The Adolescent Vaping Epidemic

Bryan Mih, MD MPH FAAP

Disclosure

- I have no relevant financial relationships with the manufacturers(s) of any commercial products(s) and/or provider of commercial services discussed in this CME activity

- I do not intend to discuss an unapproved/investigative use of a commercial product/device in my presentation.

Acknowledgements

- Forrest Batz, PharmD, Board of Directors, Hawaii Public Health Institute
- Brian A. King, PhD, MPH, Deputy Director for Research Translation, Office on Smoking & Health, Centers for Disease Control
- Tobacco Prevention Toolkit, Division of Adolescent Medicine, Stanford University
- Julius B. Richmond Center of Excellence & Section on Tobacco Control, American Academy of Pediatrics

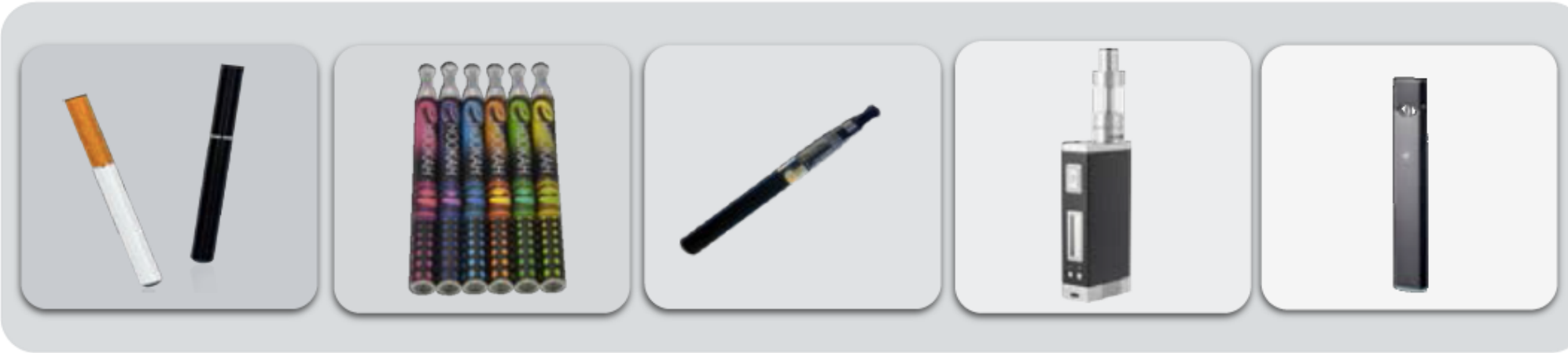
Outline

1) Overview of e-cigarettes, vaping devices, JUUL
2) What are the risks?
3) How is it an epidemic?
4) What can we do as pediatricians?

Section 1:
Overview of e-cigarettes, vaping devices, JUUL

- Components of e-cigarette solutions generally include nicotine, flavoring chemicals, and other additives (including those unknown and/or unadvertised to the user).
- There are no federal quality standards to ensure the accuracy of e-cigarette constituents as advertised or labeled

Electronic Smoking Devices (ESDs)



Cig-a-Like

E-cigarettes came onto the market around 2007.

Most delivered nicotine and were disposable.

Variations

Variations on the first e-cigarettes included products like e-hookah and rechargeable versions.

Vape Pens

These have batteries that can reach higher temperatures, have refillable e-liquid cartridges, and allow users to regulate the frequency of inhalations.

Mods

Large size, modifiable e-cigarettes allow for more aerosol, nicotine, and other chemicals to be breathed into the lungs, at a faster rate.

Pod-Based

These e-cigarettes are shaped like USBs and contain pods with higher amounts of nicotine than previous generations.

Volcano Vape Pen

VOLCANO
FINE ELECTRONIC CIGARETTES

Starter Kits | Tanks & Coils | e-Liquid | Accessories | Deals

THE LAVATUBE Kit

The culmination of exhaustive research and development, the LAVATUBE v2.5 takes your vaping experience to the highest possible level. The LAVATUBE is VOLCANO's most powerful and customizable e-Cigarette and the most advanced device currently on the market.

Shop Now | Learn more

Vape Pen

tubetank

Heating coils

Power unit
Controller
Battery
LCD screen


SMOK
ALIEN
Various Color For Your Option
halo
Suorin Air

Juul and Similar Products

Juul

KandyPen's Rubi

MLV's Phix

Mylé

ITG Brands' myblu

Altria's MarkTen Elite

More nicotine delivery devices

Trap RX by Mig Vapor
Uses refillable pods

Suorin Air

Suorin Drop
Refillable pods
Can vape while charging

SMOK Infinix

Aspire Breeze 2

More nicotine delivery devices

JUUL charging on a laptop USB drive

Terminology

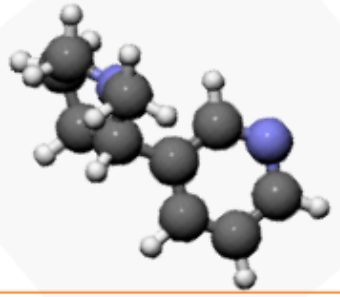
- Young people often will say no if you ask if they use “e-cigarettes”.
- Revise your questions to ask if they vape or JUUL

Section 1: Summary

- Recognize the all forms of nicotine delivery—currently JUUL and similar products are most popular.
- Revise your questions. “Do you smoke or use e-cigarettes” might not work anymore. Ask if they vape or JUUL.

Section 2: Risks of electronic nicotine devices

Nicotine



- **Highly addictive** substance
- Causes changes in brain chemistry – stimulates pleasure centers, alters normal brain function
- As nicotine levels in brain drop, brain craves nicotine to feel pleasure and relieve feelings of anxiety and stress (withdrawal)

Nicotine: salts vs base

nicotine salts

59 mg nicotine per mL

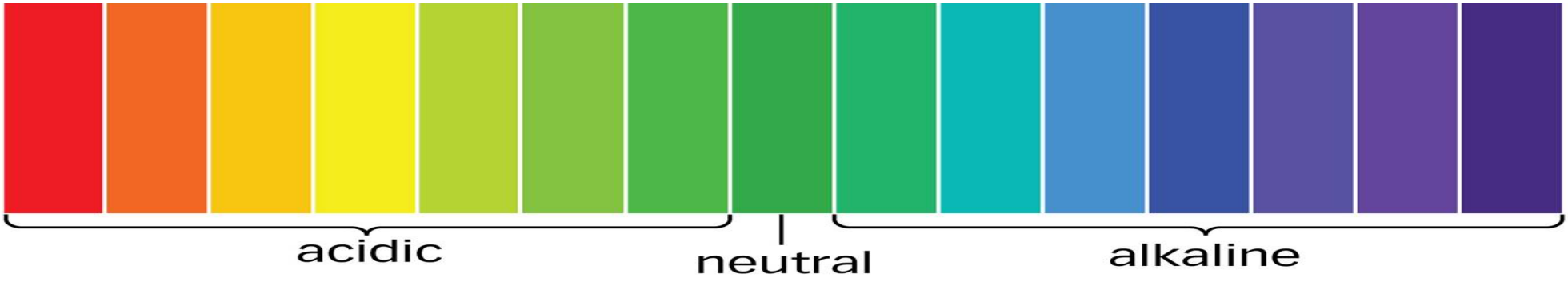
pods *not intended* for refill

nicotine base

0 - 36 mg nicotine per mL

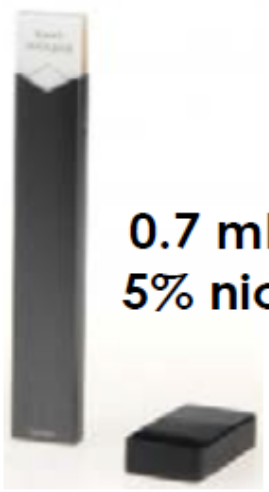
refillable tank

Nicotine salts allow particularly high levels of nicotine to be inhaled more easily and with less irritation than free base nicotine



Pod-Based ESDs

Pod-Based ESD Nicotine Delivery



0.7 mL pod
5% nicotine

=

1.5 mL pod
5% nicotine

=

HAWAI'I PUBLIC HEALTH INSTITUTE

Nicotine

- Highly addictive
- Excess amounts can be lethal.
- **Adversely affects brain development until mid-20s**
  - Slows cognitive and behavioral development. Associated with problems with mood, attention, and learning.
  - Makes it harder to control impulses.
- Increases heart rate variability. Increases risk of heart disease, aortic aneurysms.
- Increases insulin resistance
- Associated with peptic ulcers.

- JUUL can **deliver nicotine 2.7 times faster** than other e-cigarettes, increasing the risk of addiction

Ingestion vs. Inhalation

Propylene glycol, vegetable glycerine and other e-juice ingredients may be approved as safe for *use in foods*…
NOT approved as safe for **inhaling**

TOBACCO PREVENTION TOOLKIT

The Solvent—Propylene Glycol
The Solutes—Flavoring Agents

- These things are FDA-approved, so they should be safe, right? Depends on how they enter the body:
  - Propylene glycol and some flavoring agents have been FDA-approved for **ingestion**
  - They have been found to be irritants when **inhaled**.
- The contents of e-cigarettes are not regulated—what is promised on the package may not be what's inside:
  - Some ingredients can be carcinogenic
  - Metals such as tin, nickel, and lead have been found

It's Aerosol *not* Water Vapor

Vape aerosol- mixture of many different tiny chemical droplets and particles suspended in the air, some present in e-juice, others produced during e-cig heating process

Evaporated water

WHAT'S IN A "VAPE" CLOUD?

NICOTINE

TOBACCO-SPECIFIC NITROSAMINES

FORMALDEHYDE

CARCINOGENS

BENZENE

ACETALDEHYDE

AMERICAN LUNG ASSOCIATION®

- ✓ **88%** of youth who use ESDs **use flavored e-juice**[1]
- ✓ **More rewarding** (work harder at task leading to flavored vs unflavored ESD reward)[2]
- ✓ **Increase ESD use** (users puff flavored ESDs twice as often as unflavored over same time period)[2]
- ✓ **Longer inhalations** (longer puff duration with sweet flavor vs nicotine flavor)[3]

1. McMillen R, et al. Adolescent Use of Different E-cigarette Products. Pediatrics. 2018;142(4):e20180260.
2. Audrain-McGovern J, et al. The impact of flavoring on the rewarding and reinforcing value of e-cigarettes with nicotine among young adult smokers. Drug Alcohol Depend. 2016;166():263-267.
3. St. Helen G, et al. Impact of e-liquid flavors on e-cigarette vaping behavior. Drug Alcohol Depend. 2018;189:42-48.

Among ESD users, *if flavors did not* exist:

- ✓78% of youth would NOT use
- ✓74% of 18-24 yo would NOT use

Harrell MB, et al. Flavored tobacco product use among youth and young adults: What if flavors didn't exist. Tob Reg Sci. 2017;3(2):168-173.

Flavourings significantly affect inhalation toxicity of aerosol generated from electronic nicotine delivery systems (ENDS).

Leigh NJ, Lawton RI, Hershberger PA, et al

Tobacco Control 2016;25:ii81-ii87.

Certain e-cigarette flavors can irritate the airways:

- Benzaldehyde—cherry flavored liquids
- Cinnamaldehyde—cinnamon flavor
- Diacetyl—buttery flavor
  - Can cause “popcorn lung”—bronchiolitis obliterans
  - Supposedly phased out by “reputable” manufacturers

Formation of flavorant–propylene Glycol Adducts With Novel Toxicological Properties in Chemically Unstable E-Cigarette Liquids

Hanno C Erythropel, Sairam V Jabba, Tamara M DeWinter, Melissa Mendizabal, Paul T Anastas, Sven E Jordt, Julie B Zimmerman. *Nicotine & Tobacco Research*, 18 October, 2018

Duke University and Yale's Tobacco Center of Regulatory Science

- When certain flavors are mixed with propylene glycol, they produce acetals that **irritate airways and lungs**.
  - Flavor aldehydes included benzaldehyde, cinnamaldehyde, citral, ethylvanillin, and vanillin
  - Propylene glycol is the most common e-liquid solvent
  - Acetals remained stable in physiological aqueous solution, with half-lives above 36 hours, suggesting they persist when inhaled by the user.
  - Acetals activated aldehyde-sensitive TRPA1 irritant receptors and aldehyde-insensitive TRPV1 irritant receptors

Adolescent Exposure to Toxic Volatile Organic Chemicals From E-Cigarettes

Mark L. Rubinstein, Kevin Delucchi, Neal L. Benowitz, Danielle E. Ramo

Pediatrics. April 2018, VOLUME 141 / ISSUE 4

- Urine was analyzed for metabolites of a panel of 8 VOCs that are toxic environmental or tobacco smoke constituents: benzene, 1,3-butadiene, ethylene oxide, acrylonitrile, acrolein, propylene oxide, acrylamide, and crotonaldehyde.
- The participants were 16.4 years old on average.
- Adolescent e-cigarette–only users had levels of 5 VOC toxicants detected in their urine in quantities up to 3 times greater than in matched controls, including metabolites of **acrylonitrile**, acrolein, **propylene oxide**, **acrylamide**, and **crotonaldehyde**. (known carcinogens boldfaced)
- Levels of toxicant exposure in dual users were up to 3 times higher than in those who used only e-cigarettes.
- The use of fruit-flavored products produced significantly higher levels of the metabolites of acrylonitrile

Association of Noncigarette Tobacco Product Use With Future Cigarette Smoking Among Youth in the Population Assessment of Tobacco and Health (PATH) Study, 2013-2015

Shannon Lea Watkins, PhD1; Stanton A. Glantz, PhD2; Benjamin W. Chaffee, DDS, PhD3

JAMA Pediatr. 2018;172(2):181-187. doi:10.1001/jamapediatrics.2017.4173

- Approximately 90% of adult smokers first tried a cigarette by 18 years of age
- Population Assessment of Tobacco and Health (PATH) = nationally representative longitudinal cohort of 13,651 US youth ages 12-17 years at baseline with follow-up 1 year later.
- Cigarette ever use at follow-up was higher among youths who had ever used e-cigarettes (78 [19.1%]), hookah (60 [18.3%]), noncigarette combustible tobacco (45 [19.2%]), or smokeless tobacco (29 [18.8%].
- The odds of past 30-day cigarette use at follow-up were approximately **twice as high among users of e-cigarettes** (odds ratio [OR], 1.87), hookah (OR, 1.92), noncigarette combustible tobacco (OR, 1.78), and smokeless tobacco (OR, 2.07).
- Youths who had tried more than 1 type of tobacco product had 3.81 greater adjusted odds of past 30-day cigarette smoking

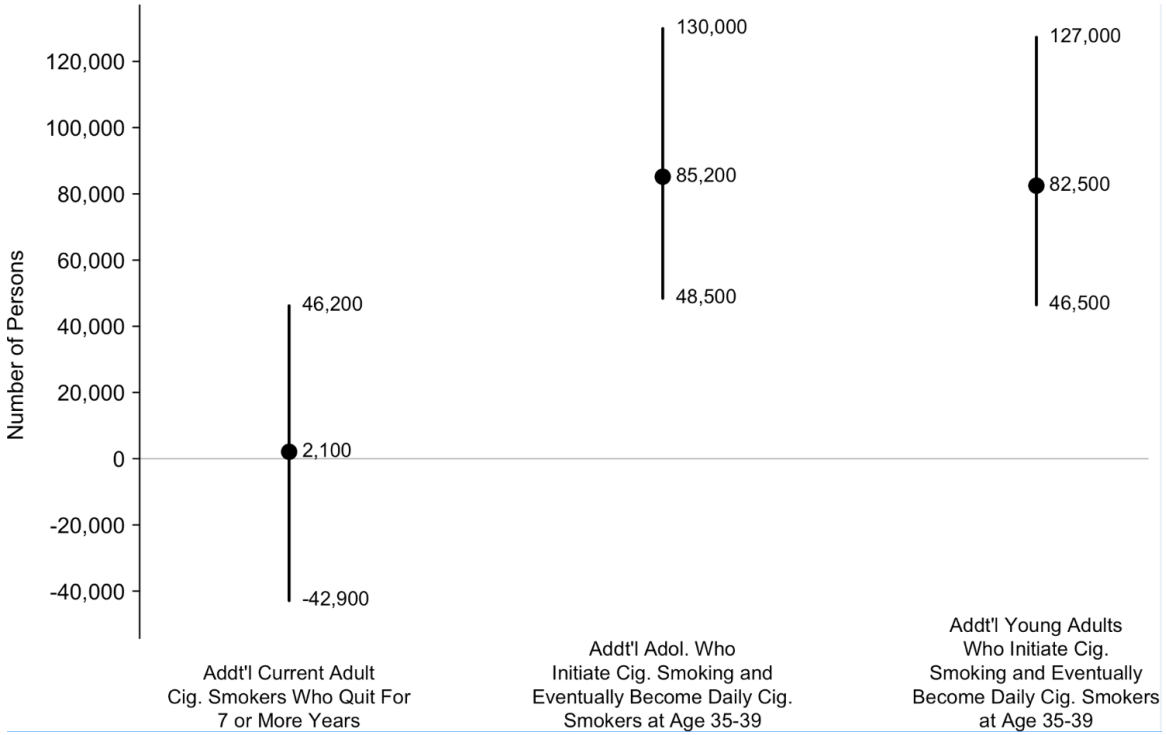
Association Between Initial Use of e-Cigarettes and Subsequent Cigarette Smoking Among Adolescents and Young Adults: A Systematic Review and Meta-analysis

Samir Soneji, PhD[1,2]; Jessica L. Barrington-Trimis, PhD[3]; Thomas A. Wills, PhD[4]; et al

JAMA Pediatr. 2017;171(8):788-797. doi:10.1001/jamapediatrics.2017.1488

- **Question** Is there an association between e-cigarette use and cigarette smoking among adolescents and young adults?
- **Finding** A systematic review and meta-analysis showed strong and consistent evidence of an association between initial e-cigarette use and subsequent cigarette smoking initiation, as well as between past 30-day e-cigarette use and subsequent past 30-day cigarette smoking.
- **Summary**: This meta-analysis of 9 longitudinal studies found that e-cigarette use by never-smoking adolescents was associated with approximately **4 times greater odds of future cigarette smoking**.

E-cigarettes as a “cessation aid”?



- Statisical risk model. Samir Soneji, et al. Dartmouth-Hitchcock Norris Cotton Cancer Center, Lebanon, N.H. **Quantifying population-level health benefits and harms of e-cigarette use in the United States**
- In a single year, 2,070 adult smokers would successfully quit using e-cigarettes
- But the model also estimated that e-cigarette use among non-smoking teens and young adults would lead to 168,000 new smokers.
- So for every 1 adult that quits, 81 young people become future smokers

HONOLULU Star-Advertiser

July 17, 2017 | 77° | Check Traffic

Hawaii News

E-cigarettes tied to asthma in isle youth

By Kristen Consillio
Posted July 17, 2017
July 17, 2017

ASSOCIATED PRESS

More teens are trying out e-cigarettes than the real thing, according to the government's annual drug use survey.

Hawaii teens who use e-cigarettes are more likely to have asthma, according to the latest research by the University of Hawaii.

Section 2: Summary

- Nicotine is highly addictive and has significant impacts on the brain, especially for those under age 25 years.
- 90% of smokers initiate use before age 18.
- Using e-cigarettes and other nicotine products increase the odds of smoking regular cigarettes by **2-4 times**
- Each JUUL pod has as much nicotine as 1-2 packs of cigarettes
- Polyethylene glycol and flavorings can irritate the lungs and negatively impact health

Surgeon General Warns Youth Vaping Is Now An 'Epidemic'

December 18, 2018 · 12:08 PM ET

ROB STEIN

U.S. Surgeon General Dr. Jerome Adams said Tuesday that local restrictions, including bans on indoor vaping, are needed to reduce youth e-cigarette use.

Eric Baradat/AFP/Getty Images

U.S. Surgeon General Jerome Adams: "I am officially declaring e-cigarette use among youth an epidemic in the United States. Now is the time to take action. We need to protect our young people from all tobacco products, including e-cigarettes."


MILWAUKEE JOURNAL SENTINEL
"JUULing is the New Teen Vaping Fad Taking Over School Bathrooms"
THE WALL STREET JOURNAL.
"Schools and Parents Fight a Juul E-Cigarette Epidemic"
The New York Times
"'I Can't Stop': Schools Struggle With Vaping Explosion"
CNN
"Vaping Now An Epidemic Among US High Schoolers"
TobaccoFreeKids.org
Campaign for Tobacco-Free Kids

Teen vaping on the rise — at schools and on street

By Jim Mendoza | March 16, 2017 at 8:58 PM HST - Updated August 12 at 11:25 AM

(Image: Hawaii News Now)

(Image: Hawaii News Now)

HONOLULU (HawaiiNewsNow) - Pick a popular spot for teens and you're likely to see them: E-cigarettes, being passed around like a bag of chips.

A 2015 state survey estimated that roughly 1 in 4 Hawaii teens used e-cigarettes, slightly higher than the national average.

But their use is believed to have grown since then, judging by what's happening on and near Hawaii high school campuses.

"I started vaping since I was seventh grade," said a 10th grade student who Hawaii News Now is not identifying.

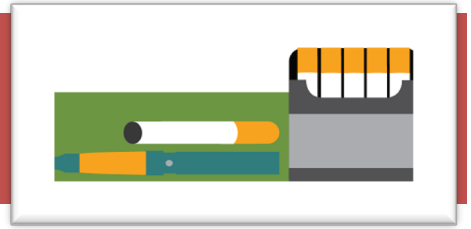
A friend of his did as well.

"I stopped for an entire year. Then more and more people started vaping," the second student said. "I'll just go back into that too."

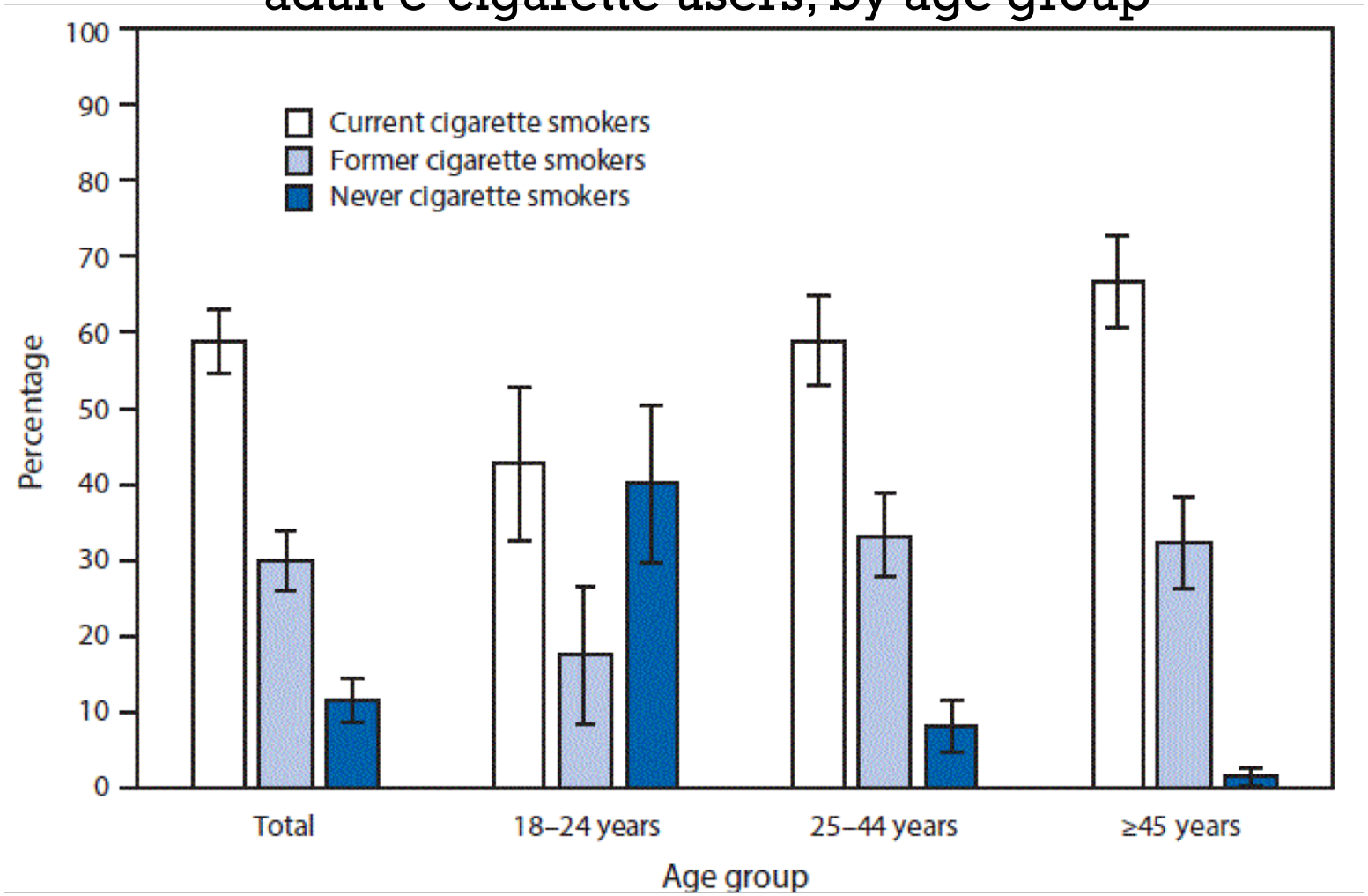
Their attitude appears to be an indication of what's happening with teens across the state -- ones who attend both public and private schools. Many admit to vaping -- the inhaling and exhaling of vapor produced by an e-cigarette -- on school property.

- According to one national survey, 3.6 million middle and high school students used e-cigarettes in 2018.
- Another found that the rise in vaping from 2017 to 2018 was the sharpest for any substance the researchers had investigated in the project's 44-year history.

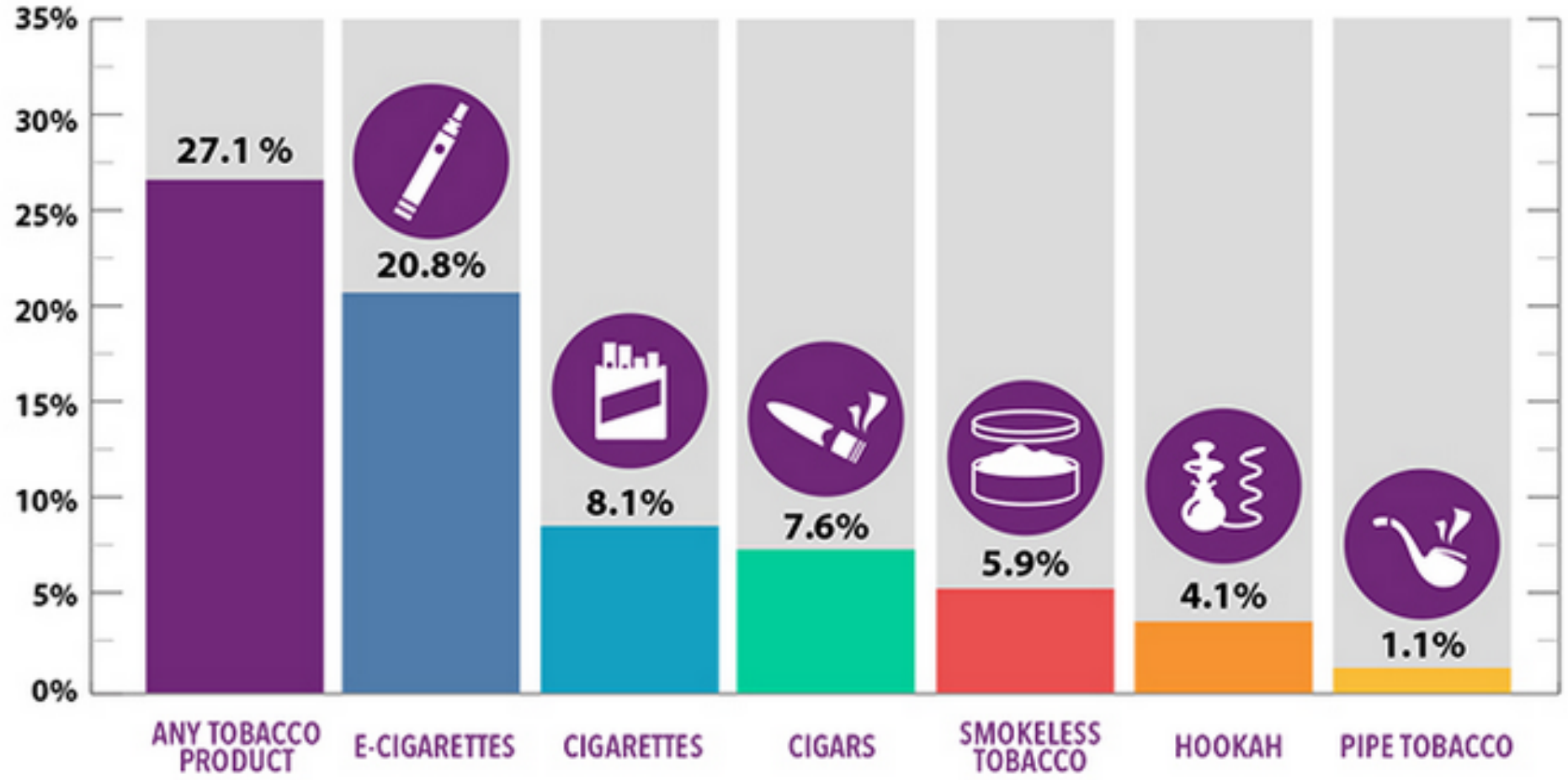
A Majority of Adult E-cigarette Users Also Smoke Conventional Cigarettes



Cigarette smoking status among current adult e-cigarette users, by age group

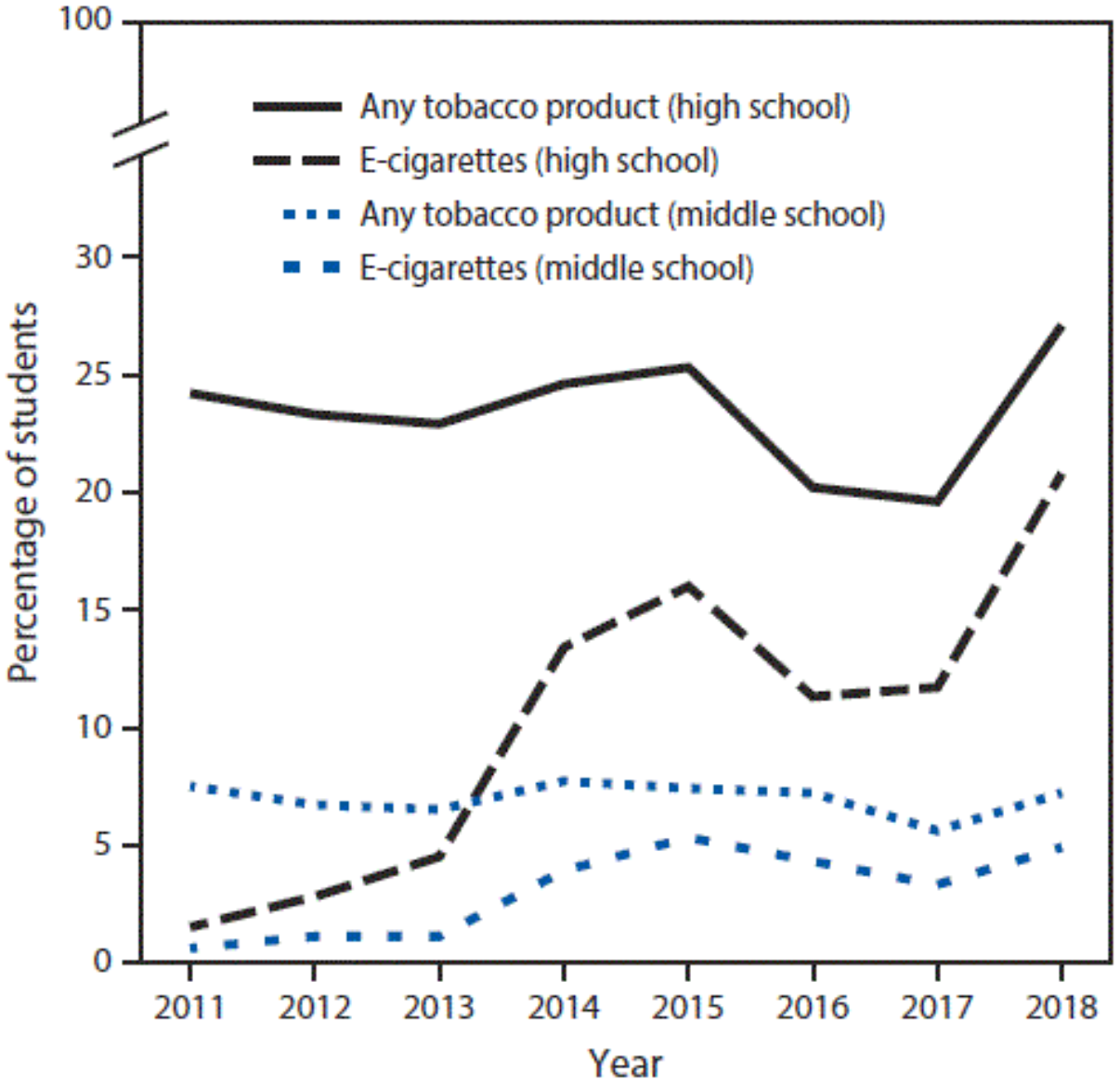


Tobacco Product Use Among High School Students – 2018

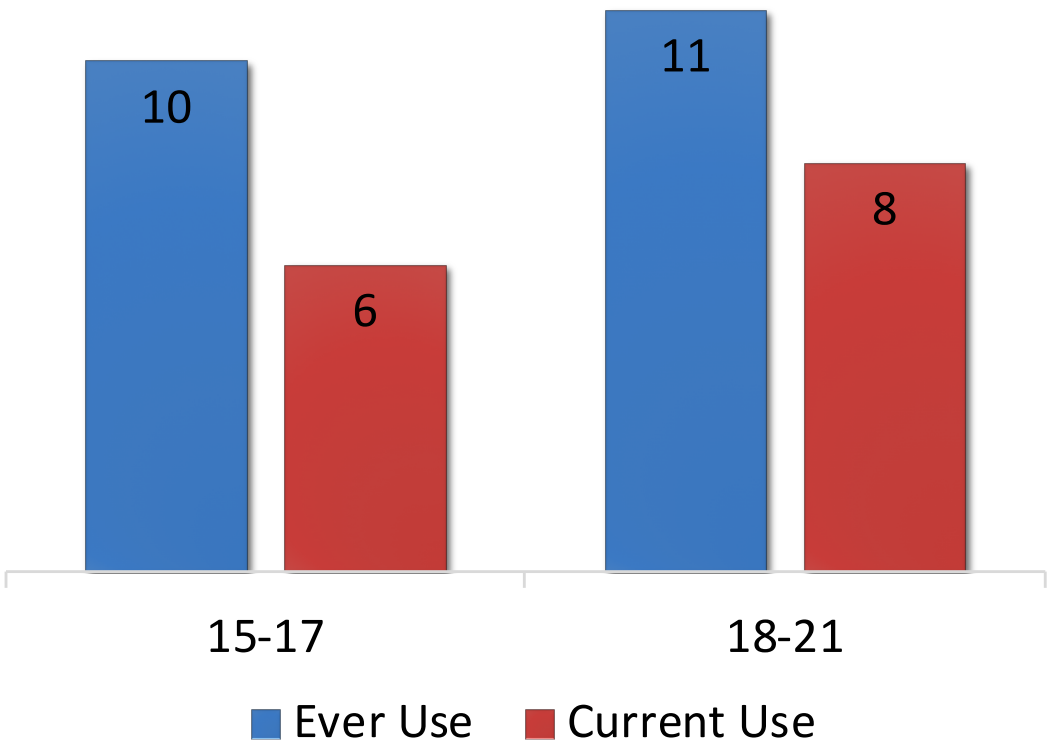


U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

Current Use of E-cigarettes and Any Tobacco Product Among Middle and High School Students— NYTS, US, 2011–2018



JUUL use, access points, and misperceptions among young people

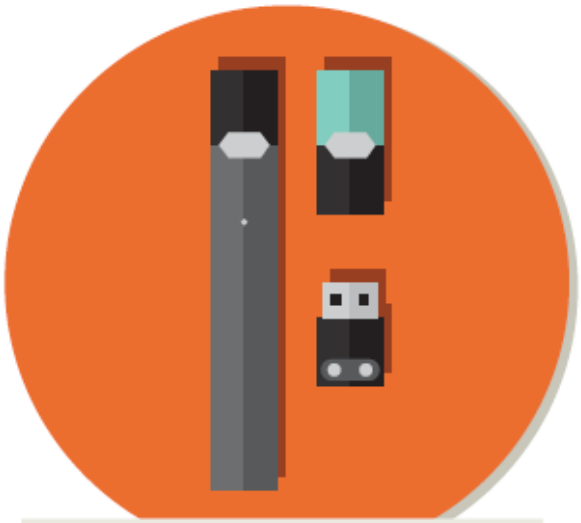


1 in 5 middle and high school students have seen JUUL used at school

3 in 4 youth who used JUUL say they got the device from a physical retail location

63% of JUUL users ages 15-24 did not know nicotine is always in the device

The Rise of JUUL



An increasingly popular e-cigarette, called JUUL, is shaped like a USB flash drive.

The Washington Times

HOME | NEWS | OPINION | SPORTS | MARKET | SUBSCRIBE

POLITICS White House confirms Trump offered to host...

POLITICS Trump slams DOJ for failing to provide req...

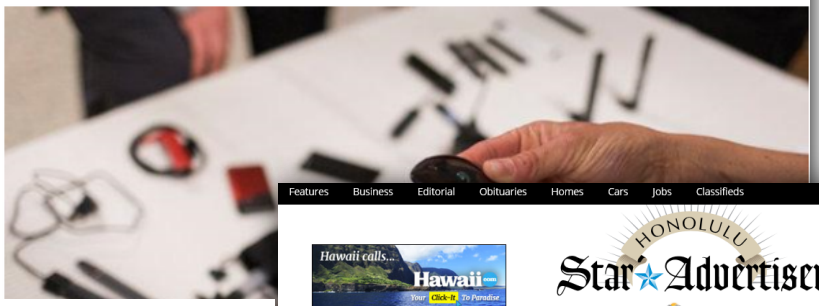
POLITICS Trump renews criticism of Amazon's p...

POLITICS White House says Trump 'push ba...

JUUL craze getting teens hooked on high levels of nicotine, health officials fear

The New York Times

'I Can't Stop': Schools Struggle With Vaping Explosion



USA TODAY

NEWS SPORTS LIFE MONEY TECH TRAVEL OPINION 46° CROSSWORDS VIDEO SUBSCRIBE NEWSLETTERS

Juuling, 'peanut butter cup'-flavored vapes: Young adults experiment with e-cigarettes

Rachel Bluth, Kaiser Health News Published 10:24 a.m. ET March 28, 2018

The U.S. Surgeon General warns e-cigarette use is a growing public health concern. Sean Dowling (@seandowlingtv) has more. Buzz60

Share your feedback to help improve our site experience!

POPULAR STORIES

Here's the biggest news you missed this weekend

usatoday.com | 21 hours ago

Features Business Editorial Obituaries Homes Cars Jobs Classifieds

Hawaii calls... Hawaii Your Click-It To Paradise

HONOLULU Star-Advertiser

April 9, 2018 | 75° | Check Traffic

NEW YORK TIMES

Juul emerges as vape of choice among teens

New York Times | April 6, 2018 Updated April 6, 2018 11:57am

BUSINESS BEAT

FDA renews concerns over teen vaping

Agency head says comments by Altria, Juul are at odds with past promises to curb youth e-cigarette use.

By Anna Edney

Tobacco giant Altria Group Inc.'s efforts to gain a toehold in the burgeoning e-cigarette market are facing scrutiny, as a top U.S. regulator signaled that curbs on sales of some vaping products are imminent.

The Food and Drug Administration is concerned that Altria's $12.8-billion stake in e-cigarette start-up Juul Labs Inc. contradicts commitments both companies have made to address what health officials have called an epidemic of youth vaping.

FDA Commissioner Scott Gottlieb wrote to the companies Friday and asked to talk with them about "public statements that seem inconsistent" with vows they made to the agency last year to combat nicotine use by minors. Youth adoption of e-cigarettes has surged in the last

Julio Cortez Associated Press

TOBACCO giant Altria's $12.8-billion stake in e-cigarette start-up Juul Labs Inc. has raised concerns from the FDA commissioner over whether the companies are committed to reducing youth vaping.

to reintroduce them to the bricks-and-mortar market before the FDA's sales restrictions are finalized.

The letters to Altria and Juul follow a move Thursday by the commissioner to single out Walgreens Boots Alliance Inc. for being the biggest violator of prohibitions on youth tobacco sales.

Walgreens said it has taken steps to crack down on such sales. Gottlieb had previously eased restrictions on e-cigarettes as he expressed hope they would offer adult smokers a way to quit, but he has reversed course given the rise in vaping among children and teens.

"I am aware of deeply concerning data showing that youth use of Juul products represents a significant proportion of the overall use of e-cigarette products by children," Gottlieb wrote to the chief executives of Altria and Juul.

"I have no reason to believe these youth patterns of use are abating in the near term, and they certainly do not appear to be reversing."

Juul has an estimated 70% share of the $3-billion e-cigarette market, according to a Bloomberg Intelligence analysis of data from market researcher IRI.

THE NATION

Vaping takes off with high school students

More than 1.3 million teens started tobacco habit in the last year.

By Karen Kaplan

The proportion of U.S. high school seniors who are vaping tobacco products nearly doubled in the last year, with more than 1 in 5 now saying they have vaped to get a hit of nicotine in the last 30 days, according to a new study.

The prevalence of nicotine vaping nearly doubled among 10th-graders as well, with nearly 1 in 6 using the electronic devices, researchers reported Monday in the New England Journal of Medicine.

The findings suggest that the total number of high school students using tobacco surged by 1.3 million between 2017 and 2018.

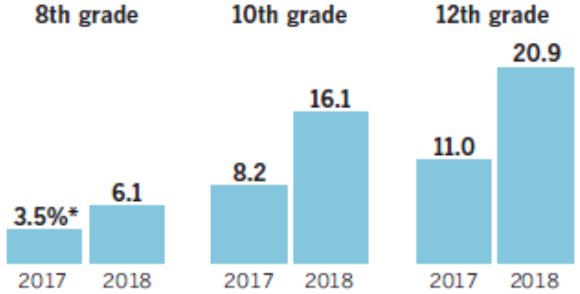
"This increase was driven solely by nicotine vaping," the researchers wrote.

The figures are based on a nationwide survey of

Scott Olson Getty Images

E-CIGARETTE products by Juul are so popular with students that "juuling" is synonymous with vaping.

Number of students vaping soars



the U.S. Food and Drug Administration has said.

The FDA ordered online retailers to stop selling such products in September as part of a broad initiative to reduce teen vaping. At the time, FDA Commissioner Scott Gottlieb said vaping had produced an "epidemic of nicotine addiction" among America's youth, with a prevalence that was "simply not tolerable."

The Monitoring the Future researchers agreed that stronger action was needed to keep vaping devices beyond the reach of minors. Regulators will need to pay close attention to the fast-changing market and be ready to modify their policies if necessary, they said.

Miech applauded the FDA's recent focus on kid-friendly flavors of vaping liquids. He also praised the agency for paying particular attention to Juul; the company's devices have become so popular among middle and high school students that "juuling" is now synonymous with vaping.

Last month, after a visit

of tobacco use declined among students, e-cigarettes continuously bucked that trend.

Still, the increase in the last year was striking.

Among 12th-graders, the proportion of students who said they had vaped a nicotine product in the 30 days before they took the survey soared from 11% in 2017 to 20.9% in 2018. Among 10th-graders, it jumped from 8.2% in 2017 to 16.1% in 2018, and among eighth-graders it rose from 3.5% last year to 6.1% this year.

The survey also asked about vaping of liquids that contained "just flavoring" to track students who may have consumed nicotine without realizing it. When both categories of vaping were combined, the researchers found that 25% of high school seniors, 20.3% of sophomores and 9.7% of eighth-graders reported recent use of e-cigarettes in 2018.

The use of any kind of nicotine-containing product — including traditional cigarettes, cigars and smokeless

come cigarette smokers than their classmates who don't vape.

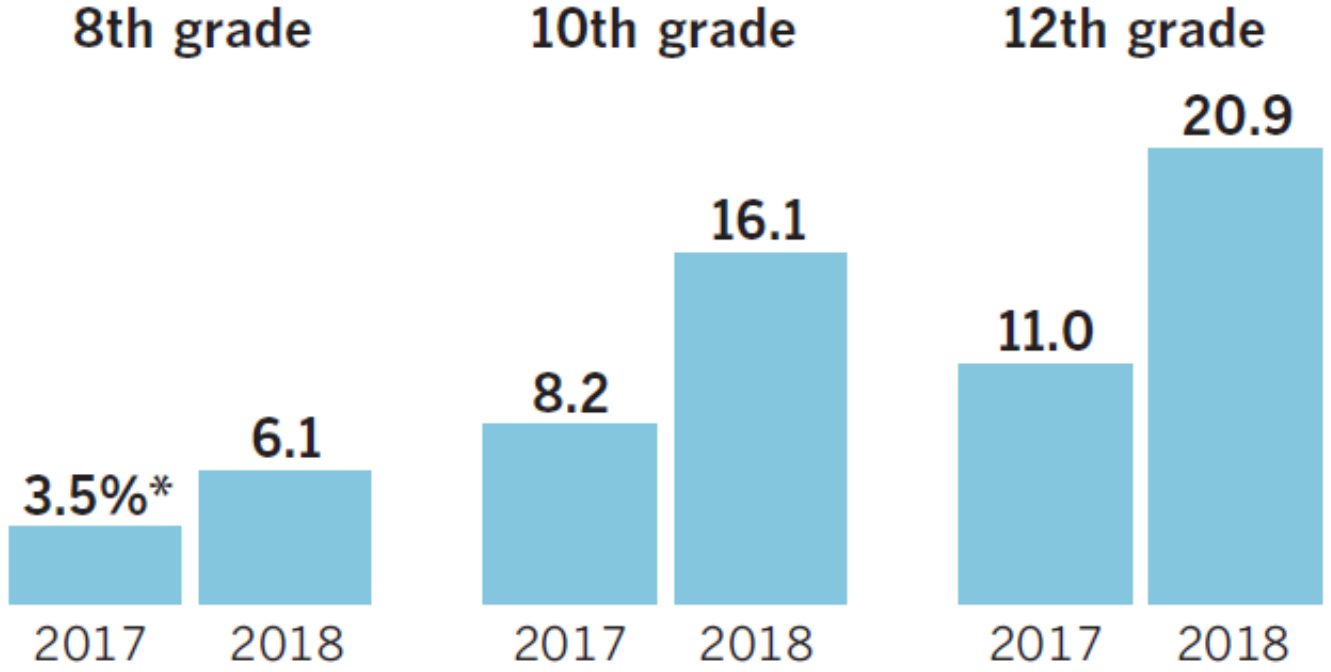
Even if they stick to vaping, they are still putting their health at risk. The aerosol produced by vaping devices contains volatile organic compounds, heavy metals and other chemicals that may cause cancer and lung disease, according to the Centers for Disease Control and Prevention.

In addition, the U.S. surgeon general has warned that exposure to nicotine during adolescence may interfere with brain development, particularly in areas important for attention, learning and impulse control.

"Kids who are vaping are acting like guinea pigs," Miech said. "We will find out in the future what the long-term risks are going to be."

Students' growing attraction to vaping extended to marijuana, which increased by at least 50% across the board. In 2018, 7.5% of seniors, 7% of sophomores and 2.6% of eighth-graders said they had vaped

Number of students vaping soars

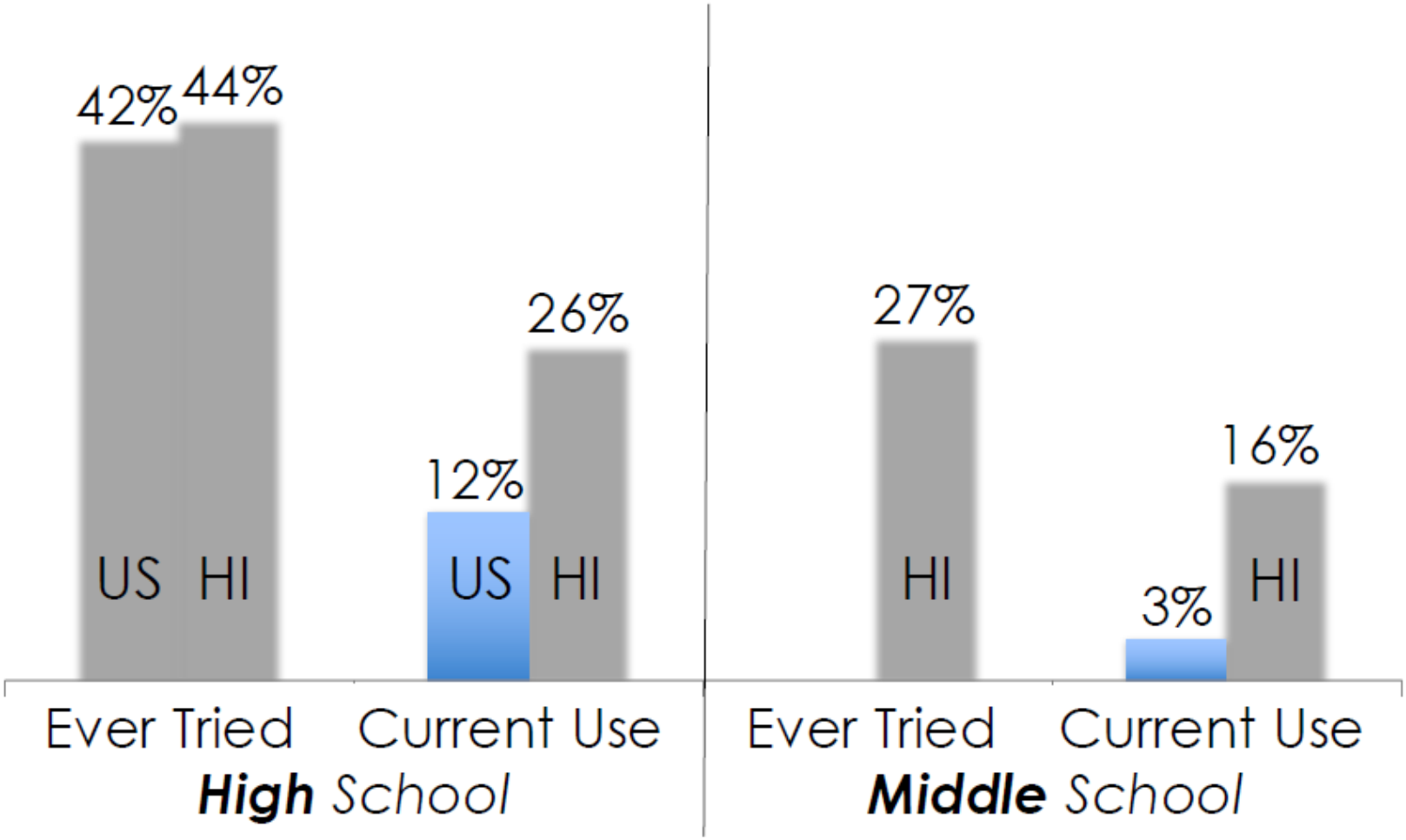


*Share who said they had vaped nicotine in 30 days prior to survey

Sources: University of Michigan, Monitoring the Future

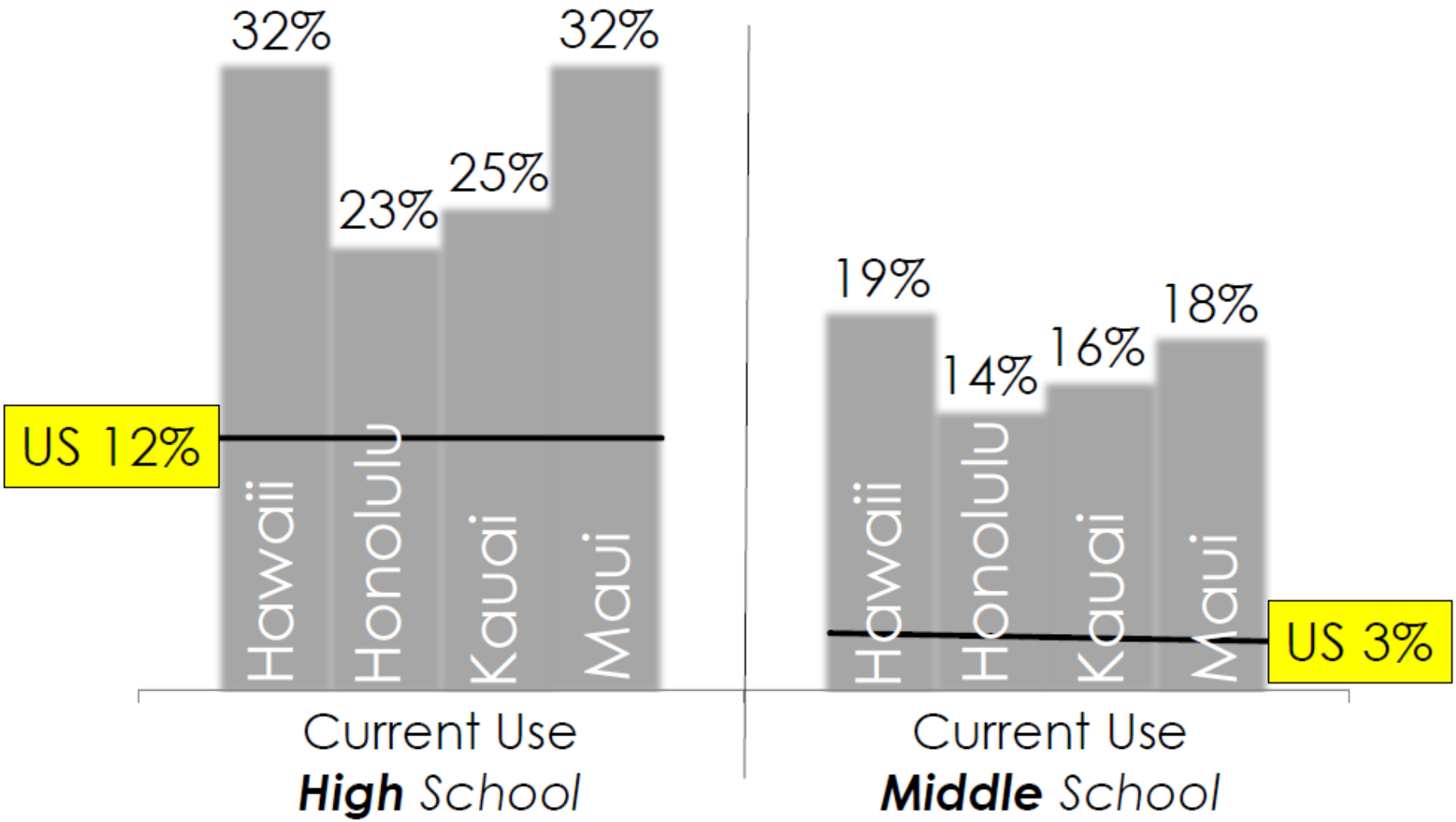
Los Angeles Times

US vs HI Youth ESD Use



1. CDC. Tobacco Use among Middle and High School Students – United States 2011-2017.
2. Hawai'i Youth Risk Behavior Survey 2017.

HI Youth ESD Use by County



1. CDC. Tobacco Use among Middle and High School Students – United States 2011-2017.
2. Hawai'i Youth Risk Behavior Survey 2017.

Why Youth Vape

- ✓ Taste and entertainment (63%)
- ✓ Experiment (29%)
- ✓ Replace cigarettes (7%)

Evans-Polce RJ, et al. Reasons for Vaping Among U.S. 12th Graders. J Adolesc Health. 2018;62(4):457-462.

Section 3: Summary

- 26% of high school students in Hawaii currently use e-cigarettes
- 16% of middle school students in Hawaii currently use e-cigarettes
- National and state numbers have dramatically increased over the past few years
- Hawaii youth vape more than U.S. average.
- Bonus fact: JUUL has 72% of the e-cig market

The New York Times

Addicted to Vaped Nicotine, Teenagers Have No Clear Path to Quitting

Dr. Susanne Tanski, a pediatrics professor at Dartmouth, holding pieces of a vape pen that can be worn on a lanyard. Elizabeth Frantz for The New York Times

Cessation strategies:
Things that work for regular adult cigarette smokers

- Behavioral therapies
  - motivational interviewing
  - Cognitive behavioral therapy
- Pharmacotherapy—FDA-approved only in adults
  - nicotine replacement therapy
  - Bupropion
  - Varenicline (Chantix)
- Other interventions
  - brief advice from a health care worker
  - telephone helplines
  - automated text messaging
  - printed self-help materials
  - Apps on mobile devices
  - social media-based cessation

Vaping and teenagers—motivational interviewing

- Teenagers may not see vaping as hazardous.
- Many even do not realize there is nicotine in the device
- Parents' negative reactions can lead to teen defensiveness and avoidance of discussion.
- Engage them in conversation and see what they know about nicotine and addiction
- Involve them in looking at research on the long-term harms of vaping
- Allow them to decide they would like to quit for their own good—internally motivated; rather than an outside force (parent) making them quit (or at least say they are doing so).

Cognitive behavioral therapy

- Redirect thoughts when they get cravings
- Talk therapy can address underlying anxiety or depression
  - Anxiety and depression cause stress which may trigger teens to vape or smoke.

Nicotine Replacement Therapy

- OTC for adults, but must be prescribed for those under 18.
- Comes as a patch, gum, lozenge
- Decreases nicotine withdrawal symptoms
- Helps address nicotine cravings
- *Unfortunately the nicotine dose with e-cigarettes is highly variable so harder to match the same nicotine dose*
- Some physicians have prescribed NRT patches off-label for older teenagers if they are heavily addicted yet motivated to quit

Bupropion

- Not labeled for use in those <18 years
- Black box warning for antidepressants: increased risk of suicidal thinking and behavior in those <24 years being treated for depression.
- randomized, double-blind, placebo-controlled trial with bupropion SR 150 mg QD and 150mg BID, age 14-17—had higher initial quit rates for the BID group, but unsustained for long term, plus had one suicide attempt
- Inpatient program with NRT with placebo or bupropion 150mg—55% of those on bupropion compared to 19% in placebo group were quit at 90 days.

- Summary—research inconclusive and black box warning for increased suicidality is a concern

Cochrane Review of smoking cessation in young people

Pharmacological interventions compared to placebo for smoking cessation in young people

Patient or population: young people
Setting: schools, community
Intervention: pharmacological interventions
Comparison: placebo

Comparisons and outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (studies)	Quality of the evidence (GRADE)	Comments
	Risk with placebo	Risk with pharmacological interventions				
NRT vs placebo Smoking cessation assessed with: biochemical verification Follow-up: range 6 months to 12 months	Study population		RR 1.11 (0.48 to 2.58)	385 (2 RCTs)	⊕◯◯◯ Very low[1,2]	Both studies included single forms of NRT (patch or gum). No evidence of significant subgroup differences based on NRT type. Control risk based on rates in included studies
	59 per 1000	66 per 1000 (28 to 153)				
NRT vs placebo Adverse events assessed with: participant report Follow-up: range 6 months to 12 months	No serious adverse events reported. NRT associated with increase in some mild adverse events: sore throat; hiccups; erythema; pruritus; shoulder/arm pain; headache; cough; abnormal dreams; and muscle pain. In the patch studies, successful quitters in NRT group reported a lower level of insomnia than those in the control group			385 (2 RCTs)	⊕◯◯◯ Very low[1,2]	Both studies included single forms of NRT (patch or gum)
Bupropion vs placebo Smoking cessation assessed with: biochemical validation Follow-up: 26 weeks	Study population		RR 1.49 (0.55 to 4.02)	207 (1 RCT)	⊕◯◯◯ Very low[1,3]	Control risk based on rates in included studies

Cochrane Review of smoking cessation in young people

	58 per 1000	87 per 1000 (32 to 234)			
Bupropion vs placebo Adverse events assessed with: participant report Follow-up: 26 weeks	2 serious adverse events resulting in hospitalization among intervention participants: anticholinergic crisis after ingesting *Datura innoxia;* intentional overdose on study medication and other substances. High level of mild adverse events reported in both groups (headache, cough, throat symptoms, sleep disturbance and nausea each reported by more than 10% of participants). 8 participants discontinued bupropion because of adverse events		207 (1 RCT)	⊕◯◯◯ Very low[1,3]	
Nicotine patch + bupropion vs nicotine patch + placebo Smoking cessation assessed with: biochemical validation Follow-up: 6 months	Study population	RR 1.05 (0.41 to 2.69)	211 (1 RCT)	⊕◯◯◯ Very low[1,3]	Control risk based on rates in included studies
	74 per 1000	78 per 1000 (30 to 199)			
Nicotine patch + bupropion vs nicotine patch + placebo Adverse events assessed with: participant report Follow-up: 6 months	No serious adverse events reported. Nausea most commonly reported adverse event		211 (1 RCT)	⊕◯◯◯ Very low[1,3]	

*__The risk in the intervention group__ (and its 95% confidence interval) is based on the assumed risk in the comparison group and the __relative effect__ of the intervention (and its 95% CI).

CI: confidence interval; **NRT**: nicotine replacement therapy; **RR:** risk ratio

GRADE Working Group grades of evidence
High quality: we are very confident that the true effect lies close to that of the estimate of the effect
Moderate quality: we are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different
Low quality: our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect

Cochrane Review of smoking cessation in young people

- “Taken together, these comparisons demonstrate that adult interventions whose effectiveness is well established cannot be assumed to be equally successful in younger age groups.”
- “Group counselling interventions and behavioural interventions designed using complex theoretical models appear to show the most promise.”
- “There remains little evidence on effectiveness of pharmacotherapies in this age group”

FDA In Brief

FDA in Brief: FDA updates label for Chantix with data underscoring it's not effective in children 16 and younger

February 22, 2019

Media Inquiries

Michael Felberbaum
240-402-9548

> "Tobacco products pose serious dangers to the health of teens and adolescents. Many methods that help adults quit smoking, including medications, have not been found to be effective for youth. Today's labeling changes for one such drug intended to help adult smokers quit cigarettes underscores the finding that current drug therapies for smoking

FDA updates label for Chantix with data underscoring it's not effective in children 16 and younger

February 22, 2019

- Chantix (varenicline) is not recommended for patients 16 years of age or younger because its efficacy in this population has not been demonstrated.
- originally approved in 2006 for use in adults
- A placebo-controlled study that examined two weight-adjusted doses of varenicline in pediatric patients, age 12 to 16 years (some patients age 17-19 years were also included) found that use of **varenicline did not significantly increase abstinence rates**.
  - While the pediatric population was defined as ages 16 and under at the time the studies were required, young adults ages 17-19 were permitted to participate; however, the study was not powered to evaluate an effect in the young adults.
- The most common adverse reactions associated with Chantix are **nausea, sleep disturbance, constipation, flatulence and vomiting**.
- Other adverse reactions have been identified during post-approval use of Chantix and are included in the label: **neuropsychiatric** adverse events, seizures, accidental injury, cardiovascular events, somnambulism, angioedema and hypersensitivity reactions. Increased alcohol effects have been reported as well.

Non-pharmacologic methods

- Sports and exercise
  - Physical exercise added to a teen cessation program improved quit rates, especially in males
- Yoga, deep breathing, meditation
- Tobacco Quitline 1-800-QUIT-NOW (784-8669)
- Social-media based cessation support
- Parental support
- Peer support—quit as a group
- Education about vaping for students, teachers, counselor, school administrators, parents

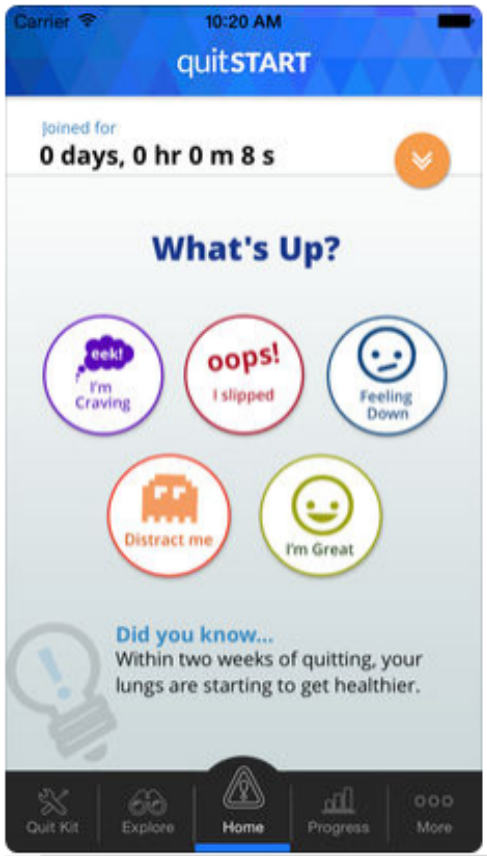
Text messaging

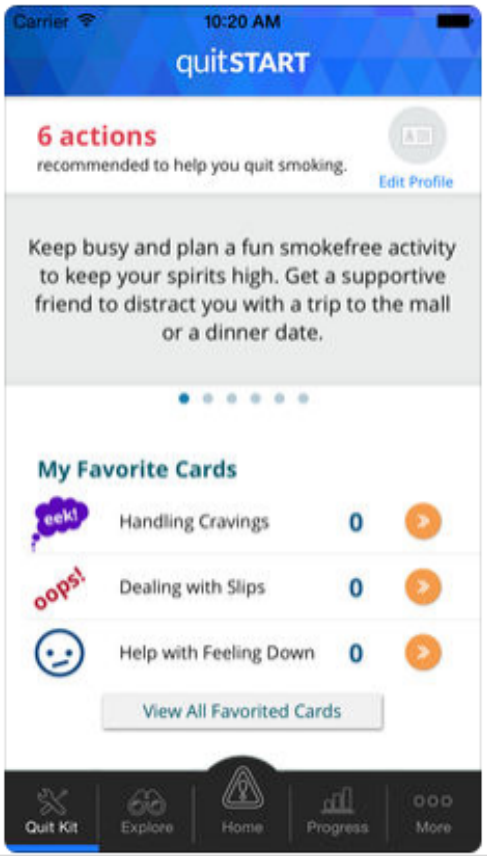
- The Truth Initiative
  - **thisisquitting.com**
  - **Text "QUIT" to (202) 804-9884**
  - The content of the messages is different based on your age (<13, 13-17, 18-24, >24, or a parent)

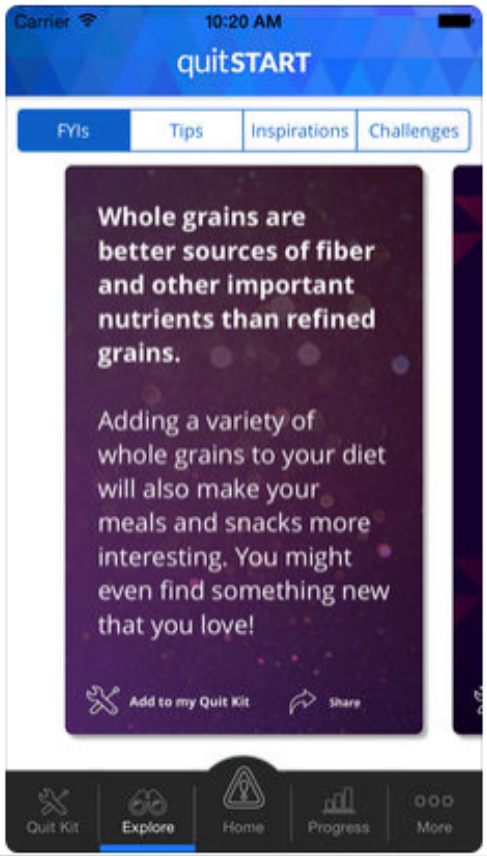
Phone Apps

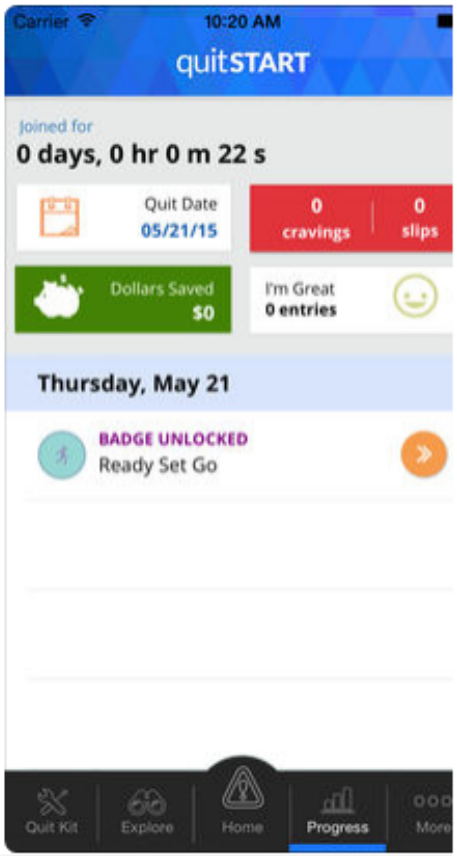
- National Cancer Institute
- SmokeFree Teen—quitSTART app
- Not clearly vape specific

quitSTART - Quit Smoking
ICF International
4.5, 95 Ratings
Free









Section 4: Summary

- Cognitive Behavioral Therapy and Motivational Interviewing can help
- Not good evidence to use NRT, bupropion, or Chantix in adolescents
- Things that help: exercise, texting/apps, parental support

Mahalo!