Vaping

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Disclosures

I have no financial relationships or affiliations to disclose.

Objectives

- **WHAT:** Describe vape devices, nomenclature and appearance
- **WHO:** Describe use among adults and youth
- **RISKS:** Review scientific evidence of health effects - EVALI
  - Risk related to COVID-19
- **YOUR ROLE:** Discuss considerations for your patients who Vape or are considering Vaping.

What Vaping Looks Like

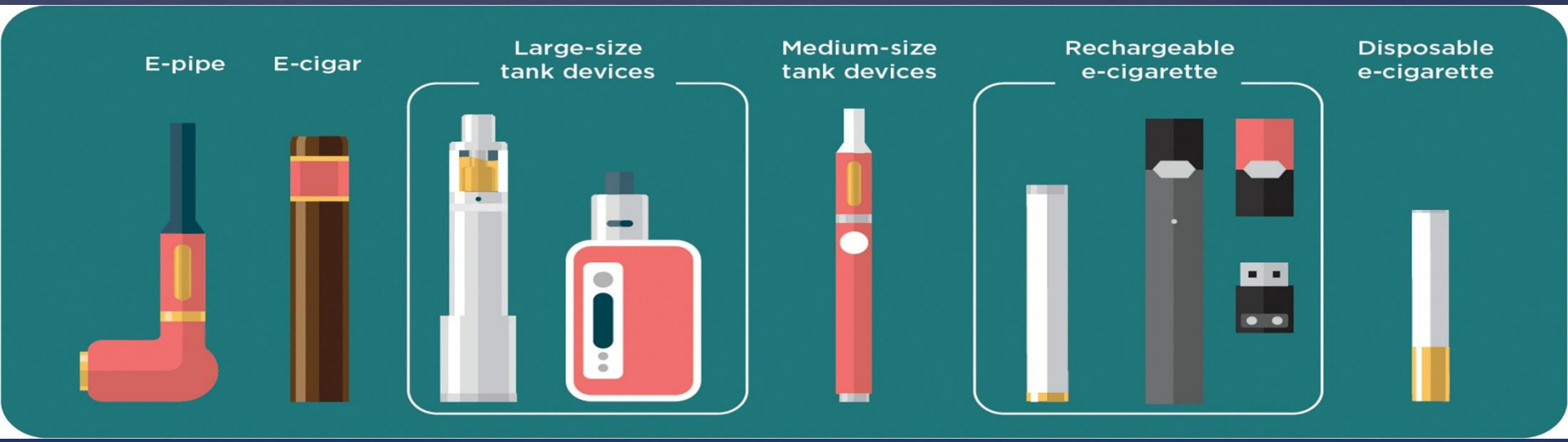
What are Vaping Devices?

- Originally developed by Hon Lik in 2003
- "an electronic atomization cigarette that functions as substitutes…for quitting smoking and cigarette substitutes."[a]
- Primarily manufactured in Shenzhen, China
- Devices that deliver an aerosol (vapor) with or without nicotine
- Create a vapor by heating nicotine, propylene glycol or glycerin, with or without additional flavoring agents – "juice" can be nicotine-free as well.

[a] Patent No. 8,490,628 B2

Nomenclature

- Electronic Nicotine Delivery Systems (ENDS)
- E-cigarettes
- Electronic cigars or e-cigars
- E-hookah or hookah pens
- Vaping devices, vapes, vape pens, and personal vaporizers
- Mods and tanks



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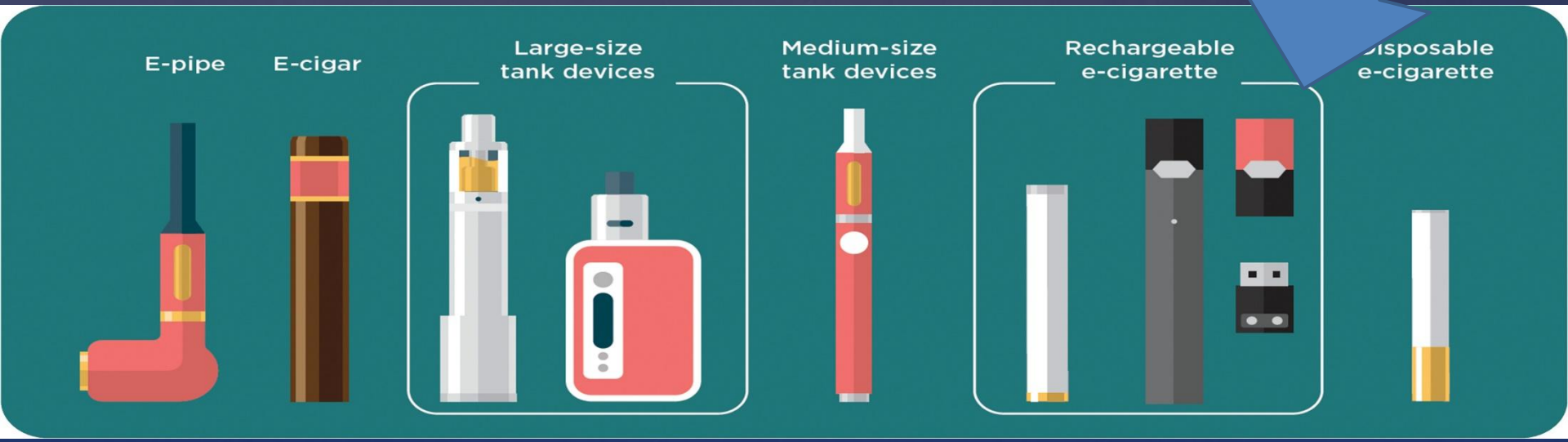
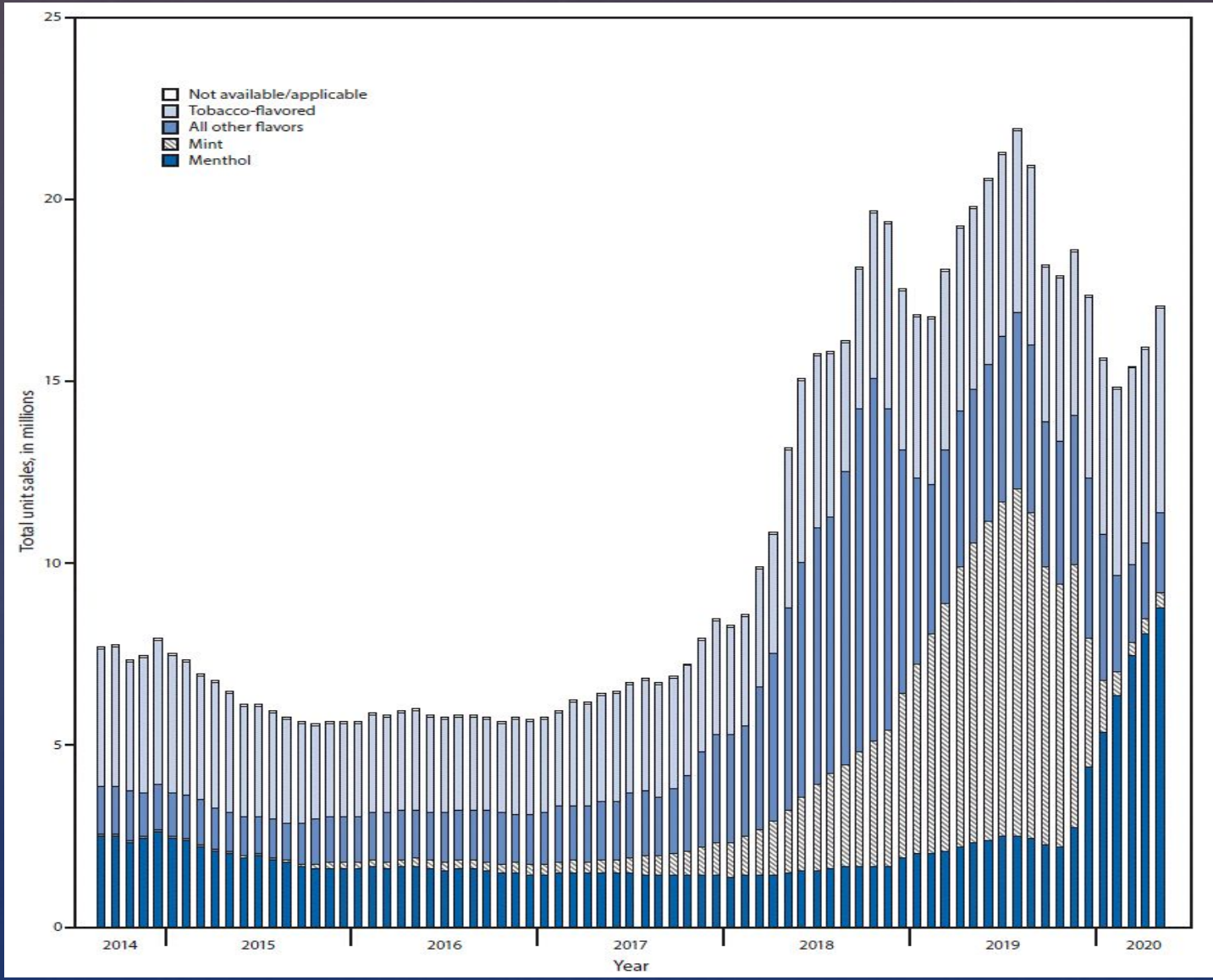
JUULE



E-liquid – Juice Constituents

- **Nicotine**
  - Varying levels, including nicotine-free
- **Carrier Solutions**
  - Propylene glycol or Vegetable glycerin
- **Flavorings**
  - Tobacco, Menthol, Cinnamon, Candy, Fruit, Wine, etc.

Total US e-cigarette unit sales, by flavor (9-201 to 5-2020)



Ali FRM, Diaz MC, et al, MMWR 2020

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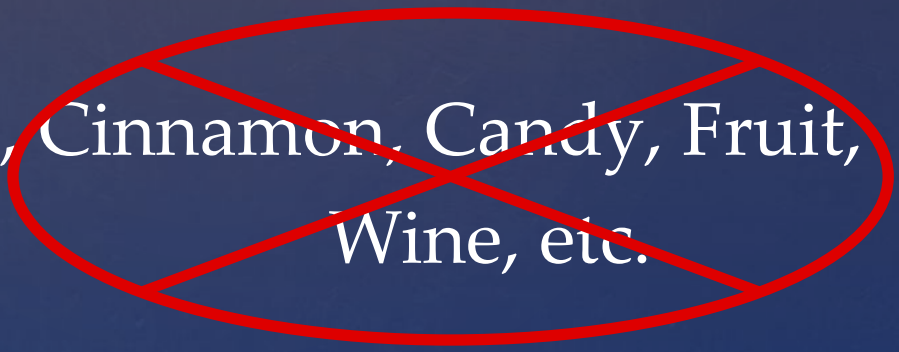


E-liquid – Vapor

NICOTINE

- Labeled amount frequently doesn't match actual amount[a]
- Each puff delivers 0 to 35ug nicotine[b]

CARRIER SOLUTIONS

- Propylene glycol and Vegetable glycerin –toxic to lung cells, increasing with dose[c]

FLAVORINGS

- Some influence satisfaction and health effects.

[a]Trehy et al 2011; [b]Goneiwicz et al *Nic Tob Res* 2013; [c]Sassano MF, Davis ES e tal 2018

E-liquid ("juice") and Vapor

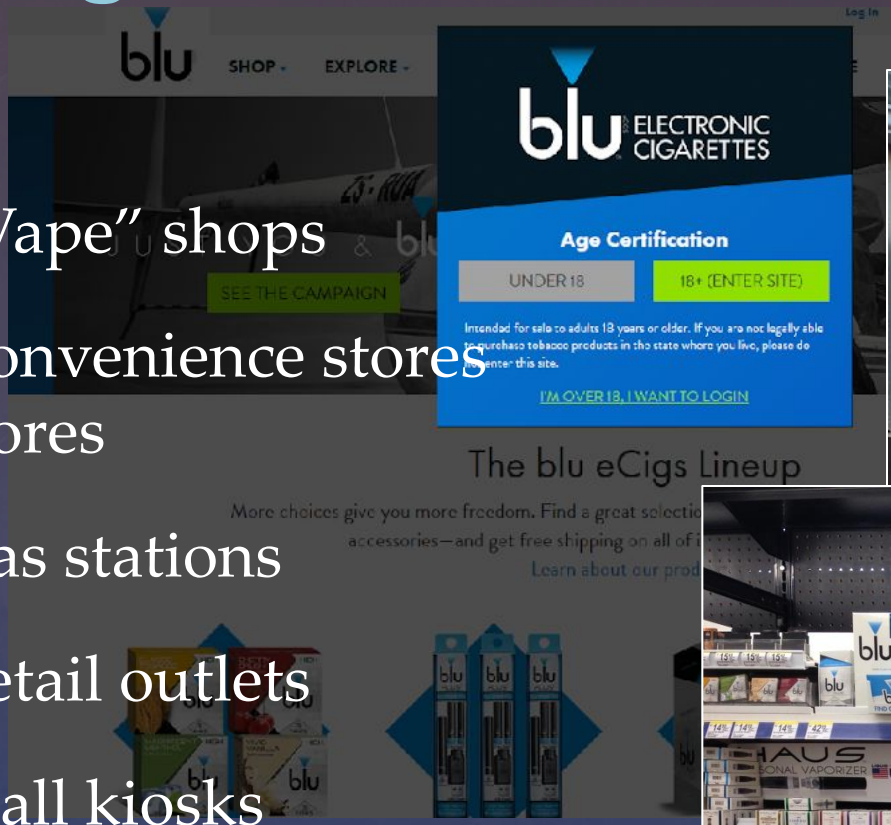
TOXINS, CARCINOGENS, and PARTICULATES

- 1-2 order of magnitude lower than cigarettes[a] (Aldehydes, metals, volatile organic compounds, phenolic compounds, polycyclic aromatic hydrocarbons, tobacco alkaloids)[b]
- Tobacco-specific nitrosamines range variability from 330-8600 ul/mL[c]
- Higher nicotine content = higher particles in vapor
- Particle size of ~120-165 mm (similar to conventional cigarettes)
- Acrolein, a herbicide, causes acutee lung injury and COPD and my cause asthma and lung Cancer[d]

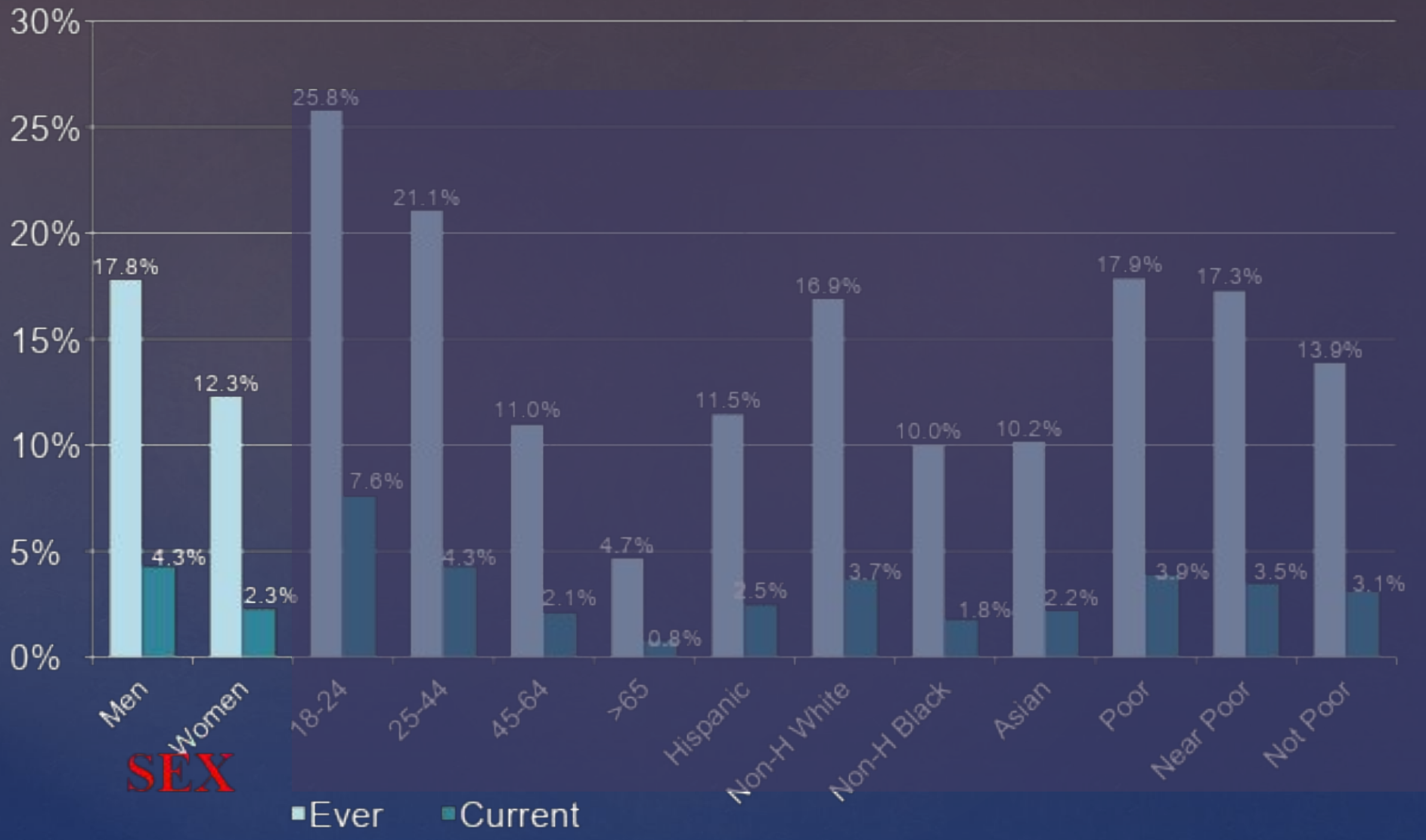
[a]Goneiwicz et al *Tob Con* 2013; [b]Cheng *Tob Con* 2014; [c]Kim and Shin *J Chromatogr A* 2013; [d]Bein K and Leikauf GD Imol Nutr Food Res 2011.

E-Cigarettes Are Sold Everywhere

- "Vape" shops
- Convenience stores stores
- Gas stations
- Retail outlets
- Mall kiosks
- Grocery stores
- Internet vendors



Adult Vaping – Current vs. Ever Use



[a]Villarroel MA, Cha AE & Vahratian A - National Health Survey 2018

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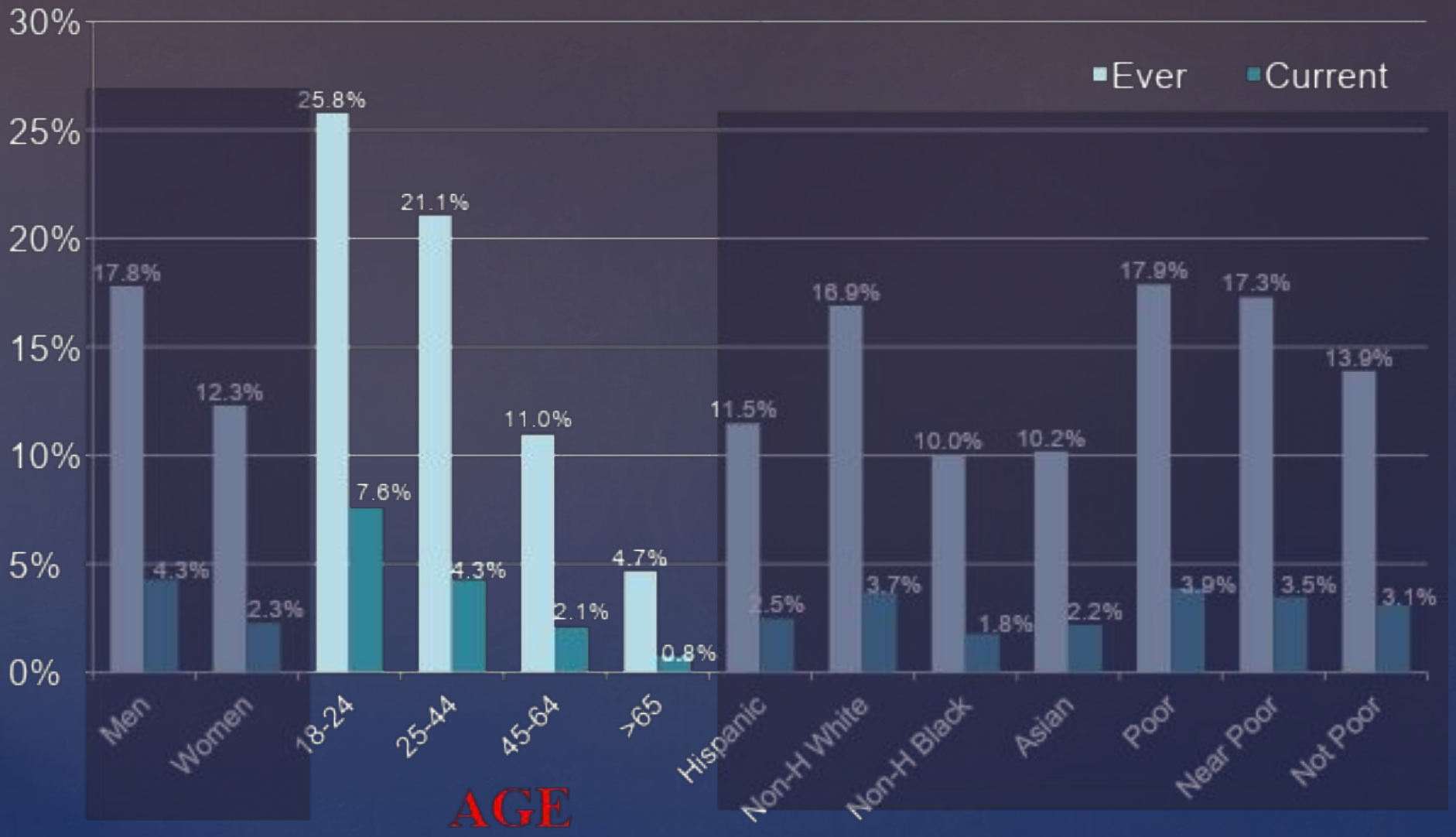

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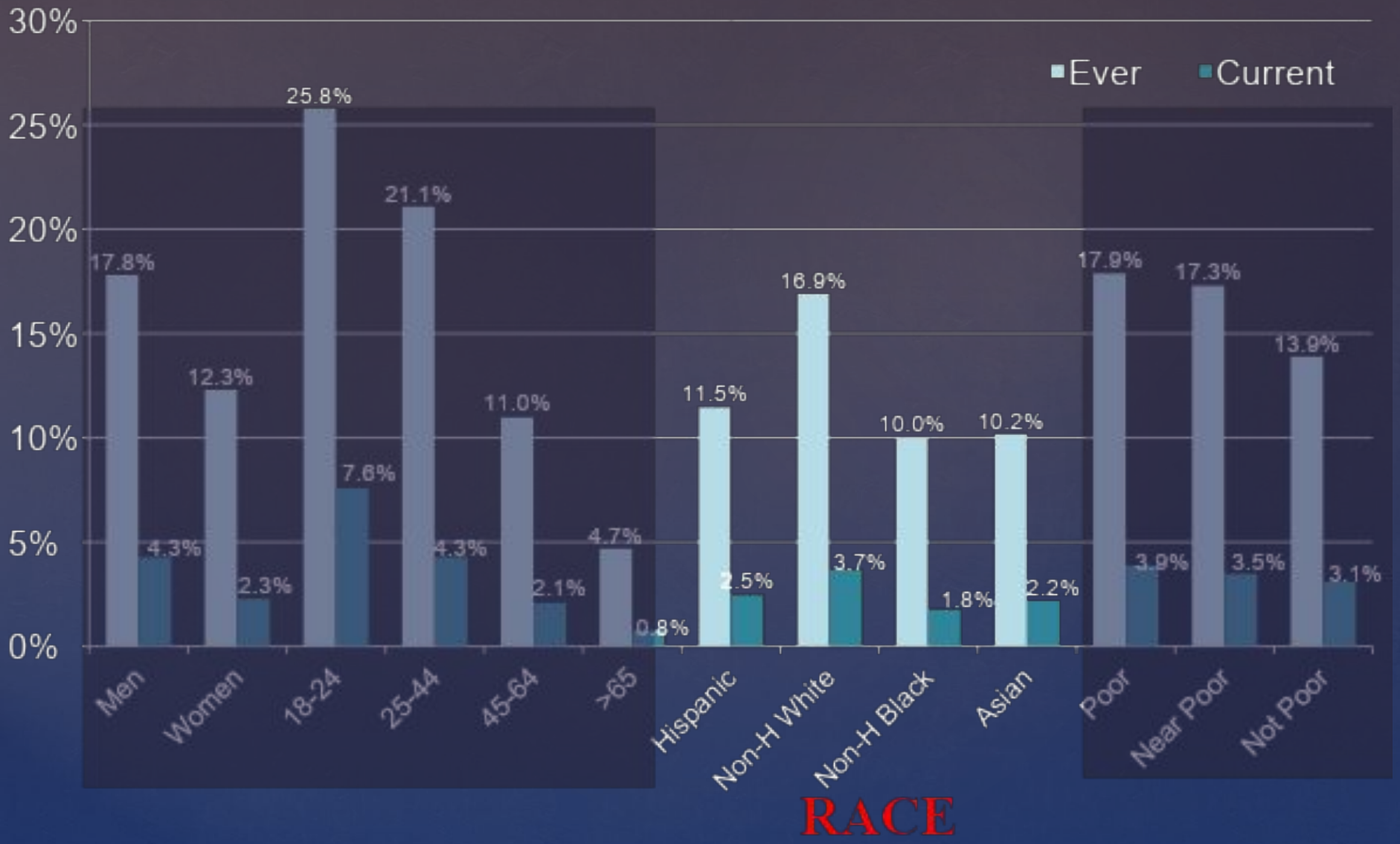

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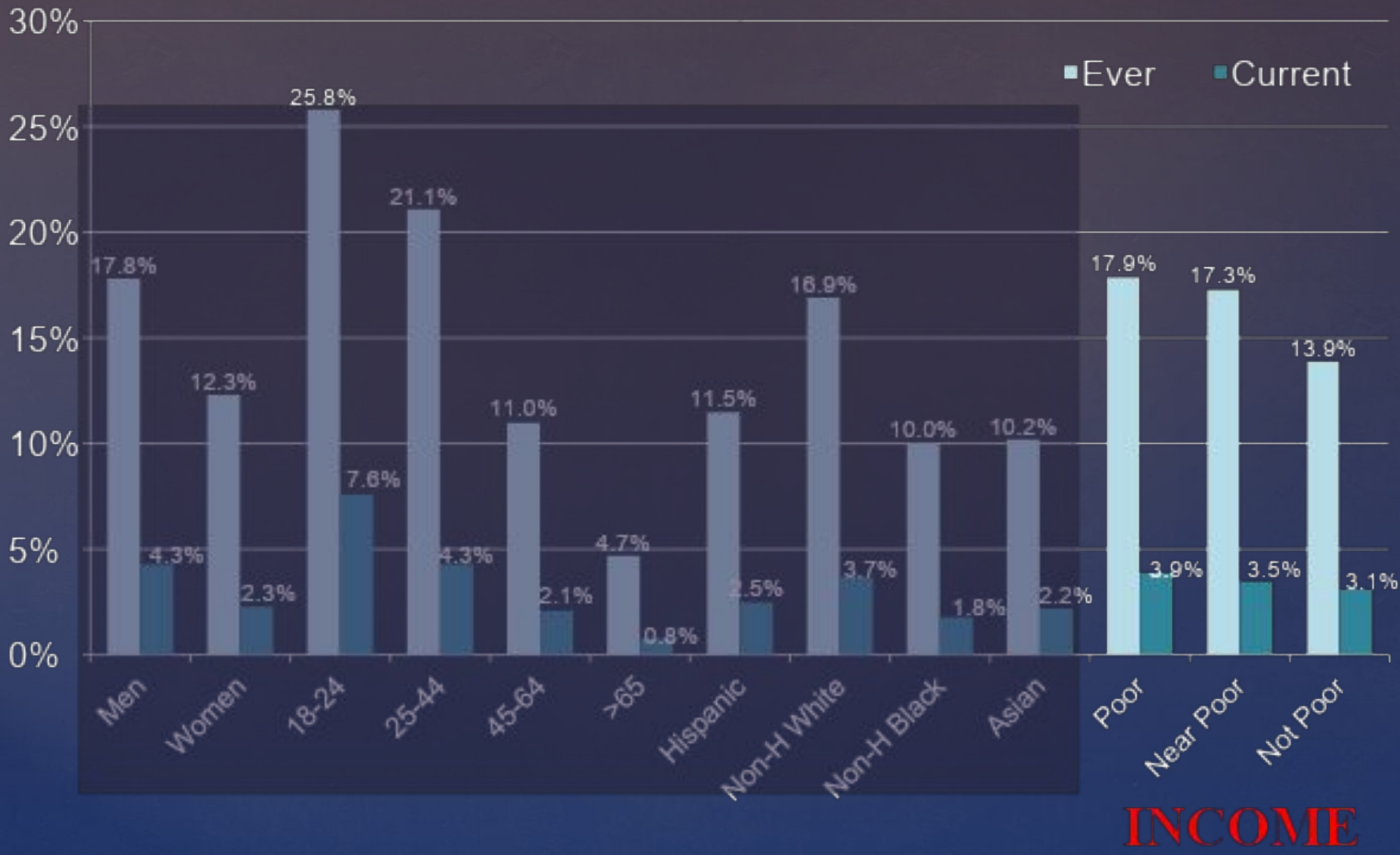
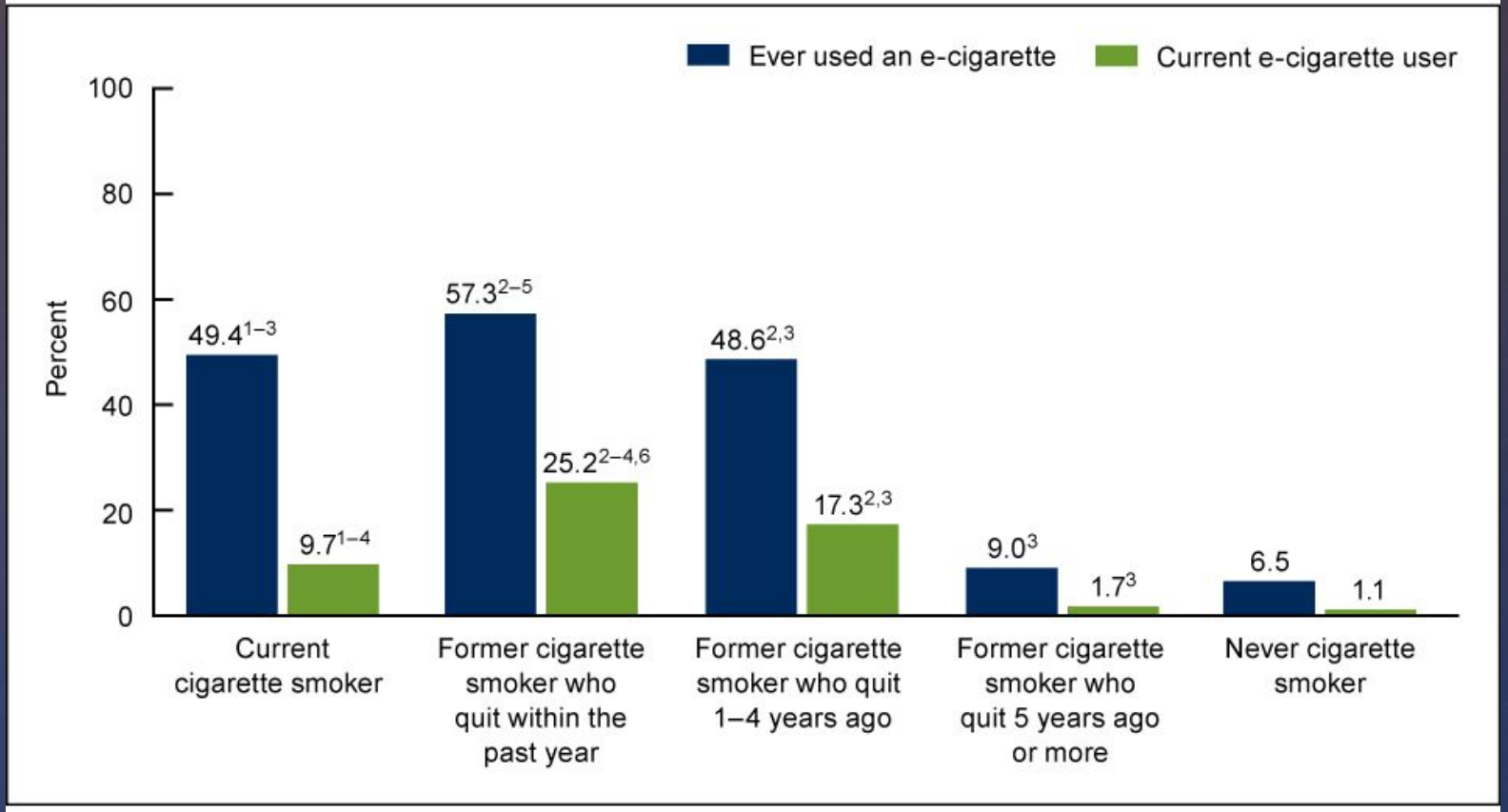


[a]Villarroel MA, Cha AE & Vahratian A - National Health Survey 2018

Adult Vaping by Smoking Status

Figure 3. Percentage of adults who had ever used an e-cigarette and were current e-cigarette users, by cigarette smoking status: United States, 2018



[1]Significantly different from former cigarette smokers who quit within the past year ($p < 0.05$).
[2]Significantly different from former cigarette smokers who quit 5 years ago or more ($p < 0.05$).
[3]Significantly different from never smokers ($p < 0.05$).
[4]Significantly different from former cigarette smokers who quit 1–4 years ago ($p < 0.05$).
[5]Significant quadratic trend by duration of quitting cigarette smoking among former smokers ($p < 0.05$).
[6]Significant linear trend by duration of quitting cigarette smoking among former smokers ($p < 0.05$).
NOTES: Estimates are based on household interviews of a sample of the civilian noninstitutionalized U.S. population. Access data table for Figure 3 at: https://www.cdc.gov/nchs/data/databriefs/db365-tables-508.pdf#3.
SOURCE: NCHS, National Health Interview Survey, 2018.

[a]Villarroel MA, Cha AE & Vahratian A - National Health Survey 2018

Smokers satisfaction with Vaping

- Largely determined by:
  - "throat hit"
  - Relief of urge to smoke
  - Mouthpiece fit
  - Draw resistance
  - Vapor Cloud
- Refillable devices generally rated higher for satisfaction than cigarette look-alikes.

Hajek et al, *Psychopharmacology*, 2018

Youth – 2019 Current Use

Youth Age	E-cigarettes	Cigarettes	All Tobacco Products
Middle School[a]	10.5%	2.3%	12.5%
High School[a]	27.5%	5.8%	31.2%

*2018

Trend in Current Use of any Tobacco Product[b]

3.6 million 5.4 million

2017 2019

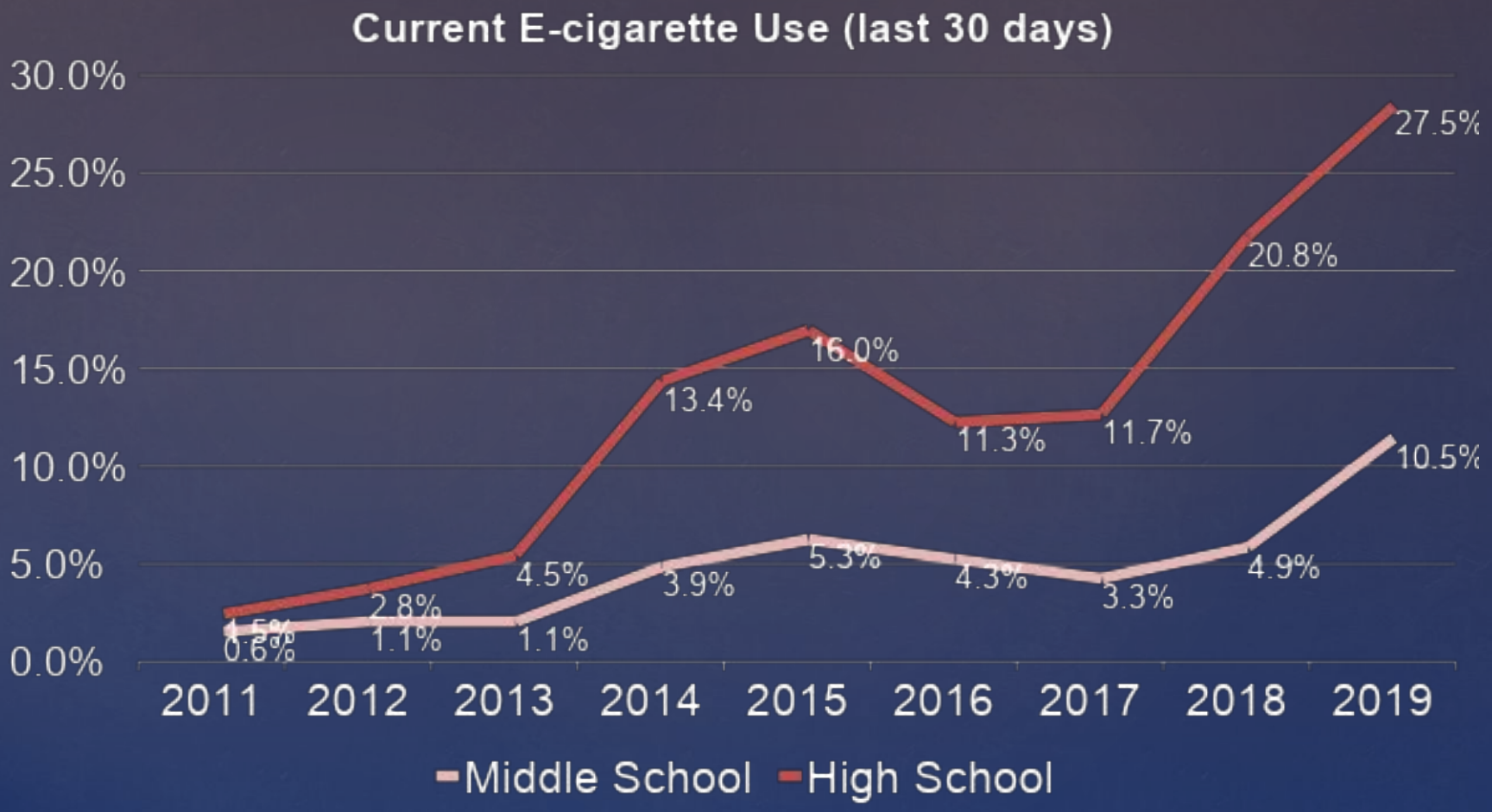
67%
from 2017

[a]MMWR 2019:68(12); [b]CDC

E-cigarette Juice Flavorings

Among middle and high school students who currently vape: 68% have used a flavored product

Youth trends: 2011-2019



National Youth Tobacco Surveys

Youth – Vaping Concerns

- Adolescent brains still developing[a]
  - Impacts how brain works
  - Increased risk for: other addiction, impulsivity and mood disorders
- Increased risk of combustible cigarette use[b], especially when flavored use is first[c]

[a]USDHHS 2016; [b]NASEM 2018; [c]Villanti AC, [c]ohnson AL, et al 2017

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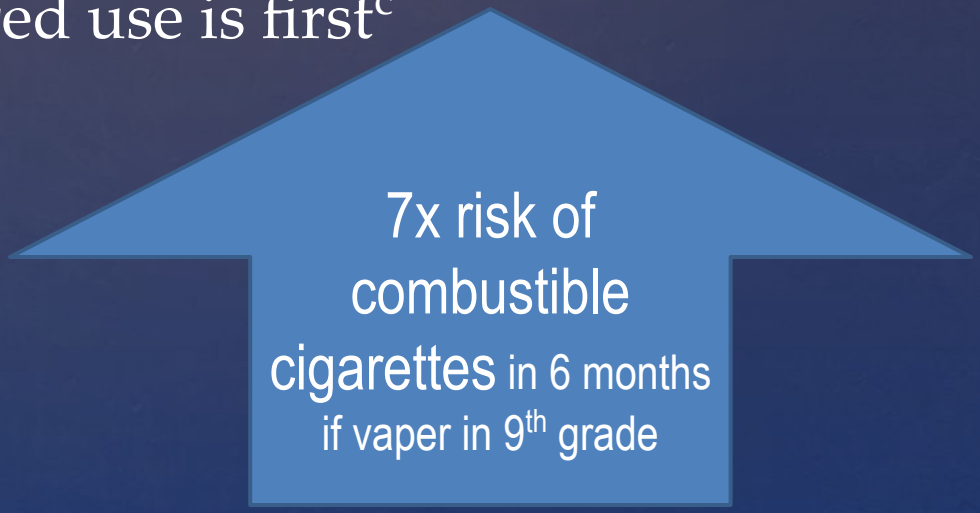


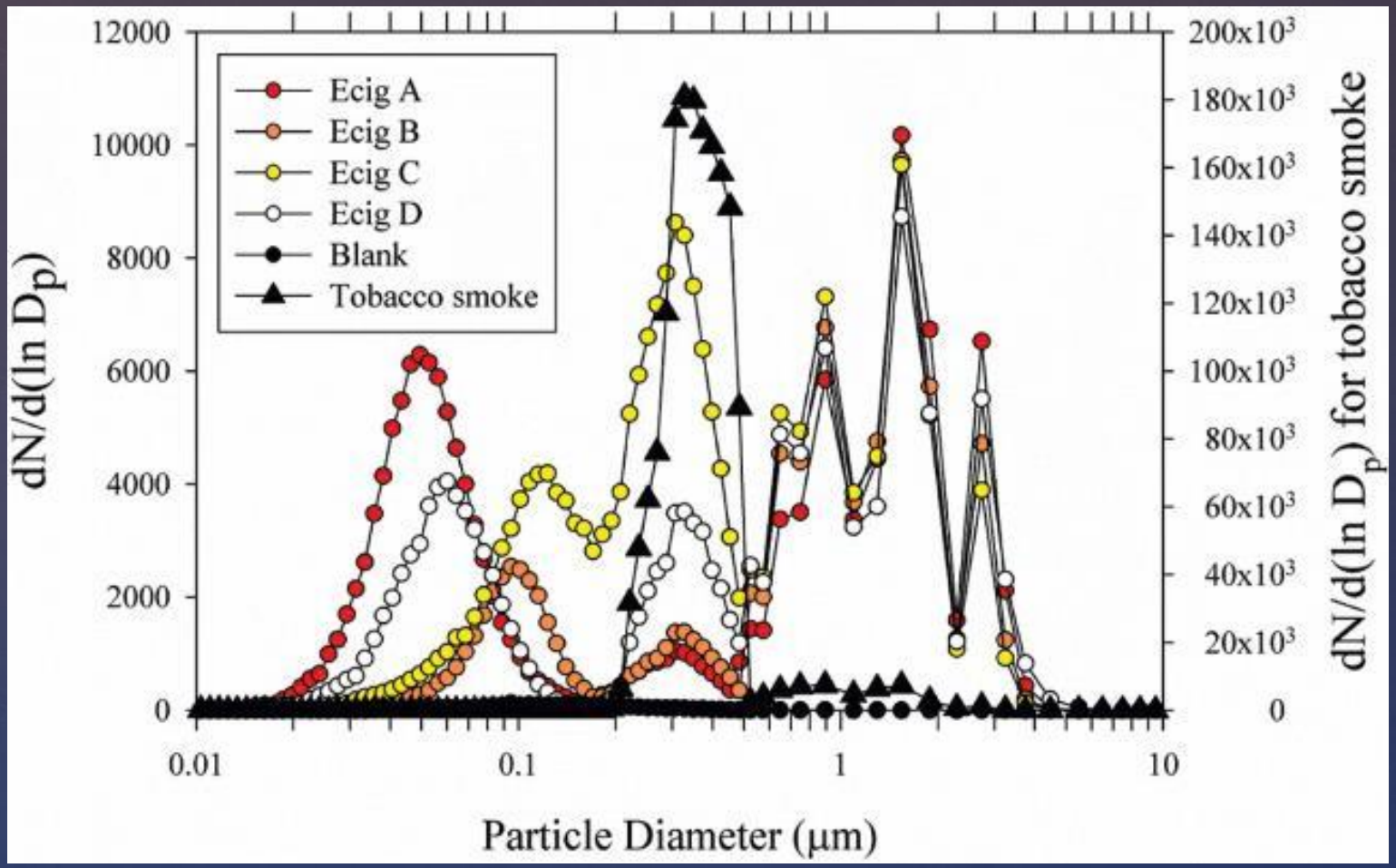
[a]USDHHS 2016; [b]NASEM 2018; [c]Villanti AC, [c]ohnson AL, et al 2017

Secondhand Vapor

- No side-stream smoke from e-cigarette
- Exposure from exhalation of vaper
  - Toxins at much lower level than conventional cigarettes[a]
  - Serum cotinine levels similar for secondhand exposure as conventional cigarettes in one study[b] and at 1/10 the level in another[c]

[a]Schripp et al *Indoor Air* 2013 [b]Flouris et al *Inhal Toxicol* 2013; [c]Czogala et al *Nic Tob Res* 2014

Secondhand Vapor: More Than Water Vapor



Overall particle number concentration (p/cm3) and size distribution data for all vapor and smoke samples

McAuley; et al. *Inhalation Toxicology* 2012.

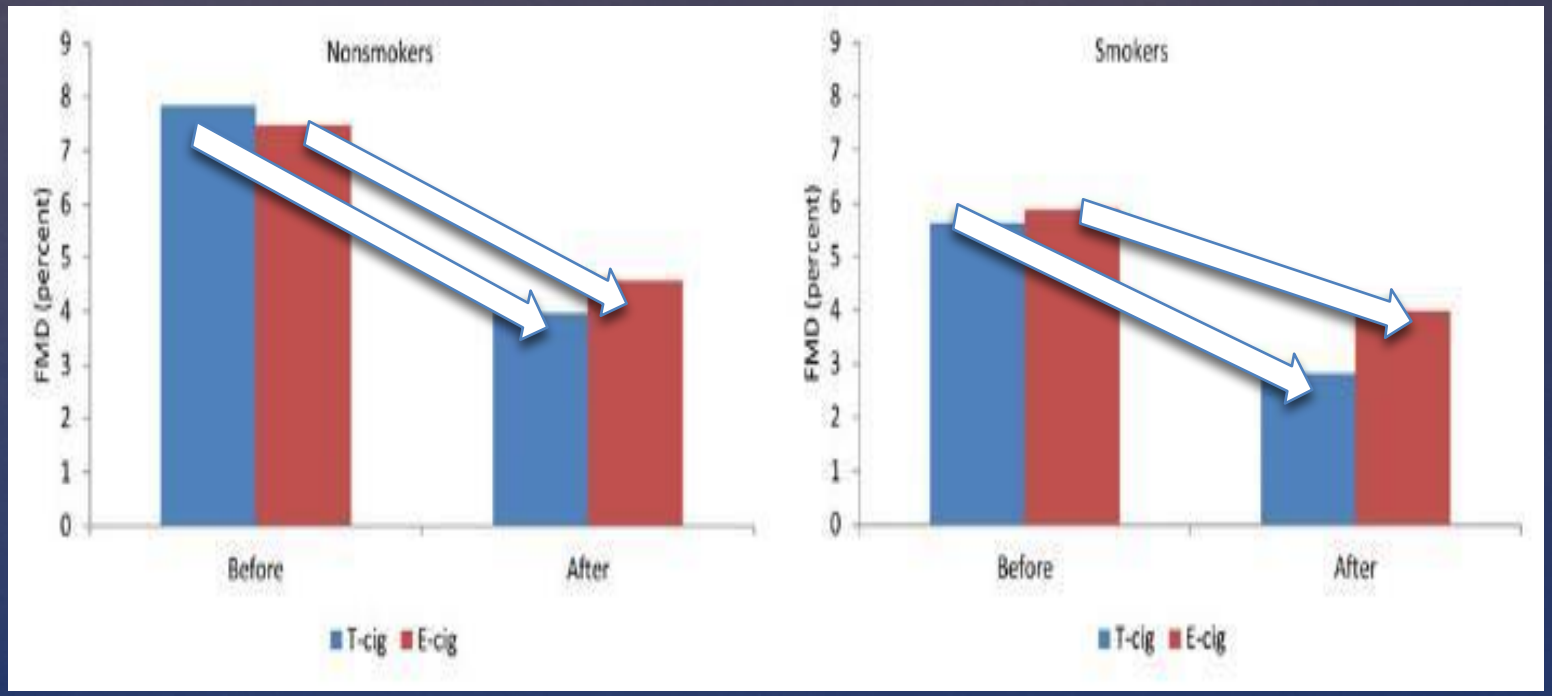
Health Effects

- Long term effects unknown at this time
- Health effects identified:
  1. Systemic
     - Oxidative Stress increased
     - Inflammation increased
     - Infections (e.g., pneumonia) increased
     - Dysregulation of repair/extracellular matric (ECM) remodeling
     - Immunity reduced
  2. Nicotine poisoning – from e-liquid
  3. Mechanical injury – battery explosion

Gilpin DF, McGown KA et al *Respir Res* 2019; Miyashita L, Suri R et al *Eur Respir J* 2018; Sohal SS, Eapen MS *ERJ Open Res* 2019; Ghosh et al, *Am J Resp Crit Care Med,* 2018

Vaping - Cardiac Effects

Similar to cigarettes for blood vessel impact and oxidative stress (whether user was a smoker before, or not)



Carnevale R, *Chest*, 2016

EVALI – E-cigarette or Vaping Product Associated Lung Injury

- DX by Exclusion:
  - Pulmonary infiltrates on scans
  - Vaping in last 90 days (THC and/or nicotine)
  - No other known cause
- Vitamin E acetate thought to be main ingredient of concern
- Primarily seen in 18-24 year old males

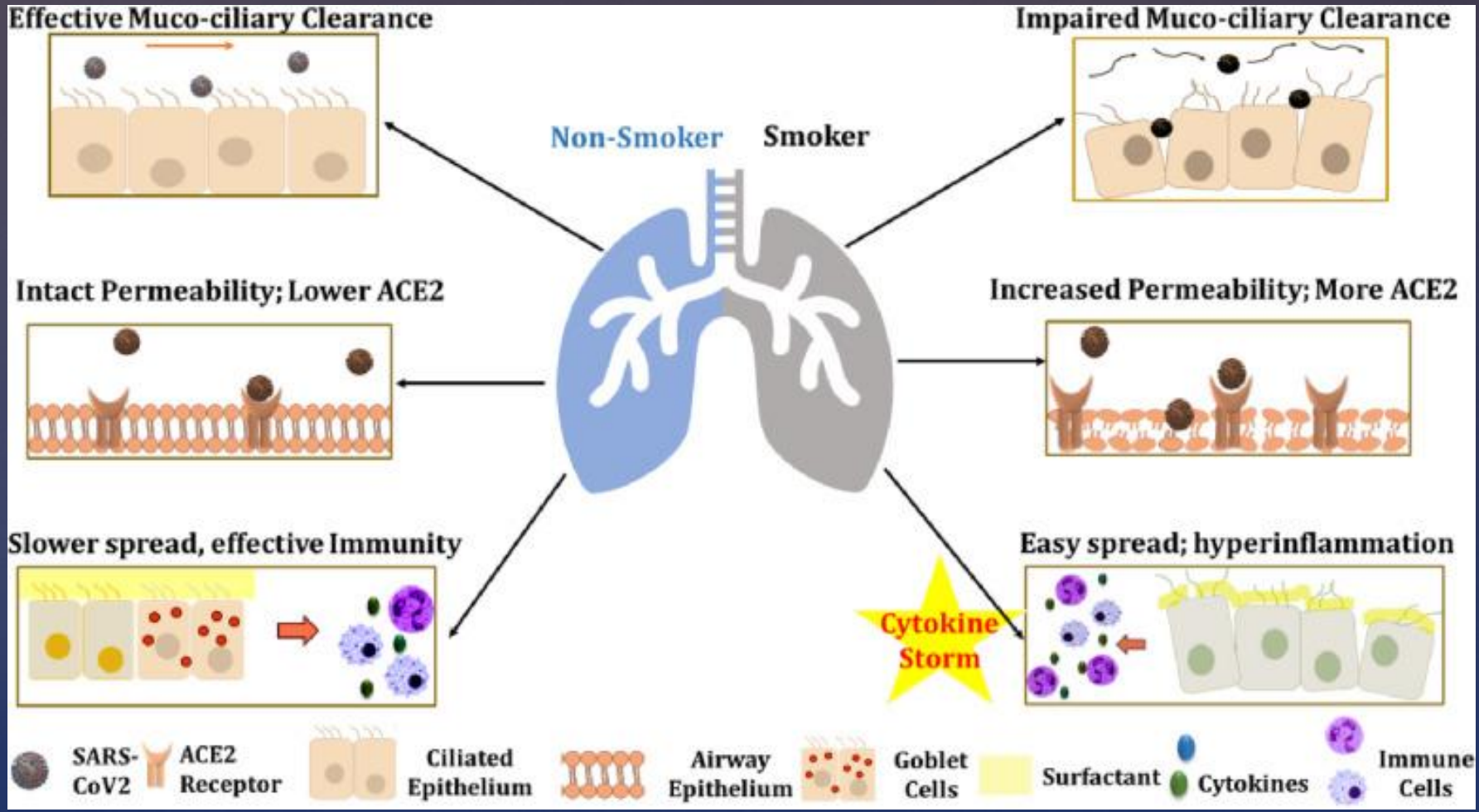
Cherian SV, Kumar A, Estrada-y-Martin RM, *Am J Med* 2020

Vaping and COVID-19 Risk

- Along with smoking, vaping may critically exacerbate COVID-19 inflammation[a]
- Nicotine and Flavors upregulate chemokines CCL5 and CCR1[a]
- Young adults 5 times more likely to receive a + diagnosis with ever vaping[b]
- Suspected increase in ACE2 (from nicotine) the cellular entry receptor

[a]Lee AC, Chaklaar J et al *In J Mol Sci* 2020; [b]Gaiha SM, Chen J & Halpern-Felsher B, et al, *J Ado Health*, 2020

Smokers/Vapers - increased susceptibility and risk for COVID19



Kaur G, Lungrella G, Rahman I *J Inflamm* 2020

Potential effects of Vaping on health determined by

- E-cig brand
- Type of device
- Flavor additives
- User puffing pattern (duration and frequency)
  - Influenced by nicotine content
- Battery voltage

Zhao, et al, *Inhal Toxicol*, 2018

Potential Health Gains

- Assumes traditional cigarettes are replaced by e-cigs over 10 years[a]
  - 1.6-6.6 million premature deaths avoided
  - 20.8-86.7 million life-years saved
  - For youth (15 years in 2006) life expectancy extended by .5 years
- Among smokers switching – reduction in BP, lung function and disease symptoms (asthma and COPD); improved mood and memory[bc]

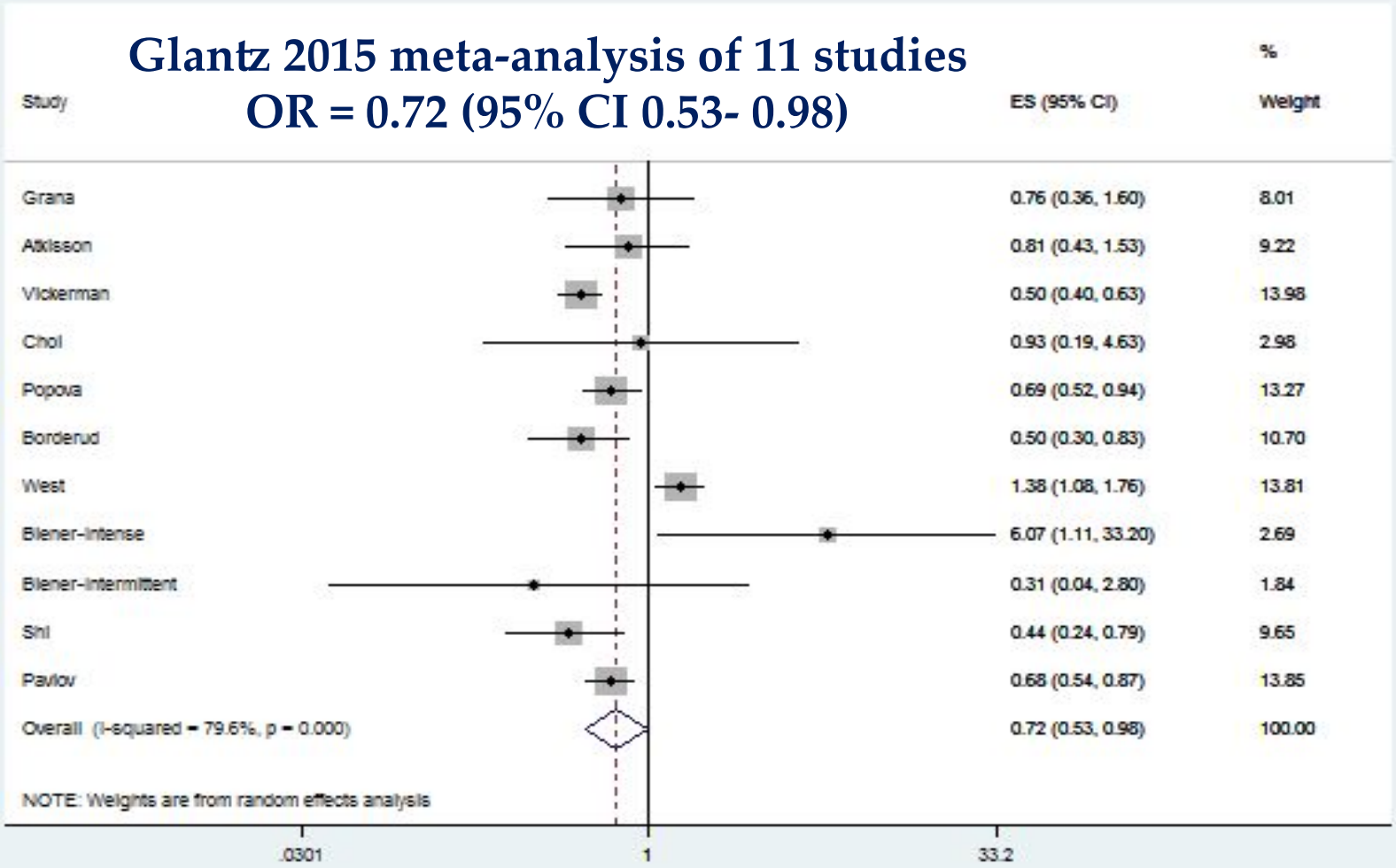
[a]Levy et al, *Tob Control*, 2018; [b]LPolosa, *J Env Res Pub Health,* 2014; [a]LFarasalinos et al, *Intern Emerg Med,* 2016

Does Vaping help to Quit Smoking?

- Evidence is mixed
  - More robust studies indicate can help some smokers
  - High quality Studies are needed

Glasser et al, *Am J Prev Med*, 2017

Are cigarette smokers who use e-cigarettes more likely to quit?



Public Health Concerns

- Addiction potential of nicotine for non and former smokers
- Potential to glamourize and re-normalize smoking
- Has not been found effective as a smoking cessation device (and thus not FDA approved)
- May maintain combusted tobacco use
- Risk of injury from battery explosions
- Increase in e-cigarette solution poisoning

Current Regulation-FDA Deeming Rule

- FDA issued the Deeming Rule to be in effect Aug 2016
  - Improved quality control and production standards
  - No sales <18 years – RECENT <21 years
  - Health warning labels
  - No vending machine sales
  - No marketing implying "healthy" or "safe"
- "Grandfather" period for products currently on the market – in March 2018 extended period to 2022
  - RECENT – no pre-filled flavor cartridges other than tobacco and menthol; no advertising to youth

Electronic Cigarette/Vaping Key Points

- They are tobacco products
- Youth who vape more likely to progress to traditional cigarettes
- Juice and aerosol found to contain toxins that include nicotine, ultra-fine particles and carcinogens
- Negative health effects compared to no smoking but fewer short term health effects compared to smoking, except equal risk of EVALI and COVID-19.
- Long term effects unknown
- Mixed reports of effectiveness for smoking cessation

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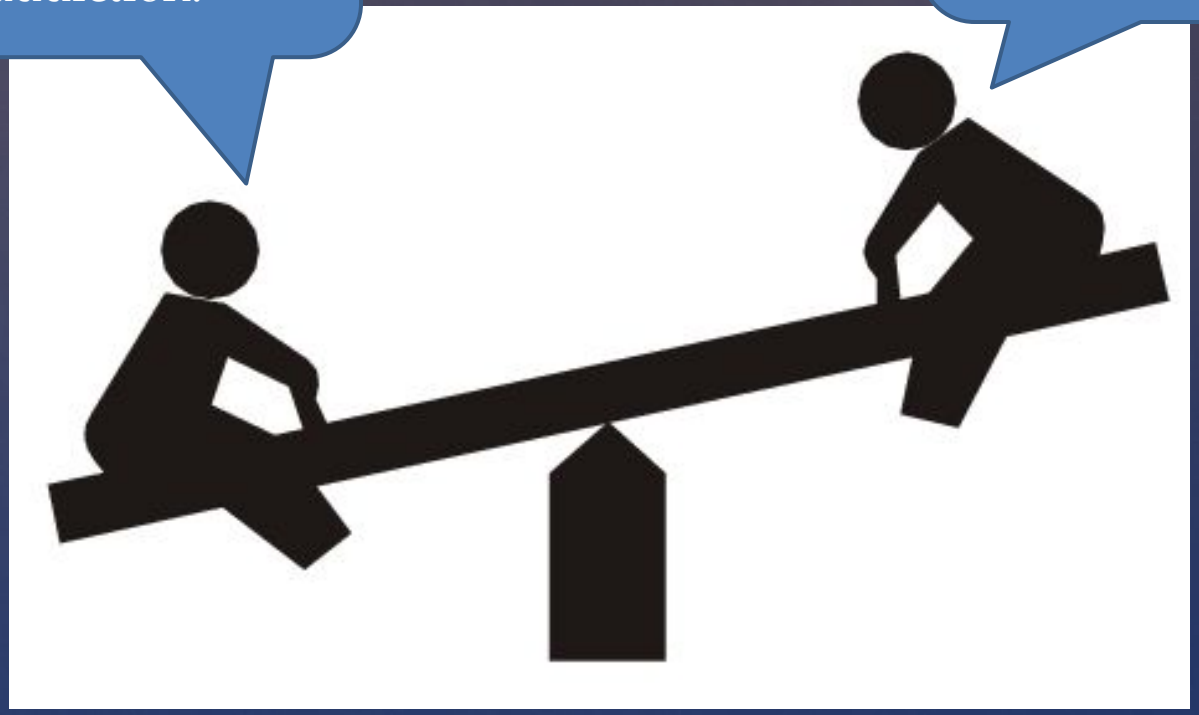
What do the Public Health experts say?

They aren't safe; they maintain and promote nicotine addiction!

They are safer than smoking cigarettes! (Harm Reduction)



Recommendations: What Can You Do in Clinical Practice?

For Youth:

- ASSESS youth for vaping when asking about tobacco
- ADVISE youth about the harms of vaping and strongly recommend they do not
- ADVISE parents and other caretakers to not vape or use other tobacco products
  - If they vape, caution about safe storage of juice

Recommendations: What Can You Do in Clinical Practice?

For Adults:

- ASSESS for vaping when asking about tobacco
- ADVISE NO tobacco use
- REFER to Tobacco Cessation Services
- ASSIST with additional pharmacotherapy to aide quit attempt

Nicotine Addition Pharmacotherapy

Medication	Contraindications	Dosage	Major Side-effects	Notes
Bupropion SR	History of seizure History of eating disorder Use of MAO-inhibiters in last 14 days	150 mg 3 days 1 am 4-84 days 1 am & 1 pm	Insomnia Dry mouth	Recommended for history of or current depression To reduce insomnia, take pm dose 8 hours after am dose. Start 1-2 weeks prior to quitting
Varenicline	Kidney disease or dialysis Psychiatric history	2 mg. 0.5 qd x 3 days 0.5 bid x 4 days 1 mg bid x 8-84 days	Impaired ability to operate machinery; Nausea; Vivid dreams; insomnia; taste perversion	Start 7 days in advance of quitting Taper dose up; no need to taper down
Nicotine Patch	Post MI Serious arrhythmia Unstable angina pectoris	21, 14 and 7 mg. Placed on torso Start with higher dose, taper down	Skin reaction Insomnia; Vivid dreams	8 weeks sufficient treatment Some quitlines will provide for free
Nicotine Gum	Post MI Serious arrhythmia Unstable angina pectoris	2 mg. <25 cigs./day 4 mg ≥25 cigs/day 1 q1-2 hours x 6 to 12 weeks	Mouth soreness Hiccups; Dyspepsia; Jaw ache	Patients chews briefly then parks the gum inside cheek Maximum of 20 pieces/day Taper down 1/day each week
Nicotine Inhaler	Post MI Serious arrhythmia Unstable angina pectoris	4 mg 80 inhalations /cartridge 6-12 doses/day	Mouth & throat irritation; Cough; Rhinitis	Taper down over 6-12 weeks, stop when reduced to 1-2 doses/day