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Breadth of Media Scanning Leads to Vaping Among Youth and Young Adults: Evidence of Direct and Indirect Pathways from a National Longitudinal Survey

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Abstract

Electronic cigarette use among youth and young adults has reached an epidemic proportion of growth. This study examined the direct and indirect effects of breadth of media scanning about e-cigarette use on subsequent vaping behavior through interpersonal communication and changes in descriptive norm perceptions. We conducted a nationally representative longitudinal phone survey of 13–25 year olds from June 2014 to March 2017, with 11,013 respondents who completed a baseline survey, among which 3,212 completed a follow-up six months later. The results from both cross-sectional and lagged analyses provided robust evidence to suggest that passive routine exposure to e-cigarette use content from more media outlets predicted increased likelihood of vaping among youth and young adults. High scanners were about twice as likely to vape as non-scanners (17% versus 9%). Mediation models using bootstrapping procedures found that breadth of scanning predicted higher descriptive norm perceptions which were associated with subsequent vaping; in addition, interpersonal communication mediated the relationship between breadth of scanning and changes in descriptive norm perceptions. These findings highlight the important roles of scanning, norm perceptions and interpersonal discussions in shaping cognition and behavior changes. The results also suggest an overall pro-e-cigarette public communication environment, which warrants further examination.

Keywords

information scanning; electronic cigarettes; social norms; interpersonal communication; youth; longitudinal panel data

Introduction

Recently released data from the 2011–2018 National Youth Tobacco Survey reveal alarming trends in electronic cigarette (e-cigarette) use in the United States. Among high school students, current e-cigarette use has increased from 1.5% (220,000) in 2011 to 20.8% (3.05 million) in 2018, with a remarkable 78% increase between 2017 and 2018 (Cullen et al., 2018). Among young adults, ever (35.8%) and current (13.6%) use is more than twice that of adults (16.4% and 5.7%) (US Department of Health & Human Services, 2016). The Food and Drug Administration (FDA) has declared that vaping among younger generations has reached an epidemic proportion of growth (2018). Although e-cigarettes are promoted as a potential reduced harm product for adult smokers, vaping is of particular concern for youth and young adult (YYA) non-smokers because it may serve as an on-ramp to nicotine dependence, and increase the frequency and amount of future cigarette smoking (NASEM, 2018; Soneji et al., 2017).

The uncertainty and heated debates around vaping lead to divides on policy strategies, as well as a prominent presence of e-cigarette related press coverage and user-generated discussions across various media outlets (Cole-Lewis et al., 2015; Huang, Kornfield, & Emery, 2016; Wackowski et al., 2018). Given the lack of regulation on e-cigarette marketing, all kinds of promotional content and advertisements have also inundated the public communication environment (Collins, Glasser, Abudayyeh, Pearson, & Villanti, 2019; Singh et al., 2016).

For decades, communication scholars have put great efforts towards answering the question of whether the media environment shapes audiences' outlook about the world; and if so, how this influence changes their behaviors (Chia & Gunther, 2006; Gerbner & Gross, 1976; Shah & Rojas, 2008). It is not hard to imagine how e-cigarette prevention campaigns (Zeller, 2019) and other intentionally persuasive media content, or the e-cigarette information audiences actively seek (Yang, Liu, Lochbuehler, & Hornik, 2019), might directly impact people's cognition and behavior. An equally interesting but perhaps less intuitive question fuels the current study: in what way does routine incidental media exposure, regardless of the content's persuasive intent, that audiences passively and repeatedly encounter in their daily lives, lead to behavior change? We are particularly interested in understanding whether accumulated incidental exposure to e-cigarette related content across different media sources (e.g., celebrity use in TV shows or movies, outdoor ads on taxi tops, e-cigarette users discussing their experiences of device modification in YouTube videos) might jointly affect YYAs' e-cigarette use. In this study, we propose and test an underlying mechanism that may account for the influence process through interpersonal discussions and changes in descriptive norm perceptions.

Information Scanning

Routine information exposure, also known as *scanning*, refers to incidental exposure that has not been actively sought, comes from different sources in the information environment, possibly offers mixed information about a topic, and receives little attention but enough attention to be recalled with a minimal prompt (Niederdeppe et al., 2007). Compared to active information seeking, scanning is less likely to reflect personal motivations. As random

and sporadic as scanned exposure may sound, several studies have observed substantial health-related scanning in various populations and consistently reported that it impacted cognition and behavior (Hornik et al., 2013; Kelly et al., 2010; Kelly, Niederdeppe, & Hornik, 2009; Moran, Frank, Chatterjee, Murphy, & Baezconde-Garbanati, 2016; Nguyen et al., 2010; Shim, Kelly, & Hornik, 2006). While active seeking may be influential for individuals, if, as is likely, passive scanning about most topics is more frequent and happens to many more individuals, on the aggregate-level, it may be more broadly influential.

Hornik et al. (2013) posited that the underlying mechanisms through which information scanning affects personal health might be 1) *new information acquisition*, such that people learn costs and benefits associated with the behavior or even skills that are necessary to carry out the behavior; or 2) *reinforcement of descriptive norms* such that repeated exposure from a range of sources might inflate people's perceptions about what is typical, and adapt their own behaviors accordingly; or 3) *reminding*, such that the reasons to engage in a behavior become more salient and accessible at the time of decision making. While the first and last pathways tap more into the direct effects of scanning on cognitions and behaviors, the second pathway describes a potential indirect mediating mechanism via changing descriptive norm perceptions. Over the years, many studies have highlighted the important mediating role of descriptive norms between media exposure and YYAs' health-related intention and behavior changes across domains (e.g., Nan & Zhao, 2016; Paek, Oh, & Hove, 2012; Yang & Zhao, 2018). Thus, the current study aims to examine both the direct and indirect effects of media scanning on e-cigarette use through changes in descriptive norm perceptions among the vulnerable YYA population.

Effects of Scanning on Descriptive Norm Perceptions

Different theories and hypotheses explicate the process through which repeated media exposure affects descriptive norm perceptions. One possibility is based on a familiarity argument: things frequently seen are assumed to be widely known, even if they weren't consciously processed at the time of exposure (Kwan, Yap, & Chiu, 2015). Another explanation, particularly related to media scanning, is rooted in the Influence of Presumed media Influence (IPI) tradition (Gunther, Bolt, Borzekowski, Liebhart, & Dillard, 2006; Gunther & Storey, 2003). The IPI model proposes that if people are exposed to some media content, they will assume that others are also exposed to the same content, and such exposure will affect others' cognitions and behaviors. People will then change their own behaviors accordingly to adapt to this subjective perception of others (Gunther et al., 2006; Tal-Or, Cohen, Tsfati, & Gunther, 2010).

Both of these hypotheses focus on individuals' subjective assumptions about others. In contrast, the two-step flow model (Katz, 1957; Katz & Lazarsfeld, 1955) and the diffusion of innovations theory (Rogers, 1962) point to another potential mechanism involving actual observations and interactions with others instead of presumed influence. With more media scanning of a topic, people may be more likely to bring up this topic in social conversations, or they may be more likely to recall interpersonal discussions about the topic. Thus, these two theories suggest interpersonal communication may serve as an important mediator between scanning and changes in descriptive norm perceptions.

Interpersonal Communication as a Mediator of Scanning

When people bring up a scanned topic in interpersonal discussions, meanings or interpretations might be provided, clarified or negotiated, which may be crucial for people's subsequent decision-making. Additionally, they may become social influencers because they relay information from media content to which they were directly exposed to others who may not have been exposed. Further, conversations might lead people to discover descriptive norms about the behavior within their discussion group, or for a larger population, and thus affect how they interpret and react to that behavior (Hornik, 2006; Hornik & Yanovitzky, 2003; Jeong, Tan, Brennan, Gibson, & Hornik, 2015).

Most prior research has investigated the mediating role of interpersonal communication in the context of direct exposure to persuasive media content, such as how exposure to campaign messages leads to interpersonal discussions, which in turn affect cognitions and behaviors (e.g., Hendriks, van den Putte, de Bruijn, & de Vreese, 2014; Jeong et al., 2015; van den Putte, Yzer, Southwell, de Bruijn, & Willemsen, 2011). To our knowledge, no prior work has tested how scanning may lead to changes in descriptive norm perceptions and behaviors by triggering people to talk with others about a topic. Therefore, the current study examines this indirect pathway. We suspect that this pathway might be particularly meaningful in our study context given that media content about e-cigarettes is likely to be fraught with ambiguity and novelty. Individuals are thus more likely to seek meaning and clarification from their social context to better understand the messages and counter-messages they encounter.

The Breadth of Scanning

Breadth of scanning is conceptualized as the total number of information sources encountered that mentioned the topic of interest (Hornik et al., 2013; Kelly et al., 2009; Nguyen et al., 2010; Niederdeppe et al., 2007; Shim et al., 2006). Classic social influence literature points to the importance of scanning breadth when forming consensus perceptions because consensus is more likely when information comes from multiple parties that each retains their own individuality (Asch, 1951; Wilder, 1977). Breadth of scanning may also reflect the level of synergy among media sources in the topics they discuss, particularly in a media environment saturated with e-cigarette content across sources. Therefore, in the current study, we focus on how breadth of scanning may influence e-cigarette use or vaping through a social chain of interpersonal communication and changes in normative perceptions.

The Present Study

The current study first examines the direct pathway through which the breadth of scanning affects individuals' e-cigarette use (Figure 1A). Next, we consider the indirect pathway through changes in descriptive norm perceptions (Figure 1B). Finally, to further understand how descriptive norm perceptions are influenced in the first place, we explore whether scanning across more media sources catalyzes interpersonal communication about e-cigarette use, which in turn leads to increases in prevalence perceptions (Figure 1C). Figure

2 presents the full model of the proposed pathways. We first test the direct effect of scanning on e-cigarette use:

H1: The breadth of media scanning is positively associated with e-cigarette use.

We then examine the potential mediating role of descriptive norm perceptions between the above association. To be specific, we first examine the two direct effects in the mediation model (H2 & H3), and then formally test the full mediation model and estimate the sizes of the indirect and residual indirect effect (H4):

H2: The breadth of media scanning is positively associated with descriptive norm perceptions about e-cigarette use.

H3: Descriptive norm perceptions are positively associated with e-cigarette use behavior.

H4: Descriptive norm perceptions will positively mediate the relationship between the breadth of scanning and e-cigarette use.

Finally, to examine whether talking with other people mediates the relationship between scanning and descriptive norm perceptions, we first examined the direct effects (H5 & H6), and then estimate the mediation model (H7):

H5: The breadth of media scanning is positively associated with talking about e-cigarettes with other people.

H6: Talking about e-cigarettes with other people is positively associated with descriptive norm perceptions about e-cigarette use.

H7: Talking about e-cigarettes with other people will positively mediate the relationship between the breadth of media scanning and descriptive norm perceptions about e-cigarette use.

All the above hypothesized pathways and mediation models are examined both cross-sectionally and longitudinally with a time lag of six months.¹

Method

Participants

This study used data from a larger project aimed at understanding how the current public communication environment about tobacco and e-cigarettes might affect YYAs' smoking and vaping related cognitions and behaviors. Over a period of three years (June 2014 – June 2017), the project collected both e-cigarette and other tobacco related media content to perform content analysis that gauges and tracks media representations of these behaviors

¹We chose the six-month lag as a tradeoff between allowing enough time for participants' descriptive norm perceptions and e-cigarette use to change, and following up fast enough to reduce the risk of substantial study drop-out that happens with longer intervals between waves. Given that we are looking at the effects of media scanning, i.e., accumulated incidental exposure to e-cigarette related content across different media sources, it takes time for such information to be accumulated, to become sufficiently salient and accessible in people's mental shortcuts (Hornik et al., 2013), and to finally exert influence on their descriptive norm perceptions and tobacco use behaviors (Tankard & Paluck, 2016).

over time (Authors, 2019a; Authors, 2019b), as well as a concurrent nationally representative phone survey of 13–25 year olds that measures knowledge, beliefs, norms, intentions, and behaviors regarding tobacco products (including e-cigarettes) among YYAs. The survey also investigated the YYAs' general and tobacco-specific media exposure, e-cigarette information seeking (Authors, 2019c) and scanning behaviors. Ultimately, the larger project aimed at combining the exogenously captured media content data and the self-report data from the survey to examine how the public communication environment may affect YYAs' cognitions and behaviors over time.

In this study, we utilized the self-report data from the nationally representative survey. A panel of participants was recruited by Social Science Research Solutions (SSRS) from a partially list-assisted, random digit dial (RDD) population of all landline and cellphone numbers in the United States to provide a probability-based sample. The American Association of Public Opinion Research response rate 3 for the cross-sectional interviews was estimated at 21%. About 35% of the participants who completed the interviews at time 1 (T1) were successfully re-interviewed at time 2 (T2) six months later. 13–15 year olds required parental consent for participating in the study (the IRB approved waiving parental consent for 16–17 year olds), thus were the most willing to be called back, and had the highest retention rate (61%). The current study included 33 months of T1 data from June 2014 to March 2017 ($n = 11,013$), and 27 months of T2 re-interview data collected between December 2014 and March 2017 ($n = 3,212$). All the T1 participants were used for cross-sectional analyses, and only participants who completed the interviews at both T1 and T2 were included in the lagged analyses. Given small percentages of missingness and that our data were missing completely at random (Allison, 2001; Little, 1988), listwise deletion was used to handle missing data in our analyses (details can be found in Appendix A of the Online Supplemental Materials).

Measures

Breadth of Media Scanning.—Breadth of scanning was measured as the total number of media sources people passively encountered that mention e-cigarette use or vaping. This measure was adapted from prior studies which used and validated parallel items in assessing seeking and scanning behaviors (Kelly et al., 2009; Nguyen et al., 2010; Niederdeppe et al., 2007). Following that prior work, we asked participants a set of questions about their active seeking of vaping or e-cigarette information during the past 30 days before the set of scanning questions were assessed; thus, passive scanning was contrasted with active seeking in the full set of measurement items. After responding to the seeking questions, participants first answered an overall question about their scanning behavior: “In the past 30 days, did you come across information about vaping or using e-cigarettes online, in the media, or from other people even when you were not actively looking for it?” The responses were recorded as 0 = *no* or 1 = *yes*. The breadth of scanning was then assessed by asking those who responded *yes* to the first question, to indicate whether they came across such information on each of the following sources: 1) In the media like TV, radio, newspapers, magazines, or movies; 2) In outdoor ads like on billboards, in stores, or on taxis; 3) Online, like on social networking or other internet sites. We then created a 4-category measure by aggregating the number of above exposure sources for each person (0 = *no exposure*, 1 = *scanned from one*

source, 2 = scanned from two sources, and 3 = scanned from three sources). Among the 30% who scanned, the average number of sources scanned out of the possible three was 1.65 ($SD = 0.97$).

Interpersonal Conversations.—Conversations with other people were assessed by asking whether participants came across information about e-cigarette use or vaping in the past 30 days while talking with other people (0 = *no*, 1 = *yes*).

Descriptive Norm Perceptions.—Descriptive norm perceptions about e-cigarette use or vaping were measured with two items that took into account both proximal and more distal social groups. For proximal descriptive norms, given the powerful peer influence at this developmental stage, we asked participants to gauge how many of their four closest friends vape or use e-cigarettes (*none* to *four*); for distal descriptive norms, we asked participants how many people their age vape or use e-cigarettes on a 4-point scale (0 = *none*, 4 = *most*). Given that we wanted an overall parsimonious descriptive norm perception construct, we created a single combined index by averaging the two variables after standardization. The two variables were correlated ($r = .35$, $p < .001$ at both T1 and T2).

Current E-cigarette Use.—Current e-cigarette use was assessed by a standard measure asking participants whether they vaped or used e-cigarettes during the past 30 days on a dichotomous scale (0 = *no*, 1 = *yes*).

Confounders.—All models were adjusted for potential confounders, including age, gender, race/ethnicity, education level, school performance, parents' education level, living with a vaper or not, whether vaping is allowed inside their home, and past 30-day cigarette use. We also measured individuals' sensation seeking tendency with four standard items, which were then averaged to form a scale ranging from 1 = *strongly disagree* to 5 = *strongly agree* (Stephenson, Hoyle, Palmgreen, & Slater, 2003). See Table S1 in the Online Supplemental Materials for question wording and values of the confounder variables.

Data Analyses

We first examined all the hypothesized pathways at the cross-sectional level with ordinary least squares and logistic regression analyses controlling for confounders. All the variables used in the analyses were measured at T1. We then carried out bootstrapping procedures (with 500 simulations; Efron & Tibshirani, 1993) to construct bias-corrected confidence intervals that assess whether the indirect effects were non-zero (Hayes, 2018; Hayes, Preacher, & Myers, 2011).

We next conducted longitudinal analyses with the hypothesized effects using two waves of panel data. We fit a series of lagged regression models with the independent variables measured at T1, and the dependent variables measured at T2 with a 6-month lag. All models adjusted for demographics and confounder variables, as well as for the corresponding outcome measure at T1. Similar to the cross-sectional mediation analysis, we then used bootstrapping procedures to confirm whether mediation occurred longitudinally. While three waves of data would be better at establishing the fully lagged causal chains (i.e., the independent variable at T1 predicting the mediator at T2 leading to changes in the dependent

variable at T3), our longitudinal mediation tests were limited to two waves of data. To reduce concerns about causal order raised by only having two waves of data, we tested both lagged mediational pathways (i.e., the mediator variable at T1, and then at T2). If the indirect effect remained significant regardless of when the mediator was assessed, the mediation claim was strengthened. All mediation models also adjusted for demographics and confounder variables, as well as the corresponding outcome measures at T1. These lagged analyses, but not the cross-sectional analyses, establish causal order among the variables. To further explore questions of causal order we conducted additional lagged regression analyses reversing predictor and outcome variables to understand whether there is reciprocal influence.

Results

Descriptive Data

For all the analyses conducted in the current study, the samples were weighted to known census population distributions (U.S. Census Bureau, 2016) on major demographic variables to allow national representativeness of the results. Table 1 summarizes the descriptive statistics of both the cross-sectional and longitudinal samples (both unweighted and weighted), including the focal variables, demographics and other confounder variables. Table 2 shows the zero-order correlations among the focal variables both cross-sectionally and longitudinally. Nearly all of these variables were significantly correlated at the bivariate level.

Hypotheses Testing

H1, which predicted that the breadth of scanning is positively associated with e-cigarette use, was confirmed both cross-sectionally and six months later (Table 3). Taking the longitudinal effect as an example, 9% of those who did not scan at all at T1 used e-cigarettes at T2. The odds ratio of 1.26 for a one unit change in the scanning variable suggests that 16.5% of those who reported scanning from all three sources at T1 reported e-cigarette use at T2.

H2 through H4 predicted that descriptive norm perceptions would mediate the relationship between scanning and e-cigarette use. We tested the underlying bivariate hypotheses at the cross-sectional and longitudinal levels. Breadth of scanning was significantly and positively associated with descriptive norm perceptions (supporting H2), which were positively related to e-cigarette use (supporting H3), both cross-sectionally and longitudinally (Table 3). We then tested the mediation model using bootstrapping procedures. As can be seen from the bottom of Table 3, take the cross-sectional mediation model for example (Media scanning T1 → Norm perceptions T1 → E-cigarette use T1), the estimated bias-corrected 95% confidence interval did not include zero, suggesting a small but significant indirect effect (indirect effect = .010, 95% CI [.008, .012]), which accounted for a substantial 45% of the total effects. This was true whether we estimated a cross-sectional model, or either of the longitudinal models (using the norms measure at T1 or T2.) H4 was supported.

A similar set of analyses supported the second meditational hypothesis: breadth of scanning increases interpersonal communication that in turn affects descriptive norm perceptions. Table 4 shows that all of the expected bivariate relationships were significant both cross-sectionally and longitudinally, supporting H5 and H6. Tests of the three meditational models (cross-sectional, longitudinal with interpersonal communication measured at T1 or T2) supported H7. Although the indirect effects were small in magnitude, e.g., for the cross-sectional model, indirect effect = .068, 95% CI [.057, .081], 60% of the total effects were mediated through interpersonal communication. We provide more detailed information for all the regression analyses in Tables 5 and 6.

The reverse lagged regression analysis results suggested that descriptive norm perceptions at T1 predicted talking with others and breadth of scanning at T2; interpersonal conversations with others at T1 predicted the breadth of scanning at T2. However, e-cigarette use at T1 did not predict scanning at T2. Detailed results can be found in Appendix B of the Online Supplemental Materials.

Discussion

While previous studies generally show evidence supporting the idea that routine media exposure affects behavior, the potential underlying pathways of the observed effects have remained less explored. The contribution of the current study is its robust evidence supporting both the direct effect of scanning e-cigarette media content on vaping behavior, and the indirect pathway through changes in descriptive norm perceptions. It provided both cross-sectional and longitudinal evidence using a nationally representative sample of YYAs. Also, scanning e-cigarette related information across multiple media channels predicted higher odds of having interpersonal discussions about the topic, which in turn predicted higher prevalence perceptions about e-cigarette use. The findings from the current study increased our understanding of the possible underlying causal chains through which media scanning affects behavior. These findings are noteworthy in several aspects.

First, even our simple measure of scanning, i.e., recall of the number of channels mentioning the behavior of interest, predicted changes in behavior prevalence. One interpretation of the influence process captured here is that if a variety of media channels mention a behavior in concert, even when one is not intentionally seeking that information, they may deliver an implicit descriptive norm signal that the behavior has gained substantial public prominence and is thus considered prevalent and popular. In this scenario, the different media sources might lend credibility to one another regarding the salience and popularity of the behavior, enhancing prevalence perceptions. This result is particularly intriguing given the current media landscape, where the numbers and types of media outlets have unprecedentedly expanded, and audiences are now constantly exposed to information from multiple media sources due to the evolving technology. Breadth of media scanning may carry the potential for communicating normative information if multiple channels all report or mention a behavior. This is one potential path for understanding how “buzz” or popular public perceptions can be generated and consolidated. For health practitioners who hope to construct an environment that facilitates desirable behavior change, holding total amount of

media exposure constant, an exposure “portfolio” that covers a diverse range of media channels and modalities, might help create a climate of shared behavioral norms.

In addition, while admittedly there may be alternative pathways accounting for how scanning may increase descriptive norm perceptions, we observed clear evidence for one path: interpersonal conversations positively mediated the relationship. Presumably, individuals with more scanning of the target behavior across media sources are more likely to either initiate conversations about the behavior or recall having heard about it in their social context. It is possible that such conversations have in turn increased the issue salience of the behavior in one’s mental shortcuts (Bargh, Chen, & Burrows, 1996; Fiske & Taylor, 2013; Higgins, 1996; Tversky & Kahneman, 1982). When individuals are highly attentive to a behavior topic after talking with others, even the subtlest normative cues may be easily noticed, called to mind, and amplified. The operation of this mechanism thus can be independent of the substantive content of the interpersonal conversations. It could also be that through conversation exchanges, individuals discover that more people vape than they previously assumed, or they learn positive things about vaping and infer that more people must be doing it. This may reflect an overall pro-e-cigarette public communication environment, where vapor-norm information prevails over non-vaper-norm information, and positive viewpoints outweigh negative ones (Cole-Lewis et al., 2015; Grana & Ling, 2014; Klein et al., 2016; Luo, Zheng, Zeng, & Leischow, 2014; Paek, Kim, Hove, & Huh, 2013). Moving forward, it would be fruitful to examine the substantive content of both media scanning and interpersonal conversations. Health campaigns and interventions may benefit from leveraging the constructive effects of interpersonal influence and incorporating it as an integral part of the campaign goals.

Our reverse lagged analyses suggested that whereas e-cigarette use at T1 did not predict scanning at T2, the other reverse effects were significant in longitudinal analyses (i.e., normative perceptions predicted scanning and interpersonal communication; interpersonal communication predicted scanning). These findings do not undermine any of the proposed pathways, and instead complete the whole picture of our full model by indicating that influence may go reciprocally among the scanning, interpersonal communication and descriptive norm perception variables, although not the behavior variable. In other words, higher normative perceptions and increased discussions with others induced by scanning may make future incidental media encounters with the vaping topic more noticeable and memorable. Whereas health communication scholars often devote more attention to the one-way predictive effects of media exposure on cognition and behavior changes, this set of results indicated the possibility of subsequent spirally-incrementing changes in the behavioral outcomes through enhanced recall of scanning.

Some limitations should be acknowledged. First, while we consider the use of longitudinal data as one of the major strengths of this study, the two-wave panel data are not ideal for testing longitudinal mediation hypotheses. Future studies using three-wave panel data are needed to replicate the findings. Second, although the focus of the study is to understand the effects of breadth of scanning, it would be informative to examine and compare that with depth of scanning. Depth of scanning refers to the frequency of media encounters that mentioned the topic of interest, either in total or by source (Hornik et al., 2013; Kelly et al.,

2009; Nguyen et al., 2010; Niederdeppe et al., 2007; Shim et al., 2006). The breadth and depth dimensions are not independent from one another, but may capture different aspects of scanning. Inferring high prevalence of a behavior could come from a few (or more) mentions on each of many sources (breadth), as well as from many mentions on one source (depth). In other words, while breadth deals with the synergy among information sources, depth captures the amount of exposure for each source, or summed across all sources, and can be large either because of intense use of one source or moderate use of multiple sources (Hornik et al., 2013). Our own data did measure depth of scanning by asking the participants to indicate the total frequency of e-cigarette scanning in all mediated and interpersonal sources, however the frequency was not measured by source, precluding us from separating the role of mediated and interpersonal communication. Future studies are encouraged to explore, when there is a clean measure of the depth of media scanning, whether breadth and depth of scanning have similar or different implications for behavior change.

Third, the media scanning and the interpersonal conversation questions were asked side-by-side in a scrambled order with a parallel structure. Participants who responded *no* to the overall scanning question were assigned as non-scanners for all of these variables. This may have increased the likelihood of correlated errors. We are also aware that, on a substantive level, effects of the media scanning and interpersonal discussion sources are not easily distinguishable, thus it is hard to know whether interpersonal conversation is indeed a relatively distinct construct compared to the other media exposure variables, which may pose possible threats to inference. To reduce these concerns, we performed a series of additional analyses that provide evidence for the validity of the interpersonal conversation measure as distinct from media scanning. We first investigated whether the interpersonal conversation variable was contaminated when media scanning variables were asked before it. The Chi-square test results using the unweighted sample show that the proportion of respondents reporting interpersonal conversations when asked *before* other media scanning behaviors did not differ significantly from the proportion when participants were asked *after* any media scanning items ($\chi^2(3) = 2.39, p = .50, 53.54\%$ responded *yes* when asked before, 53.92% when asked after). To understand whether the interpersonal conversation variable is a distinct measure, we examined whether this measure has higher over-time consistency compared to its association with the other media scanning variables over time. Those who reported having talked with others about e-cigarettes or vaping during the past 30 days at T1 were much more likely to report talking with others at T2 (39.59% versus 15.04% of those who reported not talking with others about the topic at T1; $OR = 3.70, 95\% CI [3.04, 4.51]$). The over-time correlation between the T1 and T2 interpersonal conversation variables was substantial and significant ($r = .24$), and higher than both the average correlation between T1 interpersonal conversation and the three T2 media scanning variables ($r = .15$) and the average correlation between T2 interpersonal conversation and the three T1 media scanning variables ($r = .17$). These weaker average correlations were not a function of generally weak relationships with the media scanning variables, as the over-time correlations of the three media scanning variables were comparable to that of interpersonal conversation (mass media: $r = .24$; outdoor media: $r = .25$; online media: $r = .29$). These analyses have increased our confidence in our conclusions, nevertheless, future studies should consider assessing this construct with a question structure that better separates interpersonal conversations from the

media scanning variables, and perhaps with a battery of items to further increase the reliability of the assessment. Fourth, e-cigarette use behavior was measured as a dichotomous variable, asking the participants whether they vaped or used e-cigarettes during the past 30 days or not. Future studies may consider measuring the specific number of vaping days during the past 30 days to increase the granularity of the measurement and allow distinguishing between daily and non-daily use outcomes.

It is also worth noting that, although general media scanning is often considered less purposive, it may still be a result of people's more purposeful choices. People may embed themselves in an information rich environment by leaving the TV on as background noise, or subscribing to magazines and newspapers, or listening to the news on the radio while driving to work. Media consumption habits are likely intentional preferences, but have been incorporated into a routine and normal course of life (Johnson, Case, Andrews, Allard, & Johnson, 2006; Niederdeppe et al., 2007). Scanning of specific information or topics such as passive encounters of e-cigarette or vaping related mentions in the media in our study context, however, is less likely a result of intentional or volitional choice. Nevertheless, future studies are encouraged to take into account individual differences in media diet and examine how they may interact with scanning in shaping behavior choice decisions.

Conclusion

This research advances and tests the direct and indirect pathways that may underlie the effects of breadth of media scanning on YYAs' e-cigarette use. The model predicts that scanning across various media channels exerts direct and indirect effects on YYAs' vaping behavior more immediately and after six months, through increased interpersonal conversations about the topic and higher descriptive norm perceptions. Analysis of data from a large-scale national longitudinal survey offers support for the proposed model. Overall, this research extends the current literature by illuminating a potential chain of changes that explicate how incidental, passive scanning may affect YYAs' vaping decisions. This work is particularly meaningful in the current media environment, where YYAs are constantly exposed to information from various media outlets that may trigger interpersonal discussions and normative processes. It also speaks to the need to regulate e-cigarette marketing which has a salient presence in the communication environment, and sheds light on campaign and intervention practices to leverage the constructive effects of interpersonal and normative influence to promote desirable behavior change.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1.
Proposed direct and indirect pathways by hypotheses

Figure 2.
Full model of proposed pathways

Table 1

Descriptive Statistics of the Cross-sectional and Longitudinal Samples

	Unweighted		Weighted	
	Cross-sectional	Longitudinal	Cross-sectional	Longitudinal
Any scanning (%)	30.21	35.34	29.58	34.52
Traditional media scanning (%)	17.72	20.61	17.47	20.22
Outdoor media scanning (%)	13.97	16.06	13.83	15.39
Online media scanning (%)	18.17	20.55	17.79	19.69
Breadth of scanning (%)				
No exposure	73.49	69.15	74.06	69.75
Scanned from 1 source	9.50	11.30	9.18	11.75
Scanned from 2 sources	9.82	11.83	9.52	11.23
Scanned from 3 sources	6.82	7.32	6.87	6.98
Talking with other people (%)	16.24	18.43	16.42	18.54
Proximal norm perceptions (%)				
None	64.58	68.43	63.12	62.91
One	16.23	15.57	16.52	17.90
Two	9.52	8.03	9.97	9.9
Three	4.23	3.55	4.53	4.06
Four	4.88	4.20	5.19	4.87
Distal norm perceptions (%)				
None	11.33	9.99	11.56	8.42
A few	46.77	50.19	45.36	48.59
About half	26.99	26.90	27.18	28.23
Most	14.25	12.55	15.09	14.40
Current e-cigarette users (%)	10.41	8.28	11.37	12.07
Age (years; $M \pm SD$)	18.39 $\pm$ 3.61	17.18 $\pm$ 3.44	19.06 $\pm$ 3.80	18.65 $\pm$ 3.52
Female (%)	47.04	45.24	48.98	50.57
Race/ethnicity (%)				
Non-Hispanic White	50.21	56.44	51.21	52.23
Non-Hispanic Black	14.25	11.89	13.99	13.88
Hispanic	22.76	19.40	21.15	21.10
Other	12.06	11.92	12.81	12.32
Education (%)				
Less than high school	42.36	57.38	35.45	35.60
High school	22.62	15.41	28.95	29.02
Some college	22.80	16.91	25.87	26.61
College degree or more	11.13	9.81	8.64	8.33
School performance (%)				
Mostly F's	0.83	0.44	0.94	0.41
Mostly D's	1.60	1.84	1.88	2.08
Mostly C's	10.52	8.59	12.02	10.40

	Unweighted		Weighted	
	Cross-sectional	Longitudinal	Cross-sectional	Longitudinal
Mostly B's	40.20	37.02	41.20	40.08
Mostly A's	45.17	50.93	42.04	45.79
Sensation seeking ($M \pm SD$)	2.49 ± 0.52	2.46 ± 0.52	2.50 ± 0.53	2.51 ± 0.52
Current cigarette smokers (%)	12.23	7.63	15.59	15.12
Parental education (%)				
Less than high school	5.26	4.08	6.25	6.14
High school	19.72	16.84	23.38	23.25
Some college	14.54	13.08	17.01	17.27
College degree	28.36	28.14	24.10	22.49
Completed graduate school	22.95	27.68	19.41	22.03
Living with a vaper (%)	9.47	10.06	9.96	9.89
Vaping allowed inside home (%)	20.73	18.43	23.21	23.94

Note. Cross-sectional sample n = 11,013; longitudinal sample n = 3,212. Sample sizes reflect the overall samples. For some variables, percentages may not add up to 100 due to missing cases.

Table 2

Zero-order Correlations of Focal Variables at the Cross-sectional and Longitudinal Levels

	<i>Cross-sectional</i>				<i>Longitudinal</i>			
	1 (T1)	2 (T1)	3 (T1)	4 (T1)	1 (T2)	2 (T2)	3 (T2)	4 (T2)
1 – Media scanning (T1)	--				.31	.23	.15	.11
2 – Interpersonal communication (T1)	.50	--			.21	.26	.18	.15
3 – Descriptive norm perceptions (T1)	.17	.23	--		.12	.18	.55	.28
4 – E-cigarette use behavior (T1)	.11	.20	.31	--	.04	.08	.22	.41

Note. The correlations were calculated based on the weighted sample, smallest $n = 10,592$ for the cross-sectional sample and smallest $n = 3,186$ for the longitudinal sample. Pairwise Pearson's correlation coefficients are presented. All correlation coefficients at the cross-sectional level presented in the table are significant at $p < .001$. Nearly all correlation coefficients at the longitudinal level presented in the table are significant at $p < .01$, except for the correlation between T1 behavior and T2 scanning ($p = .07$).

Table 3

Direct and Indirect Effects in Weighted Cross-sectional and Longitudinal Mediation Analyses of the Scanning – Norm – Behavior Pathway

Direct Pathways	<i>B</i>	<i>OR</i>	95% CI
H1. Media scanning → E-cigarette use			
T1 → T1		1.23***	1.14, 1.33
T1 → T2		1.26*	1.05, 1.52
H2. Media scanning → Norm perceptions			
T1 → T1	0.12***		0.09, 0.14
T1 → T2	0.04*		0.00, 0.08
H3. Norm perceptions → E-cigarette use			
T1 → T1		2.38***	2.16, 2.64
T1 → T2		2.00***	1.52, 2.63
Indirect Pathways	Indirect Effects Effect Size	BC CIs	Total Effects Effect Size
H4. Media scanning → Norm perceptions → E-cigarette use			
T1 → T1 → T1	.010	.008 – .012	.022
T1 → T1 → T2	.009	.004 – .015	.025
T1 → T2 → T2	.004	.001 – .007	.018

Note: Sampling weights applied. T1 = variable measured at first interview. T2 = variable measured at the re-contact interview. *B* = unstandardized regression coefficient. *OR* = adjusted odds ratio. *CI* = confidence interval.

*
 $p < .05$,

**
 $p < .01$,

 $p < .001$.

For the mediation results, BC CIs = Bias-corrected bootstrap confidence intervals.

The bootstrapping procedures were conducted with 500 simulations given that this size is considered sufficient for general standard bootstrapping method in most cases (Efron & Tibshirani, 1993). Simulation (Pattengale, Alipour, Bininda-Emonds, Moret, & Stamatakis, 2010) and empirical (Deng, Allison, Fang, Ash, & Ware, 2013) evidence also confirmed that 500 resamples were more computationally practical, yielded robust estimates, and had little impact on either the bootstrapped standard errors or confidence intervals compared to larger sample sizes.

Indirect and total effect sizes are standardized. Nonzero indirect effects are bolded. These analyses report the effects of the compound path from the independent variable to the dependent variable through the mediator, adjusting for demographic variables and potential confounders at T1 as listed in regression result tables found in Tables 5 and 6. Because of the non-linear nature of logistic regression (i.e., the *b* path – norm- behavior – in the mediation model), the Hayes macro applied different standardization procedures for the *a* and *b* coefficients (Hayes, 2009; Hayes et al., 2011; Mackinnon & Dwyer, 1993; MacKinnon, Lockwood, Brown, Wang, & Hoffman, 2007). Specifically, standardized $a^* = a (SD_X / SD_M)$, where *a* refers to the unstandardized coefficient of the first path, and SD_X and SD_M refer to the standard deviations of X (scanning) and M (norm). For the second path, because Y (e-cigarette use) is binary, standard $b^* = b (SD_M / SD_Y)$, with SD_Y calculated differently as

$SD_Y = \sqrt{b^2 SD_M^2 + \pi^2 / 3}$. The constant $\pi^2 / 3$ is an estimate of the binomial distribution variance. The product of the standardized paths, $a^* b^*$, is then used as the effect size estimate for the indirect effect.

Table 4

Direct and Indirect Effects in Weighted Cross-sectional and Longitudinal Mediation Analyses of the Scanning – Conversation – Norm Pathway

Direct Pathways	<i>B</i>	<i>OR</i>	95% CI
H5. Media scanning → Interpersonal conversations			
T1 → T1		3.10 ***	2.91, 3.32
T1 → T2		1.38 ***	1.20, 1.58
H6. Interpersonal conversations → Norm perceptions			
T1 → T1	0.42 ***		0.37, 0.47
T1 → T2	0.11 *		0.01, 0.22
Indirect Pathways	Indirect Effects Effect Size	BC CIs	Total Effects Effect Size
H7. Media scanning → Interpersonal conversations → Norm perceptions			
T1 → T1 → T1	.068	.057 – .081	.114
T1 → T1 → T2	.015	.004 – .028	.035
T1 → T2 → T2	.019	.011 – .031	.035

Note: Sampling weights applied. T1 = variable measured at first interview. T2 = variable measured at the re-contact interview. *B* = unstandardized regression coefficient. *OR* = adjusted odds ratio. *CI* = confidence interval.

* $p < .05$,

** $p < .01$,

*** $p < .001$.

For the mediation results, BC CIs = Bias-corrected bootstrap confidence intervals.

The bootstrapping procedures were conducted with 500 simulations given that this size is considered sufficient for general standard bootstrapping method in most cases (Efron & Tibshirani, 1993). Simulation (Pattengale, Alipour, Bininda-Emonds, Moret, & Stamatakis, 2010) and empirical (Deng, Allison, Fang, Ash, & Ware, 2013) evidence also confirmed that 500 resamples were more computationally practical, yielded robust estimates, and had little impact on either the bootstrapped standard errors or confidence intervals compared to larger sample sizes.

Indirect and total effect sizes are standardized. Nonzero indirect effects are bolded. These analyses report the effects of the compound path from the independent variable to the dependent variable through the mediator, adjusting for demographic variables and potential confounders at T1 as listed in regression result tables found in Tables 5 and 6. Because of the non-linear nature of logistic regression (i.e., the *a* path – scanning - conversation – in the mediation model), the Hayes macro applied different standardization procedures for the *a* and *b* coefficients (Hayes, 2009; Hayes et al., 2011; Mackinnon & Dwyer, 1993; MacKinnon et al., 2007). For the second path, since *Y* (norm) is a continuous variable, standardized b^* is calculated using a standard formula, $b^* = b (SD_M / SD_Y)$, where *b* refers to the unstandardized coefficient of the second path, and SD_M and SD_Y refer to the standard deviations of *M* (interpersonal conversations) and *Y* (norm). For the first path, however, because *M* is binary, standard $a^* = a (SD_X / SD_M)$, with SD_M calculated differently as $SD_M = \sqrt{a^2 SD_X^2 + \pi^2 / 3}$. The constant $\pi^2 / 3$ is an estimate of the binomial distribution variance. The product of the standardized paths, $a^* b^*$, is then used as the effect size estimate for the indirect effect.

Table 5

Cross-sectional Regression Analyses Results of the Proposed Pathways

Hypotheses IVs \ DVs	H1: EXP → BEH			H2: EXP → DN			H3: DN → BEH			H5: EXP → IC			H6: IC → DN		
	E-cigarette Use			Norm Perceptions			E-cigarette Use			Interpersonal Conversations			Norm Perceptions		
	OR (SE)	95% CI	B (SE)	OR (SE)	95% CI	B (SE)	OR (SE)	95% CI	B (SE)	OR (SE)	95% CI	B (SE)	OR (SE)	95% CI	B (SE)
Media Scanning	1.23 (0.05)***	1.14, 1.33	0.12 (0.01)***	0.09, 0.14						3.10 (0.10)***	2.91, 3.32		0.42 (0.03)***	0.37, 0.47	
Interpersonal Conversations															
Norm Perceptions							2.38 (0.12)***	2.16, 2.64							
Age	0.98 (0.02)	0.95, 1.02	0.01 (0.00)	0.00, 0.01	0.00, 0.01	0.00, 0.01	0.97 (0.02)	0.94, 1.01	0.97 (0.02)*	0.94, 1.00	0.01 (0.00)	0.01 (0.00)	0.00, 0.01		
Gender (ref. = Female)	1.34 (0.12)**	1.13, 1.59	-0.01 (0.02)	-0.04, 0.03	-0.04, 0.03	-0.04, 0.03	1.38 (0.13)**	1.15, 1.65	1.00 (0.08)	0.86, 1.17	0.00 (0.02)	0.00 (0.02)	-0.04, 0.03		
Race (ref. = White)															
Hispanic	0.93 (0.11)	0.74, 1.17	0.13 (0.03)***	0.08, 0.18	0.08, 0.18	0.08, 0.18	0.82 (0.10)	0.64, 1.04	0.69 (0.07)**	0.56, 0.85	0.14 (0.03)***	0.14 (0.03)***	0.09, 0.20		
Black	0.54 (0.08)***	0.41, 0.73	-0.01 (0.03)	-0.07, 0.05	-0.07, 0.05	-0.07, 0.05	0.55 (0.08)***	0.41, 0.73	0.56 (0.07)***	0.44, 0.72	0.01 (0.03)	0.01 (0.03)	-0.05, 0.07		
Other	0.94 (0.13)	0.71, 1.25	0.08 (0.03)*	0.02, 0.14	0.02, 0.14	0.02, 0.14	0.87 (0.12)	0.65, 1.14	0.94 (0.11)	0.75, 1.17	0.08 (0.03)*	0.08 (0.03)*	0.02, 0.14		
Education	1.04 (0.06)	0.92, 1.17	0.01 (0.01)	-0.02, 0.03	-0.02, 0.03	-0.02, 0.03	1.07 (0.07)	0.94, 1.21	1.06 (0.06)	0.95, 1.19	0.01 (0.01)	0.01 (0.01)	-0.02, 0.03		
School Performance	0.91 (0.05)†	0.82, 1.00	-0.06 (0.01)***	-0.08, -0.03	-0.08, -0.03	-0.08, -0.03	0.93 (0.05)	0.84, 1.04	1.05 (0.05)	0.95, 1.16	-0.06 (0.01)***	-0.06 (0.01)***	-0.08, -0.03		
Sensation Seeking	1.67 (0.16)***	1.38, 2.02	0.19 (0.02)***	0.15, 0.23	0.15, 0.23	0.15, 0.23	1.41 (0.13)***	1.17, 1.70	1.36 (0.11)***	1.16, 1.59	0.18 (0.02)***	0.18 (0.02)***	0.14, 0.22		
Past-30-day Cigarette Use	4.06 (0.42)***	3.31, 4.97	0.11 (0.03)**	0.04, 0.17	0.04, 0.17	0.04, 0.17	4.19 (0.45)***	3.39, 5.18	1.40 (0.15)**	1.13, 1.74	0.09 (0.03)**	0.09 (0.03)**	0.03, 0.15		
Parental Education	1.00 (0.04)	0.93, 1.07	-0.04 (0.01)***	-0.05, -0.02	-0.05, -0.02	-0.05, -0.02	1.04 (0.04)	0.97, 1.12	1.01 (0.03)	0.94, 1.07	-0.04 (0.01)***	-0.04 (0.01)***	-0.05, -0.02		
Live with a Vaper (ref. = no)	2.41 (0.28)***	1.92, 3.04	0.34 (0.04)***	0.26, 0.42	0.26, 0.42	0.26, 0.42	1.92 (0.24)***	1.50, 2.46	1.77 (0.21)***	1.40, 2.23	0.31 (0.04)***	0.31 (0.04)***	0.23, 0.39		
Household Rule (ref. = no)	3.34 (0.31)***	2.78, 4.01	0.23 (0.03)***	0.18, 0.29	0.18, 0.29	0.18, 0.29	2.96 (0.28)***	2.46, 3.57	1.76 (0.17)***	1.46, 2.12	0.20 (0.03)***	0.20 (0.03)***	0.15, 0.26		

Note: EXP = breadth of media scanning; BEH = e-cigarette use behavior; IC = interpersonal conversations; DN = descriptive norm perceptions. All analyses are weighted.

Table 6

Longitudinal Regression Analyses Results of the Proposed Pathways

Hypotheses IVs \ DVs	H1: EXP → BEH			H2: EXP → DN			H3: DN → BEH			H5: EXP → IC			H6: IC → DN		
	E-cigarette Use N = 2,755			Norm Perceptions N = 2,755			E-cigarette Use N = 2,761			Interpersonal Conversations N = 2,748			Norm Perceptions N = 2,762		
	OR (SE)	95% CI	B (SE)	OR (SE)	95% CI	B (SE)	OR (SE)	95% CI	B (SE)	OR (SE)	95% CI	B (SE)	OR (SE)	95% CI	B (SE)
Media Scanning	1.26 (0.12)*	1.05, 1.52	0.04 (0.02)*	0.00, 0.08					1.38 (0.10)***	1.20, 1.58					
Interpersonal Conversations									2.55 (0.43)***	1.83, 3.55			0.11 (0.05)*	0.01, 0.22	
Norm Perceptions			0.55 (0.03)***	0.50, 0.60	2.00 (0.28)***	1.52, 2.63						0.55 (0.03)***	0.49, 0.60		
E-cigarette Use	5.72 (1.37)***	3.57, 9.17			3.97 (0.98)***	2.45, 6.45									
Age	1.06 (0.05)	0.97, 1.17	0.02 (0.01)	0.00, 0.04	1.08 (0.05)	0.98, 1.18			0.97 (0.04)	0.90, 1.04	0.02 (0.01)	0.00, 0.04			
Gender (ref. = Female)	0.97 (0.20)	0.64, 1.46	-0.12 (0.04)**	-0.20, -0.04	1.12 (0.24)	0.74, 1.71			0.81 (0.11)	0.61, 1.06	-0.12 (0.04)**	-0.19, -0.04			
Race (ref. = White)															
Hispanic	0.59 (0.17)†	0.34, 1.02	0.02 (0.05)	-0.08, 0.11	0.57 (0.16)*	0.33, 0.97			0.62 (0.12)*	0.43, 0.90	0.02 (0.05)	-0.07, 0.12			
Black	0.50 (0.18)†	0.24, 1.01	-0.04 (0.06)	-0.15, 0.07	0.53 (0.20)	0.25, 1.10			0.60 (0.13)*	0.39, 0.93	-0.03 (0.06)	-0.14, 0.08			
Other	1.09 (0.34)	0.59, 2.01	0.04 (0.05)	-0.06, 0.14	1.13 (0.34)	0.63, 2.02			0.80 (0.17)	0.53, 1.21	0.04 (0.05)	-0.06, 0.14			
Education	0.92 (0.15)	0.67, 1.26	-0.08 (0.03)*	-0.14, -0.01	0.94 (0.16)	0.68, 1.30			1.11 (0.13)	0.88, 1.41	-0.08 (0.03)*	-0.14, -0.01			
School Performance	0.94 (0.13)	0.72, 1.23	-0.07 (0.03)*	-0.13, -0.01	0.97 (0.13)	0.74, 1.26			0.96 (0.09)	0.79, 1.16	-0.07 (0.03)*	-0.13, -0.01			
Sensation Seeking	1.23 (0.26)	0.81, 1.87	0.04 (0.04)	-0.03, 0.11	1.10 (0.23)	0.73, 1.65			1.00 (0.14)	0.76, 1.33	0.04 (0.04)	-0.03, 0.12			
Past-30-day Cigarette Use	2.80 (0.68)***	1.74, 4.51	-0.01 (0.07)	-0.15, 0.14	3.17 (0.77)***	1.97, 5.12			1.15 (0.28)	0.72, 1.85	-0.01 (0.07)	-0.15, 0.14			
Parental Education	0.96 (0.09)	0.80, 1.14	-0.01 (0.02)	-0.04, 0.02	0.99 (0.09)	0.83, 1.18			0.95 (0.06)	0.84, 1.07	-0.01 (0.02)	-0.04, 0.02			
Live with a Vaper (ref. = no)	1.66 (0.45)†	0.97, 2.81	-0.05 (0.06)	-0.17, 0.08	1.54 (0.44)	0.88, 2.68			1.06 (0.25)	0.67, 1.67	-0.05 (0.07)	-0.18, 0.08			
Household Rule (ref. = no)	1.68 (0.38)*	1.09, 2.61	0.02 (0.05)	-0.08, 0.12	1.49 (0.32)†	0.97, 2.28			1.51 (0.27)*	1.07, 2.14	0.01 (0.05)	-0.09, 0.11			

Note: EXP = breadth of media scanning; BEH = e-cigarette use behavior; IC = interpersonal conversations; DN = descriptive norm perceptions. All analyses are weighted.