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Review

E-Cigarette Marketing and Communication: How E-Cigarette Companies Market E-Cigarettes and the Public Engages with E-cigarette Information

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Abstract

Introduction: Given the lack of regulation on marketing of electronic cigarettes (e-cigarettes) in the United States and the increasing exchange of e-cigarette-related information online, it is critical to understand how e-cigarette companies market e-cigarettes and how the public engages with e-cigarette information.

Methods: Results are from a systematic review of peer-reviewed literature on e-cigarettes via a PubMed search through June 1, 2017. Search terms included: "e-cigarette*" or "electronic cigarette" or "electronic cigarettes" or "electronic nicotine delivery" or "vape" or "vaping." Experimental studies, quasi-experimental studies, observational studies, qualitative studies, and mixed methods studies providing empirical findings on e-cigarette marketing and communication (ie, nonmarketing communication in the public) were included.

Results: One hundred twenty-four publications on e-cigarette marketing and communication were identified. They covered topics including e-cigarette advertisement claims/promotions and exposure/receptivity, the effect of e-cigarette advertisements on e-cigarette and cigarette use, public engagement with e-cigarette information, and the public's portrayal of e-cigarettes. Studies show increases in e-cigarette marketing expenditures and online engagement through social media over time, that e-cigarettes are often framed as an alternative to combustible cigarettes, and that e-cigarette advertisement exposure may be associated with e-cigarette trial in adolescents and young adults.

Discussion: Few studies examine the effects of e-cigarette marketing on perceptions and e-cigarette and cigarette use. Evidence suggests that exposure to e-cigarette advertisements affects perceptions and trial of e-cigarettes, but there is no evidence that exposure affects cigarette use. No studies examined how exposure to e-cigarette communication, particularly misleading or inaccurate information, impacts e-cigarette, and tobacco use behaviors.

Implications: The present article provides a comprehensive review of e-cigarette marketing and how the public engages with e-cigarette information. Studies suggest an association between exposure to e-cigarette marketing and lower harm perceptions of e-cigarettes, intention to use e-cigarettes, and e-cigarette trial, highlighting the need to for advertising regulations that support public health goals. Findings from this review also present the methodological limitations of the

existing research (primarily due to cross-sectional and correlational analyses) and underscore the need for timely, rigorous research to provide an accurate understanding of e-cigarette marketing and communication and its impact on e-cigarette and tobacco product use.

Introduction

Electronic nicotine delivery systems (e-cigarettes) entered the US market in 2007 and reached an estimated 2.5 billion dollars in sales in 2014.[1] For the purposes of this review, the term "e-cigarettes" refers to any electronic nicotine delivery system, such as vaporizers, vape pens, hookah pens, or e-pipes. Among noncombustible tobacco and nicotine products, e-cigarette advertisements are the most widely circulated.[2] Between 2010 and 2014, e-cigarettes were the second most advertised product in magazines (16%), behind cigarettes (55%).[3] E-cigarette companies have been increasing their marketing expenditures since 2010,[4–6] increasing between 2013 and 2014 from $75.7 million to $115.3 million, although this is still lower than smokeless tobacco expenditures ($503.2 million[7] in 2013 to $600.8 million in 2014).[4,8]

Globally, 48 countries regulate the marketing of e-cigarettes; eight of these countries apply these restrictions only to e-cigarettes containing nicotine or that are regulated as medicines.[9] Unlike combustible cigarette marketing, which is heavily restricted in the United States,[10] e-cigarette marketing is not regulated at the national level in the United States. In 2016, the US Food and Drug Administration (FDA) finalized a rule extending its regulatory authority to all tobacco products, including e-cigarettes.[11] The new rule requires a health warning on all tobacco products and e-cigarettes advertisements, but no additional restrictions on e-cigarette marketing beyond warning labels.[11]

E-cigarettes are marketed through various channels, including the internet, newspapers/magazines, TV/movies, and retail stores, with most money spent on television and print media.[5,6,12,13] In addition to online marketing, e-cigarette information is also shared online by the public, with a growing presence on social media platforms.[14] These platforms extend the reach of e-cigarette information as users access and share information.[15] Benefits of such exchanges include the capacity for dialogue between users and ability of users to navigate to information that addresses their specific needs.[16] However, the exchange of information online, particularly health information, has been heavily criticized as inaccurate, misleading, and potentially dangerous.[16]

The objective of this study was to provide a comprehensive review of the published literature on e-cigarette marketing and communication.

Evidence Acquisition

Detailed methods and findings from the full systematic review on e-cigarettes are published elsewhere.[17,18] Briefly, a search of the published literature on e-cigarettes indexed in PubMed was conducted through June 1, 2017, using the following search terms: "e-cigarette*" OR "electronic cigarette" OR "electronic cigarettes" OR "electronic nicotine delivery" OR "vape" OR "vaping." Additional articles were reviewed based on targeted searches and expert recommendation. Eligible publications consisted of experimental studies, quasi-experimental studies, observational studies, case reports, case series, qualitative studies, mixed methods, and preclinical/animal studies providing empirical data on e-cigarettes. Publications were restricted to English-language articles published in peer-reviewed international journals. Out of the 1080 publications included in the full review (Figure 1),[17] 124 were relevant to e-cigarette marketing and communications and are included in the current study. To determine inclusion, studies were coded by pairs of reviewers. The first reviewer conducted primary coding, and the second reviewer checked the accuracy of the coding. The same process was used for extraction of data from included studies. Table 1 shows the number of studies relevant to each section of this review.

Terminology

Information provided to the public directly by e-cigarette companies (advertising and promotions) is referred to as "marketing," and information exchanged between members of the public and nonmarketing media as "communication."

Evidence Synthesis

Marketing

Advertisement Claims and Promotions

Twenty-one publications examined the claims and promotions in e-cigarette advertisements (studies are listed in Supplementary Table 1).[19–39] Of these, four were descriptive studies of e-cigarette companies' and retailers' marketing,[19,20,25,30] twelve were content analyses of e-cigarette advertising,[21–23,26,28,29,31,33–37] one was an e-cigarette retail audit,[27] one was an analysis of national e-cigarette advertising data,[24] two were focus group studies of e-cigarette attitudes and perceptions,[38,39] and one was a cross-sectional survey of the correlation between marketing claims and e-cigarette use.[32]

Eight studies of e-cigarette advertisements conducted between 2010 and 2015 found that, compared to combustible cigarettes, e-cigarettes were presented as healthier,[20,22,24,28,31,39] less expensive,[22,24,26,37] more socially acceptable,[28] unhindered by smoke-free policies,[24,26] and more environmentally friendly.[31] E-cigarettes were also marketed as smoking cessation aids.[20–22,24,26,29,31,32] An examination of commercially generated e-cigarette brand-sponsored social media and blog posts revealed that the majority of posts contained explicit and implicit smoking cessation claims.[29] Despite this, few participants in a cross-sectional survey conducted in 28 countries in the European Union in 2014 cited marketed health claims as a reason for use (12.3%).[32]

Table 1. Number of Articles by Section

|	
Marketing	
Advertisement Claims and Promotions	21
Exposure and Receptivity to E-Cigarette Marketing	26
E-Cigarette Marketing and Association with Perceptions and Use	33
Impact of E-Cigarette Marketing on Cigarette Smoking	4
E-Cigarette Warning Labels	4
Tobacco and E-Cigarette Prevention Messages	2
Communication	
Engagement with E-Cigarette Information	18
Portrayal of E-Cigarettes in the Media	27
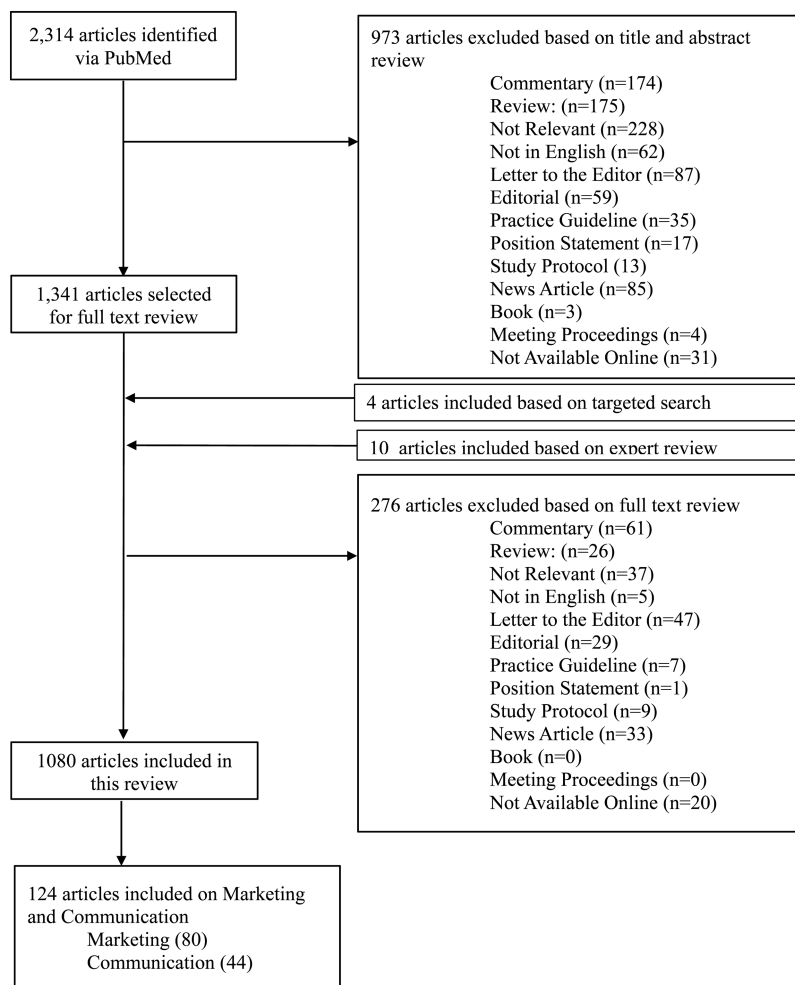
Figure 1. Flowchart of studies included in the e-cigarette systematic review.

Findings from seven studies suggest that the content and placement of e-cigarette advertisements are accessible and attractive to youth.[22,24,30,33,36,38,39] In a series of focus groups conducted in 2015, youth ages 12–17 years noted that e-cigarettes were portrayed to be appealing to youth and presented as a reduced risk cigarette "for kids."[39] A 2011 review of website content of online e-cigarette retailers identified "youthful appeals" in advertisements, such as the portrayal of e-cigarette use by celebrities, as a way to be more attractive to potential sexual partners.[22] Using e-cigarette advertising data collected between 2012 and 2013 from the United States and Canada, Richardson et al. found that e-cigarette advertisements were placed on sites with a larger youth audience than cigar, cigarette, and snus advertisements.[24] E-cigarette retailers have also leveraged the popularity of the smartphone game Pokemon Go to attract customers and promote vaping products.[30]

Seven studies of e-cigarette marketing highlight e-cigarette companies' promotional strategies in addition to advertising.[19,23,25,27,35] In a content analysis of online e-cigarette retailers' websites conducted in 2015, more than 40% of online e-cigarette retailers used promotional codes, loyalty programs, and discounts for referring new customers.[23] The same study also found that social media was a popular platform for retailers to share promotional offers, with an average of 2.6 social media platforms used per retailer website.[23] Comparatively, among brick-and-mortar retailers in North Carolina

and Virginia in 2012 and 2013, price promotions were infrequent, with only six of 162 retailers offering some type of price promotion in 2013.[27] In a study of e-cigarette advertising on mobile-enabled websites, 94% directed readers to the product's website and 15% included a financial incentive, such as a coupon.[35] Two descriptive studies reported that conventions and expos provided e-cigarette companies an opportunity to promote existing and new products directly to the consumer through instructional seminars and live entertainment.[19,25] A Korean study revealed one brand's direct marketing to youth through advertisements on college admissions forums, young adult (YA) movie ticket giveaways, sponsorships of a youth orchestra, and donations to a youth charity.[33]

Exposure and Receptivity to E-cigarette Marketing

Twenty-six publications addressed exposure and receptivity to e-cigarette advertisements.[2–6,8,12,27,40–57] Of these, seven were e-cigarette retail audits,[27,43,45–47,53,54] six were analyses of national e-cigarette advertising data,[2,4–6,8,42] ten were cross-sectional surveys of e-cigarette advertising exposure or recall,[3,12,40,44,48,49,51,55–57] one was a focus group study of e-cigarette perceptions,[41] one was a longitudinal study of the association between awareness of e-cigarette advertisements and current e-cigarette use,[50] and one was a between-subjects experimental study of the impact of e-cigarette advertisement exposure on tobacco smoking appeal.[52] Although there was some variability in

measures used to assess advertising exposure, most studies inquired about frequency of exposure to advertising in the past 6 month and through which channels.

According to the 2014 National Youth Tobacco Survey (NYTS), 68.9% of middle and high school students reported exposure to e-cigarette advertisements.[58] Sources of advertisement exposure included television, the internet, retail stores, and magazine and newspapers.[4,12,40–44,49–51,56] Four studies using e-cigarette advertising data from 2008 to 2014 showed that television and print media received the largest percentage of e-cigarette advertising expenditures.[2,5,6,8] Another study using Nielsen data showed that blu eCigs advertising accounted for 81.6% of all e-cigarette advertisements youth saw on television in 2013.[42] Data from five retail audits conducted between 2012 and 2014 reported e-cigarette advertisements present on the interior and exterior of retail stores;[27,45,47,53,54] advertisements were more prevalent on a store's interior.[27,47] Additionally, one retail audit documented e-cigarette advertisements at tobacco retailers in Harlem at youth eye-level, including those featuring flavored products.[53]

Findings from two cross-sectional studies suggest that e-cigarette users are more likely than nonusers to recall exposure to e-cigarette marketing.[48,51] Kim et al. surveyed adult current smokers in Florida in 2013 and found that current users and those who had ever used e-cigarettes in the past 12 months were significantly more likely to recall the blu eCigs television advertisement than those who had not used an e-cigarette in the past 12 months.[48] Pokhrel et al. reported higher recall of e-cigarette marketing among lifetime e-cigarette users when compared to nonusers in a sample of college students in Hawaii.[51] A longitudinal study using data from two waves of the International Tobacco Control Policy Evaluation Project (ITC) survey found that although past 6-month recall of e-cigarette advertisements and past 30-day use of e-cigarettes both increased from baseline to follow-up, the two were unrelated.[50]

The cross-sectional studies by Kim et al. and Pokhrel et al. also found that ever e-cigarette use was associated with receptivity to e-cigarette advertisements,[48,51] with Kim et al. reporting ever users were more likely to find e-cigarette advertisements worth remembering, attention-grabbing, exciting, innovative, informative, and convincing compared to nonusers.[48] E-cigarette advertisements featuring flavored products increased their appeal in a between-subjects experimental study of youth, whereby participants exposed to flavored e-cigarette advertisements rated them as more appealing than those exposed to nonflavored e-cigarette advertisements.[52] Analyses from a 2013–2014 cross-sectional analysis in a large US national cohort study found that youth who had never used tobacco or e-cigarettes who recalled e-cigarette advertisements were more likely to report receptivity to tobacco advertising compared to those who recalled advertisements for other tobacco products.[55]

E-cigarette Marketing and Association with Perceptions and Use
Thirty-three publications address relationships between e-cigarette marketing, perceptions, and use.[12,13,40,48,52,55,56,59–83] Of these, 19 were from cross-sectional surveys on the effect of e-cigarette advertisement and marketing exposure on intention to use, or perceptions of e-cigarettes, or use of e-cigarettes,[12,13,40,48,55,56,61,64,68,69,72,74,76,77,79–81,83] five were from randomized trials on the effect of e-cigarette advertisement exposure on attitudes and use of e-cigarettes,[62,63,65,66,73] five were from between-subjects experimental studies on the effect of e-cigarette advertisement exposure on intention to use e-cigarettes,[52,59,60,67,73] one was from a factorial within-subjects

quasi-experimental study of e-cigarette and snus advertising message framing,[78] one was from a longitudinal analysis of sales data to measure e-cigarette demand,[70] and two were experimental auctions to assess the impact of advertisements demand for and willingness to pay for e-cigarettes.[71,75] The specific measures used to assess e-cigarette perceptions and use are listed in Table 2.

Five studies reported lower e-cigarette harm perceptions[56,62,63,69,74] and two studies reported lower perceived addictiveness of e-cigarettes among those exposed to e-cigarette marketing.[56,69] A randomized trial conducted in 2014 among never e-cigarette users aged 13 to 17 years assigned youth to view either e-cigarette television advertisements before (treatment) or after (control) completing a survey; youth in the treatment group perceived e-cigarettes as cooler, more fun, and more enjoyable than youth in the control condition.[63] The treatment group had greater odds than the control group of agreeing that e-cigarettes were a safer alternative to combustible cigarettes (OR = 1.19, p = .01), could be used where smoking is not allowed (OR = 1.71, p < .001), could be used without affecting those around them (OR = 1.83, p < .001), and are a good way to express one's independence (OR = 1.90, p < .001).[62] Two large cross-sectional studies, one of youth and one of YAs, found that self-reported exposure to e-cigarette advertising was associated with lower perceived harm and addictiveness.[56,69] An additional cross-sectional study found an association between e-cigarette advertisement exposure and perception that e-cigarettes are safer than combustible cigarettes among women in general (OR = 2.5, p < .01; 95% CI = 1.5 to 4.1), and pregnant women (OR = 2.1, p < .05; 95% CI = 1.2 to 3.8).[74]

Twelve studies found that brief exposure to e-cigarette marketing is associated with intention to use and trial use of e-cigarettes.[40,48,61–63,66,69,71,75,76,80,81] One randomized trial in 2014 among e-cigarette-naïve youth found that those who viewed e-cigarette advertisements and then completed a survey reported a greater likelihood of future e-cigarette use, compared to youth who completed a survey and then viewed the advertisements.[62] Intention to use e-cigarettes increased as perceived effectiveness of the advertisements increased.[63] A second randomized controlled trial conducted in US YAs in 2013 found that brief ad exposure was significantly associated with e-cigarette trial among never users of both e-cigarettes and cigarettes at baseline (aOR = 2.85, p < .05; 95% CI = 1.07 to 7.61).[66] A cross-sectional survey of adult smokers in Florida in 2013 found that the majority of e-cigarette nonusers reported being likely to try e-cigarettes after seeing a blu eCigs television ad.[48] A 2015 cross-sectional, school-based survey of Scottish youth found that recall of e-cigarette displays in small shops and online was a significant predictor of e-cigarette ever use and intention to use in the next 6 months.[61] A third 2012–2013 cross-sectional of hospitalized cigarette smokers reported that among Black participants, exposure to e-cigarette advertisements in the past 6 months was associated with ever use of e-cigarettes (p =.006), after controlling for potential confounders.[40] A cross-sectional survey of US YA bar patrons showed that receptivity to marketing was associated with past 30-day e-cigarette use.[80] A study using 2014 New Jersey YTS data and assessment of the point of sale retail environment around New Jersey schools found that self-reported exposure to tobacco and e-cigarette advertising in stores was associated with ever e-cigarette use in adjusted analyses, as was e-cigarette retailer density around schools (p < .05).[81] A study using experimental auctions found that participants who were only exposed to print e-cigarette advertisements bid significantly more money on single use e-cigarettes than those who were exposed only to television advertisements.[71] An

Table 2. Measures Used to Assess E-cigarette and Cigarette Use and Perceptions

Perceptions of e-cigarette	Harm relative to cigarettes[56,67,69,78]
	Absolute harm perception[78]
	Product appeal[78]
	Addictiveness relative to cigarettes[56,69]
	Using e-cigarettes are:[63]
	unenjoyable/enjoyable; unhealthy/healthy; dangerous/safe; boring/fun; stupid/smart; not cool/cool; not attractive/ attractive
	Agreement that e-cigarettes are:[62]
	Able to be used where smoking is not allowed; Able to be used without affecting those around them; A safer alternative to regular cigarettes; Less toxic than ordinary cigarettes; A good way to express your independence
E-cigarette use	[a]Susceptibility to e-cigarette use[62–65]
	Interest in trying e-cigarette ("Not at all" to "A lot")[52,59]
	Intention to use e-cigarette[69]
	Likely to try e-cigarette ("Very likely" to "Very unlikely")[48]
	Likely to try e-cigarettes in next 6 months[61,68,78] ("Very likely" to "Very unlikely")
	Likely to buy e-cigarettes in next 3 months (Juster scale)[60]
	Ever use[40,64,66,77,81]
	Past 30-day use[12,13,64,69,72,76,80]
Combustible cigarette use	[a]Susceptibility to smoking[52,55]
	Think about smoking ("Never" to "Always")[48]
	Urge to smoke ("No urge" to "Strongest urge")[48]
Smoking cessation	Past 6-month quit attempt[50]
	Past 6-month successful quit attempt[50]
Demand for e-cigarettes	Price elasticity[70]
	Monetary bid for product[71,75]

[a]Susceptibility consists of some or all of the following questions: Do you think you will try [insert product] soon? Do you think you will try [insert product] during the next year? If one of your best friends were to offer you [insert product], would you use it?

additional experimental auction found that in cases where advertisements increase demand for e-cigarettes,[75] an advertisement was also shown to increase cigarette demand, although response to advertisements varied based on the race/ethnicity of participants.[75] Unlike the other studies, Lee et al. conducted a cross-sectional survey and found that ever e-cigarette users who did not use in the past 30 days were less likely to intend to become past 30-day users if they were exposed to TV/movie e-cigarette advertisements.[76]

Eight studies indicate that as recall of exposure to e-cigarette advertising increases, the likelihood of e-cigarette use also increases.[12,13,64,69,70,72,77,79] A cross sectional study of women in Kentucky found that for every 1-point increase on an e-cigarette advertising recall scale, the odds of ever using an e-cigarette increased by 4%.[77] Six studies utilizing the 2014 NYTS dataset indicate that more frequent exposure to e-cigarette marketing is associated with greater intention to use and use of e-cigarettes.[12,13,64,69,72,79] Two studies found that the odds of past 30-day e-cigarette use were significantly greater for middle and high school students recalling frequent exposure to e-cigarette advertisements on the internet, in newspapers/magazines, in TV/movies, and in retail stores, compared to those reporting lower levels of exposure.[12,13] Three 2014 NYTS studies found that the likelihood of e-cigarette use increased as the number of e-cigarette marketing channels exposure increased.[13,64,69] Another analysis of the same dataset revealed that minority adolescents who recalled moderate and high e-cigarette advertising exposure were more likely to report e-cigarettes as their first tobacco product compared to those who reported little to no exposure.[79] A fifth study utilizing NYTS data from 2011 to 2014 showed that compared to urban youth, rural youth reported more frequent exposure to tobacco advertising, and, as tobacco advertising recall increased, the odds of past 30-day e-cigarette use increased 6-fold.[72] A longitudinal study of Neilson sales data reported that as the

number of e-cigarette advertisements increased over time, demand for e-cigarettes increased.[70]

Nine studies demonstrate that ad content affects intention to use and use of e-cigarettes.[52,59,65,68,71,73,75,78,82] A 2013 between-subjects experiment using a national sample of e-cigarette naïve adult smokers found that advertisements showing a person using an e-cigarette elicited greater interest in use than an advertisement that did not show e-cigarette use.[59] A second between-subjects experiment of English school children aged 11 to 16 years who were tobacco and e-cigarette naïve assigned participants to either view flavored e-cigarette advertisements, nonflavored e-cigarette advertisements, or no advertisements; flavored e-cigarette advertisements elicited the greatest interest in buying and trying e-cigarettes.[52] A randomized experiment of YAs in Hawaii aged 18 to 29 years who were current nonsmokers and e-cigarette naïve exposed participants to one of three magazine e-cigarette advertisement conditions—harm reduction focused (health), social enhancement focused (social), and every day object focused (control).[65] Compared to the control condition, participants in the social condition had 2.8 times higher odds of being open to future e-cigarettes use; the association between the health condition and openness to e-cigarette use was marginally significant.[65] In a cross-sectional survey in 2013 in which students at a Southwestern public university saw three e-cigarette commercials; authors reported that a positive reaction to the commercials was associated with intention to use e-cigarettes.[68] Petrescu et al. conducted a study randomizing tobacco- and e-cigarette-naïve British children to view advertisements depicting e-cigarettes as glamorous (exposed 1) or healthy (exposed 2) versus no advertisement (control). Estimates of e-cigarette prevalence were higher for both exposed groups compared to the control group; estimates were not different between the glamor and health groups.[73] An online quasi-experimental study of the effect of message framing (contrasting

e-cigarettes and cigarettes, or highlighting their similarities) concluded that e-cigarette advertisements with a contrasting message increased favorability and credibility and lowered absolute risk perceptions compared to a snus advertisement with a similar framing.[78] An fMRI study of adolescents exposed to validated e-cigarette advertising images and neutral images revealed greater brain activation in areas associated with cognitive control, visual processing and attention, and memory when viewing the e-cigarette advertisements compared to when viewing neutral images.[82]

An additional study evaluated the impact of pro-tobacco[83,84] advertisements on e-cigarette use. This cross-sectional study used data from the 2011 NYTS to examine the impact of exposure to pro-tobacco advertising in print media, retail outlets, and the internet on ever use of e-cigarettes among US youth in grades 6 through 12. Analyses showed higher odds of ever use with e-cigarettes among youth exposed to one (OR = 1.35, NS; 95% CI = 0.88 to 2.08), two (OR = 1.83, $p < .05$; 95% CI = 1.14 to 2.93), or all three (OR = 2.23, $p < .05$; 95% CI = 1.22 to 4.06) sources of pro-tobacco advertisements.[83]

Impact of E-cigarette Marketing on Cigarette Smoking

Four publications address the impact of e-cigarette marketing on combustible cigarette use.[48,50,52,55] Of these, two were cross-sectional studies on the effect of e-cigarette marketing on combustible cigarette use,[48,55] one was a longitudinal study on the association between e-cigarette advertisement exposure and smoking cessation,[50] and one was a between-subjects experiment on the effect of e-cigarette advertisement exposure on the appeal of combustible cigarette use.[52] The specific measures used to assess cigarette smoking behaviors are listed in Table 2.

Three studies addressed whether e-cigarette marketing is associated with susceptibility to cigarette smoking among youth and adults. A cross-sectional study conducted in 2013 among adult smokers in Florida found that for the majority of participants (75.8%), viewing a blu eCig advertisement cued thoughts about smoking cigarettes, with significantly higher rates among prior e-cigarette users than nonusers (82.7% vs. 72.2%; $p < .05$); however, e-cigarette users were also more likely to be cigarette smokers, which could account for these results.[48] In a between-subjects experiment, Vasiljevic et al. reported that exposure to e-cigarette advertisements was not associated with an increase in susceptibility to smoking among English youth aged 11 to 16 years who did not smoke tobacco or use e-cigarettes.[52] Cross-sectional data from the PATH study (2013–2014) indicate that moderate to high receptivity to e-cigarette advertising is correlated with increased susceptibility to smoke cigarettes.[55]

Evidence is inconclusive as to the influence of e-cigarette marketing on smoking quit attempts.[50] In a 2013–2014 longitudinal study using data from the ITC Project, Nagelhout et al. reported that noticing e-cigarette advertisements within the last six months at follow-up was associated with an increased likelihood of a recent quit attempt in unadjusted analyses, but this did not hold in multivariable analyses.[50] The same study also found no significant association between noticing e-cigarette advertisements within the last six months and having successfully quit smoking within the past six months.[50]

E-cigarette Warning Labels

Four studies conducted between 2011 and 2015 examined e-cigarette warnings on e-cigarette packaging[20] and online retail sites.[23,85,86] Three studies showed that the content and location of warning statements vary across product packaging[20] and retail websites;[23,85] warning statements were not found on all packaging and retail sites.[20,23,85] An analysis of e-cigarette advertisements in magazines (2011–2015) found that top brands containing voluntary warnings (ranging from stating that the product contains nicotine to including a list of the potential negative effects of using nicotine) include MarkTen, MISTIC, NJOY, VUSE, and blu eCigs, all of which contain "nicotine," but only half contain "warning."[86]

Six studies addressed the effect of e-cigarette advertisement warning labels on e-cigarette perceptions and intention to use, with studies suggesting that perceived harm increases and intention to use e-cigarettes decreases after viewing warnings.[60,67,87–91] A 2015 between-subjects experiment among YAs aged 18 to 34 years found that intention to purchase e-cigarettes decreased when exposed to e-cigarette advertisements with industry (OR = 0.52, $p = .003$; 95% CI = 0.34 to 0.80) and ingredient warnings (OR = 0.41, $p < .001$; 95% CI = 0.27 to 0.62).[60] A second between-subjects experiment with nonsmoking United States. YAs found that those exposed to e-cigarette advertisements without warnings had lower e-cigarette harm perceptions compared to those exposed to advertisements with warnings or to those exposed only to e-cigarette warning statements.[67] A third between-subject experiment published in 2017 among adult cigarette smokers, e-cigarette users, and dual users found that an addiction warning on an e-cigarette advertisement increased participants' e-cigarette-related risk beliefs, reducing their willingness to try e-cigarettes.[88] A fourth between-subjects experiment showed that exposure to graphic health warning labels decreased openness to use e-cigarettes and snus, but was insignificant after accounting for emotional response to the advertisements.[89] Current e-cigarette users or cigarette-only smokers in a series of focus groups expressed that proposed e-cigarette warning messages needed to be more specific, that some were exaggerated based on their knowledge of e-cigarettes,[87] and that they were uncomfortable with messages conveying substantially lower risk of e-cigarettes compared to cigarettes because they did not "feel" like a warning.[90] In line with FDA's requirement to provide information on harmful and potentially harmful constituents in tobacco products, a cross-sectional study of adult smokers found that disclosure of the amount of chemicals in cigarettes increased interest in initiating or increasing dual use of cigarettes and e-cigarettes.[91]

Tobacco and E-cigarette Prevention Messages

Two studies addressed the impact of antitobacco or e-cigarette messages on e-cigarette use/perceptions.[84,92] In a pretest–posttest experiment conducted in 2014, YAs entering Air Force Technical Training in Texas were randomized to view one of six antismoking advertisements with the following themes—1) anti-industry; 2) health effects and anti-industry; 3) sexual health (ie, impotence); 4) secondhand smoke; 5) environment and anti-industry; and 6) control. Relative to the control condition, all but the secondhand smoke condition were associated with decreased intention to use e-cigarettes.[84] Another study examined the impact of youth and YA preferences for message framing related to the prevention of e-cigarettes use.[92] This study, conducted in Connecticut in 2013 and 2014, showed that loss-framing was preferred for message themes related to health risks, addiction potential, and social labeling as a smoker whereas gain-framing was preferred for message themes related to financial cost.

Summary

E-cigarettes are marketed as alternatives to combustible cigarettes,[20,22,24,26,38,39] with advertisements placed in retail outlets and

across various media channels.[4,12,40–42,44,50,51] Advertisements contain content appealing to youth[22,24,30,33,36,38,39] and are available through channels with youth exposure.[23,29,42,53] Cross-sectional data suggests that e-cigarette users recall more e-cigarette marketing and are more likely to find the advertisements appealing compared nonusers[48,51,55]; however, these studies are subject to recall bias and should be interpreted with caution. There is also an association between recall of e-cigarette marketing and lower e-cigarette harm perceptions, greater intention to use, and use of e-cigarettes, although most of these studies are cross-sectional, so causality cannot be inferred.[12,48,56,61–64,66,67,69] Research is limited and findings are inconclusive as to the effect of e-cigarette marketing on cigarette smoking and cessation.[48,50,52,55] The majority of e-cigarette products and retailer sites feature warnings,[20,23,85] but the content and location of the warnings is inconsistent. The inclusion of warnings in e-cigarette advertisements may increase e-cigarette harm perceptions[67,88] and reduce the odds of purchasing e-cigarettes.[60,88] Future research is needed to determine how best to present modified risk and prevention messages, as well as harmful and potentially harmful constituent information to benefit public health.

Communication

Engagement with E-cigarette Information
Eighteen publications address how people engage with e-cigarette information.[14,15,93–100,S101-S108] Of these, six were cross-sectional surveys on exposure to e-cigarette information,[14,98,99,S102,S104,S108] one was a focus group study on e-cigarette perceptions,[100] two were trend analyses of e-cigarettes search queries,[93,94] and eight were content analyses of e-cigarette information shared through online media[95,96,S107] and social media platforms.[15,97,S101,S103,S106] One study assessed the readability of publicly-available e-cigarette content.[S105]

Six studies conducted between 2012 and 2014 reported that e-cigarette information is disseminated through television,[98,100,S102,S107] in-person communication,[98,S102,S104] retail outlets,[98,100] and the internet.[95,S102,S107] Analyses conducted between 2008 and 2015 indicated that Google e-cigarette search queries have increased since 2008 in the United States,[93,94] with a 450% increase between 2010 and 2014.[94] Eight studies of online media data between 2008 and 2015 highlighted the expanding availability of e-cigarette information online, particularly on YouTube[95,96] and social media platforms.[14,15,97,S101,S103,S106] Huang et al. conducted a metadata analysis of e-cigarette-related YouTube videos between 2012 and 2013 and found that the rate of e-cigarette-related video postings on YouTube increased from several new videos per month in 2007 to approximately 2000 new videos per month in 2013.[96] Video view counts nearly doubled between 2012 and 2013, increasing by four million views per month.[96] A second study analyzing Twitter data collected over three months in 2014 demonstrated that social media platforms such as Twitter can expand the reach of e-cigarette information nearly 10-fold as users re-post information.[15] A study of a random sample of Twitter posts, or tweets, from November 2014 reported that half of the tweets came from noncommercial sources, such as people sharing coupons, deals, or product reviews.[S107]

A 2013 cross-sectional survey of US adults found that females, those with an income of ≥$35 000, and social media users were more likely to search for e-cigarette information; individuals identifying as a sexual minority and those who had not completed high school were more likely to share e-cigarette information.[S108] Additional factors associated with both searching for and sharing e-cigarette information include current tobacco use, being 18–24 years old, being Hispanic, and spending greater time online.[S108]

Portrayal of E-cigarettes in the Media
Twenty-seven publications examined how e-cigarettes are portrayed across media channels[96,S106,S109-S132] or in interpersonal communication.[S104] Of these, 23 were from content analyses of e-cigarette information shared through online media[96,S110,S113,S116,S117,S119,S121,S124,S126,S127,S131] and social media platforms,[S106,S109,S111,S112,S114,S115,S122-S130,S132] one was a randomized trial,[S104] one was from a thematic analysis of e-cigarette-related print and online press,[S120] and one examined the modification of antitobacco campaigns by e-cigarette advocates.[S118]

Content analyses of online e-cigarette communication between 2013 and 2015 showed that the majority of e-cigarette communications were neutral or positive towards e-cigarettes.[S109,S111,S112,S116,S119] However, two studies in vulnerable populations showed that negative aspects of vaping were also prevalent in online discussions.[S130,S131] In an analysis of tweets posted by physicians from June 2015 through June 2016, Glowacki et al. found that e-cigarette attitude varied by geographic location, with U.K. physicians tweeting most positively about e-cigarettes.[S124] Six studies of online e-cigarette communication conducted between 2012 and 2015 reported that e-cigarette communication addressed several content domains, including: (1) marketing;[S109-S111,S115,S119,S128] (2) policy and regulation;[S109,S111,S128] and (3) health and safety.[96,S109-S111,S115,S117,S120,S122,S128] Two studies, a content analysis of e-cigarette-related YouTube videos posted between 2008 and 2013 and a thematic analysis of U.K. news articles published between 2007 and 2012, found that e-cigarettes were most commonly presented as a healthier choice than cigarette smoking.[S117,S120] Van der Tempel et al. reviewed tweets related to e-cigarettes and cessation by user type (eg, industry, personal, etc.) in 2014 and found the majority of users within each user type endorsed e-cigarettes as an effective smoking cessation aid, except for users identified as industry-related and public health/healthcare providers.[S122] A fourth content analysis of tobacco-related tweets posted between 2012 and 2013 found that 83% of e-cigarette tweets made implicit or explicit comparisons to cigarettes, particularly with respect to cost.[S115] Ayers et al. examined the reasons for using e-cigarettes discussed in tweets posted from 2012 to 2015 and found that the reasons people used e-cigarettes shifted from cessation to social image.[S125] An additional content analysis of vape shop Yelp reviews in Southern California between 2013 and 2014 found that 32% of stores had reviews stating that the store was a place to quit smoking.[S123] Interpersonal communication among adult smokers in North Carolina (*n* = 2149) about e-cigarettes centered on using e-cigarettes to reduce or quit smoking, describing e-cigarettes and how they work, and discussing brand and flavor preferences.[S104]

Six studies examined policy/regulation related content.[99,S109,S111,S128,S132,S133] Two text mining analyses of Twitter found that the majority of tweets were pro-vaping discussions of e-cigarette policies,[S111,S128] and another analysis found that regulatory posts most often come from individual Twitter users rather than commercial sources.[S109] One 2014 cross-sectional survey of US adults examined how exposure to e-cigarette information and contradictory or conflicting e-cigarette information affected public support for e-cigarette regulations.[99] Results showed that adults with greater exposure to e-cigarette information in the past three months were less likely to agree with an age restriction on purchasing e-cigarette products, a required addiction warning on e-cigarette packaging and advertisements, and required

labeling of nicotine content and other harmful ingredients on e-cigarette packaging; exposure to conflicting e-cigarette information was not associated with supporting addiction warnings on e-cigarette packaging and advertisements.[99] A second study, focusing on text mining of tweets immediately following FDA's May 2016 announcement of the Deeming Rule, found that initial reactions to proposed e-cigarette regulations were negative or mixed.[S133] An additional study examining geographic and tobacco control policy variation found that commercial e-cigarette tweets were more common from Twitter users in states with better tobacco control policies ($p < .0001$) and lower youth smoking prevalence ($p = .005$).[S132]

Five studies of e-cigarette-related social media highlighted the heavy influence of e-cigarette companies and advertisers in e-cigarette communication.[S114,S116,S117,S126,S127] The first study, which analyzed YouTube videos posted between 2008 and 2011, found that information cues such as retailer information and special promotions were particularly prominent among industry-sponsored videos.[S117] In analyzing e-cigarette-related YouTube videos posted between 2012 and 2013, Jo et al. found that online media platforms such as YouTube not only relayed e-cigarette information, but also served as a direct medium between e-cigarette companies and consumers.[S116] A third study, which analyzed the content of nearly 74 000 tweets posted between May and June 2012, found that 90% of the tweets contained commercial content such as URLs to online retailers.[S114] Another review of tweets from 2012–2014 revealed that most posts are automated commercial sources and contain promotional content, particularly promoting e-cigarettes as smoking cessation devices.[S126] Over half of Instagram posts tagged with #ecig or #vape from 2011–2015 were from corporate sources, and e-cigarettes were most commonly promoted as smoking cessation devices.[S127] Evidence a study examining the emergence of antibranding activism indicated that e-cigarette companies and its supporters have promoted the relative benefit of e-cigarettes by modifying elements of established antitobacco campaigns such as the Centers for Disease Control and Prevention's *Tips From Former Smokers*.[S118] A 2015 cross-sectional survey conducted using a nationally representative sample of US adults examined the level of trust in health information about e-cigarettes.[S134] Relative to White respondents, Black and Asian respondents were more likely to trust e-cigarette information from e-cigarette companies.[S134]

Summary

E-cigarette information is widely available across media channels.[95,98,100,S102,S132] Public interest in e-cigarette information has been increasing and is projected to continue to grow.[93,94,96] Content analyses of online media and social media platforms suggest e-cigarettes are primarily discussed in a neutral or positive context,[S109,S111,S112,S116,S119] but this may vary by information source[S122,S124] and population.[S130,S131] Online portrayals of e-cigarettes are heavily influenced by e-cigarette companies and advertisers, who utilize online media platforms to create a direct link with their consumers.[S116,S117,S126,S127]

Discussion

Initially characterized by independent brands, e-cigarette brands owned by major tobacco companies have become more prevalent since 2011.[S135] These companies have the financial resources to not only comply with the increasing federal regulations on e-cigarettes, but also to aggressively market e-cigarettes. The consolidation of the e-cigarette market parallels the significant increases in marketing expenditure between 2010 and 2014.[4–6]

Findings from this review demonstrate parallels in the marketing strategies for combustible cigarettes and e-cigarettes, using price promotions[23,27] and themes appealing to youth,[22,24,30,35] as well as placement of advertisements across retail and media channels.[3,4,12,34,35,40–42,44,50,51] However, e-cigarette advertisements are distinct from cigarette advertisements in that the former commonly promote their products as healthier alternatives[22,24,28,31,39] to cigarettes that can be used as aids to quit smoking.[21,22,26,31] The majority of youth in the US report having seen an e-cigarette advertisement,[58] and more youth are receptive to e-cigarette advertisements compared to advertisements for other tobacco products.[55]

Several studies in this review reported an association between exposure to e-cigarette marketing and harm and addictiveness perceptions of e-cigarettes, intention to use e-cigarettes, and use of e-cigarettes.[12,13,48,56,61–64,66,67,69,81] However, much of the research on e-cigarette marketing exposure is limited by its cross-sectional design and vulnerability to recall bias, in that e-cigarette users may be more likely to both recall e-cigarette marketing in general, and pay attention to e-cigarette marketing when they are exposed. Additionally, this review highlights the limited findings on the effects of e-cigarette marketing on combustible cigarette use.[48,50,52,55] Specifically, one longitudinal study that reported on e-cigarette marketing and cessation assessed both exposure to e-cigarette advertisements and quit attempts at follow-up.[50] Thus, analysis of the association between e-cigarette advertisement exposure and smoking cessation was cross-sectional. The other studies reporting on e-cigarette marketing and cigarette smoking show that exposure/receptivity to e-cigarette marketing may be associated with an increase in susceptibility to cigarette smoking among adults,[48] but there are mixed findings among youth.[52,55] As only three studies examined e-cigarette marketing and cigarette smoking susceptibility, findings should be interpreted with caution. Specifically, study participants were not comparable with respect to e-cigarette and cigarette use. Research suggests that the presence of warnings in e-cigarette advertisements increases e-cigarette harm perceptions and decreases the odds of purchasing e-cigarettes.[60,67,87–90]

This review also highlights the use of media channels not just for e-cigarette marketing, but also for public discourse on e-cigarettes. Findings from this review showed significant increases in public interest in e-cigarettes since 2008.[93,94,96] Public exchanges of e-cigarette information primarily presented e-cigarettes in a neutral or positive context,[S109,S111,S112,S116,S119] but this varied by information source.[S122] Although disseminated by members of the public, online portrayals of e-cigarettes were still heavily influenced by e-cigarette companies and advertisers, who utilized online media and social media platforms to influence consumers.[35,S126]

Gaps and Future Research

There are several limitations to consider when reviewing these findings. First, eligible studies were restricted to those that were peer-reviewed, indexed in PubMed, and available in English. Given these restrictions, not all publications related to e-cigarette marketing and communication may have been captured in the review. This work demonstrates that the state of the evidence on the effect of e-cigarette marketing and communication on e-cigarette and tobacco use behaviors is limited and should be interpreted with caution. Existing studies on the impact of marketing on e-cigarette and other tobacco use have only examined the relationship between advertisement

exposure and e-cigarette or tobacco product trial (ever and past 30-day use); future research should measure progression to frequent/regular use and to smoking cessation. More longitudinal prospective studies are needed to address this gap. With respect to advertising exposure, standardized measures, such as those available through PhenX (https://www.phenxtoolkit.org/), should be used for comparison across studies.

With respect to e-cigarette communication, most studies were content analyses of online and social media posts and were unable to distinguish between posts originating from youths or adults. This review found no studies on the effect of e-cigarette communication on tobacco use behaviors. Additional research is needed to examine how exposure to e-cigarette communication, particularly misleading or inaccurate information, affects e-cigarette and tobacco use behaviors. Research is limited with respect to the effect of exposure to e-cigarette information on public support of e-cigarette regulations.[99] More research will be needed to monitor the impact of any marketing restrictions on the way that e-cigarette companies market their products and on how people communicate about e-cigarettes. Future studies should also capture the types of devices being used or marketed to address potentially meaningful differences in how people communicate about various products or who is exposed to advertising.

Supplementary Material

Supplementary data are available at *Nicotine & Tobacco Research* online

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Declaration of Interests

The authors have no conflicts of interest to report.

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