Electronic Cigarettes

An increasingly popular form of nicotine delivery has become prominent in recent years bringing up many of the same public health concerns that tobacco products brought up many years ago. Electronic cigarettes (also known as e-cigarettes, e-cigs, vaporizers, vapes, electronic hookahs, and hookah pens) are devices that vaporize a combination of liquid nicotine and fillers—vegetable glycerin, propylene glycol, and flavors—at a temperature below burning to allow for the inhalation of the nicotine. Some products contain no nicotine at all, and are enjoyed for their flavor alone. Many of these devices look like regular cigarettes and produce a similar haze, but these products produce no actual smoke—only vapor. The act of using an electronic cigarette is therefore termed *vape* and *vaping*.

E-Cigarette Taxation in Other States

Electronic cigarettes are currently taxed in two states—Minnesota and North Carolina. In Minnesota e-cigarettes are taxed the same as tobacco products like cigarettes. North Carolina taxes liquid nicotine (used in e-cigarettes) at a rate of 5 cents per milliliter.¹ Some states have proposed various e-cigarette taxes this year, such as in Indiana² and Hawaii.³ Other states have introduced legislation earlier that has not passed, such as Oklahoma—where e-cigarettes are proposed to be taxed at five cents and treated as tobacco products⁴, and Oregon—where e-cigarettes are proposed to be treated as tobacco products for tax purposes.⁵ E-cigarette tax

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⁵ "HB 4129," *Oregon Legislative Information*, [https://olis.leg.state.or.us/liz/2014R1/Measures/Overview/HB4129](https://olis.leg.state.or.us/liz/2014R1/Measures/Overview/HB4129).
proposals have been introduced, but failed, in Rhode Island, Kentucky, New Jersey, and South Carolina.

The Effect of Taxes on E-Cigarette Use

A study, conducted by the University of Illinois at Chicago's Institute for Health Research and Policy, looked at the elasticity of demand for e-cigarettes and found that price is a key determinant of sales. This study estimates that a 10% increase in the price of disposable electronic cigarettes would reduce sales by approximately 12%. The same increase in price would reduce sales of reusable e-cigarettes by about 19%. These findings suggest that imposing a tax on electronic cigarettes could potentially lead to a significant reduction in use. However, the evidence does not suggest that the reduction in use of electronic cigarettes would not be made up for by an increase in traditional cigarette use. Furthermore, this study found that the price of one type of e-cigarette affects the demand of the other, suggesting that different types of e-cigarettes can be substitutes for each other. Therefore, differential tax policies based on product type could lead to substitution between different types of e-cigarettes.

Health Effects of Electronic Cigarettes

E-cigarettes have only recently become widely popular and consequently are not as well studied as other delivery methods such as smoking tobacco or oral tobacco. There have been studies on the health effects of e-cigarettes, but these have necessarily not looked at the long-term health effects of e-cigarette use. Looking only at the short-term health effects, there appears to be at least somewhat less adverse effects from vaping as compared with smoking.

One study has shown that while e-cigarettes contain potentially toxic compounds, they contain far less than normal cigarettes. Another study looked at e-cigarettes in vitro, or outside of normal real-life conditions rather than in laboratory settings, and found that e-cigarettes had less toxins than normal cigarettes—and have "the potential to demonstrate a decreased human health impact as compared to conventional tobacco-burning cigarettes." A systematic

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11 Misra, Manoj, Robert D. Leverette, Bethany T. Cooper, Melaniee B. Bennett, and Steven E. Brown, "Comparative in vitro toxicity profile of electronic and tobacco cigarettes, smokeless tobacco and nicotine replacement therapy
review of the e-cigarette studies has shown that nicotine itself is not known to be very harmful, besides the addictive nature of it. That same review demonstrated that research up to 2014 has shown that e-cigarette use is less harmful than smoking. Although e-cigarettes do give off some toxic chemicals, they are far less than those produced from smoking. A study which looked at how the heart is affected by e-cigarette use found that vaping did not cause a delay in left vertical myocardial relaxation, which is one of the immediate adverse effects of smoking.

While many studies have shown e-cigarettes to be less toxic than cigarettes and contain relatively few toxic chemicals, some scientists think that there are real risks involved in e-cigarettes that need to be studied more, especially their long-term use and their use indoors. Some researchers have found that the studies on e-cigarettes are inconclusive and, while admitting that fewer toxins can be found in e-cigarette vapor than tobacco smoke, they still point to needing more data to be definitive on the health effects of e-cigarettes.

Second-Hand Vapor and the Effects of Restrictions on Public Use

As of November, 2014, only three states—New Jersey, North Dakota, and Utah—had banned the use of electronic cigarettes in private worksites, restaurants, and bars. According to the CDC, recent increase in the popularity of e-cigarettes could be due to marketing which suggests that the products can be used in places where traditional cigarette smoking is prohibited. Huang et al. found that full smoking bans are correlated with reduced sales of disposable e-cigarette.


17 Marynak et al. "State laws."

18 Huang. "The impact of price."
Braunschweig, Germany found that secondhand vapor contains nicotine and other harmful constituents.\textsuperscript{19} The consumption of e-cigarettes causes emissions of propylene glycol, flavoring substances, and nicotine, into indoor air. Therefore, we can expect the use of electronic cigarettes to cause passive vaping. However, in contrast to the traditional cigarettes, which burn and therefore emit smoke continuously, the aerosols\textsuperscript{20} and VOCs\textsuperscript{21} from an electronic cigarette are only released during the user’s exhalation.

Research conducted in Spain, and published in \textit{Environmental Research}, measured passive exposure to nicotine by non-users who resided in homes with users of e-cigarettes and users of traditional cigarettes. The study found that the airborne markers of nicotine exposure were significantly higher (5.7 times) in the homes of traditional cigarette users, in contrast to the homes of e-cigarette users. However, the levels of airborne nicotine in the homes with e-cigarette users were higher than in the homes with no nicotine users. The study also measured biomarkers of nicotine exposure in non-users, and found statistically similar concentrations of biomarkers among those exposed to traditional cigarette smoke and those exposed to e-cigarette vapor. These results show that e-cigarette vapor caused passive exposure to nicotine.\textsuperscript{22}

Psychologists at the University of Miami surveyed current and former smokers about their support for smoking and vaping bans.\textsuperscript{23} They found that most participants supported indoor smoking bans, but were less supportive of bans that included e-cigarette use (vaping). Furthermore, they found that support for restrictions was directly related to perceptions about the safety of e-cigarettes. Support for restrictions was strongest among participants who believed e-cigarettes to pose a significant health risk. There was no support for restrictions among those who perceived them to pose no health risks. Partial bans tended to be supported by those with perceptions of moderate health risks.

\textbf{Flavored E-Liquids}

An internet survey looking at the impact of flavor variability on electronic cigarette use found that variability of flavors plays an important role in reducing cigarette craving, and the number of flavors used was associated with smoking cessation.\textsuperscript{24} The survey also found that consumers

\textsuperscript{20} Aerosols are particles suspended in air or gas.
\textsuperscript{21} Volatile organic compounds (VOCs) are chemicals that evaporate or at room temperature.
\textsuperscript{23} Huang. "The impact of price."
tend to switch their flavor preference over time. Beginning users tend to prefer tobacco flavor, but choose other flavors as they become more experienced.\(^{25}\)

**E-Cigarettes as an Aid to Quit Smoking**

Nicotine Replacement Therapy (NRT) has long had some success aiding smokers with quitting.\(^{26, 27, 28}\) The behavioral and social aspects of smoking are not often treated with standard NRT, such as the patch or nicotine gum, and e-cigarettes have been found to be more effective in these areas in the aiding of quitting.\(^{29}\)

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This report was completed on May 11, 2015 by Amanda Lowe, Ethan Hinch and Matthew West under the supervision of Professors Jack Gierzynski, Robert Bartlett and Eileen Burgin.

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Disclaimer: This report has been compiled by undergraduate students at the University of Vermont under the supervision of Professor Jack (Anthony) Gierzynski, Professor Robert Bartlett and Professor Eileen Burgin. The material contained in the report does not reflect the official policy of the University of Vermont.

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\(^{25}\) Farsalinos. “Impact of Flavour Variability.”


