Vaporizing Vaping, Electronic Cigarettes and THC

Natasha N. Bray, DO, MSEd, FACP, FACOI
Dean (Interim) Cherokee Nation Campus,
Oklahoma State University College of Osteopathic Medicine
Clinical Professor Rural Health

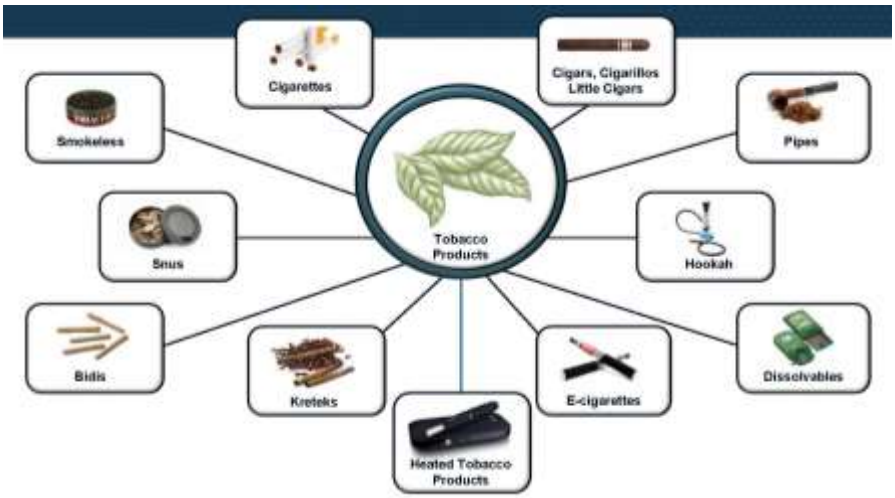
EXPLORE
HEALTHCARE SUMMIT

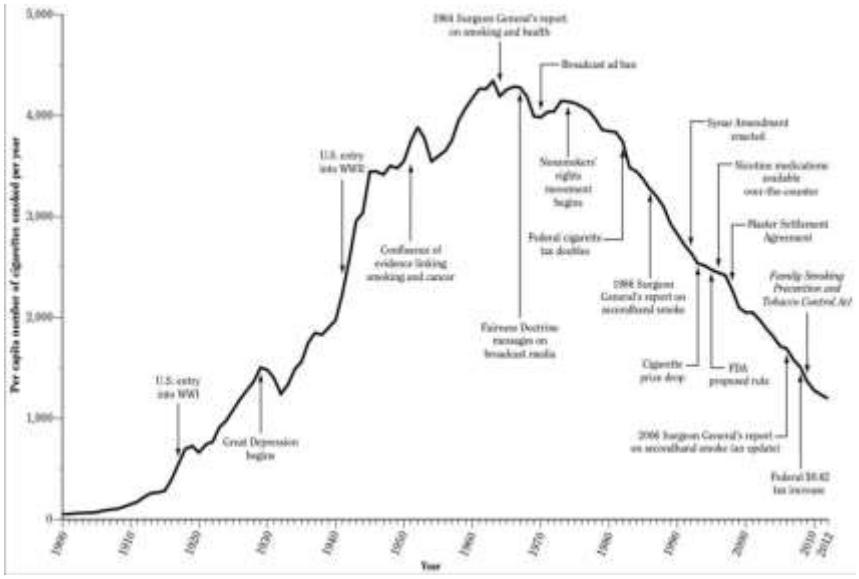
Learning Objectives

- Overview the **prevalence** of tobacco and tobacco related products in the US.
- Discuss the **known and potential risks** of e-cigarettes, vape devices, and pod systems (i.e. JUUL)
- Discuss the epidemic of **vaping associated lung injury**, diagnosis and treatment
- Review **methods to screen and counsel** patients and families
- Identify **resources** to help patients understand risks

2

Evolution in the Landscape of Tobacco Products





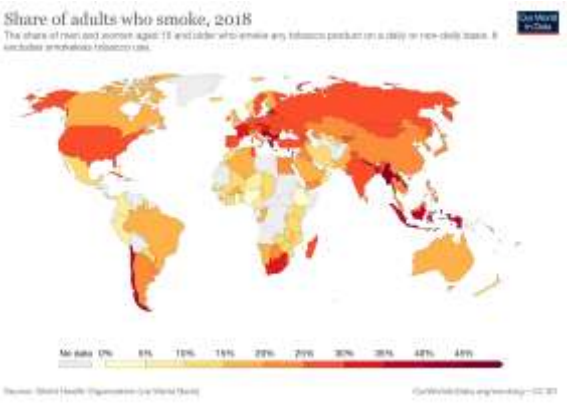
The Health Consequences of Smoking – 50 years of Progress: A Report of the Surgeon General

Worldwide

1.1 Billion Current Smokers (age >15 years)
- *** 942 million males**
- *** 175 million females**

Top 10 Countries

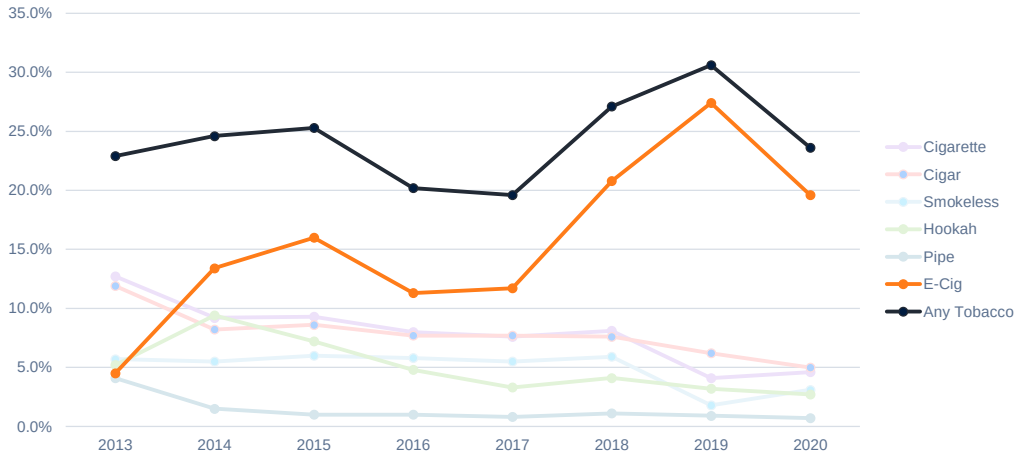
- China
- India
- Indonesia
- United States
- Russia
- Bangladesh
- Japan
- Turkey
- Vietnam
- Philippines



Besaratinia A (2021) from Tobacco Cigarettes to Electronic Cigarettes: The Two Sides of a Nicotine Coin. Front. Oral. Health 2: 790634.

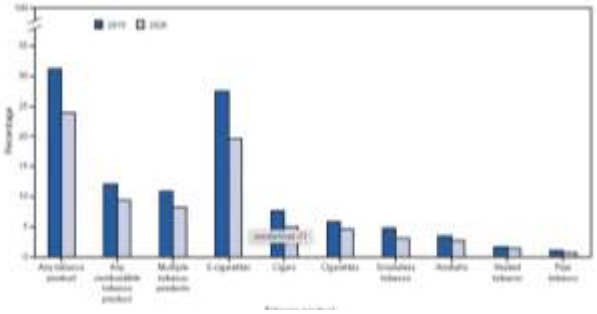

E-pipe
E-cigar
Large-size tank devices
Medium-size tank devices
Rechargeable e-cigarette
Disposable e-cigarette

Current Tobacco Product Use Among U.S. High School Students – NYTS 2013 - 2020



Public Health Crisis

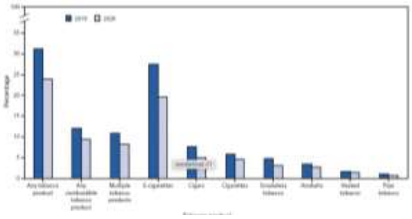
- E-cigarettes are the **MOST POPULAR** tobacco product used by adolescents.
  - In 2021, 11.3% of high school students used e-cigarettes in the past month.
  - In 2020, 19.6% of high school students used e-cigarettes in the past month.
  - In 2019, **27.5%** of high school students used e-cigarettes in the past month.
  - In 2018, 20.8% of high school students used e-cigarettes in the past month.



Current Tobacco Product Use Among U.S. High School Students – 2019 - 2020

Source: Gentzke AS, Creamer M, Cullen KA, Ambrose BK, Willis G, Jamal A, King BA. Vital Signs: Tobacco Product Use Among Middle and High School Students – United States, 2011-2018. MMWR Morb Mortal Wkly Rep 2019; 68(6):1-8.
Gentzke AS, Wang TW, Jamal A, et al. Tobacco Product Use Among Middle and High School Students — United States, 2020. MMWR Morb Mortal Wkly Rep 2020;69:1881–1888. DOI: http://dx.doi.org/10.15585/mmwr.mm6950a1

2020 National Youth Tobacco Survey



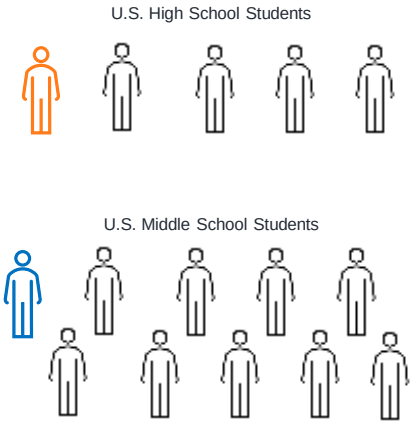
Current Tobacco Product Use Among U.S. High School Students – 2019 - 2020

Tobacco Product	Sex		Race / Ethnicity				Sexual Identity			Total
	Male	Female	White, non-Hispanic	Black, non-Hispanic	Hispanic	Other, non-Hispanic	Heterosexual	Lesbian, gay, bisexual	Not Sure	
E-cigarettes	18.7 (16.1-21.7)	20.4 (17.8-23.4)	23.2 (20.6-25.9)	9.1 (6.7-12.2)	18.9 (15.2-23.4)	12.1 (8.8-16.4)	18.5 (16.1-21.1)	25.1 (19.6-31.5)	14.5 (9.2-22.0)	19.6 (17.2-22.2)
Any Tobacco Product	22.5 (19.8-25.6)	24.7 (21.6-28.1)	25.9 (23.0-29.2)	18.4 (15.5-21.8)	23.3 (19.4-27.7)	15.7 (12.1-20.2)	22.0 (19.4-24.9)	30.9 (25.3-37.2)	20.4 (14.9-27.2)	23.6 (21.1-26.4)

Source: Gentzke AS, Creamer M, Cullen KA, Ambrose BK, Willis G, Jamal A, King BA. Vital Signs: Tobacco Product Use Among Middle and High School Students – United States, 2011-2018. MMWR Morb Mortal Wkly Rep 2019; 68(6):1-8.
Gentzke AS, Wang TW, Jamal A, et al. Tobacco Product Use Among Middle and High School Students — United States, 2020. MMWR Morb Mortal Wkly Rep 2020;69:1881–1888.
DOI: http://dx.doi.org/10.15585/mmwr.mm6950a1

2020 National Youth Tobacco Survey

- In 2020, 19.6% of high school students used e-cigarettes in the past month.
  - 3.6 million American Teens
- 80% use flavored products
  - Fruit, mint, menthol, and candy, desserts, or other sweet-flavored e-liquids



Source: Wang TW, NeffLJ, Park-Lee E, Ren C, Cullen. KA, King BA. E-cigarette use among midle and high school students – United States, 2020. Morb Mortal Wkly Rep. (2020) 69: 1310-2.
Gentzke AS, Wang TW, Jamal A, et al. Tobacco Product Use Among Middle and High School Students — United States, 2020. MMWR Morb Mortal Wkly Rep 2020;69:1881–1888. DOI: http://dx.doi.org/10.15585/mmwr.mm6950a1

2017 & 2019 30-day Prevalence of E-Cig Use

College Students	19–22-Year-Old Not in College
6% → 22%	8% → 18%

Source: Wang TW, NeffLJ, Park-Lee E, Ren C, Cullen. KA, King BA. E-cigarette use among midle and high school students – United States, 2020. Morb Mortal Wkly Rep. (2020) 69: 1310-2.
Gentzke AS, Wang TW, Jamal A, et al. Tobacco Product Use Among Middle and High School Students — United States, 2020. MMWR Morb Mortal Wkly Rep 2020;69:1881–1888.
DOI: http://dx.doi.org/10.15585/mmwr.mm6950a1

Vaping & Cannabis

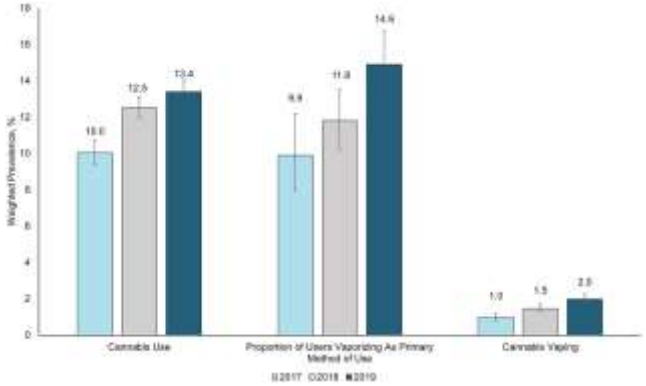
- Cannabis oil concentrates - Butane hash oil & wax
  - Faster hallucinogen effect due to higher concentration of THC
  - DANGER: Vitamin E Acetate → EVALI

- **8.4%** of adolescents have vaped cannabis in the last 30 days

- **1 in 3** High School Seniors vaped cannabis in 2018 alone.

Lim CCW, Sun T, Leung J, et al. Prevalence of Adolescent Cannabis Vaping: A Systemic Review and Meta-analaysis of US and Candain Studies. JAMA Pediatr. 2022; 176(1): 42-51.
Fuentes XF et al. VpALI-Vaping-related Acute Lung Injury: A New Killer Around the Block. Mayo Clin Proc. Dec 2019; 94(12): 2534-2545.
Kowitt SD, Osman A, Meemik C, et al. Vaping cannabis among adolescents: prevalence and association with tobacco use from a cross-sectional study in the USA. BMJ Open. 2019; 9(6): e028535.

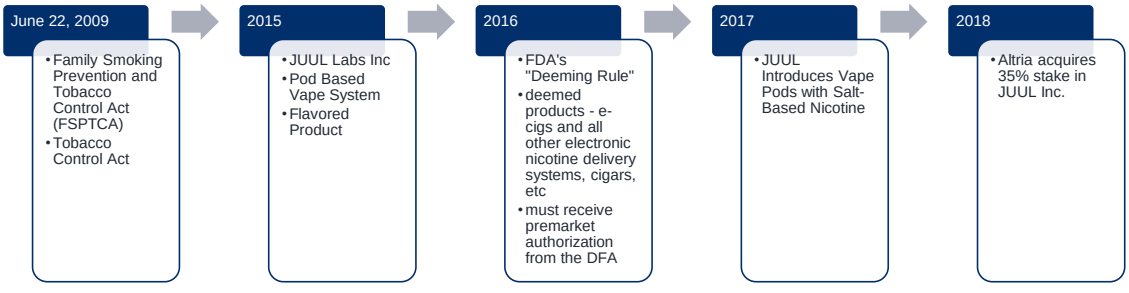
Vaping & Cannabis



Boakye E, Obisesn OH, Uddin SMI, et al. Cannabis vaping among adults in the United States: prevalence, trends, and association with high-risk behaviors and adverse respiratory conditions. Preventive Medicine 2021. 153. https://doi.org/10.1016/j.ypmed.2021.106800

Governmental Regulation

Key Timeline in Tobacco Legislation & Emergency of E-Cigarettes



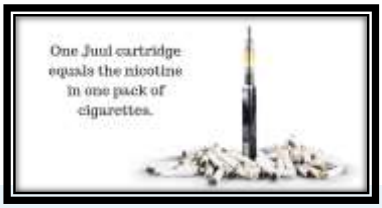
Key Timeline in Tobacco Legislation & Emergency of E-Cigarettes

2015
- JUUL Labs Inc
- Pod Based Vape System
- Flavored Product

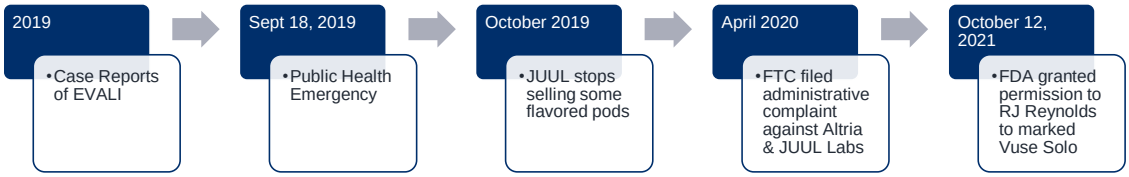
2016
- FDA's "Deeming Rule"
- deemed products - e-cigs and all other electronic nicotine delivery systems, cigars, etc
- must receive premarket authorization from the DFA

2017
- JUUL Introduces Vape Pods with Salt-Based Nicotine

2018
- Altria acquires 35% stake in JUUL Inc.



Key Timeline in Tobacco Legislation & Emergency of E-Cigarettes



September 18, 2019

Former FDA Commissioner Dr. Scott Gottlieb:

"We have an obligation to act on what we know. And what we know is very disturbing. Kids use of e-cigarettes has reached an epidemic level of growth."

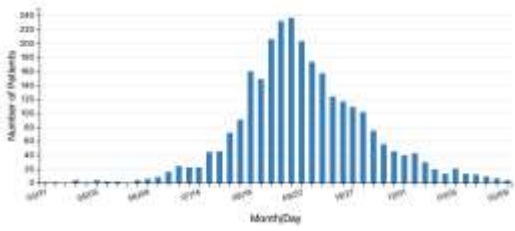
EVALI

E-cigarette, or Vaping, Product Use-Associated Lung Injury

E-cigarette, or Vaping, Product Use-Associated Lung Injury (EVALI)

AKA – VpALI
Vaping-related Acute Lung Injury

- As of February 18, 2020, **2,807** hospitalized for EVALI cases or deaths have been reported to CDC from all 50 states, the District of Columbia, and two US Territories
  - **68** deaths have been confirmed in 29 states and the District of Columbia[1]



1. CDC Website. https://www.cdc.gov/tobacco/basic_information/e-cigarettes/severe-lung-disease.html#map-cases
2. Lozier MJ et. al. Update: Demographic, Product, and Substance-Use Characteristics of Hospitalized Patients in a Nationwide Outbreak of E-cigarette, or Vaping, Product Use-Associated Lung Injuries - United States, December 2019. MMWR. December 13, 2019 / 68(49);1142–1148
3. Werner AK, et al. Hospitalizations and Deaths Associated with EVALI. NEJM 2020; 382: 1589 – 1598.

E-cigarette, or Vaping, Product Use-Associated Lung Injury (EVALI)

- Patient Demographics
  - Median age of deceased patients was 49.5 (Range 15-75 years)
  - Hospitalized Patients
    - 66% are male
    - Median age: 24 years old (Range 13 – 85 years)
    - 76% are age ≤ 34 years
  - Substance Used
    - 82% report using e-cigarette products containing THC
      - 33% reported exclusive use of THC-containing products
    - 57% reported using nicotine-containing products
      - 14% reported exclusive use of nicotine-containing products

16% commercial sources
78% informal sources

69% commercial sources
15% informal sources

1. CDC Website. https://www.cdc.gov/tobacco/basic_information/e-cigarettes/severe-lung-disease.html#map-cases
2. Lozier MJ et. al. Update: Demographic, Product, and Substance-Use Characteristics of Hospitalized Patients in a Nationwide Outbreak of E-cigarette, or Vaping, Product Use-Associated Lung Injuries - United States, December 2019. MMWR. December 13, 2019 / 68(49);1142–1148
3. Werner AK, et al. Hospitalizations and Deaths Associated with EVALI. NEJM 2020; 382: 1589 – 1598.

E-cigarette, or Vaping, Product Use-Associated Lung Injury (EVALI)

Symptoms:
Cough, dyspnea, pleuritic chest pain
Nausea, vomiting, diarrhea
Headache, fatigue, weight loss

Physical Exam Findings:
Hypoxemia, fever, tachypnea

AND

Positive Screen for Vaping-specific History:
E-cigarette ("vaping") or "dabbing" (inhaling concentrated liquid) within 30 days
Most cases involve use in days to weeks preceding presentation. CDC case definition includes vaping use in prior 90 days

\+

–

Chest X-ray:
Diffuse bilateral infiltrates/disease

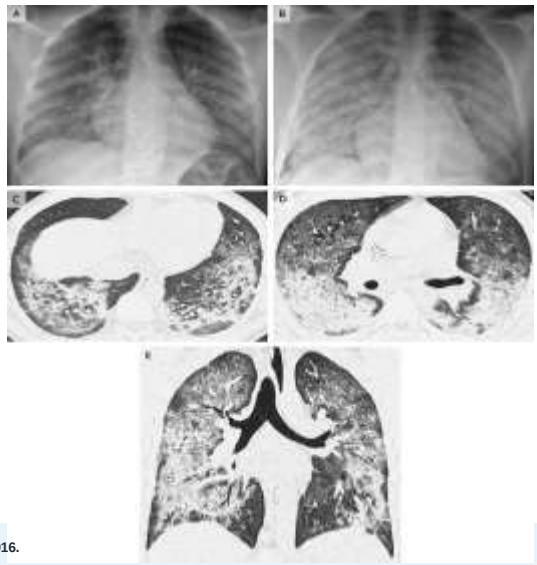
Chest CT:
Nonspecific bilateral ground glass opacities +- sub-pleural sparing
Acute eosinophilic pneumonia, diffuse alveolar damage, organizing pneumonia, or lipoid pneumonia
Diffuse lung nodules

If history, physical, &/or chest imaging not suggestive consider alternative diagnosis

If atypical presentation:
repeat imaging
Close follow-up (within 48 hours)

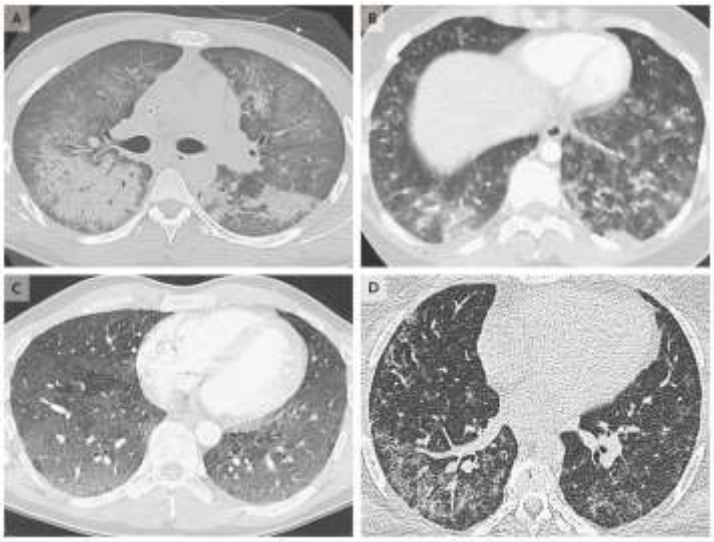
1. Lozier MJ et. al. Update: Demographic, Product, and Substance-Use Characteristics of Hospitalized Patients in a Nationwide Outbreak of E-cigarette, or Vaping, Product Use-Associated Lung Injuries - United States, December 2019. MMWR. December 13, 2019 / 68(49);1142–1148
2. Werner AK, et al. Hospitalizations and Deaths Associated with EVALI. NEJM 2020; 382: 1589 – 1598.

Chest Radiographs and High-Resolution Computed Tomographic Imaging in a 17-Year-Old Male Patient with Diffuse Lung Disease.



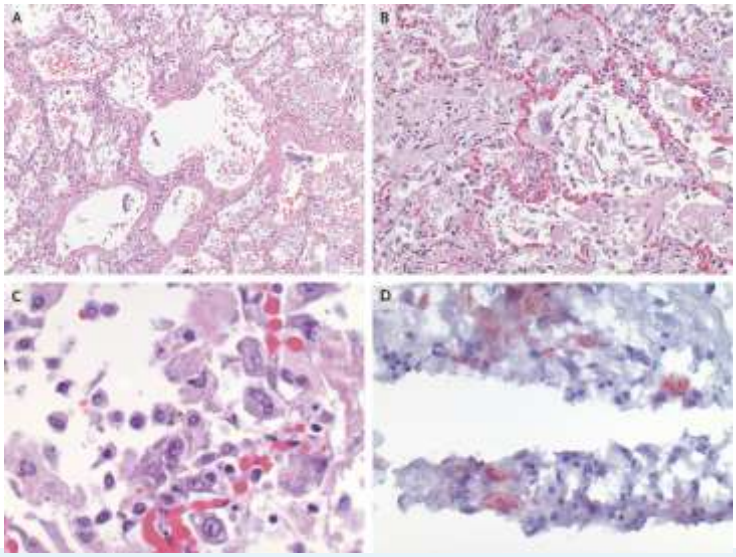
JE Layden et al. N Engl J Med 2020;382:903-916.

Computed Tomographic Scans of the Chest Obtained from Patients with Vaping-Associated Lung Injury.



TS Henry et al. N Engl J Med 2019;381:1486-1487.

Findings in the Lungs on Autopsy.



N Engl J Med 2020;382:387-390.

Vitamin E Acetate

Vitamin E acetate, an additive in some THC-containing e-cigarette, or vaping, products is closely associated with EVALI

E-cigarette, or Vaping, Product Use-Associated Lung Injury (EVALI) - Management

- Early pulmonology and toxicology consultations, including screening for urine THC
- Oxygen and respiratory / ventilatory support as required
- Empiric antibiotic coverage for at least 48 hours if history is unclear, if patient is intubated, or patient has severe hypoxemia despite supplemental oxygen
- During influenza season, antivirals should be considered until influenza is excluded
- Systemic steroids if no improvement with antibiotics and/or respiratory support
- Corticosteroid dosing and duration should be considered on a case-by-case basis
- Length of steroid taper should be made based on patient's clinical course of recovery and close follow up
- Arrange for outpatient follow up with primary care team and/or pulmonary team
- Report to local Poison Control Center for Case Surveillance
- Collect vaping cartridges for state public health lab testing

1. CDC Website. https://www.cdc.gov/tobacco/basic_information/e-cigarettes/severe-lung-disease.html#map-cases
2. Lozier MJ et. al. Update: Demographic, Product, and Substance-Use Characteristics of Hospitalized Patients in a Nationwide Outbreak of E-cigarette, or Vaping, Product Use-Associated Lung Injuries - United States, December 2019. MMWR. December 13, 2019 / 68(49);1142–1148
3. Werner AK, et al. Hospitalizations and Deaths Associated with EVALI. NEJM 2020; 382: 1589 – 1598.

Key Timeline in Tobacco Legislation & Emergency of E-Cigarettes

October 2019
- JUUL stops selling some flavored pods

April 2020
- FTC filed administrative complaint against Altria & JUUL Labs

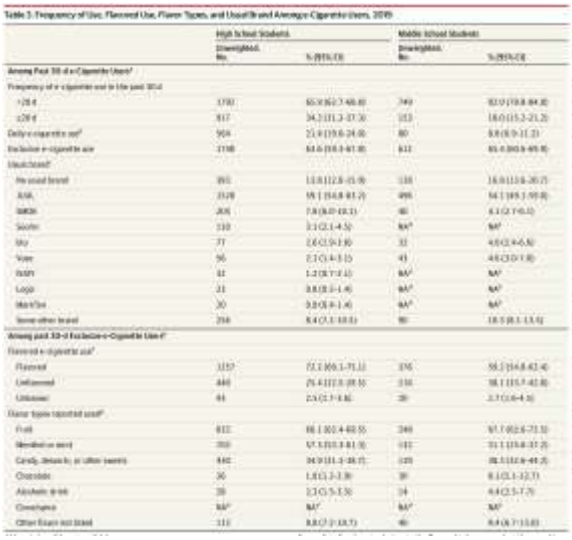
October 12, 2021
- FDA granted permission to RJ Reynolds to marked Vuse Solo

November 2019
JUUL Pods Available
Unflavored & Menthol

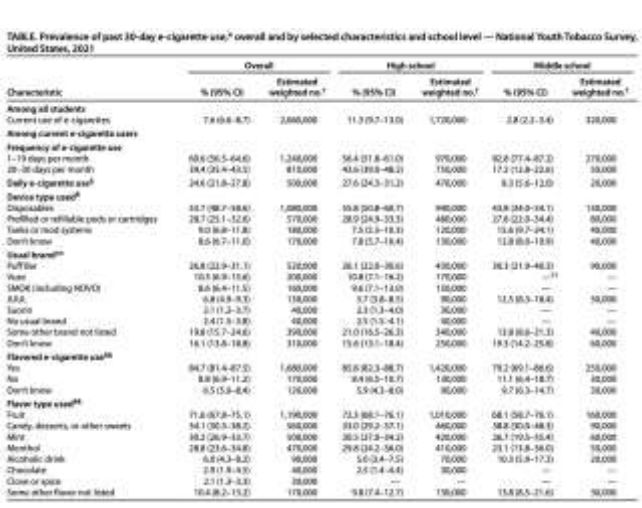
Flavored Pods Gone – Now What?

- From February 2020 to March 2021
  - e-cigarette sales increased by nearly 50%
    - from 14.8 million units to 22 million units
  - Sales of flavored e-cigarettes increased by 64% (lots of kids friendly flavors)
  - Sales of disposable e-cigarettes increased by nearly 200%
    - 2.8 million to 7.8 million units
  - Sales of menthol-flavored e-cigarettes increased by nearly 42%
    - 6.4 million to 9 million units
- September 2020 – FDA Said it would prioritize enforcement against disposable e-cigarettes
  - Sales of disposable have nearly doubled
    - 4 million to 7.8 million units
- March 2021… Menthol e-cigarette sales account for 41% of the e-cigarette market

2019 NYTS

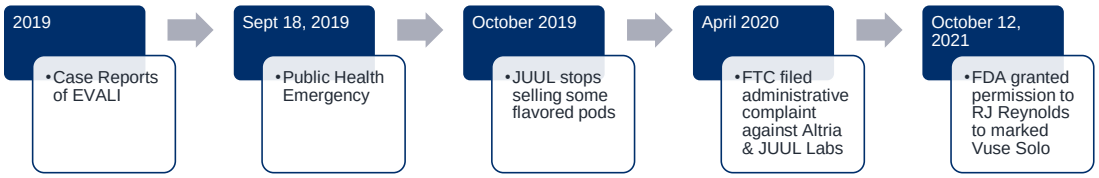


2021 NYTS



Cullen KA, Gentzke AS, Sawdey MD, et al. e-Cigarette Use Among Youth in the United States, 2019. JAMA. 2019;322(21):2095–2103. doi:https://doi.org/10.1001/jama.2019.18387
Park-Lee E, Ren C, Sawdey MD, et al. *Notes from the Field:* E-Cigarette Use Among Middle and High School Students — National Youth Tobacco Survey, United States, 2021. MMWR Morb Mortal Wkly Rep 2021;70:1387–1389. DOI: http://dx.doi.org/10.15585/mmwr.mm7039a4external icon

Key Timeline in Tobacco Legislation & Emergency of E-Cigarettes



2016
"Deeming Rule"

Sept 2020 – Sept 2021
FDA Reviewed PMTAs
~500 Companies
96% Reviewed & Adjudicated
296 denial orders for ~1,089,000
Flavored ENDS products

- October 12, 2021
  - FDA granted permission to R.J Reynolds to market its Vuse Solo closed ENDS device and two accompanying flavored e-liquid pods with a nicotine strength of 4.8%.
    - 10 other flavors were denied approval

"The authorized products' aerosols are significantly less toxic than combusted cigarettes based on available data"

"For these products, the FDA determined that the potential benefit to smokers who switch completely or significantly reduce their cigarette use, would outweigh the risk to youth, provided the applicant follows post-marketing requirements aimed at reducing youth exposure and access to the products"

June 23, 2022

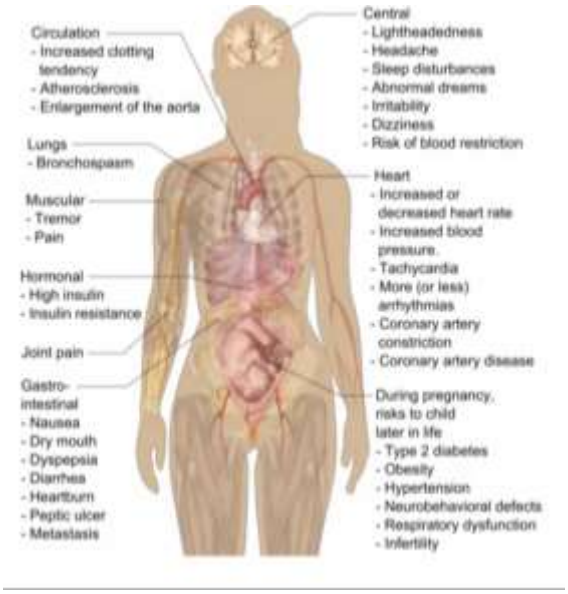
- FDA denies authorization to Market JUUL Products. (marketing denial orders (MDOs)
- JUUL Labs Inc. must stop selling and distributing all products marketed in the Unites States. This includes:
  - JUUL device
  - Virginia tobacco flavored JUUL pods at nicotine concentrations of 5.0% and 3.0%
  - Menthol flavored pods at nicotine concentrations of 5.0% and 3.0%.

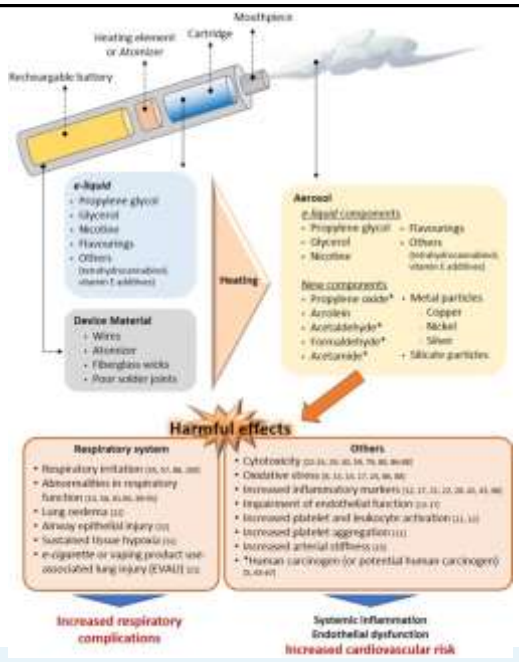
> On July 5, 2022, FDA administratively stayed the marketing denial order. The agency has determined that there are scientific issues unique to the JUUL application that warrant additional review. This administrative stay temporarily suspends the marketing denial order during the additional review but does not rescind it. All electronic nicotine delivery systems, or ENDS products, including those made by JUUL, are required by law to have FDA authorization to be legally marketed. The stay and the agency's review does not constitute authorization to market, sell, or ship JUUL products.

> On June 24, 2022, the U.S. Court of Appeals for the D.C. Circuit entered a temporary administrative stay of the marketing denial order for Juul Labs Inc. The court notes the purpose of this administrative stay is to give the court sufficient opportunity to consider petitioner's forthcoming emergency motion for stay pending court review and should not be construed in any way as a ruling on the merits of that motion.

Are E-Cigarettes safer than combustible tobacco products?

Side Effects of Nicotine





- Cigarettes
  - >7,000 Chemicals
- E-Ciagrettes
  - > 2,000 Chemicals

https://hub.jhu.edu/2021/10/07/vaping-unknown-chemicals/

Marques P, Piqueras L, Sanz, MJ. An updated overview of e-cigarette impact on human health. Respiratory Research 2021. 22:

Health-Related Effects of Electronic Cigarettes

Pulmonary Effects

- Heat- and solvent-related carcinogenic compounds
- Respiratory epithelial injury
- Reduced mucociliary clearance
- Increased risk of respiratory tract infections
- Vaping-related acute lung injury
- Increased Airway Reactivity

Cardiovascular Effects

- Increased oxidative stress and inflammation
- Increased platelet aggregation
- Increased odds of myocardial infarction

Thermal Injury

Psychosocial Effects

- Nicotine addiction
- Increased cannabis tolerance and withdrawal
- Increased use of other tobacco products, alcohol, and illicit drugs

Pulmonary Syndromes

- Inhalation injury
- Exogenous lipoid pneumonia
- Hypersensitivity pneumonitis
- Acute eosinophilic pneumonia
- Diffuse alveolar hemorrhage
- Pneumothorax/pneumomediastinum
- Acute respiratory distress syndrome
- Respiratory bronchiolitis-interstitial lung disease
- Bronchiolitis obliterans
- Acute fibrinous pneumonitis
- Organizing pneumonia
- Granulomatous pneumonitis

Fuentes XF et al. VpALI-Vaping-related Acute Lung Injury: A New Killer Around the Block. Mayo Clin Proc. Dec 2019; 94(12): 2534-2545.

	e-cigarette	Conventional cigarettes	Ref.
In vivo studies	Inhaled nitric oxide	+ (only from nicotine containing e-liquids)	++	[8]
	Inhaled carbon monoxide	-	++	[8]
	Retention of hazardous compounds in urine (metabolites of benzene, nitrobenzene, acrylonitrile, acrolein and acrylamide)	+	++ (in dual users)	[9]
	Increased platelet aggregation	+	++	[11]
	Increased platelet activation (higher levels of CD62L and P-selectin)	+	++	[11]
	Difficulties to perform physical activities (in COPD patients)	+	++	[101]
	Oxidative stress	+	++	[13, 14, 15]
	Impaired endothelial function	+	++	[11-17, 20]
	Vascular stiffness	+	++	[15, 16]
	Blood pressure	+	++	[15, 16]
In vitro studies	Lung oedema	+	++	[21]
	Enhanced IL-6 expression	+	++	[22]
	Enhanced IL-1β and TNFα expression	-	++	[22]
	Apoptotic activity	-	++	[22]
	Endothelial cells (HUVEC): Cytotoxicity, decreased proliferation and ROS production	+	++	[24, 27]
	Human airway epithelial cells (Calu-3): Reduced epithelial barrier integrity (not found in e-cigarettes)	-	++	[30]
	Gingival fibroblasts: Altered morphology, reduced proliferation and induction of apoptosis	+	++	[29]
	Retinal pigment epithelial cells (ARPE): Increased cell death	+	++	[32, 33]

Comparison of MC Carbonyl Compounds

	Formaldehyde (µg)	Acetaldehyde (µg)	Acrolein (µg)	References
E-cigarette (until ~76 puffs)	0.2–5.81	0.77–1.96	0.07–9	[2, 68]
Conventional cigarette (until)	1.6–52.1	52–824	2.4–68.2	[33, 62]

Association of Electronic Cigarette Use with Respiratory Symptom Development among U.S. Young Adults

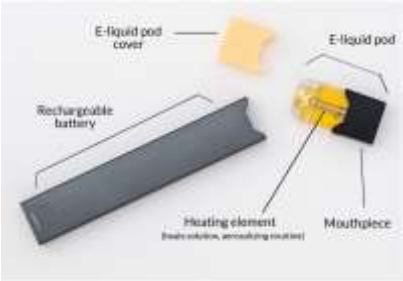
Wubin Xie [1], Alayna P. Tackett [2], Jonathan B. Berlowitz [1], Alyssa F. Harlow [3], Hasmeena Kathuria [4], Panagis Galiatsatos [5], Jessica L. Fetterman [6,7,8], Junhan Cho [2], Michael J. Blaha [9,10], Naomi M. Hamburg [6,7,8], Rose Marie Robertson [8], Show All...
+ Author Affiliations

Vape users between the ages of 18 and 24, regardless of former cigarette use, were more likely to develop wheezing or respiratory symptoms within a year of use.

Long Term Health Impact

- The health effects are not completely understood
- There is evidence that completely switching to e-cigarettes from cigarettes reduces exposure to toxicants and carcinogens. (National Academies Report)
- Concerns with
  - Inhalation of ultrafine particles deep into the lung
  - Exposure to heavy metals in e-cigarette aerosol (nickel, lead, tin, chromium, manganese, and zinc)
  - Exposure to volatile organic compounds

National Academies of Science Engineering and Medicine: Public Health Consequences of E-cigarettes (2018)
E-Cigarettes. Surgeongeneral.gov
Olmedo P, Goessler W, Tanda S, et al. Metal Concentrations in e-Cigarette Liquid and Aerosol Samples: The Contribution of Metallic Coils. *Environ Health Perspect*. 2018;126(2):027010. Published 2018 Feb 21. doi:10.1289/EHP2175



Scientists say the tiny metal coils that heat the liquid nitrogen in e-cigarettes may contaminate the resulting vapor with lead, chromium, nickel, manganese and zinc.

Initiation & Cessation

Conclusion 5-1:

There is *conclusive evidence* that in addition to nicotine, most e-cigarette products contain and emit numerous potentially toxic substances.

Does the use of e-cigarettes lead to lifelong tobacco addiction?

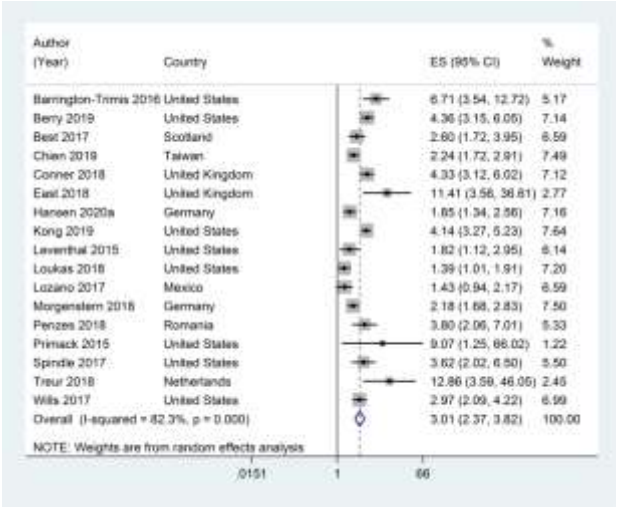
Cigarette Smoking Initiation

RESEARCH ARTICLE

Association between electronic nicotine delivery systems and electronic non-nicotine delivery systems with initiation of tobacco use in individuals aged < 20 years. A systematic review and meta-analysis

Sze Lin Yoong[1,2,3]*, Alix Hall[2,3,4,5], Heidi Turon[2,3,4,5], Emily Stockings[6], Alecia Leonard[2,3,4], Alice Grady[2,3,4,5], Flora Tzelepis[2,3,4,5], John Wiggers[1,3,4,5], Hebe Gouda[7], Randi Fayokun[7], Alison Commar[7], Vinayak M. Prasad[7], Luke Wolfenden[2,3,4,5]

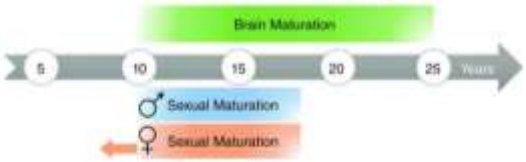
1 School of Health Sciences, Swinburne University of Technology, Hawthorn, Victoria, Australia, 2 School of Medicine and Public Health, University of Newcastle, Callaghan, NSW, Australia, 3 Hunter Medical Research Institute, New Lambton Heights, NSW, Australia, 4 Priority Research Centre for Health Behaviour, University of Newcastle, Callaghan, NSW, Australia, 5 Hunter New England Population Health, Wallsend, NSW, Australia, 6 National Drug and Alcohol Research Centre, University of New South Wales, Randwick, NSW, Australia, 7 No Tobacco Unit, Department of Health Promotion, World Health Organization, Geneva, Switzerland



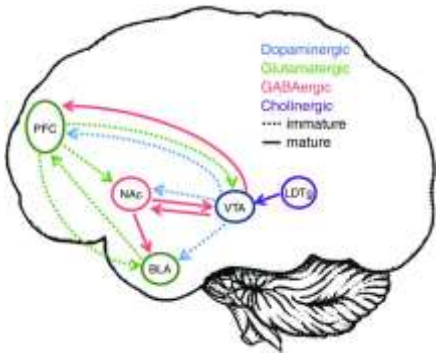
Initiation & Cessation

Conclusion 16-1:

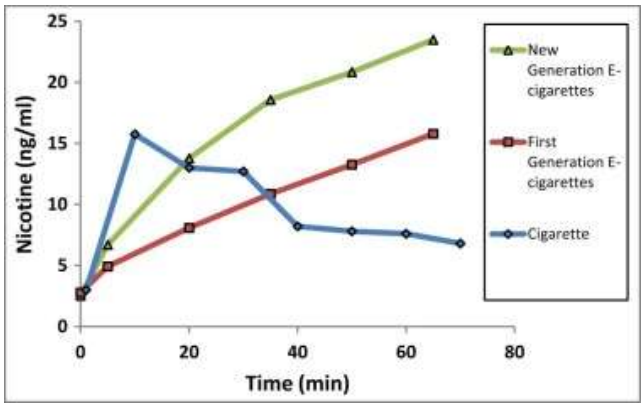
There is substantial evidence that e-cigarette use increased risk of ever using combustible tobacco cigarettes among youth and young adults



Addiction –
The adolescent brain is uniquely vulnerable to the rewarding effects of nicotine

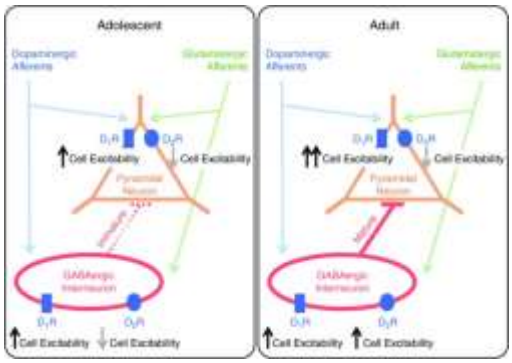


USDHHS. Health Consequences of Smoking. 50 Years of Progress. A Report of the Surgeon General. (2014)

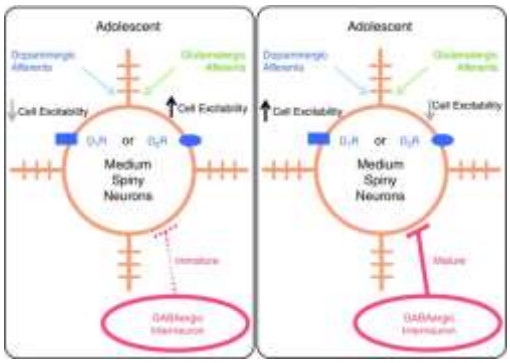


Cippolla D, Gonda I. Inhaled nicotine replacement therapy. Asian Journal of Pharmacology Sciences. 2015.10(6): 472-480

Prefrontal Cortex



Nucleus Accumbens



Yuan M, et al. Nictine and the adolescent brain. J Physiol. 2015 Aug 15; 593(Pt 16): 3397–3412

Are e-cigarettes an effective smoking cessation tool?

E-Cigarettes As Smoking Cessation?

NEJM 2019 380: 629-637.

RESULTS

A total of 886 participants underwent randomization. The 1-year abstinence rate was 18.0% in the e-cigarette group, as compared with 9.9% in the nicotine-replacement group (relative risk, 1.83; 95% confidence interval [CI], 1.30 to 2.58; P<0.001). **Among participants with 1-year abstinence, those in the e-cigarette group were more likely than those in the nicotine-replacement group to use their assigned product at 52 weeks (80% [63 of 79 participants] vs. 9% [4 of 44 participants]).** Overall, throat or mouth irritation was reported more frequently in the e-cigarette group (65.3%, vs. 51.2% in the nicotine-replacement group) and nausea more frequently in the nicotine-replacement group (37.9%, vs. 31.3% in the e-cigarette group). The e-cigarette group reported greater declines in the incidence of cough and phlegm production from baseline to 52 weeks than did the nicotine-replacement group (relative risk for cough, 0.8; 95% CI, 0.6 to 0.9; relative risk for phlegm, 0.7; 95% CI, 0.6 to 0.9). There were no significant between-group differences in the incidence of wheezing or shortness of breath.

E-Cigarette Use and Adult Cigarette Smoking Cessation: A Meta-Analysis

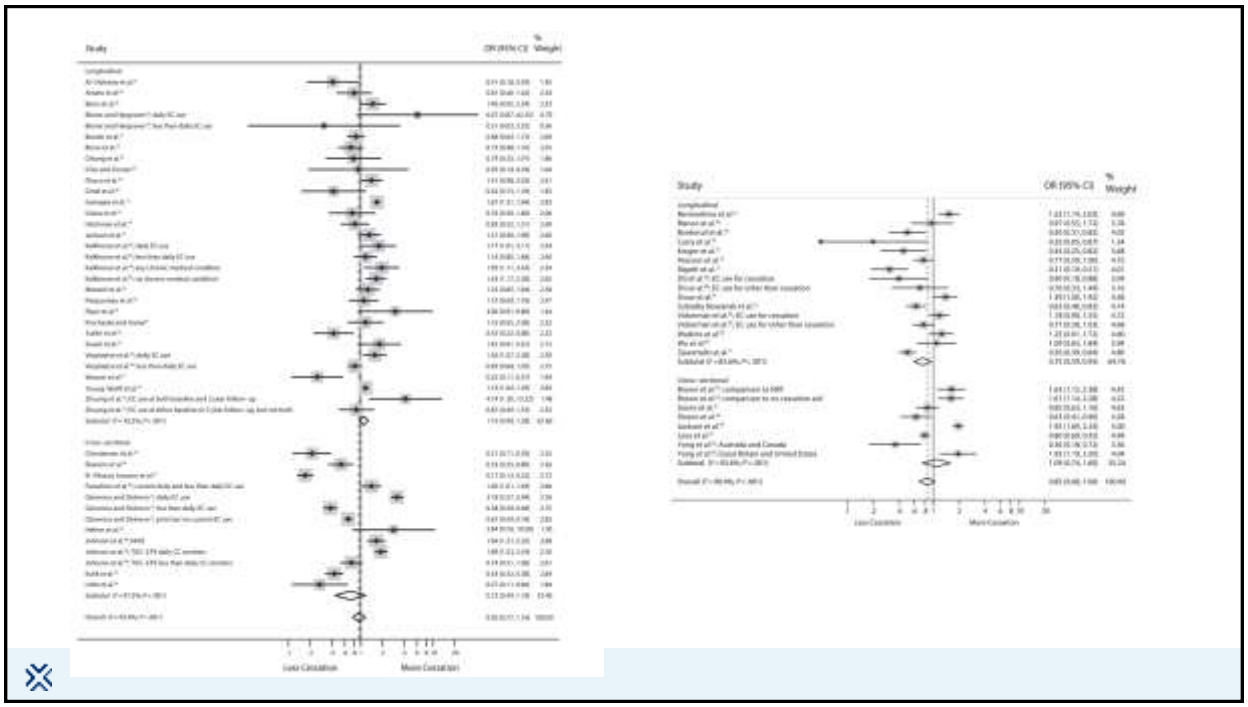
Objectives. To determine the association between e-cigarette use and smoking cessation.

Methods. We searched PubMed, Web of Science Core Collection, and EMBASE and computed the association of e-cigarette use with quitting cigarettes using random effects meta-analyses.

Results. We identified 64 papers (55 observational studies and 9 randomized clinical trials [RCTs]). In observational studies of all adult smokers (odds ratio [OR] = 0.947; 95% confidence interval [CI] = 0.772, 1.160) and smokers motivated to quit smoking (OR = 0.851; 95% CI = 0.684, 1.057), e-cigarette consumer product use was not associated with quitting. Daily e-cigarette use was associated with more quitting (OR = 1.529; 95% CI = 1.158, 2.019) and less-than-daily use was associated with less quitting (OR = 0.514; 95% CI = 0.402, 0.665). The RCTs that compared quitting among smokers who were provided e-cigarettes to smokers with conventional therapy found e-cigarette use was associated with more quitting (relative risk = 1.555; 95% CI = 1.173, 2.061).

Conclusions. As consumer products, in observational studies, e-cigarettes were not associated with increased smoking cessation in the adult population. In RCTs, provision of free e-cigarettes as a therapeutic intervention was associated with increased smoking cessation.

Public Health Implications. E-cigarettes should not be approved as consumer products but may warrant consideration as a prescription therapy. (*Am J Public Health*. 2021;111:230–246. https://doi.org/10.2105/AJPH.2020.305999)



Other Injuries Linked to E-Cigarettes

Safety Risks

- **Burns**
  - **3,369** explosion and burn injuries seen in US Emergency Departments from 2015-2019
  - 676 visits in 2019 alone

Source: Hickey S., Goverman J., Friedstat J., Sheridan R., and Schulz J.: Thermal injuries from exploding electronic cigarettes. Burns 2018; 44: pp. 1294-1301

- **Poisonings**
  - **2018-2019,** 1550 cases of children < 5 years old ingested ECIG liquids
  - **8,269** liquid nicotine exposures reported among children <6 from 2012-2017
  - Child-resistant packaging laws associated with decreasing exposure rates

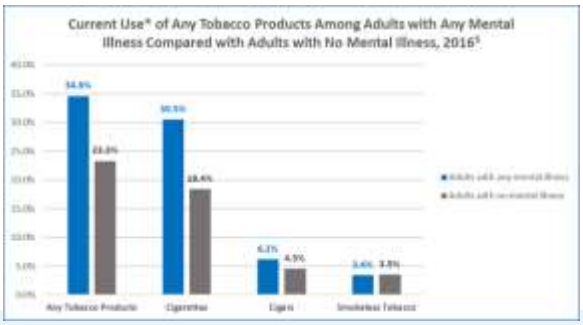
Rossheim ME, Livingston MD, Soule EK, et al. Electronic Cigarette explosion and burn injuries, US Emergency Departments 2015-2017. Tobacco Control 2019; 28: 472-474.
Govindarajan P, Spiller HA, Casvant MJ, Chounthirath T, Smith GA. E-Cigarette and Liquid Nicotine Exposures Among Young Children. Pediatrics May 2018, 141(5). E20173361
Rossheim ME, et al. Electronic cigarette explosion/burn and poisoning related emergency department visits, 2018-2019. American Journal of Emergency Medicine. 2020. 38(12): 2637-2640.

Other Tobacco use Data

Mental Illness – Tobacco Use

Adults with Mental Illness or Substance Use Disorder Account for 40% of All Cigarettes Smoked.

34.6% of adults with any mental illness reported current use* of tobacco in 2016 compared to 23.3% of adults with no mental illness.



* "Current Use" is defined as self-reported consumption of cigarettes, cigars, and smokeless tobacco in the past month (at the time of survey).
** Any Tobacco Products includes cigarettes, smokeless tobacco (i.e., snuff, dip, chewing tobacco, or "snus"), cigars, and pipe tobacco.
† Data taken from the National Survey on Drug Use and Health, 2016, and refer to adults aged 18 years and older self-reporting any mental illness in the past year, excluding serious mental illness.

SUD & Tobacco

In 2016,

- **43.5%** of adults who smoke cigarettes reported binge drinking in the past month compared to 21.7% of adults who don't smoke.
- **14.6%** of adults who smoke cigarettes reported heavy drinking in the past month compared to 4.5% of adults who don't smoke

https://www.cdc.gov/tobacco/disparities/mental-illness-substance-use/index.htm

Current Illicit Drug and Alcohol Use Among Adults Who Smoke Compared with Those Who Don't (2016) ‡5

	Adults Who Smoke	Adults Who Don't Smoke
Current illicit drug use (in past month)	25.3%	7.1%
Marijuana	21.8%	5.9%
Cocaine	2.5%	0.3%
Heroin	0.8%	0.0%
Hallucinogens	1.5%	0.3%
Inhalants	0.4%	0.1%
Non-medical use of prescription drugs	5.9%	1.5%
Current alcohol use (in past month)	63.5%	52.8%
Binge drinking¶	43.5%	21.7%
Heavy drinking¶	14.6%	4.5%

Screening & Counseling

- Include e-cigarette terminology in tobacco screening
- Education patients and families about the health risks of e-cigarettes

Slang for e-cigarettes

- Cloud Chasing
- Cold Boxing
- E-cigs
- EGo
- E-hookahs
- E-Juice
- ENDs
- Flavor Chaser
- Flavor Ghosting
- Flooding
- Ghosting
- JUULing
- Mech Mod
- Mods
- Nic
- Nic Base
- Nic Salt
- Ride the Mist
- Tank Systems
- Skitzin
- Squonking
- Stealth Vape
- Vaping
- Vapes
- Vape Pens
- Vooping
- Vaples
- Vapindaganja

https://www.gosmokefree.co.uk/e-cigarette-slang-and-definitions-glossary/

E-Cigarette Advertising

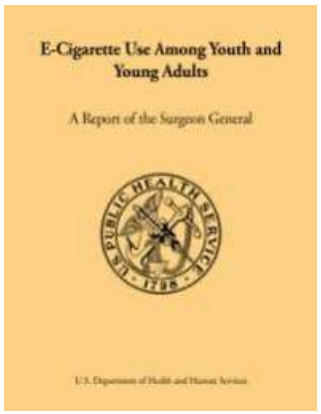
Receptivity to e-cigarette advertising is associated with trying e-cigarettes and cigarettes in the future.

Tobacco Advertising

Public Health Cigarette Smoking Act of 1969

- Required package warning label— Warning: The Surgeon General Has Determined that Cigarette Smoking Is Dangerous to Your Health" (other health warnings prohibited)
- Temporarily preempted FTC requirement of health labels on advertisements
- Prohibited cigarette advertising on television and radio (authority to Department of Justice [DOJ])
- Prevents states or localities from regulating or prohibiting cigarette advertising or promotion for health-related reasons

Counsel About Risk



"Tobacco use among youth and young adults in **any form**, including e-cigarettes, **is**

e-cigarettes.surgeongeneral.gov

Counsel About Risks of Nicotine

Nicotine is very common in e-cigarettes.

Nicotine can harm the developing adolescent brain. The brain keeps developing until about age 25.

Counsel About Risks of Nicotine

Counsel About Risks of Nicotine

Scientists are still learning about the long-term health effects of e-cigarettes

Some of the ingredients in e-cigarettes could be harmful to the lungs in the long-term.

Point of Care Actions

ASK	about tobacco **USE**
ADVISE	Tobacco users to **QUIT**
ASSESS	Readiness to make a **QUIT** attempt
ASSIST	with the **QUIT ATTEMPT**
ARRANGE	**FOLLOW-UP** care

Counsel About Health Risks Associated with E-Cigarettes

Defective E-Cigarette batteries have caused fires & explosions.

Poisoning have occurred by swallowing, breathing, or absorbing e-cigarette liquid through skin or eyes.

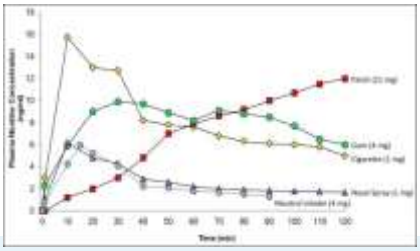
E-Cigarettes & Vaping – both nicotine & THC – is linked to EVALI

Counsel About Medication Assisted Therapy

There are FDA Approved Medication to Assist with Stopping Smoking

Nicotine Replacement Therapy include patches, gum, lozenges, inhalers, and nasal sprays.

E-Cigarettes have not been shown to be an effective cessation medication.



Summary

- E-cigarettes are **the most common tobacco product** used by adolescents
- There are **substantial risks** associated with trying E-cigarettes
- **Screen** all patients for tobacco exposure, and include E-cigarette terminology in tobacco screening
- **Educate** patients and families about the health risks of E-cigarettes.

Natasha N. Bray, DO, MSEd, FACOI, FACP

Interim Dean – OSUCOM – Cherokee Nation Campus

O | 918.280.1844
C | 918.817.2576
E | natasha.bray@okstate.edu

19500 E. Ross St.
Tahlequah, OK 74464

Medicine.okstate.edu

Twitter: @drbray

EXPLORE HEALTHCARE SUMMIT

Resources

- Oklahoma Laws Related to Vaping – https://www.publichealthlawcenter.org/resources/us-e-cigarette-regulations-50-state-review/ok
- Tobacco Stops With Me (TSET Program) - https://stopswithme.com/not-ok/?gclid=Cj0KCQiAjc2QBhDgARIsAMc3SqSEyB0RCNKqSO6g2Teec_DsLMZAOlc9LVWK11uo44-z58HqwFqqTGAaApy-EALw_wcB
- Surgeon General - https://e-cigarettes.surgeongeneral.gov/
- AAP Richmond Center: www.richmondcenter.og
- AAP Tobacco control and e-cigarette policy: https://www.aap.org/en-us/about-the-aap/Sections/Section-on-Tobacco-Control/Pages/Policy.aspx
- American Lung Association - https://www.lung.org/stop-smoking/smoking-facts/e-cigarettes-and-lung-health.html
- Substance Abuse and Mental Health Service Administration (SAMHSA) – www.samhsa.gov
- CDC – https://www.cdc.gov/tobacco/basic_information/e-cigarettes/sever-lung-disease.html

References

- Besaratinia A (2021) from Tobacco Cigarettes to Electronic Cigarettes: The Two Sides of a Nicotine Coin. Front. Oral. Health 2: 790634.
- Boakye E, Obisesn OH, Uddin SMI, et al. Cannabis vaping among adults in the United States: prevalence, trends, and association with high-risk behaviors and adverse respiratory conditions. Preventive Medicine 2021. 153. https://doi.org/10.1016/j.ypmed.2021.106800
- CDC Website. https://www.cdc.gov/tobacco/basic_information/e-cigarettes/severe-lung-disease.html#map-cases
- CDC Website. https://www.cdc.gov/tobacco/disparities/mental-illness-substance-use/index.html
- Cippolla D, Gonda I. Inhaled nicotine replacement therapy. Asian Journal of Pharmacology Sciences. 2015.10(6): 472-480
- Cullen KA, Gentzke AS, Sawdey MD, et al. e-Cigarette Use Among Youth in the United States, 2019. JAMA. 2019;322(21):2095–2103. doi:https://doi.org/10.1001/jama.2019.18387
- E-Cigarettes. Surgeongeneral.gov
- Fuentes XF et al. VpALI-Vaping-related Acute Lung Injury: A New Killer Around the Block. Mayo Clin Proc. Dec 2019; 94(12): 2534-2545.
- Gentzke AS, Creamer M, Cullen KA, Ambrose BK, Willis G, Jamal A, King BA. Vital Signs: Tobacco Product Use Among Middle and High School Students – United States, 2011-2018. MMWR Morb Mortal Wkly Rep 2019; 68(6):1-8.
- Gentzke AS, Wang TW, Jamal A, et al. Tobacco Product Use Among Middle and High School Students — United States, 2020. MMWR Morb Mortal Wkly Rep 2020;69:1881–1888. DOI: http://dx.doi.org/10.15585/mmwr.mm6950a1

References

- Goriounova NA, Mansvelder HD. Short- and long-term consequences of nicotine exposure during adolescence for prefrontal cortex neuronal network function. *Cold Spring Harb Perspect Med*. 2012;2(12):a012120. Published 2012 Dec 1. doi:10.1101/cshperspect.a012120
- Govindarajan P, Spiller HA, Casvant MJ, Chounthirath T, Smith GA. E-Cigarette and Liquid Nicotine Exposures Among Young Children. Pediatrics May 2018, 141(5). E20173361
- Hajek P, Phillips-Waller A, Przulji D, Pesola F, Myers Smith K, Bisal N, Li J, Phil M, Parrott S, Sasieni P, Dawkins L, Ross L, Goniewicz M, et al. A Randomized Trial of E-Cigarettes versus Nicotine-Replacement Therapy. N Engl J Med 2019; 380: 629-637.
- Henry TS, Kanne JP, Kligerman SJ. Imaging of Vaping-Associated Lung Disease. N Engl J Med 2019;381:1486-1487.
- Hickey S., Goverman J., Friedstat J., Sheridan R., and Schulz J.: Thermal injuries from exploding electronic cigarettes. Burns 2018; 44: pp. 1294-1301
- Khouja JN, Suddell SF, Peters SE, et al. Is e-cigarette use in non-smoking young adults associated with later smoking? A systematic review and meta-analysis. *Tobacco Control* Published Online First: 10 March 2020. doi: 10.1136/tobaccocontrol-2019-055433.
- Kowitt SD, Osman A, Meemik C, et al. Vaping cannabis among adolescents: prevalence and association with tobacco use from a cross-sectional study in the USA. BMJ Open. 2019; 9(6): e028535.
- Layden JE, Ghinai I, Pray I, Kimball A, Layer M, Tenforde MW, Navon Li, Hoots B, Salvatore PP, Elderbrook M, Haupt T, Kanne J, et al. Pulmonary Illness Related to E-Cigarette Use in Illinois and Wisconsin – Final Report. N Engl J Med 2020;382:903-916.

References

- Lim CCW, Sun T, Leung J, et al. Prevalence of Adolescent Cannabis Vaping: A Systemic Review and Meta-analaysis of US and Candain Studies. JAMA Pediatr. 2022; 176(1): 42-51.
- Lozier MJ et. al. Update: Demographic, Product, and Substance-Use Characteristics of Hospitalized Patients in a Nationwide Outbreak of E-cigarette, or Vaping, Product Use-Associated Lung Injuries - United States, December 2019. MMWR. December 13, 2019 / 68(49);1142–1148
- Marques P, Piqueras L, Sanz, MJ. An updated overview of e-cigarette impact on human health. Respiratory Research 2021. 22:
- Marsden L, Michalicek ZD, Christensen ED. More on the Pathology of Vaping-Associated Lung Injury. N Engl J Med 2020;382:387-390.
- National Academies of Science Engineering and Medicine: Public Health Consequences of E-cigarettes (2018)
- Olmedo P, Goessler W, Tanda S, et al. Metal Concentrations in e-Cigarette Liquid and Aerosol Samples: The Contribution of Metallic Coils. *Environ Health Perspect*. 2018;126(2):027010. Published 2018 Feb 21. doi:10.1289/EHP2175
- Park-Lee E, Ren C, Sawdey MD, et al. *Notes from the Field:* E-Cigarette Use Among Middle and High School Students — National Youth Tobacco Survey, United States, 2021. MMWR Morb Mortal Wkly Rep 2021;70:1387–1389. DOI: http://dx.doi.org/10.15585/mmwr.mm7039a4external icon
- Rossheim ME, Livingston MD, Soule EK, et al. Electronic Cigarette explosion and burn injuries, US Emergency Departments 2015-2017. Tobacco Control 2019; 28: 472-474.

References

- Rossheim ME, et al. Electronic cigarette explosion/burn and poisoning related emergency department visits, 2018-2019. American Journal of Emergency Medicine. 2020. 38(12): 2637-2640.
- USDHHS. Health Consequences of Smoking. 50 Years of Progress. A Report of the Surgeon General. (2014)
- Wang RJ, Bhadriraju S, Glantz SA. Cigarette Use and Adult Cigarette Smoking Cessation: A Meta-Analysis. American Journal of Public Health. 2021; 111: 230-246.
- Wang TW, NeffLJ, Park-Lee E, Ren C, Cullen. KA, King BA. E-cigarette use among middle and high school students – United States, 2020. Morb Mortal Wkly Rep. (2020) 69: 1310-2.
- Werner AK, et al. Hospitalizations and Deaths Associated with EVALI. NEJM 2020; 382: 1589– 1598.
- Yoong SL, Hall A, Turon H, Stockings E, Leonard A, Grady A, Tzelepis F, Wiggers J, Gouda H, Fayokun R, Commar A, Prasad VM, Wolfenden L. Association between electronic nicotine delivery systems and electronic non-nicotine delivery systems with initiation of tobacco use in individuals aged < 20 years. A systematic review and meta-analysis. PLoS One. 2021 Sep 8;16(9):e0256044. doi: 10.1371/journal.pone.0256044. PMID: 34495974; PMCID: PMC8425526.
- Yuan M, et al. Nictine and the adolescent brain. J Physiol. 2015 Aug 15; 593(Pt 16): 3397–3412