

E-Cigarettes: Current Evidence and Policy

by Kate Lichtenberg, DO

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History of Electronic Cigarettes

The Surgeon General's landmark report on smoking and tobacco celebrated its 50th anniversary in 2014. Since its release, there have been great advances in reducing the rates of smoking. A recent analysis has quantified the effect of tobacco prevention and control interventions since the release of that report. It is estimated that eight million premature deaths have been averted and 175 million years of life have been saved over the last half century as a result of those interventions. Yet, tobacco use continues to cause 443,000 premature deaths a year and \$96.8 billion in productivity losses in the United States alone. Health care spending on smoking-attributable illnesses accounts for 5-14% of total health costs in this country.¹

The first electronic cigarettes (e-cigarettes) were developed in 1965 and were patented in 2003. They were introduced in North America in 2007. Since then, multiple versions have been developed, and it is estimated that there are more than 400 different brand names available on the market. E-liquids are now available in more than 7,000 unique flavors, including kid-friendly

flavors like cherry, bubblegum, and chocolate. E-liquids contain nicotine along with flavorings, propylene glycol, glycerin, and other ingredients. The liquid is heated by the device and aerosolized for inhalation. The vapor has been shown to contain lead, cadmium, nickel, formaldehyde, and hydrocarbons, among other chemicals.^{2,3}

Several sources estimate that 30-50% of e-cigarette sales occur over the internet.⁴ Until the FDA announced in April 2016 that it would begin regulating e-cigarettes and its component parts, there had been no regulation of the devices or the liquid. There was no way for the consumer to know how much nicotine they were inhaling or what other chemicals might be in the e-liquid they were utilizing. Once the new rules are fully enacted, packages will be required to list what the product contains.

Prevalence

Recent epidemiologic surveys estimate e-cigs are the most commonly used tobacco product in U.S. adolescents in the past 30 days at 13.4%. This is followed by hookah, traditional cigarettes, and cigars.⁵ In 2014, there were an estimated 2.46 million middle and high school students that used e-cigarettes. The rate rose to more than three million in 2015. Availability of appealing flavors was the primary reason for use in 81% of current youth e-cigarette users.⁶

Between 2011 and 2015, e-cigarette use rose 900% among high school students.⁷ These products are now the most commonly used form of tobacco among U.S. youth.



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Missouri Prisons Go Smoke-Free

A recent federal court decision has ordered the Missouri prison system to go smoke-free on or before April 1, 2018. The case was brought by an asthmatic inmate who was paired with cellmates who smoked.

Although indoor smoking has already been prohibited inside the state's prisons, the rule was commonly violated. Missouri now joins the majority of other state prison systems in banning smoking. The federal prison system also prohibits smoking.



At least 21% of US adults use tobacco products occasionally. In 2014, an estimated 4% of U.S. adults used e-cigarettes every day or some days. Many of them are dual users of both regular tobacco cigarettes and e-cigarettes. Up to 52% of cigarette smokers also used e-cigarettes in an attempt to lower their cigarette consumption or as a cessation aid. This increases the risk of potential nicotine overdose and toxicity.⁸

Costs

Sales were expected to exceed more than \$3.5 billion in 2015 in the United States.⁹ A pack of name-brand cigarettes in Missouri runs approximately \$5.50. E-cigarette devices start at \$10 and can run upwards of \$100. Disposable devices are less expensive, but even rechargeable devices may need to be replaced periodically. A pack of flavor cartridges or a refill tank of e-liquid costs \$10-15 and may last as long as 150 cigarettes. A pack a day smoker might spend \$2,000 per year on cigarettes, but if using a mid-range priced e-cigarette (\$20) and a refill tank a week (\$15), that cost could be just \$800 per year.³

Missouri continues to have the lowest cigarette tax in the nation, so annual costs would vary based on the state tax rates.

Smoking Cessation Aid or Gateway to Other Drugs?

Proponents of e-cigarettes tout their value as cessation aids, although evidence supporting this is lacking. A review of e-cigarettes commissioned by Public Health England (an executive agency in the United Kingdom's Department of Health) published its review in 2015 declaring vaping is at least 95% safer than smoking.¹⁰ This statement is being used in marketing campaigns in the U.S. and billboards proclaiming this have been seen along Missouri interstates.¹¹

E-cigarette use is strongly associated with the use of other tobacco products in youth and young adults.⁷ Advertising may also be "re-normalizing" nicotine addiction. In addition to the advertising, the media and social influences play important roles in teens' experimentation with "vaping."³

There has been great interest in e-cigarettes over the past seven years, and much research has been conducted. Many studies have looked at the chemical components of the e-liquid and others at use patterns. There have few randomized, controlled studies looking at e-cigarettes as cessation aids. To date, the evidence has shown

that e-cigarettes may be as effective as other forms of nicotine replacement, but only the e-cigarettes require the user to inhale nicotine along with other chemicals. No studies have demonstrated e-cigarettes to be safer or more effective than any currently FDA-approved smoking cessation treatment.^{12,13,14,15,16}

The lack of studies documenting potential harms of e-cigarette use has led to a perceived safety of the devices. Advertising campaigns have promoted e-cigarettes as safer alternatives when it comes to cardiac and lung disease. Analyses have shown that the vapor exhaled by users contains variable levels of formaldehyde, acetaldehyde, isoprene, acetone, propylene glycol, and nicotine in the air. It is unknown if the ultra-fine particles of the vapor affect indoor air quality or have the same effects as tobacco second hand smoke. Because of the relative newness of e-cigarettes, there is very little information on long-term effects and safety, especially among chronic users.¹⁵

Calls to poison control centers continue to concern public health experts. Nationally, from January 1 to October 31, 2016, there have been 1,292 exposures (ingestion, inhalation, absorption) to liquid nicotine across all age groups. Not all exposures have resulted in overdoses or poisonings, but there have been a number of children who have required emergent care.¹⁷ In 2014, more than half of all reported exposures occurred in children under the age of six. A one-year old child died in late 2014 as the result of liquid nicotine ingestion.³

Other health concerns related to e-cigarettes include explosions due to malfunctioning batteries leading to thermal injuries of the face and hands. Some of these have been extensive. No safe levels of inhalation have been established for the nickel, lead, and cadmium that can be found in e-cigarette vapor. Lead exposure is known to cause neurologic damage, especially in children, and can also cause hematologic dysfunction.³

Federal, State, and Local Laws

In 2016, the FDA finalized a rule that grants regulatory authority over all tobacco products including all types of Electronic Nicotine Delivery Systems (ENDS). Beginning in 2018, product packages and advertisements of all of the newly-regulated covered tobacco products must include the warning statement:

“WARNING: This product contains nicotine. Nicotine is an addictive chemical.”⁶

New regulations are being phased in between 2016 and 2019. If a vape shop or other retailer mixes or prepares e-liquids, mixes or modifies vaporizers, or mixes loose tobacco and then sells any of those products, they will be regulated as both a retailer and manufacturer.

Beginning August 8, 2016, retailers were required to begin the following:

- Check photo ID of everyone under age 27 who attempts to purchase e-cigarettes or other ENDS.
- Only sell e-cigarettes and other ENDS to customers age 18 or older.
- Do NOT sell e-cigarettes or other ENDS in a vending machine unless in an adult-only facility.
- Do NOT give away free samples of e-cigarettes or other ENDS, including any of their components or parts.

Further, beginning May 10, 2018, the following will be enforced:

- Do NOT sell or distribute e-cigarettes or other ENDS without a health warning statement on the package.
- Do NOT display advertisements for e-cigarettes or other ENDS without a health warning statement.²¹

State Laws

State laws vary across the country and include everything from a ban on all tobacco products indoors to no law at all.²²

Local County/City Laws

Many counties and cities across the country have enacted local Clean Air Acts. In Missouri, several cities are smoke-free, and recently the age to purchase tobacco products, including e-cigarettes, has been raised to age 21. Columbia led the way in December 2014, and since then, Kansas City, Independence, Gladstone, Grandview, and Lee’s Summit have followed. St. Louis County voted to increase the age in September, and St. Louis City is expected to follow soon.

Table 1. Summary of Statewide Smoke-free Laws

Some Type of Statewide Smoke-Free Law	No Statewide Smoke-Free Law
AZ, AR, CA, CO, CT, DE, DC, FL, HI, IL, IA, KY, ME, MN, NH, NJ, NM, NY, NC, ND, OH, OK, OR, SC, SD, TX, UTZ, VT, VA, WA, WV	AL, GA, ID, IN, KS, LA, MD, MA, MI, MS, MO, MT, NE, NV, PA, RI, TN, WI, WY

Future Considerations and Action

There are environmental concerns with disposal of the devices, the batteries that run the devices, and incompletely used liquid cartridges. Nicotine and heavy metals may pollute both land and water. We can only wait to see what the environmental effects will be.³

In 2016, the MSMA House of Delegates adopted Substitute Resolution 6: Minimum Age for Tobacco and Vapor Product Purchase. The substitute resolution reads: “Resolved, that MSMA support legislation to raise the state’s tax on tobacco and nicotine-containing vapor products and to raise the age required for the purchase of those products from 18 to 21.”²³

In December, 2016, the Surgeon General released his report “E-Cigarette Use Among Youth and Young Adults.” Action can be taken at all levels (national, state, local) and can include incorporating e-cigarettes into smoke-free policies, preventing access to e-cigarettes by youth, price and tax policies, retail licensure, regulation of e-cigarette marketing likely to attract youth, and educational initiatives targeting youth and young adults.⁷

Summary

For now, the evidence does not support recommending e-cigarettes over FDA approved smoking cessation treatments. As more research is done and manufacturers are required to disclose the ingredients in their products, a clearer picture may emerge. Keeping middle-school and high school students from starting to use these devices remains imperative and accidental exposure or ingestion of e-liquids will continue to be a concern for children, but especially those under the age of six.

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