NBER WORKING PAPER SERIES

INFORMATION SOURCE AND CIGARETTES: EXPERIMENTAL EVIDENCE ON THE MESSENGER EFFECT

Johanna Catherine Maclean
John Buckell
Joachim Marti

Working Paper 25632
http://www.nber.org/papers/w25632

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
March 2019

Research reported in this publication was supported by grant number P50DA036151 from the NIDA and FDA Center for Tobacco Products (CTP). The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH or the Food and Drug Administration. We thank Paul Allison, Andrew Barnes, Daniel Barsky, Stefan Boes, Laura Gibson, Robert Hornik, Melissa Oney, Kurt Petschke, Jody Sindelar, Janice Vincent, and Douglas Webber for helpful feedback. The views expressed herein are those of the authors and do not necessarily reflect the views of the National Bureau of Economic Research.

Information Source and Cigarettes: Experimental Evidence on the Messenger Effect
Johanna Catherine Maclean, John Buckell, and Joachim Marti
NBER Working Paper No. 25632
March 2019
JEL No. D9,I1,I12

ABSTRACT

We examine the importance of information source (the 'messenger') on consumer choice in the context of cigarettes, electronic and tobacco. We proxy choice with intentions to use cigarettes and risk perceptions. We experimentally vary the messenger across three information sources: government, physicians, and private companies. We compare effects relative to a no source control in a sample of adult smokers. Neoclassical theory predicts that the information source, or the messenger, should not influence choices. Behavioral economics suggests that the messenger can have important implications for how consumers process information and, in turn, make decisions. Our findings provide evidence in line with behavioral economics: the messenger influences intention to use e-cigarettes, and risk perceptions about e-cigarettes and tobacco cigarettes. Private companies appear to be particularly important messengers and are potentially the economic agents most likely to shape the future adult demand for cigarettes.

Johanna Catherine Maclean
Department of Economics
Temple University
Ritter Annex 869
Philadelphia, PA 19122
and NBER
catherine.maclean@temple.edu

John Buckell
Yale School of Public Health
P.O. Box 208034
New Haven, CT 06520-8034
john.buckell@yale.edu

Joachim Marti
Institute of Social and Preventive Medicine
University of Lausanne
j.marti@imperial.ac.uk

A data appendix is available at http://www.nber.org/data-appendix/w25632

1 Introduction

Electronic cigarettes ('e-cigarettes') are battery-operated devices that simulate smoking. The device heats a liquid, which often contains nicotine – the addictive ingredient in e-cigarettes, tobacco cigarettes, and many other tobacco products – and flavors, into a vapor which is inhaled by the user (called 'vaping'). These products were developed in 2003 (Riker, Lee, Darville, & Hahn, 2012) and are becoming increasingly popular worldwide. Global sales of e-cigarettes exceeded $11B in 2016 (BIS Research, 2018). In the United States, the focus of our study, 5.5% adults currently use e-cigarettes (Coleman et al., 2017) and 15% of adults have ever used these products (Weaver et al., 2016).

E-cigarette use has progressed in a largely unregulated environment and there is controversy regarding the health effects of these products. On the one hand, e-cigarettes are generally believed to be less harmful than tobacco cigarettes for both smokers and non-smokers, and may assist at least some smokers in quitting (Bullen et al., 2013; Hajek, Etter, Benowitz, Eissenberg, & McRobbie, 2014; Dinakar & O'Connor, 2016; Shahab et al., 2017; National Academies of Sciences, Engineering and Medicine, 2018). The potential for harm reduction – that is addicted smokers who cannot quit tobacco products can consume nicotine in a less harmful manner for themselves and those around them – could be important as, despite numerous anti-smoking campaigns, tax increases, and use bans over several decades, 15.5% of U.S. adults continue to smoke (Jamal et al., 2018). Alternatively, there are concerns among some public health advocates that e-cigarettes may re-normalize smoking, help smokers circumvent indoor smoking bans, act as a gateway product to tobacco cigarettes, and that the health benefits of e-cigarettes are over-stated (Zhong, Cao, Gong, Fei, & Wang, 2016; McKee & Capewell, 2015; Allen et al., 2016; Shi, Cummins, & Zhu, 2017).[1]

Faced with this controversy, governments in many countries are determining whether and how to establish e-cigarettes policies. In particular, communication strategies based on the risks of e-cigarettes and tobacco cigarettes are emerging. For instance, in the U.S., the Food and Drug Administration (FDA) expanded its 'Real Cost' youth anti-smoking campaign, initiated in 2014, to include e-cigarettes in 2018. At the same time, e-cigarette companies spend millions of dollars each year advertising these products to consumers; e.g., in 2012 these companies spent $18.3M on advertising and this number is escalating (Kim, Arnold, & Makarenko, 2014). Tobacco cigarette companies are increasingly entering the e-cigarette market (Kamerow, 2013) which suggests that advertising efforts may become even more

[1] We note that the importance of the gateway effect is debated within the public health community. See, for instance, Etter (2018).

aggressive in the future. Recent data shows that an increasing proportion of U.S adults have misconceptions about the harmfulness of e-cigarettes and that risk perceptions are associated with product use (Viscusi, 2016; Czoli, Fong, Mays, & Hammond, 2017). This confluence of factors suggests that there is substantial scope for communication efforts, public or private, to shape the demand for e-cigarettes.

Understanding how consumers incorporate information on the relative risks of e-cigarettes and tobacco cigarettes is important to inform government policies related to these products, and to understand how advertising from private companies may influence consumer demand. Neoclassical economics predicts the format in which new information is conveyed is irrelevant for consumer choice. Behavioral economics suggests that format, 'choice architecture' (Thaler & Sunstein, 2008), has an important role in consumer decisions (Thaler & Sunstein, 2008; Oullier, Cialdini, Thaler, & Mullainathan, 2010). Dolan et al. (2012) highlight the importance of information source (the 'messenger'). For instance, consumers are more likely to incorporate information from authority figures into decision making and are less likely to incorporate information from individuals or groups that they dislike.

We provide the first evidence on whether and how information source, the messenger, affects adult smokers' intentions to use e-cigarettes and tobacco cigarettes, and risk perceptions about these products. Given the rapid growth of the e-cigarette market, controversy over the relative health effects of e-cigarettes and tobacco cigarettes, and large-scale communication efforts by both public and private agents, studying this question is important from a policy, public health, and economic perspective. We take an experimental approach in which we present adult smokers with information on the health benefits of e-cigarettes vis-a-vis tobacco cigarettes. We vary the messenger and compare intentions to use e-cigarettes and tobacco cigarettes, and product risk perceptions in the various experimental arms. We select three plausible messengers for cigarette information: government (which we proxy with the FDA, the federal agency with the authority to regulate tobacco products in the U.S.; through the Family Smoking Prevention and Tobacco Control Act of 2009), physicians (an important source of health information), and private companies (which we proxy with a fictitious e-cigarette company). We compare each messenger to a no source control.

Our findings support behavioral economic theories that suggest that messengers play an important role in how consumers incorporate information into decision making and their choices. In particular, our findings imply that private companies have a substantial influence on smokers' intention to use e-cigarettes, but not tobacco cigarettes, and consumers risk perceptions of both products. Our findings suggest that government and physician messengers

are generally not important predictors of our outcomes. These findings imply that private companies may play a substantial role in shaping future adult demand for e-cigarettes.

The paper proceeds as follows. Section 2 provides background on messengers and outlines hypotheses that will be tested in the empirical work. Data, variables and methods are described in Section 3. The main results are listed in Section 4. Robustness checks and extensions are presented in Section 5. Finally, Section 6 concludes.

2 Background and hypotheses

A large literature that overlaps economics and psychology explores deviations from neoclassical economic theories of consumer choice (Kahneman, Knetsch, & Thaler, 1990; Loewenstein, O'Donoghue, & Rabin, 2003; Thaler & Sunstein, 2008). While it is beyond the scope of our paper to describe this voluminous literature, we simply note that over several decades numerous scholars have made important advancements in our understanding of choice behavior that often depart from standard neoclassical theories.

We consider one aspect of choice architecture – the manner in which information is presented to consumers – in our study: the messenger effect. A messenger is an agent who delivers information to the consumer (Dolan et al., 2012). The messenger effect is understudied within economics broadly and cigarettes specifically.[2] The dearth of economic studies on messenger effects is surprising as the vast majority of public and private media campaigns include a messenger. Put differently, someone or something must communicate the message to the audience. Further, the importance of information in consumer choice is well-studied in economics (Stigler, 1961; Arrow, 1963; Akerlof, 1970; Spence, 1973; Cawley, Susskind, & Willage, 2018). This question is particularly relevant in an emerging market such as the market for e-cigarettes as it can offer insight on the agents most likely to shape future consumer demand and the associated health implications. For instance, if private e-cigarettes companies have the ability to shape demand, then we may expect substantial increases in e-cigarettes which may induce non-smokers to use these products and/or current tobacco cigarette smokers to switch to using e-cigarettes. These changes will likely influence public health in heterogeneous ways. We outline the messenger concept and develop hypotheses based on the available evidence to test in our experiment. We focus on the economics, psychology, and marketing literature, all of which have considered the messenger.

[2]We are not aware of any economic or non-economic studies that address this question empirically. We note that Schmidt, Ranney, Noar, and Goldstein (2017) explore the messenger conceptually from an epidemiological perspective.

2.1 The messenger effect

Dolan et al. (2012) describe the messenger effect and discuss empirical evidence for its importance. The concept is straightforward: the same information received from different messengers can have differential effects on consumer beliefs and choices. Messenger credibility is particularly important: consumers are more likely to respond – i.e., to view the information as accurate and incorporate it into decision-making – to information from sources deemed as credible (i.e., trustworthy and believable). Several studies have linked messenger credibility to authority and congruence, or likeness, between the source of information and the individual, with congruence defined broadly as common values, ideologies, backgrounds, shared experience, and so forth (Kelman, 1961; Wilson & Sherrell, 1993; Durantini, Albarracin, Mitchell, Earl, & Gillette, 2006). In general, information from messengers who are perceived as authorities or experts to, sharing similar characteristics with, and likeable to consumers will have a greater effect on consumer choice than alternative messengers.

Messenger effects have been documented across a range of economic activities. Nurses have been shown to comply with physicians' (authority figures) instructions, even when the instructions are clearly incorrect (Hofling, Brotzman, Dalrymple, Graves, & Pierce, 1966). Karlan and List (2012) document that charitable donations are larger when the donation solicitation is linked to a perceived authority figure (e.g., Bill and Melinda Gates, prominent U.S. philanthropists). Meer (2011) shows that university donations are larger when an alumni (which proxies for similarities in background) requests a donation than an otherwise similar individual. Boddery and Yates (2014) document that shared political affiliation is important for individuals' probability of agreeing with U.S. Supreme Court decisions (where shared political affiliation refers to congruence between the surveyed individual and the Supreme Court Justices forming the majority opinion). On the other hand, if the consumer dislikes the messenger, then the consumer is less likely to incorporate received information into their decision-making (Cialdini, 2007). Numerous marketing studies investigate messenger effects for government, private companies, and citizen groups; which includes physicians (Trumbo & McComas, 2003). Government and private companies are perceived as less credible for risk-based information than citizen groups (Frewer, Howard, Hedderley, & Shepherd, 1996; Kunreuther, Easterling, Desvousges, & Slovic, 1990; McCallum, Hammond, & Covello, 1991; Slovic, Flynn, & Layman, 1991). Consumers are least likely to view government and private companies as credible messengers if consumers believe these messengers have hidden agendas (Kasperson, 1986; Mitchell, 1992).

Overall, the literature suggests that messengers can have important effects on consumer

choice. We hypothesize the following:

Hypothesis H_1: Information from the FDA and physicians will have a greater effect on consumer intention to use and risk perception than information provided with no source as the FDA and physicians will be perceived as authority figures.

Hypothesis H_2: Because consumers will view these agents has having an agenda (selling e-cigarettes), information from an e-cigarette company will have no effect, relative to information provided with no source, on intentions to use and risk perceptions.

However, if the FDA is viewed as a direct arm of the government, rather than an independent scientific agency, this messenger may be viewed as less credible and thus have a muted effect on consumer choice (hypothesis H_1). This behavior may be particularly important as, during our study period, there was a growing wave of anti-government and anti-science sentiment (American Academy of Arts and Sciences, 2018). We note that hypothesis H_2 may not hold if consumers view e-cigarette companies as 'combating' or taking business away from tobacco cigarette companies. Within the U.S., due to revelations of misconduct and false advertising claims (Brandt, 2007), tobacco cigarette companies are viewed unfavorably by many individuals. We note that many e-cigarette companies are owned by tobacco cigarette companies (Kamerow, 2013), but consumers may not be aware of this fact.

3 Data, variables, and methods

3.1 Data

We focus on adult smokers to study the importance of the messenger within a homogeneous group of established smokers. Further, adult tobacco cigarette smokers are at greatest risk for health problems associated with smoking and reducing smoking in this group is likely to have a substantial effect on public health (Levy et al., 2017). Data were collected through an online platform by the survey firm Qualtrics on adult smokers 18 to 64 years between April 6th, 2017 and May 26th, 2017. This survey platform is commonly used by economists to study health-related outcomes, including e-cigarettes and tobacco cigarettes (Bradford, Courtemanche, Heutel, McAlvanah, & Ruhm, 2017; Marti, Buckell, Maclean, & Sindelar, 2018; Buckell, Marti, & Sindelar, 2018).

We constructed our sample to match a sample of adult smokers in the 2014 Centers for Disease Control and Prevention's Behavioral Risk Factor Surveillance System (BRFSS). At the time of survey development, the 2014 BRFSS was the most recent year of this data set

available. The BRFSS is a large national and state representative health survey conducted annually, and is used within economics to study smoking (Courtemanche & Zapata, 2014; Horn, Maclean, & Strain, 2017). We matched our sample to BRFSS on sex, age (18 to 34, 35 to 49, and 50 to 64 years), education (less than a college degree and a college degree or more), and region (New England, Mid-Atlantic, Midwest, South, Mountain, and Pacific). Our survey instrument is provided in the Supplementary Appendix.

We conducted an experiment in which we varied the messenger of cigarette risk information and then compared outcomes across the experimental arms. We included three messengers: the FDA, a fictitious e-cigarette company developed by the authors for the purposes of this study (called the 'Ave'), and physicians. Cigarette risk information provided with no messenger seved as the control group. We choose these messengers as they are important economic agents in the e-cigarette market and/or common sources of health information. For instance, the FDA is the federal government agency within the U.S. that has the authority to regulate cigarettes; e-cigarette companies manufacture, sell, and market e-cigarettes; and physicians are important sources of health information, in particular for smoking-related information (Hesse et al., 2005). We operationalized the messenger with an image representing each source. We do not test the effect of information directly received from a messenger. For example, we did not examine the effect of receiving information from the consumer's physician in a professional healthcare consultation. Instead, our experiment mimics the type of information that is plausibly conveyed through a real-world advertising campaign, a common communication mode for governments and private companies. For instance, in 2012 59% of e-cigarette advertising expenditures were allocated to magazines (Kim et al., 2014). We view our ability to capture information that could be conveyed in a real-word advertising campaign as an advantage of our study.

Respondents were randomized to one of four messengers and were shown the corresponding image and were asked to carefully view the image. The survey paused for 30 seconds to encourage viewing. Respondents could continue to view the image beyond this time period. Each picture had an image of two hands holding e-cigarettes in the right hand and tobacco cigarettes in the left hand. We altered the messenger by using different logos.[3] The source was placed in the upper right hand corner of each image. The information conveyed to smokers related to the relative health harms of e-cigarettes and tobacco cigarettes: 'E-cigarettes are much safer than tobacco cigarettes. If you switch to e-cigarettes now, you are likely to

[3]We obtained permission to use the official FDA logo. We attempted to obtain permission from other organizations (e.g., major medical organizations representing physicians), but we were not successful. For this reason, we use a generic image of physicians. Details available on request.

live five years longer' or 'Tobacco cigarettes are much more harmful than e-cigarettes. If you don't switch to e-cigarettes now, you are likely to die five years earlier.' Figures 1 to 4 present the images shown to respondents with the change in health status associated with a transition to e-cigarettes as a health gain.[4]

We selected life expectancy as this outcome is a relatively easy to understand and objective health metric, and is used within economics (Viscusi, 2016). Determining the changes in life expectancy associated with switching from tobacco cigarettes to e-cigarettes was not straightforward. The clinical literature on e-cigarettes is nascent with no consensus on the relative safety of e-cigarettes vs. tobacco cigarettes. However, there is general consensus that e-cigarettes are the safer product. We selected a five year change in expectancy as we deemed it plausible based on available clinical evidence (Jha et al., 2013).

Prior to the survey, we conducted a 50-person pilot study. We asked respondents to note any issues related to the viewing the images and/or any other problems with the survey. Further, we had several research assistants complete the survey and report any problems, and had the survey reviewed by Qualtrics programmers. We incorporated feedback to improve our survey. In paritcular, no pilot respondent, research assistant, or Qualtrics programmer noted any issues with the life expectancy measure, and we specifically asked these individuals whether the life expectancy question was problematic.

Our sample included 2,722 currently smoking non-elderly adults. We excluded several respondents to improve data quality. Respondents who reported that they had difficulty viewing the image were excluded. We asked 'How hard did you find it to understand the image you viewed?' Response categories were: not difficult at all, not very difficult, somewhat difficult, and extremely difficult. Respondents who found the image extremely difficult to understand were excluded. We placed an attention test in the middle of the survey: we asked respondents to select the number two (options one and two) with the two placed farthest to the right (Krosnick, 1991). Respondents who failed this attention test were excluded. We also excluded respondents who completed the survey in less than 1/3 of the median survey time. Qualtrics recommends this practice in all online surveys as this is an industry standard. Our analysis sample included 2,499 adults (or 92% of the full sample). This sample is large relative to other online experiments (Pesko, Kenkel, Wang, & Hughes, 2016; Bradford et al., 2017; Marti et al., 2018; Kenkel, Peng, Pesko, & Wang, 2017; Buckell et al., 2018).

[4]We also randomized whether the information was framed as a gain or a loss. Our analysis of framing health changes as a gain or loss generated inconclusive results, but these results are available on request. The figures reported in this manuscript represent the health changes associated with switching to e-cigarettes as a health gain. Figures that display the changes in health as a loss are available on request from the authors.

3.2 Variables

Our outcome variables were measured immediately following image viewing, and included questions on intentions to use and risk perceptions about e-cigarettes and tobacco cigarettes. These variables are established proxies for cigarette use and are grounded in the theory of planned behavior (Ajzen, 1991; Godin & Kok, 1996; Harakeh, Scholte, Vermulst, de Vries, & Engels, 2004; Rise, Kovac, Kraft, & Moan, 2008; Kleinjan et al., 2009; Czoli et al., 2017). We asked respondents about their perceived likelihood of using e-cigarettes in the following 30 days. We constructed an indicator for reporting being extremely or somewhat likely to use e-cigarettes in the next 30 days, and zero otherwise. Analogously, we constructed an indicator for the likelihood of quitting tobacco cigarettes in the next 30 days. These two variables proxy intentions to use e-cigarettes and tobacco cigarettes.

We developed four indicators of tobacco cigarette and e-cigarette risk perceptions. More specifically, the indicators were coded one (and zero otherwise) for strongly agreeing or agreeing with the following four statements: e-cigarettes are healthier than tobacco cigarettes, people who switch from tobacco cigarettes to e-cigarettes are healthier, the government should encourage people to switch from using tobacco cigarettes to using e-cigarettes, and the government should ban the sale of e-cigarettes. We adopted a forced response approach.

3.3 Methods

As we randomized respondents to treatments, we can compare outcome proportions across arms. However, we apply a linear probability model (LPM) that controls for personal characteristics to allow us to reduce residual variation in our outcomes and increase statistical power (Angrist & Pischke, 2009). Equation 1 outlines our regression model:

$$C_{i,m} = \beta_0 + \beta_1 FDA_m + \beta_2 Physicians_m + \beta_3 Ave_m + X_{i,m}\beta_4 + \mu_{i,m} \tag{1}$$

$C_{i,m}$ is a cigarette outcome for respondent i assigned to messenger m. We include fixed effects for the messenger; no messenger is the reference. $X_{i,m}$ is a vector of demographic variables. Demographics were collected in a survey following the experiment. We control for sex, age, race/ethnicity, education, region, family size, political affiliation, survey duration (this variable measures the entire time between survey initiation and completion; some respondents did not complete the survey in one sitting),[5] reporting that the image

[5]In robustness checking, reported later in the manuscript, we exclude respondents with both very short and long survey duration: below the 5th percentile and above the 90th percentile of the empirical distribution. Results based on this restricted sample are not appreciably different from the results reported here.

was somewhat hard to understand,[6] excellent or very good health self-assessed health, daily smoking, nicotine addiction (proxied by the number of minutes between waking up and first tobacco cigarette (Heatherton, Kozlowski, Frecker, & Fagerström, 1991)), and current vaping. We impute the mean/mode for observations with missing control variable information and include indicators for missingness to maximize statistical power.

$\mu_{i,m}$ is the error term. Heteroscedasticity robust standard errors are reported. Because we randomize our treatment across respondents, we follow recent literature and do not cluster at the treatment level (Abadie, Athey, Imbens, & Wooldridge, 2017). Results are unweighted as Qualtrics does not provide weights.

4 Results

4.1 Summary statistics

Table 1 reports summary statistics. We assess balance across arms following Kruskal and Wallis (1952). We reject the null hypothesis of no difference in mean rank across arms in four of twenty-five variables (16%): age 18 to 34 years (p-value = 0.0810), age 35 to 49 years (p-value = 0.0747), Pacific region (p-value = 0.0038), and South region (p-value = 0.0258). However, the practical significance of these differences is small and we control for these variables in our regression models.

We asked respondents questions related to their knowledge of our messengers (Table 2). 96% report that they are familiar with the FDA and, interestingly, 18% report that they have heard of the fictitious e-cigarette company. 80% have a regular physician. Familiarity with the messengers is balanced across experimental arms with the exception of FDA awareness (p-value = 0.0769). However, the differences in FDA awareness across experimental arms are very small: 98% in the FDA arm, 96% in the fictitious e-cigarette company arm, 97% in the physician arm, and 95% in the no source arm. In a robustness check reported later in the manuscript we control for source familiarity in our regression model.

4.2 Regression results

Results for the effects of messenger on intentions to use cigarettes and risk perceptions are reported in Tables 3 and 4 respectively. We report unadjusted (top panel) and adjusted (bottom panel) regression results.

[6] We exclude respondents who report that the image was very hard to understand from the sample.

52% of the sample plans to use an e-cigarette and 54% plans to quit tobacco cigarettes in the next 30 days. We observe that receiving information from the fictitious e-cigarette company increases the probability of reporting an intention to use e-cigarettes in the next 30 days. In particular, we observe that information from the fictitious e-cigarette company raises intentions to use e-cigarettes by 8.0 percentage points (ppts) in the unadjusted model and 6.5 ppts in the adjusted model. Relative the sample proportion these estimates imply a 15% and 12% increase in intentions to use e-cigarettes (all relative effects are calculated compared to the relevant sample proportions throughout the manuscript). We observe no other statistically significant relationships.

In our sample 62% agree that e-cigarettes are healthier than tobacco cigarettes, 58% agree that switching to e-cigarettes from tobacco cigarettes will improve health, 47% agree that the government should promote switching to e-cigarettes, and 20% agree that the government should ban e-cigarettes. We observe that receiving information from the fictitious e-cigarette company has a statistically significant effect on the probability of agreeing with our risk perception variables. In unadjusted models, we observe that receiving information from the fictitious e-cigarette company increases the probability of agreeing that e-cigarettes are healthier than tobacco cigarettes by 8.5 ppts (14%) and increases the probability of agreeing that switching to e-cigarettes will improve health by 6.4 ppts (11%), and decreases the probability of agreeing that the government should ban e-cigarettes by 3.9 ppts (20%). In adjusted models the estimates are very similar: 7.1 ppts (11%), 5.2 ppts (9%), and 4.3 ppts (22%). No other coefficient estimates are statistically different from zero.

We report covariate-adjusted results only for the remainder of the paper. Unadjusted results are similar and available on request.

5 Robustness checking and extensions

5.1 Robustness checking

Our results are broadly stable across several different robustness checks. We lose precision in some checks in which we exclude substantial shares of the sample. For brevity, we summarize our analysis and note where findings depart from our main results.

We apply linear probability models in our main analysis. Our outcome variables are binary and therefore arguably more appropriately modeled with a specification that respects the non-continuous nature of these variables. We estimate logit models and report average marginal effects (Tables A1 and A2). In our main analysis we impute the mean and

mode for observations with missing information. We exclude observations with any missing information on the control variables; n=110. Results are reported in Tables A3 and A4.

We drop the 446 respondents who report having heard of the fictitious e-cigarette company (Tables A5 and A6). We note that receiving health information with physicians as the messenger increases the probability of reporting an intention to quit tobacco cigarettes by 6.4 (ppts) or 12.5%. We control for messenger familiarity (Tables A7 and A8). We drop all respondents who report that they find the fictitious e-cigarette company somewhat or very trustworthy, n=922, and report results in Tables A9 and A10. As when we drop respondents who have heard of the fictitious e-cigarette company, receiving information from a physician increases the probability of reporting an intention to quit tobacco cigarettes. We exclude respondents with survey duration below the 5th percentile and above the 95th percentile of the empirical distribution. Results are listed in Tables A11 and A12. We observe that receiving information from physicians increases the probability of reporting and intention to use e-cigarettes in the next 30 days in this sample.

We re-estimate Equation 1 using an ordered logit, which may better capture the ordinal nature of our outcomes than an LPM or logit model. Results are reported in Tables A13 through A18. We convert beta coefficients to average marginal effects. The general pattern of results that we observed in our main specifications holds when we use an ordered logit. In particular, receiving information from the fictitious e-cigarette company appears to shift intentions to use e-cigarettes and risk perceptions from the two bottom categories toward the two top categories. As we observe in our main specification, no other sources of information predict outcomes and no source predicts intentions to quit tobacco cigarettes. One exception to this pattern of results is agreeing with the statement that the government should promote switching from tobacco cigarettes to e-cigarettes. In the ordered logit, we observe that receiving information from the FDA reduces (increases) the probability of agreeing (disagreeing) with this statement.

5.2 Extensions

Given the importance of the fictitious e-cigarette company in our study, we wish to dig deeper into the type of respondent who finds the fictitious e-cigarette company a credible messenger. We separate respondents into those who report finding the fictitious e-cigarette company somewhat or very trustworthy and those who do not. We then examine demographics for these groups. Results are reported in Table A19. Members of these groups appear to be broadly similar across age, gender, education, region, race, ethnicity, family size, political

affiliation, and smoking. For instance, 57% of the group that finds the fictitious e-cigarette company somewhat or very trustworthy is male and 55% of the group that does not find the fictitious e-cigarette company trustworthy is male. There are non-trivial differences across groups in terms of survey duration, difficulty viewing the image, self-assessed health, and vaping. Average survey duration is 9,716 seconds, 9% have some difficulty viewing the image, 32% report their health as excellent or very good, and 35% are current vapers among those who find the fictitious e-cigarette company somewhat or very trustworthy. In the sample that does not find the fictitious e-cigarette company trustworthy these values are 16,998 seconds, 5.5%, 24%, and 16%. In unreported analysis, we conducted two-tailed t-tests for continuous variables and differences in proportion tests for binary variables. Differences between the two groups are often statistically different from zero, results are available on request.

One interpretation of these results is that those who reported that they found the fictitious e-cigarette company trustworthy had more difficulty with the survey and spent less time answering questions. Because we had various research assistants and programmers at Qualtrics complete our survey, conducted a pilot study, and excluded those respondents who had a great deal of difficulty with the image, failed our attention test, or spent very little time completing the survey, we do not suspect that a problematic survey can fully explain our findings. We note, in real-world markets, that many individuals exposed to information do not spend adequate time focusing on the communicated information and have difficulty understanding information (Thaler & Sunstein, 2008). Such consumers may be particularly influenced by communication efforts by private companies. Alternatively, those who reported finding the fictitious e-cigarette company trustworthy were more likely to vape (35% vs. 16%). Vapers plausibly find e-cigarettes a valuable product, as evidenced by their consumption of the product, and view *all* e-cigarette manufacturers favorably.

We explore political affiliation and education heterogeneity. We interact messenger variables with an indicator for Republican/Republican-leaning, and college education, and estimate an augmented version of Equation 1. To classify political affiliation, Independents were asked whether they more so agreed with Democratic policies or Republican policies, and were coded as Republican- or Democrat-leaning based on their response to this question. Results from this analysis are reported in Tables A20 and A21 (political affiliation), and A22 and A23 (education). We find no statistically significant evidence of heterogeneity in messenger effects. We note that our experiment was not designed to test interactions and we may be under-powered for this analysis.

6 Discussion

We provide experimental evidence on the of the importance source (the 'messenger') to consumers in influencing intention to use and risk perceptions about e-cigarettes and tobacco cigarettes. While neoclassical theory predicts that choice architecture, including factors such as the messenger, should not affect choice, behavioral economic theory highlights its importance. Our findings support behavioral economic theory: the messenger is empirically important for consumer intentions to use cigarettes and risk perceptions about these products. In particular, private companies, proxied in our study by a fictitious e-cigarette company, appear to be important messengers for adult smokers. On the other hand, information provided by government agencies and physicians, common sources of health-related media campaigns and health information generally, does not have a discernible effect on intentions to use and risk perceptions versus a no messenger control. These findings have important implications for governments attempting to develop communication strategies related to cigarettes. In addition to developing the message of the campaign, the selection of the messenger, the conveyer of the information, is important for improving public health.

The importance of a fictitious e-cigarette company that we document deserves some discussion. While we cannot test the reasons why this messenger appears to be important for adult smokers we can propose possible explanations. First, congruence between the messenger (an e-cigarette company) and the follow-up questions (intentions to use cigarettes and risk perceptions of these products) may play a role. Respondents may expect cigarette questions after viewing an image of an e-cigarette company but may not have this expectation if they are presented with a different image. Second, tobacco cigarette companies are viewed unfavorably by many Americans (Brandt, 2007). Respondents may interpret e-cigarette companies as taking business away from tobacco companies and/or offering a new cessation product, which respondents may view positively, leading to the importance of the fictitious e-cigarette company. Recall that we focus on a sample of adult current smokers, many of whom want to quit smoking but cannot as smoking is addictive (Babb, 2017). Smokers may have particularly negative views toward tobacco cigarette companies. Finally, respondents may simply have found the fictitious e-cigarette company image appealing, credible, or important for other intangible reasons.

The generally null findings for a government agency (the FDA) and physicians as messengers run counter to our hypotheses. In particular, we expected that information received from these sources – who we hypothesized would be viewed as authorities able to provide credible information by respondents – would influence consumers' intentions to use cigarettes and risk

perceptions relative to a no source control. In general, our findings did not support these hypotheses. Our survey was conducted during a time of general distrust towards science and the government among many segments of the U.S. population (American Academy of Arts and Sciences, 2018), which may have influenced how respondents viewed these messengers. For instance, consumers are less likely to find a messenger credible if that source is perceived as having a hidden agenda, which may apply to a non-trivial share of the U.S. population in terms of the government at the time our survey was fielded. Similar to public sentiment towards government, many Americans were distrustful towards science generally at the time our survey was fielded, which may extend to physicians. In addition, some respondents may not have interpreted the associated image as capturing physicians, and instead viewed the image as representing healthcare workers generally who may, as a group, not be viewed as authorities in the context of the relative risk of e-cigarettes and tobacco cigarettes, leading to diluted effects.

We can use our estimates to understand how advertising may shape future demand for e-cigarettes among adult smokers. To this end, we consider our findings for intentions to use e-cigarettes and quit tobacco cigarettes in the next 30 days. Using our estimates, if future advertising were provided by private companies, we could expect a 12% increase in intentions to use e-cigarettes among current adult smokers with no corresponding increase in intentions to stop using tobacco cigarettes. One of the potential health benefits of e-cigarettes is the ability for addicted smokers to substitute from tobacco cigarettes to (arguably) less harmful e-cigarettes. A concern is that, rather than substituting to the less harmful product, smokers will use both products and consume e-cigarettes in situations where tobacco cigarette smoking is prohibited (e.g., public venues) or discouraged (e.g., in close proximity to children). If we assume that 25% of smokers who report an intention to use e-cigarettes in the next 30 days transition to regular use of these products,[7] then our estimates would suggest an 3.0% increase in dual use among adult smokers. The most recent estimates suggest that 15.5% of adults smoke (Jamal et al., 2018), combining this estimate of the smoking prevalence with our findings implies a 0.5% increase in dual use in the population. Our findings for risk perceptions also suggest that advertising by private companies will increase dual use. Collectively, our findings do not suggest that advertising by private companies will lead to substantial reductions in tobacco product use among adult tobacco cigarette smokers.[8]

[7]We are not aware of studies that link intentions to use e-cigarettes to future vaping among established adult smokers.

[8]Of course, our analysis does not allow us to speak towards changes in the intensity of e-cigarette vs. tobacco cigarette use. For instance, it is possible that while smokers use both products they may reduce

We note that, while the studies apply different identification strategies, our findings are in line with Dave, Dench, Grossman, Kenkel, and Saffer (2018) who find no evidence that e-cigarette magazine advertising influences quitting behavior among U.S. adult smokers. The authors do provide evidence that exposure to television e-cigarette advertising may prompt some smokers to quit smoking. However, we believe the images in our experiment are more reflective of a magazine advertising campaign rather than a television advertising campaign.

Our study has limitations. We use an online sample and the generalizability of our findings is unclear. We do not study product use and rely on proxies. Finally, while we emphasize messenger effects when interpreting findings for our source of information, we acknowledge that the messenger could be interpreted as a signal of information *quality*. While our data does not allow us to isolate messenger vs. signaling effects, our findings strongly imply that the organization or person who conveys information to consumers plays an important role for intentions to use cigarettes and risk perceptions about these products. Future work could further explore the extent to which our findings are attributable to messenger and/or signaling effects.

These findings suggest that subtle differences in message presentation can lead to different outcomes. In line with previous research on tobacco cigarette smokers – e.g. Gruber and Köszegi (2001), Giné, Karlan, and Zinman (2010), Halpern et al. (2015), and Bradford et al. (2017) – our findings imply that neoclassical theory may not fully explain consumer choice in the context of cigarettes. We build on this line of literature by focusing on choice architecture in the context of cigarettes, in particular the source of information. As has been documented in the context of tobacco cigarettes (Avery, Kenkel, Lillard, & Mathios, 2007), our results suggest an important role for private companies in shaping the trajectory of e-cigarette use.

tobacco smoking on the intensive margin (e.g., smoke less but continue to smoke), which would likely reduce smoking-related health risks.

Table 1: Summary statistics

Sample;	Full sample	FDA	Ave	Physician	No source
18 to 34 years	0.37	0.38	0.38	0.33	0.40
35 to 49 years	0.30	0.27	0.29	0.34	0.30
50 to 64 years	0.33	0.34	0.33	0.33	0.30
Male	0.56	0.56	0.56	0.56	0.55
Female	0.44	0.44	0.44	0.44	0.45
No college	0.58	0.57	0.57	0.61	0.58
College	0.42	0.43	0.43	0.39	0.42
Mid Atlantic	0.12	0.13	0.11	0.13	0.12
Midwest	0.24	0.24	0.24	0.24	0.25
Mountain	0.064	0.057	0.056	0.064	0.080
New England	0.041	0.040	0.043	0.043	0.038
Pacific	0.12	0.15	0.098	0.14	0.096
South	0.41	0.39	0.46	0.38	0.42
White	0.82	0.79	0.81	0.82	0.83
African American	0.10	0.11	0.100	0.10	0.093
Other race	0.082	0.092	0.085	0.074	0.077
Hispanic	0.10	0.12	0.11	0.10	0.089
Family size	3.05	3.02	3.04	3.02	3.12
Democrat	0.54	0.51	0.57	0.53	0.53
Survey duration	14,312	18,776	10,244	12,163	15,990
Image difficulty	0.068	0.073	0.064	0.077	0.056
SAH	0.27	0.29	0.26	0.28	0.26
Daily smoker	0.84	0.83	0.83	0.85	0.86
Addicted smoker	0.30	0.30	0.30	0.29	0.32
Vaper	0.23	0.23	0.25	0.22	0.22
Observations	2,499	630	621	622	626

Notes: The Ave is the fictitious e-cigarette company created by the authors for the purposes of this study. Image difficulty = Respondent reports some trouble understanding the image. SAH = Respondent assesses her health as excellent or very good. Addicted smoker = Respondent smokes her first tobacco cigarette within five minutes of waking up.

Table 2: Familiarity with messengers

Familiarity:	All	FDA	Ave	Physician	No source
Respondent has heard of the FDA	0.96	0.98	0.96	0.97	0.95
Respondent has heard of the Ave	0.18	0.20	0.17	0.18	0.16
Respondent has a personal physician	0.80	0.81	0.78	0.81	0.78
Observations	2,499	630	621	622	626

Notes: The Ave is the fictitious e-cigarette company created by the authors for the purposes of this study.

Table 3: Effect of messengers on e-cigarette and tobacco cigarette use

Outcome variable:	Use e-cigarette in next 30 days	Quit tobacco cigarettes in next 30 days
Sample proportion:	0.52	0.54
No controls		
FDA	0.032	0.024
	(0.028)	(0.028)
Ave	0.080***	0.038
	(0.028)	(0.028)
Physician	0.026	0.042
	(0.028)	(0.028)
Controls		
FDA	0.032	0.018
	(0.025)	(0.028)
Ave	0.065***	0.028
	(0.025)	(0.028)
Physician	0.033	0.038
	(0.025)	(0.028)
Observations	2,499	2,499

Notes: The Ave is the fictitious e-cigarette company created by the authors for the purposes of this study. All models estimated with an LPM. Outcome variables coded one if the respondent reports being extremely likely or somewhat likely to use an e-cigarette/quit tobacco cigarettes in the next 30 days, and zero otherwise. Controls include personal characteristics listed in Table 1. Reference category is no source. Heteroskedasticity robust standard errors are reported in parentheses. ***,**,* = statistically different from zero at the 1%,5%,10% level.

Table 4: Effect of messengers on e-cigarette and tobacco cigarette risk perceptions

Outcome variable:	Outcome 1	Outcome 2	Outcome 3	Outcome 4
Sample proportion:	0.62	0.58	0.47	0.20
No controls				
FDA	0.039	0.044	0.034	-0.003
	(0.028)	(0.028)	(0.028)	(0.023)
Ave	0.085***	0.064**	0.034	-0.039*
	(0.027)	(0.028)	(0.028)	(0.022)
Physician	0.009	0.020	0.011	-0.000
	(0.028)	(0.028)	(0.028)	(0.023)
With controls				
FDA	0.039	0.043	0.033	-0.011
	(0.027)	(0.027)	(0.027)	(0.023)
Ave	0.071***	0.052*	0.019	-0.043*
	(0.027)	(0.027)	(0.027)	(0.022)
Physician	0.008	0.020	0.014	-0.007
	(0.027)	(0.027)	(0.027)	(0.023)
Observations	2,499	2,499	2,499	2,499

Notes: The Ave is the fictitious e-cigarette company created by the authors for the purposes of this study. Outcome 1 = E-cigarettes are healthier than tobacco cigarettes. Outcome 2 = Switching from tobacco cigarettes to e-cigarettes improves health. Outcome 3 = Government should promote switching from tobacco cigarettes to e-cigarettes. Outcome 4 = Government should ban e-cigarettes. All models estimated with an LPM. Outcome variable is coded one if the respondent reports agreeing strongly or agreeing with the particular cigarette belief question, and zero otherwise. Controls include personal characteristics listed in Table 1. Reference category is no source. Heteroskedasticity robust standard errors are reported in parentheses. ***,**,* = statistically different from zero at the 1%,5%,10% level.

Figure 1: FDA as the messenger

Figure 2: The fictitious e-cigarette company (the Ave) as the messenger

Figure 3: Physicians as the messenger

Figure 4: No messenger

Table A1: Effect of messengers on e-cigarette and tobacco cigarette use: Use a logit model

Outcome variable:	Use e-cigarette in next 30 days	Quit tobacco cigarettes in next 30 days
Sample proportion:	0.52	0.54
FDA	0.030	0.018
	(0.025)	(0.028)
Ave	0.063**	0.029
	(0.025)	(0.027)
Physician	0.033	0.039
	(0.025)	(0.028)
Observations	2,499	2,499

Notes: The Ave is the fictitious e-cigarette company created by the authors for the purposes of this study. All models estimated with a logit model. Average marginal effects reported. Outcome variables coded one if the respondent reports being extremely likely or somewhat likely to use an e-cigarette/quit tobacco cigarettes in the next 30 days, and zero otherwise. Controls include personal characteristics listed in Table 1. Reference category is no source. Heteroskedasticity robust standard errors are reported in parentheses. ***,**,* = statistically different from zero at the 1%,5%,10% level.

Table A2: Effect of messengers on e-cigarette and tobacco cigarette risk perceptions: Use a logit model

Outcome variable:	Outcome 1	Outcome 2	Outcome 3	Outcome 4
Sample proportion:	0.62	0.58	0.47	0.20
FDA	0.039	0.043	0.033	-0.011
	(0.026)	(0.027)	(0.027)	(0.022)
Ave	0.073***	0.052*	0.019	-0.045*
	(0.027)	(0.027)	(0.027)	(0.023)
Physician	0.009	0.020	0.014	-0.007
	(0.026)	(0.027)	(0.027)	(0.022)
Observations	2,499	2,499	2,499	2,499

Notes: The Ave is the fictitious e-cigarette company created by the authors for the purposes of this study. Outcome 1 = E-cigarettes are healthier than tobacco cigarettes. Outcome 2 = Switching from tobacco cigarettes to e-cigarettes improves health. Outcome 3 = Government should promote switching from tobacco cigarettes to e-cigarettes. Outcome 4 = Government should ban e-cigarettes. All models estimated with a logit model. Average marginal effects reported. Outcome variable is coded one if the respondent reports agreeing strongly or agreeing with the particular cigarette belief question, and zero otherwise. Controls include personal characteristics listed in Table 1. Reference category is no source. Heteroskedasticity robust standard errors are reported in parentheses. ***,**,* = statistically different from zero at the 1%,5%,10% level.

Table A3: Effect of messengers on e-cigarette and tobacco cigarette use excluding observations with missing controls

Outcome variable:	Use e-cigarette in next 30 days	Quit tobacco cigarettes in next 30 days
Sample proportion:	0.53	0.54
FDA	0.033	0.015
	(0.026)	(0.029)
Ave	0.059**	0.026
	(0.026)	(0.028)
Physician	0.032	0.028
	(0.026)	(0.028)
Observations	2,389	2,389

Notes: The Ave is the fictitious e-cigarette company created by the authors for the purposes of this study. All models estimated with an LPM. Outcome variables coded one if the respondent reports being extremely likely or somewhat likely to use an e-cigarette/quit tobacco cigarettes in the next 30 days, and zero otherwise. Controls include personal characteristics listed in Table 1. Reference category is no source. Heteroskedasticity robust standard errors are reported in parentheses. ***,**,* = statistically different from zero at the 1%,5%,10% level.

Table A4: Effect of messengers on e-cigarette and tobacco cigarette risk perceptions excluding observations with missing controls

Outcome variable:	Outcome 1	Outcome 2	Outcome 3	Outcome 4
Sample proportion:	0.62	0.58	0.48	0.20
FDA	0.039	0.040	0.030	-0.015
	(0.028)	(0.028)	(0.028)	(0.024)
Ave	0.078***	0.055**	0.026	-0.049**
	(0.027)	(0.028)	(0.028)	(0.023)
Physician	0.017	0.031	0.022	-0.007
	(0.027)	(0.028)	(0.028)	(0.024)
Observations	2,389	2,389	2,389	2,389

Notes: The Ave is the fictitious e-cigarette company created by the authors for the purposes of this study. Outcome 1 = E-cigarettes are healthier than tobacco cigarettes. Outcome 2 = Switching from tobacco cigarettes to e-cigarettes improves health. Outcome 3 = Government should promote switching from tobacco cigarettes to e-cigarettes. Outcome 4 = Government should ban e-cigarettes. All models estimated with an LPM. Outcome variable is coded one if the respondent reports agreeing strongly or agreeing with the particular cigarette belief question, and zero otherwise. Controls include personal characteristics listed in Table 1. Reference category is no source. Heteroskedasticity robust standard errors are reported in parentheses. ***,**,* = statistically different from zero at the 1%,5%,10% level.

Table A5: Effect of messengers on e-cigarette and tobacco cigarette use excluding respondents who report that they have heard of the Ave

Outcome variable:	Use e-cigarette in next 30 days	Quit tobacco cigarettes in next 30 days
Sample proportion:	0.47	0.51
FDA	0.042	0.033
	(0.028)	(0.031)
Ave	0.069**	0.043
	(0.027)	(0.031)
Physician	0.041	0.064**
	(0.028)	(0.031)
Observations	2,053	2,053

Notes: The Ave is the fictitious e-cigarette company created by the authors for the purposes of this study. All models estimated with an LPM. Outcome variable is coded one if the respondent reports agreeing strongly or agreeing with the particular cigarette belief question, and zero otherwise. Controls include personal characteristics listed in Table 1. Reference category is no source. Heteroskedasticity robust standard errors are reported in parentheses. ***,**,* = statistically different from zero at the 1%,5%,10% level.

Table A6: Effect of messengers on e-cigarette and tobacco cigarette risk perceptions excluding respondents who report that they have heard of the fictitious e-cigarette company

Outcome variable:	Outcome 1	Outcome 2	Outcome 3	Outcome 4
Sample proportion:	0.59	0.55	0.43	0.17
FDA	0.033	0.042	0.041	-0.025
	(0.030)	(0.030)	(0.030)	(0.024)
Ave	0.082***	0.066**	0.014	-0.040*
	(0.030)	(0.030)	(0.030)	(0.023)
Physician	0.024	0.049	0.015	-0.004
	(0.030)	(0.030)	(0.030)	(0.024)
Observations	2,053	2,053	2,053	2,053

Notes: The Ave is the fictitious e-cigarette company created by the authors for the purposes of this study. Outcome 1 = E-cigarettes are healthier than tobacco cigarettes. Outcome 2 = Switching from tobacco cigarettes to e-cigarettes improves health. Outcome 3 = Government should promote switching from tobacco cigarettes to e-cigarettes. Outcome 4 = Government should ban e-cigarettes. All models estimated with an LPM. Outcome variable is coded one if the respondent reports agreeing strongly or agreeing with the particular cigarette belief question, and zero otherwise. Controls include personal characteristics listed in Table 1. Reference category is no source. Heteroskedasticity robust standard errors are reported in parentheses. ***,**,* = statistically different from zero at the 1%,5%,10% level.

Table A7: Effect of messengers on e-cigarette and tobacco cigarette use controlling for messenger source familiarity

Outcome variable:	Use e-cigarette in next 30 days	Quit tobacco cigarettes in next 30 days
Sample proportion:	0.47	0.51
FDA	0.027	0.008
	(0.025)	(0.028)
Ave	0.064**	0.029
	(0.025)	(0.028)
Physician	0.030	0.033
	(0.025)	(0.028)
Observations	2,053	2,053

Notes: The Ave is the fictitious e-cigarette company created by the authors for the purposes of this study. All models estimated with an LPM. Outcome variables coded one if the respondent reports being extremely likely or somewhat likely to use an e-cigarette/quit tobacco cigarettes in the next 30 days, and zero otherwise. Controls include personal characteristics listed in Table 1. Reference category is no source. Heteroskedasticity robust standard errors are reported in parentheses. ***,**,* = statistically different from zero at the 1%,5%,10% level.

Table A8: Effect of messengers on e-cigarette and tobacco cigarette risk perceptions controlling for messenger familiarity

Outcome variable:	Outcome 1	Outcome 2	Outcome 3	Outcome 4
Sample proportion:	0.59	0.55	0.43	0.17
FDA	0.032	0.038	0.026	-0.013
	(0.027)	(0.027)	(0.027)	(0.023)
Ave	0.071***	0.052*	0.020	-0.043*
	(0.026)	(0.027)	(0.027)	(0.022)
Physician	0.004	0.017	0.009	-0.009
	(0.027)	(0.027)	(0.027)	(0.023)
Observations	2,053	2,053	2,053	2,053

Notes: The Ave is the fictitious e-cigarette company created by the authors for the purposes of this study. Outcome 1 = E-cigarettes are healthier than tobacco cigarettes. Outcome 2 = Switching from tobacco cigarettes to e-cigarettes improves health. Outcome 3 = Government should promote switching from tobacco cigarettes to e-cigarettes. Outcome 4 = Government should ban e-cigarettes. All models estimated with an LPM. Outcome variable is coded one if the respondent reports agreeing strongly or agreeing with the particular cigarette belief question, and zero otherwise. Controls include personal characteristics listed in Table 1. Reference category is no source. Heteroskedasticity robust standard errors are reported in parentheses. ***,**,* = statistically different from zero at the 1%,5%,10% level.

Table A9: Effect of messengers on e-cigarette and tobacco cigarette use excluding respondents who find the fictitious e-cigarette company somewhat or very trustworthy

Outcome variable:	Use e-cigarette in next 30 days	Quit tobacco cigarettes in next 30 days
Sample proportion:	0.36	0.45
FDA	0.042	0.034
	(0.029)	(0.035)
Ave	0.089***	0.043
	(0.030)	(0.035)
Physician	0.031	0.060*
	(0.030)	(0.035)
Observations	1,577	1,577

Notes: The Ave is the fictitious e-cigarette company created by the authors for the purposes of this study. All models estimated with an LPM. Outcome variables coded one if the respondent reports being extremely likely or somewhat likely to use an e-cigarette/quit tobacco cigarettes in the next 30 days, and zero otherwise. Controls include personal characteristics listed in Table 1. Reference category is no source. Heteroskedasticity robust standard errors are reported in parentheses. ***,**,* = statistically different from zero at the 1%,5%,10% level.

Table A10: Effect of messengers on e-cigarette and tobacco cigarette risk perceptions excluding respondents who find the fictitious e-cigarette company somewhat or very trustworthy

Outcome variable:	Outcome 1	Outcome 2	Outcome 3	Outcome 4
Sample proportion:	0.47	0.44	0.30	0.20
FDA	0.027	0.023	0.020	-0.002
	(0.035)	(0.035)	(0.032)	(0.028)
Ave	0.095***	0.053	0.023	-0.035
	(0.035)	(0.035)	(0.032)	(0.028)
Physician	-0.017	-0.007	-0.002	0.004
	(0.035)	(0.034)	(0.031)	(0.028)
Observations	1,577	1,577	1,577	1,577

Notes: The Ave is the fictitious e-cigarette company created by the authors for the purposes of this study. Outcome 1 = E-cigarettes are healthier than tobacco cigarettes. Outcome 2 = Switching from tobacco cigarettes to e-cigarettes improves health. Outcome 3 = Government should promote switching from tobacco cigarettes to e-cigarettes. Outcome 4 = Government should ban e-cigarettes. All models estimated with an LPM. Outcome variable is coded one if the respondent reports agreeing strongly or agreeing with the particular cigarette belief question, and zero otherwise. Controls include personal characteristics listed in Table 1. Reference category is no source. Heteroskedasticity robust standard errors are reported in parentheses. ***,**,* = statistically different from zero at the 1%,5%,10% level.

Table A11: Effect of messengers on e-cigarette and tobacco cigarette use excluding respondents with extreme survey duration

Outcome variable:	Use e-cigarette in next 30 days	Quit tobacco cigarettes in next 30 days
Sample proportion:	0.52	0.54
FDA	0.039	0.014
	(0.027)	(0.030)
Ave	0.070***	0.029
	(0.026)	(0.029)
Physician	0.045*	0.048
	(0.027)	(0.029)
Observations	2,253	2,253

Notes: Extreme survey duration is defined as a survey duration below the 5th percentile or above the 95th percentile of the empirical distribution. The Ave is the fictitious e-cigarette company created by the authors for the purposes of this study. All models estimated with an LPM. Outcome variables coded one if the respondent reports being extremely likely or somewhat likely to use an e-cigarette/quit tobacco cigarettes in the next 30 days, and zero otherwise. Controls include personal characteristics listed in Table 1. Reference category is no source. Heteroskedasticity robust standard errors are reported in parentheses. ***,**,* = statistically different from zero at the 1%,5%,10% level.

Table A12: Effect of messengers on e-cigarette and tobacco cigarette risk perceptions excluding respondents with extreme survey duration

Outcome variable:	Outcome 1	Outcome 2	Outcome 3	Outcome 4
Sample proportion:	0.62	0.58	0.47	0.19
FDA	0.037	0.038	0.030	-0.017
	(0.029)	(0.029)	(0.029)	(0.024)
Ave	0.081***	0.056**	0.021	-0.034
	(0.028)	(0.029)	(0.029)	(0.023)
Physician	0.014	0.033	0.014	-0.011
	(0.028)	(0.029)	(0.028)	(0.024)
Observations	2,253	2,253	2,253	2,253

Notes: Extreme survey duration is defined as a survey duration below the 5th percentile or above the 95th percentile of the empirical distribution. The Ave is the fictitious e-cigarette company created by the authors for the purposes of this study. Outcome 1 = E-cigarettes are healthier than tobacco cigarettes. Outcome 2 = Switching from tobacco cigarettes to e-cigarettes improves health. Outcome 3 = Government should promote switching from tobacco cigarettes to e-cigarettes. Outcome 4 = Government should ban e-cigarettes. All models estimated with an LPM. Outcome variable is coded one if the respondent reports agreeing strongly or agreeing with the particular cigarette belief question, and zero otherwise. Controls include personal characteristics listed in Table 1. Reference category is no source. Heteroskedasticity robust standard errors are reported in parentheses. ***,**,* = statistically different from zero at the 1%,5%,10% level.

Table A13: Effect of messengers on intentions to use e-cigarettes using an ordered logit model

Outcome variable:	Outcome 1	Outcome 2	Outcome 3	Outcome 4
Sample proportion:	0.27	0.21	0.35	0.17
FDA	-0.025	-0.003	0.013	0.015
	(0.019)	(0.003)	(0.010)	(0.011)
Ave	-0.038*	-0.005*	0.021*	0.022*
	(0.019)	(0.003)	(0.011)	(0.011)
Physician	-0.015	-0.002	0.008	0.009
	(0.020)	(0.003)	(0.011)	(0.011)
Observations	2,499	2,499	2,499	2,499

Notes: The Ave is the fictitious e-cigarette company created by the authors for the purposes of this study. Outcome 1 = Not likely at all. Outcome 2 = Not very likely. Outcome 3 = Somewhat likely. Outcome 4 = Extremely likely. All models estimated with an ordered logit model. Average marginal effects reported. Controls include personal characteristics listed in Table 1. Reference category is no source. Heteroskedasticity robust standard errors are reported in parentheses. ***,**,* = statistically different from zero at the 1%,5%,10% level.

Table A14: Effect of messengers on intentions to quit tobacco cigarettes using an ordered logit model

Outcome variable:	Outcome 1	Outcome 2	Outcome 3	Outcome 4
Sample proportion:	0.19	0.28	0.37	0.16
FDA	-0.017	-0.010	0.012	0.015
	(0.015)	(0.009)	(0.011)	(0.014)
Ave	-0.004	-0.002	0.003	0.003
	(0.016)	(0.009)	(0.011)	(0.014)
Physician	-0.016	-0.009	0.011	0.015
	(0.016)	(0.009)	(0.011)	(0.014)
Observations	2,499	2,499	2,499	2,499

Notes: The Ave is the fictitious e-cigarette company created by the authors for the purposes of this study. Outcome 1 = Not likely at all. Outcome 2 = Not very likely. Outcome 3 = Somewhat likely. Outcome 4 = Extremely likely. All models estimated with an ordered logit model. Average marginal effects reported. Controls include personal characteristics listed in Table 1. Reference category is no source. Heteroskedasticity robust standard errors are reported in parentheses. ***,**,* = statistically different from zero at the 1%,5%,10% level.

Table A15: Effect of messengers on believing that e-cigarettes are healthier than tobacco cigarettes using an ordered logit model

Outcome variable:	Outcome 1	Outcome 2	Outcome 3	Outcome 4
Sample proportion:	0.11	0.27	0.45	0.17
FDA	-0.018	-0.021	0.016	0.023
	(0.011)	(0.013)	(0.010)	(0.014)
Ave	-0.026**	-0.032**	0.024**	0.035**
	(0.011)	(0.013)	(0.010)	(0.014)
Physician	-0.003	-0.004	0.003	0.004
	(0.011)	(0.014)	(0.010)	(0.015)
Observations	2,499	2,499	2,499	2,499

Notes: The Ave is the fictitious e-cigarette company created by the authors for the purposes of this study. Outcome 1 = Strongly disagree. Outcome 2 = Disagree. Outcome 3 = Agree. Outcome 4 = Strongly agree. All models estimated with an ordered logit model. Average marginal effects reported. Controls include personal characteristics listed in Table 1. Reference category is no source. Heteroskedasticity robust standard errors are reported in parentheses. ***,**,* = statistically different from zero at the 1%,5%,10% level.

Table A16: Effect of messengers on believing that people who switch from tobacco cigarettes to e-cigarettes are healthier using an ordered logit model

Outcome variable:	Outcome 1	Outcome 2	Outcome 3	Outcome 4
Sample proportion:	0.12	0.30	0.41	0.17
FDA	-0.016	-0.019	0.016	0.020
	(0.011)	(0.013)	(0.011)	(0.014)
Ave	-0.027**	-0.032**	0.026**	0.033**
	(0.011)	(0.013)	(0.011)	(0.014)
Physician	-0.011	-0.013	0.010	0.013
	(0.012)	(0.014)	(0.011)	(0.014)
Observations	2,499	2,499	2,499	2,499

Notes: The Ave is the fictitious e-cigarette company created by the authors for the purposes of this study. Outcome 1 = Strongly disagree. Outcome 2 = Disagree. Outcome 3 = Agree. Outcome 4 = Strongly agree. All models estimated with an ordered logit model. Average marginal effects reported. Controls include personal characteristics listed in Table 1. Reference category is no source. Heteroskedasticity robust standard errors are reported in parentheses. ***,**,* = statistically different from zero at the 1%,5%,10% level.

Table A17: Effect of messengers on believing that the government should promote switching to e-cigarettes using an ordered logit model

Outcome variable:	Outcome 1	Outcome 2	Outcome 3	Outcome 4
Sample proportion:	0.23	0.30	0.31	0.16
FDA	-0.031*	-0.012*	0.019*	0.024*
	(0.018)	(0.007)	(0.011)	(0.014)
Ave	-0.027	-0.010	0.016	0.021
	(0.017)	(0.006)	(0.011)	(0.013)
Physician	-0.006	-0.002	0.003	0.004
	(0.018)	(0.007)	(0.011)	(0.014)
Observations	2,499	2,499	2,499	2,499

Notes: The Ave is the fictitious e-cigarette company created by the authors for the purposes of this study. Outcome 1 = Strongly disagree. Outcome 2 = Disagree. Outcome 3 = Agree. Outcome 4 = Strongly agree. All models estimated with an ordered logit model. Average marginal effects reported. Controls include personal characteristics listed in Table 1. Reference category is no source. Heteroskedasticity robust standard errors are reported in parentheses. ***,**,* = statistically different from zero at the 1%,5%,10% level.

Table A18: Effect of messengers on believing that the government should should ban e-cigarettes using using an ordered logit model

Outcome variable:	Outcome 1	Outcome 2	Outcome 3	Outcome 4
Sample proportion:	0.45	0.34	0.12	0.08
FDA	0.021	-0.007	-0.007	-0.006
	(0.026)	(0.009)	(0.009)	(0.008)
Ave	0.064**	-0.022**	-0.022**	-0.020**
	(0.026)	(0.009)	(0.009)	(0.008)
Physician	0.006	-0.002	-0.002	-0.002
	(0.026)	(0.009)	(0.009)	(0.008)
Observations	2,499	2,499	2,499	2,499

Notes: The Ave is the fictitious e-cigarette company created by the authors for the purposes of this study. Outcome 1 = Strongly disagree. Outcome 2 = Disagree. Outcome 3 = Agree. Outcome 4 = Strongly agree. All models estimated with an ordered logit model. Average marginal effects reported. Controls include personal characteristics listed in Table 1. Reference category is no source. Heteroskedasticity robust standard errors are reported in parentheses. ***,**,* = statistically different from zero at the 1%,5%,10% level.

Table A19: Characteristics of respondents who find the fictitious e-cigarette company somewhat or extremely trustworthy and respondents who do not

Sample:	Find the Ave trustworthy	Do not find the Ave trustworthy
18 to 34 years	0.37	0.37
35 to 49 years	0.33	0.28
50 to 64 years	0.30	0.34
Male	0.57	0.55
Female	0.43	0.45
No college	0.57	0.59
College	0.43	0.41
Mid Atlantic	0.14	0.11
Midwest	0.23	0.25
Mountain	0.046	0.075
New England	0.046	0.039
Pacific	0.11	0.12
South	0.42	0.40
White	0.79	0.83
African American	0.13	0.087
Other race	0.078	0.084
Hispanic	0.12	0.096
Family size	3.10	3.02
Democrat-leaning	0.55	0.53
Survey duration	9,716	16,998
Image difficulty	0.090	0.055
SAH	0.32	0.24
Daily smoker	0.85	0.84
Addicted smoker	0.32	0.30
Vaper	0.35	0.16
Observations	922	1,577

Notes: The Ave is the fictitious e-cigarette company created by the authors for the purposes of this study. Image difficulty = Respondent reports some trouble understanding the image. SAH = Respondent assesses her health as excellent or very good. Addicted smoker = Respondent smokes her first tobacco cigarette within five minutes of waking up.

Table A20: Effect of messengers on e-cigarette and tobacco cigarette use: Heterogeneity by political affiliation

Outcome variable:	Use e-cigarette in next 30 days	Quit tobacco cigarettes in next 30 days
Sample proportion:	0.52	0.54
FDA	-0.003	-0.022
	(0.035)	(0.038)
Ave	0.074**	0.012
	(0.034)	(0.037)
Physician	0.023	0.013
	(0.035)	(0.038)
FDA*Republican	0.072	0.082
	(0.050)	(0.056)
Ave*Republican	-0.023	0.034
	(0.050)	(0.056)
Physicians*Republican	0.020	0.053
	(0.051)	(0.056)
Observations	2,499	2,499

Notes: The Ave is the fictitious e-cigarette company created by the authors for the purposes of this study. Republican = coded one if the respondent is a Republican and coded zero if the respondent is a Democrat or an Independent. All models estimated with an LPM. Outcome variables coded one if the respondent reports being extremely likely or somewhat likely to use an e-cigarette/quit tobacco cigarettes in the next 30 days, and zero otherwise. Controls include personal characteristics listed in Table 1. Reference category is no source. Heteroskedasticity robust standard errors are reported in parentheses. ***,**,* = statistically different from zero at the 1%,5%,10% level.

Table A21: Effect of messengers on e-cigarette and tobacco cigarette risk perceptions: Heterogeneity by political affiliation

Outcome variable:	Outcome 1	Outcome 2	Outcome 3	Outcome 4
FDA	0.037	0.033	0.009	-0.003
	(0.037)	(0.038)	(0.038)	(0.033)
Ave	0.098***	0.076**	0.032	-0.043
	(0.036)	(0.036)	(0.037)	(0.031)
Physician	-0.004	-0.006	0.007	-0.005
	(0.037)	(0.038)	(0.037)	(0.033)
FDA*Republican	0.005	0.020	0.050	-0.016
	(0.054)	(0.054)	(0.055)	(0.046)
Ave*Republican	-0.062	-0.055	-0.032	0.002
	(0.054)	(0.055)	(0.055)	(0.045)
Physicians*Republican	0.026	0.056	0.015	-0.004
	(0.054)	(0.055)	(0.054)	(0.046)
Observations	2,499	2,499	2,499	2,499

Notes: The Ave is the fictitious e-cigarette company created by the authors for the purposes of this study. Outcome 1 = E-cigarettes are healthier than tobacco cigarettes. Outcome 2 = Switching from tobacco cigarettes to e-cigarettes improves health. Outcome 3 = Government should promote switching from tobacco cigarettes to e-cigarettes. Outcome 4 = Government should ban e-cigarettes. Republican = coded one if the respondent is a Republican and zero if the respondent is a Democrat or Independent. All models estimated with an LPM. Outcome variable is coded one if the respondent reports agreeing strongly or agreeing with the particular cigarette belief question, and zero otherwise. Controls include personal characteristics listed in Table 1. Reference category is no source. Heteroskedasticity robust standard errors are reported in parentheses. ***,**,* = statistically different from zero at the 1%,5%,10% level.

Table A22: Effect of messengers on e-cigarette and tobacco cigarette use: Heterogeneity by education

Outcome variable:	Use e-cigarette in next 30 days	Quit tobacco cigarettes in next 30 days
Sample proportion:	0.52	0.54
FDA	0.018	0.036
	(0.033)	(0.037)
Ave	0.056*	0.022
	(0.033)	(0.037)
Physician	0.043	0.064*
	(0.033)	(0.037)
FDA*college	0.033	-0.042
	(0.051)	(0.056)
Ave*college	0.020	0.014
	(0.050)	(0.056)
Physicians*college	-0.026	-0.064
	(0.051)	(0.056)
Observations	2,499	2,499

Notes: The Ave is the fictitious e-cigarette company created by the authors for the purposes of this study. College = coded one if respondent has some college education and zero otherwise. All models estimated with an LPM. Outcome variables coded one if the respondent reports being extremely likely or somewhat likely to use an e-cigarette/quit tobacco cigarettes in the next 30 days, and zero otherwise. Controls include personal characteristics listed in Table 1. Reference category is no source. Heteroskedasticity robust standard errors are reported in parentheses. ***,**,* = statistically different from zero at the 1%,5%,10% level.

Table A23: Effect of messengers on e-cigarette and tobacco cigarette risk perceptions: Heterogeneity by education

Outcome variable:	Outcome 1	Outcome 2	Outcome 3	Outcome 4
FDA	0.055	0.049	0.051	-0.022
	(0.036)	(0.036)	(0.036)	(0.030)
Ave	0.074**	0.029	-0.001	-0.035
	(0.036)	(0.037)	(0.036)	(0.030)
Physician	0.024	0.022	0.003	0.008
	(0.036)	(0.036)	(0.035)	(0.031)
FDA*college	-0.036	-0.014	-0.040	0.027
	(0.054)	(0.055)	(0.055)	(0.047)
Ave*college	-0.007	0.055	0.045	-0.018
	(0.053)	(0.055)	(0.055)	(0.045)
Physicians*college	-0.038	-0.004	0.029	-0.037
	(0.054)	(0.055)	(0.055)	(0.047)
Observations	2,499	2,499	2,499	2,499

Notes: The Ave is the fictitious e-cigarette company created by the authors for the purposes of this study. Outcome 1 = E-cigarettes are healthier than tobacco cigarettes. Outcome 2 = Switching from tobacco cigarettes to e-cigarettes improves health. Outcome 3 = Government should promote switching from tobacco cigarettes to e-cigarettes. Outcome 4 = Government should ban e-cigarettes. College = coded one if respondent has some college education and zero otherwise. All models estimated with an LPM. Outcome variable is coded one if the respondent reports agreeing strongly or agreeing with the particular cigarette belief question, and zero otherwise. Controls include personal characteristics listed in Table 1. Reference category is no source. Heteroskedasticity robust standard errors are reported in parentheses. ***,**,* = statistically different from zero at the 1%,5%,10% level.

References

Abadie, A., Athey, S., Imbens, G. W., & Wooldridge, J. (2017). *When should you adjust standard errors for clustering?* (Tech. Rep. No. 24003). National Bureau of Economic Research.

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179–211.

Akerlof, G. A. (1970). The market for" lemons": Quality uncertainty and the market mechanism. *The Quarterly Journal of Economics*, *84*(3), 488–500.

Allen, J. G., Flanigan, S. S., LeBlanc, M., Vallarino, J., MacNaughton, P., Stewart, J. H., & Christiani, D. C. (2016). Flavoring chemicals in e-cigarettes: diacetyl, 2, 3-pentanedione, and acetoin in a sample of 51 products, including fruit-, candy-, and cocktail-flavored e-cigarettes. *Environmental Health Perspectives*, *124*(6), 733.

American Academy of Arts and Sciences. (2018). *The Public Face of Science: Perceptions of Science in America* (Tech. Rep.). American Academy of Arts and Sciences. Retrieved from `https://www.amacad.org/content/publications/publication.aspx?d=43055`

Angrist, J. D., & Pischke, J.-S. (2009). *Mostly harmless econometrics: An empiricist's companion*. Princeton University Press.

Arrow, K. J. (1963). Uncertainty and the welfare economics of medical care. *The American Economic Review*, *53*(5), 941–973.

Avery, R., Kenkel, D., Lillard, D. R., & Mathios, A. (2007). Private profits and public health: Does advertising of smoking cessation products encourage smokers to quit? *Journal of Political Economy*, *115*(3), 447–481.

Babb, S. (2017). Quitting smoking among adults—United States, 2000–2015. *MMWR. Morbidity and Mortality Weekly Report*, *65*.

BIS Research. (2018). *Global e-cigarette and t-vapor market, analysis and forecast (2017-2025) (focus on product segments, distribution channels and country analysis)* (Tech. Rep.). BIS Research. Retrieved from `https://bisresearch.com/industry-report/global-e-cigarette-t-vapor-market-2025.html`

Boddery, S. S., & Yates, J. (2014). Do policy messengers matter? Majority opinion writers as policy cues in public agreement with Supreme Court decisions. *Political Research Quarterly*, *67*(4), 851–863.

Bradford, D., Courtemanche, C., Heutel, G., McAlvanah, P., & Ruhm, C. (2017). Time preferences and consumer behavior. *Journal of Risk and Uncertainty*, *55*(2-3), 119–

145.

Brandt, A. M. (2007). *The Cigarette Century: The Rise, Fall, And Deadly Persistence Of The Product That Defined America*. Basic Books (AZ).

Buckell, J., Marti, J., & Sindelar, J. L. (2018). Should Flavours Be Banned In Cigarettes And E-cigarettes? Evidence On Adult Smokers And Recent Quitters From A Discrete Choice Experiment. *Tobacco Control*, *In press*.

Bullen, C., Howe, C., Laugesen, M., McRobbie, H., Parag, V., Williman, J., & Walker, N. (2013). Electronic cigarettes for smoking cessation: A randomised controlled trial. *The Lancet*, *382*(9905), 1629–1637.

Cawley, J., Susskind, A., & Willage, B. (2018). *The Impact of Information Disclosure on Consumer Behavior: Evidence from a Randomized Field Experiment of Calorie Labels on Restaurant Menus* (Tech. Rep. No. 24889). National Bureau of Economic Research.

Cialdini, R. (2007). *Influence: The Psychology of Persuasion*. New York, NY: William Morrow and Company.

Coleman, B. N., Rostron, B., Johnson, S. E., Ambrose, B. K., Pearson, J., Stanton, C. A., ... others (2017). Electronic cigarette use among us adults in the population assessment of tobacco and health (path) study, 2013–2014. *Tobacco Control*, *26*, e117-e126.

Courtemanche, C. J., & Zapata, D. (2014). Does universal coverage improve health? the massachusetts experience. *Journal of Policy Analysis and Management*, *33*(1), 36–69.

Czoli, C. D., Fong, G. T., Mays, D., & Hammond, D. (2017). How do consumers perceive differences in risk across nicotine products? a review of relative risk perceptions across smokeless tobacco, e-cigarettes, nicotine replacement therapy and combustible cigarettes. *Tobacco Control*, *26*, e49-e58.

Dave, D. M., Dench, D., Grossman, M., Kenkel, D. S., & Saffer, H. (2018). *Does E-Cigarette Advertising Encourage Adult Smokers to Quit?* (Tech. Rep. No. 24277). National Bureau of Economic Research.

Dinakar, C., & O'Connor, G. T. (2016). The health effects of electronic cigarettes. *New England Journal of Medicine*, *375*(14), 1372–1381.

Dolan, P., Hallsworth, M., Halpern, D., King, D., Metcalfe, R., & Vlaev, I. (2012). Influencing behaviour: The MINDSPACE way. *Journal of Economic Psychology*, *33*(1), 264–277.

Durantini, M. R., Albarracin, D., Mitchell, A. L., Earl, A. N., & Gillette, J. C. (2006). Conceptualizing the influence of social agents of behavior change: A meta-analysis of the effectiveness of HIV-prevention interventionists for different groups. *Psychological*

Bulletin, *132*(2), 212.

Etter, J.-F. (2018). Gateway effects and electronic cigarettes. *Addiction*, *113*(10), 1776–1783.

Frewer, L. J., Howard, C., Hedderley, D., & Shepherd, R. (1996). What determines trust in information about food-related risks? Underlying psychological constructs. *Risk Analysis*, *16*(4), 473–486.

Giné, X., Karlan, D., & Zinman, J. (2010). Put your money where your butt is: A commitment contract for smoking cessation. *American Economic Journal: Applied Economics*, *2*(4), 213–35.

Godin, G., & Kok, G. (1996). The theory of planned behavior: A review of its applications to health-related behaviors. *American Journal of Health Promotion*, *11*(2), 87–98.

Gruber, J., & Köszegi, B. (2001). Is addiction "rational"? Theory and evidence. *The Quarterly Journal of Economics*, *116*(4), 1261–1303.

Hajek, P., Etter, J.-F., Benowitz, N., Eissenberg, T., & McRobbie, H. (2014). Electronic cigarettes: review of use, content, safety, effects on smokers and potential for harm and benefit. *Addiction*, *109*(11), 1801–1810.

Halpern, S. D., French, B., Small, D. S., Saulsgiver, K., Harhay, M. O., Audrain-McGovern, J., ... Volpp, K. G. (2015). Randomized trial of four financial-incentive programs for smoking cessation. *New England Journal of Medicine*, *372*(22), 2108–2117.

Harakeh, Z., Scholte, R. H. J., Vermulst, A. A., de Vries, H., & Engels, R. C. M. E. (2004). Parental factors and adolescents' smoking behavior: An extension of the theory of planned behavior. *Preventive Medicine*, *39*(5), 951–961.

Heatherton, T. F., Kozlowski, L. T., Frecker, R. C., & Fagerström, K. (1991). The Fagerström test for nicotine dependence: A revision of the Fagerström Tolerance Questionnaire. *Addiction*, *86*(9), 1119–1127.

Hesse, B. W., Nelson, D. E., Kreps, G. L., Croyle, R. T., Arora, N. K., Rimer, B. K., & Viswanath, K. (2005). Trust and sources of health information: the impact of the internet and its implications for health care providers: findings from the first health information national trends survey. *Archives of Internal Medicine*, *165*(22), 2618–2624.

Hofling, C. K., Brotzman, E., Dalrymple, S., Graves, N., & Pierce, C. M. (1966). An experimental study in nurse-physician relationships. *The Journal of Nervous and Mental Disease*, *143*(2), 171–180.

Horn, B. P., Maclean, J. C., & Strain, M. R. (2017). Do minimum wage increases influence

worker health? *Economic Inquiry*, *55*(4), 1986–2007.

Jamal, A., Phillips, E., Gentzke, A. S., Homa, D. M., Babb, S. D., King, B. A., & Neff, L. J. (2018). Current cigarette smoking among adults—United States, 2016. *Morbidity and Mortality Weekly Report*, *67*(2), 53.

Jha, P., Ramasundarahettige, C., Landsman, V., Rostron, B., Thun, M., Anderson, R. N., ... Peto, R. (2013). 21st-century hazards of smoking and benefits of cessation in the united states. *New England Journal of Medicine*, *368*(4), 341–350.

Kahneman, D., Knetsch, J. L., & Thaler, R. H. (1990). Experimental tests of the endowment effect and the Coase theorem. *Journal of Political Economy*, *98*(6), 1325–1348.

Kamerow, D. (2013). Big Tobacco lights up e-cigarettes. *BMJ: British Medical Journal (Online)*, *2013*.

Karlan, D., & List, J. A. (2012). *How can Bill and Melinda Gates increase other people's donations to fund public goods?* (Tech. Rep. No. 17954). National Bureau of Economic Research.

Kasperson, R. E. (1986). Six propositions on public participation and their relevance for risk communication. *Risk Analysis*, *6*(3), 275–281.

Kelman, H. C. (1961). Processes of Opinion Change. *Public Opinion Quarterly*, *25*(1), 57–78.

Kenkel, D. S., Peng, S., Pesko, M. F., & Wang, H. (2017). *Mostly harmless regulation? electronic cigarettes, public policy and consumer welfare* (Tech. Rep. No. 23710). National Bureau of Economic Research.

Kim, A. E., Arnold, K. Y., & Makarenko, O. (2014). E-cigarette advertising expenditures in the US, 2011–2012. *American Journal of Preventive Medicine*, *46*(46), 409–412.

Kleinjan, M., Engels, R. C. M. E., van Leeuwe, J., Brug, J., van Zundert, R. M. P., & van den Eijnden, R. J. J. M. (2009). Mechanisms of adolescent smoking cessation: Roles of readiness to quit, nicotine dependence, and smoking of parents and peers. *Drug and Alcohol Dependence*, *99*(1-3), 204–214.

Krosnick, J. A. (1991). Response strategies for coping with the cognitive demands of attitude measures in surveys. *Applied Cognitive Psychology*, *5*(3), 213–236.

Kruskal, W. H., & Wallis, W. A. (1952). Use of ranks in one-criterion variance analysis. *Journal of the American Statistical Association*, *47*(260), 583–621.

Kunreuther, H., Easterling, D., Desvousges, W., & Slovic, P. (1990). Public attitudes toward siting a high-level nuclear waste repository in Nevada. *Risk Analysis*, *10*(4), 469–484.

Levy, D. T., Borland, R., Villanti, A. C., Niaura, R., Yuan, Z., Zhang, Y., ... others (2017).

The application of a decision-theoretic model to estimate the public health impact of vaporized nicotine product initiation in the United States. *Nicotine & Tobacco Research*, *19*(2), 149–159.

Loewenstein, G., O'Donoghue, T., & Rabin, M. (2003). Projection bias in predicting future utility. *The Quarterly Journal of Economics*, *118*(4), 1209–1248.

Marti, J., Buckell, J., Maclean, J. C., & Sindelar, J. L. (2018). To 'vape'or smoke? Experimental evidence on adult smokers. *Economic Inquiry*.

McCallum, D. B., Hammond, S. L., & Covello, V. T. (1991). Communicating about environmental risks: how the public uses and perceives information sources. *Health Education Quarterly*, *18*(3), 349–361.

McKee, M., & Capewell, S. (2015). Evidence about electronic cigarettes: a foundation built on rock or sand? *British Medical Journal*, *351*, h4863.

Meer, J. (2011). Brother, can you spare a dime? Peer pressure in charitable solicitation. *Journal of Public Economics*, *95*(7-8), 926–941.

Mitchell, J. V. (1992). Perception of risk and credibility at toxic sites. *Risk Analysis*, *12*(1), 19–26.

National Academies of Sciences, Engineering and Medicine. (2018). *Public health consequences of e-cigarettes* (Tech. Rep.). National Academies of Sciences, Engineering, and Medicine.

Oullier, O., Cialdini, R., Thaler, R. H., & Mullainathan, S. (2010). Improving public health prevention with a nudge. *Economic Perspectives*, *6*(2), 117–36.

Pesko, M. F., Kenkel, D. S., Wang, H., & Hughes, J. M. (2016). The effect of potential electronic nicotine delivery system regulations on nicotine product selection. *Addiction*, *111*(4), 734–744.

Riker, C. A., Lee, K., Darville, A., & Hahn, E. J. (2012). E-cigarettes: promise or peril? *Nursing Clinics*, *47*(1), 159–171.

Rise, J., Kovac, V., Kraft, P., & Moan, I. S. (2008). Predicting the intention to quit smoking and quitting behaviour: Extending the theory of planned behaviour. *British Journal of Health Psychology*, *13*(2), 291–310.

Schmidt, A. M., Ranney, L. M., Noar, S. M., & Goldstein, A. O. (2017). Development of the FDA Tobacco Credibility Scale (FDA-TCS). *Tobacco Regulatory Science*, *3*(1), 47–55.

Shahab, L., Goniewicz, M. L., Blount, B. C., Brown, J., McNeill, A., Alwis, K. U., ... West, R. (2017). Nicotine, carcinogen, and toxin exposure in long-term e-cigarette

and nicotine replacement therapy users: a cross-sectional study. *Annals of Internal Medicine*, *166*(6), 390–400.

Shi, Y., Cummins, S. E., & Zhu, S.-H. (2017). Use of electronic cigarettes in smoke-free environments. *Tobacco Control*, *26*, e19-e22.

Slovic, P., Flynn, J. H., & Layman, M. (1991). Perceived risk, trust, and the politics of nuclear waste. *Science*, *254*(5038), 1603–1607.

Spence, M. (1973). Job market signaling. *The Quarterly Journal of Economics*, *87*(3), 355–374.

Stigler, G. J. (1961). The economics of information. *Journal of Political Economy*, *69*(3), 213–225.

Thaler, R. H., & Sunstein, C. R. (2008). *Nudge: Improving decisions about health, wealth, and happiness*. Yale University Press.

Trumbo, C. W., & McComas, K. A. (2003). The function of credibility in information processing for risk perception. *Risk Analysis*, *23*(2), 343–353.

Viscusi, W. K. (2016). Risk beliefs and preferences for e-cigarettes. *American Journal of Health Economics*, *2*(2), 213–240.

Weaver, S. R., Majeed, B. A., Pechacek, T. F., Nyman, A. L., Gregory, K. R., & Eriksen, M. P. (2016). Use of electronic nicotine delivery systems and other tobacco products among usa adults, 2014: results from a national survey. *International Journal of Public Health*, *61*(2), 177–188.

Wilson, E. J., & Sherrell, D. L. (1993). Source effects in communication and persuasion research: A meta-analysis of effect size. *Journal of the Academy of Marketing Science*, *21*(2), 101.

Zhong, J., Cao, S., Gong, W., Fei, F., & Wang, M. (2016). Electronic cigarettes use and intention to cigarette smoking among never-smoking adolescents and young adults: A meta-analysis. *International Journal of Environmental Research and Public Health*, *13*(5), 465.