

POISON ALERT

MISSOURI
POISON
CENTER



1-800-222-1222

Nicotine - Acute Toxic Hazard in E-Cigarettes

Acute nicotine toxicity in children is on the rise due to the increase in “vaping” with electronic cigarettes by adults. E-cigarettes utilize nicotine and flavoring dissolved in a solution of propylene glycol, polyethylene glycol, and/or vegetable glycerin. When a small quantity of this liquid is passed over an interior heating element, a dense vapor is produced that simulates the smoke of burning tobacco.

Although some e-cigarettes are disposable when empty, most have an intact, self-contained cartridge (cartomizer) with a refillable reservoir, holding 0.3 to 1.6 mL of nicotine liquid. The nicotine concentration typically ranges from 0 to 36 mg/mL, but as high as 72 mg/mL. Liquid nicotine refill bottles typically range in size from 10 to 100 mL, and contain potentially fatal amounts of nicotine if ingested.



Other sources of nicotine include traditional tobacco products; smoking cessation aids in the form of gum, lozenges, transdermal patches, metered dose inhalers, nasal sprays, and spittoons of expectorated saliva from smokeless tobacco users. Blue cohosh, an herbal product used as an abortifacient, contains methylcysteine, a nicotine-like alkaloid.

Ganglionic stimulation then paralysis:

Nicotine is systemically absorbed by all routes. Toxicity is dose-related and occurs in 2 phases: initial acetylcholine receptor stimulation followed by receptor inhibition and failure.

Initial stimulation of ganglion-type nicotinic acetylcholine receptors occurs in the CNS and parasympathetic and sympathetic autonomic ganglia, including epinephrine release from the adrenal gland. Muscle-type nicotinic receptors are not as readily affected.

Peripheral symptoms can be various combinations of sympathetic and parasympathetic activations, such as salivation and vomiting plus tachycardia and hypotension or vagal – mediated bradycardia. Adrenergic influences dominate the cardiovascular system early in toxicity and also with lower doses.

Secondary acetylcholine receptor fatigue and inhibition follows continued presence of high concentration of nicotine at the receptors, so that ganglia do not transmit signals from the brain to the vasculature and other innervated tissues. At very high nicotine doses, neuromuscular transmission may fail causing weakness and respiratory compromise. Death results from the paralysis of respiratory muscle and/or central respiratory failure.

Symptoms of Acute Nicotine Toxicity:

Gastrointestinal: Sharp burning in the mouth and throat on contact, gagging, nausea, vomiting, profuse salivation, cramping abdominal pain, occasionally diarrhea.

Central Nervous System: Headache, dizziness, lethargy, agitation, confusion, incoordination, delirium, seizures and coma.

Cardiovascular: Transient vasospasm-induced hypertension and tachycardia, followed in high doses by hypotension and bradycardia. Hypotension has a prominent orthostatic component if sympathetic ganglia fail. Transient cardiac standstill due to intense vagal stimulation; arrhythmias, and coronary ischemia.

Symptoms: (continued)

Neuromuscular: Muscles fasciculation, poor reflexes, hypotonia, muscle weakness, and respiratory failure.

Toxic Dose:

One cigarette contains 15 to 20 mg of nicotine. Approximately 10% of the available nicotine is delivered by smoking and about 4 mg remains in the cigarette butt after smoking. One cigar contains 15 to 40 mg nicotine. **One to 2 cigarettes or 3 to 6 butts or 1 to 2 mL of 18 mg/mL nicotine liquid** for electronic cigarettes are *potentially* toxic ingestions in children. (McGee 1995).

Two to 5 mg of nicotine can rapidly cause nausea and vomiting, which unloads the stomach of much of the ingested tobacco and its nicotine content. However, vomiting may do little to reduce the rapidly absorbed dose from nicotine liquid.

In general, more than 1 mg/kg is expected to cause significant toxicity; 5 mg/kg is potentially fatal.

Management of nicotine exposure:

- Wash hands and any contaminated skin, if necessary.
 - Avoid activated charcoal due to the expected rapid vomiting and potential for seizures if toxicity is severe.
 - Observe for vomiting within 20 minutes as an early sign of a potentially significant ingestion, especially when the amount of tobacco or nicotine liquid involved is uncertain.
 - Give symptomatic and supportive care with attention to blood pressure, oxygenation, and respiratory effort.
- There is no specific antidote for nicotine.** EKG is not routinely required. Fluids and vasopressors for hypotension; atropine for bradycardia and excessive secretions; benzodiazepines for seizures; ventilator support for patients with muscle weakness or respiratory failure.

Kinetics:

The half-life of nicotine is an hour or less. Mild toxicity rapidly resolves in 1 to 4 hours, but severe toxicity may last 18 to 24 hours.

Laboratory:

Nicotine levels are not clinically useful. Urinary cotinine, a metabolite, can confirm a suspected exposure.

Things to remember:

E-cigarette liquid contains very concentrated nicotine and is more readily bioavailable than the nicotine in tobacco. Nicotine is rapidly absorbed if ingested; the onset of symptoms can be within minutes. Dermal absorption is possible. There is no antidote; treatment of more severe symptoms is symptomatic and supportive.

Assistance with nicotine is just a phone call away!

For consultation with a specially trained Certified Specialist in Poison Information or our Medical Toxicologist; please contact the Missouri Poison Center at 1-800-222-1222.

Healthcare providers can also call 1-888-268-4195.

References:

Betholon JF, Becquemin MH, Annesi-Maesanol, Dautzenberg B. Electronic Cigarettes: A Short Review. *Respiration*. 2013; 86: 433-438.

Goniewicz ML, Kuma T, Gawron M, Knysak J, Kosmider L. Nicotine levels in electronic cigarettes. *Nicotin Tob Res*. 2013; 15(1):158-66.

Goniewicz ML, Knysak J, Gawron M, Kosmider L. Levels of selected carcinogens and toxicants in vapour from electronic cigarettes. *Tob Control*. 2013; 050859: 1-7.

McGee D, Brabson T, McCarthy J, Picciotti M. Four-year review of cigarette ingestion in children. *Pediatr Emerg Care*. 1995; 11(1):13-16.

Poison centers nationwide report an uptick in e-cigarettes and liquid nicotine exposures.

Over 3,000 exposures to e-cigarette devices and liquid refills have been reported in 2014.



PoisonSafe Practices

Cut this public education article out of every issue to copy and distribute or post for your clientele.

Be aware and take care! Electronic Vapor E-Cigarettes

Unfortunately, the vaping craze has reached the toddler set, according to the Missouri Poison Center call statistics. The adult market for smokeless cigarettes that vaporize a nicotine-laced liquid has been booming.

This means that curious kids can find themselves playing with the hand-held vaporizing gadgets and the liquid nicotine inside them.

Nicotine can be a dangerous poison if swallowed or if left on the skin.

There are **3 main types** of electronic cigarettes:

- Disposable e-cigarettes that cannot be refilled and used again.
- An e-cigarette device that uses pre-packaged replacement cartridges.
- An e-cigarette that has a small tank that can be refilled from a big bottle of nicotine liquid.



Disposable and prefilled cartridge e-cigarettes are the least dangerous because the liquid nicotine ordinarily can't leak out unless the cartridge is somehow broken.

However, the refillable devices need to be refilled from larger containers, which are not fitted with child-resistant caps. The liquid nicotine easily flows out and can be swallowed or spilled onto the child's skin or clothing. The nicotine is so concentrated that even a small amount can be toxic. Symptoms occur within minutes and include a stinging bitter taste, drooling, gagging, vomiting, and dizziness. In severe cases, seizures and a fatal drop in blood pressure could occur.

Children's natural behavior and curiosity automatically puts them at risk for dangers within their reach. They also like to play with interesting things they find, and to imitate the grown-ups in their lives, who just might be vaping with e-cigarettes. The final attraction for young children can be the array of colors and candy flavors that the nicotine liquid comes in.

If e-cigarettes are in your home, be aware and take care!

- Always keep e-cigarette devices and liquid nicotine locked up and out of the reach of children.
- Use caution when refilling e-cigarettes. Protect your own skin when handling the products.
- Follow the specific disposal instructions on the label.
- If you think someone has been exposed to an e-cigarette device or liquid nicotine, call the Missouri Poison Center at 1-800-222-1222 immediately.



Poison centers give expert advice fast, over the phone. We can help you and your family with poison emergencies and with questions about poisoning. You can call day or night, 7 days a week, any day of the year.

POISONALERT

A quarterly publication of the Missouri Poison Center

Missouri Poison Center Staff

Specialists in Poison Information

Anne Marie Bailey, RN, CSPI; Maureen Bredenkoetter, RN, CSPI; Jenny Burt, RN, CSPI; Jan Cocayne, RN, CSPI; Jackie Coffey, RN, CSPI; Sue Dougan, RN, CSPI; Barbara Eichhorn, RN, CSPI; Shelly Enders, Pharm D, CSPI; Kendal Gravitt, RN, SPI; Darlene Green, RN, CSPI; Kathy Hahn, BS Pharm, CSPI; Rachel Harrison, RN, CSPI; Sandra Heffner, RN, CSPI; Peggy Huebner, RN, CSPI; Peggy Kinamore, RN, CSPI; Joanne Menendez, RN, CSPI; Julie Moore, RN, CSPI; Sue Nielsen, RN, CSPI; Carolyn Odom, RN, CSPI; Amanda Ruback, RN, CSPI; Tonia Saettele, Pharm D, SPI; Joy Thompson, RN, CSPI; Rosanna Tochtrop, RN, CSPI; Connie Wilkinson, RN, SPI; Janelle Williams, RN, CSPI.

*CSPI denotes Certified Specialist in Poison Information

Managing Director

Julie A. Weber, BS Pharm, CSPI

Medical Director

Rebecca L. Tominack, MD

Public Education Coordinator

Peggy Kinamore, RN, BSN, CSPI

Administrative Assistant

Jimmie Carter

PoisonAlert Editors

Rebecca L. Tominack, MD

Julie A. Weber, BS Pharm, CSPI

PoisonAlert Contributors

Anne Marie Bailey, RN, CSPI

Jenny Burt, RN, CSPI

Shelly Enders, PharmD, CSPI

Peggy Kinamore, RN, CSPI

Carolyn Odom, RN, CSPI

Publisher

Julie Weber

Please send comments and suggestions for future articles to:

Editors, PoisonAlert
7980 Clayton Road, Suite 200
Saint Louis, MO 63117

Or send e-mail to Jimmie_Carter@ssmhc.com

The Missouri Poison Center website can be found at: <http://www.cardinalglennon.com>. Click on Poison Center under the Support Services tab.



Public Education Materials

Missouri Poison Center is offering a variety of educational materials **FREE** of charge including magnets, stickers, and brochures. For a small fee, you can order the Toxic Plants Brochure for your garden club, the Bites and Stings Brochure for your scout troop, or the Poison Look-Alikes Brochure for your child care providers and parents. Please help us teach about poison prevention and spread the word that the Missouri Poison Center is open 24/7 and the call is free and confidential.