



MYTHS AND FACTS: E-CIGARETTES

E-cigarettes have gained significant popularity in recent years, rivaling the use of traditional cigarettes, due to a number of myths surrounding their presumed safety and purported benefits.

By Ronale Tucker Rhodes, MS

TOBACCO IS ONE of the most abused substances in the world. According to the Centers for Disease Control and Prevention (CDC), cigarette smoking is the leading cause of preventable disease and death in the U.S., accounting for more than 480,000, or one of every five, deaths each year. CDC estimates that in 2015, 15 of every 100 U.S. adults aged 18 years or older (15.1 percent) smoked cigarettes, which translated to about 36.5 million adults.¹

Fortunately, cigarette smoking is on the decline, with a 6 percent drop in the number of smokers from 2005 to 2015.¹ Furthermore, a high number of current smokers would like to quit, which is no surprise. Quitting means reduced cancer risk, improved physical health, lower insurance premiums, cost savings and elimination of unwanted side effects such as wrinkles, yellow teeth and loss of taste. Yet, because tobacco is such an addictive substance, quitting is far from easy. So, when e-cigarettes debuted in the U.S. in 2007, many looked to them as a possible solution.

Although the first non-tobacco cigarette was patented in 1963, it wasn't until 2003 that the first prototype e-cigarette was developed by Hon Lik, a Chinese pharmacist, who marketed the product as a way to enjoy smoking without the risks.² Today, most e-cigarettes consist of three components: 1) a cartridge that holds a liquid solution containing varying amounts of nicotine, flavorings and other chemicals; 2) a heating device (vaporizer); and 3) a power source (usually a battery). Puffing on the e-cigarette activates the heating device, which vaporizes the liquid in the cartridge. The resulting aerosol, or vapor, is then inhaled, which is known as vaping.³ Today's higher-end models allow users to adjust the voltage from the battery, which regulates the intensity of the heating element. As the solution gets hotter, it intensifies the effect of the nicotine.⁴ E-cigarettes don't replace the actual smoking experience, particularly when it comes to the delivery of nicotine; however, rather than getting into the bloodstream through the lungs, nicotine travels through the soft tissue of the buccal mucosa (the mucous membranes lining the inside of the mouth).²

Today, more than 250 different e-cigarette brands are on the market, with the leading producers in the U.S. including Reynolds American Inc., Fontem U.S. and Logic, reporting total sales of \$795 million for the 52 weeks ending Nov. 2, 2014.⁵ Although e-cigarettes were originally touted as risk-free, much has been learned about their "so-called" safety and purported benefits. Therefore, it would be prudent for smokers who are looking for a better alternative to the tobacco cigarette to choose e-cigarettes only after understanding the facts about them.

Separating Myth from Fact

Myth: The ingredients in e-cigarettes are safe.

Fact: The primary component of e-cigarettes is the liquid contained in the cartridges. To create the liquid, nicotine is extracted from tobacco and mixed with a base (usually propylene glycol) along with flavorings, colorings and other chemicals.

Nicotine is addictive and can lead to negative health impacts, including heart disease, stroke, cancer and decreased adolescent brain development. The more nicotine a person uses, the greater potential for addiction.⁶ Aside from the danger of inhaling nicotine, liquid nicotine (which is contained in the e-cigarette's cartridge, many of which are refillable) is extremely toxic when swallowed. Robert Basset, MD, medical toxicologist and emergency medicine physician at Philadelphia's Einstein Medical Center, said that while nicotine is perceived as safe, it can be fatal when taken in high doses. According to Dr. Basset, "Nicotine mistakenly has this reputation for being safe because it is purchased over the counter." But, he says, one teaspoon of liquid nicotine is enough to kill a 200-pound person.² Indeed, bottles of liquid nicotine are available for individual purchase, some of which may contain as many as 36,000 milligrams of nicotine, which is enough to kill 500 people.⁷

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Poisoning from liquid nicotine can occur by ingestion, inhalation or absorption through the skin or eyes. Reports of poisoning due to e-cigarette liquids is rising, with the number of calls to poison centers increasing from one per month in September 2010 to 215 per month in February 2014, according to a CDC study. More than half (51.1 percent) of calls to poison centers due to e-cigarettes involved young children under age 5, and about 42 percent of calls involved people aged 20 years and older.⁸

Many studies show the substances used in the mix with liquid nicotine could be toxic. While marketers claim flavors used are safe because they have FEMA GRAS status, that status applies only to food, meaning it's safe to eat, but it doesn't apply to inhaling through e-cigarettes. [FEMA is the group of independent experts that evaluates flavor ingredients to determine whether they are generally recognized as safe, or "GRAS," under conditions of intended use.] One flavoring sometimes used is diacetyl, a

buttery flavored chemical often added to food products such as popcorn, caramel and dairy products, which is known to cause a serious and irreversible lung disease commonly known as “popcorn lung.”

Other chemicals are also of concern. In 2009, the U.S. Food and Drug Administration (FDA) conducted lab tests that found detectable levels of toxic cancer-causing chemicals, including an ingredient used in antifreeze, in two leading brands of e-cigarettes and 18 various cartridges. In another review of studies, it was found that levels of toxins in e-cigarette aerosol varied considerably within and among brands. In 2014, a study found aerosol from e-cigarettes with a higher voltage level contains more formaldehyde, another carcinogen that can potentially cause cancer.⁹ Another study found that increasing the voltage from 3.2V to 4.8V while using an e-liquid with glycerin and propylene glycol solvents produced almost as much formaldehyde as a traditional cigarette, which is suspected as being carcinogenic when inhaled. And, while the study also found that at lower voltages, e-cigarettes produced up to 800 times less formaldehyde than a cigarette, the size of the vapor particles can travel deep into the lungs and heavily impact the risk of disease.⁴ In fact, another study in 2014 found that using e-cigarettes has the same short-term effects on the lungs as smoking tobacco cigarettes.¹⁰

Finally, a study in 2015 found that e-cigarettes reduce the body’s ability to fight off infections from strep and flu germs. In the study, mice exposed to e-cigarette vapors for two weeks had an increase in inflammation and susceptibility to infections.¹⁰

Even some products that claim not to have any nicotine in them may still contain it.

Myth: Some e-cigarettes don’t contain nicotine.

Fact: Even some products that claim not to have any nicotine in them may still contain it. In the 2009 FDA lab tests, cartridges labeled as nicotine-free had traceable levels of nicotine. And, they found little consistency between the amount of nicotine delivered by e-cigarettes of the same brand and strength.⁹ Indeed, nicotine levels in e-cigarette juice have been found to be significantly higher or lower than the labels claim. Consequently, users face nicotine intake that is higher than what they’re used to, which can cause mild overdose and feelings of



jitteriness and nausea, or lower than what they’re addicted to, causing withdrawal and cravings.⁷

Myth: E-cigarettes don’t produce dangerous secondhand emissions.

Fact: Breathing secondhand vapor is not totally harmless. While the amount of toxic levels is smaller compared to secondhand smoke, e-cigarettes have the same amount of tiny particles of heavy metals and other substances that can affect the lungs.² Two studies have found formaldehyde, benzene and tobacco-specific nitrosamines (all carcinogens) coming from secondhand emissions. Other studies have shown that chemicals in the emissions contain formaldehyde, acetaldehyde and other potential toxins. As such, the U.S. surgeon general concluded that e-cigarette aerosol is not harmless and can contain harmful and potentially harmful chemicals, including nicotine.⁹

Myth: E-cigarettes help smokers quit the habit.

Fact: While some people use e-cigarettes for the purpose of quitting, and some even vouch for its effectiveness, whether they do help is unclear. Worth noting, FDA’s Center for Drug Evaluation and Research has not approved any e-cigarette as a safe or effective method for quitting. In fact, according to a 2015 CDC survey, 58.8 percent of people who recently used

e-cigarettes also currently smoked conventional cigarettes.⁹ In addition, a 2016 report from the World Health Organization also claimed there was not enough evidence to show e-cigarettes actually help people stop smoking.¹⁰

Myth: E-cigarettes aren't marketed to children.

Fact: According to former CDC Director Tom Frieden, MD, "The same advertising tactics the tobacco industry used years ago to get kids addicted to nicotine are now being used to entice a new generation of young people to use e-cigarettes."¹¹ And, they're doing so with aggressive industry tactics such as cartoon characters and candy flavors, including bubble gum, Froot Loops, chocolate and strawberry.⁶ A joint study by FDA and the National Institutes of Health showed that from 2013 to 2014, about 80 percent of youth tobacco users reported using a flavored tobacco in the past 30 days, with the availability of flavors being the primary reason for use.¹² Discouragingly, a study published in *JAMA Pediatrics* showed kids can easily buy e-cigarettes online.⁹

In 2015, FDA reported that three million middle and high school students were using e-cigarettes.¹² And, according to a report by the U.S. surgeon general, e-cigarette use among youth and young adults is a major public health concern, with e-cigarettes now the most commonly used form of tobacco among youth in the United States. From 2011 to 2015, usage grew an astounding 900 percent among high school students.¹³

Myth: E-cigarettes are not regulated.

Fact: Upon their introduction to the U.S. in 2007, e-cigarettes were not regulated. But, on May 5, 2016, FDA extended the Family Smoking Prevention and Tobacco Control Act of 2009 to regulate e-cigarettes along with other tobacco products.¹² This means manufacturers of e-cigarettes will have to show the products meet the applicable public health standard set forth in the law and receive marketing authorization from FDA.¹⁴ While the regulations are not scheduled to go into effect until FDA has time to fully evaluate e-cigarettes, manufacturers were required to register with FDA by August 8, 2016, after which they have an additional two years to submit an application to remain in the marketplace.⁹ During that time, FDA will conduct a review process to evaluate ingredients, product design and health risks, as well as their appeal to youth and nonusers. FDA will then issue an order granting marketing authorization where appropriate.¹⁴

In addition, under the new FDA regulation, the age requirement for purchasing e-cigarettes as of May 5, 2016, is now 18.¹² And, beginning in 2018, product packages and advertisements of e-cigarettes and other regulated tobacco products must bear the following warning statement: "WARNING: This product con-

tains nicotine. Nicotine is an addictive chemical." If the tobacco product manufacturer submits a self-certification statement to FDA that the tobacco product does not contain nicotine (and the manufacturer has data to support this assertion), an alternate statement must be used on product packages and advertisements: "This product is made from tobacco."¹⁵

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Dispelling the Myths Now

The bottom line: E-cigarettes are a tobacco product, and no tobacco products are safe. Until FDA's evaluation of the 250 brands and 7,700 flavors of e-cigarettes is completed, they will remain on the market, and there are few ways for anyone other than the manufacturers to know what chemicals are contained in e-liquids or how e-cigarette use might affect health in the short- and long-term. For now, understanding the facts surrounding e-cigarettes is the best and only way to decide whether the risks and purported benefits are worth their use. ❖

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References

- Centers for Disease Control and Prevention. Current Cigarette Smoking Among Adults in the United States. Accessed at www.cdc.gov/tobacco/data_statistics/fact_sheets/adult_data/cig_smoking/index.htm.
- Russell J. Industry News: Truths and Myths About E-Cigarettes. *Confirm Biosciences*, July 6, 2016. Accessed at www.confirmbiosciences.com/knowledge/blog/industry-news-truths-and-myths-about-e-cigarettes.
- National Institute on Drug Abuse. Electronic Cigarettes (E-cigarettes). Accessed at drugabuse.gov/publications/drugfacts/electronic-cigarettes-e-cigarettes.
- Dorausch M. Studies Reveal Health Risks of E-Cigarettes. *IGL Science*. Accessed at www.iglsience.com/health-and-medicine/studies-reveal-health-risks-e-cigarettes.
- Statista. Electronic Cigarettes (E-cigarettes) — Statistics & Facts. Accessed at www.statista.com/topics/1913/electronic-cigarettes-e-cigarettes.
- American Lung Association. Myths and Facts About E-Cigarettes. Accessed at www.lung.org/stop-smoking/smoking-facts/myths-and-facts-about-e-cigs.html.
- Debunking the Myths of Electronic Cigarettes. University of California, Davis, *Health Trends*, June 5, 2014. Accessed at shcs.ucdavis.edu/blog/health-trends/debunking-myths-electronic-cigarettes-e-cigs.
- New CDC Study Finds Dramatic Increase in E-Cigarette-Related Calls to Poison Centers. Centers for Disease Control and Prevention press release, April 3, 2014. Accessed at www.cdc.gov/media/releases/2014/p0403-e-cigarette-poison.html.
- American Lung Association. E-Cigarettes and Lung Health. Accessed at www.lung.org/stop-smoking/smoking-facts/e-cigarettes-and-lung-health.html.
- Drain K. Smoking vs. Vaping 2016: 4 Facts and Myths About E-Cigarettes and Health. *Medical Daily*, Nov. 4, 2016. Accessed at www.medicaldaily.com/smoking-vs-vaping-2016-4-facts-and-myths-about-e-cigarettes-revealed-403561.
- Fox M. E-Cigarette Ads Target Millions of Kids, CDC Says. *NBC News*, Jan. 5, 2016. Accessed at www.nbcnews.com/health/kids-health/e-cigarette-ads-target-millions-kids-cdc-says-n490601.
- Drug Watch. E-Cigarettes. Accessed at www.drugwatch.com/e-cigarettes.
- U.S. Department of Health and Human Services. E-Cigarette Use Among Youth and Young Adults: A Report of the Surgeon General 2016. Accessed at e-cigarettes.surgeongeneral.gov/documents/2016_SGR_Full_Report_non-508.pdf.
- FDA Takes Significant Steps to Protect Americans from Dangers of Tobacco Through New Regulation. U.S. Food and Drug Administration press release, May 5, 2016. Accessed at www.fda.gov/NewsEvents/Newsroom/PressAnnouncements/ucm499234.htm.
- U.S. Food and Drug Administration. Vaporizers, E-Cigarettes, and other Electronic Nicotine Delivery Systems (ENDS). Accessed at www.fda.gov/TobaccoProducts/Labeling/ProductsIngredientsComponents/ucm456610.htm.