

The Adolescent Vaping Epidemic:

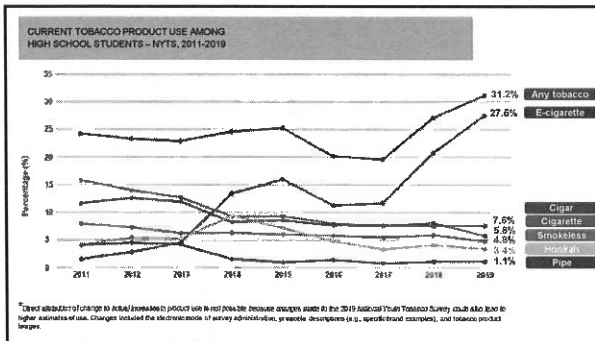
Seeing Through The Haze

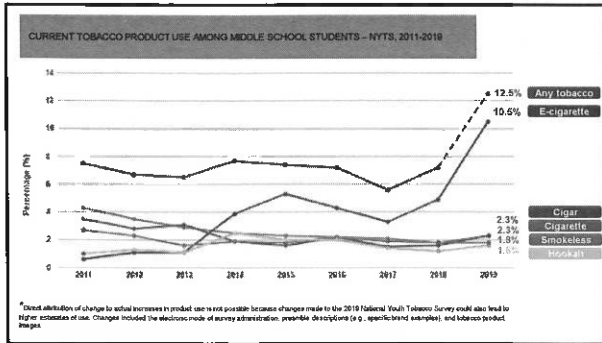
Brian Burt, PA-C, MSHS, DFAAPA
 CDR, USPHS
 IHS Deputy Chief PA

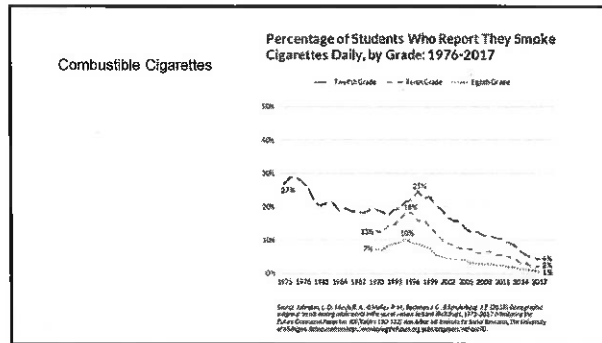


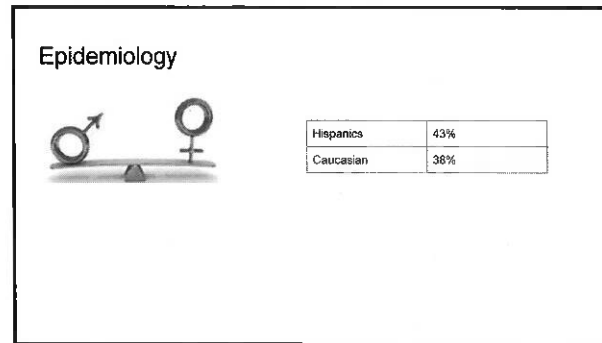
Pre-presentation assessment of knowledge

- 1) What percentage of high school students vaped in the last 30 days?
- 2) Vaping is safer than smoking combustible cigarettes. True or False?
- 3) There are no risks to bystanders (secondhand vapor). True or False?
- 4) Vaping can lead to bronchiolitis obliterans (Popcorn Lung), True or False?



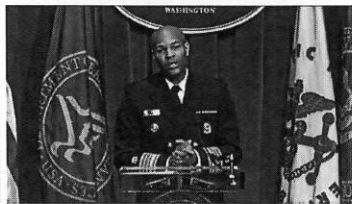






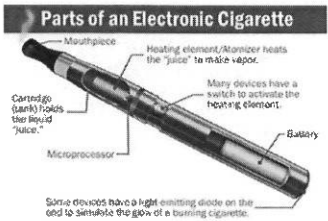
E-cigarette use among high school students grew 900% from 2011 to 2015





"I am officially declaring e-cigarette use among youth an epidemic in the United States" - US Surgeon General VADM Adams Dec 18, 2014

What is an E-Cigarette?

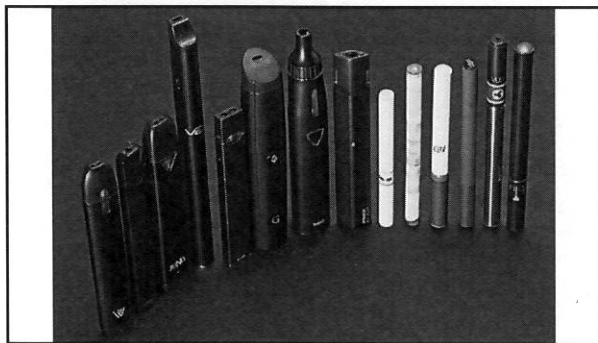


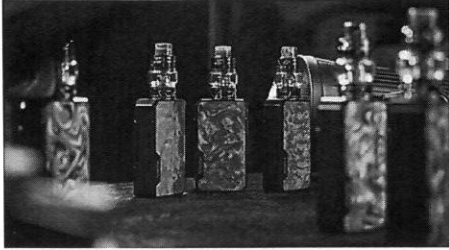
E-Cigarettes & Vape Pens Generations

				
<p>Cig-a-Like E-cigarettes came onto the market around 2007. Most delivered nicotine and were disposable.</p>	<p>Variations Variations on the first e-cigarettes included products like e-hookah and rechargeable versions.</p>	<p>Vape Pens These have batteries that can reach higher temperatures, have refillable e-liquid cartridges, and allow users to regulate the frequency of inhalations.</p>	<p>Mods Large size, modifiable e-cigarettes allow for more aerosol, nicotine, and other chemicals to be breathed into the lungs, at a faster rate.</p>	<p>Post-Based These e-cigarettes are shaped like USBs and contain pods with higher amounts of nicotine than previous generations.</p>

Tobacco Prevention Toolkit
Division of Tobacco Medicine, Harvard University
© 2014 American Cancer Society







Vape Hoodie?



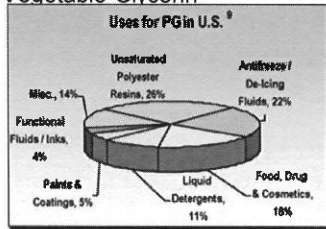


E-Liquid Contents

- Propylene Glycol/Vegetable Glycerin
- Flavors
- Nicotine
- Vitamin E Acetate

E-Liquid Contents: Propylene Glycol/Vegetable Glycerin

Solvent Carrier



E-Liquid Contents: Nicotine

Studies found the nicotine content to be between 0 and 21.8 mg/cartridge.



= approx 20 mg nicotine

Nicotine Salts

The pH of inhaled aerosol plays a large role in nicotine bioavailability

The image is a composite. On the left, there is a pack of cigarettes and a single cigarette. In the center, a person is shown smoking. On the right, there are two chemical structures: 'FREEBASE NICOTINE' and 'NICOTINE SALT'. The text 'Smooth' is written in a stylized font below the cigarette. The entire image is enclosed in a rectangular border.

E-Liquid Content: Flavorings

- Thousands of flavors
- Chemicals vary depending on flavor
- Saccharine
- Diacetyl



Contents of Vapor Aerosol

- Metals
- Carbonyl compounds such as formaldehyde, acetaldehyde, acrolein, and glyoxal



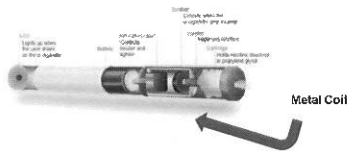
Contents of Vapor Aerosol: Heavy Metals

There is substantial evidence that e-cigarette aerosol contains metals. The origin of the metals could be the metallic coil used to heat the e-liquid, other parts of the e-cigarette device, or e-liquids. Product characteristics and use patterns may contribute to differences in the actual metals and metal concentrations measured in e-cigarette aerosol.

Lead: Neurotoxicity/CV disease

Nickel: Allergic reaction

Chromium: Lung cancer



Contents of Vapor Aerosol: Carbonyl Compounds

Formaldehyde

Acetaldehyde



TABLE 18-1 Comparison of Toxicant Levels Among Combustible Tobacco Cigarette Smokes and E-Cigarette Aerosol

Toxic Compound	Combustible Tobacco Cigarette (ng in mainstream smoke)	E-Cigarette (ng per 15 puffs)	Average Ratio (combustible tobacco cigarette versus e-cigarette)
Formaldehyde	1.6-3.2	0.20-3.61	9
Acetaldehyde	53-149	0.11-1.36	450
Acrolein	2.4-62	0.07-1.19	15
Toluene	8.3-70	0.03-0.61	120
NNN	0.0093-0.19	0.00008-0.00015	280
NNK	0.012-0.11	0.0011-0.00245	40

NOTE: NNN = 4-(methylnitrosamino)-1-(3-pyridyl)butanone; NNK = N'-nitro-N-norfluorenone

SOURCE: Samuels et al., 2013

In Better News...



No carbon monoxide in e-cigarette aerosol!!

Why Kids Vape

Social Lubricant



Why Kids Vape

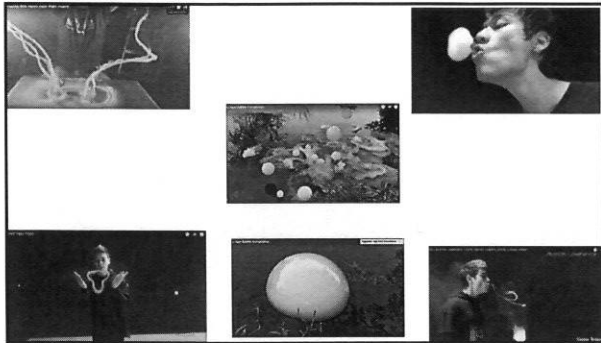
Flavors

Some claim flavors are safe because they meet the FDA definition of "Generally Recognized As Safe, or GRAS"

GRAS doesn't apply to products that aren't in food

We don't know the long term side effects on inhaling these substances (propylene glycol)

The lungs don't likely do as good of a job at protecting ourselves from these substances.



Where Are They Getting It?

Online

Brick and Mortar

Friends

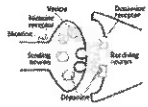
Prefrontal Cortex (PFC)

- Judgement
- Reasoning
- Self-regulation

Images of Brain Development in Healthy Children and Teens (ages 5–20)

Blue represents maturing of brain areas.

Pathophysiology



Why nicotine in adolescent brains is harmful

- PFC doesn't fully develop until age 25
- Nicotine mimics acetylcholine and binds to the nicotinic acetylcholine receptors

This leads to:

- desensitization, upregulation, and reduced synaptic transmission
- persistent changes in gene expression and likely produces changes in prefrontal cortex neurons such as an increased dendritic length and spine density

This leads to:

- Increase in dopamine as well as a prolonged effect

All this to say

Exposure to Nicotine in Adolescence results in:

- Disturbances in working memory and attention
- Adolescent tobacco use is associated with later risk of developing mental and behavioral problems such as major depressive disorder, anorexia, panic disorder, addiction to other substances, antisocial personality disorder, or academic problems
- **With early chronic nicotine exposure, quit attempts as adult are largely unsuccessful (receptor upregulation)**

These structural changes in PFC neurons last into adulthood and the resulting effects are long term

These changes are not seen in the smoker that initiated after age 25.

Adverse Health Effects of E-Cigarettes

Respiratory:

Mucus Membrane irritation (Acrolein) ← **Most Common Side Effect**

Cough/Phlegm Production

Impaired bacterial clearance due to toxicity to alveolar macrophages

POPCORN LUNG?????

8 employees of a popcorn plant in Jasper, Missouri developed *bronchiolitis obliterans* caused by diacetyl

Diacetyl is in many e-liquids

No cases of popcorn lung have been attributed to vaping.



EVALI

E-cigarette or vaping product use-associated lung injury

No definitive cause has been determined. VITAMIN E ACETATE strongly linked

Nearly 3,000 cases, 68 deaths. Cases are declining

THC containing products were the vast majority of cases (but not all)

SOB, Cough, chest pain, hemoptysis, fever, NVV

Supportive Care. Antibiotics are usually initiated to cover other causes of symptoms. Steroids can be used

Adverse Health Effects: CV

E-Cigarette users found to have a 71% higher risk of stroke, 59% higher risk of myocardial infarction, and 40% higher risk of heart disease compared with non-users

-Holtkamp P, Vindhyal M, Muthu T, Murgali C. Two-year trends and determinants of electronic cigarette use among patients with cardiovascular disease in the United States. *Circulation*. 2019;139(1):30

Other Substances

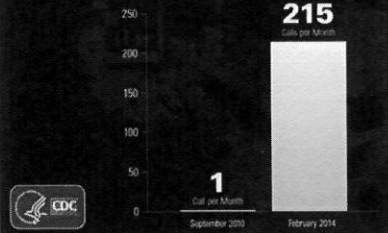
Marijuana concentrates contain extraordinarily high THC levels ranging from 40 to 90%

Easy to conceal

Dabbing



Poison center calls involving e-cigarettes



E Cigarette Explosions

Marketing and Advertising

Altria paid \$12.9 billion to acquire its Juul stake in December 2018

What can YOU do as a PA-C?

Become knowledgeable about vaping

Screen appropriately

Provide anticipatory guidance to adolescents

Include no vaping in your hospital/office no smoking policy

Talk to your local schools, youth clubs, places or worship

https://www.cdc.gov/tobacco/basic_information/e-cigarettes/youth-guide-to-e-cigarettes-presentation.html



Screening

If you ask about smoking, include e-cigarette use

Know your local terminology

Use EHR

Do you JUUL?
Do you vape?

ANTICIPATORY GUIDANCE

When do you start talking to your young patients about vaping?

ANTICIPATORY GUIDANCE

Ask about vaping at every visit (before middle school) by using specific terms such as JUUL and vaping

Explain that most e-cigarettes/JUUL contains nicotine

Stress that nicotine in any amount is addictive and harmful to developing brains

Educate parents about the high prevalence of vaping in schools and encourage dialogue

Treatment Options

Slide Intentionally Left Blank

Clinical Dependence Combustible vs E-Cigarette

How soon after you wake up do you smoke your first cigarette?	5 min or less 6-30 minutes 31-60 minutes 60+ minutes	3 points 2 points 1 point 0 points
Do you find it hard to refrain from smoking in places where it is forbidden?	Yes No	1 point 0 points
What cigarette would you hate most to give up?	First Morning Any other	1 point 0 points
How many cigarettes per day do you smoke?	10 or less 11-20 21-30 31 or more	0 points 1 point 2 points 3 points
Do you smoke more during the first hours after waking?	Yes No	1 point 0 points
Do you smoke if you are so ill you can't get out of bed?	Yes No	1 point 0 points

>6 indicates a high level of dependence

Frequency/Intensity

Frequency is easy. You ask about it.

Intensity (cigarettes per day) → Fagerstrom Scale

Clinical Dependence

Frequency: Easy

Intensity: Not so easy

Nicotine concentration

Temperature

Clinical Dependence

It is important to NOT go back to cigarette scales.

Treat the nicotine withdrawal

Treat this as a substance use disorder

Treatment Options

- No clinical practice guidelines exist
- Most traditional methods/approaches used for adults are ineffective for youth

Pharmacotherapy:

- NRT
- Bupropion
- Varenicline

None are approved by the FDA for quitting e-cigarettes OR under 18 years of age

Nicotine Replacement Therapy

Is well tolerated by youth

High rates of non-adherence in youth

High rates of relapse after stopping NRT in youth

Very difficult to determine starting dose due to high variability of nicotine doses

Is OTC for adults but if under 18--**Need RX**



Bupropion SR

Not FDA Approved under 18

Low adherence in adolescents

Black box warning of increased risk of suicidal thoughts in youth

Contraindicated in patients with seizure disorder

Black Box Warnings

- Increased risk of suicidal thoughts and behavior in children, adolescents, and young adults; monitor for clinical worsening or unusual behavioral changes in all patients
- Monitor for neuropsychiatric reactions
- Not studied in pediatric patients

Varenicline

Not recommend for use in 16 years and older (Data supports ineffective)

WARNING: SERIOUS NEUROPSYCHIATRIC EVENTS
See full prescribing information for complete boxed warning.

- Serious neuropsychiatric events have been reported in patients taking CHANTIX. (5.1 and 6.2)
- Advise patients and caregivers that the patient should stop taking CHANTIX and contact a healthcare provider immediately if agitation, hostility, depressed mood, or changes in behavior or thinking that are not typical for the patient are observed, or if the patient develops suicidal ideation or suicidal behavior while taking CHANTIX, or shortly after discontinuing CHANTIX. (5.1 and 6.2)
- Weigh the risks of CHANTIX against benefits of its use. CHANTIX has been demonstrated to increase the likelihood of abstinence from smoking for as long as one year compared to treatment with placebo. The health benefits of quitting smoking are immediate and substantial. (5.1 and 6.2)

Behavioral Interventions

- Data is lacking
- Traditional smoking cessation programs: **INEFFECTIVE**
- **Facts only!**
- **Texting: This is Quitting**

Jan 2019

30K enrolled first 12 weeks

61% reduced or stopped

Low dropout rate



Regulation

2009: Tobacco Control Act: FDA can regulate the tobacco industry

8/2016: FDA Deeming Rule: FDA can "deem" any new nicotine product a tobacco product

Since Aug 2016, All vaping products on the market are illegally

On the market on Aug 2016? Grandfathered

FDA Requires premarket approval for all vaping devices! **DELAYED** until 2022

Regulation

AAP files a federal lawsuit challenging this delay

May 2019 → Federal judge rules FDA orders all premarket tobacco product applications for vaping products such as devices and e-liquids that were on the market as of August 8, 2016, must be submitted to the FDA no later than May 12, 2020



What is FDA's Plan to Regulate?

FDA has reconsidered and, in its discretion, plans to modify its August 2017 Compliance Policy and will now require ALL vaping products (including the ones that were on the market prior to Aug 8, 2016

- New tobacco products require premarket authorization before they can be legally marketed.

FDA's Enforcement Priorities (In Order)

- Flavored ENDS products that are offered for sale in ways that pose a greater risk for minors to access such products;
- Flavored ENDS products (*other than tobacco, mint, and menthol flavored products*) that are offered for sale in the United States after August 8, 2021, without the manufacturer submitting a premarket application
- All vaping products that are targeted to minors or likely to promote use of vaping by minors

Why the menthol exemption??

Some adults may be using mint- and menthol-flavored ENDS products with the goal of ceasing combustible tobacco use

They may revert back to combustibles if menthol products are obsolete

RECAP!

Youth vaping is an epidemic

The developing brain is vulnerable to the effects of nicotine and results in long lasting structural changes

Adverse health effects aren't well established

No treatment guidelines exist

Nicotine content can vary

It is important to screen and be able to provide anticipatory guidance to youth and young adults

Treat nicotine withdrawal and initiate or refer for behavioral therapies

Safer doesn't mean safe

We are at a crossroad as a nation to decide whether the product is appropriate for the protection of public health with respect to the risks and benefits to the population as a whole

THANK YOU FOR YOUR TIME

Brian Burt, PA-C, DFAAPA
brian.burtpac@gmail.com