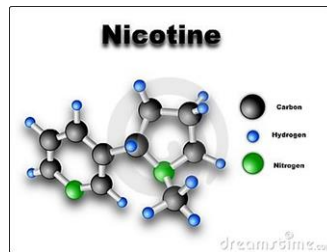


BEYOND CIGARETTES:

It's not just tobacco anymore



Linda S. Efferen, MD, MBA, FACP
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Office Of Population Health
Suffolk Care Collaborative

Objectives & Disclosure

- **Objectives**
 - **Summarize demographic trends in tobacco and other nicotine delivery device(s) use.**
 - **Interpret evolving evidence related to toxic effects of nicotine and/or other agents in Electronic Nicotine Delivery Systems (ENDS).**
 - **Assess relative risk / benefit of ENDS relative to tobacco use prevention / cessation strategies.**
- **No COI or disclosures**

Methods of Tobacco Use

- **Smoked:**
 - **Cigarettes, cigars, pipes**
 - **Waterpipe (hookah, nargile, shisha)**
 - **"Bidis"**
 - **"Clove" cigarettes**
- **Smokeless:**
 - **Chewing tobacco or "dip"**
 - **Snuff**
 - **SNUS, ORBS**



The Best 10 Hookah Bars in Your Town, NY

[Best Hookah Bars in - Yelp](#)
1. www.yelp.com/search?cflt=hookah_bars&find... Top Hookah Bars in xxxxxxx, NX - Aladdin Hookah Lounge, Le Roi, Arabica Hookah Lounge, Bamboleo Night Club, 1001 Nights Cafe & Lounge, Ambiance ...

Hookah Menu

Regular Hookah

- \$15

Fresh Grapefruit

- \$18

- * **Mix up to 3 Flavors For Free**
- * **Additional Mix Charge - \$2**
- * **2 people Max per hookah**
- * **Each Additional Person Will be \$5 More**



Add To Your Experience By
Using & Keeping Your Very
Own Brand New Hose **\$3.00**

• Hookah Specials

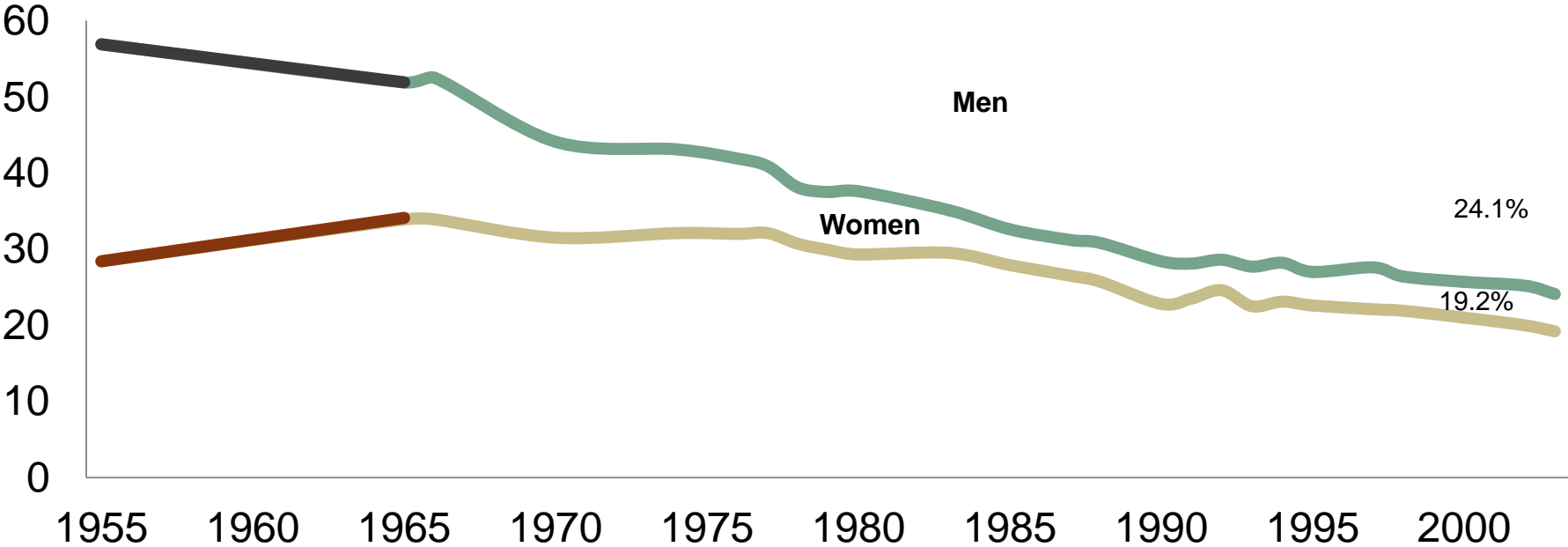
Try our special variety of mixes:

- **Almond Joys (Chocolate Mint & Cinnamon)**
- **Arabica Special (Blue Mist, Pink, & Belize)**
- **Belly Dancer (Blue Mist, Mango, & Gum)**
 - **Big Pete (Cherry, Vanilla, & Gum)**
 - **Big Red (Cinnamon & Mint Gum)**
 - **Blue Balls (Blueberry & Blue Mist)**

Is Tobacco Use Safe?

- **An hour long hookah smoking session involves 200 puffs; equivalent to 10 cigarettes**
- **Bidis / Kreteks have higher concentrations of nicotine, tar, CO than conventional cigarettes**
- **Smokeless tobacco is not a safe alternative to smoking (cancer, addiction, etc.)**
- **Snuff products deliver more cancer-causing nitrosamines than cigarettes**

Trends in cigarette smoking among adults aged ≥ 18 years United States, 1955-2003



Source: 1955 Current Population Survey; 1965-2003 National Health Interview Surveys

Adult Smoking Prevalence 2014

	TOTAL	MEN	WOMEN
USA	16.8%	18.8%	14.8%
NYS	14.5%	17%	12%
NYC	13.9%	18.1%	10%

Source: CDC, New York City Department of Health

How we got as far as we did...

Office-based Tobacco Interventions CDC Clinical Practice Guideline

- Treat tobacco use as a chronic disease
- Use proven counseling techniques
- Use pharmacotherapy
- Develop follow up procedures
- Identify smokers--label charts
- Give secondhand smoke counseling

Population-based Interventions CDC Best Practices for States

- Raise price (excise taxes)
- Clean indoor air laws (limit opportunities)
- Counteract tobacco industry
- Public cessation aids: Quit lines, NRT
- Curtail youth access

Treating Tobacco Use and Dependence 2008 Update

<http://www.ahrq.gov/professionals/clinicians-providers/guidelines-recommendations/tobacco/clinicians/update/index.html>

CDC Best Practices for Comprehensive Tobacco Control Programs—2014

http://www.cdc.gov/tobacco/stateandcommunity/best_practices/pdfs/2014/comprehensive.pdf

Nicotine delivery systems

- **Tobacco**
 - **Cigarettes most efficient format for nicotine delivery**
- **Non-tobacco**
 - **ENDS (electronic nicotine delivery system)**

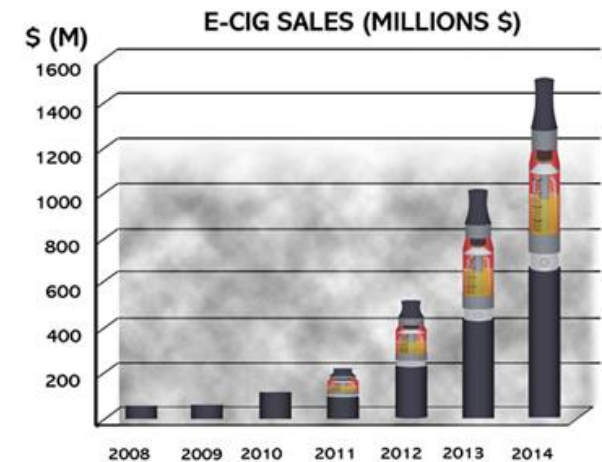


1 ml e-liquid consumed over length of time typical smoker consumes 5.63 combustible cigarettes
1 PPD \approx 3.55 ml e-liquid

Lieber et al. Tob Control 2016; 0:1-6

ENDS Sales

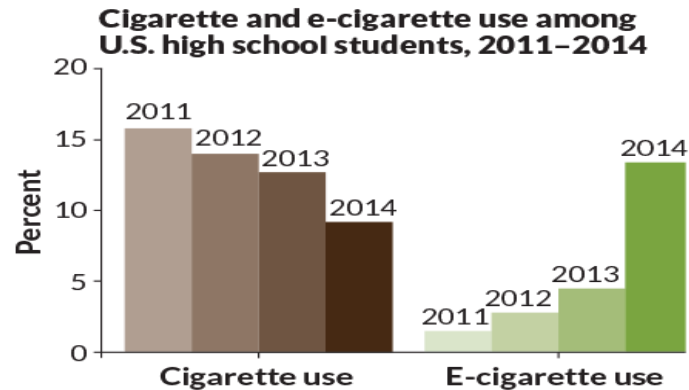
- Available in US since 2007
- Adult use doubled 2010 to 2013
- Unregulated market: no consumer protection, etc.
- Product marketing unrestricted: unlike combustible tobacco
- Market trends
 - Sales increasing
 - Strongest growth in convenience store channel
 - Best selling brand: Blue e-cigs (2013 44% of overall sales)
 - Single unit products (disposable) increased 216%
 - Need to expand surveillance to online & “vape shops” sales



2014 National Youth Tobacco Survey:

E-Cigarette Use in Middle and HS Students Triples from 2013 to 2014

	E cigarettes		Hookah		Cigarettes		Other		OVE RALL
	2013	2014	2013	2014	2013	2014	2013	2014	2014
MS	1.1	3.9	1.1	2.5		2.5		4.1	7.7
HS	4.5	13.4	5.2	9.4		9.2		17.1	24.6



Arrazola et al. Tobacco use among middle and HS students 2011-2014. MMWR2015;65:381-5
 CDC Press Release: <http://www.cdc.gov/media/releases/2015/p0416-e-cigarette-use.html>

Policy and Evolving Markets: A loop hole?

- **2009 Family Smoking Prevention & Control Act**
 - Prohibits 'characterizing' flavors (candy, fruit, chocolate, etc.) in tobacco and menthol cigs
- **FDA**
 - Regulates cigarettes, cigarette tobacco, roll your own tobacco, smokeless tobacco
 - *Does not regulate e-cigs, hookahs, cigars.....May 2016*
- **New York City**
 - No sale to persons under age 21
 - No use in places where smoking tobacco products is prohibited
- **New York State**
 - No sale to persons under age 18
 - Proposed: add to NYS Clean Indoor Air Act & increase legal sale age to 21

Policy and Evolving Markets: A loop hole?

- **FDA –May 2016: The Deeming Rule**
 - Extended authority to ENDS, cigars, hookas, pipe tobacco, gels, dissolvables
 - No sale in vending machines, free samples, or age less than 18
 - Tobacco product review authority: ingredients, product design, health risks, appeal to youth and non-users
 - Advertising and marketing will be ‘greatly restricted’
 - Warning labels: addictive nature of nicotine May 2018
- **White House cuts ‘deeming’ rule – June 2016**
 - Deleted provision requiring removal of flavored products from market
- **Other limitations**
 - Products on market pre-2007 grand-parented
 - Tobacco Product Application: 2 year submission period + 1 year review period for products on market post-2007

Objectives

- **Objectives**
 - **Summarize demographic trends in tobacco and nicotine delivery device(s) use:**
 - Tobacco trending down 😊.**
 - Nicotine trending up ☹️.**
 - **Interpret evolving evidence related to toxic effects of nicotine and/or other agents in Electronic Nicotine Delivery Systems**
 - **Assess relative risk / benefit of ENDS relative to tobacco use prevention / cessation strategies.**

Electronic Nicotine Delivery Systems



Liquid: propylene glycol &/or glycerol, nicotine, flavorant



formaldehyde + PG /glycerol -> hemiacetals (industrial biocides)



group 1 carcinogen

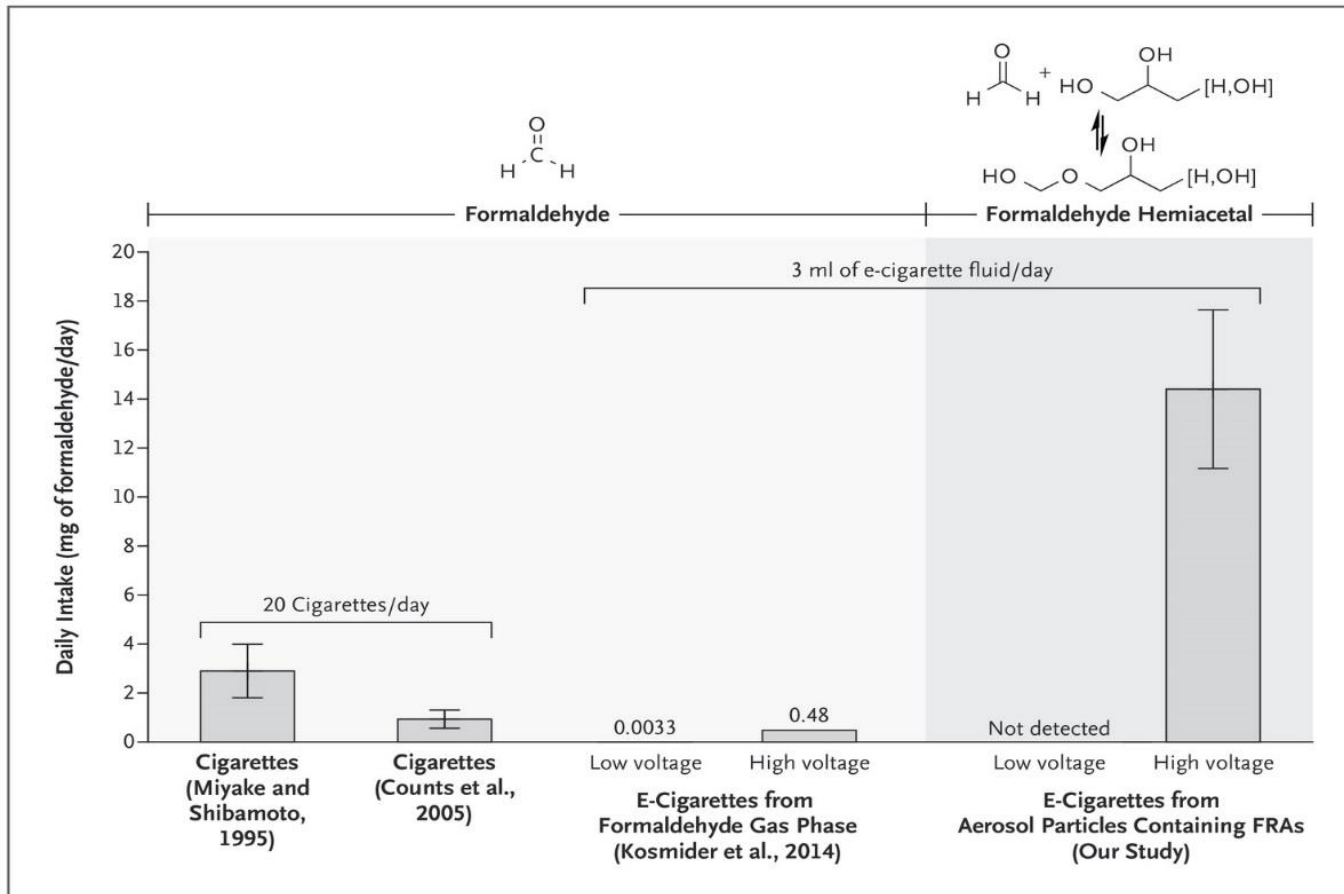
Exposure Levels



Levels of Toxicants in E-Cigarette Aerosol Compared With Nicotine Inhaler & Cigarette Smoke

Toxicant	Aerosol From 12 E-Cig Samples / 15 Puffs*	C-Cigarette Micrograms in Smoke From 1 Cigarette	Content in Nicotine Inhaler Mist / 15 Puffs*
Formaldehyde, µg	0.2–5.61	1.6–52	0.2
Acetaldehyde, µg	0.11–1.36	52–140	0.11
Acrolein, µg	0.07–4.19	2.4–62	ND
o-Methylbenzaldehyde, µg	0.13–0.71	...	0.07
Toluene, µg	ND–0.63	8.3–70	ND
p,m-xylene, µg	ND–0.2	...	ND
NNN, ng	ND–0.00043	0.0005–0.19	ND
NNK, ng	ND–0.00283	0.012–0.11	ND
Cadmium, ng	ND–0.022	...	0.003
Nickel, ng	0.011–0.029	...	0.019
Lead, ng	0.003–0.057	...	0.004

Daily Exposures to Formaldehyde Associated with Cigarettes and E-Cigarettes



Vape 3 ml/day = inhale 14.4 (± 3.3) mg formaldehyde (5.0 V) vs cigarettes 3 mg / pack
 Jensen et al. Hidden Formaldehyde in E-Cigarette Aerosols. NEJM 2015; 372(4): 392-394

Secondhand Exposure:

Passive Vaping \approx ETS – Side Stream



"I didn't know you could get electronic pipes too! Whatever next!"

CHEST 2015:

Electronic Cigarettes: Latest Developments in Understanding the Respiratory Effects of Vaping

- **In vivo and in vitro model – mice:**
 - **Nicotine dose dependent effect: development of emphysema, airway hyperactivity, remodeling, mucin production and apoptosis**
- **Cough reflex sensitivity – humans:**
 - **Acute pro- and delayed antitussive effect**
- **Chemical analysis – e-cigarettes:**
 - **Toxicants in nicotine, flavorings and additives**
- **Smoking cessation aid – studies to date:**
 - **No evidence to support benefit vs other NRT**

Impact of Tobacco Smoke & Nicotine Exposure in Lung Development

- “Although multiple tobacco toxins likely affect the fetus, nicotine is the best studied component of tobacco smoke”
 - Nicotine readily crosses placenta
 - Cotinine levels in neonates exposed to in utero tobacco smoke similar to active smoking adult
- Lung tissue (fetal & infant sudden death cases) findings associated with maternal smoking:
 - Higher incidence of nicotinic acetylcholine receptors
 - Lung hypoplasia
 - Hypoplasia of specific brainstem regions
- Animal studies: nicotine exposure impacted gene expression and development of offspring
 - Fibroblast differentiation in embryonic stem cells
 - Increased nicotinic acetylcholine receptors in airway, cartilage, vessels
 - Decreased total body weight and alveolar hypoplasia
 - Decreased forced expiratory flows

Adverse Health Effects of Nicotine

- Release of catecholamines:
 - Hemodynamic effects
 - ↑ HR, BP, vasoconstriction
 - Adverse effect on lipids
 - Induction of insulin resistance
- Endothelial dysfunction
- Fetal teratogenicity
- In vivo and in animals:
 - Inhibit apoptosis
 - Increase angiogenesis

Objectives

- **Objectives**
 - Summarize demographic trends in tobacco and nicotine delivery device(s) use.
 - **Interpret evolving evidence related to toxic effects of nicotine and/or other agents in Electronic Nicotine Delivery Systems**
 - It's not just water in that vapor ☹️**
 - Research is ongoing 😊**
 - **Assess relative risk / benefit of ENDS relative to tobacco use prevention / cessation strategies.**

Hype?

- **E-Cigs 95% Less Harmful than Smoking and Helpful for Cessation.** Roxanne Nelson, August 26, 2015;
http://www.medscape.com/view_article/850083
- **Report Endorsing e-Cigarettes Called into Question.** Liam Davenport, September 25, 2015
http://www.medscape.com/view_article/851566
- **Evidence, Policy, and E-Cigarettes – Will England Reframe the Debate.** Green et al. April 7, 2016. NEJM 374; 14:1301-3

Pro/Con Debate:

Does the risk of e-cigarettes exceed potential benefits?

- **Yes: Lack of evidence of harm ≠ evidence of safety**
 - For current smokers: no proof of safety
 - Evidence of increase use in non-smokers
 - No evidence to support e-cigs as superior to traditional USFDA approved strategies
 - Direct toxic effects of e-cigarettes
- **Not FDA regulated**

Pro/Con Debate:

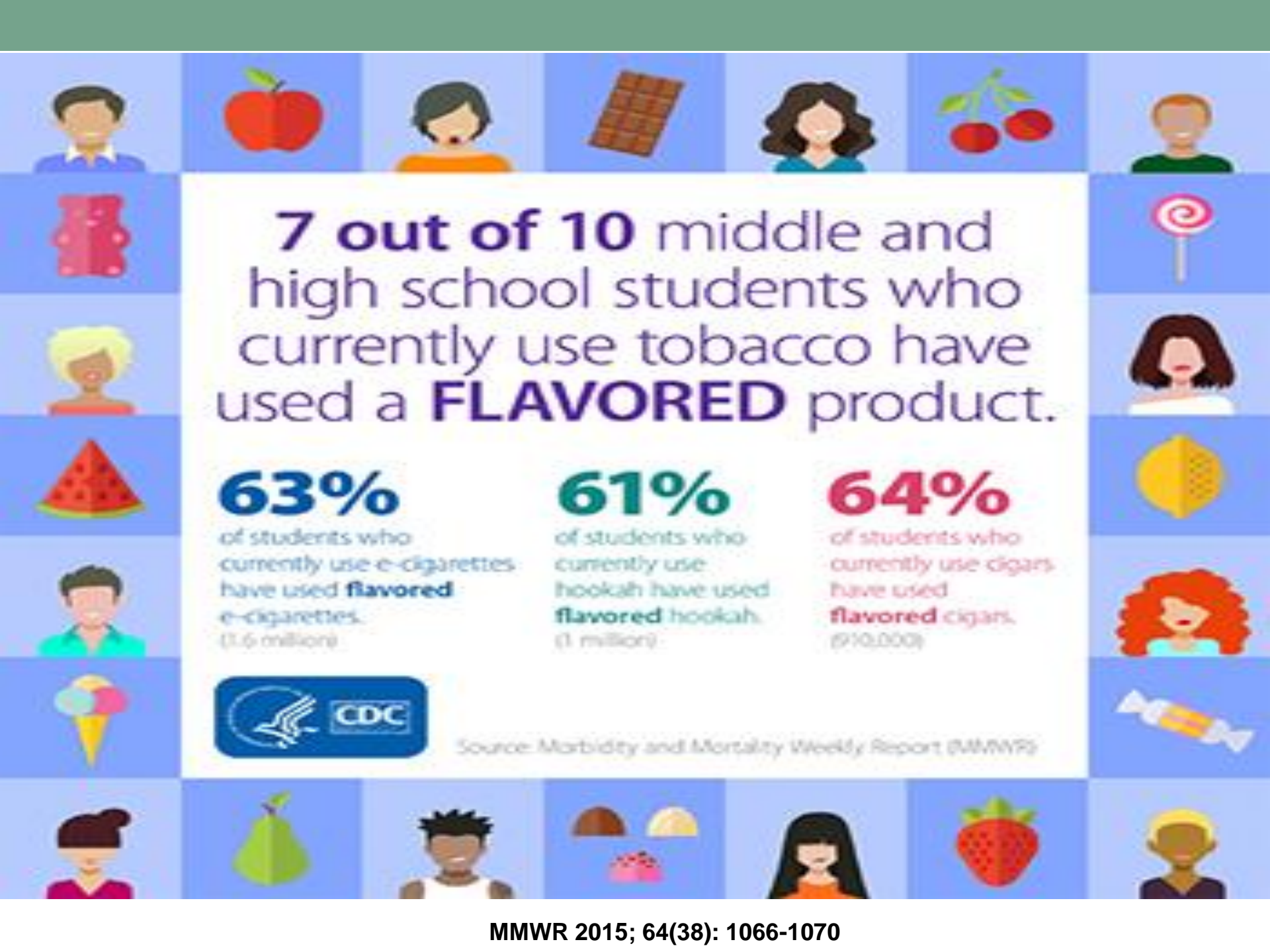
Does the risk of e-cigarettes exceed potential benefits?

- **No: E-cigarettes ≠ traditional cigarettes**
 - Vapor: trace/no detectable toxicants
 - Principal carrier: propylene glycol
 - present in FDA approved injectables
 - Not everything known, but data support vastly less toxic
 - Data insufficient to support e-cigs as a smoking cessation tool
- **Not FDA regulated: Support regulation**

Avdalovic & Murin v. Middlekauf. Chest 2015; 148(3):580-586

Public / Population Health: Prevention Agenda

- **2012 Surgeon General Report**
 - **90% of smokers try 1st cigarette as a teen**
 - **75% of teen smokers continue into adulthood**



7 out of 10 middle and high school students who currently use tobacco have used a **FLAVORED** product.

63%

of students who currently use e-cigarettes have used **flavored** e-cigarettes.
(1.6 million)

61%

of students who currently use hookah have used **flavored** hookah.
(1 million)

64%

of students who currently use cigars have used **flavored** cigars.
(910,000)

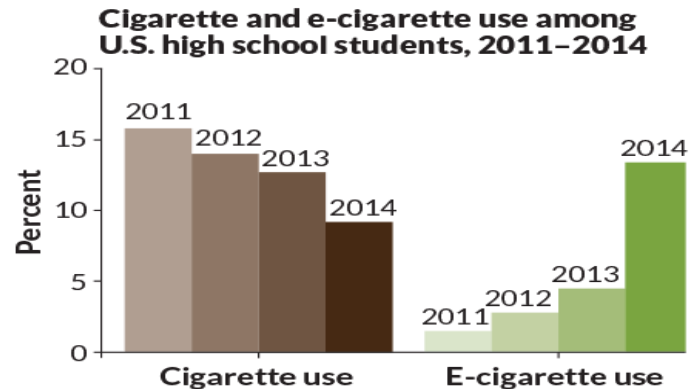


Source: Morbidity and Mortality Weekly Report (MMWR)

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E-Cigarette & Combustible Cigarette

Progression to Traditional Cigarette Smoking after Electronic Cigarette Use US Adolescents & Young Adults

- **n=694 Baseline 2.3% EC use**
- **12 mo f/u: 11/16 (68%) EC vs 128/678 (19%) non-EC users initiated smoking**

Association of Electronic Cigarette Use with Initiation of Combustible Tobacco Product Smoking in Early Adolescence

- **n=2530 Baseline 8.7% EC users**
 - **6 mo f/u 30.7 vs 8% EC vs non-EC users initiated smoking**
 - **12 mo f/u 25.2 vs 9% EC vs non-EC users initiated smoking**

Nicotine & the Adolescent Brain

- **Prefrontal cortex:**
 - **Responsible for emotions and impulse control**
 - **Doesn't finish developing until \approx age 25**
 - **Area vulnerable to nicotine addiction**
- **Nicotine**
 - **Triggers release of dopamine & serotonin 😊**
 - **Repeated exposure alters body's ability to release natural pleasure-giving chemicals**
 - **Teen brains will create more receptors**
 - **Increased # receptors = need more nicotine to get same effect**

Public / Population Health: Cessation Agenda

Population Studies of the Association Between E-Cigarette Use and Cessation of Conventional Cigarette Smoking

Study	Location and Study Design	Odds of Quitting (95% CI)
Longitudinal studies Adkison et al ⁴ (2013)	US, UK, Canada, Australia (ITC), surveyed, 1 yr apart	0.81 (0.43–1.53)*
Vickerman et al ⁸⁰ (2013)	US quit-line callers from 6 states surveyed at enrollment and 7 mo later	0.50 (0.40–0.63)†
Grana et al ⁷⁹ (2014)	US sample drawn from a nationally representative Internet panel, 1 yr apart	0.76 (0.36–1.60)
Choi and Forster ⁸¹ (2014)	Midwestern young adults, 1 yr apart	0.93 (0.19–4.63)
Cross-sectional study Popova and Ling ⁸² (2013)	US sample drawn from a nationally represented Internet panel	0.69 (0.52–0.94) *
All studies Pooled ‡		0.61 (0.50–0.75)

Public / Population Health: Cessation Agenda

Studies of the Association Between E-Cigarette Use and Cessation of Conventional Cigarette Smoking

Study	Location and Study Design	
Caponnetto et al ²¹ (2013)	12 month prospective RC study (n=300) no intention to quit 7.2 v 5.4 v 0 mg nicotine	ND in # CS
Adriaens et al ²² (2014)	8 week RCT study	↓ # CS
Tseng et al ²³ (2016)	3 week RCT study	↓ # CS
Bullen et al ²⁴ (2013)	New Zealand RCT w/ 6 month f/u (n= 657) 10 v 16 v 0 mg EC v patch	NS quit rates Dual use EC and CS > patch users

Public / Population Health: Cessation Agenda

- **Relative risk argument**

- **Smoke for the nicotine but die from the tar**

- VS -

- **Known Issues with ENDS**

- **Nicotine equivalency**
- **Nicotine delivered via an aerosol of UF particles**
- **Particles can be variable & chemically complex**
- **Specific components responsible for toxicity and relative importance of particle size/composition generally unknown**
- **Evidence of frequent low or short term exposure to fine or UF particles causes pulmonary and systemic inflammation and increased risk of cardiac and pulmonary disease**

Issues ENDS

- **Expanding (profitable) market**
- **No restrictions on advertising**
- **No quality control of ingredients or manufacture**
- **Carrier, additives and nicotine can all cause cellular damage and symptoms**
- **Toxins identified in inhaled as well as environmental vapor**
- **Long-term effects unknown**
- **Evidence suggests decrease success rates of tobacco quit attempts with concomitant use of ENDS**

Electronic Cigarettes:

A Policy Statement From the American Heart Association

Table 2. Summary of Current Recommendations for Clinical Guidance

E-cigarette use should be included in tobacco screening questions that are part of every health examination.

Clinicians should be educated about e-cigarettes and should be prepared to counsel their patients regarding comprehensive tobacco cessation strategies. Patients should be separated into 3 treatment categories based on their tobacco/e-cigarette use status¹³³:

1. Tobacco product users who are willing to quit should receive intervention to help them quit
2. Tobacco product users unwilling to quit at the time should receive interventions to increase their motivation to quit
3. Those who recently quit using tobacco products should be provided relapse prevention treatment

There is not yet enough evidence for clinicians to counsel their patients who are using tobacco products to use e-cigarettes as a primary cessation aid.

If a patient has failed initial treatment, has been intolerant to or refuses to use conventional smoking cessation medication, and wishes to use e-cigarettes to aid quitting, it is reasonable to support the attempt. However, patients should be informed that although e-cigarette aerosol is likely to be much less toxic than cigarette smoking, the products are unregulated, may contain low levels of toxic chemicals, and have not been proven to be effective as cessation devices.

In the absence of long-term safety studies of e-cigarette use, it may be appropriate to advise the patient to consider setting a quit date for their e-cigarette use and not to plan to use it indefinitely (unless needed to prevent relapse to cigarettes).


It is also important to stress that patients should quit smoking cigarettes entirely as soon as possible, because continued cigarette smoking, even at reduced levels, continues to impose tobacco-induced health risks.

For patients with existing CVD or stroke, or at risk of a CVD event, intensive cessation counseling and pharmacotherapy should be offered as soon as possible.

Objectives

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 - Summarize demographic trends in tobacco and nicotine delivery device(s) use.
 - Interpret evolving evidence related to toxic effects of nicotine and/or other agents in Electronic Nicotine Delivery Systems
 - **Assess relative risk / benefit of ENDS relative to tobacco use prevention / cessation strategies:**

Conclusions – ENDS:

- Sales (and use) are increasing
- Nicotine addiction risk
- Smoking cessation tool 
- Proof of health harm specific to ENDS
 - Acute intoxications
 - AW & cellular toxicity
 - Environmental exposure
 - Long term health impact 