E-Cigs, Vaping, & Marijuana
Emerging Drug Trends in College Students

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E-Cigs and & Vaporizers – What are they?

- Devices to heat a substance and create a vapor

Figure 1. Parts of an e-cigarette.

1. Rechargeable, tank-style
2. Rechargeable, pen-style
3. Disposable, cigarette-style

(Prochnow, 2017)
(Giroud et al., 2015)
Wet & Dry Vaping

- Cartridges = wet
  - Refillable or closed
- Cannabis or THC wax = dry
  - ...most of the time
Juul sales are booming

Dollar share percentage of the e-cigarette traditional retail market, as of March 2018

Source: Nielsen Total US xAOC/Convenience Database and Wells Fargo Securities, LLC
Juul Maker to Invest $30M to Combat Underage Vaping

The maker of the much-debated e-cigarette brand Juul says it will spend $30 million to try to keep its products from underage users.

April 25, 2018, at 6:11 a.m.

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new study reveals teens 16 times more likely to use juul than older age groups

e-cigarettes|youth/young adults
Did Juul Lure Teenagers and Get ‘Customers for Life’?

The e-cigarette company says it never sought teenage users, but the F.D.A. is investigating whether Juul intentionally marketed its devices to youth.
Juul went into a ninth-grade classroom and called its device 'totally safe,' teens testify

By Arman Azad, CNN
Updated 10:31 AM ET, Thu July 25, 2019

Juul targeted teens by spending over $200K on influencers

By Amanda Woods
July 26, 2019 | 3:53pm | Updated
Marlboro Modernizes Its Method Of Peddling Death To Kids

Altria Buys 35 Percent Stake In E-Cigarette Maker Juul

Juul Labs gets $12.8 billion investment from Marlboro maker Altria Group

Juul workers get $2 billion bonus from tobacco giant investment

After a $2 Billion Company Bonus, Employees at Juul Just Became Overnight Millionaires

Approximately 1,500 Juul employees will get an average of $1.3 million.
Ahead Of Congressional Hearing, Juul Crosses $1 Million In Quarterly Lobbying Payouts For The First Time

Kenrick Cai Forbes Staff
I write about tech.

Vaping Industry Group Sues FDA To Delay E-Cigarette Review

Lisette Voytko Forbes Staff
Business
Breaking News Reporter

San Francisco Chronicle

Juul dominates SF ballot measure spending, shelling out $4.3 million to defend vaping

Catherine Ho Aug. 16, 2019 Updated: Aug. 16, 2019 5:08 p.m.
*Did Juul Lure Teenagers and Get ‘Customers for Life’?*

The e-cigarette company says it never sought teenage users, but the F.D.A. is investigating whether Juul intentionally marketed its devices to youth.
PAX 3
A vaporizer for both flower and waxy extracts.

PAX 2
A flower vaporizer to rediscover cannabis.

PAX Era
The effortless system for cannabis oils.

SHOP PAX 3
SHOP PAX 2
SHOP PAX ERA
Recent changes...

Juul Suspends Sales of Flavored Vapes And Signs Settlement To Stop Marketing To Youth

October 17, 2019 · 6:34 PM ET

But....
Vaping Jargon – A Select List

- Drug subculture, group identification
- **Terms**
  - Juice
  - Throat hit
  - Blend
E-Liquids

- **PG vs. VG**
  - **PG**
    • Thinner, + Throat Hit
  - **VG**
    • Thicker, sweeter, more vapor

**Buying E-Liquid**
Vaping – Appealing to Teenagers

- Easy to conceal use
  - Low odor
  - No smoke
- Can use in the bathroom, or discreetly in a classroom
- Marketing advantage with flavors
- JUUL looks like a flash drive
Background and Prevalence

- Invented in 2003 in China
- Introduced to the US in 2006
- Generally produced in China, few regulations exist
- Adult use is rare, less than cigarettes
  - 8.5%-12.6% ever used
  - 2.4%-5.5% current use
  - Many also smoke cigarettes

(NAS, 2018)
Youth Use Trends

**TABLE 1-1 Percentage of High School and Middle School Students Who Have Ever Used E-Cigarettes; National Youth Tobacco Survey (NYTS) 2011-2016**

<table>
<thead>
<tr>
<th></th>
<th>2011 % (95% CI)</th>
<th>2012 % (95% CI)</th>
<th>2013 % (95% CI)</th>
<th>2014 % (95% CI)</th>
<th>2015 % (95% CI)</th>
<th>2016 % (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>1.5 (1.2-2.0)</td>
<td>2.8 (2.3-3.5)</td>
<td>4.5 (3.8-5.3)</td>
<td>16.1</td>
<td>18.0</td>
<td>11.3 (9.9-)</td>
</tr>
<tr>
<td>School</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Middle</td>
<td>0.6 (0.4-0.9)</td>
<td>1.1 (0.9-1.5)</td>
<td>1.1 (0.8-1.5)</td>
<td>3.9 (3.0-5.0)</td>
<td>5.3 (4.6-6.2)</td>
<td>4.3 (3.7-4.9)</td>
</tr>
<tr>
<td>School</td>
<td></td>
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</table>

**SOURCES:** HHS, 2016b; Jamal et al., 2017.

This graph shows recent trends in tobacco-product use by high school students. The bars represent the percent of students who said they'd used each product in the past 30 days.

Adapted from T.Singh et al., April 15, 2016, MMWR

(NAS, 2018) (Raloff, 2016)
2018 NATIONAL YOUTH TOBACCO SURVEY FINDS CAUSE FOR CONCERN

Current e-cigarette use among middle and high school students increased alarmingly between 2017 and 2018.

Here is a breakdown of the recent findings:

SURGE IN YOUTH CURRENT E-CIGARETTE USE — 1.5 Million More Students Used E-Cigarettes in 2018 vs 2017

78% Increase Among High School Students

20.8%

11.7% 2017 2018

48% Increase Among Middle School Students

4.9%

3.3% 2017 2018
AMONG HIGH SCHOOL CURRENT E-CIGARETTE USERS — Rise in Frequency and Use of Flavors

More Used E-Cigarettes on 20 or More Days

28% in 2018 vs 20% in 2017

68% in 2018 vs 61% in 2017

E-CIGARETTE USE SURGE LED TO UPTICK IN OVERALL TOBACCO USE — Reversing Previous Declines

Current Use of Any Tobacco Product

Percentage of Students

Years

2015 2016 2017 2018

High School Students

27.1%

Middle School Students

7.2%
College Use Trends

- Use doubled in the past year
- Peer estimates exceed Pew and MTF statistics (80%)
- Vaping in college is associated with...
  - Drinking & binge drinking
  - Psychiatric disorders
  - Substance use disorders

(American College Health Association, 2018) (Hefner et al., 2019)
Why do people vape?

- Perceived as healthier than regular cigarettes
  - PG and VG based solutions are viewed as “natural”
  - “Vapor” sounds like water
- Smoking cessation
  - Easy to change dosages
- Adolescents & Young Adults
  - Flavors
  - It “looks cool”
  - Entry into a social group/identity
Conclusion 5-1. There is **conclusive evidence** that in addition to nicotine, most e-cigarette products contain and emit numerous potentially toxic substances.

Conclusion 5-4. There is **substantial evidence** that e-cigarette aerosol contains metals. The origin of the metals could be the metallic coil used to heat the e-liquid, other parts of the e-cigarette device, or e-liquids. Product characteristics and use-patterns may contribute to differences in the actual metals and metal concentrations measured in e-cigarette aerosol.

Conclusion 10-4. There is **substantial evidence** that some chemicals present in e-cigarette aerosols (e.g., formaldehyde, acrolein) are capable of causing DNA damage and mutagenesis. This supports the biological plausibility that long-term exposure to e-cigarette aerosols could increase risk of cancer and adverse reproductive outcomes. Whether or not the levels of exposure are high enough to contribute to human carcinogenesis remains to be determined.
number of toxic chemicals Berkeley Lab researchers found at significant levels in e-cigarette vapor

maximum number of puffs per day, on average (survey of 983 vapers)

Cancer-causing chemicals in e-cigarette vapor

1. Benzene
2. Cadmium
3. Isoprene
4. Lead
5. Nickel
6. Formaldehyde
7. Acetaldehyde
8. Toluene
9. N-Nitrosonornicotine
10. Nicotine
Vaping appears to be making hundreds of people sick. No one knows exactly why.

The mysterious spike in respiratory illnesses is a reminder that e-cigarettes may be more dangerous than they seem.

By Julia Belluz | @julioftoronto | julia.belluz@voxmedia.com | Sep 3, 2019, 2:20pm EDT

City of Milwaukee urges residents to stop vaping 'immediately'; 89% of Wisconsin sick cite THC

First death linked to vaping reported in Illinois

© 24 August 2019

HEALTH AND SCIENCE

Vaping illness deaths climb to 33 as outbreak spreads and doctors worry flu season could make it worse

PUBLISHED THU, OCT 17 2019•2:41 PM EDT | UPDATED THU, OCT 17 2019•6:44 PM EDT
‘It’s going to attack your lungs’: Gurnee teen hospitalized for vaping has message for his peers

"You literally don't know what you're inhaling into your body."

Dylan Nelson, 26, of Burlington, Wisconsin, was
Conclusion 5-1. There is **conclusive evidence** that in addition to nicotine, most e-cigarette products contain and emit numerous potentially toxic substances.

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Conclusion 5-2. There is **conclusive evidence** that, other than nicotine, the number, quantity, and characteristics of potentially toxic substances emitted from e-cigarettes is highly variable and depends on product characteristics (including device and e-liquid characteristics) and how the device is operated.

Conclusion 8-1. There is **substantial evidence** that e-cigarette use results in symptoms of dependence on e-cigarettes.
Areas of Benefit – Current Smokers

**Conclusion 5-3.** There is *substantial evidence* that except for nicotine, under typical conditions of use, exposure to potentially toxic substances from e-cigarettes is significantly lower compared with combustible tobacco cigarettes.

**Conclusion 18-5.** There is *moderate evidence* that second-hand exposure to nicotine and particulates is lower from e-cigarettes compared with combustible tobacco cigarettes.

**Conclusion 18-1.** There is *conclusive evidence* that completely substituting e-cigarettes for combustible tobacco cigarettes reduces users’ exposure to numerous toxicants and carcinogens present in combustible tobacco cigarettes.

**Conclusion 18-2.** There is *substantial evidence* that completely switching from regular use of combustible tobacco cigarettes to e-cigarettes results in reduced short-term adverse health outcomes in several organ systems.

**Conclusion 8-2.** There is *moderate evidence* that risk and severity of dependence are lower for e-cigarettes than combustible tobacco cigarettes.

**Conclusion 17-4.** While the overall evidence from observational trials is mixed, there is *moderate evidence* from observational studies that more frequent use of e-cigarettes is associated with increased likelihood of cessation.
Cannabis – A Particularly Bad Idea for Teenagers

- Increased risk for addiction

(Volkow, 2014)
Cannabis – A Particularly Bad Idea for Teenagers

- Increased risk for addiction
- This isn’t Woodstock pot anymore – much stronger
Marijuana Potency

(Volkow, 2014)
Cannabis – A Particularly Bad Idea for Teenagers

- Increased risk for addiction
- This isn’t Woodstock pot anymore – much stronger
- Negative academic and vocational outcomes
Academic and Vocational Outcomes

- **High School**
  - Lower grades, higher dropout rates, increased school disciplinary problems
    - May be social/functional, may be cognitive, may be both
    - Earlier use = worse outcomes
    - Greater frequency = worse outcomes

- **College**
  - Increased chance to skip class
  - Lower GPA
  - Potentially longer time to graduate

- Decreased lifetime earning potential
Cannabis – A Particularly Bad Idea for Teenagers

- Increased risk for addiction
- This isn’t Woodstock pot anymore – much stronger
- Negative academic and vocational outcomes
- Brain morphology changes
  - Residual impairment in memory, processing speed, and decision-making

(Volkow, 2014)
Figure 4. Percentage of studies reporting associations between regional neuroanatomy and cannabis use measures. Significant associations (red), nonsignificant associations (n.s.; blue), and associations unexamined (gray). Amyg, amygdala; Hipp, hippocampus; Para-hipp, parahippocampal gyrus; PFC, prefrontal cortex.
In the largest known brain imaging study, scientists from Amen Clinics, Google, John's Hopkins, UCLA, and UC San Francisco evaluated 62,454 brain SPECT scans of individuals from nine months old to 105 years of age to investigate factors that accelerate brain aging.

**Accelerated Aging Prediction**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Prediction</th>
</tr>
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<tbody>
<tr>
<td>Schizophrenia</td>
<td>4 years</td>
</tr>
<tr>
<td>Cannabis Abuse</td>
<td>2.8 years</td>
</tr>
<tr>
<td>Bipolar Disorder</td>
<td>1.6 years</td>
</tr>
<tr>
<td>ADHD</td>
<td>1.4 years</td>
</tr>
<tr>
<td>Alcohol Abuse</td>
<td>0.6 years</td>
</tr>
</tbody>
</table>

128 brain regions studied to predict the chronological age of a patient.

“We can now link clinical diagnoses and addictions to premature aging of the brain. Better treatment of these disorders can slow or even halt brain aging. The cannabis abuse result was especially important, as our culture is starting to view marijuana as a harmless substance. These findings invite us to rethink its effects on the brain.”

Daniel G. Amen, MD, founder of Amen Clinics

Caption: Drivers of Brain Aging. Credit: Daniel G. Amen
A Population-Based Analysis of the Relationship Between Substance Use and Adolescent Cognitive Development

Jean-François G. Morin, B.A., Mohammad H. Afzali, Ph.D., Josiane Bourque, M.Sc., Sherry H. Stewart, Ph.D., Jean R. Seguin, Ph.D., Maeve O’Leary-Barrett, Ph.D., Patricia J. Connod, Ph.D.

FIGURE 2. Between-Subject and Within-Subject (Concurrent and Lagged) Relationships Between Cannabis Use Frequency and Working Memory Errors, Perceptual Reasoning Performance, Delayed Memory Recall Performance, and Inhibitory Control Errors

A. Cannabis Use Frequency and Working Memory

B. Cannabis Use Frequency and Perceptual Reasoning

C. Cannabis Use Frequency and Delayed Memory Recall

D. Cannabis Use Frequency and Inhibitory Control

- No use
- Any use
- Any use + concurrent use
- Any use + concurrent use + past year use
Cannabis – A Particularly Bad Idea for Teenagers

- Increased risk for addiction
- This isn’t Woodstock pot anymore – much stronger
- Negative academic and vocational outcomes
- Brain morphology changes
  - Residual impairment in memory, processing speed, and decision-making
- Impaired judgement
  - Increased risky sexual behavior
- Psychotic breaks
  - Increases with higher % THC

(Volkow, 2014)
Psychotic Disorders as Function of THC dose, Frequency of Use
11 Sites, 6 Nations in Europe, Brazil: 3 of the cities

The contribution of cannabis use to variation in the incidence of psychotic disorder across Europe (EU-GEI): A multicentre case control study
Di Forti et al
www.thelancet.com/psychiatry
Published online March 19, 2019

If high-potency cannabis were no longer available:
- 12.2% of cases of first-episode psychosis could be prevented across 11 cities
- 30-33% prevented London
- 50-53% prevented Amsterdam

Chart prepared by BK Madras
ER visits linked to marijuana rose at Colorado hospital after legalization, study finds

People who consume marijuana edibles may be ingesting unsafe levels because they don’t feel the immediate high, researcher says.

He loved weed. Then the vomiting began. Months later, he died
Cannabis – A Particularly Bad Idea for Teenagers

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- Impaired judgement
  - Increased risky sexual behavior
- Psychotic breaks
  - Increases with higher % THC
- Drugged driving

(Volkow, 2014)
Gateway Drug?

Age, sex, and race/ethnicity adjusted past-month prevalence of cigarette, alcohol, and illicit drug other than marijuana use among youth aged 12-17 years, by marijuana use status (n = 17,000*)

* Substance Abuse and Mental Health Services Administration (SAMHSA) requires that any description of overall sample sizes based on the restricted-use data files has to be rounded to the nearest 100 to minimize potential disclosure risk.

FIGURE 1. Level of Wave 1 Cannabis Use and Incident Wave 2 Prescription Opioid Use Disorder in the NESARC

^ NESARC = National Epidemiological Survey on Alcohol and Related Conditions; wave 1 was conducted in 2001 and 2002, and wave 2 in 2004 and 2005.
Percentage of heroin/prescription painkiller users who first used another addictive drug in previous years

- Marijuana -> Heroin: 92%
- Marijuana -> Painkillers: 57%
- Painkillers -> Heroin: 47%
- Marijuana -> Painkillers -> Heroin: 36%
- Painkillers -> Marijuana -> Heroin: 6%

Source: National Survey on Drug Use and Health (NSDUH, 2013 & 2014)
90% of addictions start in teenage years

Current practices

- Local Example / Another Local Example
  - For comparison: Colorado
  - Flowers Edibles
One in four 12th graders indicated they would try marijuana, or increase their current use more, **if it were legalized** (Monitoring the Future, 2018)
Vaping linked to marijuana use in young people, research says

By Arman Azad, CNN

Updated 11:09 AM ET, Mon August 12, 2019

Findings  In this systematic review and meta-analysis, the odds of past or current marijuana use among youth who used e-cigarettes were 3.5 times higher than for those who denied e-cigarette use; this association was significant in both cross-sectional and longitudinal studies. Studies conducted in adolescents aged 12 to 17 years (vs young adults aged 18 to 24 years) showed a stronger association between e-cigarette and marijuana use.
So, what can we do?

- Policy change
  - School policies (with enforcement plan)
  - Go upstream – advocate for flavor bans
- Public health campaigns
  - Impact ambivalent students
  - Cultural problems require cultural solutions
- Offer nicotine cessation assistance
  - Therapy, medications, etc.
  - Truth Initiative: This is Quitting
Summary

- Vaping and marijuana are both chronically misunderstood…and this isn’t an accident
- From a health perspective, nobody should vape if they aren’t already smoking cigarettes
  - Heavy metals, carcinogens, addictive nature
- Marijuana is far from a benign substance, and is particularly harmful for youth
- Marijuana and THC extracts can be vaped, and higher potency is associated with more severe side effects
Thank You!