Update on E-cigarettes & Vaping Associated Lung Injury (EVALI)

Linda Hancock, FNP, PhD
linda@lindagivesback.com
www.LindaGivesBack.com
804 314-7167
I ❤️ people who smoke/vape!

Remember, smoking doesn’t kill people. People who are quitting smoking kill people.

Links to data sources and articles are on each slide.
Genetic Snowflakes & molecule use (nicotine, alcohol, etc.)

Out of 4 people..  
1 in 4 are missing a gene to metabolize nicotine.

https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0026668
What’s in your genetic family tree?

Who could metabolize nicotine (Who could use tobacco)?
Any tobacco related illnesses? (cancer, heart disease, stroke, etc)

History -

When did cigarette smoking become popular?

TECHNOLOGY changed Nicotine Use & Consequences
EVALI - E-cig or Vaping Associated LUNG INJURY
as of Jan 7, 2020

2,602 cases in all 50 states
&
57 deaths in 27 states

https://www.cdc.gov/tobacco/basic_information/e-cigarettes/severe-lung-disease.html

54%
under
age 24

4 imaging patterns:
1. acute eosinophilic pneumonia,
2. diffuse alveolar damage,
3. organizing pneumonia, and
4. lipoid pneumonia.

diagrams of computed tomographic scans of the chest obtained from patients with vaping-associated lung injury.
What’s the most common addictive thing in the US today?
Brain Science shows…

Neurons that fire together wire together!

PAX Labs (maker of JUUL) also makes PAX ERA for THC concentrates.

Pax Era is the vaporizer of the future for concentrates lovers (review)

https://www.thecannabist.co/2017/10/17/pax-vaporizers-era-vape-pen-review/85103/
2 basic types of Electronic Nicotine Delivery Systems (ENDS)

1. VAPES
   - Free base nicotine ammonia
   - Lower & slower uptake
   - Usually less nicotine
   - More PV/GV

2. POD VAPES (like JUUL)
   - Nicotine salt benzoic acid
   - Rapid absorption, less harsh
   - Very high nicotine level and absorption rates

How much nicotine is in e-juice? It depends

- Study of 70 samples
  - Labeled nicotine concentrations - 0 and 18mg/mL

- FINDINGS
  - In 35 e-liquid samples labeled 18mg/mL nicotine
    - Ranged from 11.6 and 27.4mg/mL
      - (M=18.7, SD=3.3) nicotine
  - In 35 samples labeled 0mg/mL
    - nicotine was detected in 91.4% of the samples
      - (range 0-23.9mg/mL; M=2.9, SD=7.2).

The bottom line: NO QUALITY CONTROL
Vape labels are NOT accurate!
Over 90% of those labeled 0% contain nicotine!

Pod vaping is not just JUUL
Pod Vapes come in all sorts of sizes and shapes

**Vape Watch** - available since July 2019
purchased online for $34.95

**Vaper Wear** – hats, hoodies, backpacks, etc
Why did JUUL use attract young users? 
YOU have been the target market

The vape company Juul said it doesn’t target teens. Its early ads tell a different story.

A new analysis of Juul’s marketing campaign suggests it targeted youth from its inception.

By Julia Belluz | @juliaofteronto | julia.belluz@voxmedia.com | Jan 25, 2019, 9:10am EST

Social media and JUUL

Research show expenditures are in Instagram and Twitter

This site was recently taken down...  https://www.instagram.com/juul_university/

Haung et al, “Vaping versus JUULing: How the extraordinary growth and marketing of JUUL transformed the US retail e-cigarette market,” Tobacco Control, published May 31, 2018
2014- EU enacted the Tobacco Product Directive (TPD)

**Nicotine content in e-liquids limited to 2% or 20mg/ml**

E-liquids must come with warning labels and require a review & emission testing

**December 4, 2019** - European Respiratory Society said it cannot back vaping as a safe aid to quitting smoking.

https://www.whitecloudelectroniccigarettes.com/blog/vapers-guide-traveling-through-europe/

https://erj.ersjournals.com/content/53/2/1801151
Vapes came to the US in 2007

• By 2017...
  • Number of e-cig brands?
    • 433 e-cig brands
  • Number of e-juice flavors?
    • 15,586

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5869180/  Zho et al 2017
Packaging introduced in 2015
### Trends in Adolescent Vaping, 2017–2019

#### TEEN USED DOUBLED IN THE PAST 2 YEARS

<table>
<thead>
<tr>
<th>Reporting Interval and Grade in School</th>
<th>Prevalence in 2017 (95% CI)</th>
<th>Prevalence in 2018 (95% CI)</th>
<th>Prevalence in 2019 (95% CI)</th>
<th>Change, 2018 to 2019 (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Past 30 days</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12th grade</td>
<td>11.0 (9.2–13.0)</td>
<td>20.9 (17.7–24.5)</td>
<td>25.4 (22.6–28.4)</td>
<td>4.5 (0.9–8.1)</td>
</tr>
<tr>
<td>10th grade</td>
<td>8.2 (6.6–10.2)</td>
<td>16.1 (14.0–18.6)</td>
<td>20.2 (17.8–22.8)</td>
<td>4.1 (0.9–7.2)</td>
</tr>
<tr>
<td>8th grade</td>
<td>3.5 (2.9–4.2)</td>
<td>6.1 (5.1–7.4)</td>
<td>9.0 (7.6–10.5)</td>
<td>2.8 (1.2–4.4)</td>
</tr>
<tr>
<td><strong>Past 12 months</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12th grade</td>
<td>18.8 (16.5–21.4)</td>
<td>29.7 (26.1–33.6)</td>
<td>35.1 (31.8–38.6)</td>
<td>5.4 (1.1–9.6)</td>
</tr>
<tr>
<td>10th grade</td>
<td>15.8 (13.6–18.3)</td>
<td>24.7 (21.9–27.7)</td>
<td>31.1 (28.3–34.0)</td>
<td>6.4 (2.7–10.1)</td>
</tr>
<tr>
<td>8th grade</td>
<td>7.5 (6.6–8.5)</td>
<td>10.9 (9.4–12.6)</td>
<td>16.1 (14.1–18.2)</td>
<td>5.2 (2.8–7.6)</td>
</tr>
<tr>
<td><strong>Ever</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12th grade</td>
<td>25.0 (22.4–27.7)</td>
<td>34.0 (30.3–38.0)</td>
<td>40.5 (37.3–43.8)</td>
<td>6.5 (2.3–10.7)</td>
</tr>
<tr>
<td>10th grade</td>
<td>21.4 (19.2–23.9)</td>
<td>28.6 (25.8–31.6)</td>
<td>36.4 (33.5–39.4)</td>
<td>7.7 (4.0–11.5)</td>
</tr>
<tr>
<td>8th grade</td>
<td>10.6 (9.5–11.8)</td>
<td>13.5 (11.8–15.3)</td>
<td>20.7 (18.5–23.1)</td>
<td>7.2 (4.6–9.9)</td>
</tr>
<tr>
<td><strong>Daily</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12th grade</td>
<td>—</td>
<td>—</td>
<td>11.7 (9.8–14.0)</td>
<td>—</td>
</tr>
<tr>
<td>10th grade</td>
<td>—</td>
<td>—</td>
<td>6.9 (5.7–8.0)</td>
<td>—</td>
</tr>
<tr>
<td>8th grade</td>
<td>—</td>
<td>—</td>
<td>1.9 (1.4–2.5)</td>
<td>—</td>
</tr>
</tbody>
</table>

* In all years, increases in prevalence are significant at P<0.05. The 95% confidence intervals (CI) have not been adjusted for multiple comparisons. Unweighted sample sizes vary slightly by outcome. In 12th grade, the range is from 4077 to 4310; in 10th grade, from 4420 to 4721; and in 8th grade, from 4382 to 4909. (For trends in cigarette smoking during the previous 30 days in 2018–2019, see the Supplementary Appendix.)

† Values may differ slightly from the difference between the 2019 and 2018 estimates because of rounding.

‡ Daily nicotine vaping was defined as vaping nicotine on 20 or more of the previous 30 days and was first assessed in 2019.

2019, past 30 day use: 1 in 4 in the 12th grade, 1 in 5 in the 10th grade, 1 in 11 in the 8th grade.

2019 Daily nicotine vaping

12% 12th grade
7% 10th grade
2% 8th grade

1.15.20 Seniors PHS e-cig perception/reality
Hancock clicker data

**PERCEPTION**
How many days in the past MONTH did *most students* use e-cigs (vapes & pod vapes such as JUUL)?

a. Zero days  
b. 1-5 days  
c. 6-10 days  
d. 11-20 days  
e. 21-29 days  
f. Everyday

205

**REALITY**
How many days in the past MONTH did *YOU* use e-cigs (vapes and pod vapes such as JUUL)?

a. Zero days  
b. 1-5 days  
c. 6-10 days  
d. 11-20 days  
e. 21-29 days  
f. Everyday

203
Marijuana use Data from Jan 2020 Public High school in VA

What do you notice?

**SENIOR DATA**

**REALITY**

How many days per MONTH do YOU use marijuana or THC products?

a. Zero days  
b. 1-5 days  
c. 6-10 days  
d. 11-20 days  
e. 21-29 days  
f. Everyday  

```
<table>
<thead>
<tr>
<th>Days</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zero days</td>
<td>58%</td>
</tr>
<tr>
<td>1-5 days</td>
<td>11%</td>
</tr>
<tr>
<td>6-10 days</td>
<td>3%</td>
</tr>
<tr>
<td>11-20 days</td>
<td>3%</td>
</tr>
<tr>
<td>21-29 days</td>
<td>3%</td>
</tr>
<tr>
<td>Everyday</td>
<td>22%</td>
</tr>
</tbody>
</table>
```

**FRESHMEN DATA**

**REALITY**

How many days per MONTH do YOU use marijuana or THC products?

a. Zero days  
b. 1-5 days  
c. 6-10 days  
d. 11-20 days  
e. 21-29 days  
f. Everyday  

```
<table>
<thead>
<tr>
<th>Days</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zero days</td>
<td>64%</td>
</tr>
<tr>
<td>1-5 days</td>
<td>5%</td>
</tr>
<tr>
<td>6-10 days</td>
<td>3%</td>
</tr>
<tr>
<td>11-20 days</td>
<td>2%</td>
</tr>
<tr>
<td>21-29 days</td>
<td>3%</td>
</tr>
<tr>
<td>Everyday</td>
<td>24%</td>
</tr>
</tbody>
</table>
```
loophole in the legislation, which allows vaping stores to continue to sell “vape tanks.”

Juul Is Now Valued at $19 Billion, Down From $38 Billion a Year Ago

By Gabriela Barkho • 12/10/19 2:53pm

Juul faces mounting state lawsuits in US

O 19 November 2019


Could life insurance go up in smoke for some vapers?

LONDON/NEW YORK (Reuters) - Global reinsurers are stepping up their warnings to life insurer clients about the potential risks of vaping, putting pressure on underwriters to charge certain vapers higher rates than smokers, or even exclude them altogether.
Harm reduction:
Tips to avoid battery explosion in vapes

1. Consider using vape devices with safety features such as firing button locks, vent holes, and protection against overcharging.

2. Keep loose batteries in a case to prevent contact with metal objects.
   Don’t let batteries come in contact with coins, keys, or other metals in your pocket.

3. Never charge your vape device with a phone or tablet charger.
   Always use the charger that came with it.

4. Don’t charge your vape device overnight or leave it charging unattended.

5. Replace the batteries if they get damaged or wet.
   If your vape device gets damaged and the batteries are not replaceable, contact the manufacturer.

https://www.fda.gov/tobacco-products/products-ingredients-components/tips-help-avoid-vape-battery-explosions
WHAT ARE THE POSSIBLE HEALTH IMPACTS ON ATHLETES WHO USE?
Vaper’s Tongue: What is it, what causes it and how to cure it!

By: James Dunworth Categories: E-LIQUID, ECIGARETTE ACADEMY  52 Comments

Updated: 24/05/2019

How Taste Works

Above: Microscopic images of taste buds. Original image via Fine Art America.

https://www.ecigarettedirect.co.uk/ashtray-blog/2014/03/vapers-tongue.html
E-cig fluids -at least 6 categories of toxins

1. Nicotine
2. Carbonyls
3. Volatile organic compounds (such as benzene and toluene)
4. Particles (silicates, etc)
5. Trace metal elements according to flavor
   - Two flavorants alone, diacetyl and 2,3-pentanediol, have been shown to perturb gene expression pathways related to cilia and cytoskeletal processes in normal human bronchial epithelial cells.¹
6. Bacterial endotoxins and fungal glucans

https://www-ncbi-nlm-nih-gov.proxy.library.vcu.edu/pubmed/31491071
CAUTION: Cigs to E-cigs is an apple to orange comparison – they are not equal.

Pack to pod comparisons just don’t work well.
E-cigs - So many variables impact health and addictiveness

Some electronic cigarette product designs, heating element features, liquid components, and user behaviors likely related to nicotine and other toxicant delivery. Each box lists a subset of many variables, and the product of the number of choices in each box conceptually represents the number of configurations available.

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4837999/
Cigs in a Pod

**PREVENTION POINTER**

Use CAUTION when slides like this are used.
It’s complicated and student know it.

**ALL PODS CONTAIN HIGH LEVELS OF NICOTINE**

- 1 Pack of Cigarettes: ≈20 mg of nicotine
- 1 JUUL pod: ≈41.3 mg of nicotine
- 1 PHIX pod: ≈75 mg of nicotine
- 1 Suorin pod: ≈90 mg of nicotine

SOURCE
https://med.stanford.edu/tobaccopreventiontoolkit/E-Cigs.html
Motor vehicles better explain e-cig exposure to chemicals

• Like motorized machines, e-cigs can be driven indefinitely as long as fuel, spare parts and other supplies are available.

• Example – what would happen if you put a 400 horsepower engine in a motorcycle or a freight truck – very different vehicle performance
  • The motorcycle would be interesting on a race track but potentially deadly on the streets because of uncontrollable acceleration and excessive speed
  • Hence Power to rate ration – a metric in road vehicle regulations

EU Commission Directive 2012/36/EU
Does JUUL contain water vapor?

JUUL contains a lot of toxins
But NO water

It is aerosol not vapor

https://www.biorxiv.org/content/biorxiv/early/2018/12/09/490607.full.pdf
Weed Killer

Good Morning America 12/17/18


Adolescent Exposure to Toxic Volatile Organic Chemicals From E-Cigarettes
Mark L. Rubinstein, Kevin Delucchi, Neal L. Benowitz, Danielle E. Ramo
Analyzed 22 Cartomizers for heavy metals

https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0057987
Extreme nicotine, flavoring chemicals, plastics, and metal all exposed to heat
Toxic metal, leached from e-cigarette coil, permanently scars woman's lung

The illness is usually only seen in industrial metal workers.

By Erika Edwards

Sample (total n= 75)- 37 cartridges and 38 e-liquid products (top 10 selling brands)

**Endotoxins** (found in gram negative bacteria) **found in 23%** of products

**Glucan** (found in fungus) **in 81%** of products

Exposure to these microbial toxins- associated with health problems, including asthma, reduced lung function, and inflammation.
Microbial Toxins in Nicotine Vaping Liquids.

Lee MS1, Christian DC2.

Author information
1 Harvard School of Public Health, Department of Environmental Health, Boston, Massachusetts, United States.
2 Harvard School of Public Health, Occupational Medicine and Epidemiology, Boston, Massachusetts, United States; dchris@hsph.harvard.edu.

KEYWORDS: E-cigarette; JUUL; glucan; microbial toxin

PMID: 31816248 DOI: 10.1164/rcrm.201911-2178LE
Teen's graphic images of vaping damage go viral: 'My lung tissue was just completely destroyed'

Abby Haglage
Yahoo Lifestyle January 10, 2020

"After conducting many more tests and a bronchoscopy, it was determined that there was no infection and that my lung tissue was just completely destroyed from using juuls and vapes and oil cartridges," she wrote.

Out of 56 commercially available vape juice samples:
- all but three contained ethanol, and
- 11 contained more than 10% ethanol.

That study, published in 2017 in the journal Drug Testing and Analysis, warned that the implications of vaping ethanol as an e-liquid component are not known.

If vaping e-liquids containing ethanol, ?? trigger a positive result in a sobriety test, ?? major consequences for public safety and criminal justice.

https://www.news.vcu.edu/article/Eliquids_often_contain_alcohol_as_an_unlisted_ingredient_What
The **cannabis** plant is known as a **hyperaccumulator**; as it grows, it can take up unusually high levels of metals from the soil or growing medium through its roots and potentially into its flowers.

**Focus**

**Cannabis Contaminants: Regulating Solvents, Microbes, and Metals in Legal Weed**

*Nate Seltenrich*

[https://doi.org/10.1289/EHP5785](https://doi.org/10.1289/EHP5785)

In June 2019, Illinois became the 11th U.S. state—plus the District of Columbia—to legalize recreational cannabis sales or use. Many more permit medical cannabis. Tax collectors, entrepreneurs, and law enforcement officials have all watched closely as legalization has hopscotched across the United States since 2014.

So have some environmental health experts. That’s because products derived from cannabis can deliver a number of contaminants—solvents, microorganisms, metals, and even pesticides to the consumer along with the active phytocannabinoids.

Oil and tincture products are especially troubling because cannabis is a hydrophyte, meaning it’s likely to extract metals from the soil or water it’s grown in. This means metals—such as cadmium and lead—may be present in the plant and carried over to the product.

In 2019, the U.S. Environmental Protection Agency set interim levels for metals in cannabis to protect personal and environmental health. But these levels are already higher than those in the soil from which the plants were grown. The difference suggests that the plants are accumulating the metals.

Cannabis users include not only healthy adults but also more sensitive or vulnerable members of the population, including children and patients with cancer or HIV.

At the federal level in the United States, cannabis is still considered an illegal drug. But the simultaneous push to decriminalize and legalize cannabis has resulted in the unintended consequences of environmental contamination.
THC is a social justice issue — A great discussion prompter

https://www.ted.com/talks/ben_cort_surprising_truths_about_legalizing_cannabis
What type of products have caused serious Lung Injury (EVALI)?

a. THC Carts from legal stores in Colorado and Washington
b. THC Carts off the streets (illegal)
c. CBD Vapes
d. Nicotine only vapes/pod vapes
e. All of the above

177
First Belgian death linked to vaping after teen given e-cigarette for his 18th birthday

Raphaël Pauwaert, from Brussels, died less than a month after getting pneumonia, which doctors attributed to vaping.

He used a legal liquid filling containing CBD, the non psychoactive part of cannabis.
How your lungs work... or don’t with inflammation

An **alveolus** is small!
Between 200 and 500 micrometer (or micron)

Inflammation (like a burn) from fats, chemicals and toxins isn’t supposed to happen in the lung
• Among 573 patients who reported using e-cigs in past 90 days preceding symptom onset:
  • 76% - THC-containing products,
  • 58% - nicotine-containing products
  • 32% - exclusive use of THC products
  • 13% - exclusive use of nicotine-containing products.

• No single compound or ingredient has emerged as the cause of these injuries to date
• There might be more than one cause
• Available data suggest THC-containing products play a role in this outbreak, but the specific chemical or chemicals responsible for EVALI have not yet been identified
• Nicotine-containing products have not been excluded as a possible cause.

https://www.cdc.gov/mmwr/volumes/68/wr/mm6841e3.htm?s_cid=mm6841e3_w
Patient history – what the data shows

Based upon medical chart abstraction data submitted to CDC (n=339)

- **95%** (323/339) initially experienced respiratory symptoms
  - (e.g., cough, chest pain, and shortness of breath)

- **77%** (262/339) had gastrointestinal (GI) symptoms
  - (e.g., abdominal pain, nausea, vomiting, and diarrhea).
  - Gastrointestinal symptoms preceded respiratory symptoms in some patients (1:3).

- **85%** (289/339) **constitutional symptoms** (such as fever, chills, and weight loss) accompanied respiratory or GI symptoms.
Some patients with vaping-related lung injuries are being hospitalized a second time

The hospital readmissions have taken place as quickly as five days and up to 55 days after discharge.

It’s not known what triggered the relapses. In some cases, patients had resumed vaping.

“Nicotine is like the flu, it mutates”

– Jack Henningfield Director NIDA

Addiction is so profitable, there will always be a market (me)
8 mg nicotine salt pouches

No proof of Safety – still have to have FDA warning that it may cause mouth cancer, gum disease, tooth loss, etc
Pouches contain no tobacco leaf. Pouches are filled with powdery nicotine salts derived from tobacco, along with various flavorings, sweeteners and a few other ingredients.

Heated Tobacco Products

IQOS Store
What does it remind you of?

https://www.cdc.gov/tobacco/basic_information/heated-tobacco-products/index.html
RESOURCES
The Snowball Survey
a useful team tool for breaking the spiral of silence

What questions or comments do you have related to today’s topic?
As this investigation continues, CDC encourages clinicians to continue to report possible cases of e-cigarette, or vaping, product use-associated lung injury (EVALI) to their local or state health department for further investigation.
TIRED OF WEIRDLY CRAVING MANGOS
EVERY TIME YOU TRY TO LIVE YOUR LIFE?

IF YOU’VE REALIZED NEEDING YOUR JUUL ISN’T A GREAT FEELING...

...AND ALL MY MONEY IS GOING TO JUUL PODS

(OR WHATEVER VAPE PRODUCT YOU FORMERLY LOVED)

WE’VE GOT YOU.

TEXT “DITCHJUUL” TO 88709
AND GET FREE ADVICE, TIPS AND INSPIRATION FOR QUITTING.
Our goal is to inform and empower, while engaging you in daily practices that enhance and/or maintain your happiness, while you undertake the challenge of quitting smoking.

https://scholar.harvard.edu/bettina.hoeppner/sis
#MYLIFEMYQUIT, FREE HELP, JUST FOR TEENS.

https://mylifemyquit.com
Call 800 QUIT NOW (many states have this)

– Free 24/7 service to all callers
– Aged 13 and older
– Confidential individualized English- and Spanish-speaking Quit Coaches
– Translation for 140 languages
– All tobacco and nicotine products
– TEXT2QUIT Support
New Tool kit
12 pages with links to lesson plans and online materials
2 FREE online education programs: Suspension Alternatives for first offense

INDEPTH: An Alternative to Teen Nicotine Suspension or Citation

Free 4 sessions

https://www.lung.org/stop-smoking/helping-teens-quit/indepth.html

Stanford

FREE 1 hour Healthy Futures Curriculum

http://med.stanford.edu/tobacco prevention toolkit/curriculums/HealthyFutures.html
How are you feeling?
A little confused?
Any questions?