E-cigarettes and Vaping

Don't Go Up In Smoke!

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Objectives

Let's Discuss:

-Describe what an e-cigarette is and their mechanism of action

-Explain the risks associated with e-cigarette use

-Interpret the research on e-cigarette use and its effect on the body

Hon Lik

Electronic Cigarettes

-Also known as e-cigarettes, electronic nicotine delivery systems (ENDS), vapes/vaporizer, juul, mods, pods, APVs, e-hookahs

-Devices that are battery operated designed to deliver nicotine and/or flavorings in an aerosol/vapor form

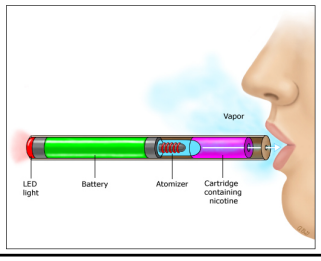
-Engineered in many forms to fit the user's profile

How do e-cigarettes work?

Most e-cigarettes consist of three different components, including:

1. a cartridge/pod/tank, which holds the liquid solution containing varying amounts of nicotine, flavorings, and other chemicals
2. a heating device or atomizer ("atty" - houses the coil and wick that is heated to produce vapor from e-liquid)
3. a power source (usually a battery)

Puffing activates the battery-powered heating device, which aerosolizes the liquid in the cartridge/tank, resulting aerosol inhaled, called "vaping"



Mods vs Pods




MODS

- **Advanced Personal Vaporizer (APV) –** referred to as mods (or modified e-cigarettes), these units are larger, have replaceable batteries (sometimes 2), and can either be variable voltage or wattage
- refillable tank
- customizable coils
- used by enthusiasts (cloud chasers, tricksters)
- geared towards people that want to “tinker with”, modify, and improve the performance of their vaporizers
- Sub Ohm Vaping

Sub Ohm Vaping

- It's all about the coil
- *"Vaping while using an electronic cigarette that has a coil with a resistance level of less than one ohm"*
- Ohm's Law
- Increase the voltage and reduce the resistance of coil (increase size of coil) = increases wattage and vapor production
- Some MODs you can control temperature and wattage mode

Ohm's Law

$$I = \frac{V}{R}$$

Electric current = Voltage / Resistance

Vaping Power Chart: Wattage For Given Voltage and Resistance

Voltage

Coil Resistance in Ohms	3.0	3.2	3.4	3.7	4.0	4.2	4.5	4.75	5.0	5.25	5.5	5.75	6.0	6.25	6.5	6.75	7.0	7.25	7.5	7.75	8.0
1.2	7.5	8.5	9.6	11.4	13.3	14.7	16.9	18.8	20.8	23.5	25.2	27.6	30.0	33.6	35.2	38.0	40.8	43.8	46.9	50.1	53.3
1.3	6.9	7.9	8.9	10.5	12.3	13.6	15.6	17.4	19.2	21.2	23.3	25.4	27.7	30.1	32.5	35.1	37.7	40.4	43.3	46.2	49.2
1.5	6.0	6.8	7.7	9.1	10.7	11.8	13.5	15.0	16.7	18.4	20.2	22.0	24.0	26.0	28.2	30.4	32.7	35.0	37.5	40.0	42.7
1.8	5.0	5.7	6.4	7.6	8.9	9.8	11.3	12.5	13.9	15.3	16.8	18.4	20.0	21.7	23.5	25.3	27.2	29.2	31.3	33.4	35.6
2.0	4.5	5.1	5.8	6.9	8.0	8.8	10.1	11.3	12.5	13.8	15.1	16.5	18.0	19.5	21.1	22.8	24.5	26.3	28.1	30.0	32.0
2.2	4.0	4.7	5.3	6.2	7.3	8.0	9.2	10.3	11.4	12.5	13.8	15.0	16.4	17.8	19.2	20.7	22.3	23.9	25.6	27.3	29.1
2.4	3.8	4.3	4.8	5.7	6.7	7.4	8.4	9.4	10.3	11.5	12.6	13.8	15.0	16.2	17.6	19.0	20.4	21.9	23.4	25.0	26.7
2.8	3.2	3.7	4.1	4.9	5.7	6.3	7.2	8.1	8.9	9.8	10.8	11.8	12.9	14.0	15.1	16.3	17.5	18.8	20.1	21.5	22.9
3.0	3.0	3.4	3.9	4.6	5.3	5.9	6.8	7.5	8.3	9.2	10.1	11.0	12.0	13.0	14.1	15.2	16.3	17.5	18.8	20.0	21.3
3.2	2.8	3.2	3.6	4.3	5.0	5.5	6.3	7.1	7.8	8.6	9.5	10.3	11.3	12.2	13.2	14.2	15.3	16.4	17.6	18.8	20.0
3.5	2.6	2.9	3.3	3.9	4.6	5.0	5.8	6.5	7.1	7.9	8.6	9.5	10.3	11.2	12.1	13.0	14.0	15.0	16.1	17.2	18.3
4.0	2.3	2.6	2.9	3.4	4.0	4.4	5.1	5.6	6.3	6.9	7.6	8.2	9.0	9.8	10.1	11.4	12.3	13.1	14.1	15.0	16.0
4.5	2.0	2.3	2.6	3.0	3.6	3.9	4.5	5.0	5.6	6.1	6.7	7.4	8.0	8.7	9.4	10.1	10.9	11.7	12.5	13.4	14.2
5.0	1.8	2.1	2.3	2.7	3.2	3.5	4.1	4.5	5.0	5.5	6.1	6.6	7.2	7.8	8.5	9.1	9.8	10.5	11.3	12.0	12.8
5.5	1.6	1.9	2.1	2.5	2.9	3.2	3.7	4.1	4.6	5.0	5.5	6.0	6.6	7.1	7.7	8.3	8.9	9.6	10.2	10.9	11.6
6.0	1.5	1.7	1.9	2.3	2.7	2.9	3.4	3.8	4.2	4.6	5.0	5.5	6.0	6.5	7.0	7.6	8.2	8.8	9.4	10.0	10.7
6.50	1.4	1.6	1.8	2.1	2.5	2.7	3.1	3.5	3.9	4.2	4.7	5.1	5.5	6.0	6.5	7.0	7.5	8.1	8.7	9.2	9.9

Legend	Just Right
Too Hot, Burnout Certain	A little cool, decreased vapor
Too Hot, Risk of Coil Burnout	Too cool, minimal vapor
Too warm, some juices may burn	Cold, basically no vapor

Power is measured in watts , calculated by V^2/R

This chart may not apply to RDA's, RBA's, or Clearomizers with advanced airflow systems

PODS

PODS

- usually a closed system where the e-juice is stored in disposable pods
- popular with people that want a simple, easy to use device (former smokers)
- popular with people who want to use quickly, easily, and inconspicuously (youth)
- sleek and relatively inexpensive
- small device that can be tossed in your pocket, purse, nightstand or backpack
- typically small pods of e-juice that can be swapped out in a matter of seconds

Components of E-Cigarette Liquid

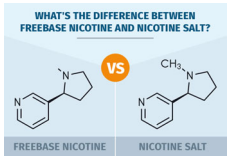
Nicotine: The nicotine content of e-cigarettes and liquids vary in form and strength

Propylene Glycol: produces a better "throat hit", thinner consistency, less gunk/residue, little impact on flavor

Vegetable Glycerin: produces a bigger vapor cloud, thicker consistency, more gunk/residue, sweeter than PG probably impacting flavor

Flavoring: are the same as those used in the food industry

Nicotine



FREEBASE NICOTINE

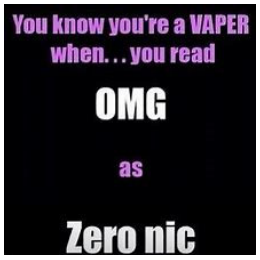
- The addition of **ammonia**, a base, which de-protonates nicotine, making it cross through membranes in the body much more easily
- Increases the "bio-availability" to the lungs, brain and tissues
- Stronger throat hit
- Used in sub ohm devices (MODs)
- Longer effect

NICOTINE SALTS "NIC SALTS"

- The addition of benzoic acid
- Smooth throat hit
- Used in POD systems
- Shorter effect
- Higher concentration of nicotine delivered in devices with a lower power output

Nicotine Dosing

- Strengths of Free Base Nicotine: 6, 12, 18, 36 (45) mg/ml
- Strengths of Nicotine Salts: 25-75 mg/ml
  Juul is 5% nicotine by weight or 59 mg/ml
  one Juul pod is 0.7 ml or approximately 45 mg nicotine
- There is no well-demonstrated figure for the amount of nicotine in e-cigarette vapor and no agreement on how much of the nicotine in e-liquid is transferred into the vapor
- Individuals ultimately decide on an equivalence. There seems to be a wide variation in the individual tolerance to nicotine



Nicotine Exposure

- Nicotine exposure from e-cigarette use
  - -increases heart rate and blood pressure
  - -produces measurable levels of blood cotinine, a nicotine metabolite
- The amount of nicotine delivered and the level of nicotine in the blood varies depending on nicotine concentration, user experience, puffing intensity, device characteristics, and vaping technique[1]
- Experienced e-cigarette users use the device more intensively and have higher blood nicotine levels than less-experienced users. The nicotine delivered by free base nicotine in e-cigarettes is consistently lower than nicotine delivered by conventional cigarettes[2]

Components of E-Cigarette Liquid

Flavorings – Unlike conventional cigarettes, e-cigarettes can be sold with varying flavors. More than 7000 flavors are available, including candy, fruit, soda, and alcohol flavors. Flavorings may increase the attractiveness of e-cigarettes to youths, especially those who are not already smokers.

Components of E-Cigarette Liquid

Other compounds – Metals such as tin, lead, nickel, and chromium have been found in e-cigarette liquids and vapor. Other compounds detected include tobacco-specific nitrosamines, carbonyl compounds, metals, volatile organic compounds, and phenolic compounds.

Risks of Vaping vs Combustible Tobacco

- E-cigarettes spare the user exposure to many of the ingredients in traditional cigarette smoke (eg tars, oxidant gases, and carbon monoxide) [3]
- Inhaling e-cigarette vapor is likely to be less harmful than inhaling cigarette smoke [3,4]
- Consequences of chronic inhalation of e-cigarette vapor are unknown. The levels of toxic and carcinogenic compounds may vary by e-cigarette liquid components and device used [5]

Risks of Vaping: Pulmonary Fibrosis

- The effect of inhaling flavoring in respiratory function is not completely clear[6]
- Some studies have found a link between cytotoxicity (cell death) and certain flavorings, especially sweet and cinnamon flavors[7]
- The chemical diacetyl (particularly sweet-flavored e-cigarettes) is linked to bronchiolitis obliterans - referred to as "popcorn lung" which is a scarring of the tiny air sacs in the lungs resulting in the thickening and narrowing of the airways causing coughing, wheezing and shortness of breath[8]
- Cherry-flavored e-cigarettes have been found to contain benzaldehyde, a compound that has been associated with respiratory irritation[9]

What's in the Vapor:

Toxic chemicals are formed as the e-liquid heats up to make the aerosol that e-cig users inhale

AEROSOL COMPOSITION

Propylene glycol	Chlorobenzene	Benzo(ghi)perylene	Cadmium
glycerin	Crotonaldehyde	Acetone	Silicon
Flavorings (many)	Propionaldehyde	Acrolein	Lithium
Nicotine	Benzaldehyde	Silver	Lead
NNN	Valeric acid	Nickel	Magnesium
NNK	Hexanal	Tin	Manganese
NAB	Fluorine	Sodium	Potassium
NAT	Anthracene	Strontium	Titanium
Ethylbenzene	Pyrene	Barium	Zinc
Benzene	Acenaphthylene	Aluminum	Zirconium
P,m, xylene	Acenapthene	Chromium	Calcium
Toluene	Fluoranthene	Boron	Iron
Acetaldehyde	Benz(a)anthracene	Copper	Sulfur
Formaldehyde	Chrysene	Selenium	Vanadium
Naphthalene	Retene	Arsenic	Cobalt
Styrene	Benzo(a)pyrene		Rhubidium
Benzo(b)fluoranthene	Indeno(1,2,3-cd)pyrene		

Compounds in yellow are from FDA 2012, Harmful and Potentially Harmful Substances – Established List

Risks of Vaping: Exposure to Formaldehyde

- Both propylene glycol (PG) and vegetable glycerin (VG) decompose to form the carcinogens formaldehyde and acetaldehyde, with levels varying depending on the voltage of the battery used
- Overall safety regarding effects of propylene glycol or glycerol when heated and aerosolized is unknown

At high temperatures:

PG→ propylene oxide
(a probable human carcinogen)[10]

VG → acrolein
(a toxin, but levels lower than conventional cigarettes)[11]

Risks of Vaping: Lipoid Pneumonia

- Exogenous forms of lipid (vegetable glycerin or vitamin E acetate?) inhaled, lipid is phagocytosed by macrophages which fill alveoli causing an acute pneumonitis
- Presents with ground glass opacities and consolidation
- Fevers, chills, shortness of breath
- Cough, chest pain, hemoptysis
- Vomiting, night sweats, weight loss

Risks of Vaping: Nicotine Addiction

-Nicotine drives repetitive long term use

-The use of nicotine salts allows for higher concentrations of nicotine to be delivered

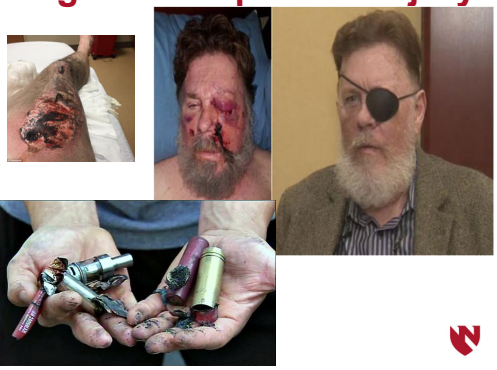
-The amount of nicotine delivered and the level of nicotine in the blood varies depending on nicotine concentration, user experience, puffing intensity, device characteristics, and vaping technique

-It produces measurable levels of blood or urine cotinine, a nicotine metabolite

Risks of Vaping: Device Failure

- No specific data, given lack of reporting
- Typically occurs secondary to failure of lithium battery
- Of those reported, 80% of incidents occurred during charging of the device[14]
- Generally characterized as explosions, events occurred suddenly and accompanied by a loud noise, a flash of light, smoke, flames, and often vigorous ejection of the battery and other parts that can cause combustible items to ignite
- Incidents occurring while at use can cause serious injury

E Cigarette Explosion/Injury



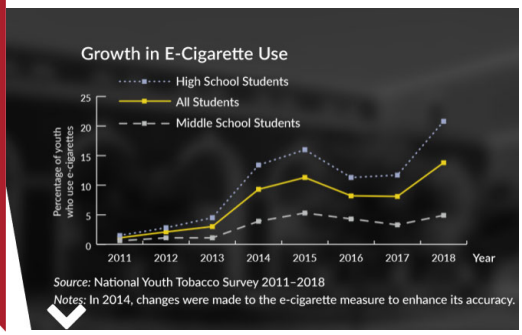
Adolescent Use

E-cigarettes use has been rising among adolescents in the United States[12]

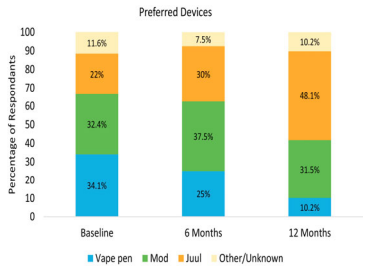
- E-cigarette use grew 78% among high school students and 48% among middle school students in just one year from 2017 to 2018
- Middle and high school students report current use of e-cigarettes more than conventional cigarettes, and e-cigarette use has surpassed use of any other tobacco product

The BRAIN:
- Brain and judgement not formed until age 25
- Nicotine Addiction
- Mood disorders
- Lowers impulse control
- Affects attention and learning

Behavior Risks:
- E-cigarette use among youth and young adults is strongly linked to the use of other tobacco products, such as regular cigarettes, cigars, hookah, and smokeless tobacco
- Some suggest "gateway" to alcohol use and other substance use[13]
- E cigarettes as vessels for illicit drugs



So What Devices are being used?



Vogel, EA. et al. Journal of Adolescent Health, 64 (2019) 770-775

Risks of Vaping: Nicotine Poisoning

When an individual is exposed to nicotine, their symptoms are directly related to the dose of nicotine they received. Mild nicotine poisoning causes nausea, vomiting, dizziness, tremors, sweating and high blood pressure. Severe poisoning can be life-threatening and lead to seizures or even death.

The American Association of Poison Control Centers recommends the following steps:

- Protect your skin when handling the products
- Always keep e-cigarettes and liquid nicotine locked up and out of the reach of children
- Follow the specific disposal instructions on the label
- If you think someone has been exposed to an e-cigarette or liquid nicotine, call your local poison center at 1-800-222-1222

Risks of Vaping: Accidental Poisoning

From January 2011 to August 30, 2018, a total of 650 emergency calls related to tobacco/nicotine poisoning were received by the Nebraska Regional Poisoning Center, with a significant increase in the number of nicotine liquid poisoning cases in 2014 and 2015. Most of the tobacco-related emergencies (82%) were involving young children less than age 6

Number of Tobacco-Related Calls to Nebraska Regional Poison Center

	2011	2012	2013	2014	2015	2016	2017	2018 (through 6/31/18)	Total
Cigarettes	51	45	43	43	49	51	37	25	**344**
Smokeless Tobacco	6	9	6	17	11	12	15	14	**90**
Other Tobacco (Including Unknown)	3	4	10	5	1	6	11	4	**44**
Electronic Cigarette or Nicotine Liquid	4	2	11	36	37	32	23	27	**172**
Total	**64**	**60**	**70**	**101**	**98**	**101**	**86**	**70**	**650**

Source: Nebraska Regional Poison Center

Talking to your child

When talking about vaping, play it casual. Ask them if they have heard of it and what they know.

Teens whose parents talk to them about these difficult subjects make better choices

Keep it open-ended. Teenagers will look for any chance to answer a question with a yes or no. What do you think about vaping?

Talk about the uncertainty of e-cigarette safety and about the definite possibility of addiction to nicotine that goes along with vaping

Stress the seriousness of vaping as a decision to not just make on a whim, but one with potential consequences to their health

Children of people that use e-cigarettes and other nicotine products are more likely to use them

Be the message. If you don't want your kids to vape, don't vape either!

Nebraska Legislation

How does the state define an e-cigarette?
Electronic nicotine delivery system means "any product or device containing nicotine, tobacco, or tobacco derivatives that employs a heating element, power source, electronic circuit, or other electronic, chemical, or mechanical means, regardless of shape or size, to simulate smoking by delivering the nicotine, tobacco, or tobacco derivatives in vapor, fog, mist, gas, or aerosol form to a person inhaling from the product or device [including] any substance containing nicotine, tobacco, or tobacco derivatives, whether sold separately or sold in combination with [an aforementioned product, and products] marketed, manufactured, distributed, or sold as an electronic cigarette, electronic cigar, electronic cigarillo, electronic pipe, electronic hookah, or similar products…and any component, part or accessory [of such a product]."
Neb. Rev. Stat. § 28-1418.01(3) (2019) (effective January 1, 2020)

Is there a state excise or special tax (non-sales tax) placed on e-cigarettes?
N/A

What regulations are in place for e-cigarette packaging?
N/A

What restrictions are in place for retail or youth access?
Sale/distribution of electronic nicotine delivery systems to persons under age 19 prohibited.
Neb. Rev. Stat. §§ 28-1419, 28-1425 (2019) (increased MLSA effective January 1, 2020)
Use of electronic nicotine delivery systems by persons under age 19 prohibited.
Neb. Rev. Stat. § 28-1418 (2019) (increased MLSA effective January 1, 2020)
Persons under age 19 prohibited from obtaining electronic nicotine delivery systems.
Neb. Rev. Stat. § 28-1427 (2019) (increased MLSA effective January 1, 2020)
Vending machine sales of vapor products are restricted to locations inaccessible to the general public or in locations where liquor is sold.
Neb. Rev. Stat. § 28-1429.02 (2019) (increased MLSA effective January 1, 2020)
Self-service displays restricted to tobacco specialty stores and cigar bars.
Neb. Rev Stat. § 28-1429.03 (2019)

Is a retail license or permit required to sell e-cigarettes?
Yes.
Neb. Rev. Stat. § 28-1420 (2019) (effective January 1, 2020)

What smoke-free restrictions exist for e-cigarette use?
N/A

iQOS

- IQOS heats specially designed tobacco units call HeatSticks
- Heat-not-burn products differ from e-cigarettes because they use actual tobacco, not the flavored e-liquid
- Heated tobacco products are not proven to be safer than cigarettes
- According to a commentary from Tobacco Control, "Tobacco companies are attempting to undermine government regulation by using harm reduction claims as a strategy for reframing the industry as part of the solution instead of part of the problem"

PRECAUTIONARY PRINCIPLE: *Introduction of a new product or process whose ultimate effects are disputed or unknown should be resisted*

The importance of interactions between providers and patients

E-cigarettes are not safe for youth, young adults, pregnant women, or adults who do not currently use tobacco products

If you've never smoked or used other tobacco products or e-cigarettes, DON'T START

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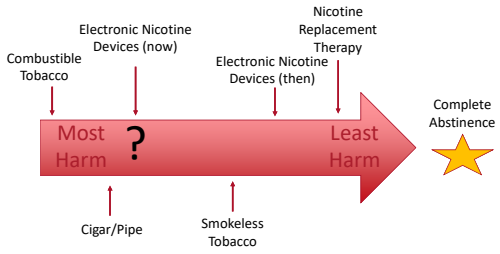
What I Tell Patients About E-Cigarettes?

- E-cigarettes are not approved by the US Food and Drug Administration (FDA) for smoking cessation and the FDA has not endorsed their safety or efficacy as a cessation method
- Using e-cigarettes is probably less harmful than smoking conventional/combustible cigarettes, but we do not know how safe they are to users or to those around them
- E-cigarettes will continue to expose user to nicotine and other compounds
- Ultimate long term health consequences of vapor exposures are unknown

The Nicotine Risk Continuum



Newsworthy…

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