

**Electronic Nicotine Delivery Systems: Key Facts**  
**CDC Office on Smoking and Health**

**July 2015**

This document outlines key facts related to electronic nicotine delivery systems (ENDS), including e-cigarettes.

- **Youth use of ENDS continues to rise rapidly in the U.S.**
  - From 2011 to 2014, past 30-day use of e-cigarettes increased nine-fold for high school students (1.5% to 13.4%) and more than six-fold for middle school students (0.6% to 3.9%).<sup>1</sup>
  - Nearly 2.5 million U.S. middle and high school students were past 30-day e-cigarette users in 2014, including about 1 in 7 high school students.<sup>1</sup>
  - In 2013, more than a quarter of a million (263,000) middle and high school students who had never smoked cigarettes had ever used e-cigarettes.<sup>2</sup>
  
- **Most adult ENDS users also smoke conventional cigarettes, which is referred to as “dual use.”**
  - In 2012/2013, 1.9% of adults were past 30 day e-cigarette users, including 9.4% of conventional cigarette smokers.<sup>3</sup> Among adult past 30 day e-cigarette users, 76.8% were also current cigarette smokers (i.e., “dual users”) in 2012/2013.<sup>3</sup>
  
- **Nicotine poses dangers to pregnant women and fetuses, children, and adolescents. Youth use of nicotine in any form, including ENDS, is unsafe.**<sup>4,5</sup>
  - Nicotine is highly addictive.<sup>4</sup>
  - Nicotine is toxic to developing fetuses and impairs fetal brain and lung development.<sup>4,5</sup>
  - Because the adolescent brain is still developing, nicotine use during adolescence can disrupt the formation of brain circuits that control attention, learning, and susceptibility to addiction.<sup>5</sup>
  - Poisonings have resulted among users and non-users due to ingestion of nicotine liquid, absorption through the skin, and inhalation.<sup>6</sup> E-cigarette exposure calls to poison centers increased from one per month in September 2010 to 215 per month in February 2014, and over half of those calls were regarding children ages 5 and under.<sup>6</sup>
  - According to the Surgeon General, the evidence is already sufficient to warn pregnant women, women of reproductive age, and adolescents about the use of nicotine-containing products such as smokeless tobacco, dissolvables, and ENDS as alternatives to smoking.<sup>4</sup>

- **Any combusted tobacco use at any age is dangerous.**
  - The burden of death and disease from tobacco use in the U.S. is overwhelmingly caused by cigarettes and other combusted tobacco products.<sup>4</sup>
  - There is no safe level of exposure to secondhand tobacco smoke.<sup>7</sup>
  
- **In order for adult smokers to benefit from ENDS, they must completely quit combusted tobacco use. Smoking even a few cigarettes per day is dangerous to your health.**
  - Smokers who cut back on cigarettes by using ENDS, but who don't completely quit smoking cigarettes, aren't fully protecting their health:
    - Smoking just 1-4 cigarettes a day doubles the risk of dying from heart disease.<sup>8</sup>
    - Heavy smokers who reduce their cigarette use by half still have a very high risk for early death.<sup>9</sup>
  - Benefits of quitting smoking completely:
    - Heart disease risk is cut in half 1 year after quitting and continues to drop over time.<sup>4</sup>
    - Even quitting at age 50 cuts your risk in half for early death from a smoking-related disease.<sup>4</sup>
  
- **ENDS are not an FDA-approved quit aid.**
  - The evidence is currently insufficient to conclude that ENDS are effective for smoking cessation.
  - Seven medicines are approved by the FDA for smoking cessation, and are proven safe and effective when used as directed.<sup>10</sup>
  
- **ENDS aerosol is NOT harmless “water vapor” and is NOT as safe as clean air.<sup>18</sup>**
  - ENDS generally emit lower levels of dangerous toxins than combusted cigarettes. However, in addition to nicotine, ENDS aerosols can contain heavy metals, ultrafine particulate, and cancer-causing agents like acrolein.<sup>11</sup>
  - ENDS aerosols also contain propylene glycol or glycerin and flavorings. Some ENDS manufacturers claim that the use of propylene glycol, glycerin, and food flavorings is safe because they meet the FDA definition of “Generally Recognized as Safe (GRAS). However, GRAS status applies to additives for use in foods, NOT for inhalation. The health effects of inhaling these substances are currently unknown.
  
- **ENDS are aggressively marketed using similar tactics as those proven to lead to youth cigarette smoking.**
  - Although the advertisement of cigarettes has been banned from television in the United States since 1971, ENDS are now marketed on television and other mainstream media channels.

- Spending on advertising of ENDS tripled each year from 2011 to 2013.<sup>12,13</sup> Sales of ENDS also increased dramatically over a similar period.<sup>14</sup>
  - ENDS marketing has included unproven claims of safety and use for smoking cessation, and statements that they are exempt from clean air policies that restrict smoking.<sup>4</sup> These messages could:
    - Promote situational substitution of ENDS when smokers cannot smoke cigarettes, rather than complete substitution of ENDS for cigarettes.
    - Undermine clean indoor air standards, smokefree policy enforcement, and tobacco-free social norms.
  - In a randomized controlled trial, adolescents who viewed e-cigarette TV advertisements reported a significantly greater likelihood of future e-cigarette use compared with the control group. They were also more likely to agree that e-cigarettes can be used in places where smoking is not allowed.<sup>15</sup>
  - Some ENDS companies are using techniques similar to those used by cigarette companies that have been shown in the 2012 Surgeon General’s Report to increase use of cigarettes by youth, including: candy-flavored products; youth-resonant themes such as rebellion, glamour, and sex; celebrity endorsements; and sports and music sponsorships.<sup>13,16</sup>
  - Visual depictions of ENDS use in advertisements may serve as smoking cues to smokers and former smokers, increasing the urge to smoke and undermining efforts to quit or abstain from smoking.<sup>17</sup>
- **Given the currently available evidence on ENDS, several policy levers are appropriate to protect public health:**
    - Prohibitions on marketing or sales of ENDS that result in youth use of any tobacco product, including ENDS.
      - States laws prohibiting sales of ENDS to minors that feature strong enforcement provisions and allow localities to develop more stringent policies are more likely to help prevent youth access.<sup>18</sup>
    - Prohibitions on ENDS use in indoor areas where conventional smoking is not allowed could:<sup>18</sup>
      - Preserve clean indoor air standards and protect bystanders from exposure to secondhand ENDS aerosol.
      - Support tobacco-free norms.
      - Support enforcement of smoke-free laws.
    - When addressing potential public health harms associated with ENDS, it is important to simultaneously uphold and accelerate strategies found by the Surgeon General to prevent and reduce combustible tobacco use, including tobacco price increases, comprehensive smoke-free laws, high-impact media campaigns, barrier-free cessation treatment and services, and comprehensive statewide tobacco control programs.<sup>4,18</sup>

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- <sup>1</sup> Centers for Disease Control and Prevention. Tobacco Use Among Middle and High School Students — United States, 2011–2014. *MMWR* 64(14);381-385.
- <sup>2</sup> Bunnell, Agaku, Arrazola, Apelberg, Caraballo, Corey, Coleman, Dube, and King. Intentions to smoke cigarettes among never-smoking U.S. middle and high school electronic cigarette users, National Youth Tobacco Survey, 2011-2013 *Nicotine Tob Res*.
- <sup>3</sup> King, Patel, Nguyen, and Dube. Trends in Awareness and Use of Electronic Cigarettes among U.S. Adults, 2010-2013 *Nicotine Tob Res* ntu191 first published online September 19, 2014 doi:10.1093/ntr/ntu191
- <sup>4</sup> USDHHS. *The Health Consequences of Smoking – 50 Years of Progress: A Report of the Surgeon General*. Atlanta, GA.: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2014.
- <sup>5</sup> England, L. et al. Nicotine and the Developing Human: A Neglected Element of the E-cigarette Debate. *Am J Prev Med*. 2015 Mar 7. [Epub ahead of print].
- <sup>6</sup> Centers for Disease Control and Prevention. Notes from the field: calls to poison centers for exposures to electronic cigarettes—United States, September 2010 – February 2014. *MMWR* 63(13):292-3.
- <sup>7</sup> USDHHS. *The Health Consequences of Involuntary Exposure to Tobacco Smoke: A Report of the Surgeon General*. Atlanta, GA.: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2006.
- <sup>8</sup> Bjartveit K, Tverdal A. Health Consequences of Smoking 1-4 Cigarettes per Day. *Tobacco Control* 2005; 14(5):315-20.
- <sup>9</sup> Tverdal A, Bjartveit K. Health Consequences of Reduced Daily Cigarette Consumption. *Tobacco Control*. 2006; 15(6): 472–80.
- <sup>10</sup> FDA 101: Smoking Cessation Products. Available at: <http://www.fda.gov/ForConsumers/ConsumerUpdates/ucm198176.htm#learn>
- <sup>11</sup> Goniewicz, ML, Knysak J, Gawron M, Kosmider L, Sobczak A, Kurek J, Prokopowicz A, Jablonska-Czapla M, Rosik-Dulewska C, Havel C, Jacob P, Benowitz N. Levels of selected carcinogens and toxicants in vapour from electronic cigarettes. *Tobacco Control* 2014,23(2): 133–9.
- <sup>12</sup> Kim AE, Arnold KY, Makarenko O. E-cigarette advertising expenditures in the U.S., 2011–2012. *Am J Prev Med* 2014;46:409–12.
- <sup>13</sup> Legacy. Vaporized: E-cigarettes, advertising, and youth. May 2014. Available at: [http://legacyforhealth.org/content/download/4542/63436/version/1/file/LEG-Vaporized-E-cig\\_Report-May2014.pdf](http://legacyforhealth.org/content/download/4542/63436/version/1/file/LEG-Vaporized-E-cig_Report-May2014.pdf).
- <sup>14</sup> Loomis B et al. National and State-Specific Sales and Prices for Electronic Cigarettes—U.S., 2012–2013. *Am J Prev Med* 2015 July 7 [Epub ahead of print].
- <sup>15</sup> Farrelly MC et al. A Randomized Trial of the Effect of E-cigarette TV Advertisements on Intentions to Use E-cigarettes. *Am J Prev Med* 2015 July 8. [Epub ahead of print].
- <sup>16</sup> U.S. Department of Health and Human Services (2012). Reports of the Surgeon General. Preventing Tobacco Use Among Youth and Young Adults: A Report of the Surgeon General. Atlanta (GA), Centers for Disease Control and Prevention (US).
- <sup>17</sup> Maloney EK, Cappella JN. Does Vaping in E-Cigarette Advertisements Affect Tobacco Smoking Urge, Intentions, and Perceptions in Daily, Intermittent, and Former Smokers? *Health Commun*. 2015 Mar 11:1-10.
- <sup>18</sup> Centers for Disease Control and Prevention. State Laws Prohibiting Sales to Minors and Indoor Use of Electronic Nicotine Delivery Systems — United States, November 2014. *MMWR* 63(49);1145-1150.