Exposure to Digital Alcohol Marketing and Alcohol Use: A Systematic Review

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ABSTRACT. Objective: Alcohol marketing has proliferated on digital media, such as websites, social media, and apps. A systematic review was conducted to examine studies of associations between exposure to digital alcohol marketing and alcohol consumption. **Method:** Eight electronic databases were searched for "alcohol" and "marketing" through 14 February 2017. Studies were included if exposure to digital alcohol marketing and alcohol consumption, or related attitudes and intentions, were assessed. Studies were excluded if they only measured exposure to alcohol depictions posted online by family and friends. Study quality was also assessed. **Results:** In all, 25 studies were included, including 2 randomized controlled trials, 15 cross-sectional studies, and 8 prospective cohort studies. There was a consistent finding across studies that participation and engagement with digital alcohol marketing—such as clicking on an alcohol ad, visiting an alcohol-branded website, liking or sharing an ad on social media, or downloading alcohol-branded content—was positively associated with alcohol use. The effects of simple exposure to digital alcohol advertising were inconclusive. Proper blinding of subjects, measuring exposures before the outcomes, and measuring the exposures multiple times would improve study quality. **Conclusions:** Although more research is needed, existing studies suggest that engagement with digital alcohol marketing is positively associated with increased alcohol consumption and increased binge or hazardous drinking behavior. Governments should consider implementing digital alcohol marketing regulations under the precautionary principle as the alcohol industry's self-regulated marketing codes are likely ineffective at protecting populations vulnerable to alcohol-related harm. (*J. Stud. Alcohol Drugs, Supplement 19,* 57–67, 2020)

RECENT EVIDENCE SUGGESTS that there is no safe level of alcohol consumption (GBD 2016 Alcohol Collaborators, 2018), and moderate alcohol consumption does not reduce all-cause mortality or improve cardiovascular disease outcomes (Stockwell et al., 2016; Zhao et al., 2017). Moreover, 5.3% of deaths and 5.1% of the disease burden globally was attributable to alcohol use in 2016 (World Health Organization, 2018). Because of the public health impact, numerous efforts have been made to identify upstream, environmental risk factors that lead to excessive alcohol use. One such risk factor is exposure to alcohol marketing. Previous systematic reviews have concluded that increased exposure to alcohol marketing is associated with earlier alcohol initiation and increased alcohol consumption among adolescents and young adults, although the effects were described as moderate (Anderson et al., 2009; Smith & Foxcroft, 2009). More recent evidence strongly suggests that exposure to alcohol marketing is also associated with an increased risk of binge and hazardous drinking behaviors (Jernigan et al., 2017a).

Previously published reviews are informative but limited by a principal focus on exposure to alcohol marketing through traditional media channels, such as television, radio, billboards, movies, and branded merchandise. Yet, modern alcohol marketing activities often include digital media channels, such as websites, apps, and social media (Lobstein et al., 2017). For example, 20 Indian and Australian alcoholic beverage brands elicited approximately 100,000 subscriptions on YouTube since the brands created YouTube accounts, which occurred between 2005 and 2015 (Gupta et al., 2018). The videos posted by these brands included general marketing approaches, such as the use of camaraderie and tie-ins with sporting events, music festivals, and competitions, along with country-specific strategies. Indian brands tended to use more sexually suggestive content, whereas tradition and heritage was a more common theme among Australian alcohol brands. An evaluation of Instagram posts published by 15 alcohol brands identified product appeals and the physical benefits of alcohol use as the most common themes, although a large minority of posts focused on positive emotions, personal achievement, individuality, and camaraderie (Barry et al., 2018). Inappropriate alcohol consumption was the most common risk-related theme.

An evaluation of Facebook posts published by alcohol brands determined that many posts encouraged interaction with the brand, used attraction or humor to elicit an emotional response, and had tie-ins to real-world events (Lim et al., 2016). A separate evaluation of Facebook posts published around the U.S. National Football League's Super Bowl de-

termined that 82% of the posts evaluated were in violation of the alcohol industry's internal regulations that govern the content of all alcohol marketing materials (Noel & Babor, 2017). Furthermore, 10 thematic content areas identified in the posts (i.e., animals, negative emotions, positive emotions, games/contests/promotions, female characters, minorities, party, sexuality, nighttime, sunrise) perfectly predicted the presence of any violation. Ten content areas also had a high (>80%) specificity for violations of regulations intended to protect minors: animals, negative emotions, famous people, friendship, games/contests/promotions, minorities, responsibility messages, sexuality, sunrise, and video games.

Alarmingly, youth can easily access digital alcohol marketing. Age-gating technologies have been shown to be ineffective (Jones et al., 2014), and underage social media profiles could access content published by alcohol brands (Barry et al., 2015, 2016). For example, fictitious YouTube profiles of 14-, 17-, and 19-year-old adolescents successfully subscribed to 100% of the alcohol brands tested and viewed two thirds of the brands' videos (Barry et al., 2015). A similar test demonstrated that Twitter's and Instagram's age-gating technology is inadequate as well (Barry et al., 2016). All underage Twitter and Instagram profiles could access content posted by alcohol brands, and underage Instagram profiles were able to receive alcohol-branded promotional materials. Approximately 30% of the youth can recall viewing digital alcohol marketing (Jernigan et al., 2017b), and adolescents and young adults who have seen alcohol marketing on Facebook interpret the posts as suggesting that alcohol can improve relaxation, mood, social success, and confidence (Weaver et al., 2016).

Alcohol marketing on digital platforms has grown over the past two decades. The alcohol industry has stated that social media marketing can reach more consumers than broadcast media and has a 600% return on investment (Bouckley, 2013; WARC, 2013). Because of the role of traditional alcohol marketing in alcohol consumption and the focus on digital advertising by the alcohol industry, we conducted a systematic review of the available literature to determine whether exposure to digital alcohol marketing is associated with alcohol consumption. The search included peer-reviewed articles, manuscripts published in conference proceedings, and theses or dissertations. All study types were included, and studies were reviewed for methodological rigor. Outcomes of interest included alcohol consumption, as well as drinking intentions and alcohol-related attitudes.

Method

The project coordination team searched eight electronic databases for the concepts of "alcohol" and "marketing" up to February 14, 2017 (see search details in Sargent at al., 2020—this supplement). Articles were included in this review if they specifically addressed exposure to, or engagement with, digital alcohol advertising and the measured outcomes included alcohol consumption (e.g., alcohol initiation, alcohol use frequency, binge drinking), intentions to consume alcohol, intentions to purchase alcohol, or alcohol-related attitudes. Digital alcohol advertising was defined as alcohol-branded websites, social media pages, banner advertisements, chat rooms or forums, emails, apps, and downloadable content. References to exposure to alcohol depictions posted by friends, family, and other connections on social networking sites were excluded unless the posts were in specific response to an alcohol brand's marketing campaign.

After receiving the initial article list from the project coordination team, two authors (JK and CS) reviewed the text of each article to determine if it met the inclusion and exclusion criteria. If the authors differed on their assessment of an article, another author (SR) reviewed the article and cast the deciding vote. Studies were organized by marketing assessment because some studies assessed receptivity to digital alcohol marketing whereas others focused exclusively on exposure.

Exposure to digital marketing includes a general viewing or awareness of digital alcohol marketing practices and implies passive exposure. Receptivity suggests information-seeking behavior and active exposure to alcohol marketing. It has been defined as having used or being prepared to use a promotional item (Gilpin et al., 2007), and was operationalized as clicking on an alcohol ad that appears on a nonbranded website, purposefully visiting a branded website, participating with a contest online, following an alcohol-branded social media account, liking or sharing an alcohol-branded social media post, and receiving updates from a brand via a digital medium. Actively engaging in brand messages in this way is known to correlate strongly with brand trust, positive attitudes toward a brand, and purchase intentions by the user (Beukeboom et al., 2015; Chu & Sung, 2015; Kim et al., 2014; Toldos-Romero & Orozco-Gómez, 2015), although the effect may be reciprocal (McClure et al., 2016). Furthermore, when a shared ad is viewed on Facebook by a Facebook connection, the message is seen as more credible and less intrusive (Morris et al., 2016). Moreover, publishing comments in direct response to digital alcohol marketing that actively promote alcohol use may increase the desire to drink among social media users by reinforcing the post's message (Kim & Sun, 2006; Noel & Babor, 2018). Similar effects have been documented for other consumer products (Lim, 2015; Meuter et al., 2013; Sandes & Urdan, 2013; See-To & Ho, 2014; Wu, 2013).

The National Heart, Lung and Blood Institute's (2014) Study Quality Assessment Tools were used to assess study quality (Appendices 1 and 2), which was assessed by two raters. (Appendices 1 and 2 are included in the supplemental material that appears as an online-only addendum to the article on the journal's website.) Inter-rater reliability was measured using the pooled kappa (de Vries et al., 2008), and
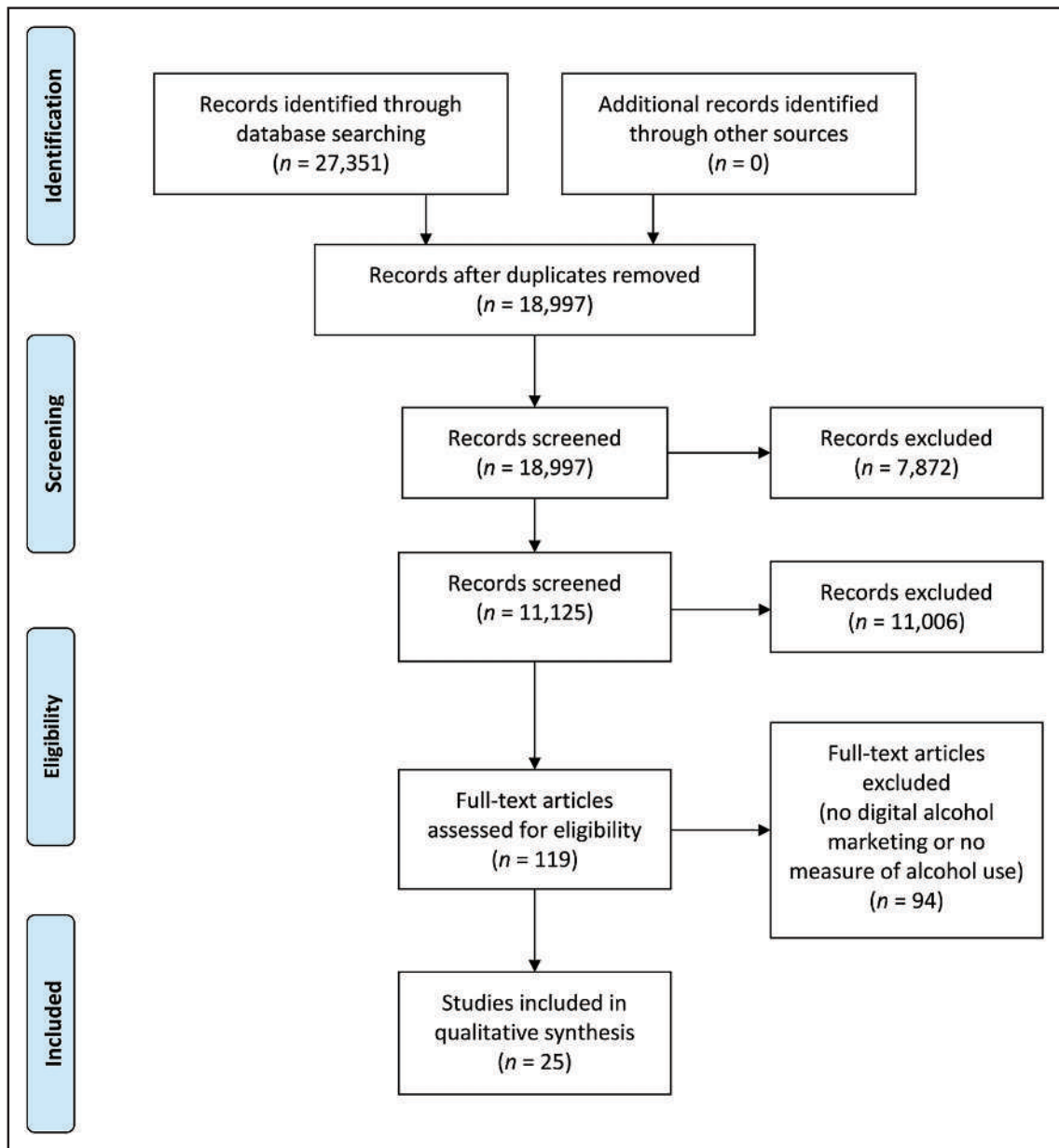
FIGURE 1.   PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) 2009 flow diagram

a study quality criterion was considered met if both raters agreed it was present. Because of the heterogeneity of the studies, a meta-analysis was not conducted.

Results

Search strategy results

As described in the introductory chapter (this supplement), the search of key concepts by the project coordination team yielded 27,351 results (Figure 1). After de-duplication and two rounds of title and abstract screening, 119 titles remained potentially eligible for review. The project coordination team provided full texts of these remaining articles, which were screened according to the inclusion/exclusion criteria. A further 94 articles were excluded for not measuring exposure to digital alcohol marketing or not measuring alcohol use, or intentions to use, as an outcome.

Study characteristics

Summaries of all included studies are in Supplemental Table 1. Of the 25 studies included, there were 2 randomized controlled trials (RCTs), 15 cross-sectional studies, and

8 prospective cohort studies (Tables 1 and 2). One cohort study used ecological momentary assessment procedures. The target populations were adolescents and young adults generally, with recruitment ages as young as 9 years old. Median sample size was approximately 1,100 participants (interquartile range: 552–2,765), and studies were conducted in the United States (7 studies), the United Kingdom (5 studies), Australia (4 studies), Taiwan (4 studies), Europe (2 studies), Brazil, New Zealand, and Thailand. Ten studies measured exposure to alcohol-branded websites, whereas 13 measured exposure to alcohol advertisements on nonbranded websites. Sixteen studies included social media exposures, 7 included downloadable content, 7 included email advertisements, and 1 included alcohol-branded apps.

Receptivity to digital marketing

Twelve studies assessed engagement with digital alcohol marketing (Carrotte et al., 2016; Critchlow et al., 2016; Crow, 2014; de Bruijn et al., 2016a, 2016b; Gordon et al., 2010, 2011; Hoffman et al., 2014, 2017; Jones et al., 2016; Lin et al., 2012; McClure et al., 2016). Engagement with digital marketing included clicking on alcohol advertisements on nonbranded websites, liking or sharing social media advertisements, streaming alcohol-branded videos, downloading alcohol-branded content, and receiving alcohol-branded email. Measured outcomes included lifetime drinking, drinking frequency, drinks per occasion, binge drinking, drinking status, problem drinking, AUDIT scores, and intention to drink. Receptivity studies met an average of 7.7 of 14 ($SD = 2.0$) study quality criteria (Table 3).

Three studies were prospective cohort studies (de Bruijn et al., 2016b; Gordon et al., 2010; McClure et al., 2016). McClure et al. (2016) recruited adolescents and young adults and concluded that receptivity to Internet alcohol marketing at baseline, when measured as a latent construct, was positively associated with binge drinking initiation at subsequent follow-ups, although there was no effect on any alcohol initiation. De Bruijn et al. (2016b) and Gordon et al. (2010) aggregated marketing engagement across multiple marketing platforms, including digital platforms. Positive associations were reported between engagement and binge drinking (de Bruijn et al., 2016b) and drinking frequency (de Bruijn et al., 2016b; Gordon et al., 2010).

Nine studies were cross-sectional surveys (Carrotte et al., 2016; Critchlow et al., 2016; Crow, 2014; de Bruijn et al., 2016a; Gordon et al., 2011; Hoffman et al., 2014, 2017; Jones et al., 2016; Lin et al., 2012). All studies that measured interactions with alcohol content on social media reported significant, positive associations. For example, interacting with an alcohol-branded post, such as with Facebook's Like function, was associated with drinking frequency, alcohol use amount, and binge drinking frequency (Jones et al., 2016) and with AUDIT-C scores (Carrotte et al., 2016).

When measured as a latent variable, interacting with alcohol-related social media content was also associated with alcohol use frequency, problematic drinking, and binge drinking (Hoffman et al., 2014, 2017).

Four cross-sectional studies aggregated marketing engagement across multiple digital platforms. Three studies recruited subjects that were approximately 14 years old (range: 12–15 years old; Critchlow et al., 2016, de Bruijn et al., 2016a; Gordon et al., 2011). Each study reported significant findings. Participation with digital marketing was positively associated with drinking intentions (de Bruijn et al., 2016a; Gordon et al., 2011), past-12-month drinking (Lin et al., 2012), and past-30-day binge drinking (de Bruijn et al., 2016a). The fourth study recruited adolescents and young adults 18–25 years old and reported that participation with digital marketing was associated with heavy episodic drinking (Critchlow et al., 2016).

Exposure to digital marketing

Thirteen studies exclusively assessed exposure to digital alcohol marketing (Alhabash et al., 2015; Chang et al., 2014, 2016; Chen et al., 2016; Faulkner et al., 2017; Goldfarb & Tucker, 2011; Harris et al., 2015; Huang et al., 2015; Jones & Magee, 2011; Kheokao et al., 2013; Martino et al., 2016; Pinsky et al., 2010; Stautz et al., 2017). Exposure to alcohol marketing on branded websites, advertisements on nonbranded websites, social media, email, and downloadable content was assessed. Outcome measures included current alcohol use; hazardous, risky, or heavy drinking; AUDIT scores; drinking initiation; and drinking or purchase intentions.

Five of these studies were prospective cohort studies (Chang et al., 2014; Chen et al., 2016; Harris et al., 2015; Huang et al., 2015; Martino et al., 2016), with one study using ecological momentary assessment techniques (Martino et al., 2016). These studies met an average of 9.1 ($SD = 2.5$) study quality criteria (Table 3). Four studies aggregated exposure across multiple marketing platforms, including digital marketing. Of these, three reported positive associations between exposure to marketing and the outcome measures (Chang et al., 2014; Harris et al., 2015; Martino et al., 2016). The fifth study reported a positive association between exposure to alcohol ads on nonbranded websites and drinking initiation (Huang et al., 2015).

Two studies were randomized controlled trials (Alhabash et al., 2015; Stautz et al., 2017), and these studies met 10.5 ($SD = 3.5$) study quality criteria on average. In an RCT of heavy drinking 18- to 25-year-olds, there were no significant differences in alcohol consumption between those exposed to YouTube alcohol ads and those exposed to either alcohol-warning or neutral videos (Stautz et al., 2017). In a separate RCT, alcohol advertisements on Facebook that were associated with a high number of likes and shares significantly increased participants' drinking intentions compared to ads

TABLE 1. Characteristics of studies that measured marketing receptivity

Author(s)	Target population	Location	Study design	Included digital media	Follow-up period	Outcome(s)
Carrotte et al., 2016	15- to 29-year-olds	Australia	Cross sectional	Facebook, Instagram, Twitter	N.A.	AUDIT scores
Critchlow et al., 2016	18- to 25-year-olds	United Kingdom	Cross sectional	Apps, display ads, downloadable content, email, on-demand or streaming content, social media, websites	N.A.	AUDIT scores
Crow, 2014	18- to 24-year-olds	United States	Cross sectional	Facebook	N.A.	Binge drinking, drinks per week, drinking days per month
de Bruijn et al., 2016a	10- to 18-year-olds	Europe	Cross sectional	Display ads, downloadable content, email, social media, websites	N.A.	Binge drinking
de Bruijn et al., 2016b	10- to 18-year-olds	Europe	Prospective cohort	Display ads, downloadable content, email, social media, websites	14–17 months (3 waves)	Binge drinking, drinking days per month
Gordon et al., 2010	12- to 16-year-olds	United Kingdom	Prospective cohort	Downloadable content, email, social media, websites	2 years (2 waves)	Drinking frequency
Gordon et al., 2011	12- to 14-year-olds	United Kingdom	Cross sectional	Downloadable content, email, social media, websites	N.A.	Drinking status
Hoffman et al., 2014	College students	United States	Cross sectional	Social media	N.A.	Problem drinking, alcohol use frequency, drinks per occasion
Hoffman et al., 2017	College students	United States	Cross sectional	Social media use	N.A.	Problem drinking, binge drinking
Jones et al., 2016	16- to 24-year-olds	Australia	Cross sectional	Facebook	N.A.	Problem drinking
Lin et al., 2012	13- to 14-year-olds	New Zealand	Cross sectional	Downloadable content, email, social media, websites	N.A.	Intention to drink, drinking frequency, drinks per occasion
McClure et al., 2016	15- to 20-year-olds	United States	Prospective cohort	Display ads, social media, websites	1 year (2 waves)	Ever drink, binge drink

Notes: N.A. = not applicable; AUDIT = Alcohol Use Disorders Identification Test.

TABLE 2.   Characteristics of studies that measured marketing exposure only

Author(s)	Target population	Location	Study design	Included digital media	Follow-up period	Outcome(s)
Alhabash et al., 2015	College students	United States	RCT	Facebook	N.A.	Intention to drink
Chang et al., 2014	High school students	Taiwan	Prospective cohort	Internet (general)	1 year (2 waves)	Drinking initiation, drinking persistence
Chang et al., 2016	High school students	Taiwan	Cross sectional	Internet (general)	N.A.	Current alcohol use, intention to drink
Chen et al., 2016	High school students	Taiwan	Prospective cohort	Websites	1–2 years (2 waves)	Drinking initiation, drinking persistence
Faulkner et al., 2017	12- to 17-year olds	Australia	Cross sectional	Display ads, websites	N.A.	Risky drinking
Goldfarb & Tucker, 2011	21 years old and older	United States	Cross sectional	Display ads	N.A.	Alcohol purchase intent
Harris et al., 2015	12- to 16-year-olds	Scotland	Prospective cohort	Downloadable content, email, social media, websites	2 years (2 waves)	Hazardous alcohol consumption
Huang et al., 2015	Middle school students	Taiwan	Prospective cohort	Display ads	1–2 years (2 waves)	Drinking initiation
Jones & Magee, 2011	12- to 17-year-olds	Australia	Cross sectional	Internet (general)	N.A.	Drinking initiation, drinking frequency
Kheokao et al., 2013	9- to 22-year-olds	Thailand	Cross sectional	Internet (general)	N.A.	AUDIT scores, intention to drink
Martino et al., 2016	11- to 14-year-olds	United States	Prospective cohort (EMA)	Display ads, social media	14 days	Perceptions of alcohol
Pinksy et al., 2010	14- to 25-year-olds	Brazil	Cross sectional	Internet (general)	N.A.	Heavy drinking
Stautz et al., 2017	18- to 25-year-olds	United Kingdom	RCT	Internet video ads	N.A.	Alcohol consumption

Notes: RCT = randomized controlled trial; N.A. = not applicable; AUDIT = Alcohol Use Disorders Identification Test; EMA = ecological momentary assessment.

TABLE 3. Assessment of study quality—observational studies (n = 23)

Studies	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total (%)
Carrotte et al., 2016	☑	☑		☑	☑				☑		☑			☑	7 (50.0)
Chang et al., 2014	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑			☑	12 (85.7)
Chang et al., 2016	☑	☑	☑	☑	☑			☑	☑		☑			☑	9 (64.3)
Chen et al., 2016	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑		☑	☑	13 (92.9)
Critchlow et al., 2016	☑	☑			☑			☑	☑		☑			☑	7 (50.0)
Crow, 2014	☑	☑		☑	☑				☑		☑				6 (42.9)
de Bruijn et al., 2016a	☑	☑	☑	☑	☑		☑		☑	☑	☑			☑	10 (71.4)
de Bruijn et al., 2016b	☑	☑	☑	☑	☑		☑	☑	☑		☑			☑	10 (71.4)
Faulkner et al., 2017	☑	☑	☑	☑	☑		☑		☑		☑			☑	9 (64.3)
Goldfarb & Tucker, 2011	☑			☑				☑	☑		☑			☑	6 (42.9)
Gordon et al., 2010	☑	☑		☑		☑	☑	☑	☑		☑	☑		☑	10 (71.4)
Gordon et al., 2011	☑	☑		☑	☑			☑	☑		☑	☑		☑	9 (64.3)
Harris et al., 2015	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑			☑	12 (85.8)
Hoffman et al., 2014	☑	☑			☑			☑	☑		☑				6 (42.9)
Hoffman et al., 2017	☑	☑			☑			☑	☑		☑				6 (42.9)
Huang et al., 2015	☑	☑	☑	☑	☑					☑			☑	☑	8 (57.1)
Jones & Magee, 2011	☑	☑									☑			☑	4 (28.6)
Jones et al., 2016	☑	☑		☑							☑			☑	5 (35.7)
Kheokao et al., 2013	☑	☑		☑	☑			☑	☑		☑			☑	8 (57.1)
Lin et al., 2012	☑	☑	☑	☑			☑		☑		☑			☑	8 (57.1)
Martino et al., 2016	☑	☑		☑		☑		☑	☑	☑	☑			☑	9 (64.3)
McClure et al., 2016	☑	☑		☑		☑	☑	☑	☑		☑			☑	9 (64.3)
Pinsky et al., 2010	☑	☑	☑	☑	☑			☑	☑		☑			☑	9 (64.3)
Number of studies met criteria	23	22	10	19	16	6	9	15	20	6	22	2	2	20	
Percentage studies met criteria	100	95.7	43.5	82.6	69.6	26.1	39.1	65.2	87	26.1	95.7	8.7	8.7	87	

Notes: 1 = Research question clearly stated; 2 = study population clearly defined; 3 = participate rate ≥ 50%; 4 = subjects from the same population and inclusion/exclusion criteria specified; 5 = sample size justification included; 6 = exposure measured before outcome; 7 = sufficient timeframe to see an effect; 8 = different levels of exposure included; 9 = clearly defined exposure measures; 10 = exposures measured more than once; 11 = clearly defined outcome measures; 12 = outcome assessors blinded to exposure status; 13 = loss to follow-up ≤ 20%; 14 = confounders measured and adjusted for.

associated with relatively few likes and shares (Alhabash et al., 2015).

The remaining studies were cross-sectional surveys (Chang et al., 2016; Faulkner et al., 2017; Goldfarb & Tucker, 2011; Jones & Magee, 2011; Kheokao et al., 2013; Pinsky et al., 2010), and they met 7.5 (*SD* = 1.9) study quality criteria on average (Table 3). Three cross-sectional studies assessed exposure to Internet advertising. One found that exposure to Internet advertising significantly increased the odds of drinking in the past 12 months and past 4 weeks among males 12–15 years old (Jones & Magee, 2011), whereas another found no associations (Faulkner et al., 2017). A third assessed the impact of Internet ads immediately after exposure (Goldfarb & Tucker, 2011). Exposure to Internet alcohol ads significantly increased purchase intentions (*p* < .01). Three cross-sectional studies assessed aggregate exposure to alcohol marketing, which included through digital platforms. All three studies reported significant positive associations between exposure and the included outcome measures (Chang et al., 2016; Kheokao et al., 2013; Pinsky et al., 2010).

Study quality

Overall, the included observational studies (*n* = 23) met an average of 8.3 of 14 study quality criteria (*SD* = 2.3) (Table 3). The most common criteria were clearly stating the research question(s) (100%), defining the study population (95.7%), defining the outcomes (95.7%), and defining the exposures (87.0%). The least common criteria included blinding of the participants (8.7%), loss to follow-up (8.7%), measuring the exposure before the outcome (26.1%), and measuring the exposure multiple times (26.1%). Mean study quality criteria met by the RCTs (*n* = 2) was 10.5 (*SD* = 3.5). The criteria that were not addressed included blinding of participants (0%), assessing between-group differences at baseline (50%), a sufficiently low dropout rate (50%), assessing if the dropout rate differed between groups (50%), and sufficient adherence to study protocols (50%). Both randomized controlled trials met all other study criteria.

Discussion

The current literature suggests that there is an association between active participation and interaction with digital alcohol marketing content, although not simple exposure, and alcohol consumption. Consistent findings were reported under longitudinal and cross-sectional conditions across digital platforms, although more research is needed to confirm the results. The results do not preclude the possibility that mere exposure to digital marketing content can influence alcohol consumption, but such independent effects have not been consistently reported.

Future directions

More research is needed on the effects of digital alcohol marketing to determine whether the effects seen in cross-sectional studies would be replicated under more rigorous conditions. Specifically, multiwave prospective cohort studies should allow for the construction of path models that can test a marketing receptivity to attitudes to behavior onset causal chain and test for any reciprocal effects between digital alcohol marketing practices, attitudes, and behaviors. However, there are two primary challenges that researchers will need to address to ensure the veracity of the results. First, an objective method of determining exposure to digital marketing is required because of the constantly changing nature of online platforms. Although digital platforms are distinct from traditional media (e.g., television, radio), the group encompasses both passive and active forms of marketing exposure. For example, individuals are passively exposed to banner advertisements that appear on nonbranded websites but may have to actively seek out branded websites and social media accounts. Furthermore, the platforms that qualify as social media contain numerous methods of interacting with digital alcohol marketing and other social media users. Ecological momentary assessment techniques or screen capturing software may be helpful in this regard, but new methods of data collection that focus on capturing data from platforms that automatically delete posts after viewing or incorporate the various methods of engaging with digital marketing (e.g., liking, sharing, retweeting) may be needed.

Second, it is necessary to separate the effects of digital marketing exposures from other risk factors of alcohol consumption, such as general marketing exposures, friends and family posting depictions of alcohol use, peer alcohol use, family alcohol use, socioeconomic status, demographic group, and other environmental stimuli, such as availability and price. Here, large sample sizes that are representative of the underlying target population will be needed because there may be extensive overlap between these two types of exposure.

Because engaging with digital alcohol marketing may have a greater influence on alcohol consumption than mere exposure, additional research is also needed on the mechanism of action. Although research highlights the potential importance of user engagement values (e.g., likes and shares) and social media comments, there is an insufficient number of articles published to make overarching conclusions. Experimental and observational work is needed in this area.

Based on the study quality assessment performed here, there are several specific methodological issues that can be remedied in future studies. Longitudinal research that recruits subjects before alcohol initiation can ensure that exposure to digital alcohol marketing is measured before

the outcome, but sufficient time between study waves is needed for the effect to manifest. Additional efforts are needed to ensure participation rates are sufficiently high and loss to follow-up is sufficiently low to maintain sample representativeness, and the use of objective measures of digital marketing exposure may allow for the blinding of participants when alcohol consumption is self-reported. For all studies, regardless of type, it is also important for protocols to be registered at clinicaltrials.gov or with other similar services to prevent investigators from presenting post hoc analyses as a primary purpose for conducting a study. For instance, only one of the RCTs included in the review (Stautz et al., 2017) indicated in the manuscript that the protocols were registered before study initiation. Adhering to PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines may provide substantial help in this regard.

Interestingly, some gaps in the current literature may be met, in part, by reanalyses of existing data sets, specifically from the cohort studies that aggregated exposures across platforms. Determining the unique contribution of exposure to digital alcohol marketing, rather than aggregating across multiple platforms, using longitudinal data can significantly further knowledge on this topic without requiring substantial resources.

Implications

The literature prohibits statements of causality between digital alcohol marketing and alcohol consumption from being made. However, because of the precautionary principle, the consistency of results in cross-sectional studies, and the plausibility of the relationship, parties should not be dissuaded from proactively implementing regulations that limit the potential impact of digital alcohol marketing practices. Finland was the first nation to promulgate statutory regulations that limit the marketing of alcoholic beverages on social media by banning the publication of content that is meant to be digitally shared (YLE, 2015). No formal evaluation of Finland's regulations has been published. Several international alcohol producers have supported the Digital Guiding Principles, which are a set of voluntary, self-regulated guidelines created by the alcohol industry via the International Alliance for Responsible Drinking (IARD, 2014). The Principles are intended to protect youth and other populations vulnerable to alcohol marketing, and such documents imply that the international alcohol industry acknowledges that their digital marketing efforts may cause harm to portions of the population. Initial studies indicate that the Digital Guiding Principles have not prevented youth exposure to digital alcohol marketing practices (Collins et al., 2016; Jernigan et al., 2017b) or the use of content that may be harmful to vulnerable populations (Noel & Babor, 2017).

Limitations

There are several limitations to this study. Although a comprehensive search strategy was implemented, the most recent articles were excluded by necessity. The review included English language articles only, and relevant non-English publications may have been overlooked due to language barriers. Because of the heterogeneity of the measured exposures and outcomes, a meta-analysis was not attempted, and the result of a meta-analysis would be difficult to interpret. Although research was conducted in countries from several World Health Organization regions, research has not been conducted in low- and middle-income countries, nor has research been conducted in all relevant high-income countries. Several of the studies included in the review relied on different versions of convenience sampling that may have resulted in selection bias, and if so, biases in study results could have influenced the results of the larger review. The possibility of publication and reporting bias also needs to be considered as studies that only found nonsignificant results may not have been published.

Last, an important confound to consider is that drinkers may be more likely to seek out digital alcohol marketing, which may lead to spurious results in cross-sectional settings. When focusing on only those studies that can effectively test such relationships, all included prospective cohort studies and RCTs in this review reported significant effects of marketing exposure on later alcohol-related endpoints, but the strength of such associations was mixed, with p values ranging from marginally significant (e.g., $p = .038$) to highly significant (e.g., $p < .001$). This suggests that additional studies with increased methodological rigor are required to ensure confidence in the replication of the results. This may be obtained through more sophisticated study designs (e.g., cohort vs. cross-sectional studies) or better transparency of existing protocols.

Conclusions

Existing research suggests that participation in digital alcohol marketing by adolescents and young adults is associated with increased alcohol consumption, although only awareness of digital marketing practices may have no effect. More research using rigorous prospective designs is needed. However, despite limited available research, regulating digital alcohol marketing practices may be warranted under the precautionary principle.

Conflict of Interest Statement

The authors declare they have no conflicts of interest.

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