
Review

A Systematic Review of the Impact of Exposure to Internet-Based Alcohol-Related Content on Young People's Alcohol Use Behaviours

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Abstract

Aims: To conduct a systematic review of studies exploring the relationship between exposure to Internet-based alcohol-related content and alcohol use among young people.

Methods: Searches of electronic databases and reference lists of relevant articles were conducted to retrieve studies of relevance up until December 2015. Full texts of the studies that met the inclusion criteria were read, appraised for quality using the Kmet forms and guidelines, and included in this review.

Results: Fifteen relevant studies were identified. The included studies were a mix of cross-sectional, longitudinal, experimental and qualitative studies conducted in the USA, the UK, Australia and New Zealand. The age range of the participants involved in these studies was 12–25 years. Included studies employed a variety of study designs and a range of different exposure variables and outcome measures. Studies demonstrated significant associations between exposure to Internet-based alcohol-related content and intentions to drink and positive attitudes towards alcohol drinking among young people.

Conclusion: Exposure to alcohol-related content on the Internet might predispose young people to patterns of alcohol use by promoting alcohol as a natural and vital part of life. However, the research exploring the influence of this novel form of advertising on young people's alcohol use is emergent, and comprised primarily of cross-sectional studies. To evaluate the direction of the association between exposure to online alcohol-related content and alcohol use, we call for further research based on longitudinal designs.

Short summary: From 15 relevant studies identified, this review reports significant associations between exposure to Internet-based alcohol-related content and intentions to drink and positive attitudes towards alcohol drinking among young people, with different influences found at different stages of alcohol use.

INTRODUCTION

The alcohol industry portrays alcohol as a valuable commodity and associates it with strength, success, and fun (Casswell, 2004; Austin and Knaus, 2005; Austin *et al.*, 2006), and depicts alcohol

consumption as normative (Pettigrew *et al.*, 2012). The industry is often seen to be in discord with public health due to its efforts to encourage weaker policies, deter more effective ones (Dobson, 2012), and to target youth via alcohol advertising using various

marketing platforms (Smith and Foxcroft, 2009; Dobson, 2012). Researchers have previously explored the association between alcohol advertising on traditional media (such as TV, print, radio and billboards) and its effect on alcohol use among young people. These studies show that exposure to alcohol-related content influences young people's beliefs about and attitudes towards drinking (Casswell and Zhang, 1998; Wyllie *et al.*, 1998; Stacy *et al.*, 2004; Ellickson *et al.*, 2005; Sargent *et al.*, 2006; Snyder *et al.*, 2006; Thomsen and Rekve, 2006; Anderson *et al.*, 2009; Smith and Foxcroft, 2009). These studies have also demonstrated that exposure to alcohol advertising is likely to promote drinking among youth and increases the likelihood that they will consume more if they already drink (Anderson *et al.*, 2009; Griffin *et al.*, 2009; Babor *et al.*, 2010). A recent review examined the role of social media in alcohol use but did not use a systematic approach (Westgate and Holliday, 2016). The authors are not aware of any systematic reviews of studies investigating the relationship between exposure to Internet-based alcohol-related content and alcohol use among young people. Internet-based alcohol advertising is a relatively new form of advertising utilized by the alcohol industry to target young people in particular, and is therefore worthy of deeper investigation.

METHODS

Types of studies

A PICo (Population, Interest, and Context) framework was utilized to conceptualize the search strategy for this review (Appendix 1). Studies investigating the impact of exposure to Internet-based alcohol-related content on alcohol use among young people were included. Those that only included alcohol advertising in traditional media were excluded. If studies included alcohol-related content presented both online and in traditional media, these were included where the effects of online content were analysed separately. This strategy informed an exclusive estimation of the effect of exposure to Internet-based alcohol-related content on alcohol use among young people.

Studies utilizing cross-sectional, longitudinal, experimental and qualitative research designs were included in this review (Appendix 2). Reviews and mixed-methods studies were excluded because the Kmet forms and guidelines (a quality appraisal tool used to evaluate the quality of studies) do not provide quality appraisal measures for these (Kmet *et al.*, 2004).

Types of participants

The target age range for participants was 12–25 years. Studies that included young people as participants were excluded if results were not presented separately by age group.

Types of exposure

Given the dearth of studies directly assessing the topic of interest, studies exploring both exposure to user-generated online alcohol-related content (e.g. exposure to friends' online pictures of drinking, alcohol-related status updates) and exposure (content that is initiated by the alcohol industry as a part of their marketing efforts) to alcohol advertising were included. Studies were excluded if the results were not presented separately for online exposure to alcohol-related content so that the separate effect of online exposure could be assessed.

Types of outcome measures

In order to increase the available evidence base included in the review, studies that reported intention to drink or attitude to drinking were included along with those relating to self-reported alcohol use. Studies aimed at evaluating awareness of and responses to advertising in the absence of measured effects on drinking were excluded.

Identification of studies

We piloted search terms to balance specificity and sensitivity of the search terms and fields. Iterative refinements were carried out, including MESH terms. The literature search was carried out using online databases (Medline, Embase, PsycINFO, Scopus, CINAHL Plus, and Sociological abstracts) and search engines to identify academic and organizational papers up to December 2015 (Appendix 3). Reference lists of potentially relevant studies were also manually scanned to identify additional relevant studies. Searches were restricted to English language papers. To locate grey literature (documents published by organizations, rather than academic journal articles or books), Google Scholar, MedNAR, PsycEXTRA and NTIS (National Technical Information Service) were used. Theses and conference presentations related to the topic of review were also eligible.

Relevant articles were selected in three stages on the basis of the eligibility criteria described above (Appendix 2). Preliminary scrutiny of the titles was undertaken to remove articles irrelevant to the review. Next, articles deemed irrelevant by abstract content were discarded and full texts of the remaining potentially relevant articles were obtained. Manual reference searches were carried out on potentially relevant articles to increase the evidence base. Data from included studies were extracted and summarized as a narrative synthesis.

The search strategy retrieved 640 potentially relevant peer-reviewed articles. Ninety-three articles deemed relevant by titles and abstracts were identified for further consideration and full texts of these articles were obtained. Ten additional relevant articles were identified following the manual scanning of reference lists of retrieved articles. Ultimately, 15 articles that conformed to the eligibility criteria were included in this review (Fig. 1). After assessing the exposure and outcome measures reported by these studies, it was evident that the relevant variables were too heterogeneous to be combined into a single effect size estimate, or even clustered into several estimates.

Quality appraisal of included studies

Quality appraisal of the included studies was carried out using the Kmet forms and guidelines (Kmet *et al.*, 2004). These guidelines informed evaluation of quantitative and qualitative studies using different checklists/scoring systems. Rating of individual studies was carried out by two researchers independently (HG, RJT). The scores were calculated as (actual score/potential maximum score)*100 and the mean quality scores are reported in Table 1.

RESULTS

Characteristics of the included studies are tabulated in Table 1. Nine studies utilized a cross-sectional design (Gordon *et al.*, 2011; Jones and Magee, 2011; Glassman, 2012; Stoddard *et al.*, 2012; McClure *et al.*, 2013; Hoffman *et al.*, 2014; Westgate *et al.*, 2014; Moreno *et al.*, 2014; Jones *et al.*, 2015), two studies were experimental

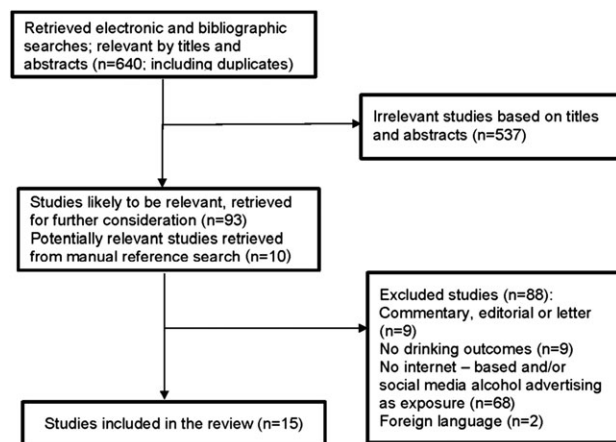


Fig. 1. Results of the articles search.

(Litt and Stock, 2011; Alhabash *et al.*, 2015), and one was longitudinal (Huang *et al.*, 2014). Three further studies adopted a qualitative approach (Moraes *et al.*, 2014; Cavazos-Rehg *et al.*, 2015; Barnes *et al.*, 2016). The quality scores for all 15 studies were higher than 65% (mean of 85%) and were thus deemed suitable for inclusion in the systematic review.

Ten studies were conducted in the USA (Litt and Stock, 2011; Glassman, 2012; Stoddard *et al.*, 2012; McClure *et al.*, 2013; Hoffman *et al.*, 2014; Huang *et al.*, 2014; Westgate *et al.*, 2014; Moreno *et al.*, 2014; Alhabash *et al.*, 2015; Cavazos-Rehg *et al.*, 2015), two in the UK (Gordon *et al.*, 2011; Moraes *et al.*, 2014), two in Australia (Jones and Magee, 2011; Jones *et al.*, 2015), and one in New Zealand (Barnes *et al.*, 2016).

The age range of the participants across these studies was 12–25 years. Studies operationalized exposure to alcohol-related content through various methods such as free-recall or recognition of advertising seen on social networking sites. Types of exposure included participants' exposure to user-generated online alcohol-related content (e.g., exposure to friends' online pictures of drinking, alcohol-related status updates, and posted pictures of alcohol use on Facebook) (Gordon *et al.*, 2011; Litt and Stock, 2011; Glassman, 2012; Stoddard *et al.*, 2012; Westgate *et al.*, 2014; Moreno *et al.*, 2014; Huang *et al.*, 2014; Cavazos-Rehg *et al.*, 2015; Barnes *et al.*, 2016) and exposure to alcohol advertising (Jones and Magee, 2011; McClure *et al.*, 2013; Hoffman *et al.*, 2014; Moraes *et al.*, 2014; Jones *et al.*, 2015; Alhabash *et al.*, 2015).

The primary outcomes of interest relate to youth alcohol use. In addition to estimates of quantities consumed, various proxy indicators for alcohol use were employed. Types of outcomes included measuring alcohol consumption intentions when exposed to alcohol status updates (Alhabash *et al.*, 2015) and participants posting pictures of themselves drinking on Facebook as evidence of their alcohol consumption (Glassman, 2012; Westgate *et al.*, 2014; Moreno *et al.*, 2014). Other combinations of predictors and outcomes included exposure to alcohol advertising as a predictor of uptake of drinking and increased frequency of drinking (Jones *et al.*, 2015) and viewing Facebook profiles portraying alcohol use as normative among older peers as a predictor of greater willingness to use alcohol (Litt and Stock, 2011). Stoddard and colleagues used the prevalence of alcohol content on social networking websites and peer AOD use as predictors of alcohol use (2012), while an increase in participant recall of Internet advertising of alcohol was used as a

predictor of heavy drinking in another study (McClure *et al.*, 2013). Westgate *et al.* (2014) utilized posting of alcohol-related content on Facebook as a positive and independent predictor of number of drinks consumed per week, alcohol-related problems, risk of alcohol use disorders, and alcohol cravings. Lastly, the number of pro-alcohol Tweets was considered an outcome measure of the normalization of drinking by Cavazos-Rehg *et al.* (2015).

Individual studies

Studies on exposure to user-generated online alcohol-related content Glassman (2012) conducted a cross-sectional survey to examine whether posting pictures of alcohol consumption on Facebook of oneself or friends was associated with the number of drinks consumed per week. The study found posting pictures of themselves drinking on Facebook was the strongest predictor of respondents' reported alcohol consumption for students of both genders and across the legal drinking age groups, after controlling for demographic factors ($P = 0.0001$).

A cross-sectional study conducted by Gordon *et al.* (2011) explored drinking behaviours and future drinking intentions through participants' recall of alcohol marketing awareness across multiple forms of alcohol marketing, including social networking sites. Results suggested that participation in electronic alcohol marketing (including social networking sites) was significantly associated with drinking, albeit within a small sample ($n = 72$, $P < 0.001$).

In an experimental study conducted by Litt and Stock (2011), participants viewed experimenter-created Facebook profiles of older high school students portraying alcohol use as normative and rated those profiles. Participants viewed experimenter-created Facebook profiles of older high school students portraying alcohol use as normative (including photographs of the students drinking or not drinking, and drinking or non-drinking-related comments made by friends, depending on the experiment condition). Participants then rated those profiles on a series of personality traits. Participants were randomly assigned to one of two Facebook conditions – either an alcohol user condition or a control condition. Alcohol-related cognitions (including willingness to drink alcohol) were assessed after viewing the assigned Facebook profiles. Results showed that participants who viewed Facebook profiles portraying alcohol use as normative among older peers reported greater willingness to use alcohol ($P = 0.01$), more acceptance towards alcohol use ($P = 0.04$), and lower perceived vulnerability towards alcohol-related consequences ($P = 0.01$) compared to those in the control condition.

A cross-sectional study conducted by Stoddard *et al.* (2012) measured frequency of alcohol use in the past 30 days, prevalence of alcohol-related online behaviours (e.g. uploading alcohol-related pictures and posts on social networking sites), attitudes about posting pictures of alcohol and other drug (AOD) use on social networking sites, peer AOD use, peer support online and offline, and anticipated regret about the consequences of posting evidence of AOD use online. Past 30 day alcohol use was significantly and positively associated with greater exposure to social network alcohol content and peer AOD use ($P < 0.01$). Young adults with higher educational attainment were more likely to report more alcohol use ($P < 0.01$). No significant associations were found between posting alcohol content on social networking websites and alcohol use, including when analysed separately for sex, age and race/ethnicity.

Westgate *et al.* (2014) used a cross-sectional study design to investigate the relationship between posting and viewing alcohol-

Table 1. Characteristics of included studies, subdivided into passive exposure and active exposure studies

Study characteristics	Participants' characteristics	Analysis (Kmet quality rating*)
Passive exposure studies		
<ul style="list-style-type: none"> • Study: Glassman (2012) • Design: Cross-sectional • Location: USA • Data collection: Online questionnaire 	<ul style="list-style-type: none"> • Sample: $n = 445$, recruited from a large U.S. Midwestern public university, with 73% of the participants aged 18–22 years ($M = 23.09$, $SD = 7.45$) • Sex: Female 60% • Ethnicity: Caucasian (76%), African -American (11%), Asian/Pacific Islander (4%), Hispanic (2%), American Indian/Alaskan Native (0.5%), other ethnic groups (5%) 	<ul style="list-style-type: none"> • Chi square tests, multiple linear regression, and independent-samples t-test with control for confounders. Data were analysed separately for gender, age, race/ethnicity, grades, Sorority/Fraternity • (0.91)
<ul style="list-style-type: none"> • Study: Gordon et al. (2011) • Design: Cross-sectional • Location: Scotland, UK • Data collection: Face-to-face interviews, accompanied by a self-completion questionnaire 	<ul style="list-style-type: none"> • Sample: $n = 920$, second year pupils, aged 12–14 years, attending schools in three local authority areas in the West of Scotland. • Sex: Female 53% • Ethnicity: White (93%), Asian (3%), mixed race (1%), Black (1%), Chinese and other (< 1%) 	<ul style="list-style-type: none"> • Regression analyses, with multiple control variables (age, gender, social grade (based upon occupation of head of household), ethnicity and religion) • (0.95)
<ul style="list-style-type: none"> • Study: Litt and Stock (2011) • Design: Experimental • Location: USA • Data collection: Data collection method not reported (Showing experimenter created Facebook profiles) 	<ul style="list-style-type: none"> • Sample: $n = 189$, adolescents aged 13–15 years ($M = 14.7$, $SD = 0.77$) recruited from five private high schools, a swim team, and a church youth group • Sex: Female 51% • Ethnicity: As the study involved seeking information on illegal behaviours of minors, IRB did not allow collection of ethnic/racial information to protect anonymity 	<ul style="list-style-type: none"> • MANCOVA, and bootstrap estimation multiple mediation analysis with multiple control variables (age, gender, past alcohol use, school site, and hours on Facebook) • (0.68)
<ul style="list-style-type: none"> • Study: Stoddard et al. (2012) • Design: Cross-sectional • Location: USA • Data collection: Online survey 	<ul style="list-style-type: none"> • Sample: $n = 3448$, college students, aged 18–24 years recruited through an online Facebook advertisement. • Sex: Female 48.4% • Ethnicity: White (70%), African American (5%), Asian/Pacific Islander (11%), Hispanic/Latino (8%), Native American (1%), other (1%), Multiracial (2%) 	<ul style="list-style-type: none"> • Pearson's correlations and multivariate regression analyses, weighted sample was used. Analysed weighted sample $n = 817$. Data were not controlled for potential confounding • (0.91)
<ul style="list-style-type: none"> • Study: Westgate et al. (2014) • Design: Cross-sectional • Location: USA • Data collection: Online survey 	<ul style="list-style-type: none"> • Sample: $n = 1099$, full time undergraduate students aged 18–25 years ($M = 20.40$, $SD = 1.60$) randomly selected from large university in the Pacific Northwest • Sex: Female = 654, male = 449, transgender = 2, 1 declined to answer • Ethnicity: 59% White, 27% Asian, 8% biracial or multiracial, and the remaining 6% Black/African American, American Indian/Alaska Native, Native Hawaiian/other Pacific Islander, unknown, or declined to answer 	<ul style="list-style-type: none"> • Factor analysis, Pearson's correlations and regression, with multiple control variables – gender, drinking motives number of Facebook friends • (0.91)
<ul style="list-style-type: none"> • Study: Huang et al. (2014) • Design: Longitudinal • Location: USA • Data collection: Online survey 	<ul style="list-style-type: none"> • Sample: $n = 1563$, tenth grade adolescents (average age 15 years) across five Southern California high schools • Sex: Female: Male- evenly distributed • Ethnicity: 67% Hispanic, 33% Asian 	<ul style="list-style-type: none"> • Linear regression models, controlled for effects of online activity with friends on smoking and alcohol use outcomes at time-point 2 • (0.82)
<ul style="list-style-type: none"> • Study: Moreno et al. (2014) • Design: Cross-sectional • Location: USA • Data collection: Social Network Study, a longitudinal study of high school adolescents 	<ul style="list-style-type: none"> • Sample: $n = 224$, aged 18–20 years) enrolled at two state universities • Sex: Female = 122, male = 102 • Ethnicity: 68% White, 32% Others 	<ul style="list-style-type: none"> • Fisher exact test and Chi- square tests, zero-inflated negative binomial (ZINB) regression. Data were controlled for age and sex • (0.91)
<ul style="list-style-type: none"> • Study: Cavazos-Rehg et al. (2015) • Location: USA • Data collection: Tweets containing alcohol- or drinking-related keywords were collected from March 13 to April 11, 2014 	<p>Sample: $n = 5000$, random sample of drinking-related Tweets in the English language</p>	<ul style="list-style-type: none"> • Thematic analyses of the Tweets collected • (0.80)

Continued

Table 1. Continued

Study characteristics	Participants' characteristics	Analysis (Kmet quality rating*)
<ul style="list-style-type: none"> • Study: Barnes et al. (2016) • Design: Group discussions (recruited by word-of-mouth and snowballing techniques) • Location: New Zealand • Data collection: 34 Focus groups (ranged mainly between 3 and 7 participants, with 2 groups of 2 participants) and 23 individual interviews 	<ul style="list-style-type: none"> • Sample: $n = 141$, aged 18–25 years recruited from multiple start-points, including workplaces, universities and community groups. • Sex: Female = 80, male = 57, Fa'afafine = 4 • Ethnicity: Maori, Pasifika, (e.g. Pacific Islander), and Pakeha (e.g. European) 	<ul style="list-style-type: none"> • Thematic analyses for focus group data and a multi-modal approach to individual interviews • (0.75)
Direct exposure studies		
<ul style="list-style-type: none"> • Study: Alhabash et al. (2015) • Design: Experimental design: <ul style="list-style-type: none"> – x3 display ad type (alcohol ad vs. anti-binge drinking public service announcement vs. local bank) – x2 likes (low vs. high) – x2 shares (low vs. high) – x6 status update repetitions • Location: USA • Data collection: Online questionnaire 	<ul style="list-style-type: none"> • Sample: $n = 413$, recruited from introductory classes at a large U.S. Midwestern university, with a mean age of 21 years ($M = 20.58$, $SD = 1.52$) • Sex: Female 57.1% • Ethnicity: White/Caucasian (77.2%), Other (22.8%) 	<ul style="list-style-type: none"> • Linear regression model with no control for confounders. Genders not analysed separately • (0.67)
<ul style="list-style-type: none"> • Study: Hoffman et al. (2014) • Design: Cross-sectional • Location: USA • Data collection: Online survey 	<ul style="list-style-type: none"> • Sample: $n = 737$, college students (average age 21.4 years) recruited from two universities, one public (61% of participants) in the Pacific Northwest and the other private (39% of participants), Catholic university in the Northeast • Sex: Female (68%), male (32%), ($n = 91$ did not report their sex) • Ethnicity: Caucasian (76%), African American (3%), Asian (7%), Hispanic (4%), other (3%), 7% declined to report their ethnicity 	<ul style="list-style-type: none"> • Multiple regression analyses, with multiple control variables (sex, age, reported family income, reported grades in school, expectations for educational attainment, year in college, and university affiliation) • (0.86)
<ul style="list-style-type: none"> • Study: Jones and Magee (2011) • Design: Cross-sectional • Location: NSW, Australia • Data collection: Online and offline surveys 	<ul style="list-style-type: none"> • Sample: $n = 1113$, adolescents aged 12–17 years recruited from high schools, shopping malls, online Facebook advertising, and a parallel focus group study on consumption of alcopops • Sex: Female 57.5% • Ethnicity: Not collected 	<ul style="list-style-type: none"> • Logistic regression, with multiple control variables – age, gender, country of birth, religion, parents' alcohol consumption, siblings', and friends' alcohol consumption • (1.00)
<ul style="list-style-type: none"> • Study: Jones et al. (2015) • Design: Cross-sectional • Location: Australia • Data collection: Online survey 	<ul style="list-style-type: none"> • Sample: $n = 283$, Australian Facebook users aged 16–24 years recruited via a market research panel, iView • Sex: Female 71.7% • Ethnicity: Not collected (85.9% born in Australia) 	<ul style="list-style-type: none"> • Chi square and logistic regression, with multiple control variables – gender, age, education, employment, and country of birth • (0.91)
<ul style="list-style-type: none"> • Study: McClure et al. (2013) • Design: Cross-sectional • Location: USA • Data collection: Phone and web-based survey • (NB Conference abstract) 	<ul style="list-style-type: none"> • Sample: $n = 2012$, younger than 21 years • Sex: Not reported in the abstract 	<ul style="list-style-type: none"> • Logistic regression, with multiple control variables – age, gender, race, sensation-seeking, friend and parent drinking. All estimates were weighted to account for sampling bias • (0.86)
<ul style="list-style-type: none"> • Study: Moraes et al. (2014) • Design: Online recruitment • Location: UK • Data collection: 3 Focus groups (ranged mainly between 4 and 6 participants per group) and netnographic study (conducted between March and June 2011) 	<ul style="list-style-type: none"> • Sample: $n = 15$, Facebook users aged 18–24 years recruited online via a web portal. The netnographic study involved collecting data from alcohol-related groups, nightclub groups and pages, and official brand pages through Facebook ($n = 11$) • Sex: Female 75% 	<ul style="list-style-type: none"> • Template analyses for both focus group data and netnographic or online ethnography) data. Data were managed using NVivo9 • (0.90)

*Mean quality rating: the scores by each assessor were calculated as (actual score/potential maximum score).

related content on Facebook and alcohol use (drinking motives, alcohol consumption, alcohol problems, alcohol use disorders and alcohol cravings). After controlling for drinking motives, posting alcohol-related content on Facebook was found to be significantly associated with number of drinks consumed per week, alcohol-

related problems, risk of alcohol use disorders and alcohol cravings (all $P < 0.001$).

[Huang et al. \(2014\)](#) conducted a longitudinal study with 1563 10th grade adolescents across five Southern California high schools. The study assessed their Myspace and Facebook use and online risk

behaviours. Exposure to friends' online pictures of partying or drinking were found to be significantly associated with alcohol use ($P < 0.05$).

Moreno *et al.* (2014) conducted a cross-sectional study with 224 undergraduate students aged 18–20 years with public Facebook profiles who were enrolled at two US state universities. The study explored the associations between displayed alcohol use and intoxication/problem drinking (I/PPD) references on Facebook, and self-reported problem drinking. Male I/PPD displayers had an 89% higher Alcohol Use Disorders Identification Test (AUDIT) score than their non-displayer counterparts ($P = 0.001$). However, no significant associations were found for female participants ($P = 0.07$). The I/PPD displayers also reported more incidents of an alcohol-related injury in the past year ($P = 0.002$) compared to the alcohol displayers (19% vs 7%) and the non-displayers (19% vs 3%).

A qualitative study conducted by Cavazos-Rehg *et al.* (2015) thematically analysed a random sample of drinking-related Tweets. Results suggested that of the 4800 drinking-related Tweets collected, 3813 were pro-alcohol. Most of the pro-alcohol Tweets were associated with normalizing and/or encouraging drinking. Pro-drinking Tweets outnumbered the anti-drinking Tweets by a factor of 10. It was concluded that although it is difficult to determine the extent to which these Tweets correspond to real drinking behaviours, it could be inferred that people (especially young people) use social media to reveal their intent to drink.

Barnes *et al.* (2016) qualitatively explored the practices of being 'drunk while online' and 'drinking while online'. Thematic analyses of focus group and individual interview data found that youth engagement with social networking sites encourages cultures of intoxication, normalizes heavy drinking, and reinforces a culture of risky drinking.

Studies on exposure to online alcohol advertising

Alhabash *et al.* (2015) investigated the spread of social media content through 'viral' behaviours such as 'liking', sharing, and commenting on messages. They presented participants with alcohol marketing Facebook status updates (usually short messages on the user's thoughts, feelings or whereabouts) and advertisements, and assessed their attitudes and viral behaviour intentions toward the stimuli. Participants were exposed to 12 Facebook screenshots in random order. Each screenshot was followed by collection of information on the above variables. Alcohol consumption intentions were found to be higher when participants' attitudes toward alcohol status updates ($P < 0.05$) and their viral behavioural intentions toward status updates ($P < 0.01$) were more positive. Intentions towards drinking alcohol were significantly related to viral behavioural intentions for status updates ($P < 0.001$), even in the condition where an anti-binge-drinking message was present.

Hoffman *et al.* (2014) assessed recall of social media exposure to alcohol marketing content in the past 3 months, alcohol use during the past 30 days, problem drinking, and quantity of alcohol usually consumed on a single occasion. Exposure to alcohol-related social media was significantly associated with more frequent alcohol use ($P < 0.001$), problem drinking ($P < 0.001$), and higher quantities consumed on a single occasion ($P < 0.001$). The results represent a plausible reciprocal relationship between participants' exposure to alcohol marketing content in social media and alcohol-related behaviours rather than an exclusively predictive one. For example, alcohol users and/or those interested in alcohol use may look for alcohol marketing messages more frequently than other people.

Jones and Magee (2011) evaluated the relationship between drinking patterns and recall of exposure to alcohol advertising across various media (television, newspapers, magazines, bars or pubs, billboards/posters, the Internet, and promotional materials) via an online survey. Exposure to Internet advertising was significantly associated with frequency of alcohol consumption in the past 12 months among males aged 12–15 years (adjusted odds ratio (AOR) = 2.18, $P < 0.05$). However, the results for males aged 16–17 years and for females across the age groups were not statistically significant. Similarly, alcohol advertising on the Internet was significantly associated with the frequency of alcohol consumption in the previous four weeks among males aged 12–15 years (AOR = 3.05, $P < 0.05$), but not among females across the age groups.

McClure *et al.* (2013) investigated the association between Internet advertising exposure and underage drinking using telephone and web-based surveys. Participants were asked to recall having seen alcohol advertising on the Internet, visiting any alcohol websites, recognizing five specific alcohol home pages, and being an online 'fan' of an alcohol brand. After controlling for covariates and weighting all the estimates to control for sampling bias, the odds of 'binge' drinking increased by 39% (AOR = 1.39) for every point increase in the Internet score. Exposure to Internet alcohol advertising was not significantly associated with initiation of alcohol use. This was in contrast to exposure to television advertising, which was positively associated with initiation. It should be noted that these results were reported in a conference abstract and it was not possible to obtain further data on the study.

An Australian study (Jones *et al.*, 2015) explored the association between alcohol-related behaviour and interaction with alcohol advertising and branding on Facebook via an online survey. Interaction with alcohol brands on Facebook was significantly and positively associated with reported frequency of alcohol consumption ($P < 0.001$). Similarly, interaction with alcohol advertising and branding on Facebook was strongly associated with quantity of alcohol consumed ($P < 0.001$). A significant association was also found between interaction with alcohol brands on Facebook and heavy episodic drinking ($P = 0.002$).

Moraes *et al.* (2014) conducted a netnographic study (defined as a form of ethnography used to study online cultures and communities) that involved collecting data from alcohol-related groups online. Results indicated that alcohol brands and nightclubs use Facebook as a channel to facilitate pro-alcohol communication and reproduce user-generated references and conversations relating to drinking, which promote a heavy drinking culture among young adults.

DISCUSSION

To our knowledge, this review is the first to explore the impact of exposure to Internet-based alcohol-related content on alcohol use among young people. This systematic review found that exposure to Internet-based alcohol-related content was consistently associated with young people's alcohol use. The included studies employed various study designs and a range of exposure and outcome measures. However, despite the heterogeneity of designs and measures, the results were consistent across studies.

Overall, the findings suggest that exposure to alcohol-related content in online environments predisposes young Internet users to pro-alcohol discourses and constitutes an active and continuous conduit for the flow of apparently enjoyable peer-to-peer transmissions of marketers' messages (Stoddard *et al.*, 2012; Glassman, 2012;

Moraes *et al.*, 2014; Westgate *et al.*, 2014; Cavazos-Rehg *et al.*, 2015). These environments have been described elsewhere as ‘cultures of intoxication’ (Measham, 2006:258; Barnes *et al.*, 2016), ‘intoxicogenic social environments’ (McCreanor *et al.*, 2008:2), or ‘alcoegenic environments’ (Huckle *et al.*, 2012:1614). Exposure to both consumer and alcohol industry created content are likely to promote positive attitudes towards alcohol use (Litt and Stock, 2011; Moraes *et al.*, 2014; Winpenny *et al.*, 2014; Huang *et al.*, 2014; Cavazos-Rehg *et al.*, 2015; Alhabash *et al.*, 2015), regular alcohol consumption (Jones and Magee, 2011; Gordon *et al.*, 2011; Stoddard *et al.*, 2012; Hoffman *et al.*, 2014; Jones *et al.*, 2015), cultures of heavy and risky drinking (Litt and Stock, 2011; Westgate *et al.*, 2014; Jones *et al.*, 2015; Barnes *et al.*, 2016), and alcohol-related problems and risk of developing alcohol use disorders among youth (McClure *et al.*, 2013; Westgate *et al.*, 2014; Hoffman *et al.*, 2014; Moreno *et al.*, 2014). However, from the current data it is difficult to establish the direction of influence – whether drinkers are more likely to create and engage with alcohol-related content while online, whether exposure to this content affects alcohol use at a later stage, or a combination of both. This warrants a call for longitudinal research that can establish the temporal ordering, if not definitive causality, between these two behaviours. Also, the differential influences of exposure to online alcohol-related content on stages of alcohol use (from initiation to augmenting existing use) necessitate further research to better understand this phenomenon.

There are several limitations that should be considered when interpreting the results of this review. The majority of the quantitative studies included in this review were cross-sectional (except two that were experimental and one that was longitudinal), and therefore have a greater likelihood of systematic biases than more robust study designs, such as longitudinal studies and RCTs. However, the majority of these studies employed statistical strategies to control for a number of potential confounding factors possibly related to alcohol consumption behaviours which made them less susceptible to the effect of systematic bias (Gordon *et al.*, 2011; Jones and Magee, 2011; Litt and Stock, 2011; Glassman, 2012; Stoddard *et al.*, 2012; McClure *et al.*, 2013; Hoffman *et al.*, 2014; Westgate *et al.*, 2014; Moreno *et al.*, 2014; Huang *et al.*, 2014; Jones *et al.*, 2015). However, there is always scope for unknown, and hence unmeasurable, confounding factors that may influence the results. Although longitudinal studies provide a high level of evidence for investigating the relationship between an exposure and an outcome, even such studies are susceptible to bias if not designed and executed rigorously (Smith and Foxcroft, 2009), particularly in terms of systematic loss to follow-up. It is worth noting that RCTs are considered the best design for inferring causality (Smith and Foxcroft, 2009), but this design is impractical to use in this research area because it is unethical to expose participants outside the laboratory to online alcohol-related content for some time to investigate subsequent potentially harmful effects of alcohol consumption.

Two studies included in this review utilized experimental study designs (Litt and Stock, 2011; Alhabash *et al.*, 2015). These studies evaluated associations between a single exposure to Internet-based alcohol advertising and immediate effects on intentions to drink alcohol (Alhabash *et al.*, 2015), and the effect of exposure to online alcohol-related content and reported drinking (Litt and Stock,

2011). As post-exposure effects were evaluated using a single time point, these studies have limited external validity when comparing to a more typical setting where young people are exposed to multiple messages over an extended period of time (Smith and Foxcroft, 2009). A lack of generalizability of study results to different populations and subgroups is another limitation of the studies included in this review. For example, university students were often used as participants, but they are not similar to others in the same age group in many respects. A strength of this review is that many of the included quantitative studies collected data from a large number of participants (seven of the 11 studies had more than 500 participants) (Jones and Magee, 2011; Gordon *et al.*, 2011; Stoddard *et al.*, 2012; McClure *et al.*, 2013; Hoffman *et al.*, 2014; Huang *et al.*, 2014; Jones *et al.*, 2015), with only a few quantitative studies using smaller samples (Litt and Stock, 2011; Glassman, 2012; Moreno *et al.*, 2014; Alhabash *et al.*, 2015; Jones *et al.*, 2015). Future longitudinal studies are warranted to explore the potential causal impact of exposure to Internet-based alcohol content on alcohol use among young people.

Another important issue is the possibility of publication bias, with papers reporting significant findings more likely to be published and the associated practice of authors selectively reporting significant associations. In contrast, it is also possible that studies sponsored by the alcohol industry and other such organizations may have found a positive association between exposure to Internet alcohol content and alcohol use among young people, but have not been published due to perceived conflicts of interest. Hence, it is not possible to predict the likely impact of unpublished data on the evidence base in this area. However, the comprehensive search of electronic databases, including the grey literature, and bibliographic searches conducted to retrieve relevant studies have attempted to minimize these issues.

CONCLUSION

Exposure to alcohol-related content on the Internet might predispose young people to patterns of alcohol use by promoting alcohol as a natural and vital part of life. However, the research exploring the influence of this novel form of exposure on young people’s alcohol use is emergent and comprised primarily of cross-sectional studies. To evaluate the direction of the association between alcohol use and exposure to alcohol-related content in online environments, further longitudinal research is required.

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CONFLICT OF INTEREST STATEMENT

None declared.

Appendix 1. Search strategy using the PICO concept

P (Population)	I (Interest)	Co (Context)
Young people (adolescents and young adults)	Impact on alcohol consumption behaviours	Internet-based alcohol advertising/marketing

Appendix 2. Eligibility criteria

Types of studies	Types of participants	Language	Types of exposure	Types of outcome measures
<ul style="list-style-type: none"> • Cohort/ Longitudinal • Cross-sectional • Experimental • Time-series • Econometric • RCT – not possible in this context • Qualitative • Theses • Conference Presentations 	Young people of school or college age (age 12–25)	English	Exposure to Internet-based alcohol-related content, including both passive exposure and exposure to direct advertising	<ul style="list-style-type: none"> • Inclusion criteria: self-reported alcohol use, intention to drink, or attitude to drinking • Exclusion criteria: studies aimed at evaluating awareness and response to advertising that did not measure effects on drinking were excluded

Appendix 3. Search strategy

Medline (OVID)	Embase (OVID)	PsycINFO (OVID)	Scopus	CINAHL Plus	Sociological abstracts
1 • Drinking behaviour?r • Explode all fields	• Drinking behaviour?r • Explode all fields	• Drinking behaviour?r • Explode all fields	• Drinking behaviour?r • Explode all fields	• Drinking behaviour?r • Explode all fields	• Drinking behaviour?r • Explode all fields
2 • Alcohol drinking • Explode all fields	• Alcohol drinking • Explode all fields	• Alcohol drinking • Explode all fields	• Alcohol drinking • Explode all fields	• Alcohol drinking • Explode all fields	• Alcohol drinking • Explode all fields
3 (Alcohol* OR drink*). ti,ab	(Alcohol* OR drink*). ti,ab	(Alcohol* OR drink*). ti,ab	(Alcohol* OR drink*). ti,ab	(Alcohol* OR drink*). ti,ab	(Alcohol* OR drink*). ti,ab
4 (Alcohol* OR drink*) AND young people or youth or adolescents or teens. ti,ab	(Alcohol* OR drink*) AND young people or youth or adolescents or teens. ti,ab	(Alcohol* OR drink*) AND young people or youth or adolescents or teens. ti,ab	(Alcohol* OR drink*) AND young people or youth or adolescents or teens. ti,ab	(Alcohol* OR drink*) AND young people or youth or adolescents or teens. ti,ab	(Alcohol* OR drink*) AND young people or youth or adolescents or teens. ti,ab
5 Alcohol marketing OR adverti?ing. Explode all fields	Alcohol marketing OR adverti?ing. Explode all fields	Alcohol marketing OR adverti?ing. Explode all fields	Alcohol marketing OR adverti?ing. Explode all fields	Alcohol marketing OR adverti?ing. Explode all fields	Alcohol marketing OR adverti?ing. Explode all fields
6 (Alcohol or drink) and (youth or young people or adolescents or teens) and (Alcohol marketing or adverti?ing) and (internet or social media or social networking sites) (all fields)	(Alcohol or drink) and (youth or young people or adolescents or teens) and (Alcohol marketing or adverti?ing) and (internet or social media or social networking sites) (all fields)	(Alcohol or drink) and (youth or young people or adolescents or teens) and (Alcohol marketing or adverti?ing) and (internet or social media or social networking sites) (all fields)	(Alcohol or drink) and (youth or young people or adolescents or teens) and (Alcohol marketing or adverti?ing) and (internet or social media or social networking sites) (all fields)	(Alcohol or drink) and (youth or young people or adolescents or teens) and (Alcohol marketing or adverti?ing) and (internet or social media or social networking sites) (all fields)	(Alcohol or drink) and (youth or young people or adolescents or teens) and (Alcohol marketing or adverti?ing) and (internet or social media or social networking sites) (all fields)

Grey Literature – MedNAR, PsycEXTRA and NTIS (National Technical Information Service). Theses and conference presentations related to the topic of the review were also sought.

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