

HEALTH EFFECTS OF ELECTRONIC CIGARETTES, VAPES, AND HOOKAH

E-cigarettes, which are sold in over 7,000 flavors, are already known to have negative cardiovascular effects, including an over 40% increased chance of heart attack on top of the risk that comes from smoking any conventional cigarettes.¹

Effects of Nicotine Found in E-Cigs/Vapes²

- Nicotine in youth may have adverse health effects, such as:
 - causing addiction
 - having lasting adverse consequences for brain development and cognition
- Nicotine while pregnant may have adverse health effects, such as:
 - crossing the placenta and effect fetal and postnatal development
 - causing Sudden Infant Death Syndrome (SIDS)
 - resulting in altered corpus callosum
 - creating deficit in auditory processing
 - leading to obesity
- Nicotine in adults may have adverse cardiovascular health effects, such as:
 - increased heart rate
 - increased blood pressure (BP)
 - greater cardiac output, leading to an increase in myocardial oxygen demand
- Other effects include:
 - acute toxicity and possibly death if the contents of refill cartridges or bottles containing nicotine are consumed (often lands in the hands of infants and children who mistake it for food)
 - production of various inflammatory responses, including, at the cellular level, inducing C-reactive protein (CRP) expression, which contributes pro-inflammatory and pro-atherosclerotic effects
 - aerosol produced by e-cigarettes and released into the environment during second hand smoke contains harmful and potentially harmful chemicals, including nicotine



Possible Effects of Other Chemicals Found in E-Cigs/Vapes

E-cigarettes can expose users to several chemicals. In addition to nicotine, carbonyl compounds and volatile organic compounds found in these products are known to have adverse health effects. The health effects and potentially harmful doses of heated and aerosolized constituents of e-cigarette liquids, including solvents, flavorants, and toxicants, are not completely understood.

- **Aldehydes (i.e., benzaldehyde and vanillin):**
 - categorized as primary irritants of the respiratory tract
- **Amino-tadalafil (structural analogue of tadalafil) and rimonabant:**
 - FDA approval of a drug containing tadalafil has been withheld because of unresolved issues involving rimonabant therapy and increased frequencies of psychiatric adverse events, including suicide and an ill-defined constellation of neurologic symptoms and seizures
- **Carbonyls (i.e. formaldehyde, acetaldehyde, acrolein):**
 - levels of carbonyls increase with device voltage
 - long-term exposure to carbonyl compounds increases the risk of cancer
 - **Propylene glycol and glycerol:** not thought to be dangerous on their own; may decompose when heated and be transformed into toxic compounds (for example, formaldehyde)
 - **Acetaldehyde:** an irritant and a probable carcinogen
 - **Acrolein:** may cause respiratory and ocular irritation; in cigarette smoke, it has been linked to several pulmonary diseases, including increased risk of lung cancer, asthma,

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and COPD; a study found an association between acrolein exposure and risk of cardiovascular disease (CVD)

- **Diacetyl (DA) and acetyl propionyl (AP):**
 - used in flavorings, it is associated with a decline in respiratory function in persons exposed to it through inhalation
 - has been implicated in the development of bronchiolitis obliterans, an irreversible respiratory disease also called “popcorn lung disease”
 - acute inhalation exposure to AP has been shown to cause airway epithelial damage similar to DA
- **Diethyl phthalate (DEP) and diethylhexyl phthalate (DEHP):**
 - both DEP and DEHP have estrogenic and antiandrogenic activity that cause premature breast development in girls
- **Tobacco Specific Nitrosamines (TSNAs):**
 - potent carcinogens identified in tobacco and tobacco smoke (NNN, NNK, NAB, and NAT) were found in e-cigs in low levels
 - the aerosol of some e-cigarettes contains traces of the carcinogenic nitrosamines NNN and NNK
- **Toxic heavy metals (i.e., lead and cadmium):**
 - have been found in e-cig aerosols in lab tests conducted at temperatures within the range of most e-cig products

See health effects of flavored tobacco and nicotine products in our companion factsheet.

¹ (Temesgen N, et al. 2017. A cross sectional study reveals an association between electronic cigarette use and myocardial infarction. School of Medicine and Health Sciences Poster Presentations, George Washington University.)

² U.S. Department of Health and Human Services. E-Cigarette Use Among Youth and Young Adults. 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, 2016. https://e-cigarettes.surgeongeneral.gov/documents/2016_SGR_Full_Report_non-508.pdf