Emerging Data Show E-Cigarettes May Pose Heart Risk

Bridget M. Kuehn

The use of e-cigarettes likely poses a risk to heart health based on emerging data that suggest it increases cardiovascular risk factors.

E-cigarettes are often promoted as a safer alternative to traditional tobacco cigarettes or even as a cessation tool. The perception that these devices are safer than cigarettes has led to a surge in their use. A 2016 report from the US Surgeon General, for example, noted that 1 in 6 teens now uses e-cigarettes, even as use of traditional cigarettes has dropped in this age group. This has canceled out some of the gains in reducing youth use of nicotine-containing products, explained Holly R. Middlekauff, MD, a cardiologist and professor of medicine at the University of California-Los Angeles.

> *"People who wouldn't have used tobacco products in the past are using e-cigarettes now probably because they think they are harmless," she said.*

However, limited data are available on the health effects of e-cigarettes, particularly the long-term effects of exposure, which could take decades to fully understand. Preliminary studies, however, have suggested that e-cigarette use may cause cardiovascular system changes that have been linked to increased cardiovascular risk.

> *"The main message is they are not harmless," Middlekauf said.*

Preliminary studies suggest that e-cigarettes may be associated with heart risks.

UP IN VAPOR

In an e-cigarette, nicotine is heated along with chemicals like glycerin and polyethylene glycol and flavorings until it becomes a vapor that is then inhaled. E-cigarettes are believed to be safer than traditional tobacco cigarettes because the aerosols they produce do not contain the high levels of carcinogens that result from burning tobacco.

> *"There is likely a greatly reduced cancer risk," said Aruni Bhatnagar, PhD, professor of medicine at the University of Louisville in Kentucky and director of the American Heart Association Tobacco Center.*

But how inhaling e-cigarette vapor affects the heart is only beginning to be studied. Middlekauf and her colleagues conducted a case-controlled study of 42 e-cigarette users and nonuser controls in Los Angeles that was published in *JAMA Cardiology*. Participants had no known health problems and were not taking prescription medications. The study showed changes in heart rate and increased oxidative stress among the e-cigarette users compared with nonusers.

> *"Our e-cigarette users were healthy, but had this same pattern of increased sympathetic tone and decreased vagal tone that has been reported in people with cardiovascular disease," Middlekauf said.*

Other studies have linked these changes to the development of athlerosclerosis. The exact component of e-cigarettes that might be contributing to these changes is unclear. Participants abstained from

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e-cigarette use on the day the measurements were taken so the effects were likely not caused by acute nicotine exposure. However, nicotine might trigger longer term effects on sympathetic nervous system activity and oxidative stress, suggested Middlekauf.

> *"Even when nicotine is out of their system this snowball has begun to form and continues to develop," she said. "Nicotine is a likely culprit."*

Nicotine is known to increase blood pressure and heart rate and to boost the release of catacholamines, Bhatnagar explained. Nicotine patches and other nicotine replacement products are routinely prescribed and have been shown to increase cessation rates without increasing heart risks compared with smoking. However, Bhatnagar noted that patches are designed to deliver nicotine much more slowly than e-cigarettes, which may alter the drug's effects.

> *"The pharmacokinetics are critical here," he said.*

Other components of e-cigarettes might also have harmful effects. For example, e-cigarettes expose users to small particulates, which can cause oxidative stress.

> *"We know that air pollution has a strong effect on cardiovascular risk and the same size particles are in e-cigarette vapor," Bhatnagar said.*

A recent crossover study published in the journal *Chest* showed that smoking a single e-cigarette could affect blood vessel function as much as smoking a conventional cigarette. The study included 20 smokers and 20 nonsmokers. The e-cigarettes, however, did not cause as much inflammation as traditional cigarettes.

> *"The blood vessels were less functional and that has been shown to be detrimental," said Bhatnagar said.*

In addition, >8000 flavorings—many that taste like candy or dessert—are added to e-cigarettes, according to Middlekauf. Although the US Food and Drug Administration may have approved these flavorings for use in food, Bhatnagar said, "we have no idea what they do to people in their lungs." There is cause for concern with a flavoring called diacetyl, noted Middlekauf. This flavoring has been linked to severe lung disease in workers who inhaled it while producing microwave popcorn products, and it is found in many e-cigarette flavorings, according to a 2015 study in the journal *Environmental Health Perspectives*.

FILLING IN THE GAPS

With limited data to guide their decision making, cardiologists trying to advise patients about e-cigarette use are in a tough spot.

> *"They might be less risky, but we don't know how much less risky," Bhatnagar said.*

Studies of traditional cigarettes suggest that although smoking less may reduce lung cancer risk, the cardiovascular diseases risks may be more immediate and less sensitive to how frequently someone smokes, Middlekauf noted.

> *"People who smoke 1 to 3 tobacco cigarettes a day have a similar cardiovascular risk as those that smoke 1 to 3 packs a day," she said. "There's almost an on off [switch for cardiovascular risk]."*

That information can be hard for patients to understand, Middlekauf said, but it is why cardiologists typically recommend that patients try to completely quit cigarettes rather than just cutting back.

Given the many unknowns about e-cigarettes' heart effects, Bhatnagar believes a similar approach makes sense for e-cigarettes.

> *"The goal of cardiologists should always be complete abstinence," Bhatnagar said.*

Further investigation is needed to understand whether a similar risk profile applies to e-cigarettes, including long-term studies. Middlekauf and her colleagues just completed a study comparing the effects of using e-cigarettes that contain nicotine with e-cigarettes that have the same flavorings and chemicals but lack nicotine, which may help tease out the role of nicotine.

Studies that measure the cardiovascular effects of switching from cigarettes to e-cigarettes are also needed, Bhatnagar said. He cautioned that even if e-cigarettes prove to be a useful harm reduction tool, it is imperative to have adequate regulation of e-cigarettes, something the US Food and Drug Administration has recently begun doing. He recommended policies that limit youth access to these devices to prevent another generation of people from becoming addicted to nicotine.

> *"The bigger issue is that some people think that if you liberalize e-cigarette use it will renormalize smoking," he explained.* ■

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