

(Continued)

Table 1 Continued

Study [reference] Country Baseline survey date Age group (years)	Study objective Alcohol marketing and media exposure Drinking behaviour outcome measure ^a	Sample/study design	Survey method	Baseline sample size	Follow-up (months) Follow-up rate	Analysis	Covariates/ confounders analysed	Outcome at follow-up
Wills <i>et al.</i> (2008) USA 2003 10–14	Influence of exposure to alcohol use in movies on ever use of alcohol, binge drinking and alcohol-related problems Exposure to US box-office hit movies content-coded for on-screen alcohol use (consumption, implied possession and purchase of alcohol) Initiation of alcohol drinking (unknown to parents); ever binge drinking (≥ 5 drinks in a row); recent binge drinking; whether experienced problems caused when someone drinks alcohol	Random longitudinal digit dial telephone survey of adolescents aged 10–14 years	Telephone survey with computer-assisted telephone- interviewing procedure	6522	8, 16 and 24 5503/6522 (84%) at 8 months; 5019 (77%) at 16 months; 4574 (70%) at 24 months	Structural equation modelling analysis	Age Gender Ethnicity Parenting (maternal responsiveness and maternal monitoring) Rebelliousness Sensation seeking Self-regulation School performance Availability of alcohol at home Friend's use of alcohol Expectancy about alcohol Parental use of alcohol Parental education Family structure Family income Urbanicity Region	Viewed alcohol use in movies averaged 31 min at baseline, 35 min at 8 months, 30 min at 16 months. Movie alcohol exposure at baseline predicted alcohol use at 8 months (coefficient = 0.1). Movie alcohol exposure between baseline and 8 months did not predict alcohol use at 8 months (coefficient = -0.03), but did predict alcohol problems at 16 months (coefficient = 0.13). Movie alcohol exposure between 8 and 16 months predicted alcohol use at 16 months (coefficient = 0.08). At all times, alcohol use predicted alcohol problems and there were significant indirect and independent effects of movie exposure at baseline, 8 and 16 months on alcohol problems at 24 months
McClure <i>et al.</i> (2008). Same sample as Wills <i>et al.</i> (2008) above USA 2003 10–14	Influence of ownership of alcohol branded merchandise (ABM) on the initiation of alcohol use and binge drinking ABM (e.g. clothing, headwear, jewellery, key chains, shot glasses, posters, pens) ownership Initiation of alcohol drinking (unknown to parents); ever binge drinking (≥ 5 drinks in a row)	Random digit dial telephone survey of adolescents aged 10–14 years	Telephone survey with computer-assisted telephone- interviewing procedure	4309 non-drinkers	8 and 16 3762/4309 (87%) at 8 months 3317/4309 (77%) at 16 months	Logistic regression to estimate hazards ratios (HR)	Age Gender Ethnicity Susceptibility to alcohol use (response to peer offers, intentions and positive expectancies) Exposure to movie alcohol use Peer drinking Parent drinking Alcohol availability at home Sensation seeking Rebelliousness Parenting (maternal responsiveness and maternal monitoring) Extracurricular activities School performance TV viewing length of time Parent report education Household income	ABM ownership increased from 11% at baseline to 20% at 16 months. 10% of adolescents tried drinking for the first time and 5% tried binge drinking during each of the two 8-month periods. There was a reciprocal relationship between susceptibility and ABM ownership. Ownership of ABM at baseline did not have a significant direct impact on alcohol initiation at 8 months (HR = 1.41, 95% CI: 0.98–2.01), nor on alcohol initiation between 8 and 16 months (HR = 1.57, 95% CI: 0.99–2.5), but did on initiation of binge drinking at 8 months (HR = 1.80, 95% CI: 1.28–2.54), but not initiation of binge drinking between 8 and 16 months (HR = 1.44, 95% CI: 0.90–2.31). New ownership of ABM at 8 months had a significant direct impact on alcohol initiation at 16 months (HR = 2.31, 95% CI: 1.6–3.35) and initiation of binge drinking at 16 months (HR = 2.22, 95% CI: 1.49–3.32)

^aAlthough some included studies measured additional outcomes, this systematic review was concerned with longitudinal studies measuring self-reported drinking behaviour at follow-up. Thus, it is the only outcome measure detailed in this table.

et al., 1994; Casswell and Zhang, 1998; Casswell *et al.*, 2002), by postal survey in one (Fisher *et al.*, 2007) and computer-aided telephone interview in three (Snyder *et al.*, 2006; Sargent *et al.*, 2006; McClure *et al.*, 2008; Wills *et al.*, 2008). One study used digital photography and GPS positioning to ascertain exposure and self-reported questionnaire for consumption data (Pasch *et al.*, 2007).

Connolly *et al.* (1994) investigated the impact of the number of commercial advertisements recalled at ages 13 and 15 years on average and maximum amounts of alcohol consumed on an occasion and on the frequency of drinking and age 18 years amongst 667 participants in a multi-disciplinary longitudinal study of growth and development in New Zealand. There was no significant relationship with wine and spirit consumption. For males, the number of commercial advertisements recalled at age 15, but not 13, predicted average ($P = 0.047$) and maximum amounts of beer ($P = 0.008$) consumed on an occasion. For females, the number of commercial advertisements recalled at age 13, but not 15, predicted the frequency of beer consumption ($P = 0.029$). Although significant relationships were detected, they could have been due to chance, since results for more than 35 statistical tests were reported. Based on the same cohort, Casswell and Zhang (1998) followed 630 aged 18 beer drinkers until age 21 years, and found that liking of alcohol advertisements at age 18 predicted beer consumption at age 21 [standardized coefficient 0.36 (SE = 0.06, $T = 6.6$)]. The measure of liking of alcohol advertising was based on responses to three items: 'alcohol advertisements have plenty of action'; 'alcohol advertisements show the type of people I admire'; 'Comparing alcohol adverts generally with other ads, which of the following you most agree with?' Based on the same cohort, Casswell *et al.* (2002) studied 714 participants who were alcohol drinkers at ages 18, 21 and 26 years, and found that liking of alcohol advertisements at age 18 did not predict trajectories of quantities of alcohol consumed per occasion for both men and women over the age 18–26 years. Liking of alcohol advertisements at age 18 marginally predicted being in a higher trajectory for the frequency of drinking for men (OR = 1.6, $P = 0.0706$), but not for women over the age 18–26 years.

Robinson *et al.* (1998) studied the impact of media exposure (TV, music video and videotape viewing, and computer and video game use) on initiation of alcohol use and maintenance of drinking among existing drinkers amongst 1533 14- to 15-year olds from six public high schools in California. During 18-months follow-up, 325 (36%) baseline non-drinkers initiated drinking and 322 (51%) drinkers continued drinking. Controlling for the effects of age, gender, ethnicity, and the exposure to other media, each 1-h increase per day in television viewing was associated with a 9% increased risk for initiating drinking [OR = 1.09 (1.01–1.18)]. Each 1-h increase per day in watching music videos was associated with a 31% increased risk for initiating drinking [OR = 1.31 (1.17–1.47)]. During 18-month follow-up, 322 (51%) drinkers continued drinking. There were no significant associations between media exposure and the maintenance of drinking.

Stacy *et al.* (2004) studied the impact of TV alcohol commercials on alcohol use amongst 2250 12- to 13-year-old school children in California. At baseline, 16% reported drinking beer, 15% wine and 8% three-drink episodes in the past month. At 12-month follow-up, the prevalence was 18% reported drink-

ing beer, 20% wine and 12% three-drink episodes. At 1-year follow-up, each one standard deviation increase in alcohol advertising exposure as measured by the watched TV shows index was associated with a 44% increase in odds of beer drinking (95% CI: 27–61%), a 34% increase in odds of wine/liquor drinking (95% CI: 17–52%) and a 26% increase in odds of consuming three or more drinks on one occasion (95% CI: 8–48%) during the previous 30 days, controlling for covariates related to drinking behaviour. Self-reported frequency of exposure was also positively associated with beer drinking, OR = 1.21 (95% CI: 1.04–1.41), but not to wine/liquor drinking or three or more drinks on one occasion. The cued-recall memory test and draw-an-event memory test did not show significant relationships with any of the outcomes, and, although the relationships were in the direction of positive associations, there was one exception, the draw-an-event memory test being associated with a reduced risk of beer use (OR = 0.86, 95% CI: 0.75–0.99).

Van den Bulck and Beullens (2005) studied the impact of TV and music video exposure on the use of alcohol whilst going out amongst 2546 first- and fourth-year secondary school students in Flanders, Belgium. Two-thirds of students (64%) watched music videos at least several times a week, and about one-third watched daily. The quantity of alcohol consumed while going out at follow-up period related to overall TV viewing ($\beta = 0.068$, $t = 3.46$, $P = 0.001$) and music video exposure ($\beta = 0.073$, $t = 3.05$, $P = 0.004$).

Ellickson *et al.* (2005) studied the impact of exposure to different forms of alcohol advertising on the initiation of alcohol use and the frequency of drinking amongst existing drinkers, and whether exposure to a prevention programme mitigates any such relationship amongst US adolescents aged 12–13 years. Forty-eight percent of 1206 grade 7 non-drinkers consumed alcohol during the previous year at grade 9. Bivariate relationships found a significant impact of all types of alcohol advertisement exposure on initiation of drinking. Controlled for main confounders, including exposure to all different types of advertising and the impact of the prevention programme, exposure to beer concession stands at sports or music events predicted the drinking onset for non-drinkers in the previous 12 months (OR = 1.42, $P < 0.05$), whereas exposure to TV beer adverts (OR = 1.05, $P > 0.05$), magazines with alcohol advertisements (OR = 1.12, $P > 0.05$) and exposure to in-store advertisements (OR = 1.06, $P > 0.05$) did not. Weekly television viewing, controlled for alcohol advertisement exposure, was inversely related to the onset of drinking, explained as a 'babysitter' effect, whereby youth who watch more TV have fewer opportunities to drink. Seventy-seven percent of 1905 grade 7 drinkers consumed alcohol in the previous year at grade 9. Exposure to beer concession stands at sports or music events predicted the frequency of drinking amongst existing drinkers in the previous 12 months (coefficient = 0.09, $P < 0.05$), as did exposure to magazines with alcohol advertisements (coefficient = 0.10, $P < 0.05$), whereas exposure to TV beer adverts (coefficient = -0.01 , $P > 0.05$) and exposure to in-store advertisements (coefficient = 0.02, $P > 0.05$) did not.

Snyder *et al.* (2006) studied the impact of alcohol advertising expenditures and the degree of exposure to alcohol advertisements (TV, radio, outdoor advertising and magazines) on alcohol use amongst 15- to 26-year olds in 24 Nielsen local geographical media markets (a company that tracks media

exposure) in USA. Individuals were randomly sampled within households and households within media markets. Local geographical markets were systematically selected from the top 75 media markets in the US representing 79% of the population. For those aged <21 years, each additional alcohol advertisement seen increased the number of drinks consumed in the previous month by 1% (event rate ratio = 1.01, 95% CI: 1.001–1.021). Each additional dollar per capita spent on alcohol advertisements increased the number of drinks consumed in the previous month by 2.8% (event rate ratio = 1.028, 95% CI: 1.002–1.056). Seeing more or fewer advertisements in a particular month than he or she typically saw was a predictor of drinking (event rate ratio = 1.002, 95% CI: 1.001–1.003). The study has been criticized for the attrition in the study sample (from 1872 at wave one to 588 at wave four), and for confusing correlation with causality (Schultz, 2006; Smart, 2006). However, attrition was greatest among the heaviest drinking segment of the sample, suggesting under-estimation in the findings, and although the study provided associational, prospective evidence on alcohol advertising effects on youth drinking, it addressed limitations of other research, particularly the unreliability of exposure measures based on self-reporting (Snyder and Slater, 2006).

Sargent *et al.* (2006) conducted a randomized school-based cross-sectional survey, with longitudinal follow-up amongst 2406 non-drinkers at baseline 12–26 months later, to evaluate the impact of exposure to alcohol use in popular contemporary movies and incident alcohol drinking. Baseline median exposure to alcohol use in 601 movies was 8.6 h, [inter-quartile range (IQR) = 4.6–13.5]. Out of 2406 students, 357 (15%) initiated drinking alcohol. Exposure predicted the use of alcohol during the follow-up period (OR = 1.15, 95% CI: 1.06–1.25). The analysis with quadratic exposure effect (OR = 0.996, 95% CI: 0.992–0.999) showed that the relationship between exposure of alcohol use in motion pictures and initiation of alcohol use was stronger among adolescents in lower exposure categories.

Collins *et al.* (2007) carried out a school-based longitudinal survey that evaluated the impact of exposure of alcohol marketing on beer use amongst 1786 grade 6 students (11- to 12-year olds) 1 year later. Seventeen percent reported past year beer drinking at grade 7. The odds ratios (95% CI) for beer drinking were ESPN cable network (an American cable television network dedicated to broadcasting and producing sports-related programming 24 h a day) 1.08 (0.83–1.42); other sports beer ads 1.19 (1.01–1.40); other TV beer ads 1.13 (0.95–1.34); magazine reading 0.96 (0.87–1.06); radio listening 1.17 (1.00–1.37); beer concessions 1.01 (0.91–1.13); in-store beer displays 1.03 (0.92–1.14); beer promotional items 1.76 (1.23–2.52). The joint effect of exposure to advertisements from all sources: $F(8, 28) = 8.36, P < 0.0001$, and from three TV sources: $F(3, 33) = 3.35, P < 0.05$. Twenty percent of youth in the 75th percentile of alcohol marketing exposure at grade 6 reported past year beer drinking at grade 7, compared with 13% in the 25th percentile.

Fisher *et al.* (2007) conducted a non-random, prospective cohort study to investigate the impact of ownership of or willingness to use an alcohol promotional item on the initiation of alcohol use and binge drinking (five or more alcohol drinks over a few hours at least once over the past year). Out of 3283 girls, 611 (19%) and of 2228, 384 boys (17%) initiated alcohol use. The odds ratio of alcohol initiation during the 12-month

period was 1.74 (1.37–2.19) for girls and 1.78 (1.36–2.33) for boys for those who owned or were willing to use an alcohol promotion item compared with those who did or would not. Out of 611 drinking girls, 149 (24%) and out of 384 drinking boys, 112 (29%) engaged in binge drinking. The odds ratio of binge drinking amongst drinkers was 1.79 (1.16–2.77) for girls and 0.87 (0.51–1.48) for boys for those who owned or were willing to use an alcohol promotion item compared with those who did or would not.

Pasch *et al.* (2007) investigated the impact of exposure of outdoor alcohol advertisements within 1500 feet (457 m) of 63 Chicago school sites of 61 schools that were part of Project Northland Chicago, a randomized controlled trial of an alcohol use prevention programme. On average, each school site had 14.8 alcohol advertisements within 1500 feet (457 m). Out of 2586, 2027 (78%) students followed up were non-users of alcohol at baseline, but initiation of alcohol use was not reported. The exposure to alcohol advertisements at sixth grade did not predict alcohol behaviour amongst sixth grade alcohol users and non-users at eighth grade, but, amongst sixth grade non-users, did predict at eighth grade intentions to use (e.g. 'do you think you will be drinking alcohol in the next month'), $f = 6.29, P = 0.01$; and outcome expectancies, $f = 4.62, P = 0.03$.

Henriksen *et al.* (2008) used a non-random longitudinal survey to investigate the influence of alcohol advertising and promotions on the initiation of alcohol use amongst 1080 non-drinking students. Twenty-nine percent of never drinkers at baseline had initiated alcohol use at follow-up. Brand recognition, OR = 1.15 (1.02–1.29); brand recall, OR = 1.16 (1.05–1.29); and high receptivity to alcohol marketing, OR = 1.77 (1.27–1.48) predicted initiation. When receptivity to alcohol marketing was controlled, recall and recognition no longer statistically significantly predicted alcohol initiation.

Hanewinkel and Sargent (2008) studied the impact of exposure to alcohol use in movies on initiation of alcohol use amongst 3432 never drinking German adolescents. Estimated mean movie alcohol exposure was 3.2 h, subsequently divided into four quartiles. One-third (33%) of students initiated drinking without parental knowledge and 14% initiated binge drinking (five or more drinks within 2 h) over 12- to 13-month follow-up. Compared with quartile 1, the adjusted RRs (95% CI) for drinking without parental knowledge were 1.42 (1.16–1.74) for Q2, 1.94 (1.65–2.28) for Q3, and 2.0 (1.69–2.37) for Q4; and for binge drinking 1.44 (0.96–2.17) for Q2, 1.95 (1.27–3.0) for Q3, and 2.23 (1.48–3.37) for Q4. The un-adjusted dose–response curve showed that the response was greatest for relatively low exposure adolescents. Adjusting for covariates accentuated this effect, because the attenuation was larger for the highly exposed adolescents; this was probably due to risk factors for alcohol use tending to cluster among the high exposure adolescents who are at risk for alcohol use for reasons other than their excessive media exposure. In another study, Hanewinkel *et al.* (2008) found a positive dose–response relationship between lack of parental movie restriction and risk of initiation of binge drinking amongst the same sample.

Wills *et al.* (2008) studied the impact of exposure to alcohol use in movies on ever use of alcohol, binge drinking and alcohol-related problems amongst a random sample of 6522 US 10- to 14-year olds. A previous survey had shown that 83% of movies viewed by the sample, including 57% of movies rated

as acceptable for child viewing, depicted alcohol use, with over half (52%), including one in five (19%) of child acceptable movies, containing at least one alcohol brand appearance, exposing the adolescents on average to 5.6 h of movie use and 244 alcohol brand appearances (Cin *et al.*, 2008). In the impact study, viewed alcohol use in movies averaged 31 min at baseline, 34 min at 8-month follow-up, and 30 minutes at 16-month follow-up. Movie alcohol exposure at baseline predicted alcohol use at 8 months (coefficient = 0.1). Movie alcohol exposure between baseline and 8 months did not predict alcohol use at 8 months (coefficient = -0.03) but did predict alcohol problems at 16 months (coefficient = 0.13). Movie alcohol exposure between 8 and 16 months predicted alcohol use at 16 months (coefficient = 0.08). At all times, alcohol use predicted alcohol problems and there were significant indirect and independent effects of movie exposure at baseline, 8 and 16 months on alcohol problems at 24 months. Using the same cohort, McClure *et al.* (2008) studied the impact of ownership of alcohol branded merchandise (ABM) on initiation of alcohol use and binge drinking. ABM ownership increased from 11% at baseline [the 8-month measurement period reported by Wills *et al.* (2008)] to 20% 16 months later. Ten percent of adolescents tried drinking for the first time and 5% tried binge drinking during each of the two 8-month periods. There was a reciprocal relationship between susceptibility to alcohol use (three survey items that assessed response to peer offers, intentions and positive expectancies) and ABM ownership. The ownership of ABM at baseline did not have a significant direct impact on alcohol initiation at 8 months (HR = 1.41, 95% CI: 0.98–2.01), nor on alcohol initiation between 8 and 16 months (HR = 1.57, 95% CI: 0.99–2.5), but did on initiation of binge drinking at 8 months (HR = 1.80, 95% CI: 1.28–2.54), but not on initiation of binge drinking between 8 and 16 months (HR = 1.44, 95% CI: 0.90–2.31). New ownership of ABM at 8 months had a significant direct impact on alcohol initiation at 16 months (HR = 2.31, 95% CI: 1.6–3.35) and initiation of binge drinking at 16 months (HR = 2.22, 95% CI: 1.49–3.32).

DISCUSSION

This review identified 13 longitudinal studies that have investigated the relationship between adolescent exposure to alcohol advertising and promotion and drinking. Twelve of the thirteen studies found evidence that such exposure predicts both the onset of drinking amongst non-drinkers and increased levels of consumption among existing drinkers. In each case, researchers controlled for key confounding variables, including family and peer drinking, and relevant demographic variables. The study that did not find an effect on behaviour examined the impact of exposure to outdoor advertising placed within 453 metres of schools (Pasch *et al.*, 2007). This study found an impact of exposure on intentions to drink in the next month.

Seven (Robinson *et al.*, 1998; Ellickson *et al.*, 2005; Sargent *et al.*, 2006; Hanewinkel and Sargent, 2008; Henriksen *et al.*, 2008; Wills *et al.*, 2008) of the eight studies that measured the impact of exposure on initiation of drinking included an interval or continuous level exposure measure, and all seven studies found a dose–response relationship. For example, in the study by Hanewinkel and Sargent (2008), there was a dose–response

relationship between hours of movie alcohol exposure and initiation of drinking without parental knowledge and binge drinking, steeper for low hours of exposure than higher; the study by Sargent *et al.* (2006) found a linear association between movie exposure portraying alcohol use and onset of alcohol use from zero incidence at zero exposure to an incidence of 20% when exposure reached 11 h. Two (Robinson *et al.*, 1998; Ellickson *et al.*, 2005) of the three studies that measured the impact of exposure on maintenance of drinking amongst baseline drinkers included an interval level exposure measure, one of which (Ellickson *et al.*, 2005) found a dose–response relationship with the frequency of drinking. Six of the seven studies (Connolly *et al.*, 1994; Stacy *et al.*, 2004; Van den Bulck and Beullens 2005; Sargent *et al.*, 2006; Snyder *et al.*, 2006; Pasch *et al.*, 2007) on alcohol use of the total sample of non-drinkers and drinkers at baseline included an interval level exposure measure, and all studies found a dose–response relationship. For example, in the study by Stacy *et al.* (2004), each one standard deviation increase in alcohol advertising exposure was associated with a 44% increase in odds of beer drinking, a 34% increase in odds of wine/liquor drinking and a 26% increase in odds of consuming three or more drinks on one occasion during the previous 30 days; in the study by Snyder *et al.* (2006) of US individuals aged 15–26 years, for each additional advertisement seen, the number of drinks consumed increased by 1%, and for each additional dollar spent per capita on alcohol advertisements, the number of drinks consumed increased by 3%; in the study by Collins *et al.* (2007), youth in the 75th percentile of alcohol marketing exposure at grade 6 were 50% more likely to be drinking at grade 7 than youth in the 25th percentile; finally, in the study by Pasch *et al.* (2007), the greater the exposure to outdoor advertising near schools, the greater the intention to drink (although, this study found no impact on drinking behaviour, possibly due to a lack of statistical power). It is clear, therefore, that longitudinal studies demonstrate that alcohol advertising, amongst other factors, encourages youth drinking.

As explained in the introduction, this review focused on longitudinal studies because the dimension of time makes them a particularly powerful way of untangling cause and effect. Nonetheless, cross-sectional studies, although only providing a snapshot of advertising exposure and levels of drinking, have consistently reported correlations between increased exposure and greater likelihood of current drinking (see Kuo *et al.*, 2003; McClure *et al.*, 2006; Hanewinkel *et al.*, 2007; Hurtz *et al.*, 2007). For example, the cross-sectional study of Hanewinkel *et al.* (2007) found a dose–response relationship between exposure to alcohol use from popular contemporary movies and alcohol use without parental knowledge and binge drinking in Germany. Therefore, despite their inherently weaker design, cross-sectional studies do corroborate the effects found by longitudinal studies. Advertising influences youth drinking.

Furthermore, both cross-sectional and longitudinal studies are likely to underestimate any effects, because they focus principally on advertising, which is only a part of the promotional effort that is put behind alcohol products. As noted in the introduction, for instance, the most recent estimate for expenditure on alcohol advertising in the UK is actually only a quarter of that for alcohol promotion as a whole. While some of the selected studies looked at promotion (e.g. merchandising) as well as advertising, none looked at the cumulative impact that

a coherent and fully fledged 'marketing communications mix' (Kotler *et al.*, 2005) may have. This communication effort is, in turn, only part of a company's marketing strategy that also includes price promotions, packaging, distribution and product design.

Three limitations should be considered in interpreting the results of this review. First, it included 13 studies that are comparatively heterogeneous. We controlled for quality by including only longitudinal studies that followed a cohort of individuals. We did not attempt to quantify the quality of other study characteristics. One of the limitations of observational studies is the relationship between the variables of interest and other confounding factors. Whilst all the studies to some extent, measured and controlled for other variables likely to be associated with drinking uptake, it is impossible to know if all relevant variables were measured and adjusted for, and thus not possible to know if residual confounder influenced the analysis.

Second, there is a possibility that publication bias may have affected the studies identified for inclusion. Other cohort studies that examined the relationship between advertising exposure and youth drinking but found no association may not have been published or may have been published with no reference to advertising and so would not be retrieved by our search strategy.

Third, the way in which exposure to advertising was operationalized varied across studies (e.g. receptivity, influence and awareness). An important methodological challenge in evaluating evidence on the effect of advertising on drinking behaviour of adolescents is to achieve standardization and consistency in measuring of exposure to alcohol advertising (for an example of standardization, see Jernigan and Ross (2007)).

CONCLUSION

This review found consistent evidence to link alcohol advertising with the uptake of drinking among non-drinking young people, and increased consumption among their drinking peers. This evidence comes from high quality longitudinal studies and is corroborated by weaker cross-sectional ones. Because it focuses on mass media advertising, it almost certainly underestimates the impact of wider alcohol promotion and marketing. These findings are not surprising: exactly the same conclusions have emerged from reviews of the impact of tobacco (Lovato *et al.*, 2003) and food (Hastings *et al.*, 2003) marketing on young people.

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