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. 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. 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. The liquid solution often contains flavoring as well as a variety of other chemical components, which may or may not include nicotine. 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.

**Figure 1.1 Diversity of e-cigarette products**

Source: Photo by Mandie Mills, CDC

Health risks of vaping versus smoking

There is evidence that e-cigarette vapors are less harmful to human health than cigarette smoke, and may substantially reduce exposure to toxic chemicals among smokers who are unwilling to quit; however, this does not mean that vaping comes without health risks. 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. For example, one of the compounds that has been repeatedly identified during the vaping process is formaldehyde, a compound that is classified as carcinogenic to humans. While data is not yet available detailing the long-term effects of vaping, there is some research about how vaping affects a user’s body in the short term. For example, 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, 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 concluded there are simply not enough studies from which to draw any meaningful conclusions regarding the relationship between the two. 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, and to provide the critical information needed 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. However, only one study has compared quitting with e-cigarettes against a method that has already been proven effective. Bullen et al. (2013) found no significant differences in abstinence rates between those using the nicotine patch and those using e-cigarettes. This suggests e-cigarettes are no better than what is currently available and carry more risk given the unknowns about the 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 declined 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. 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, and there is not yet enough research to understand the long-term effects. Prospective, multi-year, population-based studies are needed in order to fully understand the health effects of vaping at the population level and to analyze parallel trends in their effect on helping current smokers quit smoking. Only then will we have the necessary information to make an informed decision about the true effects of vaping and e-cigarettes.

Note: For the most comprehensive report to date summarizing the research on vaping and e-cigarettes, visit the National Academies of Sciences, Engineering, and Medicine at nap.edu/catalog/24952/public-health-consequences-of-e-cigarettes to read the full report online for free (774 pages).

References