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Electronic Cigarettes

Electronic cigarettes (also known as e-cigarettes, e-cigs, vaporizers, or vapes) are devices that aerosolize liquids – often containing nicotine, vegetable glycerin, propylene glycol, and artificial flavorings – for inhalation.¹ Some products contain no nicotine at all and are enjoyed for their flavor alone. While these devices may resemble traditional tobacco cigarettes, e-cigarette use creates no actual smoke—only vapor. The act of using an electronic cigarette is therefore termed *vape* and *vaping*.

Electronic Cigarette Regulations in Vermont

In Vermont, state law prohibits the use of e-cigarettes on school grounds and at child care facilities.² Currently, Vermont statutes that impose restrictions on smoking in public places prohibit “the possession of lighted tobacco products.”³ H.171, an act relating to restrictions on the use of electronic cigarettes, would amend these statutes to prohibit the use of tobacco substitutes where possession of lighted tobacco products has already been banned.⁴

Electronic cigarette products are not taxed in Vermont. H. 879, an act relating to the taxation of e-cigarettes, would expand taxes currently placed on tobacco substitutes to include “liquids, whether nicotine based or not, or delivery devices sold separately for use with a tobacco

¹ Breland, Alison, Eric Soule, Alexa Lopez, Carolina Ramôa, Ahmad El-Hellani, and Thomas Eissenberg, “Electronic Cigarettes: What Are They and What Do They Do?” *Annals of the New York Academy of Sciences*, January 1, 2016, accessed April 10, 2016, <http://onlinelibrary.wiley.com/doi/10.1111/nyas.12977/abstract>.

² American Nonsmokers’ Rights Foundation, “States and Municipalities with Laws Regulating Use of Electronic Cigarettes,” accessed April 4, 2016, <http://www.no-smoke.org/pdf/ecigslaws.pdf>.

³ Vermont Statutes Online, Title 18: Health: Chapter 037: Smoking In Public Places, “Restrictions on smoking in public places,” Vermont General Assembly, accessed April 10, 2016, <http://legislature.vermont.gov/statutes/section/18/037/01742>.

⁴ “H. 171: An act relating to restrictions on the use of electronic cigarettes,” Vermont General Assembly, accessed April 10, 2016, <http://legislature.vermont.gov/bill/status/2016/H.171>

substitute.”⁵ The measure would impose a 92 percent tax on electronic cigarette products at point of wholesale.⁶

Health Effects of Electronic Cigarettes

E-cigarettes have only recently become widely popular and consequently are not as well studied as other nicotine delivery methods such as smoking or oral tobacco. While some studies of the health effects of e-cigarettes have been conducted, these studies have not necessarily assessed the long-term health effects of e-cigarette use. As we will discuss below, many studies of e-cigarette use suggest that vaping does have negative health effects in the short-term, but significantly smaller negative effects on a user’s health than those associated with regular cigarettes.

A number of acute negative health effects are associated with e-cigarette use, including airway obstruction, increased blood pressure, and heart palpitations.⁷ In rare cases, some users have reported experiencing more serious effects, such as heart failure, seizures, and disorientation.⁸ E-cigarettes contain the chemical glycerol that when heated produces acrolein, a toxic constituent.⁹ The risk associated with inhaling these chemicals hundreds of times a day is unknown.¹⁰ One concern with flavored e-cigarettes is that they contain different compounds and ingredients have not been tested for safety when inhaled in aerosol form. Further, a number of these flavoring ingredients have been found to be cytotoxic, or toxic to cells.¹¹

One study looked at e-cigarettes *in vitro*, or outside of normal real-life conditions, and found that e-cigarette fluids contained less toxins than normal cigarettes—and have "the potential to demonstrate a decreased human health impact as compared to conventional tobacco-burning cigarettes."¹² This study also concluded that the chemicals in e-cigarettes had very little or no

⁵ “H. 879: An act relating to the Health Care Fund contribution assessment and the taxation of e-cigarettes,” Vermont General Assembly, accessed April 10, 2016, <http://legislature.vermont.gov/bill/status/2016/H.879>.

⁶ Caroline Shapiro, “Vermont grapples with e-cigarette legislation — from taxes to manufacturing and marketing,” *VT Digger*, March 29, 2015, accessed April 20, 2016, <http://vtdigger.org/2015/03/29/vermont-grapples-with-e-cigarette-legislation-from-taxes-to-manufacturing-and-marketing/>.

⁷ Pesko, Michael F., Donald S. Kenkel, Hua Wang, Jenna M. Hughes, “The effect of potential electronic nicotine delivery system regulations on nicotine product selection,” *Addiction*, accessed April 14, 2016, <http://onlinelibrary.wiley.com/doi/10.1111/add.13257/abstract>.

⁸ Ribisl, Kurt M., Andrew B. Seidenberg, Elizabeth N. Orlan, “Recommendations for U.S. Public Policies Regulating Electronic Cigarettes,” *Journal of Policy Analysis and Management*, accessed April 15, 2016, <http://onlinelibrary.wiley.com/doi/10.1002/pam.21898/abstract>.

⁹ Ribisl et al., “Recommendations for U.S. Public Policies Regulating Electronic Cigarettes.”

¹⁰ Ribisl et al., “Recommendations for U.S. Public Policies Regulating Electronic Cigarettes.”

¹¹ Ribisl et al., “Recommendations for U.S. Public Policies Regulating Electronic Cigarettes.”

¹² Misra, Manoj, Robert D. Leverette, Bethany T. Cooper, Melanee B. Bennett, and Steven E. Brown, “Comparative *in vitro* toxicity profile of electronic and tobacco cigarettes, smokeless tobacco and nicotine replacement therapy products: e-liquids, extracts and collected aerosols,” *International Journal of Environmental Research and Public Health* 11.11 (2014): 11325-11347, accessed May 6, 2015, <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4245615/>.

cytotoxic or mutagenic¹³ activity when compared to the harmful Wet Total Particulate Matter (WTPM) of traditional cigarettes.¹⁴

Studies indicate that the nicotine in e-cigarettes itself is not carcinogenic, does not lead to smoking related diseases, and is not known to be very harmful (aside from its well-documented addictive potential).¹⁵ Some e-cigarettes may contain toxic chemicals similar to those found in regular cigarettes, albeit in much lower concentrations.¹⁶ A study of acute health effects associated with e-cigarette use found that vaping did not cause some of the cardiovascular effects observed when traditional cigarettes are smoked.¹⁷ Public Health England, an organization sponsored by the UK Department of Health, which provides research about health concerns, recently began research on the health risks associated with electronic cigarette use. A Public Health England report summarizing the findings of electronic cigarette studies concluded that best estimates show e-cigarettes are 95 percent less harmful to a user's health than normal cigarettes.¹⁸

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 require further research.¹⁹ More data must be collected before the long-term health effects of electronic cigarette use may be accurately assessed.²⁰

Research on Second-Hand Vapor

Research conducted by the Department of Material Analysis and Indoor Chemistry, Fraunhofer Wilhelm-Klauditz-Institut (WKI), Braunschweig, Germany found that secondhand vapor contains

¹³ 'Mutagenic' means capable of causing a mutation in an organism.

¹⁴ Misra, Manoj, Robert D. Leverette, Bethany T. Cooper, Melanee B. Bennett, and Steven E. Brown, "Comparative in vitro toxicity profile of electronic and tobacco cigarettes, smokeless tobacco and nicotine replacement therapy products: e-liquids, extracts and collected aerosols."

¹⁵ Farsalinos, Konstantinos E., and Riccardo Polosa, "Safety evaluation and risk assessment of electronic cigarettes as tobacco cigarette substitutes: a systematic review," *Therapeutic Advances in Drug Safety* 5.2 (2014): 67-86, accessed April 15, 2016, <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4110871/>.

¹⁶ Farsalinos, et al., "Safety evaluation and risk assessment of electronic cigarettes as tobacco cigarette substitutes: a systematic review."

¹⁷ Farsalinos, Konstantinos E., Dimitris Tsiapras, Stamatis Kyrzopoulos, Maria Savvopoulou, and Vassilis Voudris, "Acute effects of using an electronic nicotine-delivery device (electronic cigarette) on myocardial function: comparison with the effects of regular cigarettes," *BMC Cardiovascular Disorders* 14.1 (2014): 78, accessed May 6, 2015, <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4077146/>.

¹⁸ McNeill, A, Brose L.S., Calder R., Hitchman SC., Hajek P., McRobbie H., "E-cigarettes: an evidence update A report commissioned by Public Health England," *Public Health England*, accessed April 15, 2016, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/457102/Ecigarettes_an_evidence_update_A_report_commissioned_by_Public_Health_England_FINAL.pdf.

¹⁹ Callahan-Lyon, Priscilla, "Electronic cigarettes: human health effects," *Tobacco control* 23.2 (2014): 36-40, accessed May 6, 2015, http://tobaccocontrol.bmj.com/content/23/suppl_2/ii36.abstract.

²⁰ Callahan-Lyon, Priscilla, "Electronic cigarettes: human health effects."

nicotine and other harmful constituents.²¹ 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,” or the inhalation of vapors by non-users. However, in contrast to the traditional cigarettes, which burn and therefore emit smoke continuously, the aerosols²² and VOCs²³ from an electronic cigarette are only released during the user’s exhalation.

Research conducted in Spain measured passive exposure to nicotine by non-users who resided in homes with users of e-cigarettes and users of traditional cigarettes.²⁴ 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-cigarettes users.²⁵ 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. A different study found that when comparing passive exposure to nicotine from e-cigarettes and traditional cigarettes in indoor settings, passive exposure to nicotine from e-cigarette use is lower than that caused by traditional cigarette smoke.²⁶ These results show that e-cigarette vapor caused passive exposure to nicotine.²⁷

Electronic Cigarettes as Nicotine Replacement Therapy

One rationale for the recent boom in e-cigarette use is its growing popularity as a tool for cigarette smoking cessation. Nicotine Replacement Therapy (NRT) has long had some success aiding smokers with quitting.^{28,29} NRT is a treatment through which nicotine-dependent smokers use products containing low doses of nicotine while reducing their cigarette

²¹ Schripp, T., D. Markewitz, E. Uhde, and T. Salthammer, "Does e-cigarette consumption cause passive vaping?" *Indoor Air*, 23 (2013): 25–31, accessed May 6, 2015, <http://onlinelibrary.wiley.com/doi/10.1111/j.1600-0668.2012.00792.x/full>

²² Aerosols are particles suspended in air or gas.

²³ Volatile organic compounds (VOCs) are chemicals that evaporate or at room temperature.

²⁴ Ballbea, Montse, Jose M. Martinez-Sancheza, Xisca Suredaa, Marcela Fua, Raul Perez-Ortunog, Jose A. Pascualg, Esteve Saltoi, and Esteve Fernandez, "Cigarettes vs. e-cigarettes: Passive exposure at home measured by means of airborne marker and biomarkers," *Environmental Research* 135 (2014): 76–80, accessed May 6, 2015, <http://www.sciencedirect.com/science/article/pii/S0013935114003089?via%3Dihub>.

²⁵ Ballbea et al., "Cigarettes vs. e-cigarettes: Passive exposure at home measured by means of airborne marker and biomarkers."

²⁶ Gallart-Mateu, D., L. Elbal, S. Armenta, M. de la Guardia, "Passive exposure to nicotine from e-cigarettes," *Talanta: The International Journal of Pure and Applied Analytical Chemistry*, accessed April 15, 2016, <http://www.sciencedirect.com/science/article/pii/S0039914016300819>.

²⁷ Ballbea et al., "Cigarettes vs. e-cigarettes: Passive exposure at home measured by means of airborne marker and biomarkers."

²⁸ Biener, Lois, and J. Lee Hargraves, "A longitudinal study of electronic cigarette use in a population-based sample of adult smokers: association with smoking cessation and motivation to quit," *Nicotine & Tobacco Research* 17.2 (2014): 127-133, accessed May 6, 2015, <http://ntr.oxfordjournals.org/content/17/2/127.abstract>.

²⁹ Polosa, Riccardo, Pasquale Caponnetto, Jaymin B. Morjaria, Gabriella Papale, Davide Campagna, and Cristina Russo, "Effect of an electronic nicotine delivery device (e-cigarette) on smoking reduction and cessation: a prospective 6-month pilot study," *BMC public health* 11.1 (2011): 786, <http://www.biomedcentral.com/1471-2458/11/786>.

consumption.³⁰ Although the FDA has not approved e-cigarettes as a smoking cessation aid, some studies do suggest e-cigarettes may be more effective than traditional NRT products.^{31,32}

Additionally, switching to ENDS (Electronic Nicotine Delivery Systems) leads to fewer of the adverse effects associated with smoking cigarettes.³³ One study assessing ENDS viability as a form of NRT showed ENDS helped some quit using cigarettes completely, while for others e-cigarettes helped to reduce the number of cigarettes participants smoked.³⁴ However, other studies have shown no connection ENDS use and cigarette smoking cessation.³⁵

E-Cigarettes and Taxation

E-Cigarette Taxation in Other States

Electronic cigarettes are taxed in four states—Minnesota, North Carolina, Louisiana, and Kansas – as well as in the District of Columbia.³⁶ An additional 23 states considered proposals imposing excise taxes on electronic cigarette products in 2015.³⁷

In North Carolina and Louisiana, e-cigarette products are taxed by volume, at a rate of five cents per milliliter of nicotine.³⁸ In Kansas, where e-cigarette taxation is set to go into effect on July 1, 2016, e-cigarette products will be taxed twenty cents per milliliter of nicotine.³⁹

In Minnesota, e-cigarettes are treated as tobacco products by the state’s Department of Revenue.⁴⁰ E-cigarette products sold in Minnesota are taxed at 95 percent of wholesale price.⁴¹

³⁰ “Nicotine Replacement Therapy,” United States National Library of Medicine, accessed on April 16, 2016, <https://www.nlm.nih.gov/medlineplus/ency/article/007438.htm>.

³¹ Callahan-Lyon, Priscilla, "Electronic cigarettes: human health effects."

³² Barbeau, Amanda M., Jennifer Burda, and Michael Siegel, "Perceived efficacy of e-cigarettes versus nicotine replacement therapy among successful e-cigarette users: a qualitative approach," *Addict Sci Clin Pract* 8.1 (2013): 5, <http://www.ascjournal.org/content/8/1/5>.

³³ Pesko, Michael F., Donald S. Kenkel, Hua Wang, Jenna M. Hughes, "The effect of potential electronic nicotine delivery system regulations on nicotine product selection."

³⁴ Kaufman, Nancy, and Margaret Mahoney, "E-Cigarettes: Policy Options and Legal Issues Amidst Uncertainty," *Journal Of Law, Medicine & Ethics* 43, 23-26 (2015), accessed April 3, 2016, <http://onlinelibrary.wiley.com/doi/10.1111/jlme.12209/abstract>.

³⁵ Breland et al., "Electronic Cigarettes: What Are They and What Do They Do?"

³⁶ Drenkard, Scott, "Vapor Products and Tax Policy," The Tax Foundation, Accessed on April 9, 2016, <http://taxfoundation.org/article/vapor-products-and-tax-policy>.

³⁷ Drenkard, Scott, "Vapor Products and Tax Policy."

³⁸ Drenkard, Scott, "Vapor Products and Tax Policy."

³⁹ "State Tax Increase Legislation," National Association of Tobacco Outlets, accessed April 14, 2016 http://www.natocentral.org/?page_id=2603.

⁴⁰ Drenkard, Scott, "Vapor Products and Tax Policy."

⁴¹ Drenkard, Scott, "Vapor Products and Tax Policy."

The Effect of Taxes on E-Cigarette Use

The methods by which e-cigarette products are taxed may have distinct effects upon consumer choices. *Ad valorem* taxes, or taxes calculated as a percentage of a product's sale price, such as e-cigarette taxes in Minnesota or proposed in Vermont, affect vapor products differently than specific taxes do.⁴² Disposable e-cigarettes, which may be favored by low-income smokers or consumers without expensive reusable devices, include the value of the device and nicotine fluid in sale prices.⁴³ As a result, these products may be effectively taxed at a higher rate than traditional cigarettes or nicotine fluid for reusable devices.⁴⁴

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.⁴⁵ This study used market trend data to estimate that a ten percent increase in the price of disposable electronic cigarettes would reduce sales by approximately 12 percent.⁴⁶ The same increase in price would reduce sales of reusable e-cigarettes by about 19 percent.⁴⁷ These findings suggest that imposing a tax on electronic cigarettes could potentially lead to a significant reduction in use. Furthermore, this study found that the price of one type of e-cigarette affects the demand for 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.

A survey of 1,200 adult cigarette smokers in the United States sought to measure the likelihood of individuals' tobacco product purchases under hypothetical tax regimes.⁴⁸ The data collected indicates that cigarette smokers are much less likely to purchase disposable electronic cigarettes when their price is high relative to combustible cigarettes.⁴⁹ Taxing electronic cigarettes may reduce harms to public health associated with vaping, while also slowing the adoption of e-cigarettes as smoking cessation tools.⁵⁰

⁴² Drenkard, Scott, "Vapor Products and Tax Policy."

⁴³ Drenkard, Scott, "Vapor Products and Tax Policy."

⁴⁴ Drenkard, Scott, "Vapor Products and Tax Policy."

⁴⁵ Huang, Jidong, John Tauras, and Frank J Chaloupka, "The impact of price and tobacco control policies on the demand for electronic nicotine delivery systems," *Tobacco Control* 23.3 (2014): 41–47, accessed April 6, 2016, <http://www.ncbi.nlm.nih.gov/pubmed/24935898>

⁴⁶ Huang et al., "The impact of price."

⁴⁷ Huang et al., "The impact of price."

⁴⁸ Pesko, Michael F., Donald S. Kenkel, Hua Wang, Jenna M. Hughes, "The effect of potential electronic nicotine delivery system regulations on nicotine product selection."

⁴⁹ Pesko, Michael F., Donald S. Kenkel, Hua Wang, Jenna M. Hughes, "The effect of potential electronic nicotine delivery system regulations on nicotine product selection."

⁵⁰ Pesko, Michael F., Donald S. Kenkel, Hua Wang, Jenna M. Hughes, "The effect of potential electronic nicotine delivery system regulations on nicotine product selection."

Restrictions on Use of E-Cigarettes

Restrictions on Public Use of E-Cigarettes

As of April 4, 2016, seven states have banned the use of electronic cigarettes in private worksites, restaurants, and bars.⁵¹ Seventeen other states, including Vermont, have enacted bans in specific areas such as school properties, universities, or corrections facilities.⁵² According to the Centers for Disease Control (CDC), the recent increase in e-cigarette popularity could be due to marketing, which suggests that the products can be used in places where traditional cigarette smoking is prohibited.⁵³ A 2014 study of tobacco control policies found that full smoking bans are correlated with reduced sales of disposable e-cigarette.⁵⁴ Restrictions on public indoor use could be beneficial to public health if e-cigarette consumption causes passive exposure to nicotine in nonusers.

Attitudes Regarding Public Use

Psychologists at the University of Miami surveyed current and former smokers about their attitudes towards proposed for smoking and vaping bans.⁵⁵ They found that most participants favored indoor smoking bans, but were less supportive of bans that included e-cigarette use (vaping). Individual attitudes towards public use restrictions were 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.⁵⁶ There was no support for restrictions among those who perceived them to pose no health risks.⁵⁷

A similar survey of electronic cigarette users in the United Kingdom indicates e-cigarette users approve of regulations that prohibit vaping near schools or child-care facilities.⁵⁸ This group professed some opposition to public use bans, citing a lack of medical evidence regarding possible risks of secondhand exposure to e-cigarette aerosols and VOCs.⁵⁹ UK e-cigarette users opposed to such restrictions suggested their attitudes could change in light of new research on the risks of vaping in enclosed spaces.⁶⁰

⁵¹ American Nonsmokers' Rights Foundation, "States and Municipalities with Laws Regulating Use of Electronic Cigarettes."

⁵² American Nonsmokers' Rights Foundation, "States and Municipalities with Laws Regulating Use of Electronic Cigarettes."

⁵³ Marynak et al. "State laws."

⁵⁴ Huang, "The impact of price."

⁵⁵ Huang et al., "The impact of price."

⁵⁶ Huang et al., "The impact of price."

⁵⁷ Huang et al., "The impact of price."

⁵⁸ Farrimond, Hannah. "E-Cigarette Regulation and Policy: UK Vapers' Perspectives," *Addiction*, January 1, 2016, <http://onlinelibrary.wiley.com/doi/10.1111/add.13322/abstract>.

⁵⁹ Farrimond, Hannah. "E-Cigarette Regulation and Policy: UK Vapers' Perspectives."

⁶⁰ Farrimond, Hannah. "E-Cigarette Regulation and Policy: UK Vapers' Perspectives."

Additional Restrictions: Flavored E-Liquids

The extent to which electronic cigarettes serve as smoking cessation tools may be affected by flavored e-liquids. However, if flavor availability entices non-smokers to purchase electronic cigarette products, states may opt to prohibit sale of flavored nicotine fluids. Federal law currently prohibits the sale of flavors other than menthol in traditional cigarettes. The Food and Drug Administration's (FDA's) Center for Tobacco Products retains the authority to place similar restrictions on electronic cigarettes, but has declined to take action on the issue.⁶¹ In 2015, Vermont lawmakers proposed legislation banning the sale of flavored liquid nicotine.⁶² Similar bills have been authored in other states, but no flavored e-liquid bans have been passed.⁶³

Conclusion

Electronic cigarettes are increasingly popular devices that vaporize liquids, often containing nicotine, for inhalation. Electronic cigarettes use fluids that may contain toxic chemicals similar to those found in traditional cigarettes, albeit in much lower concentrations.⁶⁴ Studies of e-cigarette use indicate these devices can cause moderate short-term side effects, ranging from sore throat to disorientation. More time is needed before the long-term health effects of electronic cigarette use may be assessed. Some research does indicate electronic cigarettes may hold promise as a form of nicotine replacement therapy, but the FDA has yet to approve e-cigarettes as NRT.

Many states have either passed or proposed legislation to restrict the public use of electronic cigarettes. Such proposals often amend current statutes prohibiting use of cigarettes to include tobacco substitutes and e-cigarettes.⁶⁵ Studies of vaping in closed environments indicate that nonusers may be passively exposed to nicotine through inhalation of secondhand vapor.⁶⁶

Electronic cigarettes are currently taxed in four states.⁶⁷ Taxation may deter non-smokers from experimenting with these new devices, but such added costs may also prevent smokers from substituting electronic cigarettes for traditional cigarettes.⁶⁸ While the Minnesota Department

⁶¹ Pesko, Michael F., Donald S. Kenkel, Hua Wang, Jenna M. Hughes, "The effect of potential electronic nicotine delivery system regulations on nicotine product selection."

⁶² "H. 59: An act relating to banning the sale of flavored liquid nicotine," Vermont General Assembly, accessed April 10, 2016, <http://legislature.vermont.gov/bill/status/2016/H.59>.

⁶³ Pesko, Michael F., Donald S. Kenkel, Hua Wang, Jenna M. Hughes, "The effect of potential electronic nicotine delivery system regulations on nicotine product selection."

⁶⁴ Misra, Manoj, Robert D. Leverette, Bethany T. Cooper, Melanee B. Bennett, and Steven E. Brown, "Comparative in vitro toxicity profile of electronic and tobacco cigarettes, smokeless tobacco and nicotine replacement therapy products: e-liquids, extracts and collected aerosols."

⁶⁵ American Nonsmokers' Rights Foundation, "States and Municipalities with Laws Regulating Use of Electronic Cigarettes."

⁶⁶ Ballbea et al., "Cigarettes vs. e-cigarettes: Passive exposure at home measured by means of airborne marker and biomarkers."

⁶⁷ Drenkard, Scott, "Vapor Products and Tax Policy."

⁶⁸ Pesko, Michael F., Donald S. Kenkel, Hua Wang, Jenna M. Hughes, "The effect of potential electronic nicotine delivery system regulations on nicotine product selection."

of Revenue imposed an *ad valorem* tax on all e-cigarette products, legislatures in Louisiana, North Carolina, and Kansas have passed legislation to tax e-cigarettes by volume of nicotine.⁶⁹ *Ad valorem* taxes, or taxes calculated as a percentage of a good's sale price, may disproportionately affect the price of disposable electronic cigarettes, relative to those of other tobacco substitutes.

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⁶⁹ Drenkard, Scott, "Vapor Products and Tax Policy."