

ORIGINAL ARTICLE

When Visual Cues Activate Moral Foundations: Unintended Effects of Visual Portrayals of Vaping within Electronic Cigarette Video Advertisements

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Within multimodal persuasive messages, the roles of visual cues in producing unintended effects have been understudied. In an experiment on a sample of former and current smokers (N = 991), we manipulated the presence of visual vaping cues within electronic cigarette video advertisements (N = 25) to evaluate opinions towards vape-free policies. Such cues diminished the effects of pro-vaping arguments to increase support for vape-free policies, inadvertently benefiting public health. Consistent with the moral foundations theory (MFT), endorsement of the care/harm moral foundation strengthened message effects. Furthermore, cognitions and emotions related to moral intuitions mediated the effects of visual vaping cues. These findings suggest that MFT can help explain unintended effects of visual cues when outcomes are related to morality.

Keywords: Moral Foundations Theory (MFT), Unintended Effects, Multimodal Message, Visual Persuasion, Moral Appeal, Electronic Cigarette.

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Strategic communication can produce unintended effects (Byrne & Niederdeppe, 2011; Cho & Salmon, 2007): for example, exposure to the National Youth Anti-Drug Media Campaign unexpectedly led some young people to report lower intentions to avoid marijuana use (Hornik, Jacobsohn, Orwin, Piesse, & Kalton, 2008). In existing research on unintended effects of strategic messaging, the roles of visual message cues have been understudied. Using publicly-aired electronic cigarette (e-cigarette) video advertisements, the current research aims to experimentally demonstrate how visual portrayals of e-cigarette vaping could produce *anti-vaping* outcomes presumably against the intentions of e-cigarette advertisers.

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Drawing upon the moral foundations theory (MFT) (Graham et al., 2013; Haidt, 2012; Iyer, Koleva, Graham, Ditto, & Haidt, 2012), we hypothesize that when visual elements in a message activate moral intuitions even intuitively and inadvertently, intuitions' primacy would shift attitudes and opinions based on moral values (e.g., opinions of smoke-free policies, abortion, and death penalty) in the direction consistent with the visual. Among many types of unintended effects (Byrne & Niederdeppe, 2011; Cho & Salmon, 2007), we focused on policy opinions as the primary outcome for two reasons: first, according to Cho and Salmon (2007), policy opinions direct unanticipated outcomes of strategic messaging from the individual to the societal level—a less studied form of unintended effects than self-directed outcomes; second, policy opinions are often based on core moral values, reflecting individuals' normative positions on *right* or *wrong* (Haidt, 2012; Prinz, 2007). Existing research on visual messages and policy opinions (Powell, Boomgaarden, De Swert, & de Vreese, 2015; Scharrer & Blackburn, 2015) has not yet explicitly addressed the connection between visual elements and the moral basis of these policy opinions. To our best knowledge, the current research is the first to apply MFT to explain unintended effects of visual message cues, although MFT has already guided research on media enjoyment and appreciation (Lewis, Tamborini, & Weber, 2014; Tamborini et al., 2013), persuasiveness of textual moral frames (Feinberg & Willer, 2015; Kidwell, Farmer, & Hardesty, 2013; Wolsko, Ariceaga, & Seiden, 2016), and effects of media influences—especially narratives and exemplars—on the salience and endorsement of moral values (Eden et al., 2014).

E-cigarettes are battery-powered devices that deliver nicotine by producing an aerosol of vapor containing nicotine that a user inhales (called vaping). Unlike combustible cigarettes, e-cigarette advertising is not currently prohibited on radio, television, or Internet (Food and Drug Administration, 2016); and industry expenditure on advertising has been rapidly increasing, rising from \$6.4 million in 2011 (Kim, Arnold, & Makarenko, 2014) to \$88.1 million in 2014 (Cantrell, Emelle, Ganz, Hair, & Vallone, 2015). Despite the lack of scientific consensus regarding e-cigarettes' exact health risks (Dinakar & O'Connor, 2016), e-cigarette advertisements often contain pro-vaping verbal arguments that emphasize reduced health harms including negligible harms associated with secondhand vaping (Grana & Ling, 2014). Increased exposure to e-cigarette information including advertisements may have helped people form policy opinions, as evidenced by positive associations between exposure and participants disagreeing (versus reporting *no opinion*) with vaping restriction policies (Tan, Lee, & Bigman, 2015).

The possibility remains that certain visual cues could produce unintended effects in the direction of increasing support for vape-free policies. Portrayals of vaping resemble smoking (King et al., 2016; Maloney & Cappella, 2016) and this resemblance may inadvertently activate negative considerations about smoking combustible cigarettes—especially secondhand smoking—that have become entrenched in moral terms (Katz, 1997; Rozin & Singh, 1999). Based on MFT, we hypothesize that exposure to visual portrayals of vaping will produce *higher*

support for implementing vape-free policies, despite their known effects to trigger the urge to vape (King, Smith, McNamara, & Cao, 2018). This expectation presumably contradicts the intent of e-cigarette advertisers to promote e-cigarette use. However, this unintended effect is consistent with the moral base of vape-free policy opinions and the intuition primacy proposition in MFT, which we detail below.

Moral opinion and the effects of pro-vaping verbal arguments

Local and state governments in the United States have begun to introduce vape-free policies in public areas such as bars, restaurants, and school grounds, mirroring the implementation of smoke-free laws (American Nonsmokers Rights Foundation, 2017). Individual support for or opposition to vape-free policies is a moral opinion, because: (a) it reflects one's internalized normative position on whether e-cigarette vaping in public areas is right or wrong; and (b) expresses the intention for third-party social regulation. When opinion holders themselves are not directly involved in the action or scenario under evaluation (Haidt, 2012; Prinz, 2007), third-party social regulation is invoked. For instance, a pedestrian may attempt to stop someone smoking cigarettes near a child even though the pedestrian is not directly affected. Among other factors, whether a behavior is judged in moral terms as well as the direction of that judgment depends upon the extent to which a message portraying the behavior can successfully activate an endorsed moral foundation (Feinberg & Willer, 2015).

The MFT paradigm has identified six primary dimensions to organize human moral opinions in everyday life: care/harm, fairness/cheating, loyalty/betrayal, authority/subversion, sanctity/degradation and liberty/oppression (Graham et al., 2013; Haidt, 2012; Iyer et al., 2012). These dimensions are called moral foundations and have an evolutionary basis constituting "a first draft of the moral mind" (Graham et al., 2013, p. 62). MFT further postulates that specific moral opinions are formed when situational influences activate moral foundations through moral intuitions or moral reasoning—two processes critically differ by the degree of automaticity (Graham et al., 2013; Haidt, 2012). Whereas moral reasoning requires intentional, conscious, and effortful processing of information, moral intuitions refer to "the sudden appearance in consciousness of a moral judgment, including an affective valence (good-bad, like-dislike), without any conscious awareness of having gone through steps of searching, weighing evidence, or inferring a conclusion" (Haidt, 2001, p. 818). Importantly, the distinction is less of the contrast between emotion and cognition, but rather concerns differing levels of controllability and automaticity; although moral intuitions tend to involve affective responses (Haidt, 2001).

Although MFT has not specified how moral intuitions and moral reasoning could be differentially activated by visual versus verbal messages, information processing theory and research suggest that visuals are more likely to trigger moral intuitions and verbal information more likely to induce moral reasoning. Verbal

information consists of human-made symbols that are processed serially and require cognitive efforts to activate mental representations of the content of the symbols; in contrast, visuals are direct representations of objects and actions in the physical world that humans can readily perceive (Lang, 2014; Lang, Bailey, & Connolly, 2015). The consequence is that visuals are more likely than verbal information to *automatically* draw attention, arouse emotions, and activate evolved physiological responses (e.g., approaching food and avoiding dangers, Geise & Baden, 2015; Lang et al., 2015; Lang, 2014). Geise and Baden (2015) have reviewed extensive evidence showing that visuals could automatically grab attention, gain salience during the perception stage, and result in better encoding and recall. Since visuals are processed automatically, they should impact moral opinion formation primarily through activating moral intuitions whereas verbal information should exert influence primarily through moral reasoning.

To demonstrate unintended effects of visual cues, we first establish why verbal arguments within the same e-cigarette advertisement would produce pro-vaping harm perceptions and policy opinions. In the current study, opinions towards vape-free policies reflect moral considerations related to the care/harm foundation, which is derived from addressing the adaptive challenge of protecting one's vulnerable offspring and is later expanded to provide care for even non-human entities (e.g., animals and the environment, Graham et al., 2013; Haidt, 2012). People highly endorsing the care/harm foundation tend to morally condemn actions causing suffering to innocent others, and care/harm endorsement scores were found to predict disapproval of harm-related issues such as animal testing and death penalty, even after controlling for a battery of common predictors such as demographics and political orientation (Koleva, Graham, Iyer, Ditto, & Haidt, 2012). In the United States, people have come to treat their disapproval of smoking as a matter of fundamental right or wrong, especially after the Surgeon General's reports were released in the 1970s and 1980s to confirm harms associated with secondhand smoking, a concern reflecting the care/harm moral foundation (Katz, 1997; Rozin & Singh, 1999) and predictive of supporting smoke-free policies (Borland et al., 2006). In e-cigarette advertisements, pro-vaping verbal arguments often claim that vaping imposes reduced health harms either on self or others (Grana & Ling, 2014), reflecting concerns rooted in the care/harm moral foundation analogous to the case of smoking. Because the care/harm foundation serves as the moral basis for opinions about vape-free policies, exposure to verbal information arguing for the *absence* of harm concerns should lead to reduced support for vape-free policies. In the current context, perceived harms of secondhand vaping refer to smokers' judgments on the degree to which their vaping would harm other people in the vicinity.

H1a-b: Compared with participants randomized to receive no message exposure (no ad), those randomized to view e-cigarette advertisements with original visual

cue edited out (verbal only) will report: (a) less perceived harms of secondhand vaping; and (b) less support for vape-free policies.

H2: Perceived harms of secondhand vaping will mediate the effects of verbal arguments in the verbal only versus no ad comparison on vape-free policies opinions.

The intuition primacy proposition and the moral significance of visual vaping cues

In prior research on the connection between MFT and persuasion, the focus is on verbal messages and their efficacy to enhance persuasiveness by appealing to more (versus less) highly endorsed moral foundations (Clifford & Jerit, 2013; Feinberg & Willer, 2015; Kidwell et al., 2013; Wolsko et al., 2016). For example, for conservatives, verbal messages reframed to target the highly endorsed sanctity/degradation foundation were more effective to produce support for the Affordable Care Act than messages targeting the less endorsed fairness/cheating foundation (Feinberg & Willer, 2015, Study 3). However, the possibility that visual cues could activate moral intuitions counter to verbal arguments has not been examined. The roles of moral intuitions are prioritized over moral reasoning in MFT because moral reasoning's primary function is theorized to generate justifications for the conclusion reached by moral intuitions (Graham et al., 2013; Haidt, 2012). This intuition primacy proposition was originally developed in the social intuitionist model (Haidt, 2001), a precursor to MFT. When moral intuitions are activated (e.g., visually) in a direction opposite to moral reasoning (e.g., verbally), the intuition primacy proposition predicts that the resulting opinion should be more in line with people's moral intuitions than with their moral reasoning. The key claim that moral intuitions are able to resist or even outweigh moral reasoning is the basis for the unintended effects of visual vaping cues. In the stimuli we examined, visual vaping cues appeared to arouse *anti-vaping* moral intuitions while verbal versions stimulated *pro-vaping* reasoning.

Visual vaping cues are defined as visual portrayals of objects (e.g., e-cigarette, vapor cloud) or behaviors (e.g., holding an e-cigarette, inhaling and exhaling vapor from an e-cigarette) associated with e-cigarette vaping (Maloney & Cappella, 2016). Such cues have been shown to increase smoking urge among current smokers and to reduce abstinence intention among former smokers (King et al., 2016; Maloney & Cappella, 2016). However, visual vaping cues were also found to activate anti-smoking cognitions such as heightened perceived harms of smoking (e.g., contracting cancer) among current smokers (Yang, Tan, Hamilton, Fischbein, & Kenne, 2018). To the best of our knowledge, this study is the first to examine whether visual vaping cues could produce anti-vaping policy opinions.

Analogous to visual vaping cues' effects to active smoking-related urge and harm perceptions, the resemblance between portrayals of vaping and smoking (see Figure 1) could also automatically trigger moral considerations initially associated with smoking. In one study, Cushman, Gray, Gaffey, and Mendes (2012) had participants perform pretend harmful actions (e.g., shooting a person with a fake gun),



Figure 1 Cigarette/non-cigarette and visual vaping cue.

and found that such pretend actions triggered more aversive psychophysiological responses than performing kinetically matched non-harmful actions (e.g., using a spray bottle). This finding suggests that moral aversion can be intuitively triggered despite people being aware of the absence of harmful consequences. In the context of e-cigarette commercials, even when people' harm perceptions about e-cigarette vaping were to be reduced by pro-vaping arguments, their moral opinions could still be susceptible to the influences of visual vaping cues. Because the resembled action of smoking is morally disapproved (Katz, 1997; Rozin & Singh, 1999), and because vaping resembles smoking so closely, visual portrayals of vaping can automatically activate a sense of moral outrage. The consequence is that exposure to such cues (e.g., a young woman vaping directly into what appears to be a baby stroller, see Figure 1, Panel C) are likely to increase support for vape-free policies, not necessarily in a logically deductive way but as a set of automatic cues reminding the consumer of a morally unacceptable behavior.

If the intuition primacy proposition holds true, visual vaping cues will, at the minimum, mitigate the effects of pro-vaping verbal arguments. However, the evidence would be more convincing should such cues produce net increase in policy support, operationalized as higher support for vape-free policies for those viewing unedited advertisements with visuals (visual+verbal) than those in the no ad control. We did not seek to construct a visual-only condition because external validity for such messages would be low, whereas examples of verbal-only messages can be easily found in everyday life (e.g., radio broadcasting, podcasts).

H3: Compared with participants viewing verbal only messages, those randomized to view unedited visual+verbal messages will report more support for vape-free policies.

H4: Compared with participants randomly assigned to view no ads, those randomized to view visual+verbal messages will report more support for vape-free policies.

Since direct measures of moral foundation activation are difficult to implement, previous research instead tested how the effects of randomly assigned message stimuli targeting different moral foundations would vary by individual differences in

moral foundation endorsement (Feinberg & Willer, 2015; Wolsko et al., 2016). Following this strategy to indirectly gauge the operation of moral foundations, we hypothesize that higher endorsement of care/harm will be associated with stronger effects of: (a) pro-vaping verbal arguments; and (b) visual vaping cues.

H5a–b: The more participants endorse care/harm: (a) the more pro-vaping verbal arguments will *reduce* support for vape-free policies in the verbal only versus no ad comparison (H5a); and (b) the more visual vaping cues will *increase* policy support in the visual+verbal versus verbal only comparison (H5b).

The intuition primacy proposition further postulates that moral intuitions operate faster and can shape reasoning, pushing the deliberative mind to generate justifications for the intuitive judgment (Haidt, 2012; Mercier, 2011). In the context of e-cigarette advertisements, visual vaping cues may arouse disapproving intuitions strong enough to counter verbal harm denials and, therefore, is hypothesized to affect cognitive beliefs in the direction of increasing harm assessment of second-hand vaping.

H6a–b: Participants randomized to view visual+verbal messages will report higher levels of perceived harms of secondhand vaping than those randomized to: (a) the verbal only condition; and (b) the no ad control condition.

Although the latest exposition and review of MFT made no claims on specific correspondences between moral foundations and discrete emotions (Graham et al., 2013), moral intuitions are often empirically related to emotions (Cameron, Lindquist, & Gray, 2015; Graham et al., 2013). Some researchers found that violations of the care/harm foundation were uniquely linked to anger (Horberg, Oveis, & Keltner, 2011; Rozin, Lowery, Imada, & Haidt, 1999), whereas others disagree with specific linkages (Cameron et al., 2015; Gray & Wegner, 2011) and found that disgust was experienced stronger than anger even in care/harm violations (Hutcherson & Gross, 2011). Based on previous research, we expect visual vaping cues to increase both anger and disgust, each of which has an established role in moral opinion formation (Graham et al., 2013; Gray & Wegner, 2011). These hypotheses, though exploratory, are also consistent with existing visual persuasion research that emphasizes the affective route to visuals' effectiveness in both political (Iyer, Webster, Hornsey, & Vanman, 2014; Powell et al., 2015) and health (Dixon, 2016; King, 2016) contexts.

H7a–b: Compared with participants randomly assigned to view verbal only messages, those randomized to view visual+verbal messages will report more: (a) anger; and (b) disgust.

Lastly, the intuition primacy proposition points to mediating pathways through both emotions and cognitive beliefs, given that empirically moral intuitions usually have an emotional component and that, theoretically, intuitions should steer the way reasoning is conducted (Graham et al., 2013; Haidt, 2012). Since perceived

harms of secondhand vaping capture cognitive reasoning in addition to emotional reactions, it should remain significant as a mediator even after controlling for the mediating effects of anger and disgust.

H8a-c: When modeled as unrelated multiple mediators, anger (H8a), disgust (H8b), and perceived harms of secondhand vaping (H8c) will respectively mediate the effects of exposure to visual vaping cues on vape-free policy opinions in the visual+verbal versus verbal only comparison.

H9: After controlling for mediating effects of anger and disgust, perceived harms of secondhand vaping will remain significant in mediating the effects of exposure to visual vaping cues on vape-free policy opinions in the visual+verbal versus verbal only comparison.

Method

Research design

To systematically vary the presence of visual portrayals of vaping as well as device type, we employed a 2 (message condition: visual+verbal versus verbal only) \times 2 (device type: cigalike versus non-cigalike) + 1 (no ad control) between-subject design.¹ The interaction effects between message condition and device type were not significant for any of the outcome variables currently reported. Since the factor of device type was not the focus for the current report, it was dropped in further analyses. Given the focus on smokers for whom moral implications for secondhand smoking were salient, 497 daily and 494 former adult smokers were recruited from Survey Savvy, an online survey division of Luth Research that maintains a national panel of more than 1 million members.

The study protocol was approved by the university's Institutional Review Board. Interested participants who met screening criteria and provided informed consent were first asked to respond to questions measuring key demographics and smoking-related attributes. Next, participants were randomized to one of the five experimental conditions: those assigned to the four treatment conditions viewed three e-cigarette advertisements randomly selected from a larger pool of message stimuli, and those assigned to the control condition viewed no messages but instead answered filler questions about media use to control for the delay between pretest and posttest. Random sampling of messages per category can effectively address the methodological challenge of case-category confounding in message effects research (Jackson, 1992). After exposure to all three ads, participants answered questions assessing outcome variables and the care/harm moral foundation. Upon completion, they were directed to a debriefing webpage where the purpose of the study was disclosed and the lack of scientific consensus regarding health risks associated with e-cigarette use was emphasized. Participants were rewarded per Survey Savvy's panel policies.

Message stimuli

Between June and July 2014, the first round of search for message stimuli was described in previous research (Maloney & Cappella, 2016), and e-cigarettes in these ads closely resembled tobacco cigarettes in shape (Figure 1, Panel A). Between April and October 2015, similar search strategies were employed to update the message pool with a new collection of advertisements featuring non-cigalike e-cigarettes. In these ads, the shape of e-cigarettes considerably deviated from combustible cigarettes (Figure 1, Panel B).

After screening, 13 cigalike ads and 12 non-cigalike ads were retained,² which served as message stimuli for the visual+verbal condition and no additional editing was performed. All ads were 30 to 60 seconds in duration. For the verbal only condition, message stimuli were created by replacing each advertisement's video track with a display of text on the screen representing words as spoken and words that appeared on screen during the original ad; however, the audio track was left intact. In this way, verbal arguments were kept constant between the visual+verbal and the verbal only conditions, whereas portrayals of vaping were systematically eliminated in the verbal only condition.

Of the 25 selected advertisements, 16 explicitly made the claim that vaping poses negligible or reduced health harm and 16 ads contained explicit scenes depicting vaping with other people in the vicinity.³

Participants

People eligible for this study were 18 years of age or older, had smoked over 100 cigarettes in their lifetime, and either currently smoked cigarettes *everyday* (i.e., daily smokers) or *not at all* (i.e., former smokers). Among 503 daily smokers and 502 former smokers, 14 participants were excluded from further analysis due to inconsistent reporting (prior to message exposure) of smoking behaviors.

Measures

Summary statistics for covariates are presented in Table S1 (supplementary materials) and summary statistics for main outcomes are presented in Table 1 (collapsing device types) and Table S2 (all five conditions).

Pre-treatment covariates

For demographics, we measured participants' age, gender, number of children, education, income, ethnicity and race prior to ad exposure. We also measured several smoking-related attributes, including smokers' current stage of change regarding quitting (the contemplation ladder anchored by 0 = *I have no thoughts about quitting smoking* and 10 = *I am taking action to quit smoking*, see Biener & Abrams, 1991), smoking recency (categorized into *within 24 hours*, *within past year* or *longer than 1 year ago*), number of quit attempts (dichotomized to *no attempts* made or *one or more attempts*), smoking urge (1 = *strongly disagree* and 5 = *strongly agree*, averaged responses to the shortened scale "I have an urge for a tobacco cigarette" and "A tobacco cigarette would taste good right now," Pearson's

Table 1 Means and Standard Deviations of Main Outcomes by Message Condition

	N	Total Sample M (SD)	Visual + Verbal		Verbal Only M (SD)		No Ad n	M (SD)
			n	M (SD)	n	M (SD)		
Perceived harms of secondhand vaping	991	3.68 (1.80)	383	3.76 (1.81)	394	3.43 (1.83)	214	3.97 (1.74)
Anger	777	2.10 (1.15)	383	2.20 (1.23)	394	1.99 (1.06)		
Disgust	776	2.58 (1.28)	383	2.71 (1.35)	393	2.46 (1.19)		
Support for vape-free policy	991	2.82 (1.53)	383	2.89 (1.54)	394	2.66 (1.50)	214	2.98 (1.47)

Notes. Anger and disgust were not measured in the no ad control condition.

$r = .86$), e-cigarette awareness (*yes/no* to “had you ever heard of electronic cigarettes”), and e-cigarette use (*yes/no* to “Have you ever used an e-cigarette, even one puff”).

The care/harm moral foundation

This study focuses on the care/harm dimension of MFT. The measure was taken from the moral relevance of care/harm sub-scale of the Moral Foundations Questionnaire. Previous research has established the reliability and validity of this sub-scale (Graham et al., 2011). Participants were asked to rate to what extent three criteria (i.e., “whether or not someone suffered emotionally/someone cared for someone weak or vulnerable/someone was cruel”) were relevant to their thinking when deciding “something is right or wrong” on a 6-point Likert-type scale (1 = *not at all relevant—this consideration has nothing to do with my judgments of right and wrong* and 6 = *extremely relevant—this is one of the most important factors when I judge right and wrong*). These items were averaged to form a single score (Cronbach’s $\alpha = .90$, $M = 4.03$, $SD = 1.44$). This variable was measured after message exposure because previous research suggests that moral foundations function as relatively stable personality traits (Graham et al., 2013), and measuring it prior to message exposure might prime thoughts related to care/harm.

Support for vape-free policies

Following previous research (Tan et al., 2015), we asked participants whether they agree that “vaping or using e-cigarettes should be banned [or people should be able to vape or use e-cigarettes] in places where smoking tobacco cigarettes is banned.” The response options were *strongly disagree*, *somewhat disagree*, *somewhat agree*, *strongly agree* and *no opinion*. Each participant randomly received one of the two versions of question wording to balance potential wording effects; and responses to the second framing were reverse-recoded so that *strongly agree* also indicated being supportive of vape-free policies. *No opinion* was treated as the mid-point of the

5-point Likert-type continuous scale.⁴ Higher values indicated more support for vaping restriction ($M = 2.82$, $SD = 1.53$).

Perceived harms of secondhand vaping

Three questions were asked: (a) “Do you think that your exhaling vapor from e-cigarette would be...?” (1 = *not at all harmful to the health of people around you* and 7 = *very harmful to the health of people around you*); (b) “How concerned are you that vapor from e-cigarettes could affect the health of people around you?” (1 = *not at all concerned* and 7 = *very concerned*); and (c) “How harmful would you say that vapor from your e-cigarettes is to people around you compared to smoke from tobacco cigarettes?” (1 = *much less harmful* and 5 = *much more harmful*). After linearly rescaling the third item to range between 1 and 7,⁵ all three items were averaged to form a single score (Cronbach’s $\alpha = .89$, $M = 3.68$, $SD = 1.80$). For participants who had not used e-cigarettes before, a prefix (“if you were to use e-cigarettes”) was added to each item.

Anger and disgust

Single-item 5-point measures were used to assess to what degree (1 = *strongly disagree* and 5 = *strongly agree*) participants felt *angry* ($M = 2.10$, $SD = 1.15$) and *disgusted* ($M = 2.58$, $SD = 1.28$) while looking at the ads. Emotions were not measured for those randomized to the no ad control condition.

Statistical analyses

A series of ordinary least squares (OLS) models were fitted to the data, with model specifications varying as warranted to test proposed hypotheses. All tests were two-tailed. When main effects of visual vaping cues and verbal arguments were of primary interest (H1a–b, H3, H4, H6a–b, H7a–b), outcome variables were predicted with two dummies (indicator coding) specifying three message conditions: visual +verbal, verbal only (set as the reference category for H3, H6a, H7a–b), and no ad (set as the reference category for H1a–b, H4, H6b). Omnibus effects of message conditions were estimated using one-way between-subject ANOVAs. To test interaction effects with the care/harm foundation (H5a–b), main effects of care/harm and its product terms with conditions (with verbal only set as the reference category) were added to the model, in addition to the full set of pre-treatment covariates. Covariates were included to adjust for potential imbalances for subgroups formed along the scale of moral foundation, as participants were not randomized to receive different values of this continuous variable.

Mediation effects of anger (H8a) disgust (H8b) and perceived harms of secondhand vaping (H2, H8c) were estimated using the methodology developed by [Imai, Keele, and Tingley \(2010\)](#) and the mediation package in the statistical programming language *R* (version 3.3.2). The three mediators were first modeled as causally unrelated to gauge individual mediation effects assuming no post-treatment confounders (H2, H8a–c). Next, they were modeled as statistically dependent multiple mediators to assess unique mediation effects after controlling for others (H9).

Pre-treatment covariates were included in all mediation models to improve statistical estimation (Imai et al., 2010) of average causal mediation effects (ACMEs) and bootstrapping (3,000 replications) was employed to obtain bias-corrected 95% confidence intervals. Furthermore, when appropriate, sensitivity analyses were conducted to gauge the robustness of ACMEs had the threat from pre-randomization omitted variables become increasingly severe (Imai et al., 2010). The sequential ignorability assumption requires that in addition to the randomization of treatment and the inclusion of observed pre-treatment covariates, there exist no unmeasured variables—either pre- or post-treatment—that could potentially affect both the mediator and the outcome variables simultaneously (Imai et al., 2010). Randomization of treatment alone is insufficient to eliminate the potential omitted-variable bias confounding the mediator–outcome relationship. Through simulation, the sensitivity analysis (Imai et al., 2010) estimates how ACME would have changed had this ignorability assumption been progressively violated.⁶

Results

Main effects of pro-vaping arguments and unintended effects of visual vaping cues
 Unstandardized coefficients were reported throughout the results session. Main effects of message conditions were depicted in Figure 2 and summarized in Table 2. The main effects of message conditions on policy opinion were significant, $F(2, 988) = 3.65, p = .026, \eta^2 = .007$. Compared with no ad, exposure to verbal only advertisements on average reduced support for vape-free policies by .32 on a 5-point scale ($SE = .13, 95\% \text{ CI } [-.57, -.06], p = .015$). In contrast, exposure to visual+verbal advertisements on average increased policy support by .23 ($SE = .11, 95\% \text{ CI } [.01, .44], p = .039$) in comparison to verbal only. The data supported H1b and H3. However, inconsistent with H4, the group mean in the visual+verbal condition did not significantly differ from that in the no ad control ($b = -.09, SE = .13, 95\% \text{ CI } [-.35, .16], p = .483$).

Divergent effects of pro-vaping verbal arguments and visual vaping cues were also found on perceived harms of secondhand vaping (H1a and H6a). The main effects of message conditions were significant, $F(2, 988) = 6.87, p = .001, \eta^2 = .014$. Smokers viewing verbal only messages reported lower harm perceptions than those randomized to no ad: on a 5-point scale, $b = -.54, SE = .15, 95\% \text{ CI } [-.83, -.24], p < .001$. In contrast, those viewing visual+verbal advertisements reported significantly higher harm perceptions than those assigned to view verbal only advertisements: $b = .33, SE = .13, 95\% \text{ CI } [.07, .58], p = .012$. Inconsistent with H6b, the group mean in the visual+verbal condition did not significantly differ from that in the no ad control ($b = -.21, SE = .15, 95\% \text{ CI } [-.51, .09], p = .169$). H1a and H6a were supported but H6b was not supported.

Regarding emotions, participants in the visual+verbal condition reported higher levels of anger ($F[1, 775] = 6.47, \eta^2 = .008, b = .21, SE = .08, 95\% \text{ CI } [.05, .37]$,

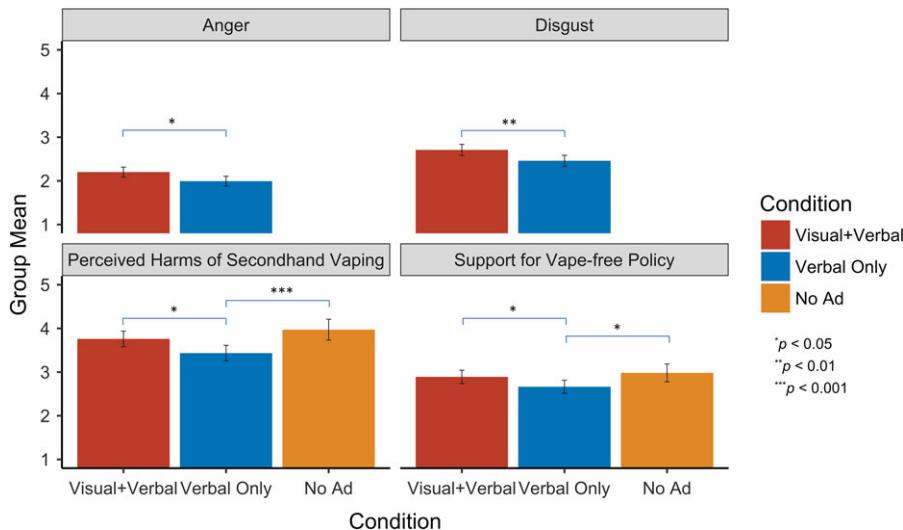


Figure 2 Main effects of message conditions by outcome.

Notes. Figure 2 depicts estimated treatment effects on four main outcomes. Effects on perceived harms of secondhand vaping and support for vape-free policy were compared among all three message conditions ($N = 991$) whereas anger and disgust were only measured in two conditions ($n = 777$). The factor of device types was dropped.

$p = .011$) and disgust ($F[1, 774] = 7.48, \eta^2 = .010, b = .25, SE = .09, 95\% \text{ CI } [.07, .43], p = .006$) than those in the verbal only condition. H7a-b were supported.

Lastly, potential moderating effects of e-cigarette use and smoker status were also tested. Their interaction effects with message conditions were not significant for any of the outcome variables, except that for anger e-cigarette use significantly moderated the effects of visual vaping cues, $F(1, 772) = 6.98, p = .008, \eta^2 = .009$. Simple main effects indicated that visual vaping cues significantly increased anger for never users of e-cigarettes ($b = .22, SE = .11, 95\% \text{ CI } [.01, .43], p = .038$) but did not significantly affect anger for those who had tried e-cigarettes before ($b = -.21, SE = .13, 95\% \text{ CI } [-.46, .04], p = .093$).

Moderating effects of endorsing the care/harm foundation

First, although the care/harm foundation was measured after message exposure, no significant differences were found across message conditions, $F(2, 988) = 1.09, p = .337, \eta^2 = .002$, which supported the claim that the care/harm moral foundation functions as a relatively stable personality trait (Graham et al., 2013). Second, endorsement of the care/harm foundation significantly moderated the effects of message conditions, $F(2, 963) = 5.33, p = .005, \eta^2 = .009$. Conditioning on pre-treatment covariates, a one-point increase in the endorsement of the care/harm foundation was associated with: (a) a further decrease of .27 in reported policy support ($SE = .08, 95\% \text{ CI } [-.43, -.10], p = .001$) after viewing verbal only

Table 2 Main Effects of Message Conditions and Moderation Effects of the Care/Harm Moral Foundation

	Perceived Harms of Secondhand Vaping <i>b</i> [95% CI]	Anger <i>b</i> [95% CI]	Disgust <i>b</i> [95% CI]	Support for Vape- free Policy <i>b</i> [95% CI]	Moderation Effects of Care/Harm on Policy Opinions <i>b</i> [95% CI]
Visual+Verbal (vs. Verbal only)	.33* [.07, .58]	.21* [.05, .37]	.25** [.07, .43]	.23* [.01, .44]	.23* [.03, .43]
No Ad (vs. Verbal only)	.54*** [.24, .83]			.32* [.06, .57]	.30* [.06, .54]
Care/Harm					-.10* [-.20, -.00]
Visual+Verbal × Care/Harm					.13 [-.01, .27]
No Ad × Care/Harm					.27** [.10, .43]
Constant	3.43*** [3.26, 3.61]	1.99*** [1.88, 2.11]	2.46*** [2.33, 2.59]	2.66*** [2.52, 2.82]	2.29*** [1.29, 2.83]
Observations	991	777	776	991	989
R ²	.01	.01	.01	.01	.15
F Statistic	6.87** (<i>df</i> = 2; 988)	6.47* (<i>df</i> = 1; 775)	7.48* (<i>df</i> = 1; 774)	3.65* (<i>df</i> = 2; 988)	6.97*** (<i>df</i> = 25; 963)

p* < .05; *p* < .01; ****p* < .001

Notes. *b* = unstandardized coefficient. CI = confidence interval. The verbal only condition was set as the reference category. Endorsement of the care/harm foundation was mean-centered. Anger and disgust were not measured in the no ad condition. For main effects models, pre-treatment covariates were excluded. For the model on the moderating effects of the care/harm foundation, all pre-treatment covariates were included.

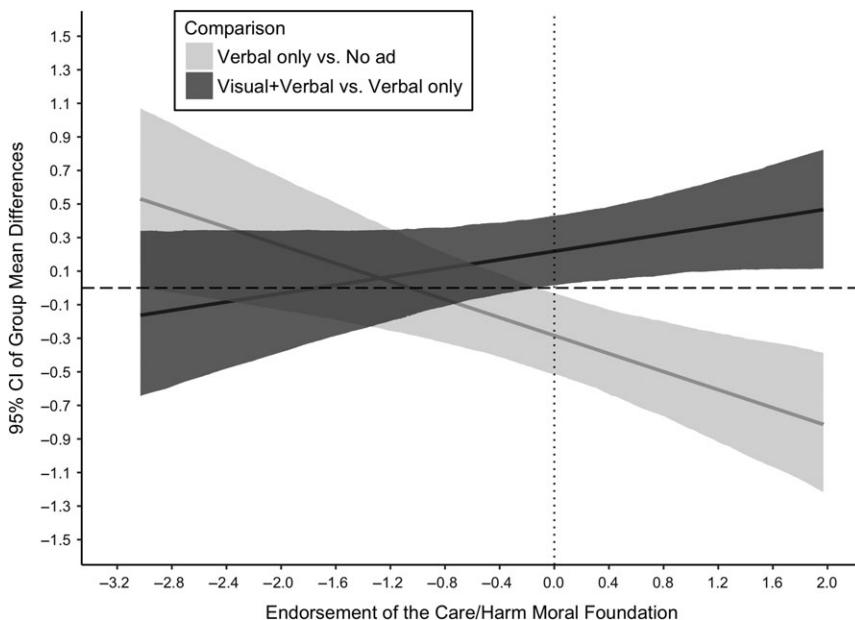


Figure 3 Moderation effects of the care/harm moral foundation.

Notes. Figure 3 depicts 95% bias-corrected bootstrapped CIs ($samples = 3,000$) of the effects of visual vaping cues (vs. verbal only) and verbal arguments (vs. no ad) on support for vape-free policies as a function of the endorsement of the care/harm foundation (mean-centered), after controlling for pre-treatment covariates. The factor of device types was dropped.

advertisements (versus no ad), and 2) a further increase of .13 in reported policy support ($SE = .07$, 95% CI $[-.01, .27]$, $p = .069$) after viewing visual+verbal advertisements (versus verbal only). In Figure 3, 95% bias-corrected bootstrapped CIs of between-condition differences were plotted as a function of the level of endorsing the care/harm moral foundation (mean-centered). H5a was supported. H5b was not supported, although estimated moderation effect was in the expected direction.

Mediation analyses

Results for mediation analyses were summarized in Table 3. First, multiple mediators were modeled as statistically independent of each other. As expected, the mediating effects of anger, disgust, and perceived harms of secondhand vaping (ACMEs = .03, .05, and .12, respectively; 95% bias-corrected bootstrapped CIs [.01, .07], [.02, .11], and [.04, .20], respectively) were all significant in the visual+verbal versus verbal only comparison. H8a-c were supported. Furthermore, results from the sensitivity analyses were depicted in Figure S1-S2 (supplementary materials). The sensitivity parameter ρ quantifies the degree to which the sequential ignorability assumption had been progressively violated by simulation. For example, for perceived harms of secondhand vaping, the critical value of ρ was .4, beyond which

Table 3 Results of Mediation Analyses

Mediator	Comparison	ACME 95% CI	ADE 95% CI
<i>Multiple mediators modeled as statistically independent</i>			
Perceived harms of secondhand vaping	visual+verbal vs. verbal only	.12 [.04, .20]	.10 [−.08, .30]
	verbal only vs. no ad	−.17 [−.27, −.07]	−.11 [−.33, .10]
Anger	visual+verbal vs. verbal only	.03 [.01, .07]	.20 [−.01, .39]
Disgust	visual+verbal vs. verbal only	.05 [.02, .11]	.17 [−.02, .38]
<i>Multiple mediators modeled as statistically dependent</i>			
Perceived harms of secondhand vaping	visual+verbal vs. verbal only	.10 [.03, .18]	.12 [−.07, .31]
Anger	visual+verbal vs. verbal only	−.01 [−.04, .02]	.24 [.04, .43]
Disgust	visual+verbal vs. verbal only	.03 [−.01, .06]	.20 [−.01, .40]

Notes. ACME = average causal mediation effect. ADE = average causal direct effect. All ACMEs and ADEs assumed no interactions with condition assignment. CI = bootstrapped bias-corrected confidence intervals (samples = 3,000). Significant effects were bolded. The upper panel summarizes estimated ACMEs and ADEs when multiple mediators were modeled as independent pathways, assuming no post-treatment confounders. The lower panel summarizes results when multiple mediators were modeled as statistically dependent pathways, under the homogeneous interaction assumption. All pre-treatment covariates (ethnicity and smoking recency excluded due to rank deficiency) were included when estimating ACMEs and ADEs to improve the credibility of causal inference.

estimated ACMEs would become indistinguishable from zero and even be reversed. In contrast, the critical values of ρ for anger and disgust were .1 and .2, respectively, indicating that the two emotional pathways were less robust to the violation of the sequential ignorability assumption than the ACME for perceived harms of secondhand vaping.

Second, in support for pro-vaping verbal messages' effects through moral reasoning (H2), the mediating effect of perceived harms of secondhand vaping in the verbal only versus no ad control comparison was significant, ACME = −.17, 95% bias-corrected bootstrapped CI [−.27, −.07]. In the visual+verbal versus verbal only comparison, the mediating effect of secondhand harm perceptions remained significant even after controlling for emotional pathways, ACME = .10, 95% bias-corrected bootstrapped CI [.03, .18]. H9 was supported.

Discussion

The current research documented a case where visual portrayals of vaping within e-cigarette commercials inadvertently helped increase public support for controlling the use of electronic nicotine delivery systems in public contexts, which extends existing research on unintended message effects that primarily focuses on self-directed outcomes (Byrne & Niederdeppe, 2011; Cho & Salmon, 2007).

Furthermore, drawing upon MFT, we identified one plausible yet not definite mechanism by which such unintended effects could be explained—visual vaping cues may have inadvertently activated anti-vaping moral intuitions rooted in the care/harm moral foundation. This explanation was supported by: (a) increased anger, disgust and perceived harms of vaping on others upon exposure to visual vaping cues; (b) the result that care/harm-related harm perceptions as well as emotions each mediated the effects of visual vaping cues on vape-free policy opinion; and (c) the finding that verbal arguments and visual vaping cues not only pulled policy opinions towards opposite directions but also responded to individual differences in the endorsement of the care/harm foundation.

Several clarifications for our interpretation of the data are worth noting. First, one may point to distraction as an alternative explanation: visuals might have distracted participants from processing pro-vaping verbal arguments, resulting in higher harm perceptions and policy support in the visual+verbal condition. The current design does not allow us to separate this attentional mechanism from moral intuitions. However, distraction alone is not sufficient to account for increased anger and disgust, which have been found to follow violations of the care/harm moral foundation (Cameron et al., 2015; Graham et al., 2013) and hence were consistent with the explanation based on moral intuitions. Therefore, MFT offers a more coherent if not definitive account for the pattern of findings. Second, alternative theoretical accounts about moral opinion formation do exist, such as the theory of dyadic morality (TDM), which argues that all moral foundations can be re-conceptualized as different versions of *harm* defined as “an intentional agent causing damage to a vulnerable patient” (Schein & Gray, 2017, p. 2). Adjudicating which theory is truer goes beyond the scope of this study (for details on the debate, see Graham et al., 2018; Schein & Gray, 2017). With that said, we agree with Graham et al. (2018) that boiling fairness, loyalty, authority, purity, and liberty in MFT all down to different versions of harm would dilute the concept of harm. Consequently, this moral monism may have limited practical utility for message design. Lastly, the finding that visual vaping cues produced pro-vaping policy opinions may appear to contradict previous research where visual vaping cues were found to activate the urge to smoke and to vape (King et al., 2016; Maloney & Cappella, 2016). Smoking/vaping urges as physiological reactions could be simultaneously aroused with cognitions, such as perceived harms of smoking on self (Yang et al., 2018) and, in the current study, moral intuitions concerning harms on others. More research is needed to determine the net impact of visual vaping cues on public health. For these reasons, we would not recommend directly employing such cues in health communication campaigns.

Findings from this study offer several theoretical insights on how MFT may inform the design of effective multimodal messages when the persuasive goal concerns moral outcomes. First, this study demonstrates the importance to consider both the content and the valence of moral intuitions visuals can automatically trigger. The current study presents a case where visual vaping cues activated moral

intuitions opposite in valence to the verbal component, although both invoked moral concerns rooted in the care/harm foundation. To extend the current set of findings, it is worthwhile to examine the impacts of visuals' content variations on moral opinion formation while holding the valence in concert with the persuasive intent. MFT has eased the start-up cost for this line of inquiry by specifying a six-dimensional framework to characterize the otherwise complex moral content space. It follows that for a given issue or policy domain, MFT provides a thematic coding scheme to categorize and link visual cues to primary moral dimensions.

Second, once the linkages between visual cues and moral foundations could be mapped, a persuasive strategy worth testing is to employ visuals through moral matching. The current study focused on the care/harm foundation, which is widely endorsed due to its evolutionary root in the universal need to protect the offspring (Graham et al., 2013; Haidt, 2012). However, care/harm is unlikely the top moral foundation uniformly for every person because individuals are known to vary in the rank order of the six moral foundations (Graham et al., 2013; Haidt, 2012). For an audience segment or a targeted individual, such individual differences could be exploited to design messages targeting the moral foundation higher (versus lower) in the rank order specific to that segment or individual—this is termed moral matching. Previous research has demonstrated the efficacy of employing moral-matched verbal messages to change opinions regarding politically entrenched issues (e.g., health care support, environmentalism, same-sex marriage, Feinberg & Willer, 2015; Wolsko et al., 2016). However, whether the moral matching strategy could be generalized to visuals remains an open and important question to examine. In the current study, the interaction effects between message conditions and the endorsement of the care/harm foundation provided preliminary evidence to support this strategy. Future research is encouraged to more systematically test this visual moral matching effect with multiple rather than a single moral foundation.

Lastly, the current study demonstrated the visuals' efficacy to shift emotions, harm beliefs, and policy opinions, which extends visuals' documented cognitive primacy effects regarding automatic attention allocation, encoding, and recall (Geise & Baden, 2015; Lang et al., 2015; Lochbuehler et al., 2017). Although there was no evidence that visual vaping cues had activated pro-vaping moral intuitions strong enough to outweigh moral reasoning ($p = \text{n.s.}$ for the visual+verbal versus no ad comparison) as would be predicted by the intuition primacy proposition, our data can be interpreted as supporting the claim that intuitions can affect moral opinion formation by changing the way reasoning is conducted. When modeled as causally dependent mediators, the mediating pathway through harm perceptions remained significant even after controlling for the mediating effects of emotions, suggesting the operation of a cognitive pathway. Few studies have explicitly tested whether moral intuitions can directly change beliefs about factual consequences. Furthermore, previous research on visual communication focuses heavily on affective mechanisms through which visuals become persuasive (Dixon, 2016; Iyer et al., 2014; King, 2016; Powell et al., 2015). Results from the mediation analyses

extended this line of research and demonstrated that visuals could also affect moral opinions through changing cognitive beliefs about a behavior's consequences. It would be an important next step to identify boundary conditions specifying when moral intuitions would and would not outweigh moral reasoning as a result of message exposure.

This study is not immune to limitations. First, although unintended effects of visual vaping cues were statistically significant, their effect sizes were mostly small. Therefore, we emphasize theoretical implications of our findings for visual communication and message design. With that said, visual message cues may produce more pronounced effects when they activate endorsed moral foundations *without* the interference from other message elements. Also, confidence intervals for most effects were wide, suggesting visual vaping cues' impacts were potentially heterogeneous. Further research should seek to identify and test additional moderators. Second, we did not directly measure the operation of moral intuitions. Measurement tools such as the Moral Foundations-Affect Misattribution Procedure (MF-AMP) may better capture the onset of moral intuitions (Tamborini, Prabhu, Lewis, Grizzard, & Eden, 2016) and hence are worth including in future research. Lastly, future research should seek to replicate the findings from the current study with multi-item measures of emotions and vape-free policy opinions.

Conclusion

The current research experimentally demonstrates that visual vaping cues within e-cigarette industry commercials can produce unintended effects and increase support for vape-free policies. We provide evidence why MFT, especially the intuition primacy proposition, could account for such unintended effects of visual cues. To the best of our knowledge, this is the first experimental study connecting MFT with multimodal message effects and visual persuasion, pointing to the importance of considering automatic and intuitive moral opinion formation processes that visuals are capable of triggering. We hope the current study will stimulate more research into MFT's broader implications for strategic communication and message effects research when the persuasive outcome is related to human morality.

Supplementary Material

Supplementary material is available at *Human Communication Research* online.

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Notes

- 1 The current study was part of a larger project with the additional goal to replicate visual vaping cues' effects on the urge to smoke (Maloney & Cappella, 2016) with newer e-cigarette devices. Furthermore, measured outcomes (not reported here) related to the replication component of the larger project included smoking-related outcomes (e.g., the urge to smoke measured using the full scale, attitudes, quitting intention), intention to vape, other emotions not related to moral foundations (e.g., hope, sadness), and self-reported smoking/vaping behaviors during the study. Results related to the replication component of the larger project are available upon request to the corresponding author.
- 2 Brands for cigalike ads: *Blu* (three ads), *NJOY* (two ads), *E-lites*, *Emperor Brand*, *Green Smoke*, *Safe Cig*, *V2 Cigs*, *FIN*, *Flavor Vapes*, and *Vuse*. For non-cigalike ads: *Boca Vapes*, *Gamucci*, *Inno-Vapor*, *J Vapes*, *KiK*, *Lizard Juice*, *Mirage*, *Vapor Craze*, *Vapor Shark*, *VaporFi*, *VaporWize*, and *VIP*.
- 3 Examples of such verbal claims include, "vaping gets the look and feel of cigarettes without deadly chemicals" "there is no risks of lung cancer or harm from passive vaping." Other themes emphasize that e-cigarettes are easy to use, are designed in an innovative way, have many favors, suit customer needs, and represent a real alternative to smoking. More than 97% smokers in either message condition received at least one ad making a reduced harm claim. If anything, we were likely to have underestimated the effects of such verbal claims as exposures could be higher when every ad made this type of claim. Similarly, more than 96% participants in either message condition have seen at least one ad depicting secondhand vaping scenes.
- 4 Across conditions, less than 9% of participants reported *no opinion*, and more than 97% of all participants reported having heard of e-cigarettes. The alternative modeling strategy to treat response options as unordered categories risks considerably losing statistical power, making it difficult to detect unintended effects. Although we acknowledge the possibility that *no opinion* could mean the lack of any thoughts or personal relevance about vape-free policies, self-reported high awareness of e-cigarettes suggests that our sample of current and former smokers might genuinely have taken a neutral position. Also, the small proportion of participants choosing this option considerably reduced the likelihood that modeling *no opinion* as a mid-point would substantially bias our main results. For a detailed discussion on the *no opinion* option in survey measures, see Krosnick and Presser (2010).
- 5 The variable was transformed using the following formula: new score = $\{[(\text{original} - 1)/(5-1)] * (7-1)\} + 1$. This transformation is linear. Therefore, the correlation between the original and transformed variable equals one. Similar linear transformation has been used to create perceived effectiveness scores (Bigsby, Cappella, & Seitz, 2013).

6 The degree of violating the ignorability assumption could be quantified by the parameter ρ : more severe the omitted variable bias became, higher would be the absolute magnitude of the correlation between the error term in the mediator regression and that in the outcome regression (Imai et al., 2010). The mediator model linearly regressed perceived harms of secondhand vaping on treatment assignment and all pre-treatment variables; and the outcome model regressed the opinion of vape-free policies on the mediator, treatment assignment and all pre-treatment variables.

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