

# VAPING 101 AND TRENDS AMONG YOUTH IN ILLINOIS

**MAY 12, 2020**

Brian Williams, MD

Assistant Professor of Internal  
Medicine and Pediatrics

UW-School of Medicine and  
Public Health



# **DISCLOSURE**

I have no relevant financial relationships to disclose



# GOALS

1. Understand the harms of traditional cigarettes and how they impact our society
2. Appreciate E-cigarette devices, how they work, how they've evolved, and what makes up the "E-juice"
3. Appreciate the epidemic of adolescent vaping and health harms associated with use
4. Understand how vaping devices are used with marijuana





# CIGARETTES ARE BAD

---

- **Increased rates of:** Lung Cancer, COPD, Cardiovascular Disease
- **AND OTHER CANCERS:** Oropharyngeal, Laryngeal, Esophageal, AML, Gastric, Liver, Pancreatic, Renal and Ureteral, Cervical, Bladder, Colorectal
- **AND:** Pneumonia, Diabetes, Infertility, Hip Fractures, Rheumatoid Arthritis, Blindness, Periodontitis, Asthma, Pulmonary Fibrosis, Tuberculosis, Sexual Dysfunction, Impaired Immune Function
- **PREGNANCY:** Pre-mature Birth, Stillbirth, Ectopic Pregnancy





# CIGARETTES ARE BAD

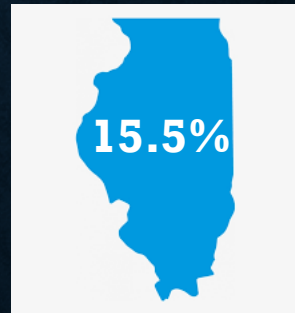
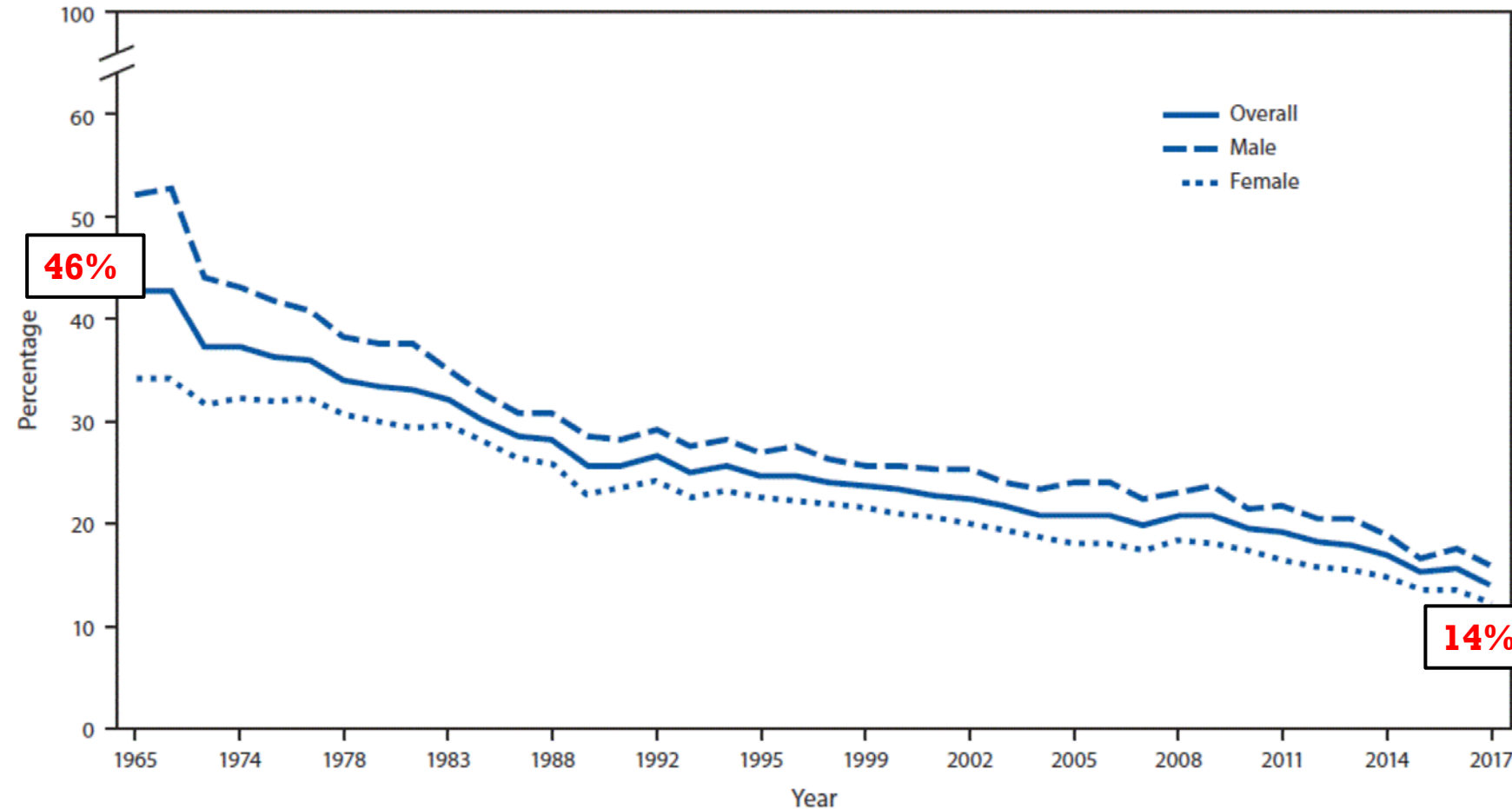
---

1,300 people will Die Today in the United States due to a health consequence of smoking cigarettes



# CIGARETTE USE - TRENDS

FIGURE 1. Percentage of adults aged  $\geq 18$  years who were current cigarette smokers,\* overall and by sex — National Health Interview Survey (NHIS), United States, 1965–2017





# E-CIGARETTES: THE REVOLUTION



Image: <https://www.theguardian.com/society/2015/jun/09/hon-lik-e-cigarette-inventor-quit-smoking-dual-user>

United States Patent Office 3,200,819  
Patented Aug. 17, 1965

1

3,200,819  
**SMOKELESS NON-TOBACCO CIGARETTE**  
Herbert A. Gilbert, 278 McKInley Road, Beaver Falls, Pa.  
Filed Apr. 17, 1963, Ser. No. 273,624  
10 Claims. (Cl. 128-298)

The present invention relates to a smokeless non-tobacco cigarette and has for an object to provide a safe and harmless means for and method of smoking by replacing burning tobacco and paper with heated, moist, flavored air; or by inhaling warm medication into the lungs in case of a respiratory ailment under direction of a physician.

Another object of the invention is to provide an article of manufacture resembling a cigarette by which air may be drawn through a porous substance of a cartridge which has been moistened with a chemically harmless flavoring preparation, combining moisture and taste following which the moist and flavored air passes through a section of the device heated by a suitable heating element so that warm, moist and flavored air is drawn into the mouth and if desired into the lungs of the user.

A further object of the invention is to provide a smokeless non-tobacco cigarette in which provision is made for circulating the fluid around the heating element in a turbulent manner to suitably raise the temperature of the inhaled mixture, with the purpose that the temperature of the flavored air may approximate that of cigarette smoke.

A further object is to insulate the heat source so that the "cigarette" may be held in the fingers without discomfort to the user's hand.

With the foregoing and other objects in view, the invention will be more fully described hereinafter, and will be more particularly pointed out in the claims appended hereto.

In the drawings, wherein like symbols refer to like or corresponding parts throughout the several views: FIGURE 1 is a side elevational view of the completed article constructed in accordance with the invention in simulation of a cigarette.

FIGURE 2 is a longitudinal section taken through the same with all interior parts assembled.

FIGURE 3 is a cross-sectional view taken on the line 3-3 in FIGURE 2.

FIGURE 4 is a side elevational view of a form of flavor cartridge employed.

FIGURE 5 is a transverse sectional view taken on the line 5-5 in FIGURE 2.

FIGURE 6 is a similar view taken on the line 6-6 in FIGURE 2.

FIGURE 7 is a longitudinal sectional view of a form of outer tube.

FIGURE 8 is a similar view of a form of insulating liner.

FIGURE 9 is a longitudinal sectional view of a form of mouthpiece that may be employed.

FIGURE 10 is a side elevational view of a form of heating element or vacuum tube or bulb that may be employed.

Referring more particularly to the drawings, 15 designates an external tube made preferably in the size, color and form of a cigarette, such tube having an outer end portion 16 and an inner end portion 17.

Subdividing the interior space of the external tube is an internal shoulder 18 which is preferably closer to the outer end portion 16 than to the opposite inner end portion 17, thus dividing the tube into relatively short and substantially longer chambers.

The tube 15 is supplied at the inner end portion 17

2

with internal threads 19 or some other means of connection for a mouthpiece as later described.

In the outer end portion 16 is detachably fitted a flavor cartridge 20 of some suitable absorbent material, preferably having longitudinal spaced passages 21 therethrough of a small diameter. The cartridge 20 is abutted against the outer edge of the internal shoulder 18 and is of an external diameter to fit snugly into the outer end portion 16 so that it will be held therein by friction or other suitable means.

Within the more forward chamber of the outer tube 15 is received a tubular liner 22 preferably of insulating material and having an internal wall 23 of a form and character to tumble the air or create turbulence therein. This internal wall may be spiralled or rifled as indicated.

A mouthpiece 24 is affixed to the inner end portion 17 of the tube 15 in any appropriate manner, preferably detachably as by external threads 25 on the hollow shank 25 of the mouthpiece which mate with the internal threads 19 in the inner end portion of the outer tube 15.

As shown in FIGURE 2, the free outer end of the hollow shank 25, when fitted home in the outer tube, will encounter and push the insert 22 against the inner wall of the internal shoulder 18 thus holding the insert 22 immovably in place.

The hollow shank 25 will preferably have an outstanding shoulder 27 forwardly of the threads 26 to engage the inner end of the tube 15 in the completely assembled position of the mouthpiece 24 relatively to the outer tube 15.

As best seen in FIGURE 6 showing a cross-section through the hollow shank portion 25 of the mouthpiece, a spider formation is shown providing air draft spaces 28 between the hollow shank 25 and an inner ring 29 spaced inwardly from the hollow shank 25 and connected therewith by radial arms 39. The air draft spaces 28 communicate with the suction orifice 40 of the mouthpiece at the inner end and at the outer end with the space circumscribed by the inner wall 23 of the tubular insert 22.

Within the inner ring 29 is a threaded electric socket 30 and forwardly thereof a battery cavity 31 for detachably receiving a battery 32 having an inner contact 33 and an outer contact 34 with a contact strip 35 between the inner contact 33 and the socket 30.

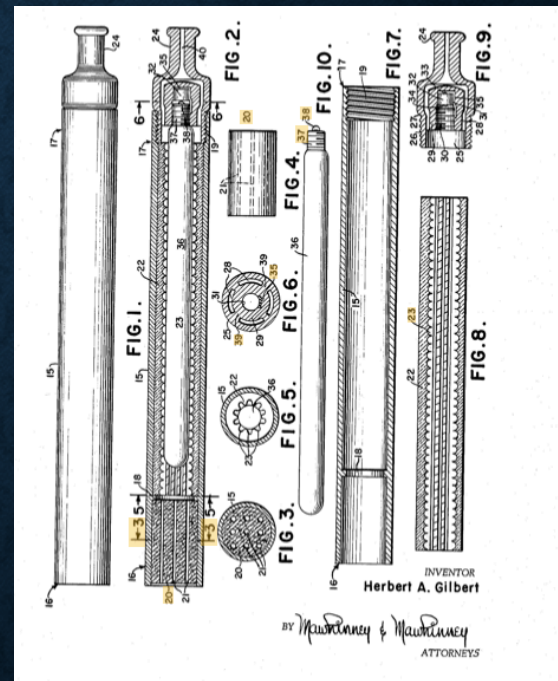
The heating element is preferably a vacuum tube or bulb 36 having a screw plug 37 for detachable engagement with the socket 30. The screw plug 37 has an end contact 34. The bulb or tube 36, similar to a light bulb, is preferably elongated and of a diameter to fit within the insert 22 in such manner as to provide an elongated heating passage throughout the length of the bulb and around the complete circumference of the bulb 36.

In assembly, the flavor cartridge 20 can be introduced and removed without regard to the other units of the device.

Before the mouthpiece 24 is assembled to the external tube 15, the liner 22 is slid through the open inner end portion of the tube until the open end of the liner 22 encounters the internal shoulder 18. The bulb 36 may be mounted to the socket 30 while the mouthpiece 24 is detached from the tube 15 whereupon the bulb 36 may be introduced into the insert 22 as the mouthpiece 24 is put into place and rotated to effect attachment of the mouthpiece to the outer tube 15. The final home position of the parts is indicated in FIGURE 2 in which the hollow shank 25 engages the inner end of the insert 22 while the outer end of the insert is abutted against the internal shoulder 18.

When the bulb 36 is assembled to the socket 30 its tip end 38 will engage the inner battery contact 33 and com-

Aug. 17, 1965 H. A. GILBERT  
3,200,819  
SMOKELESS NON-TOBACCO CIGARETTE  
Filed April 17, 1963



Gilbert, H.A. (1965). United States Patent No. 3200819A. Retrieved from: [patents.google.com/patent/US3200819](https://patents.google.com/patent/US3200819)



# E-CIGARETTES: THE REVOLUTION

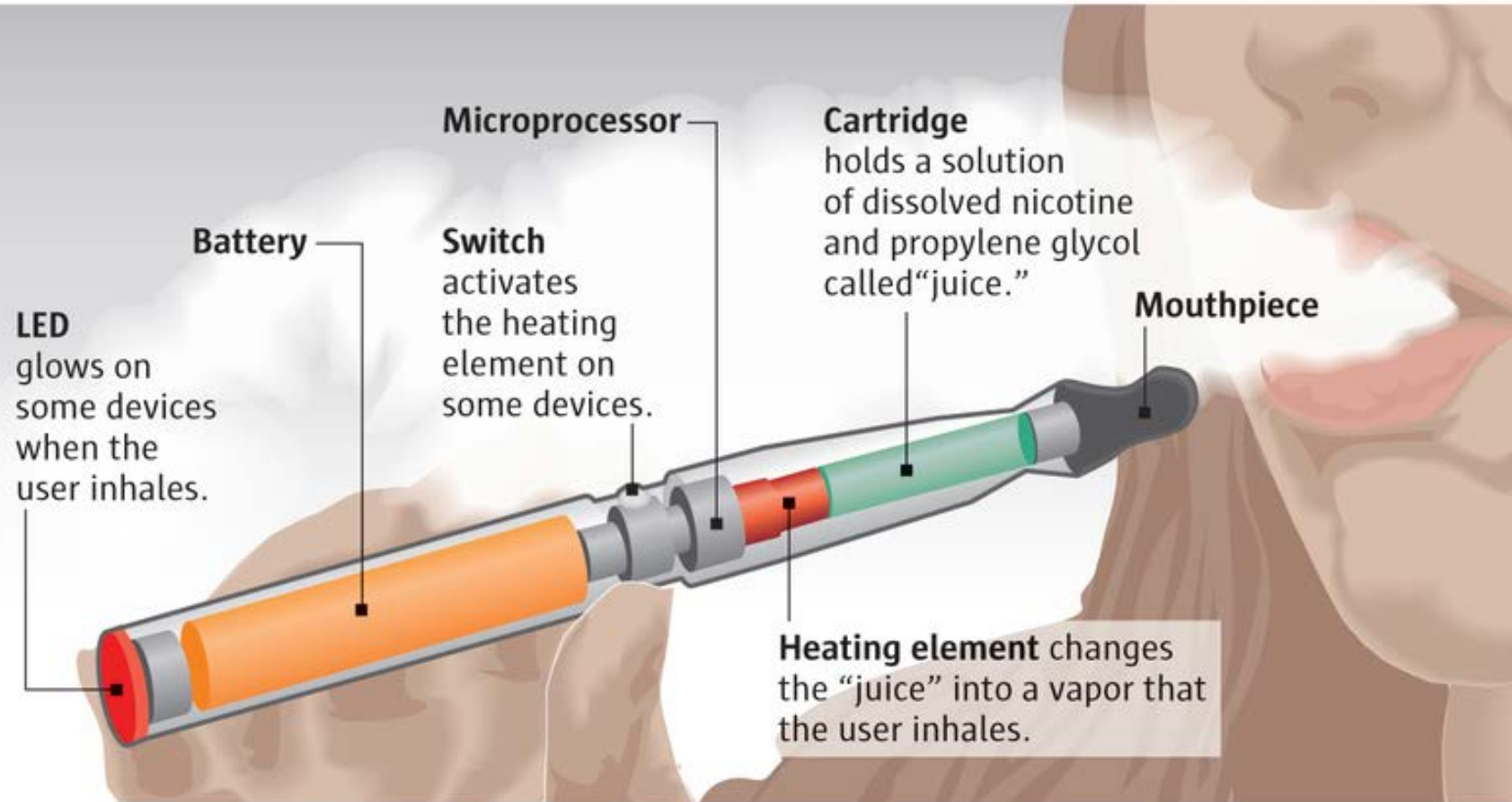
1. **Battery** Heats Metal Coil

2. Heated **Metal Coil** contacts Liquid "**E-juice**" creating an Aerosol

3. Aerosol or "**Vapor**" Inhaled by User

## How an e-cigarette works

Electronic cigarettes have been touted as a safer way to quit or cut down on smoking, but doctors say the battery-powered devices are sometimes exploding, causing severe injuries.



Source: U.S. Fire Administration

MARK NOWLIN / THE SEATTLE TIMES

Image from: <https://dailygazette.com>



# E-CIGARETTES: THE EVOLUTION

---

## Cigalikes



## Vape Pens



## Mods

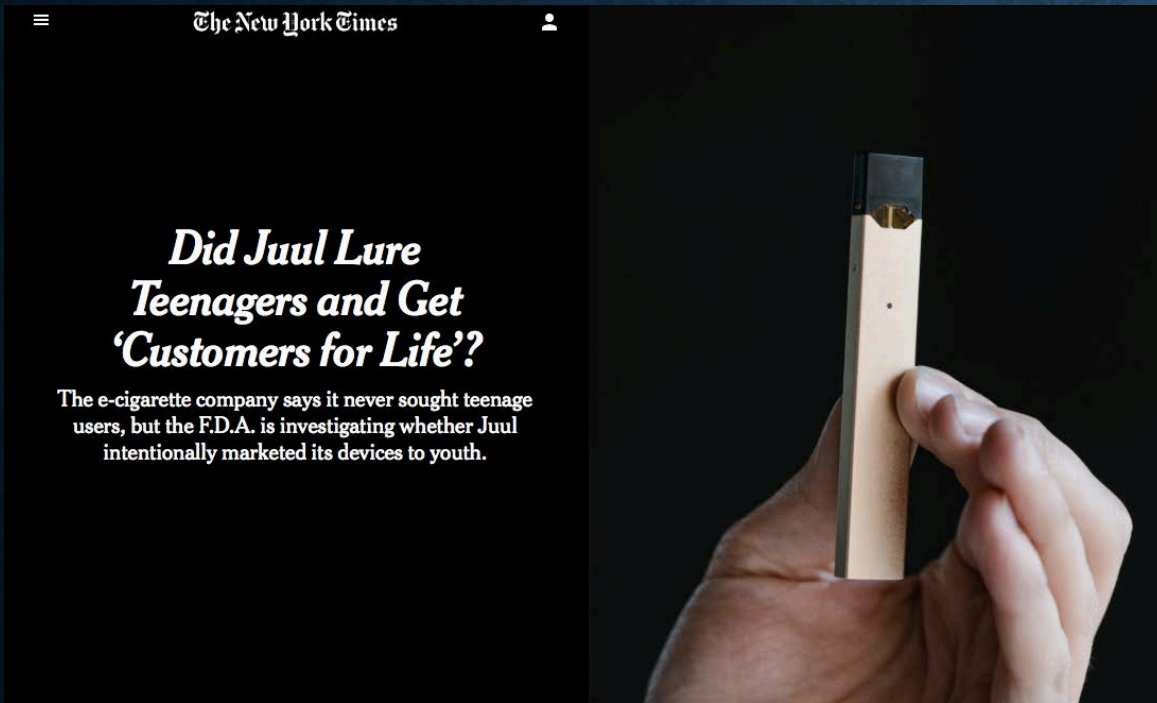


## Pod based





# E-CIGARETTE & ADOLESCENTS



## FDA warns retailers not to sell Juul e-cigarette to minors



## Teens Are 'Juuling' At School. Here's What That Means

AMERICAN CHRONICLES MAY 14, 2018 ISSUE

## THE PROMISE OF VAPING AND THE RISE OF JUUL

Teens have taken a technology that was supposed to help grownups stop smoking and invented a new kind of bad habit, molded in their own image.

## Why 'juuling' has become a nightmare for school administrators

## Juul and the vape debate: Choosing between smokers and teens

By Roni Selig, Maddie Bender and Davide Cannaviccio, CNN Aug 9, 2018

NEW YORK

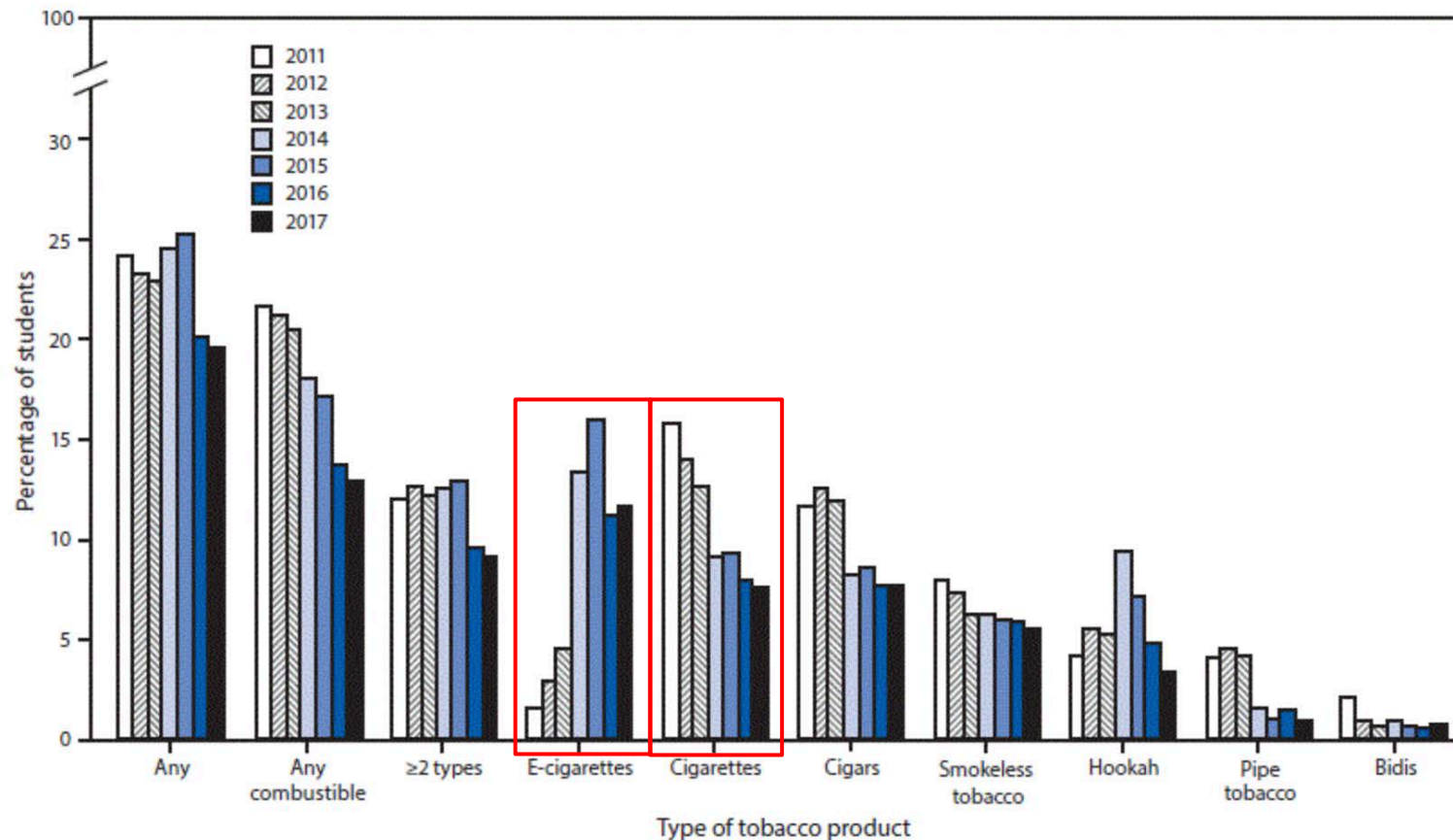
## Cool-Looking and Sweet, Juul Is a Vice Teens Can't Resist

The e-cigarettes, in flavors like Mango and Fruit Medley, offer rebellion in a sharply designed package that appeals to a driven generation.



# 2017 NAT'L YOUTH TOBACCO SURVEY

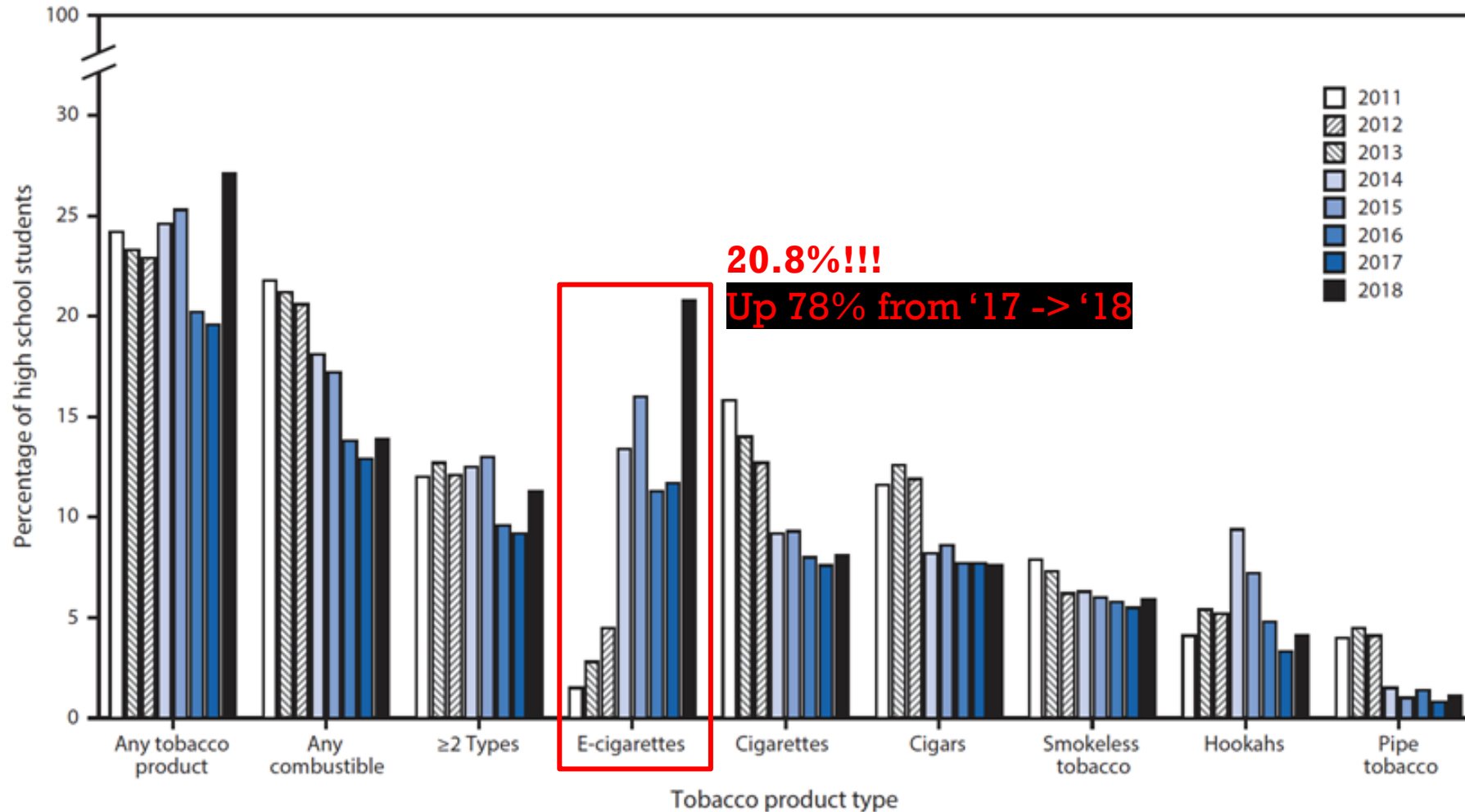
FIGURE 1. Estimated percentage of high school students who currently use any tobacco product,\* any combustible tobacco product,†  $\geq 2$  tobacco products,<sup>s</sup> and selected tobacco products — National Youth Tobacco Survey, United States, 2011–2017<sup>¶,\*\*,††</sup>





# 2018 DATA SHOW E-CIG SURGE IN H.S.

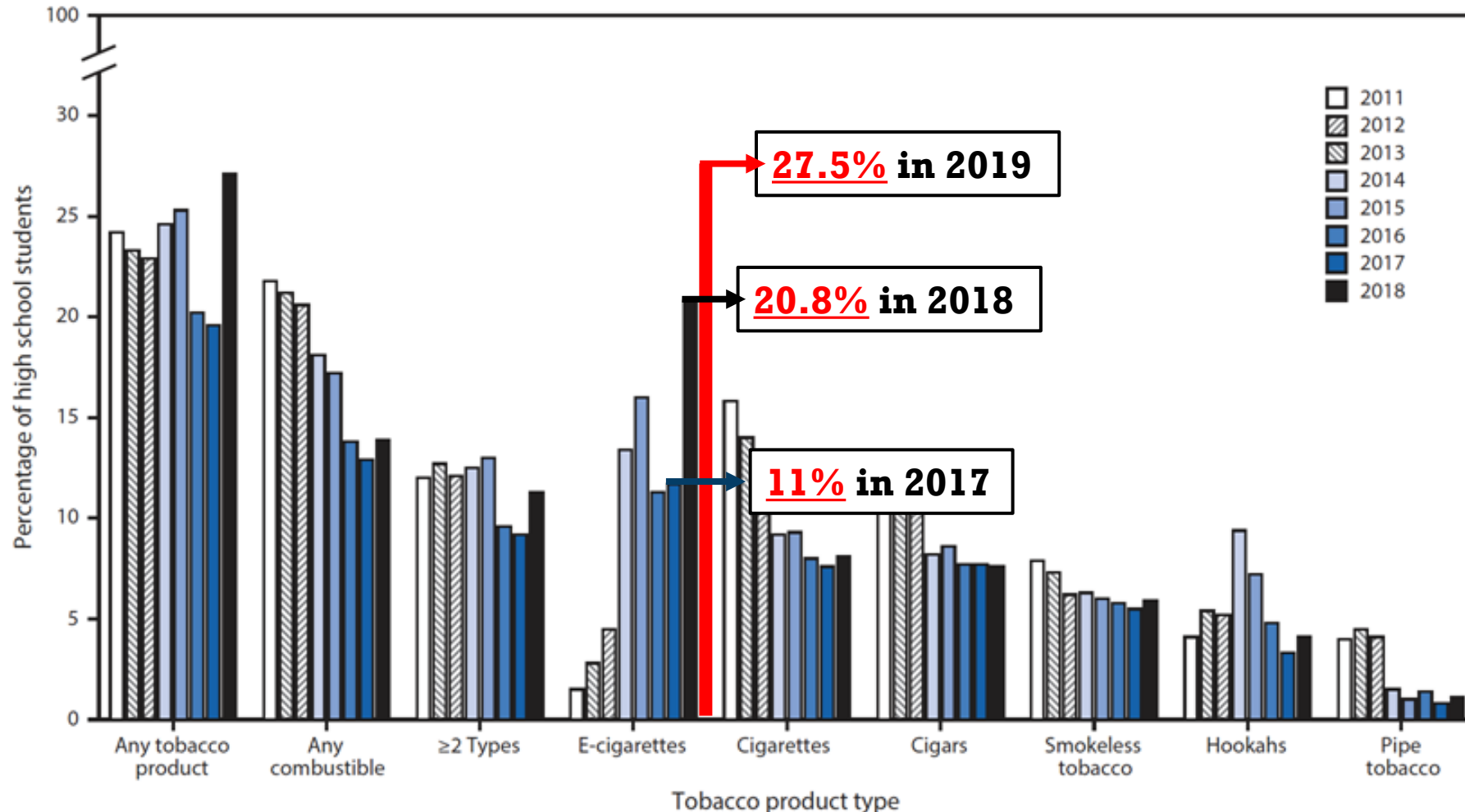
FIGURE 2. Estimated percentage of high school students who currently use any tobacco product,\* any combustible tobacco product,†  $\geq 2$  tobacco product types,§ and selected tobacco products — National Youth Tobacco Survey, 2011–2018¶,\*\*,††





# 2019 NYTS DATA

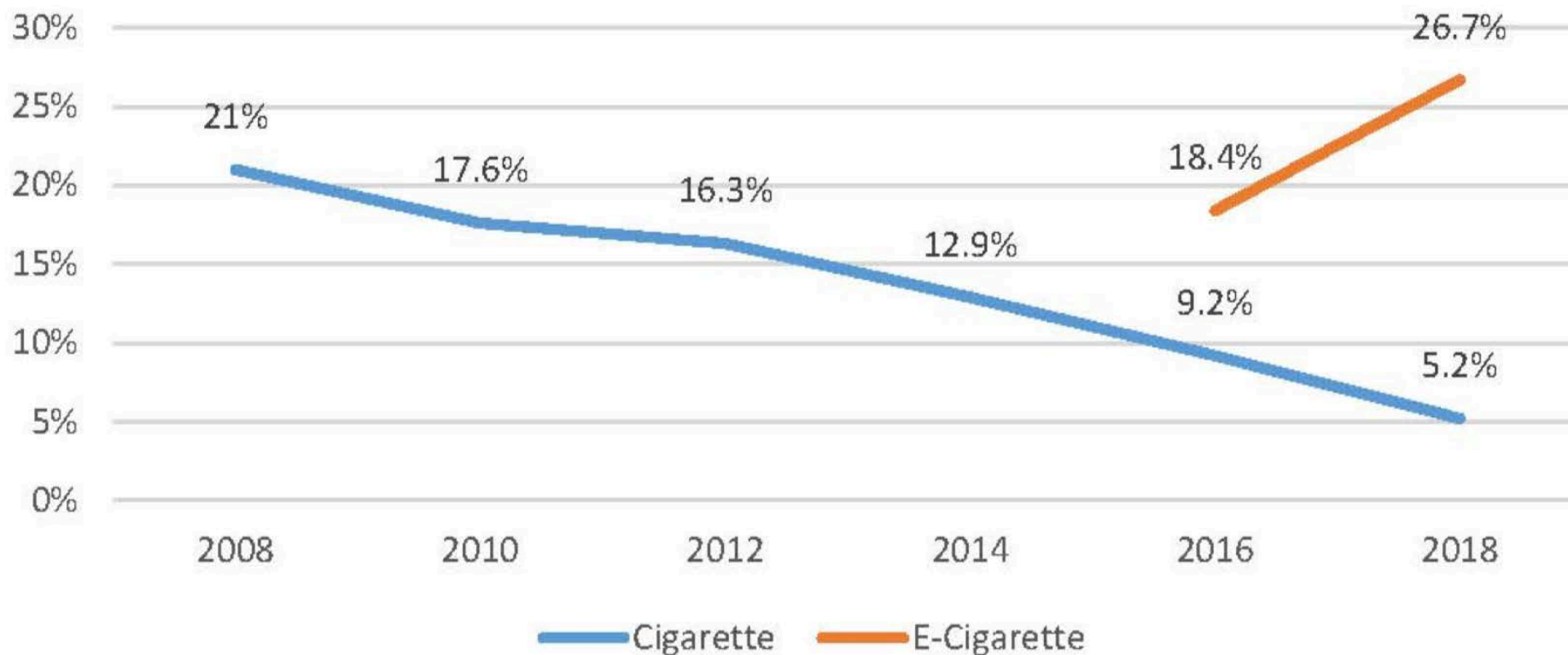
FIGURE 2. Estimated percentage of high school students who currently use any tobacco product,\* any combustible tobacco product,† ≥2 tobacco product types,§ and selected tobacco products — National Youth Tobacco Survey, 2011–2018¶,\*\*,††





# 2018 ILLINOIS DATA HIGH SCHOOL SENIORS

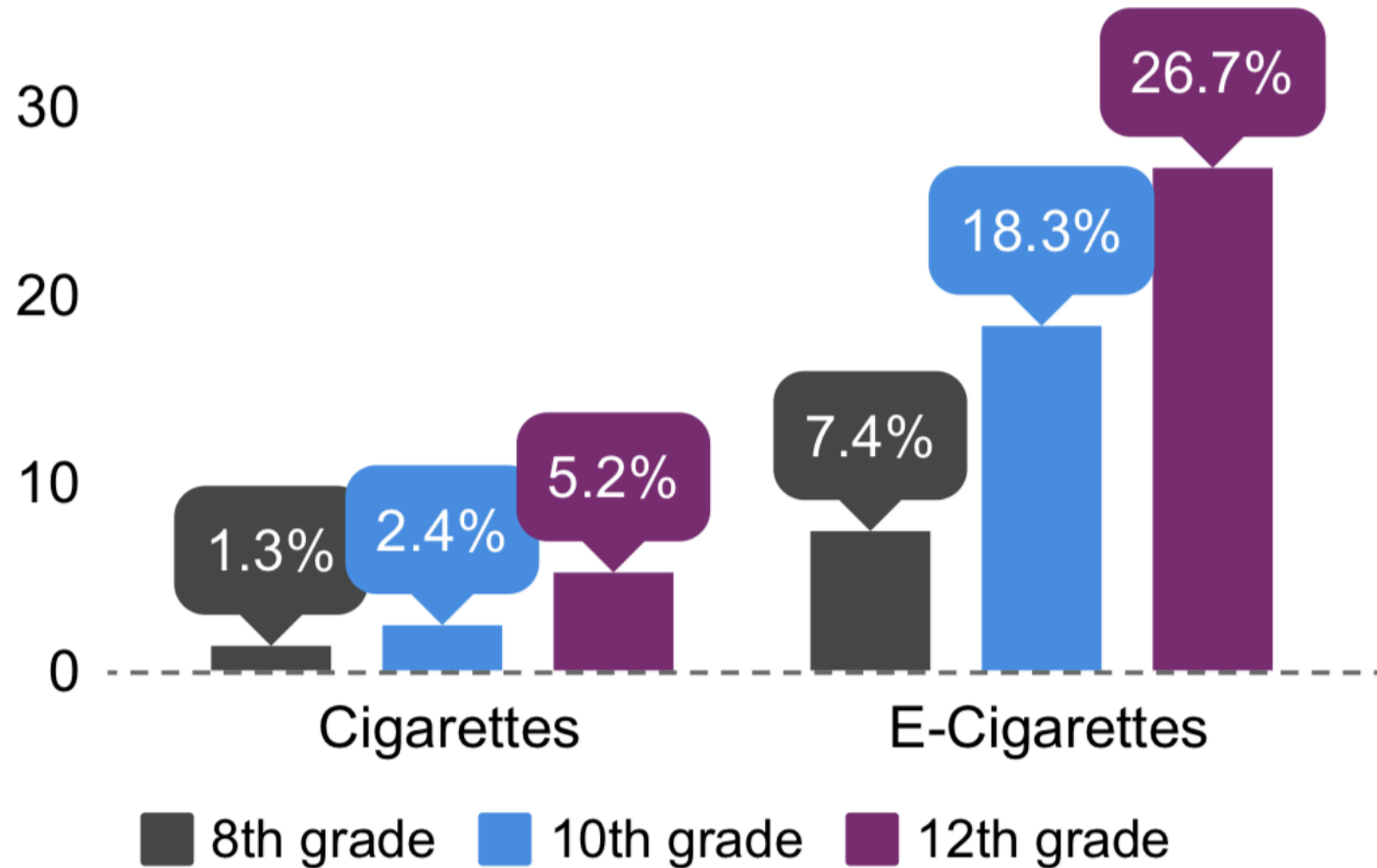
Past 30-day E-cigarette use significantly rising while cigarette smoking is declining





# 2018 ILLINOIS DATA

## Past 30 Day Use by All Grades



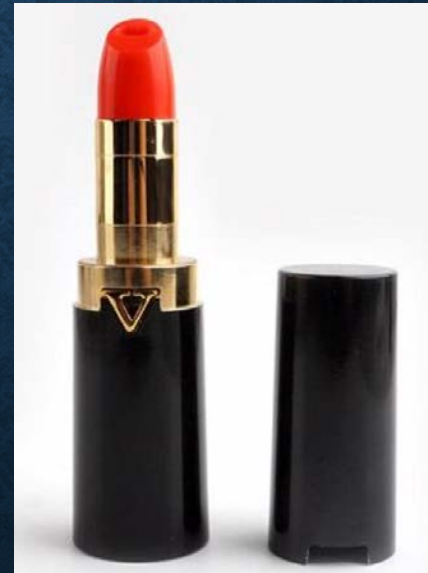


# E-CIGARETTES – SLEEK, DISCREET, SMALL

## Suorin



## Knock-Offs



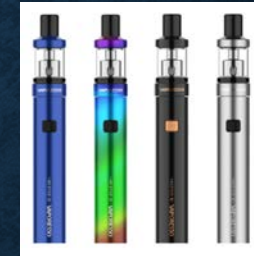


# FDA finalizes enforcement policy on unauthorized flavored cartridge-based e-cigarettes that appeal to children, including fruit and mint

## Banned

## Legal

### Re-Fillable E-Cigarettes



### "Disposable" E-cigarettes





# E-CIGARETTES: E-JUICE

- E-Juice Contents:
  - Nicotine
    - “Nic Salts”
  - Propylene Glycol
  - Vegetable Glycerin
  - Flavorings (diacetyl)
- Concentrations
  - 0–36mg/mL





# AEROSOL – IS IT SAFE?

---

- Aerosol: **NOT HARMLESS**
    - Formaldehyde, Acetaldehyde, Toluene, Nitrosamines
    - Cadmium, Nickel, Lead
    - Elevated VOC's: Acrylonitrile, Acrolein, Propylene Oxide, Acrylamide, Crotonaldehyde
    - Particulate Matter
  - We have **NO Long-Term Data** on E-Cig Use
- 

## Traditional Cigarettes:

- **~7000 Chemicals** Identified in Cigarette Smoke
- **~50 Carcinogens**
- Hydrogen Cyanide, Carbon Monoxide, Arsenic, Benzene, Lead, Ammonia, Cadmium





## **TOBACCO USE IS A PEDIATRIC DISEASE**

**“Nicotine addiction begins when most tobacco users are teenagers, so let’s call this what it really is: a *pediatric disease.*”**

***David A. Kessler, MD***

***Commissioner of FDA, 1995***



# HEALTH CONCERNS

---

“Today’s teenager is tomorrow’s potential regular customer, and the overwhelming majority of smokers first begin to smoke while still in their teens... The smoking patterns of teenagers are particularly important to... Philip Morris”

Philip Morris, Special Report, “Young Smokers: Prevalence, Trends, Implications, and Related Demographic Trends,” March 31, 1981, Bates No. 1000390803.



# NICOTINE AND THE DEVELOPING ADOLESCENT BRAIN

- Prefrontal Cortex still developing through Age 25
  - Decision-making, Impulse Control, Executive Functioning
  - Neural Remodeling, Increased connections Between Amygdala and Pre-Frontal Cortex
  - nACh-r Highly active in brain development
- Adolescent Brain Uniquely Susceptible to Nicotine
  - Addiction occurs more quickly, at smaller doses of nicotine
  - Nicotine Exposure in Adolescence Leads to: Lasting Cognitive and Behavioral Effects
    - Increased risk of later substance abuse
  - Various structural Changes in studies on Adolescent Rats
  - Reduced Pre-Frontal Cortex Activation (functional-MRI)



Image available at <http://www.dunlaplibrary.org/dev/wp-content/uploads/2016/08/brain.png>

• **90% of Adult Smokers began smoking before age 18**

U.S. Department of Health and Human Services. *The Health Consequences of Smoking: 50 Years of Progress. A Report of the Surgeon General*. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2014. Printed with corrections, January 2014.

U.S. Department of Health and Human Services. *E-Cigarette Use Among Youth and Young Adults. A Report of the Surgeon General*. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2016.



# HEALTH CONCERNS – NICOTINE

---

“Compared with older adults, the brain of youth and young adults is more vulnerable to the negative consequences of nicotine exposure. The effects include addiction, priming for use of other addictive substances, reduced impulse control, deficits in attention and cognition, and mood disorders.”

–Vivek Murthy, MD



# HEALTH CONCERNS – TRANSITIONING TO COMBUSTION

---

## Soneji S, et al. 2017 Systematic Review (JAMA Peds)

- Pooled 9 Longitudinal Studies. 17,989 participants, 14-30yo
- Baseline data, Resurvey at ~12 months

### **AT FOLLOW:UP:** Probability of Past 30-d Cigarette

- If Baseline 'non-Past 30d' E-cig user: 4.6%
- If Baseline 'past 30d E-cig user': 21.5%

### **Pooled Odds Ratio**

- For Baseline 'Past 30d E-Cig User' vs 'non-Past 30d E-cig user' = 4.28 (95% CI, 2.52-7.27)
- For Baseline 'Ever' vs 'Never' E-cig user = 3.5 (95% CI 2.38-5.16)

### **National Academies of Science (2018)**

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



# SUMMARY OF HARMS

---

1. Toxic Chemicals and Carcinogens: Risk of Cancer and Lung Disease, Heart Disease in Future. Long-term Data Lacks
2. Nicotine is toxic to the developing adolescent Brain
3. Risk of Transitioning to Traditional Cigarettes



# YOUTH POPULARITY – HOW WE GOT HERE

---

- Marketing to Youth
- Safety
- Appeal of Flavors



# YOUTH POPULARITY – MARKETING



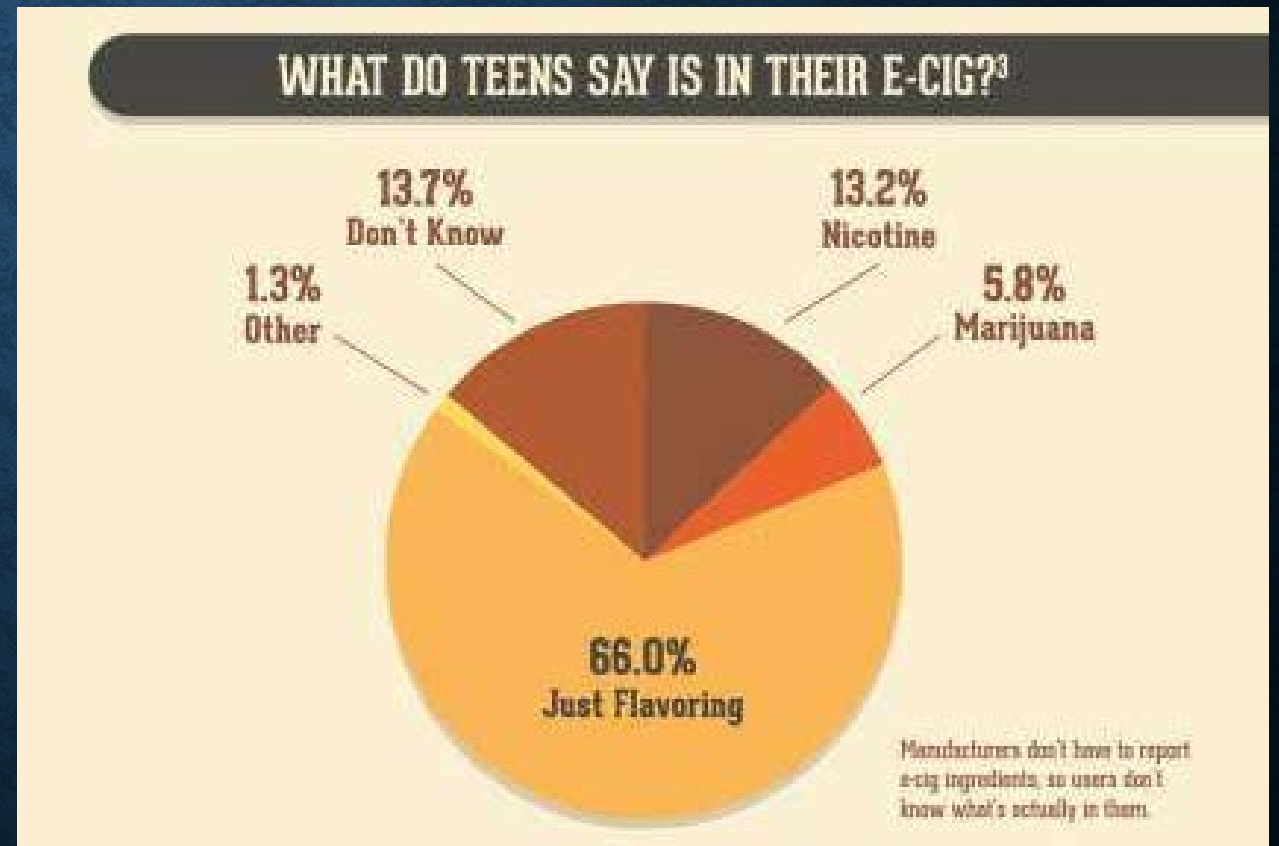
June 4, 2015 <https://twitter.com/JUULvapor/status/606656253885038592>

<http://ads.gawkerassets.com/creative/ads/live/Juul/Launch%20Party/carousel/carousel.html>



# YOUTH POPULARITY – SAFETY

- “Harm Reduction”, “Safer Alternative” = Harmless and Safe
- “Vapor” = Water
- Misleading Flavors (Healthy?)
  - Mango, Mint, Strawberry, Banana, Fruit Medley



Source: National Institute on Drug Abuse; National Institutes of Health; U.S. Department of Health and Human Services



# YOUTH POPULARITY – FLAVOR APPEAL

---

- Ambrose BK, et al (2015).
  - 85.1% of current youth e-cigarette users said they used e-cigarettes “because they come in flavors I like.”
- Wisconsin Youth Tobacco Survey (2018)
  - 89% of high school students, “would not use unflavored E-cigarettes”



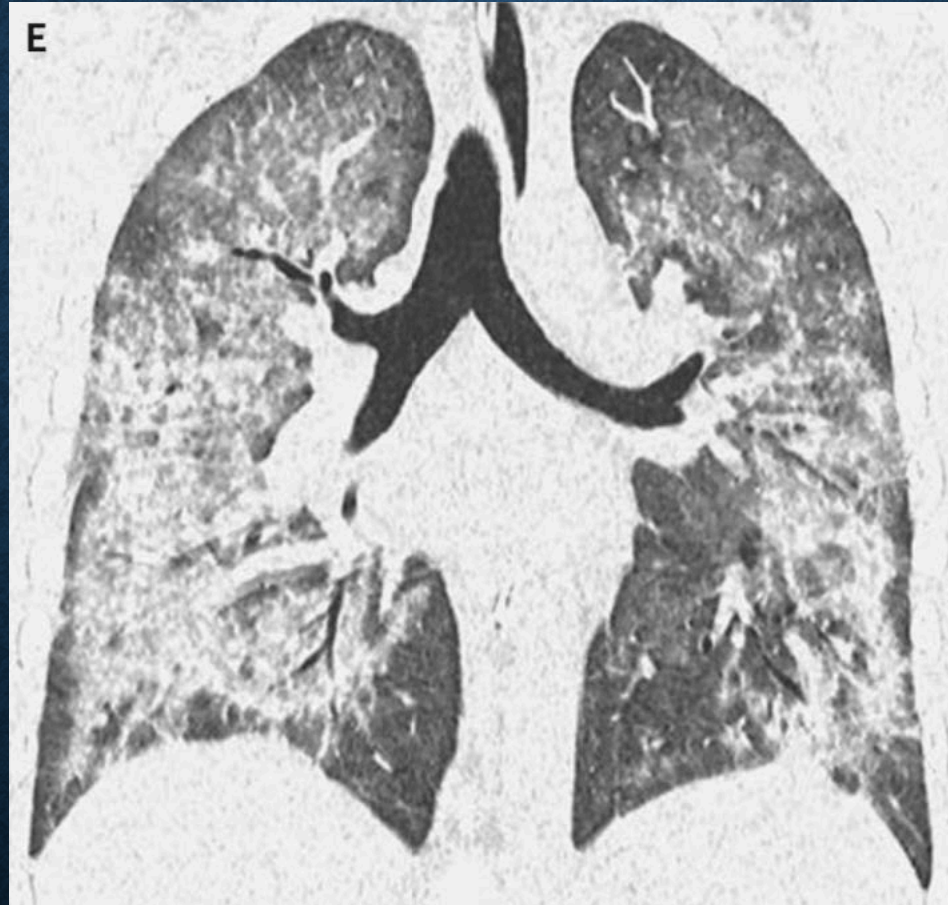
-Ambrose BK, Day HR, Rostron B, et al. Flavored tobacco product use among us youth aged 12–17 years, 2013–2014. JAMA. 2015;314(17):1871–3.

-Wisconsin Department of Public Health. (2018). *High School Snapshot, Youth Tobacco Survey* [PDF file]. Retrieved from <https://www.dhs.wisconsin.gov/publications/p01624.pdf>



# E-CIGARETTE OR VAPING ASSOCIATED LUNG INJURY (EVALI)

---





# MARIJUANA

---

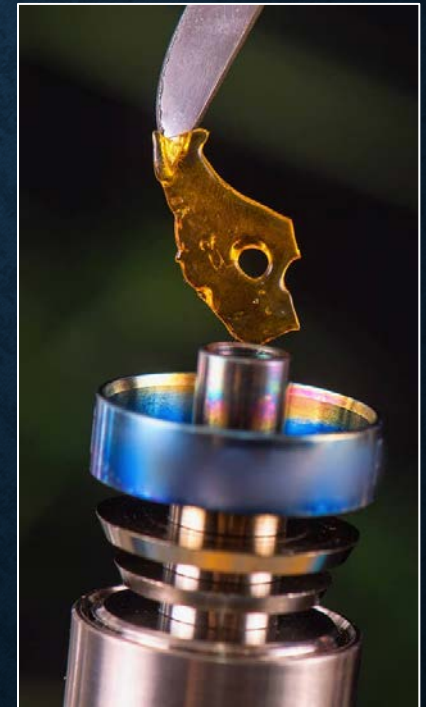
## Vaporizer “Dry Herb”



## Vape Pen “Oils”



## Dab Pen “Wax, Budder”





# MARIJUANA – LEGALIZATION AND ADOLESCENTS

---

## 2012: Colorado and Washington Legalize Marijuana (Recreational)

- 2017 Cerda et al (Monitoring the Future, National Survey)
  - In Washington: Increased use amongst 8<sup>th</sup> and 10<sup>th</sup> graders
  - In Colorado: No significant Change
- 2019 Dilley, et al (Washington Healthy Youth Survey)
  - In Washington, Decreased use amongst 8<sup>th</sup> and 10<sup>th</sup> graders
- Illinois: To Be Determined...

Cerdá M, Wall M, Feng T, et al. Association of state recreational marijuana laws with adolescent marijuana use. *JAMA Pediatr.* 2017;171(2):142-149.

Dilley JA, Richardson SM, Kilmer B, Pacula RL, Segawa MB, Cerdá M. Prevalence of cannabis use in youths after legalization in Washington State. *JAMA Pediatr.* 2019;173(2):192-193.



# Summary

---

- E-cigarette use has led to a rapid rise in adolescent vaping (27.5% of high-schoolers)
- Rising adolescent use places decades of declining cigarette use rates at risk and places an entire generation at risk for nicotine and cigarette addiction
- Long-term data on health effects of E-cigarettes are unknown but growing concerns for cancer and other long-term lungs issues exist



**QUESTIONS?**



# VAPING TRENDS AMONG YOUTH IN ILLINOIS

University of Illinois

Center for Prevention and Research Development

School of Social Work



# ABOUT THE IYS

- The Illinois Youth Survey (IYS) is a biennial survey of **8th, 10th, and 12th grade students**.
- The IYS is a self-report survey administered in school settings and is designed to gather information about a variety of health and social indicators including substance use patterns and attitudes of Illinois youth.
- In 2018, the Illinois Youth survey included over **230,000 youth** across more than **970 Illinois schools** who were surveyed between January and June of 2018.

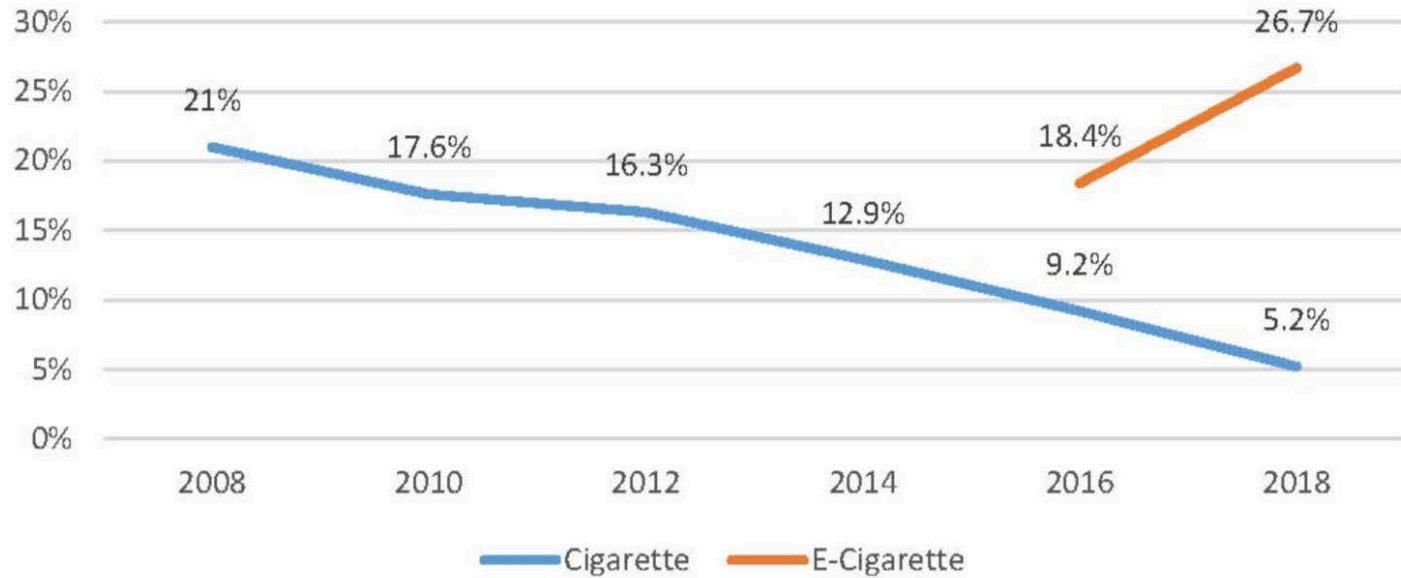
- Data is based on a statewide randomly drawn, scientifically weighted sample of **11,259 students**, selected to represent the state population of 8th, 10th, and 12th graders in Illinois' public schools, distributed across the grades as shown below.

	Weighted Count
8th	3800
10th	3885
12th	3574
Total	11259

- The sampling design assures that youth in the state sample are representative of the state's diverse community types.



Past 30-day E-cigarette use significantly rising while cigarette smoking is declining



# CIGARETTES VS. E CIGARETTES (VAPING)

- In the last two survey years, use of e-cigarettes has increased **dramatically**.
- 18.4% in 2016 → 26.7% in 2018. (Among Seniors)
- This is one of most dramatic and alarming annual changes in youth substance use trends the IYS has ever measured.

## PERCIEVED RISK:

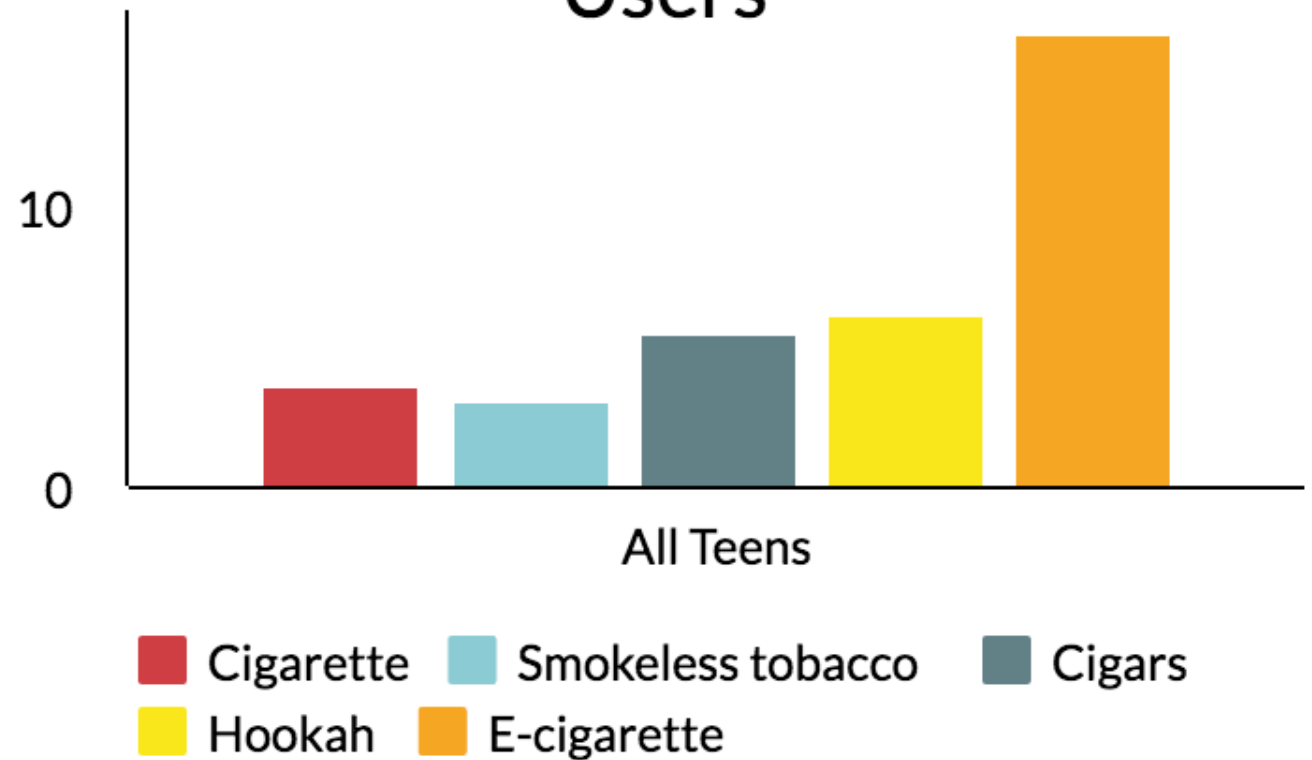
- **87.6%** of teens perceive a moderate or great risk of smoking one or more packs of **cigarettes** per day
- Only **58%** perceive moderate or great risk from **e-cigarette** use.
- **12.1%** of seniors perceive no risk from **e-cigarette use**.



## METHOD OF USE FOR TOBACCO

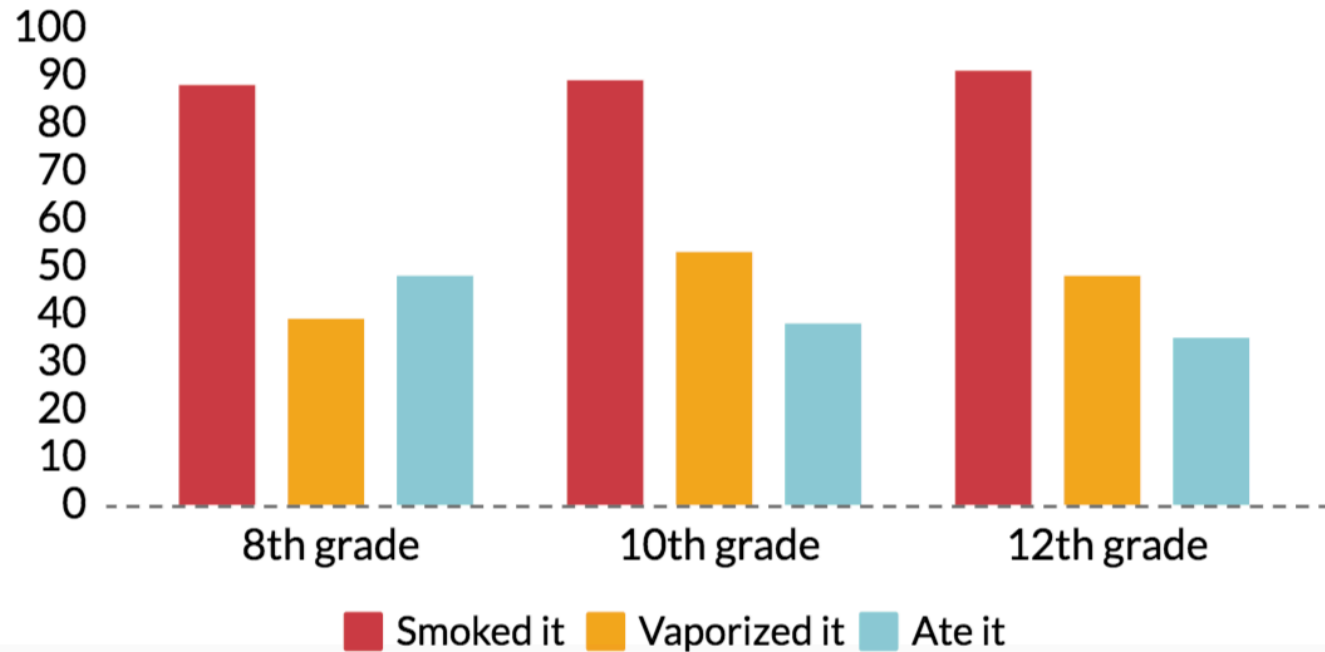
- Among all teens, e-cigarette use is nearly **3 times** more prevalent than any other form of tobacco use.
- In 2018 over a 30 day period:
  - 25.6% of seniors reported marijuana use
  - 26.7% reported use of e-cigarettes.
  - Only 5.2% reported cigarette use.

### Method of Use Among Tobacco Users





## Method of Use Among Marijuana Users\*



## METHOD OF USE FOR MARIJUANA

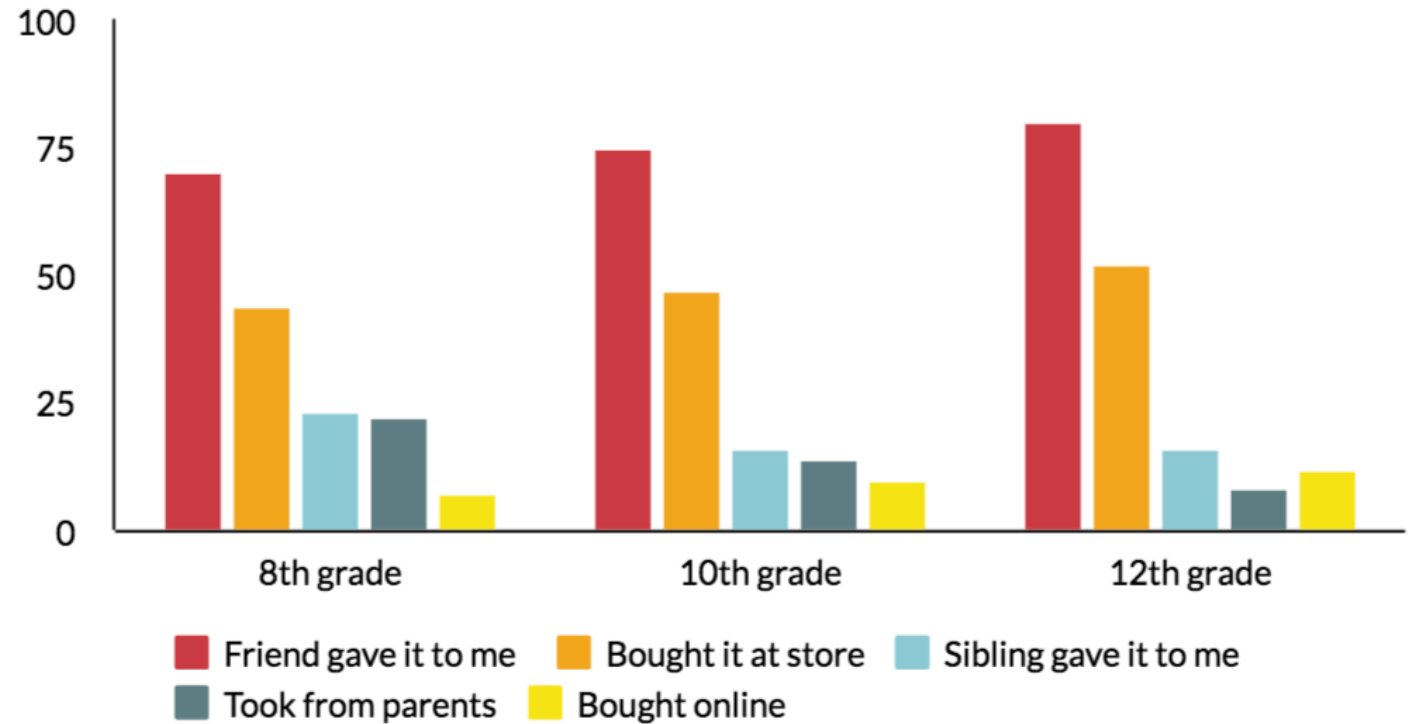
- The most common means of marijuana use was by smoking it using a joint, bong, pipe or blunt.
- However, other means were also very common among users, including vaping and edible marijuana.



## ACCESS TO PRODUCTS

- Across the grades, the most common source of tobacco or vaping products for teens is that they are given to them by a **friend**.
- Seniors are far more likely to purchase tobacco or vaping products at a store than 8th or 10th graders.
- 63% of 12th grade IYS respondents were 18 and older could **legally purchase** tobacco or vaping products.

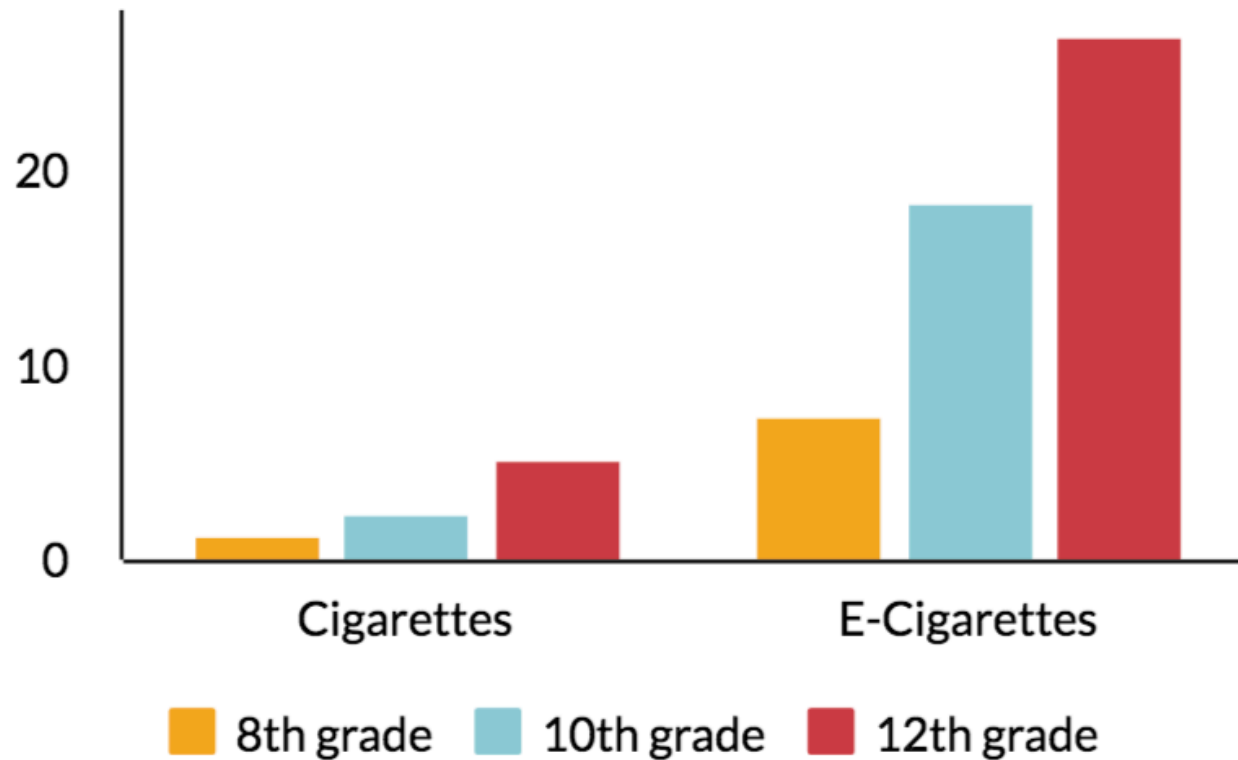
Supply Source of Tobacco or Vaping Products\*



\*those who reported using tobacco or vaping products at least once in the past year.



## Past 30 Day Use by All Grades



Use of e-cigarettes, **increases** as a young person progresses through their high school years

## PAST 30 DAY USE AMONG TEENS

- IN THE PAST 30 DAYS...
- **8<sup>th</sup> grade** → **7.4%** of youth reported e-cigarette use
- **10<sup>th</sup> grade** → **18.3%** of youth reported e-cigarette use
- **12<sup>th</sup> grade** → **26.7%** of youth reported e cigarette use.
- **7.4%** of seniors reported using e-cigarettes more than once per day.