



## Electronic Cigarettes

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**E**lectronic cigarettes (E-cigarettes) are devices that deliver nicotine to a user by heating and converting to an aerosol a liquid mixture typically composed of propylene glycol, vegetable glycerin, flavoring chemicals, and nicotine<sup>1</sup> (Figure). E-cigarette use doubled in just 1 year among both adults and children, from 3.4% to 6.2% in adults (2010–2011) and 3.3% to 6.8% in youth (2011–2012), with high levels of dual use with tobacco cigarettes.<sup>1</sup> Although most youth using e-cigarettes are dual users, up to one third of adolescents who tried an e-cigarette have never smoked a conventional cigarette, indicating that some youth are initiating use of the addictive drug nicotine with e-cigarettes.<sup>1</sup>

E-cigarettes are aggressively advertised on television, on the radio, on the Internet, and in magazines, and e-cigarette companies sponsor sporting events and music festivals.<sup>1</sup> E-cigarette advertising is very similar to cigarette advertising from the 1950s and 1960s, and e-cigarette products come in kid-friendly flavors (including grape, chocolate, bubble gum, and gummy bear). E-cigarette advertising promises

to deliver nicotine, the addictive drug in cigarettes, without the toxic chemicals produced by burning tobacco cigarettes and without exposing others to secondhand smoke. Marketing for e-cigarettes often describes them as emitting only “harmless water vapor.”<sup>1</sup> This message is often coupled with claims that one can “smoke” anytime and anywhere, often with a list of places where tobacco smoking is restricted, including restaurants, bars, offices, and airplanes.

### What Is Known About E-Cigarettes?

The claim that e-cigarettes emit only harmless water vapor is not true.<sup>1</sup> Although e-cigarette aerosol delivers lower levels of many toxins than cigarette smoke, the aerosol still contains nicotine, ultrafine particles, other toxic chemicals, and carcinogens. Users inhale a heated propylene glycol or glycerin-based solution for which there are no long-term studies. A short-term exposure study showed that 5 minutes of e-cigarette use resulted in a significant increase in airway flow resistance, which, although of unknown clinical

significance, does not support the claim the product is harmless.<sup>2</sup>

There is poor correlation between labeled and actual nicotine content, as well as varying levels of other chemicals and toxicants in the e-liquid and aerosol.<sup>1</sup> Nonsmokers (persons who do not use tobacco cigarettes or e-cigarettes) who are exposed to the exhaled, or secondhand, e-cigarette aerosol have measurable levels of the nicotine metabolite cotinine in their blood.<sup>1</sup>

If someone switched completely from tobacco cigarettes to only using e-cigarettes, he or she would inhale fewer toxic chemicals to get the same dose of nicotine. However, most e-cigarette users continue to smoke tobacco cigarettes (dual use). Because the effects of smoking on the heart, blood, and blood vessels occur at very low levels of smoking (and even secondhand smoke),<sup>3</sup> e-cigarette users are unlikely to experience any benefit in terms of reduced rates of cardiovascular disease. Even cancer risk, which depends to some extent on smoking intensity (cigarettes per day), depends in large part on duration (years of smoking).<sup>4,5</sup> Thus, use of electronic cigarettes to cut

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Product	Description	Some Brands
<b>Disposable e-cigarette</b> 	Cigarette-shaped device consisting of a battery and a cartridge containing an atomizer to heat a solution (with or without nicotine). Not rechargeable or refillable and is intended to be discarded after product stops producing vapor. Sometimes called an e-hookah.	NJOY OneJoy, Aer Disposable, Flavorvapes
<b>Rechargeable e-cigarette</b> 	Cigarette-shaped device consisting of a battery that connects to an atomizer used to heat a solution typically containing nicotine. Often contains an element that regulates puff duration and /or how many puffs may be taken consecutively.	Blu, GreenSmoke, EonSmoke
<b>Pen-style, medium-sized rechargeable e-cigarette</b> 	Larger than a cigarette, often with a higher capacity battery, may contain a prefilled cartridge or a refillable cartridge (often called a clearomizer). These devices often come with a manual switch allowing to regulate length and frequency of puffs.	Vapor King Storm, Totally Wicked Tomado
<b>Tank-style, large-sized rechargeable e-cigarette</b> 	Much larger than a cigarette with a higher capacity battery and typically contains a large, refillable cartridge. Often contains manual switches and a battery casing for customizing battery capacity. Can be easily modified.	Volcano Lavatube

**Figure.** Electronic cigarettes (e-cigarettes) come in many forms and are often not called e-cigarettes by users. Other names include e-hookah, shisha pens, and vape pens (reproduced from Grana et al).<sup>1</sup>

down on number of cigarettes smoked per day is likely to have much smaller beneficial effects on overall survival than quitting smoking completely.

### What Is Known About E-Cigarettes and Smoking Cessation?

E-cigarettes have not been approved in the United States as cessation aids, and as of March 2014, none of the e-cigarette companies had submitted applications to the US Food and Drug Administration to approve them as cessation aids.

Nevertheless, many companies directly or indirectly market the products as helpful for smoking cessation. Many news stories report testimonials from people who say that e-cigarettes helped them quit smoking.

Studies with convenience samples of e-cigarette users show that people use e-cigarettes to try to quit smoking cigarettes.<sup>1</sup> In a randomized trial comparing the effects of the use of nicotine e-cigarette, nonnicotine e-cigarette, and a nicotine patch, neither nicotine-containing or nonnicotine e-cigarettes outperformed the patch, although the users reported liking e-cigarettes better than the patch. As of March 2014, 5 population-based studies had examined

the relationship between e-cigarette use and quitting smoking. Because these studies did not measure whether people were using e-cigarettes as a smoking cessation aid or other reasons for use such as to circumvent smoke-free laws, they did not directly test the efficacy of e-cigarettes as smoking cessation aids. These 5 studies taken together, however, showed that smokers who used e-cigarettes were less likely to quit smoking than smokers who did not use e-cigarettes.<sup>1</sup>

### What Can Clinicians Do When Patients Want to Use E-Cigarettes to Quit Smoking?

A patient who asks a clinician about using the e-cigarette for quitting smoking may be signaling readiness to quit smoking. It is most important to support the patient's quit attempt and to try to ensure that any advice given does not undermine the patient's motivation to quit smoking. Use the opportunity to learn about the patient's motivation to quit, to discuss past experience with cessation, and to encourage and facilitate evidence-based treatment such as smoking cessation counseling (including use of a tobacco telephone quit

line), approved nicotine replacement therapies (eg, patch, gum, or inhaler), and oral nonnicotine medications such as Chantix (varenicline) or Zyban (bupropion),<sup>6</sup> particularly if evidence-based treatments have not been used correctly in the past.

If someone is already using e-cigarettes to quit smoking, support the quit attempt, and encourage him or her to quit all tobacco cigarette use, emphasizing the lack of reduction in health risks from dual use. Inform him or her that e-cigarettes are not approved by the US Food and Drug Administration for smoking cessation. The limited research published to date has not proven that electronic cigarettes are effective smoking cessation aids. Inform patients that e-cigarettes are unregulated and that users cannot be sure what they are exposed to. Given the lack of knowledge about long-term risks and potential harms, patients should also be urged to set a quit date for their e-cigarette use.

### Policy Recommendations

Smoke-free policies are a critical intervention both to protect nonsmokers and to support smoking cessation attempts. To avoid reversing the effectiveness of these policies, e-cigarettes should not be used anywhere where smoking cigarettes is not allowed (including in homes that are smoke-free). There is no reason to reintroduce toxins into clean indoor air environments. As of March 2014, more than 100 communities (including New York, Los Angeles, San Francisco, and Chicago) and 3 states (New Jersey, North Dakota, and Utah) included e-cigarettes in their clean indoor air laws.<sup>1</sup>

As of March 2014, e-cigarettes were not regulated by the US Food and Drug Administration. The product should be regulated by the US Food and Drug Administration, and therapeutic claims (eg, that they are effective for smoking cessation) should be prohibited until such time that the e-cigarette companies provide evidence that, as actually used, e-cigarettes improve cessation success. To prevent youth initiation, e-cigarette advertising should be

subject to the same restrictions (including being prohibited on television and radio) as cigarette advertising, and the use of flavors should be prohibited.

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### Disclosures

Dr Benowitz is a consultant to several pharmaceutical companies that market smoking cessation medications and has been a paid expert witness in litigation against the tobacco companies. The other authors report no conflicts.

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