

# E-Cigarettes



## **New Mexico Statewide Epidemiological Outcomes Workgroup White Paper Series**

October 18, 2018

*Produced by Coop Consulting, Inc. on behalf of the  
New Mexico Statewide Epidemiological Outcomes Workgroup*

**Mission** New Mexico’s Statewide Epidemiological and Outcomes Workgroup (SEOW) reviews and disseminates data about substance abuse and misuse and their consequences. It also identifies best practice information about evidence-based prevention strategies, policies and practices that can lead to successful outcomes for New Mexicans. The purpose of this two-fold work is to inform communities so that they can better target behaviors and risk factors that can be positively impacted by the implementation of well-chosen, evidence-based prevention approaches that are appropriate for the population. The important work of the SEOW is directed by the Office of Substance Abuse Prevention (Behavioral Health Services Division, Human Services Department) and supported by federal funding from the Center for Substance Abuse Prevention, Substance Abuse and Mental Health Services Administration.

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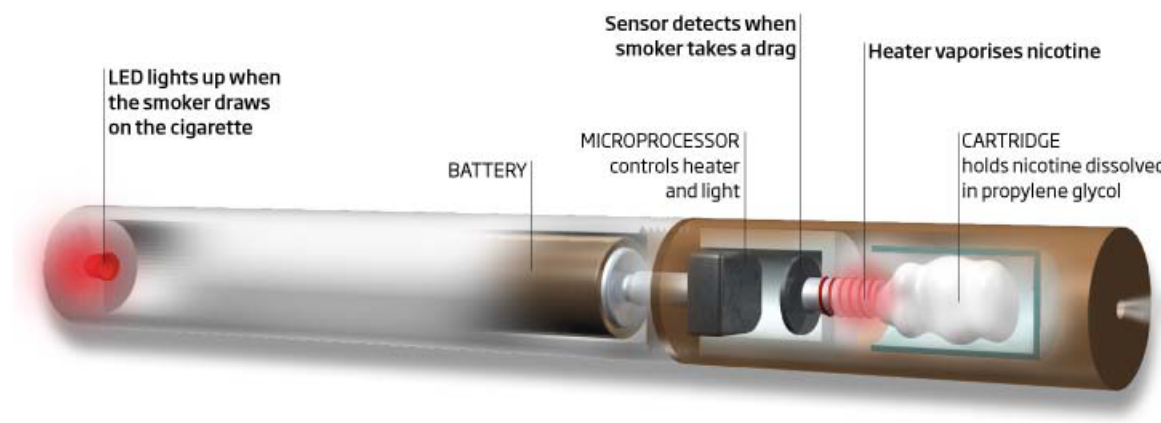
## What are e-cigarettes and how do they compare to traditional cigarettes?

E-cigarettes are nicotine delivery devices that aerosolize nicotine and other chemicals to simulate smoking a traditional cigarette. "Aerosolizing" is the process of converting liquids into small particles that are light enough to be carried in the air. E-cigarettes were developed to mimic the way nicotine is delivered in a traditional cigarette without the harmful effects of tobacco smoke.<sup>1</sup>

The US Food and Drug Administration (FDA) does not currently regulate e-cigarettes, unlike traditional tobacco products. Therefore, the engineering and ingredients of e-cigarettes vary greatly from brand to brand. Most e-cigarettes, however, consist of the following components:

- A battery, which is used to power the e-cigarette
- E-cigarette liquid, which usually contains nicotine in a solution containing propylene glycol or glycerin; most also contain additional flavoring chemicals
- An atomizer, which heats the liquid so that it becomes aerosolized. These generally contain a microprocessor, a metal coil, and a wick that is soaked in the liquid.

Figure 1. Components of an E-Cigarette



Source: Washington Poison Center

The chemical composition of the e-cigarette liquid ("e-liquid") that is aerosolized is largely unknown, since e-cigarettes are not currently regulated. Consumers rarely know exactly what ingredients are being aerosolized, as many e-cigarettes are sold without packaging containing information on their ingredients or risks. Studies have found e-liquids to contain the following ingredients:<sup>2,3</sup>

<sup>1</sup> Demick, Barbara. "A high-tech approach to getting a nicotine fix." *Los Angeles Times* 2009.

<sup>2</sup> Goniewicz, Maciej Lukasz, et al. "Levels of selected carcinogens and toxicants in vapour from electronic cigarettes." *Tobacco Control* 23.2 (2014): 133-139.

<sup>3</sup> Goniewicz, Maciej L., Peter Hajek, and Hayden McRobbie. "Nicotine content of electronic cigarettes, its release in vapour and its consistency across batches: regulatory implications." *Addiction* 109.3 (2014): 500-507.

- *Propylene glycol* – a synthetic liquid mixed with nicotine to maintain moisture. It is approved by the FDA as a “generally safe” food additive with no known risks, although its effects through inhalation are unknown.
- *Vegetable glycerin* – a liquid obtained from plant sources that is mixed with nicotine to maintain moisture. It is approved by the FDA as a “generally safe” food additive with no known risks, although its effects through inhalation are unknown.
- *Carbonyls (formaldehyde, acetaldehyde, propylene oxide)*<sup>4</sup> – compounds that are created when propylene glycol comes into contact with a heated metal coil. These are generally considered harmful to humans – formaldehyde is a confirmed carcinogen, and acetaldehyde is classified as a possible carcinogen.
- *Nicotine* – a stimulant that is highly addictive and causes increase in heart rate and blood pressure. Nicotine itself, in small doses, poses little to no health risks<sup>5</sup>, although nicotine poisoning can cause nausea, vomiting, and potentially respiratory arrest.
- *Tobacco byproducts (particulates, alkaloids)* – compounds formed when curing tobacco and found in e-liquid flavorings. These can cause cancer with repeated exposure.
- *Metals (chromium, copper, aluminum, nickel)* – metals that are present in the atomizer filament and wick in similar levels to traditional cigarettes.<sup>6</sup> Chromium is a known carcinogen, and exposure to other metals can cause irritation.

Exposure to aerosolized e-cigarette liquid is likely to be less harmful than traditional cigarette smoke, although it cannot be considered safe. A lack of regulation in the manufacturing of e-cigarettes and e-liquids and opacity by manufacturers about the ingredients and components contained in e-cigarettes further contribute to the risk associated with e-cigarette exposure.

### **Prevalence of and Trends in E-Cigarette Use**

Relatively little data is available on the prevalence of and trends in e-cigarette use since they are a new phenomenon. However, it is clear that e-cigarette use has increased among both adults and youth since they were first introduced in 2004.

The latest data from the National Health Interview Survey indicates that nationally, 15.3% of adults in 2016 had ever used an e-cigarette, an increase from 12.6% in 2014.<sup>7</sup> In contrast, the same data show that current e-cigarette use (defined as every day or every other day)

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<sup>4</sup> Bekki, Kanae, et al. "Carbonyl compounds generated from electronic cigarettes." *International Journal of Environmental Research and Public Health* 11.11 (2014): 192-200.

<sup>5</sup> Royal College of Physicians of London. *Nicotine without smoke tobacco harm reduction*. 2016.

<sup>6</sup> Williams, Monique, et al. "Metal and silicate particles including nanoparticles are present in electronic cigarette cartomizer fluid and aerosol." *PLoS one* 8.3 (2013): e57987.

<sup>7</sup> Bao, Wei, et al. "Changes in Electronic Cigarette Use Among Adults in the United States, 2014-2016." *JAMA* 319.19 (2018): 2039-2041.

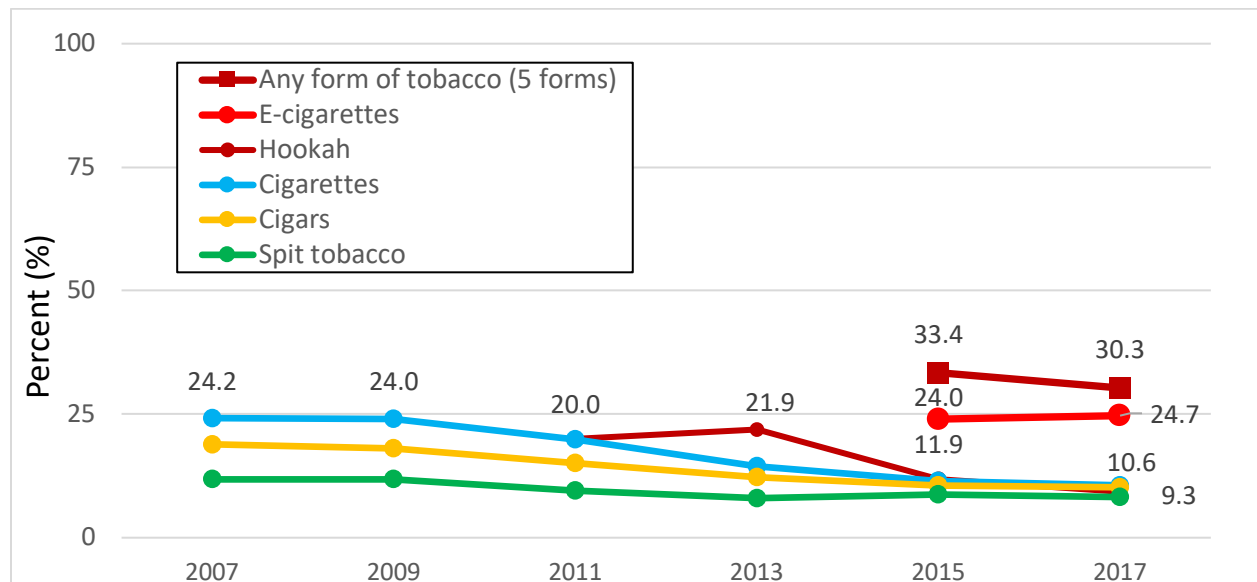
decreased from 3.7% in 2014 to 3.2% in 2016. These trends indicate that some individuals are trying but not continuing to use e-cigarettes.

Nationally, the prevalence of current e-cigarette use among adults is highest among 1) those 18 to 44, 2) males, 3) non-Hispanic whites, and 4) current or former smokers. State-specific results from the Tobacco Use Supplement to the 2014-2015 Current Population Survey indicate that 7.3% of adult New Mexicans had ever used an e-cigarette and 2.5% of adult New Mexicans currently use e-cigarettes, percentages lower than the national average.<sup>8</sup>

E-cigarette use among those under 18 is much more prevalent. Data from the 2017 Youth Risk Behavior Survey indicate that 42.2% of high school students nationally had ever used an e-cigarette, compared to 51.0% of New Mexico high school students. These data also indicate that 13.2% of high school students nationally had used an e-cigarette in the past 30 days, compared to 24.7% of New Mexico high school students.

The use of traditional cigarettes by New Mexico high school students has declined dramatically over the past ten years, from 24.2% in 2007 to 10.6% in 2017. However, there has been a concurrent rise in e-cigarette use among adolescents to a level in 2017 that is similar to the level of traditional cigarette use in 2007. When the use of any form of tobacco (traditional or e-cigarette) is considered, it is estimated that 30.3% of New Mexico high school students currently use tobacco. This indicates that more high school students use some form of tobacco now than they did in 2007, a trend that is largely accounted for by e-cigarette use.

Figure 2. Current Tobacco Use, Grades 9-12, 2007-2017, New Mexico



Source: New Mexico Department of Health, Epidemiology and Response Division

<sup>8</sup> Odani, Satomi, et al. "State-Specific Prevalence of Tobacco Product Use Among Adults—United States, 2014–2015." *Morbidity and Mortality Weekly Report* 67.3 (2018): 97.

Data from the 2017 Youth Risk Behavior Survey indicate that 23.4% of middle school students had ever used an e-cigarette, and 10.9% had used an e-cigarette in the past 30 days. Among both middle and high school students in New Mexico, e-cigarette use is higher among males, Hispanics, and students in higher grades. These data show that nearly 1 in 3 high school seniors had used an e-cigarette in the past 30 days.

Chen et al. (2017) investigated in more depth patterns of e-cigarette smoking onset among children and youth.<sup>9</sup> They found that while the minimum age for traditional cigarette smoking initiation is about 4 or 5 years of age, the minimum age of onset for e-cigarettes is 7 years of age. Different from conventional cigarette smoking, with peak initiation risk at 14 to 15 years of age, the likelihood of initiating e-cigarette use continues to increase up to age 18 years. They note that the pattern of e-cigarette use initiation is more similar to that of alcohol and marijuana, with a rapid increase after 14 years of age and a peak risk around 17 to 18 years of age.

### **E-Cigarette Marketing and Health Disparities**

E-cigarettes are heavily marketed in both traditional print and television advertising as well as in online advertising. These advertisements often feature celebrities and messages that are similar to those advertising traditional tobacco products.<sup>10</sup> Ads often suggest that e-cigarettes are a safer alternative to traditional cigarettes and are helpful to those who want to quit smoking tobacco. Currently there are no laws that address the marketing of e-cigarettes in the same way as laws restricting the advertising of traditional tobacco products.

Major tobacco companies have purchased e-cigarette brands in anticipation of emerging market opportunities. Lorillard first purchased blu eCigs in 2012, followed by Altria (formerly Philip Morris) purchasing the brand Green Smoke in 2014 and RJ Reynolds recently acquiring the VUSE brand – all major e-cigarette brands. After acquisition of blu eCigs, a national marketing campaign was introduced by Lorillard and advertising expenditures increased from \$2.1 million in 2011 to \$14.0 million in 2012.

Television advertisements are particularly problematic as they are the primary way in which youth are exposed to e-cigarette advertising. One study found that youth exposure to television e-cigarette advertisements increased by 256% between 2011 and 2013.<sup>11</sup> Research has indicated a significant relationship between youth exposure to e-cigarette advertising and

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<sup>9</sup> Chen, Xinguang, Bin Yu, and Yan Wang. "Initiation of electronic cigarette use by age among youth in the US." *American Journal of Preventive Medicine* 53.3 (2017): 396-399.

<sup>10</sup> De Andrade, Marisa, Gerard Hastings, and Kathryn Angus. "Promotion of electronic cigarettes: tobacco marketing reinvented?." *British Medical Journal* 347 (2013): f7473.

<sup>11</sup> Duke, Jennifer C., et al. "Exposure to electronic cigarette television advertisements among youth and young adults." *Pediatrics* (2014).

future intentions to use e-cigarettes<sup>12</sup>, making the proliferation of e-cigarette television advertising a serious public health concern.

Figure 2. E-Cigarette Marketing



Source: Campaign for Tobacco-Free Kids

The marketing of “kid-friendly” flavors further contributes to the likelihood of e-cigarette use among youth. One study found 7,764 unique e-cigarette flavors, including some with names like “cotton candy”, “gummy bears”, and “banana split”.<sup>13</sup> In 2018, the FDA issued warning letters to e-cigarette manufactures that misleadingly labeled e-liquids as food products such as juice

<sup>12</sup> Farrelly, Matthew C., et al. "A randomized trial of the effect of e-cigarette TV advertisements on intentions to use e-cigarettes." *American Journal of Preventive Medicine* 49.5 (2015): 686-693.

<sup>13</sup> Zhu, Shu-Hong, et al. "Four hundred and sixty brands of e-cigarettes and counting: implications for product regulation." *Tobacco Control* 23.3 (2014): iii3-iii9.

boxes, candies, and cookies (see below).<sup>14</sup> Candy and fruit-flavored tobacco products were banned in 2009, although flavored e-cigarette products are still legal to sell.

Figure 3. “Kid-friendly” e-cigarette flavoring



Source: Food and Drug Administration

Targeted tobacco marketing strategies towards specific subpopulations has contributed to health disparities in tobacco use and related health outcomes by race, socioeconomic status, and sexual orientation.<sup>15</sup> While data are limited with respect to disparities in e-cigarette use, a recent CDC report indicates a similar pattern is emerging.<sup>16</sup> The report found that e-cigarette use was highest among adults without a high school degree, those with annual incomes under \$20,000, and among those who identify as LGBT.

### Health Effects

E-cigarettes are often advertised as being a safe way to smoke without the harmful health effects cause by traditional tobacco products. While e-cigarettes undoubtedly contain fewer and less toxic chemicals compared to conventional cigarettes, data are currently insufficient to determine the potential health effects and toxicity of e-cigarettes.

Many e-cigarette products contain nicotine, which has been shown to affect brain development and cell functioning in developing humans, and therefore nicotine use by youths and pregnant women can have negative health effects.<sup>17</sup> There is some evidence that the effect of nicotine on the developing brain makes young people more vulnerable to nicotine addiction. Exposure to nicotine at a young age leads to the generation of more nicotine receptors in the brain,

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<sup>14</sup> U.S. Food and Drug Administration. *FDA, FTC take action against companies misleading kids with e-liquids that resemble children's juice boxes, candies and cookies*. 2018.

<sup>15</sup> Dilley, Julia A., et al. "Does tobacco industry marketing excessively impact lesbian, gay and bisexual communities?." *Tobacco Control* 17 (2008): 385-390.

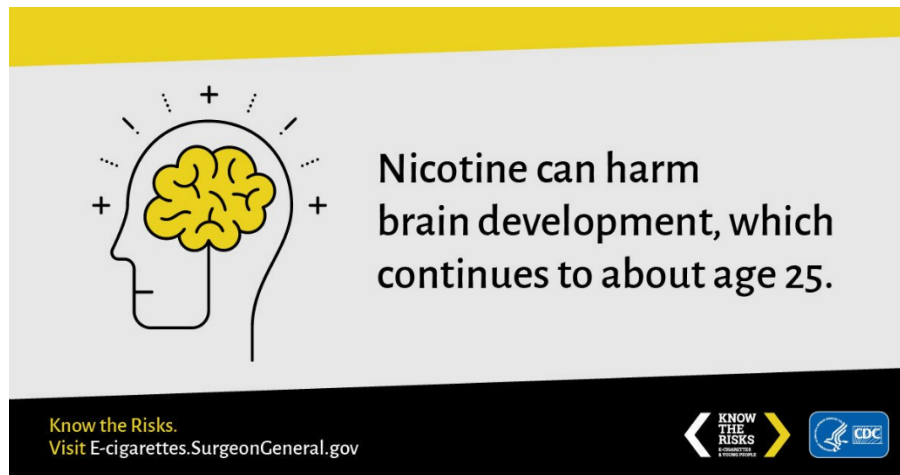
<sup>16</sup> Agaku, Israel T., et al. "Tobacco product use among adults--United States, 2012-2013." *Morbidity and Mortality Weekly Report* 63.25 (2014): 542-547.

<sup>17</sup> Yuan, Menglu, et al. "Nicotine and the adolescent brain." *The Journal of Physiology* 593.16 (2015): 3397-3412.



causing greater dependency, while adults over the age of 25 are generally unable to create more nicotine receptors.<sup>18</sup>

Many e-cigarette flavorings are known to cause respiratory irritation, and research indicates that certain e-cigarette flavorings may be more toxic or irritating than others.<sup>19</sup> The health effects of long-term exposure to aerosolized e-liquid are not yet known, as the products have not been on the market long enough to study them in depth.



### Role in Cigarette Smoking Cessation

The Cochrane Collaboration did a rigorous systematic review in 2016 of published research on the role of e-cigarettes in smoking cessation.<sup>20</sup> They found that compared to the use of e-cigarettes without nicotine, e-cigarettes containing nicotine may boost the chances of long-term cessation, and that there are no increased health risks associated with e-cigarette use compared to smokers who do not use e-cigarettes. However, they noted that there is not yet enough evidence to determine if e-cigarettes are a better cessation aid than the nicotine patch. They rated their confidence in these findings as “low” due to the limited amount of evidence that is currently available.

Large-scale studies using a variety of strategies (i.e., patches, gums, e-cigarettes) are needed to demonstrate if e-cigarettes are effective as a cessation aid. The US Public Health Service does not currently recommend e-cigarettes as a treatment for tobacco addiction in its guidelines, although the American Heart Association has issued a recommendation that e-cigarettes be offered to patients who have failed to quit smoking using currently-approved methods.<sup>21</sup>

<sup>18</sup> Kandel, Eric R., and Denise B. Kandel. "A molecular basis for nicotine as a gateway drug." *New England Journal of Medicine* 371.10 (2014): 932-943.

<sup>19</sup> Muthumalage, Thivanka, et al. "Inflammatory and Oxidative Responses Induced by Exposure to Commonly Used e-Cigarette Flavoring Chemicals and Flavored e-Liquids without Nicotine." *Frontiers in Physiology* 8 (2018): 1130.

<sup>20</sup> McRobbie, Hayden, et al. *Electronic cigarettes for smoking cessation and reduction*. 2014.

<sup>21</sup> Bhatnagar, Aruni, et al. "Electronic cigarettes: a policy statement from the American Heart Association." *Circulation* 130.16 (2014): 1418-1436.

## Regulation

The Family Smoking Prevention and Tobacco Control Act gives the FDA authority to regulate the manufacturing, distribution, and marketing of tobacco products. The law only specifies cigarettes, loose tobacco, and smokeless tobacco as subject to regulation. At the time the law was passed in 2009, e-cigarettes had not yet entered the market and policymakers did not anticipate the need to include them in this legislation.

In 2016, the FDA issued a ruling stating that they would extend their regulating authority to cover e-cigarettes and any other previously unregulated “tobacco products”. However, in August 2017, the FDA delayed a key provision that requires manufacturers to undergo an FDA review of the product’s impact on health and whether it appeals to kids. The FDA delayed the deadline for filing applications until August 2022, and has said that e-cigarette products can remain on the market during the interim period and throughout the review process, which was not given a timeline.<sup>22</sup>

Currently there are no federal restrictions on e-cigarette flavoring or the indoor use of e-cigarettes. There are few federal restrictions on e-cigarette marketing, except that the FDA can deem labeling or advertising as “misleading” at their discretion. There were no regulations on e-cigarette packaging until August 2018, when all e-cigarette products containing nicotine were required to have a warning label that nicotine is an addictive chemical. There is currently no federal tax on e-cigarettes. In 2016, the FDA established a federal minimum age of 18 for the sale of e-cigarette products, although this does not currently apply to Internet sales.<sup>23</sup>

States have the ability to regulate e-cigarettes themselves, and many are starting to do so. Eight states have imposed a tax on e-cigarettes, thirteen states have expanded their smoke-free air laws to include e-cigarettes, and more than 100 municipalities have banned the sale of flavored e-cigarettes.<sup>24</sup> Laws concerning the sale of e-cigarettes in New Mexico are limited. There is currently no special tax placed on e-cigarettes, no permit is required to sell them, and e-cigarettes are not included in New Mexico’s legal definition of tobacco products. The City of Santa Fe is the only municipality in the state that has included e-cigarettes in their indoor smoke-free ordinances.



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<sup>22</sup> U.S. Food and Drug Administration. *Regulations for E-Cigarettes, Cigars, and All Other Tobacco Products*. 2018.

<sup>23</sup> Truth Initiative. *E-Cigarettes: Facts, Stats, and Regulation*. 2018.

<sup>24</sup> Truth Initiative. *E-Cigarettes: Facts, Stats, and Regulation*. 2018.