RESEARCHUPDATE
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Hazelden Betty Ford Foundation

Research Update is published by the Butler Center for Research to share significant scientific findings from the field of addiction treatment research.

Vaping and E-Cigarettes

Since their introduction to the United States in 2006, sales of electronic cigarettes (e-cigarettes) have increased rapidly, in part due to a perception that they provide a less harmful alternative to smoking cigarettes. However, a national outbreak in 2019 of electronic-cigarette, or vaping, product use-associated lung injury (EVALI) that led to 2,807 hospitalizations and 68 deaths as of February 2020[1] suggests that while the harms may be different, they can be no less deadly. A decade of research on vaping has answered some of the questions about e-cigarettes' relative harm: this report will summarize what findings have been established conclusively, what needs to be researched further and what this evidence means for the future.

E-cigarettes and vaping versus regular cigarettes and smoking

Regular cigarettes deliver nicotine through the burning of tobacco. Cigarette smoke contains as many as 5,000 chemical compounds, of which 98 have been found to be hazardous to humans.[2] E-cigarettes use electricity to heat a liquid that is converted into a mist, or vapor that is then inhaled, a process that is termed *vaping*.[3] The liquid solution often contains flavoring as well as a variety of other chemical components, which may or may not include nicotine.[4] In one study, the liquid solution from four of the top 10 brands was tested and found to contain over 115 volatile chemical compounds, as well as many others that were produced when the liquid was heated.[5]

Figure 1.1 Diversity of e-cigarette products

Source: Photo by Mandie Mills, CDC

Health risks of vaping versus smoking

Up until recently, the existing evidence suggested that e-cigarette vapors were less harmful to humans' health than cigarette smoke, and may substantially reduce exposure to toxic chemicals among smokers who are unwilling to quit.[6] However, since July 2019, a rapid increase in severe pulmonary disease associated with vaping[7] (EVALI) has called the relative harm of e-cigarettes into question. Characterized by respiratory symptoms such as shortness of breath, cough, and chest pain, as well as gastrointestinal symptoms such as nausea, vomiting, and diarrhea, once EVALI is established, it is serious. In one study of cases from two states, nearly all patients (94%) presenting with the acute illness needed to be hospitalized, with over half into intensive care for respiratory failure. All patients reported at least daily e-cigarette use in the months leading up to the onset of their symptoms, and while many reported vaping THC products, others reported only using nicotine-containing products.[8] The rapid intensification of cases over a four-month period led the Centers for Disease Control and Prevention (CDC) and the U.S. Federal Drug Administration (FDA) to intensify their warning to the public to avoid the use of all

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THE HAZELDEN BETTY FORD EXPERIENCE

The Hazelden Betty Ford Foundation works with individuals addicted to nicotine to help them quit, including those who smoke cigarettes and e-cigarettes. Those who wish to quit nicotine are given support, NRT, or prescription medication (e.g., Chantix) along with a quit plan.

QUESTIONS AND CONTROVERSIES

Question: *What if I buy e-cigarette cartridges with no nicotine in them?*

Response: *One of the main difficulties in assessing the health effects of e-cigarettes lies in the lack of standardization, and this is seen best in the nicotine content. A summary of all the research done thus far concluded that the nicotine content of e-cigarettes varies widely between products, and the amount of nicotine a person inhales increases with higher-powered devices that heat the liquid to a higher temperature.[9] A study of the proportion of e-cigarette products sold at convenience stores and supermarkets that contained nicotine found that 99% of samples contained it, including 36.7% that did not address nicotine content on their labels.[18] Many individuals are also unaware of which popular vaping products contain nicotine. For example, one study found that only 37% of past 30-day users knew that every flavor cartridge of a popular vaping brand sold contains nicotine[19] and is therefore addictive.*

HOW TO USE THIS INFORMATION

For those seeking recovery: *Because the liquid in many e-cigarettes contains nicotine, individuals may become addicted to vaping. However, because these are still relatively new products, no research to date has tested interventions for those looking to quit vaping. There are numerous evidence-based methods for quitting nicotine addiction,[20] but these have yet to be tested with e-cigarette users.*

For service providers: *Until a cause of the surge in EVALI cases is definitively identified, all people should be discouraged from using any vaping product with THC and to exercise caution with any vaping products, in line with the CDC and FDA's current recommendation.[9]*

***For more information about vaping, see our white paper,* Electronic Cigarettes and Teen Health, *and a podcast,* Harms of Vaping.**

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Vaping and E-Cigarettes

vaping products, particularly THC-containing products,[9] as they continue to investigate the cause of the sudden surge in cases.

Researchers of e-cigarettes have long stressed that just because evidence suggests that e-cigarette vapors may be less harmful than cigarette smoke does not mean that vaping comes without health risks. For example, a large study of all available data to date determined that there is conclusive evidence that e-cigarettes contain and produce a number of known and potentially toxic substances.[10] One of the compounds that has been repeatedly identified during the vaping process is formaldehyde, a compound that is classified as carcinogenic to humans.[6,11] Furthermore, while the rapid rise in severe pulmonary disease cases occurred suddenly, years of research have shown worrisome pulmonary effects associated with vaping. One review of all studies assessing the toxicity of e-cigarettes on the lungs found that vaping impacts several regions of the respiratory system, leading to decreased air flow, increased levels of toxicity and increased oxidative stress,[12] considered a precursor of the inflammation that can lead to many chronic diseases.

A comprehensive review of the current evidence relating cancer to e-cigarette use found there are simply not enough studies to draw any meaningful conclusions regarding the relationship between the two.[10] However, in a recent study where mice were exposed to e-cigarette smoke with nicotine for a year, 22.5% developed lung cancer and over 50% developed symptoms regarded as a precursor to bladder cancer,[13] suggesting more in-depth, long-term studies with humans are warranted. It will be many years before long-term studies following the health of e-cigarette users are able to help us understand if vaping causes long-term health problems or not, critical information needed to determine if they are, in fact, a viable alternative to cigarettes.

Does vaping help smokers to quit smoking?

Based on the few high-quality studies that specifically address if e-cigarettes are an effective tool for smoking cessation, the evidence suggests that e-cigarettes may help smokers to quit smoking or reduce the number of cigarettes smoked per day.[14] However, only two studies have directly compared quitting with e-cigarettes against nicotine replacement therapy (NRT; the nicotine patch or gum), resulting in conflicting findings: Bullen et al. (2013)[15] found no significant differences in abstinence rates between those using the nicotine patch and those using e-cigarettes, while Hajek et al. (2019)[16] found that e-cigarettes were more effective than NRT when accompanied by behavioral therapy. E-cigarettes may or may not be better than currently proven methods (NRT) and carry more risk given the unknowns about the short- and long-term health effects.

Conclusion

Cigarettes had been widely used in the United States for decades before conclusive evidence of the link between their use and premature death from cancer and cardiac events was established in the 1950s and early 1960s. The immediate response and ensuing public health campaigns caused the per capita cigarette consumption to begin declining in the same decade. Despite these efforts, the rate of deaths from lung cancer continued to rise for 30 years before peaking in 1990 and declining ever since.[17] This should serve as a cautionary tale for e-cigarettes and vaping: It has been barely over a decade since vaping in its current form was introduced to the United States. In that time, a severe lung disease related to vaping emerged and led to the hospitalization of thousands of otherwise young and healthy individuals, and not enough time has passed since the introduction of e-cigarettes to accurately estimate any long-term health damage. Prospective, multi year population-based studies are needed in order to fully understand the long-term health effects of vaping at the population level and to analyze parallel trends in their effect on helping current smokers to quit smoking. In the meantime, public health policies can and should aim to restrict use, particularly by minors, in order to prevent further deaths and severe consequences as a result of vaping.

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The Butler Center for Research informs and improves recovery services and produces research that benefits the field of addiction treatment. We are dedicated to conducting clinical research, collaborating with external researchers and communicating scientific findings.

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