NBER WORKING PAPER SERIES

E-CIGARETTES AND ADULT SMOKING

Henry Saffer
Daniel Dench
Dhaval Dave
Michael Grossman

Working Paper 24212
http://www.nber.org/papers/w24212

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
January 2018

This project is funded by grant number R01-DA039968 entitled "The Economics of Electronic Nicotine Delivery Systems: Advertising and Outcomes", from the National Institute of Health to the National Bureau of Economic Research, Inc. This paper employs data from the A.C. Nielsen Company and was purchased from the Kilts Center of the University of the Chicago Booth School of Business. Results are calculated (or derived) based on data from The Nielsen Company (US), LLC and marketing databases provided by the Kilts Center for Marketing Data Center at The University of Chicago Booth School of Business. Information about the data and access are available at http://research.chicagobooth.edu/nielsen/.

We are grateful to the A.C. Nielsen Company and the Kilts Center for providing the data and for instructions in its use. The conclusions drawn from the Nielsen data are those of the researchers and do not reflect the views of Nielsen. Nielsen is not responsible for, had no role in, and was not involved in analyzing and preparing the results reported herein. All Rights Reserved. The views expressed herein are those of the authors and do not necessarily reflect the views of the National Bureau of Economic Research.

NBER working papers are circulated for discussion and comment purposes. They have not been peer-reviewed or been subject to the review by the NBER Board of Directors that accompanies official NBER publications.

E-cigarettes and Adult Smoking
Henry Saffer, Daniel Dench, Dhaval Dave, and Michael Grossman
NBER Working Paper No. 24212
January 2018
JEL No. I18

ABSTRACT

Over the past few years adult use of e-cigs has been increasing while adult smoking has been declining. It is important to determine if there is a causal effect of e-cig use on smoking because of the known health hazards associated with smoking. An important concern with most prior studies of e-cigs and smoking is that endogeneity between e-cig use and cigarette use is ignored. One contribution of this paper is to instrument e-cig use in order to avoid this endogeneity problem. The data employed to estimate the empirical models come from the 2014-2015 Tobacco Use Supplements (TUS). The data employed in this study rely on the combined July 2014, January 2015 and May 2015 waves of the TUS. The results show that e-cig use increases the probability of a quit attempt, the probability of a quit failure and the number of quit failures. E-cig use is also found to reduce smoking by failed quitters and non-attempters. Past studies have shown that successful quitting may follow after a few years of e-cig use but the TUS is limited to a one year retrospective window, which may be too short to observe the causal effect of e-cigs on successful quit attempts. Although there is no evidence in the TUS regressions that e-cigs use affects the probability of a successful quit, the results for attempts, failures and reduction of smoking suggest that e-cigs create a path toward cessation.

Henry Saffer
NBER
5 Hanover Square, 16th Floor
Suite 1602
New York, NY 10004-2630
hsaffer@gc.cuny.edu

Daniel Dench
The Graduate Center
City University of New York
365 Fifth Avenue
New York, NY 10016
ddench@gc.cuny.edu

Dhaval Dave
Bentley University
Department of Economics
175 Forest Street, AAC 195
Waltham, MA 02452-4705
and IZA
and also NBER
ddave@bentley.edu

Michael Grossman
National Bureau of Economic Research
5 Hanover Square, 16th Floor
Suite 1602
New York, NY 10004-2630
and City University of New York Graduate Center
and also IZA
mgrossman@gc.cuny.edu

1. Introduction

There are a number of devices on the market today that deliver a dose of nicotine in vapor form to the user. These devices will be referred to as e-cigarettes (e-cigs) where the 'e' stands for electronic.[1] The first e-cigs were disposable and designed to resemble cigarettes. Today, refillable devices, which do not closely resemble cigarettes, are more common. In all e-cigs a liquid containing propylene glycol and usually containing nicotine and sometimes containing added flavorings is vaporized by a battery powered heating element. There is no research on long term health issues related to e-cig use, however, e-cigs are currently believed to be less dangerous than cigarettes because the vapor does not contain the toxins found in the smoke of a conventional cigarette (Goniewicz; et al. 2013; Czogala et al. 2014). The US National Institute on Drug Abuse states that because e-cigs deliver nicotine without burning tobacco, they appear to be a safer, less toxic alternative to conventional cigarettes. [2] The UK Public Health Department has taken a more definitive view and stated that e-cigs are significantly less harmful to health than tobacco.

Adult use of e-cigs has increased from 0.3% in 2010 to 3.2% in 2016 while adult smoking declined from 20.9% in 2005 to 15.1% in 2015. Although both products are sources of nicotine, these time series cannot be interpreted as evidence of causality. We do not know the causal effect e-cig use has on smoking cessation and on the number of cigarettes consumed by smokers. However, the effect of e-cig use on smoking is an important public health question because smoking is known to be

[1] In the literature, these devices are also referred to as electronic nicotine delivery systems. Consumers also have several more colorful names for these devices.
[2] http://www.fda.gov/ForConsumers/ConsumerUpdates/ucm173401.htm
https://www.drugabuse.gov/publications/drugfacts/electronic-cigarettes-e-cigs

hazardous. Although the public health value of taxing e-cigs depends on their effect on smoking, seven states have already passed legislation that requires a tax on e-cigarettes.[3]

2. Prior Studies

One group of prior studies finds that e-cigs are associated with reduced smoking. Zhu et al. (2017) finds that those who report use of e-cigs had a higher smoking cessation rate than those who report no use of e-cigs. They replied on data from the Tobacco Use Supplements. Brown et al. (2014) assessed the effectiveness of e-cigs when used to aid smoking cessation in comparison with nicotine replacement therapy (NRT) and with unaided quitting. They rely on a cross-sectional survey of the English population which includes 5863 adults who had smoked within the previous 12 months and made at least one quit attempt during that period with either e-cigs, NRT or no aid. They found that e-cig users were more likely to report abstinence than either those who used NRT or no aid. That is, e-cig users were more likely to have quit smoking than either the users of NRT or those using no aid. Zhuang et al. (2016) argue that a common pattern is dual cigarette and e-cig use and that this dual use might delay the cessation of cigarette smoking. They rely on a nationally representative sample of 2028 US smokers from 2012 and 2014. Long-term e-cig use was defined as using e-cigs at baseline and follow-up. Use of e-cigs only at baseline or at follow-up was defined as short-term use. Non-users are defined as those that did not use e-cigs at either survey.

[3] https://chronicdata.cdc.gov/Legislation/STATE-System-E-Cigarette-Fact-Sheet/qte6-7jwd. As of June 30, 2017, the seven states are California, Kansas, Louisiana, Minnesota, North Carolina, Pennsylvania, and West Virginia. Also the District of Columbia, Puerto Rico and the U.S. Virgin Islands have a tax.

Quit attempt rates and cessation rates were compared across the three groups. At the follow-up, long-term e-cig users had a higher quit attempt rate and a higher cessation rate than either short-term users or non-users. Among those making a quit attempt, use of e-cigs as a cessation aid surpassed that of FDA-approved pharmacotherapy. They conclude that short-term e-cig use was associated with a lower rate of smoking cessation but that long-term use of e-cigs was associated with a higher rate of smoking cessation.

Another group of studies finds that e-cigs are not associated with reduced smoking. Grana, Benowitz, and Glantz (2014) have argued that although e-cig use may reduce smoking it also may inhibit complete smoking cessation. Kalkhoran and Glantz (2016) provide a review of papers that attempt to assess the relationship between e-cig use and smoking cessation by adult smokers. The question they are interested in is whether cigarette smokers who report e-cig use have a higher or lower probability of quitting smoking. They found 38 studies including two randomized controlled trials. These studies include Brown et al. (2014) referenced above. The two randomized controlled trials showed that e-cigs increased the probability of quitting. However, these studies relied on relatively small samples. Kalkhoran and Glantz (2016) conclude that these studies as a group predict that the probability of a successful quit is 28% lower for those who used e-cigs compared with those who did not use e-cigs. That is, e-cig use is associated with significantly less quitting among smokers.

3. Approach

An important concern with most prior studies of e-cigs and smoking is that endogeneity between e-cig use and cigarette use is ignored. There could be causality

in both directions or use of both products could be driven by the same underlying unobserved factor. Either situation would bias the estimation results. One contribution of this paper is to instrument e-cig use in order to avoid this endogeneity problem. To develop a research strategy to address the effect of e-cig use on smoking we begin with the choices available to cigarette smokers which are illustrated in Figure 1.[4] Adult smokers could attempt to quit or not attempt to quit (1). If they attempt to quit then they could fail (2) or succeed (3). If they fail, they could reduce the number of cigarettes per day smoked (4). Those who do not attempt to quit could also change their level of smoking (4). We estimate how the use of e-cigarettes affects each of these choices.

The empirical model consists of the following three equations. The first is a standard demand equation for e-cigs:

(1) ECIG = E (e-cig prices, cigarette prices, demographics, fixed effects),

The second equation is a quit function which is has also been used in prior studies.

(2) Quit = Q (ECIG, cigarette prices, demographics, fixed effect).

Because the estimated effect of e-cigs in this quit function is likely to be biased due to endogeneity between e-cig and cigarettes, equation (3), which is a reduced form of equations (1) and (2), is defined with the e-cig variable replaced by determinants of e-cig demand.

(3) Quit = Q (e-cig prices, cigarette prices, demographics, fixed effect).

The estimation of equation (3) eliminates the endogeneity between quitting and e-cig use in equation (2). One concern with this approach is whether the empirical version of equation (1) can be interpreted as a demand for e-cigs. E-cig prices can be thought of

[4] E-cigs could also affect the probability of starting to smoke although this is mainly limited to adolescents. This project focuses on adults so the question of initiation is not relevant.

as a function of supply and demand. We expect that in a supply and demand model, if demand was held constant and the supply was infinitely elastic then shifts in supply would reveal an inverse relationship between price and use. However, if demand is not held constant then prices and sales can both change. In the empirical models, we use a set of independent variables to control demand and test the relationship between e-cig price and use. A negative effect of e-cig prices on e-cig use is expected. Another potential concern is causality between e-cig prices and cigarette smoking. E-cig prices could affect the demand for cigarettes. E-cig prices are a function of e-cig demand which is related to cigarette demand but is not likely that an exogenous change in cigarette demand would affect the price of e-cigs. Equation (3) is estimated for all attempts, failed quit attempts, the number of failed quit attempts, successful quit attempts and the reduction in smoking by those who fail and those who do not attempt.

4. The Data

The data employed to estimate the empirical models come from the 2014-2015 Tobacco Use Supplements (TUS), which are sponsored by the National Cancer Institute and are based on a subsample of the Census Bureau's Current Population Survey (CPS). The TUS provide an extensive set of variables regarding tobacco products for adults ages 18 and over. The TUS began asking questions about e-cig use in 2014 that continued into 2015.[5] The data employed in this study rely on the combined July 2014, January 2015 and May 2015 waves of the TUS. The CPS includes about 450,000 individuals who are eligible for the TUS but data is reported only on 230,000 and of

[5] Some very limited data on e-cigs use was included in the 2011 TUS.

these only about 91,000 reported that they smoked at least 100 cigarettes during their lifetime.

The dependent variables include dichotomous measures of e-cig use, quit attempts, failed quits and successful quits. A variable measuring the number of failed quits is included in addition to the dichotomous failed quit variable. This variable includes zero quit attempts. Successful attempts are defined as attempts that result in cessation for 90 days or more. Reduction in cigarettes smoked per day is defined as past year cigarettes per day minus current cigarettes per day. The reduction variable defined in this way is positive if smoking goes down and is negative if smoking goes up.

Both continuous and dichotomous independent variables were also defined. The continuous variables measure age, family income (divided by 1000) and years of education. The dichotomous variables measure married, male, black, Asian, and Hispanic status. The dichotomous variables are equal to one if the individual is in the category defined by the variable name.

Measures of cigarette prices and e-cig prices were extracted from the Nielsen Retail Scanner data set. The Nielsen data are derived from supermarkets, drugstores convenience stores, liquor stores and mass merchandisers. One concern with the price data is that vape shops are not included. However, it is probable that vape shops prices are highly correlated with prices in other nearby stores. Another concern is the percent of e-cigs bought by adults on the internet. According to the 2014-2015 Population Assessment of Tobacco and Health Survey only 9.5% of adults buy their e-cigs online. Thus retail store prices are probably a good approximation of actual prices paid by adults. E-cigs come in disposable and reusable forms. Disposable e-cigs

provide fixed amount of nicotine and then must be disposed of. Reusable e-cigs involve buying a starter kit and then buying refills. The first e-cigs were disposable but the reusable form is more common today.

Cigarette prices and e-cig prices were aggregated to the county and month level. Nielsen Retail Scanner data are limited to about 65 larger metro areas. The TUS sample includes county FIPS codes for individuals who live in counties with a population over 50,000. This is done to enhance confidentiality. Thus, both the Nielsen price data and the TUS sample with county FIPS codes are limited to larger metro areas. The resulting matched sample is about 40% of the total TUS sample and underrepresents the rural population. However, there is no reason to assume that rural individuals respond to e-cig availability differently that urban individuals with otherwise similar demographics. Differences between the full TUS and the FIPS coded sample are examined below. For the individuals with county FIPS codes the weighted average price for cigarettes was $5.96, for starter kits was $21.95 and for replacements was $3.35.

Table 1 presents weighted means and 95% confidence intervals for individuals who reported smoking last year for those with geocodes and for the full sample. The purpose of this table is to examine the differences between these groups. Column 1 presents the data for only those with a geocode and column 2 presents the data for the full sample. These data show that the larger geographical areas are not significantly different from the total sample in e-cig use, quit attempts, failures and successes. However, the geocoded sample does have higher incomes, less married individuals,

more Blacks and more Hispanics than the full sample. This should not present a problem because these demographics are controlled in the regressions.

Table 2 presents weighted means and 95% confidence intervals for those who reported smoking last year for those who used e-cigs and for those who did not use e-cigs. The purpose of this table is to examine the differences in quit attempts, failures, number of failures, successes and cigarette reductions for these two groups. Column 1 presents the data for only those who report using e-cigs and column 2 presents the data for only those who report not using e-cigs. The data show that those who use e-cigs have significantly more attempts, failures, number of failures, total successes and greater reductions in smoking than those who do not use e-cigs. Failures as a percent of attempts are same for those who use e-cigs and those who do not. Because there are more attempts with e-cigs there are also more successes. Also, those who report using e-cigs are younger, have higher incomes, are more likely to be female, are better educated and less likely to be Black or Hispanic. These data are descriptive and not causal but suggest that e-cigarette use reduces smoking. These are the same results, with the same data, as presented by Zhu et al. (2017). The contribution of this paper is to test for causal effects of e-cigs on smoking as described in Section 3.

5. Results

Tables 3-7 present the regression results. All of the regressions include state and month fixed effects variables and clustered standard errors at the state level with 41 or more clusters. All of the regressions also use the same set of non-price independent variables. Four specifications are presented in each table and table 5 includes two

dependent variables. These specifications include alternative combinations of cigarette prices, starter kit prices and replacement prices. This tests the results for robustness with respect to collinearity between the price measures. All of the data presented are coefficients not marginal effects.

The first empirical question involves the relationship between e-cig use and e-cig price. We expect a negative relationship between use and price. That is, if the demand function is fixed then variations in supply should identify the demand function. Table 3 presents these empirical functions for e-cigs. The price of replacements is negative and significant in all specifications which include this variable. The results suggest that e-cig use is positively related to income and education. Also the e-cig use is negatively related to age, male, Black and Hispanic. The results suggest that these functions can be interpreted as demand functions and that higher e-cig prices are associated with less use of e-cigs.

Table 4 presents estimates the effect of e-cig prices on quit attempts. The price of replacements is negative and significant. That is e-cig use is positively related to the probability of a quit attempt. Also age, income and male are negatively related to quit attempts while education and Black are positively related to quit attempts. This is the same result for attempts that is shown in table 2 with descriptive data only.

Table 5 presents the results for probability of a quit failure and for the number of quit failures. The regressions for the number of failed quit tries are order logit regressions because the dependent variable includes four ordered outcomes, including zero attempts. In all regressions the price of replacements is negative and significant. That is, e-cig use is positively related to the probability of a quit failure and the number

of quit failures. Also, for both outcomes, income and male are negative while Black is positive. The positive effect of e-cig use on the number of quit failures suggests that e-cig users keep trying to quit. We converted the coefficients for the price of replacements from the first specification in table 4 and in table 5. A t-test for equality could not be rejected. This suggests that the e-cig induced attempts result primarily in failure.

Table 6 presents the results for quit successes. Both the price of starter kits and replacements is negative but not significant. Also, age and Black are negatively related to successes while education is positively related to successes. The descriptive data presented in table 2 show that e-cig use increased successes. We replaced e-cig prices with e-cig use in the regression and it was positive and significant as shown in table 2. The lack of significance in the price regression appears to indicate that there is no effect of e-cig use on quitting when causality is accounted for. This is also consistent with the t-test presented above.

Table 7 presents the OLS results for cigarette reduction for failed attempters and non-attempters. The price of starter kits is negative and significant in the three regression which include this variable. In the other regression it significant e-cig price was always for replacements rather than the starter kits. Age, income employment and Black have negative effects on cigarette reductions. The starter kit coefficient suggests that a one dollar increase in its price would result in a reduction in smoking by 0.05. This converts to an elasticity of about 0.68, which means that a 10% increase in the price of starter kits would increase smoking by about 6.8%.

6. Conclusions

The regressions show that e-cigs increase the probability of a quit attempt, the probability of a quit failure and the number of quit failures. E-cig use is also found to reduce smoking by failed quitters and non-attempters. However, there is no evidence in the regression that e-cigs affect the probability of a successful quit as argued by Grana, Benowitz, and Glantz (2014). The lack of an observed effect on successes may be a consequence of the one year retrospective nature of the TUS. According to Chaiton (2016) it can take six or more failed attempts before a smoker has a success. This process could easily stretch over more than one year. The reduction in smoking related to failed quits and e-cig use may reduce nicotine addiction making future success more likely. This is consistent with Zhuang et al. (2016) who conclude that over one year e-cig use was associated with a lower success rate but over two years the use of e-cigs was associated with a higher success rate. The increased probability of an attempt and the increased number of attempts during the past year suggest that e-cig use creates a path to cessation. In the worst case scenario, e-cig use reduces smoking by adults.

References

Brown, Jamie, Emma Beard, Daniel Kotz, Susan Michie, and Robert West. 2014. "Real-world effectiveness of e-cigarettes when used to aid smoking cessation: a cross-sectional population study." *Addiction* 109(9): 1531-1540.

Chaiton, Michael, Lori Diemert, Joanna E. Cohen, Susan J. Bondy, Peter Selby, Anne Philipneri, and Robert Schwartz. 2016. "Estimating the number of quit attempts it takes to quit smoking successfully in a longitudinal cohort of smokers." *BMJ open* 6(6): pages?.

Czogala, Jan, Maciej L. Goniewicz, Bartlomiej Fidelus, Wioleta Zielinska-Danch, Mark J. Travers, and Andrzej Sobczak. 2014. "Secondhand Exposure to Vapors from Electronic Cigarettes." *Nicotine & Tobacco Research* 16(6): 655-662.

Goniewicz, M.L., J. Knysak, M. Gawron, L. Kosmider, A. Sobczak, J. Kurek, A. Prokopowicz, M. Jablonska-Czapla, C. Rosik-Dulewska, C. Havel, P. Jacob, 3rd, and N. Benowitz. 2013. "Levels of Selected Carcinogens and Toxicants in Vapour from Electronic Cigarettes." *Tobacco Control* 23(2): 133-9.

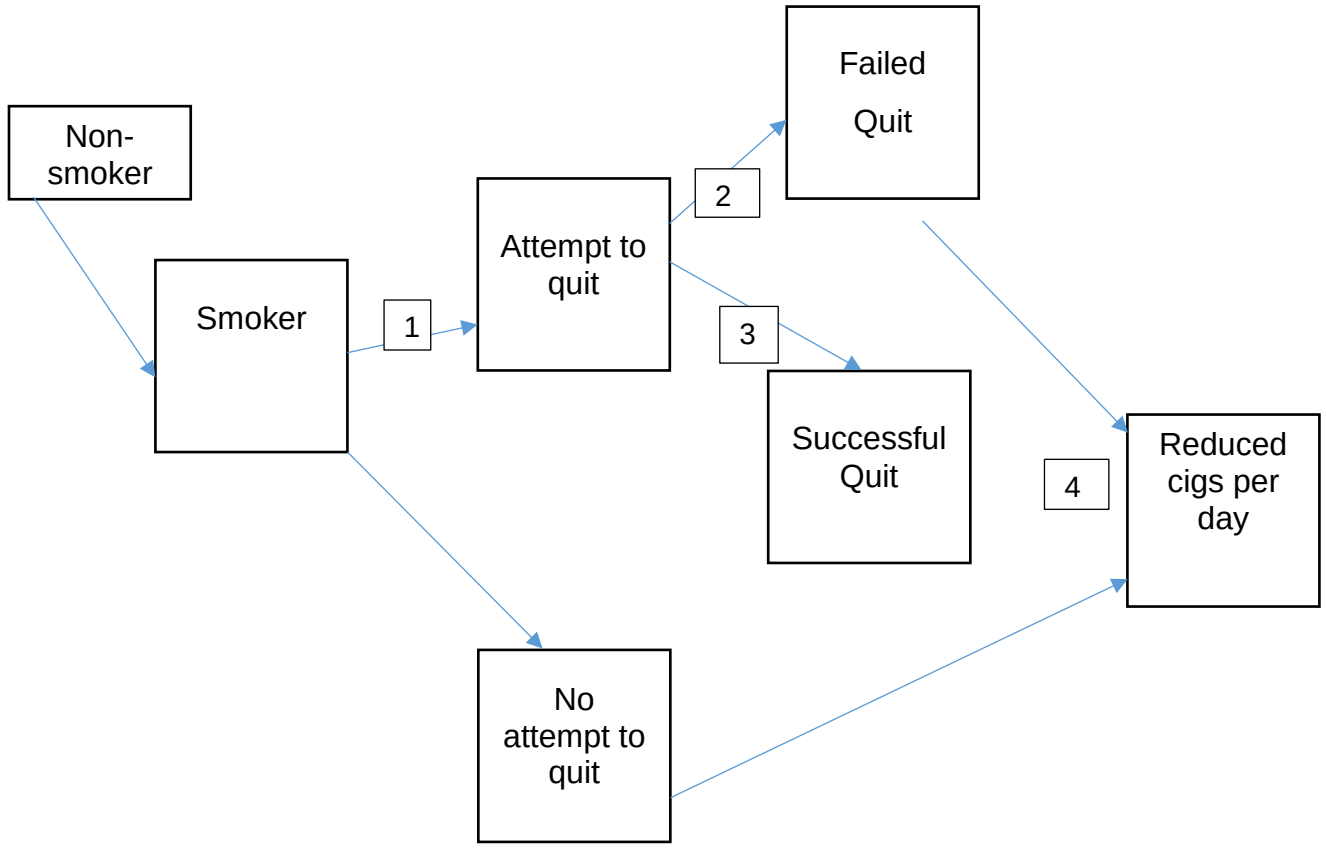
Grana, Rachel, Neal Benowitz, and Stanton A. Glantz. 2014. "E-cigarettes." *Circulation* 129(19): 1972-1986.

Kalkhoran, Sara, and Stanton A. Glantz. 2016. "E-cigs and smoking cessation in real-world and clinical settings: a systematic review and meta-analysis." *The Lancet Respiratory Medicine* 4(2): 116-128.

Zhu, Shu-Hong, Yue-Lin Zhuang, Shiushing Wong, Sharon E. Cummins, and Gary J. Tedeschi. 2017. "E-cigarette use and associated changes in population smoking cessation: evidence from US current population surveys." *BMJ* 358: j3262.

Zhuang, Yue-Lin, Sharon E. Cummins, Jessica Y. Sun, and Shu-Hong Zhu. 2016. "Long-term e-cigarette use and smoking cessation: a longitudinal study with US population." *Tobacco Control* 25(Suppl 1): i90-i95.

Figure 1
Choices by Smokers



[x] Indicates a transition by adults that may be affected by e-cig use.

Table 1
Weighted Means or Percentages
Individuals Who Report Smoking Cigarettes a Year Ago
With and Without Geocodes

	1 Only Data with Geocodes			2 No Geocodes		
Variable	Mean	95% CI		Mean	95% CI	
Use E-cig	0.11	0.104	0.116	0.11	0.107	0.113
Attempt to Quit	0.31	0.301	0.319	0.31	0.305	0.315
Failed to Quit	0.23	0.222	0.238	0.24	0.235	0.245
Number of Quit Failures in past 12 months††	0.59	0.571	0.619	.60	0.587	0.614
Successful Quit for 90 days or more	0.07	0.065	0.075	0.070	0.067	0.073
Cigarette Reduction	1.62	1.481	1.759	1.700	1.616	1.784
Age	45.51	45.229	45.791	45.25	45.086	45.414
Family Income**†	52.32	51.582	53.058	48.39	47.980	48.800
Employ	0.600	0.591	0.609	0.59	0.585	0.595
Male	0.550	0.541	0.559	0.54	0.535	0.545
Ed	12.92	12.877	12.963	12.78	12.756	12.804
Married**	0.39	0.381	0.399	0.41	0.405	0.415
Black**	0.14	0.134	0.146	0.12	0.116	0.124
Hispanic**	0.14	0.134	0.146	0.10	0.097	0.103

** reject the hypothesis of equality between users and non-users, i.e. the groups are different,
† scaled by 1000, †† includes those who do not attempt to quit

Table 2
Weighted Means or Percentages
Individuals Who Report Smoking Cigarettes a Year Ago
And Used or did not Use E-Cigs

	1 Using E-Cigs Full TUS Sample			2 Not Using E-Cigs Full TUS Sample		
Variable	Mean	95% CI		Mean	95% CI	
Attempt to Quit**	0.47	0.454	0.486	0.30	0.295	0.305
Failed to Quit**	0.36	0.344	0.376	0.23	0.225	0.235
Number of Quit Failures in past 12 months**††	0.96	0.911	1.007	0.56	0.543	0.570
Successful Quit for 90 days or more**	0.10	0.090	0.110	0.07	0.067	0.073
Cigarette Reduction**	3.71	3.385	4.035	1.30	1.218	1.382
Age**	42.62	42.136	43.104	45.62	45.444	45.796
Family Income** †	51.21	49.903	52.517	48.04	47.603	48.477
Employ	0.61	0.594	0.626	0.59	0.584	0.596
Male**	0.51	0.494	0.526	0.55	0.544	0.556
Education**	13.05	12.986	13.114	12.74	12.714	12.766
Married	0.42	0.404	0.436	0.41	0.404	0.416
Black**	0.07	0.062	0.078	0.13	0.126	0.134
Hispanic**	0.06	0.052	0.068	0.10	0.097	0.103

** reject the hypothesis of equality between e-cig users and non-users, i.e. they are different,
† scaled by 1000, †† includes those who do not attempt to quit

Table 3
Coefficients from Logit Regressions of E-cig Demand Functions

	Use e-cig	Use e-cig	Use e-cig	Use e-cig
Age	-0.0134***	-0.0134***	-0.0133***	-0.0134***
	(0.0025)	(0.0025)	(0.0025)	(0.0025)
Family Income	0.0014*	0.0014*	0.0014*	0.0014*
	(0.0007)	(0.0007)	(0.0007)	(0.0007)
Employed	-0.0818	-0.0823	-0.0828	-0.0816
	(0.0770)	(0.0769)	(0.0773)	(0.0770)
Male	-0.1186**	-0.1185**	-0.1190**	-0.1190**
	(0.0507)	(0.0506)	(0.0505)	(0.0507)
Education	0.0496***	0.0496***	0.0494***	0.0495***
	(0.0128)	(0.0127)	(0.0128)	(0.0128)
Married	0.0242	0.0241	0.0234	0.0243
	(0.0690)	(0.0688)	(0.0689)	(0.0692)
Black	-0.7083***	-0.7092***	-0.7132***	-0.7088***
	(0.1233)	(0.1236)	(0.1245)	(0.1234)
Hispanic	-0.3476***	-0.3523***	-0.3565***	-0.3485***
	(0.0955)	(0.0963)	(0.0977)	(0.0954)
Price Cigarette	-0.0248	-0.0384	-0.0577	
	(0.0801)	(0.0811)	(0.0815)	
Price Starter Kit	-0.021		-0.0219	-0.0217
	(0.0183)		(0.0174)	(0.0183)
Price of Replacement	-0.4077*	-0.4141*		-0.4202*
	(0.2432)	(0.2299)		(0.2425)
Pseudo R-Square	0.0318	0.0316	0.0314	0.0318
N	11582	11582	11582	11582

*** p<0.01, ** p<0.05, * p<0.10. State and month fixed effects variables included in all regressions. Standard Errors clustered at the state level.

Table 4
Coefficients from Logit Regressions of the Probability of an Attempt

	Attempts	Attempts	Attempts	Attempts
Age	-0.0050***	-0.0050***	-0.0050***	-0.0051***
	(0.0018)	(0.0018)	(0.0018)	(0.0018)
Family Income	-0.0030***	-0.0031***	-0.0031***	-0.0030***
	(0.0006)	(0.0006)	(0.0006)	(0.0006)
Employed	-0.0903*	-0.0904*	-0.0911*	-0.0906*
	(0.0537)	(0.0535)	(0.0537)	(0.0536)
Male	-0.2625***	-0.2625***	-0.2636***	-0.2620***
	(0.0420)	(0.0420)	(0.0422)	(0.0418)
Education	0.0606***	0.0606***	0.0606***	0.0608***
	(0.0106)	(0.0106)	(0.0106)	(0.0106)
Married	0.0104	0.0104	0.0103	0.0102
	(0.0464)	(0.0465)	(0.0467)	(0.0464)
Black	0.1370**	0.1367**	0.1317**	0.1381**
	(0.0566)	(0.0566)	(0.0578)	(0.0563)
Hispanic	-0.0164	-0.0174	-0.025	-0.0147
	(0.0878)	(0.0859)	(0.0868)	(0.0885)
Price Cigarette	0.0488	0.0461	0.0155	
	(0.0471)	(0.0470)	(0.0473)	
Price Starter Kit	-0.0042		-0.0063	-0.0029
	(0.0156)		(0.0147)	(0.0155)
Price of Replacement	-0.4072*	-0.4104*		-0.3808*
	(0.2137)	(0.2112)		(0.2101)
Pseudo R-Square	0.0161	0.0161	0.0156	0.016
N	11744	11744	11744	11744

*** p<0.01, ** p<0.05, * p<0.10. State and month fixed effects variables included in all regressions. Standard Errors clustered at the state level.

Table 5
Coefficients from Logit Regressions of the Probability of a Quit Failure and Ordered Logit Regressions of the Number of Quit Failures

	Probability Quit Failures	Probability Quit Failures	Probability Quit Failures	Probability Quit Failures	Number of Quit Failures	Number of Quit Failures	Number of Quit Failures	Number of Quit Failures
Age	-0.0016	-0.0016	-0.0016	-0.0016	-0.0007	-0.0007	-0.0007	-0.0007
	(0.0016)	(0.0016)	(0.0016)	(0.0016)	(0.0016)	(0.0016)	(0.0016)	(0.0016)
Family Income	-0.0038***	-0.0038***	-0.0038***	-0.0038***	-0.0039***	-0.0039***	-0.0039***	-0.0038***
	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0006)	(0.0007)	(0.0007)
Employed	-0.0641	-0.0641	-0.0649	-0.0644	-0.052	-0.052	-0.0529	-0.0523
	(0.0480)	(0.0479)	(0.0479)	(0.0480)	(0.0468)	(0.0468)	(0.0469)	(0.0468)
Male	-0.2624***	-0.2624***	-0.2636***	-0.2619***	-0.2622***	-0.2622***	-0.2637***	-0.2618***
	(0.0504)	(0.0505)	(0.0507)	(0.0502)	(0.0505)	(0.0504)	(0.0507)	(0.0502)
Education	0.0183	0.0183	0.0183	0.0185	0.0198*	0.0198*	0.0197*	0.0199*
	(0.0119)	(0.0119)	(0.0119)	(0.0119)	(0.0112)	(0.0112)	(0.0112)	(0.0112)
Married	-0.0384	-0.0384	-0.0386	-0.0388	-0.0359	-0.0359	-0.0362	-0.0363
	(0.0508)	(0.0509)	(0.0510)	(0.0509)	(0.0449)	(0.0449)	(0.0451)	(0.0449)
Black	0.2611***	0.2610***	0.2556***	0.2623***	0.2835***	0.2835***	0.2775***	0.2844***
	(0.0905)	(0.0905)	(0.0916)	(0.0900)	(0.0939)	(0.0938)	(0.0953)	(0.0935)
Hispanic	-0.0049	-0.0052	-0.0145	-0.0032	0.0019	0.0019	-0.0069	0.0033
	(0.1045)	(0.1030)	(0.1031)	(0.1048)	(0.1018)	(0.1004)	(0.1004)	(0.1020)
Price Cigarette	0.0515	0.0506	0.0158		0.0458	0.0458	0.0121	
	(0.0666)	(0.0658)	(0.0636)		(0.0690)	(0.0681)	(0.0667)	
Price Starter Kit	-0.0014		-0.0038	.0000	.0000		-0.0023	0.0012
	(0.0166)		(0.0165)	(0.0166)	(0.0164)		(0.0164)	(0.0163)
Price of Replacement	-0.4438**	-0.4449**		-0.4174**	-0.4160**	-0.4160**		-0.3924*
	(0.2163)	(0.2169)		(0.2105)	(0.2075)	(0.2090)		(0.2029)
Pseudo R-Square	0.0170	0.0170	0.0165	0.0170	0.0120	0.0120	0.0117	0.0120
N	11734	11734	11734	11734	11691	11691	11691	11691

*** p<0.01, ** p<0.05, * p<0.10. State and month fixed effects variables included in all regressions. Standard Errors clustered at the state level.

Table 6
Coefficients from Logit Regressions Of the Probability of a Quit Success

	Quit Successes	Quit Successes	Quit Successes	Quit Successes
Age	-0.0128***	-0.0128***	-0.0128***	-0.0128***
	(0.0028)	(0.0028)	(0.0028)	(0.0028)
Family Income	-0.0001	-0.0001	-0.0001	-0.0001
	(0.0010)	(0.0010)	(0.0010)	(0.0010)
Employed	-0.1077	-0.1076	-0.1079	-0.1078
	(0.0862)	(0.0860)	(0.0864)	(0.0864)
Male	-0.127	-0.127	-0.1273	-0.1268
	(0.0794)	(0.0794)	(0.0794)	(0.0794)
Education	0.1462***	0.1462***	0.1462***	0.1463***
	(0.0189)	(0.0188)	(0.0189)	(0.0189)
Married	0.1372**	0.1372**	0.1372**	0.1371**
	(0.0664)	(0.0664)	(0.0664)	(0.0663)
Black	-0.3185**	-0.3189**	-0.3197**	-0.3180**
	(0.1533)	(0.1534)	(0.1531)	(0.1534)
Hispanic	-0.0472	-0.0493	-0.0487	-0.0466
	(0.0870)	(0.0880)	(0.0865)	(0.0882)
Price Cigarette	0.0133	0.0069	0.0058	
	(0.1142)	(0.1133)	(0.1113)	
Price Starter Kit	-0.0096		-0.0098	-0.0092
	(0.0246)		(0.0241)	(0.0239)
Price of Replacement	-0.0876	-0.0911		-0.0795
	(0.2768)	(0.2749)		(0.2683)
Pseudo R-Square				
N	11701	11701	11701	11701

*** p<0.01, ** p<0.05, * p<0.10. State and month fixed effects variables included in all regressions. Standard Errors clustered at the state level.

Table 7
OLS Coefficients from Regressions of Cigarette Reduction
For Failed Attempters and Non-attempters

	Cigarette Reduction	Cigarette Reduction	Cigarette Reduction	Cigarette Reduction
Age	-0.0128***	-0.0128***	-0.0129***	-0.0128***
	(0.0037)	(0.0037)	(0.0037)	(0.0037)
Family Income	-0.0034**	-0.0035**	-0.0034**	-0.0034**
	(0.0014)	(0.0015)	(0.0014)	(0.0014)
Employed	-0.2739*	-0.2734*	-0.2741*	-0.2733*
	(0.1479)	(0.1480)	(0.1480)	(0.1476)
Male	-0.124	-0.124	-0.1234	-0.1249
	(0.0950)	(0.0947)	(0.0954)	(0.0952)
Education	0.0179	0.0186	0.0179	0.0179
	(0.0255)	(0.0256)	(0.0256)	(0.0255)
Married	0.0125	0.0124	0.0119	0.0134
	(0.1268)	(0.1265)	(0.1267)	(0.1271)
Black	-0.8317***	-0.8355***	-0.8293***	-0.8336***
	(0.1717)	(0.1722)	(0.1715)	(0.1714)
Hispanic	-0.313	-0.3252	-0.3063	-0.3147
	(0.2508)	(0.2482)	(0.2540)	(0.2511)
Price Cigarette	-0.1155	-0.1482	-0.0972	
	(0.2107)	(0.2168)	(0.2162)	
Price Starter Kit	-0.0494*		-0.0478*	-0.0528*
	(0.0264)		(0.0265)	(0.0280)
Price of Replacement	0.2189	0.1681		0.1553
	(0.3747)	(0.4059)		(0.4108)
Pseudo R-Square	0.0133	0.0131	0.0133	0.0133
N	6804	6804	6804	6804

*** p<0.01, ** p<0.05, * p<0.10. State and month fixed effects variables included in all regressions. Standard Errors clustered at the state level.