

Partnering to Identify a New Public Health Threat: EVALI

WCLN Webinar 1/22/20

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Vaping-Associated Lung Injury

Wisconsin, 2019

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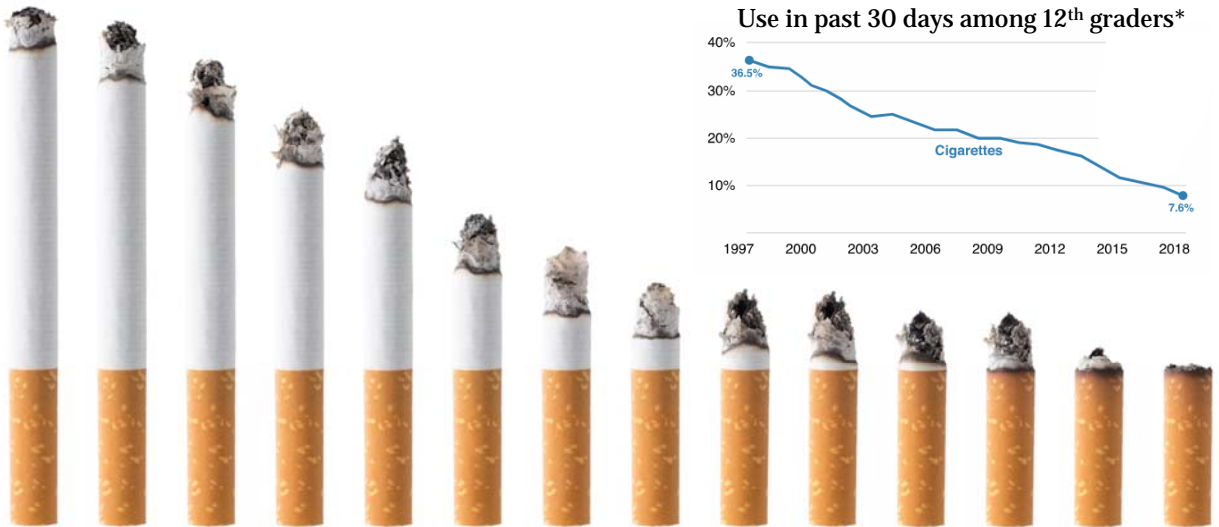
Vaping



1 in 5 high school students reports **vaping** in past 30 days*

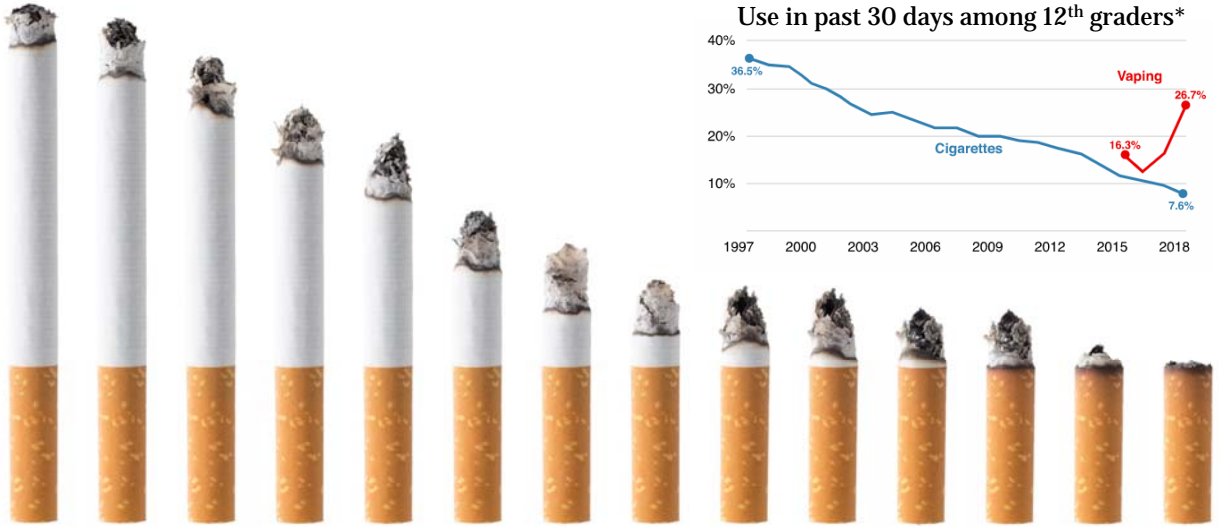
*2018, CDC

Vaping



*National adolescent drug trends, NEJM

Vaping

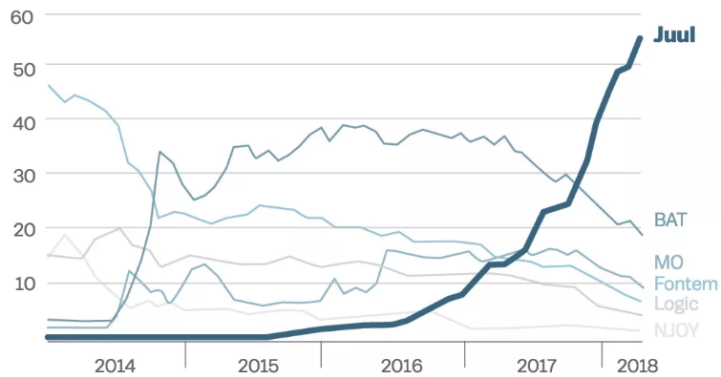


*National adolescent drug trends, NEJM

Vaping

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



Marijuana

30% of youth who vape report vaping **marijuana products**¹

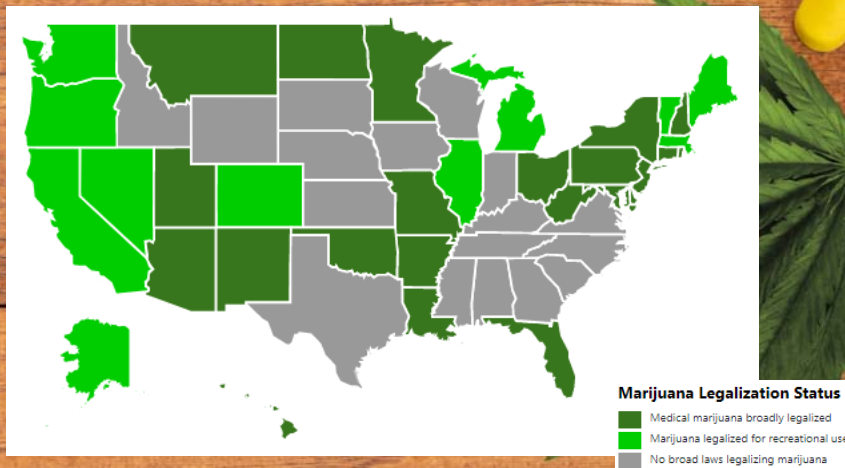
7% of college student vape non-nicotine products²

¹JAMA Pediatrics, 2018
²Kenna et al, 2017



Marijuana

Legal in **33 states** (11 recreational)



THC Cartridges



THC Cartridges



July 10 – Children's Hospital of Wisconsin

- **Five** teenagers hospitalized with severe respiratory illnesses
- **2 of 5** in ICU with severe respiratory failure requiring mechanical ventilation
- All reported recent **vaping**

July 10 – Children's Hospital of Wisconsin

- Young and otherwise healthy (16-17 years old)
- Symptoms: Shortness of breath, fever, weakness, nausea, vomiting for 3-6 days prior to admission
- On admission: Hypoxic, acute respiratory distress, abnormal chest x-ray and CT scans

July 10 – Children's Hospital of Wisconsin



- Diffuse bilateral infiltrates
- “Ground-glass” opacities

July 10 – Children's Hospital of Wisconsin

- Extensive negative work-up for possible causes
 - Respiratory viruses
 - Bacterial (*Legionella*, *M. pneumoniae*, *S. pneumoniae*)
 - Fungal infections
 - Neoplasm, cardiac, rheumatoid

Initial Investigation

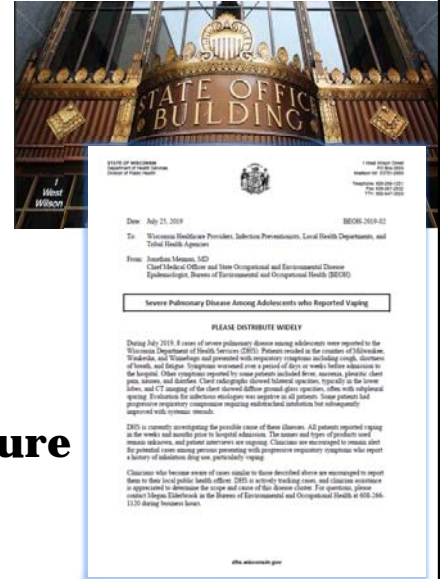
1. Develop a **case definition**

- ✓ Vaping in past 3 months
- ✓ Infiltrates on chest imaging
- ✓ Rule out other possible causes

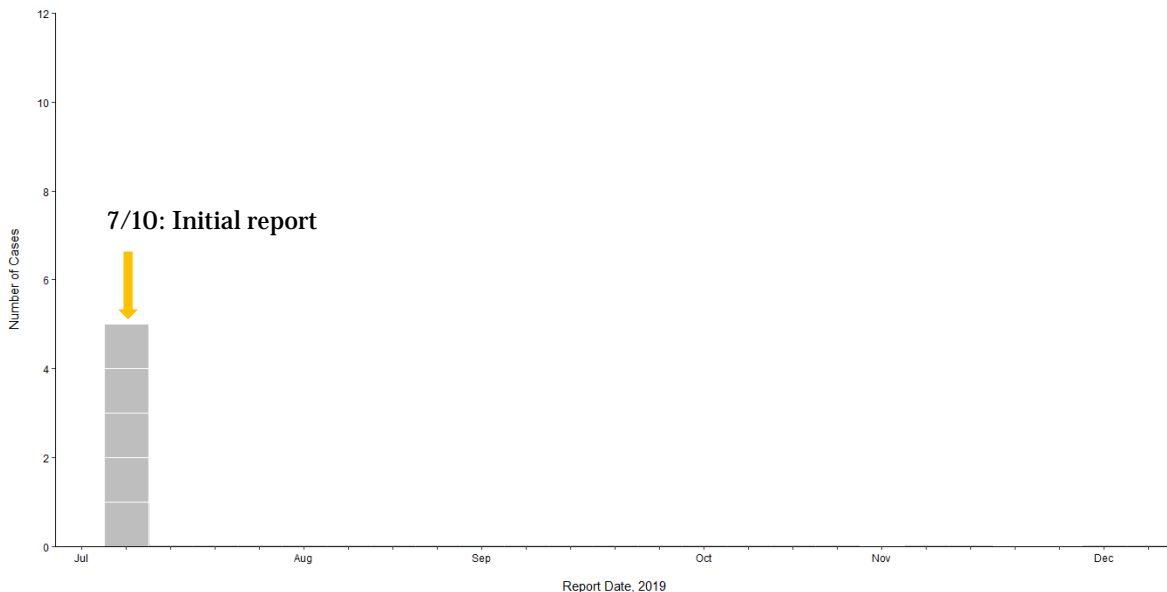
2. Determine the **extent** of the outbreak

- ✓ Memo to clinicians to report cases
- ✓ Develop reporting criteria
- ✓ Alert local public health

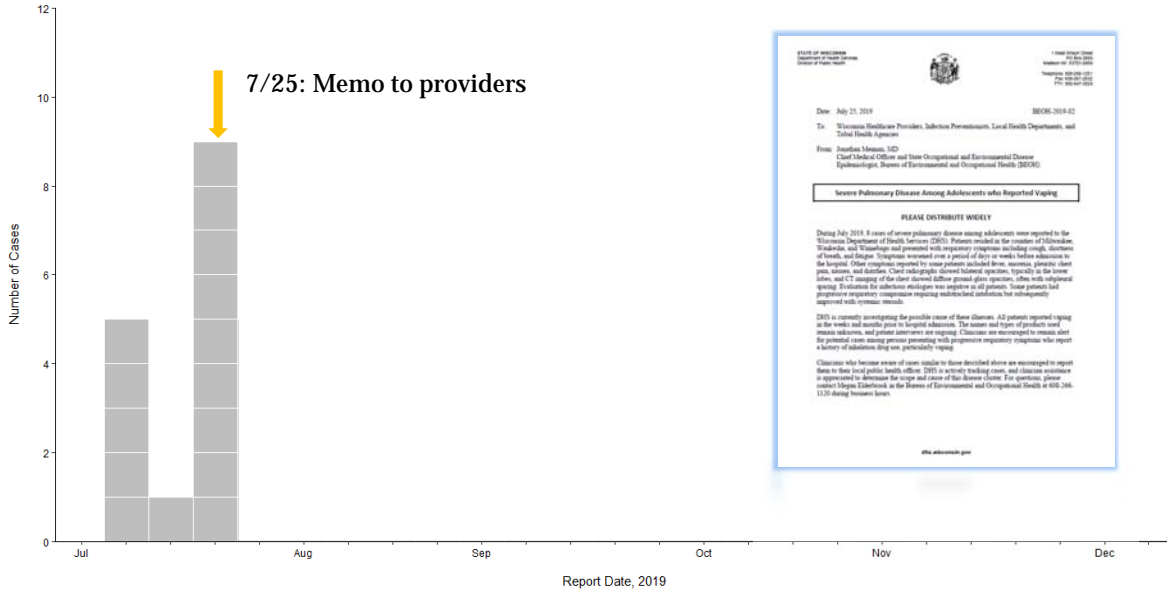
3. Interview cases to find **common exposure**



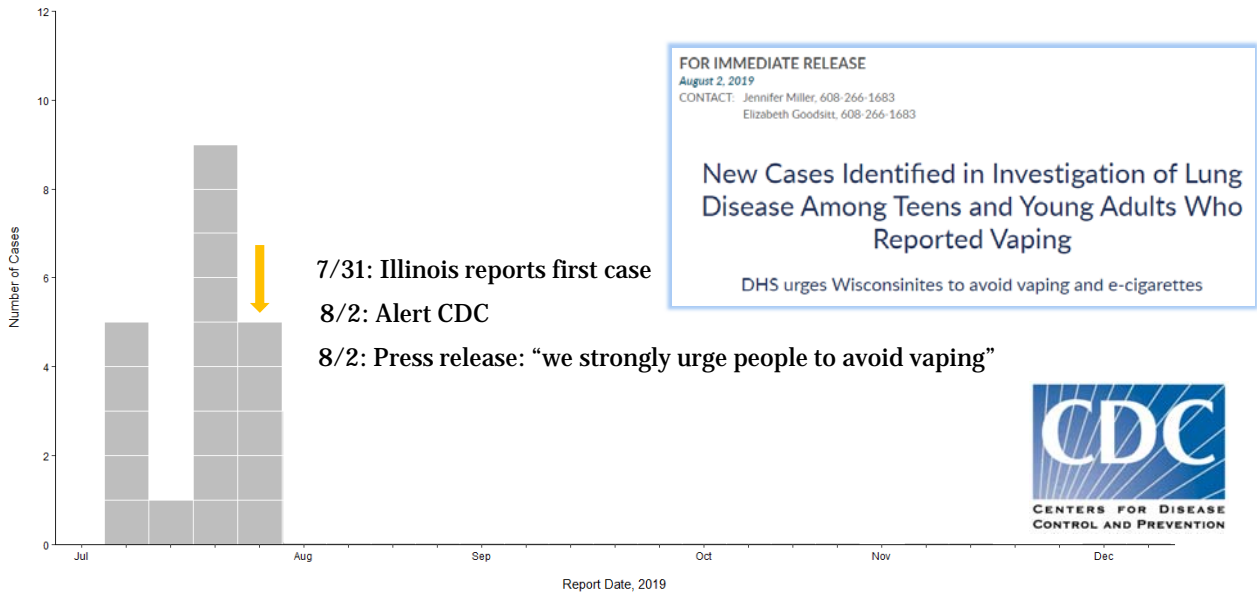
Timeline



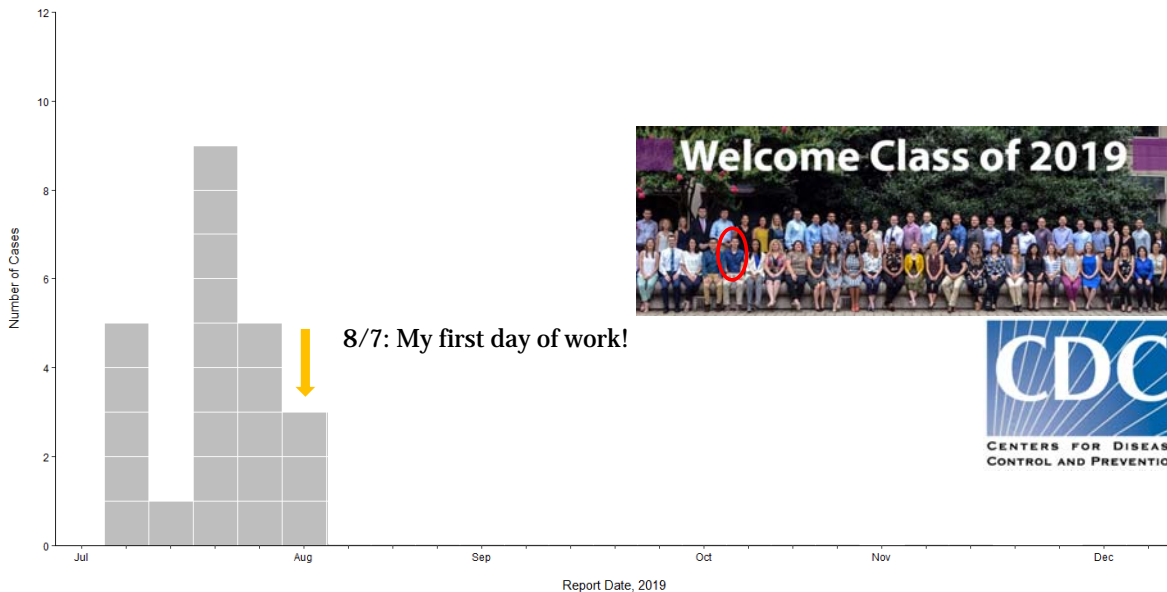
Timeline



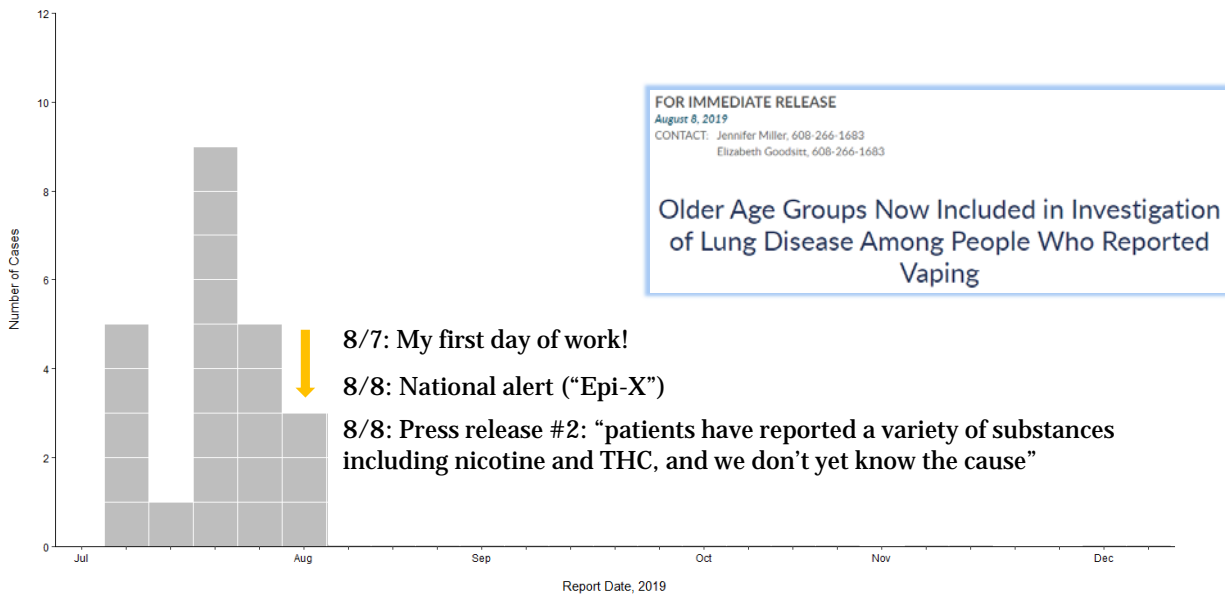
Timeline

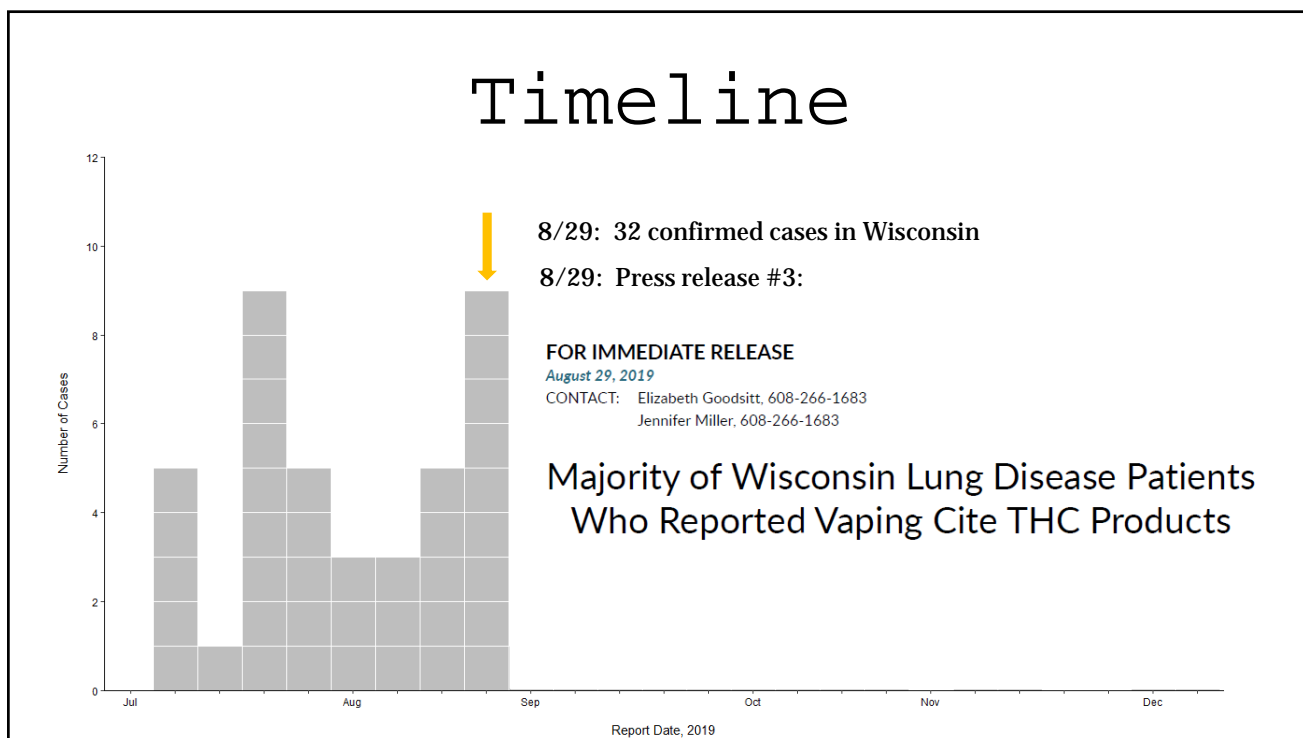
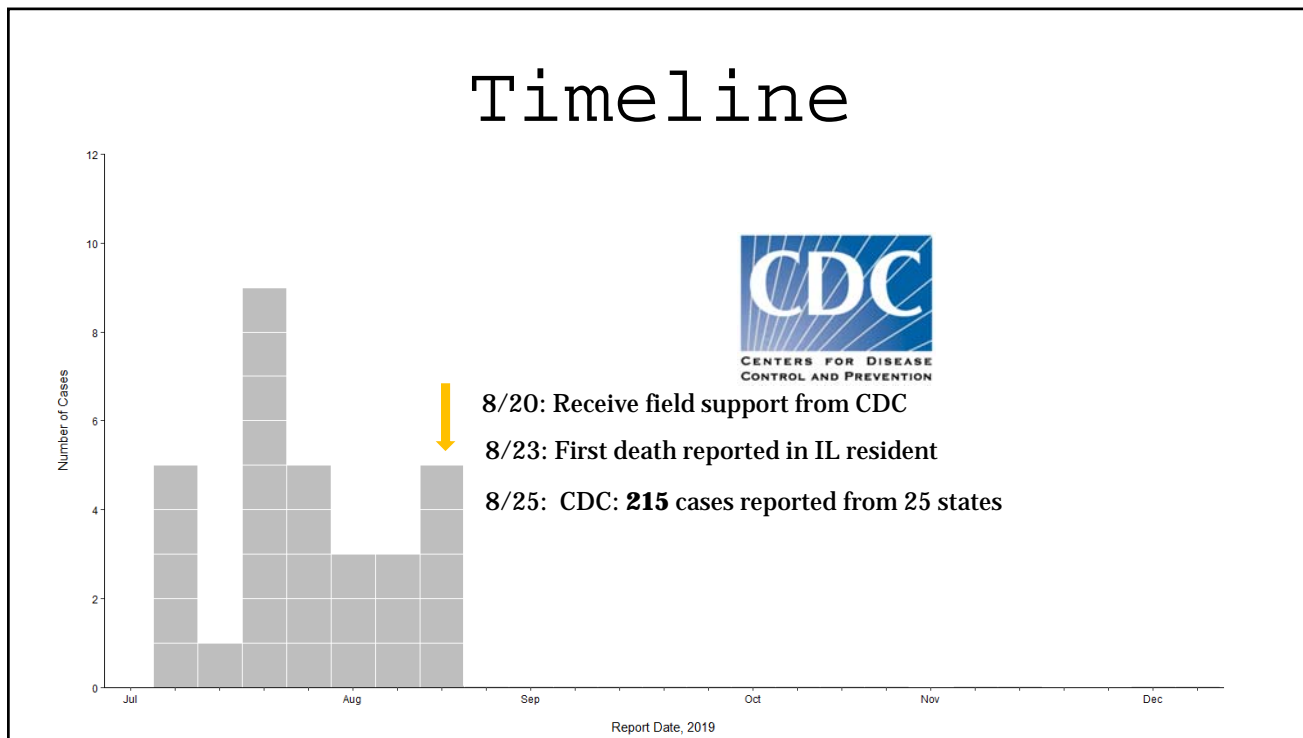


Timeline

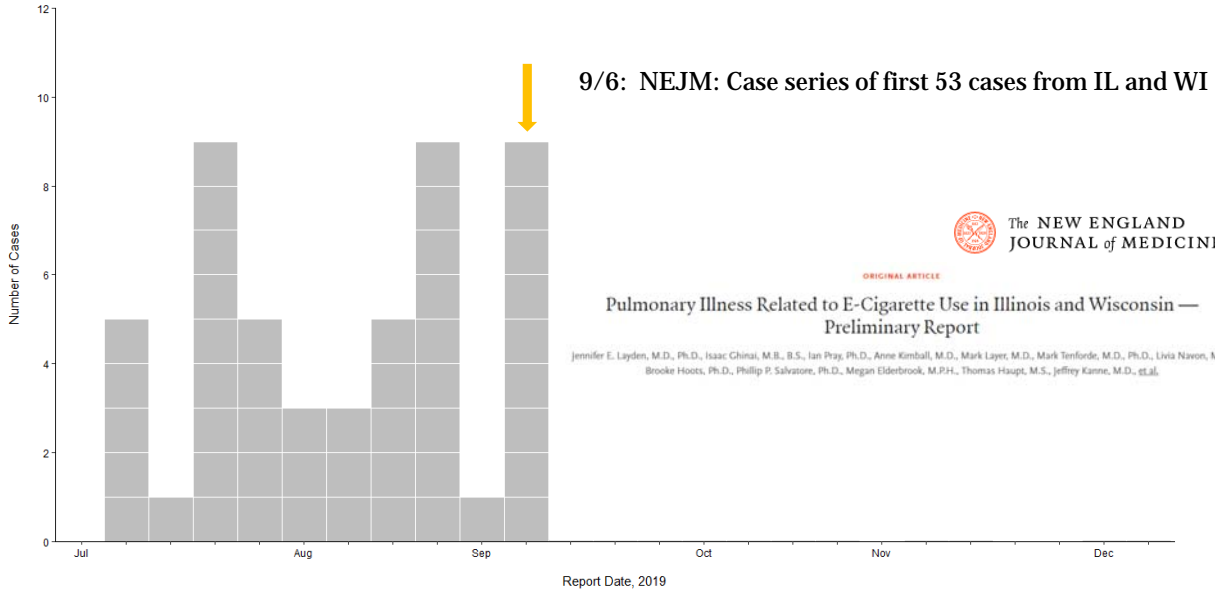


Timeline

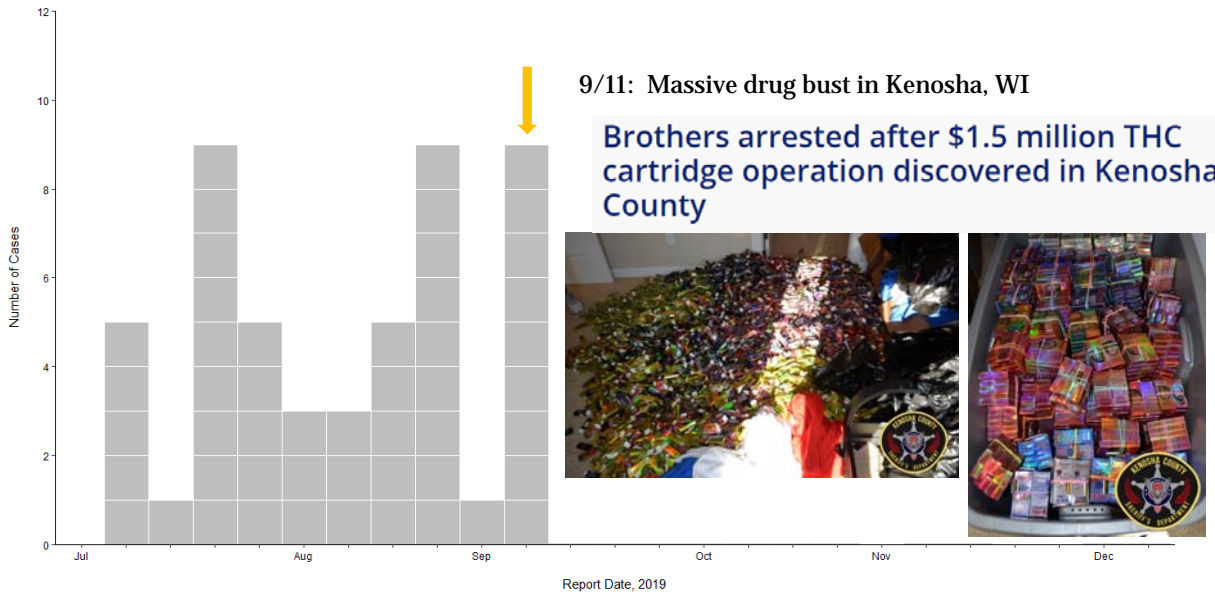


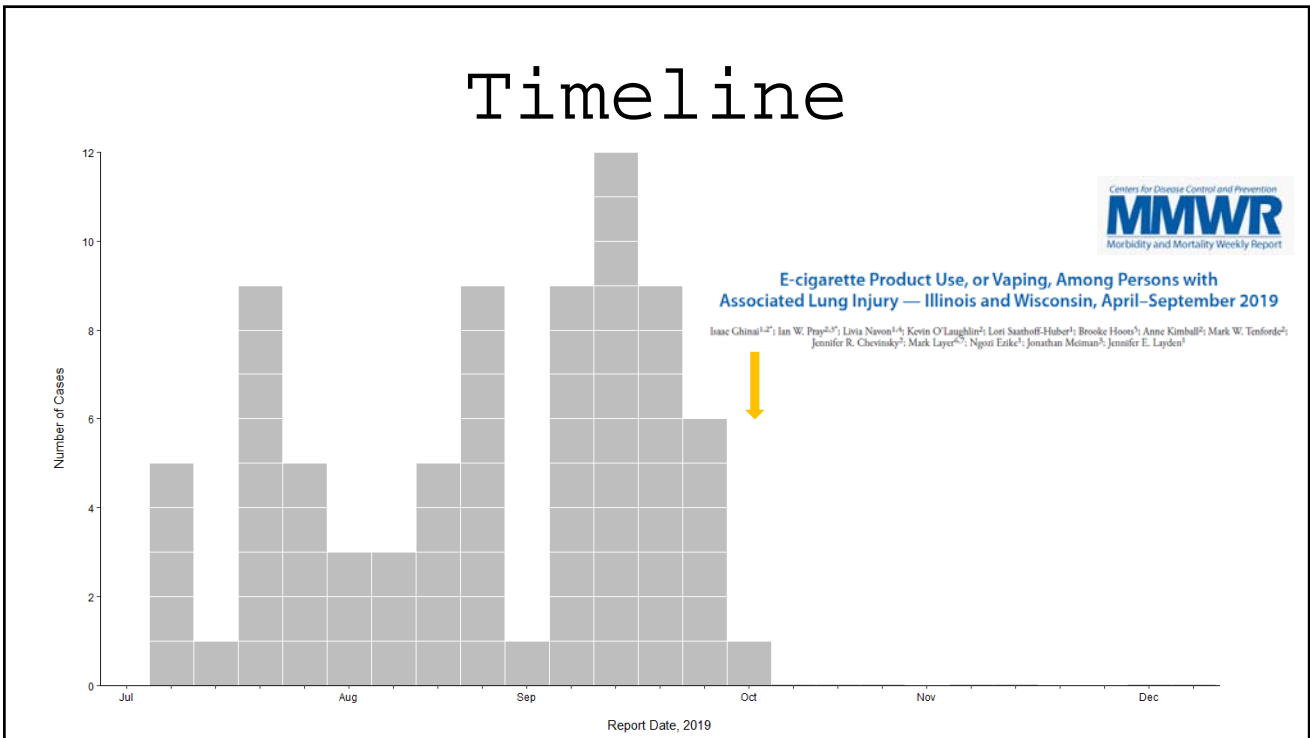
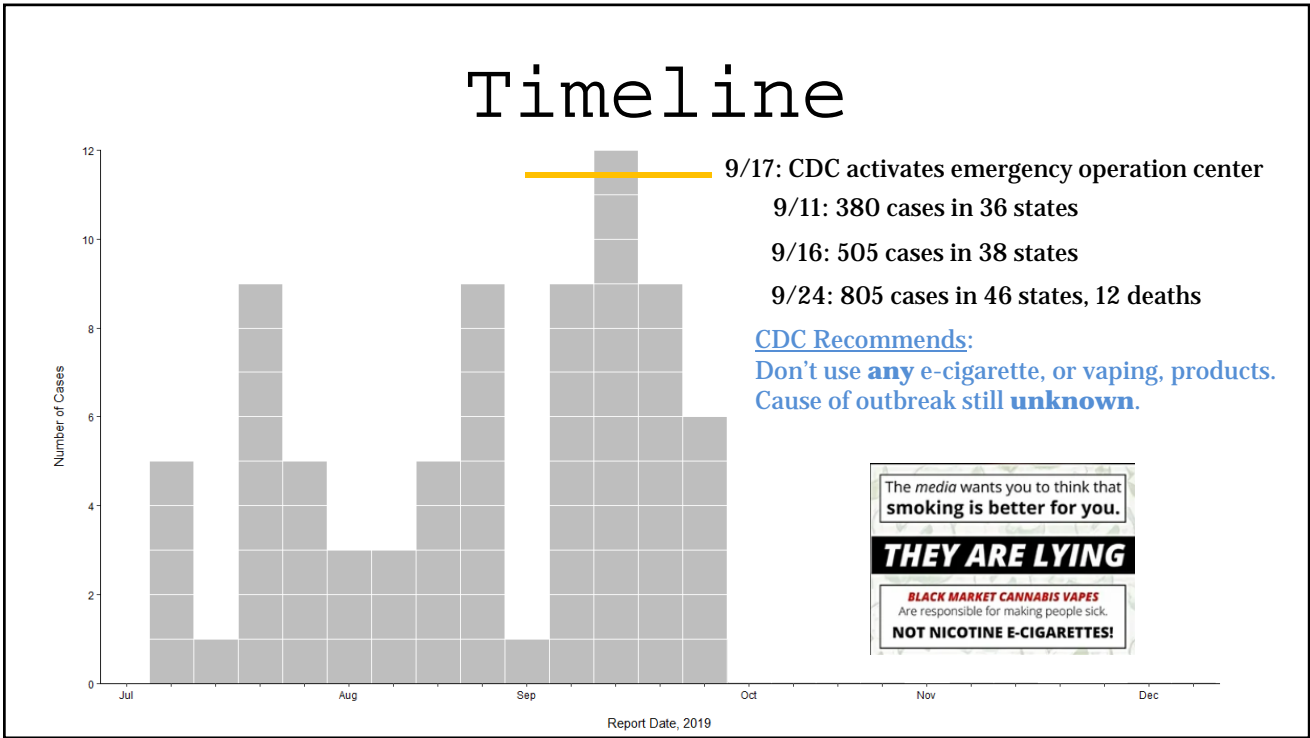


Timeline



Timeline





Results

86 patient interviews complete

79% male

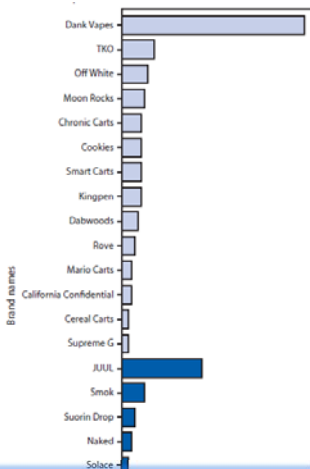
Median age: **21 years old** (15-53)

87% used THC cartridges

89% of cartridges purchased from “informal sources”

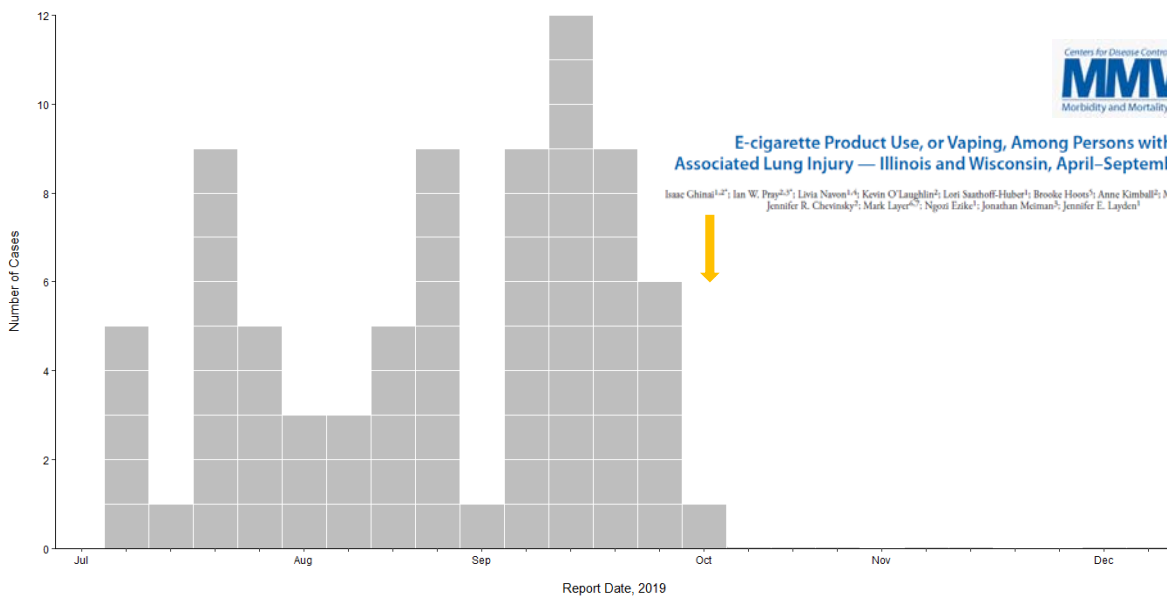
66% used Dank Vapes

13% used *only* nicotine



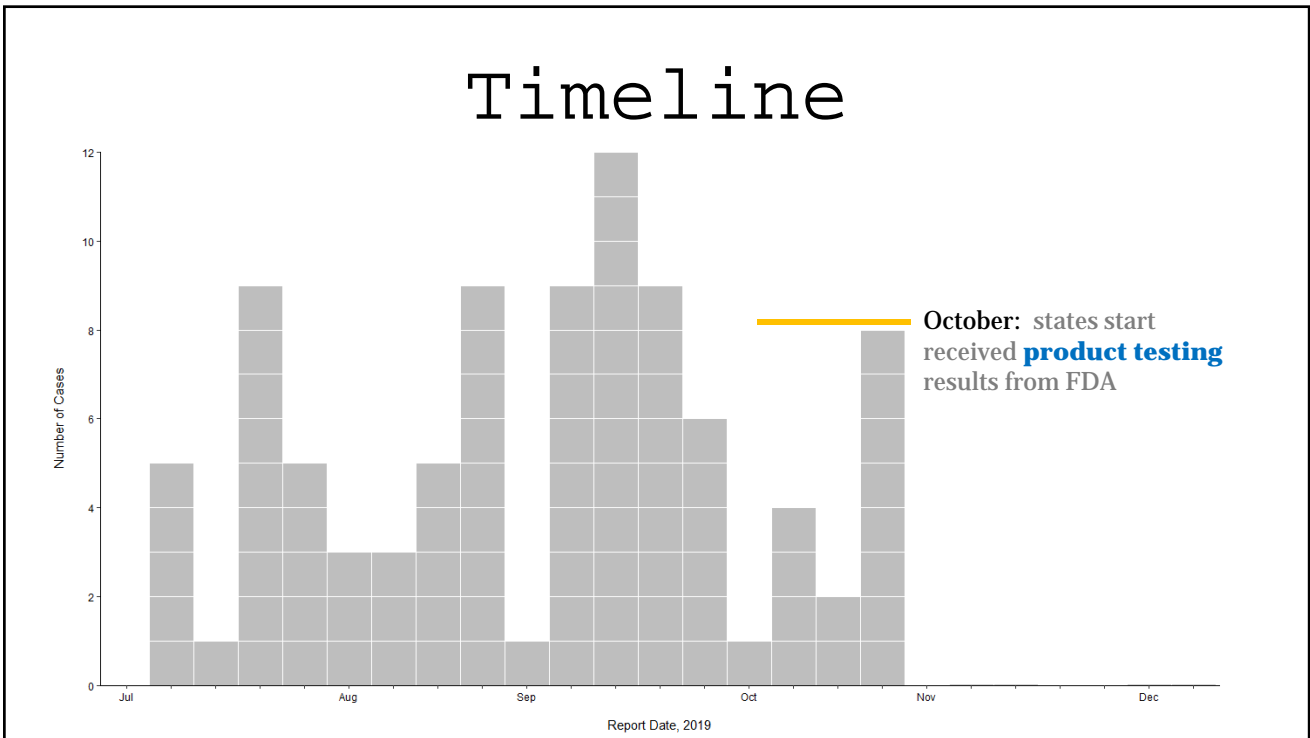
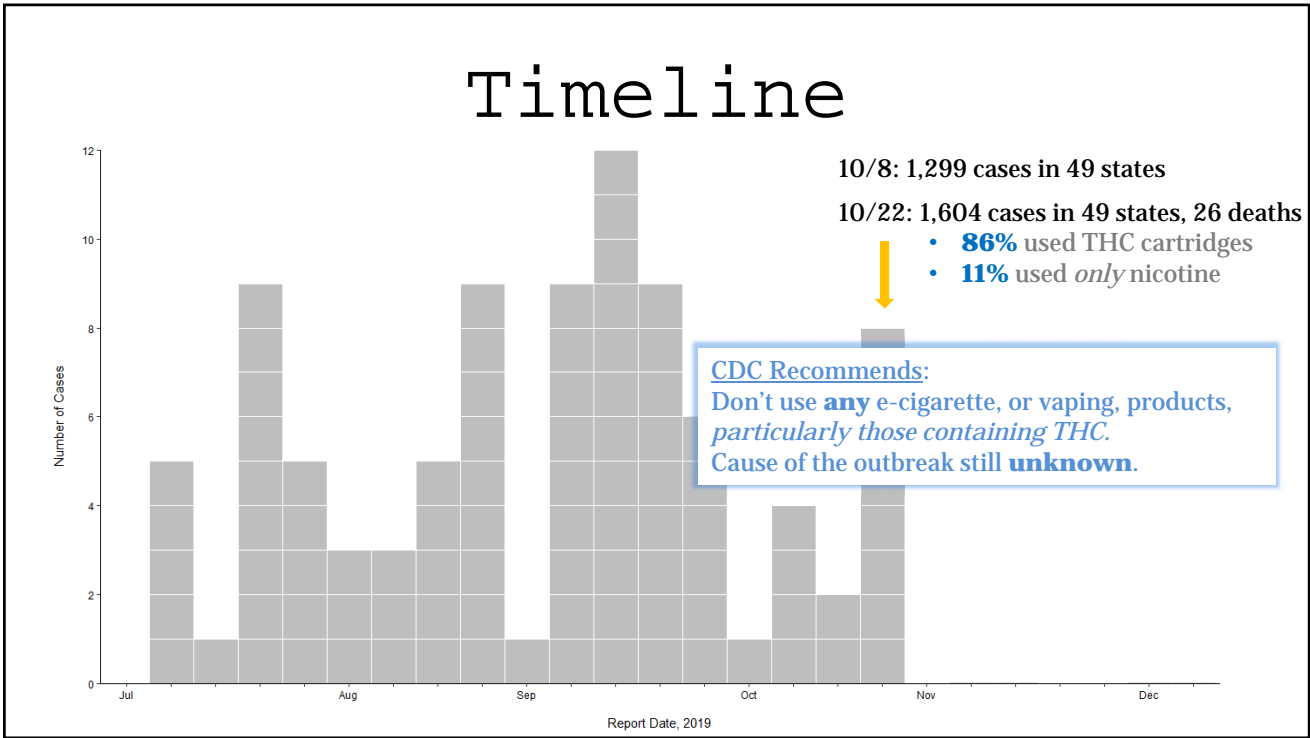
CDC Recommends:
 Don't use **any** e-cigarette, or vaping, products, particularly those containing **THC**.
 Cause of the outbreak still **unknown**.

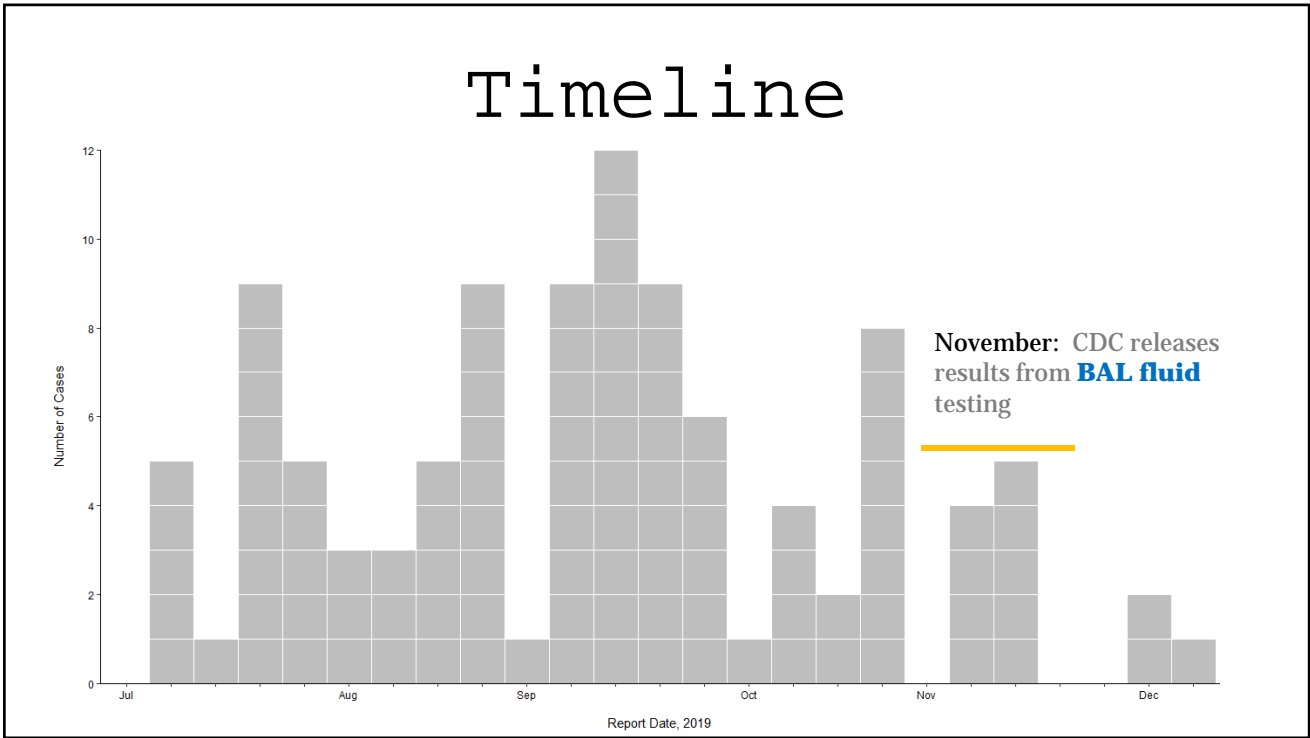
Timeline



E-cigarette Product Use, or Vaping, Among Persons with Associated Lung Injury — Illinois and Wisconsin, April–September 2019

Isaac Ghimai^{1,2}, Ian W. Pray^{3,4}, Livita Navon^{1,4}, Kevin O’Laughlin², Lori Sarrhoff-Huber¹, Brooke Hoos⁵, Anne Kimball², Mark W. Tenforde², Jennifer R. Chevinsky², Mark Layer⁶, Ngosi Ezike¹, Jonathan Meiman⁵, Jennifer E. Layden¹





Finding the cause: Laboratory evidence

The figure displays logos for the FDA, CDC (Centers for Disease Control and Prevention), and the Wisconsin State Laboratory of Hygiene (University of Wisconsin-Madison). It also includes two photographs: one showing various consumer products like DANK, Diablo, Funko Carts, Cookies, and Nalgene bottles, and another showing laboratory evidence such as syringes and small containers.



So Where is WSLH in the EVALI RESPONSE?

Finding the cause: Laboratory evidence



WISCONSIN STATE LABORATORY OF HYGIENE - UNIVERSITY OF WISCONSIN



WSLH Activities

- Initial screening of BAL specimens
 - QTOF testing
 - Analytical Library focused on drugs, pesticides
 - Early findings of THC metabolites, treatment drugs, phthalates
 - Phthalates likely an artifact of plastics used for BAL
 - Drugs included steroids, antibiotics, benzos, anti-nausea drugs



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WSLH Activities

- FACILITATION
- Worked closely with WDPH to coordinate
- Submissions from LPH, LE, clinical labs, and pathologists
- Provided proper collection, packaging, and shipment information
- Directed samples to FDA, CDC (two branches)
- Assisted with result interpretation

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Vaping in WI

- Samples received:
 - ~170 vaping pods, devices, cartridges
 - One package edibles, two dabs
 - One white grape flavored white owl cigar
 - Many examples of packaging
 - 12 BAL specimens
 - Many more not retained
 - 8 FFPE blocks
 - 2 frozen lung tissue samples
 - 1 hunk of brain tissue
 - 1 each blood, plasma, sputum, nasal swab
- 2 LIMS, a BIG spreadsheet, DHS Redcap database

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Vitamin E Acetate Testing

- Developed and verified method (GCMS)
- 22 tested, quantified
- Additional 30 pending
 - Qualitative, due to limited sample volume
- None detected in nicotine-based products
- None detected in 2018 products
- Detected in 2019 products
- Concentration range 25.6-37.2% w/v
 - Nationally, range~2-82%
- Consistent with national observations

Finding the cause: Laboratory evidence

FDA Product Analysis

810 vaping products analyzed

51% of THC products (n=501) contained **vitamin E acetate**

~20-60% VEA by volume

77% of cases had product with vitamin E acetate

No significant levels of other toxicants, pesticides, metals, etc in THC or nicotine-containing products



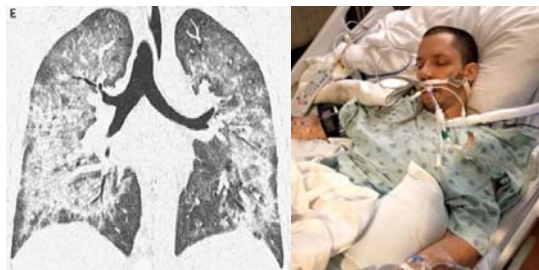
What is Vitamin E acetate??

Finding the cause: Laboratory evidence



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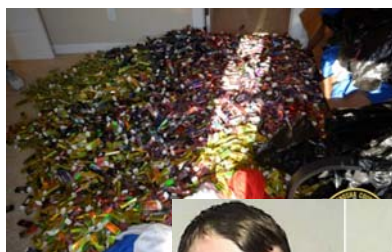
Finding the cause: Laboratory evidence

100% (29 of 29) of case-associated BAL fluids contained **Vitamin E acetate**

Evaluation of Bronchoalveolar Lavage Fluid from Patients in an Outbreak of E-cigarette, or Vaping, Product Use—Associated Lung Injury — 10 States, August–October 2019



Finding the cause: Laboratory evidence



Vitamin E acetate

- Added as **diluent** to THC oils in late 2018*

*Leafly.com - <https://www.leafly.com/news/health/toxic-vaping-vapi-evali-lung-injury-rise-and-fall-of-vitamin-e-oil-honey-cut>

Finding the cause: Laboratory evidence



Vitamin E acetate

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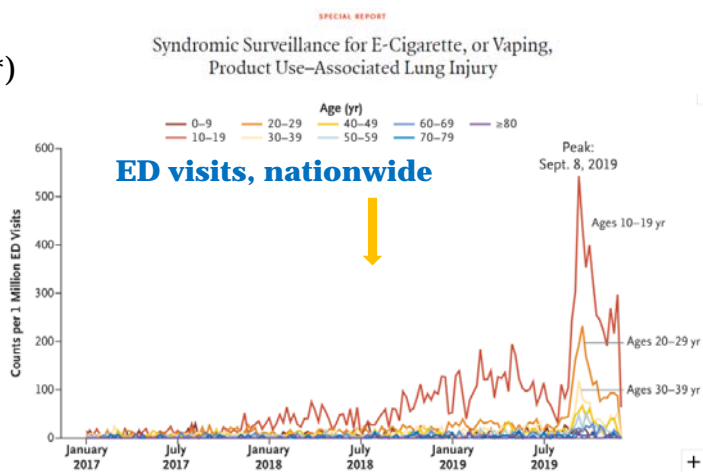


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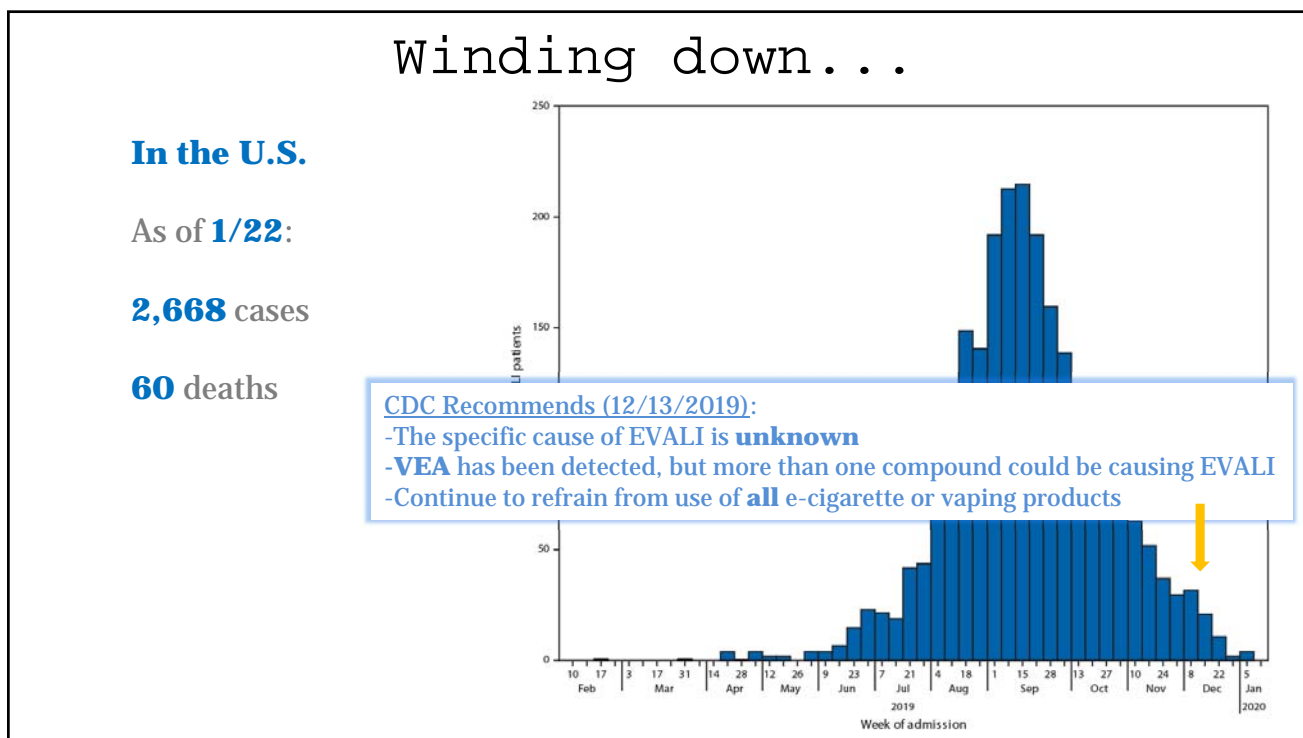
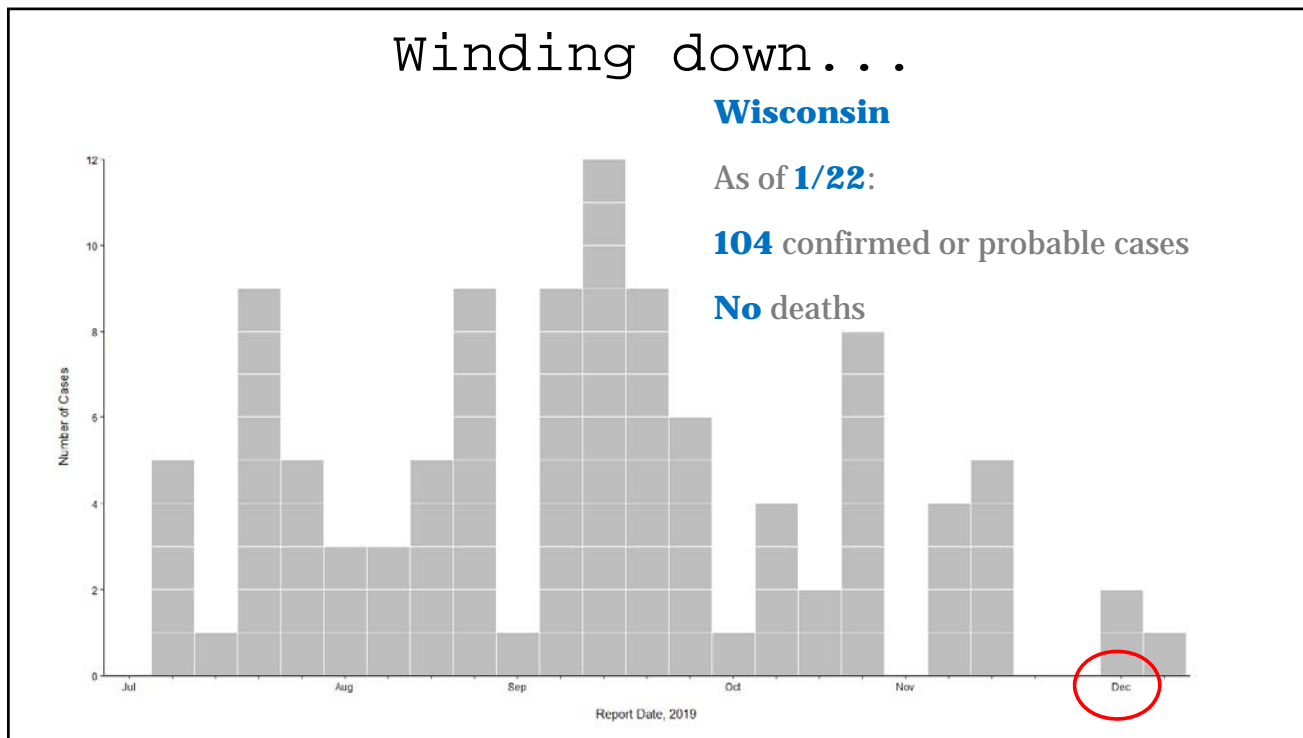
Finding the cause: Laboratory evidence

Law enforcement seizures (WI / MN*)

- 2019: **VEA** detected
- 2018: **VEA** not detected



*MMWR: https://www.cdc.gov/mmwr/volumes/68/wr/mm6847e1.htm?s_cid=mm6847e1_w



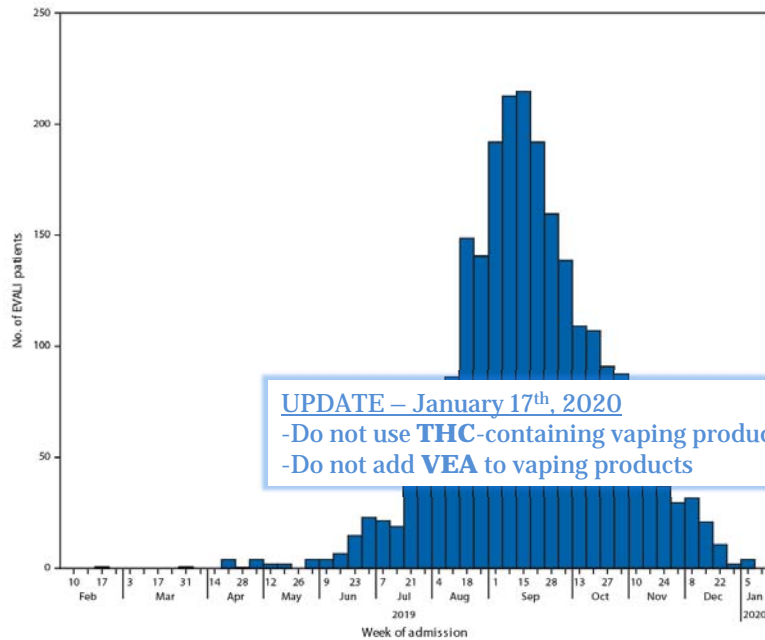
Winding down...

In the U.S.

As of **1/22**:

2,668 cases

60 deaths



Role of clinical labs

Detection of vitamin E acetate in **BAL fluid** was the key to solving the outbreak

Identify case-associated samples

Retain samples

Ship to WSLH



Wisconsin State Laboratory of Hygiene
 UNIVERSITY OF WISCONSIN - MADISON

Prof. James J. Schmitt, PhD, Director
 Dr. J. Kurtz, MD, Medical Director
 2601 Agriculture Drive
 Madison, WI 53718

Wisconsin State Laboratory of Hygiene
 Vaping solution sample submission form

| | |
|--|--|
| Patient Name (if available) | Submitter |
| Patient ID # | |
| Patient DOB | Contact Phone Number |
| Submitter Specimen ID | Contact email address |
| Date Collected | Note: please provide a separate sheet for each sample submitted. |
| Case info, descriptive info, or other comments | |

Send to:
 Wisconsin State Lab of Hygiene
 Attn: Neal Stanton / Michel Lange
 Chemical Emergency Response Dept.
 2601 Agriculture Dr.
 Madison, WI 53718

For question please contact: Neal Stanton 608-224-6271 Neal.Stanton@wslh.wisc.edu Michel Lange 608-263-4428 Michel.Lange@wslh.wisc.edu

Challenges for clinical labs

Short **retention time** for clinical specimens (~7 days for BAL)

Communication between clinical team and lab

EVALI was not standardized with a **test** or “**flag**”



Prof. James J. Sabatow, PhD, Director
D.F.A. Karpman, MD, Medical Director
2601 Agriculture Drive
Madison WI 53718-7866

Wisconsin State
Laboratory of Hygiene
UNIVERSITY OF WISCONSIN-MADISON

Wisconsin State Laboratory of Hygiene
Vaping solution sample submission form

| | |
|--|--|
| Patient Name (if available) | Submitter |
| Patient ID # | |
| Patient DOB | Contact Phone Number |
| Submitter Specimen ID | Contact email address |
| Date Collected: / / | Note: please provide a separate sheet for each sample submitted. |
| Case info, descriptive info, or other comments | |

Send to:
Wisconsin State Lab of Hygiene
Attn: Noel Stanton / Moshel Lange
Chemical Emergency Response Dept.
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Madison WI 53718

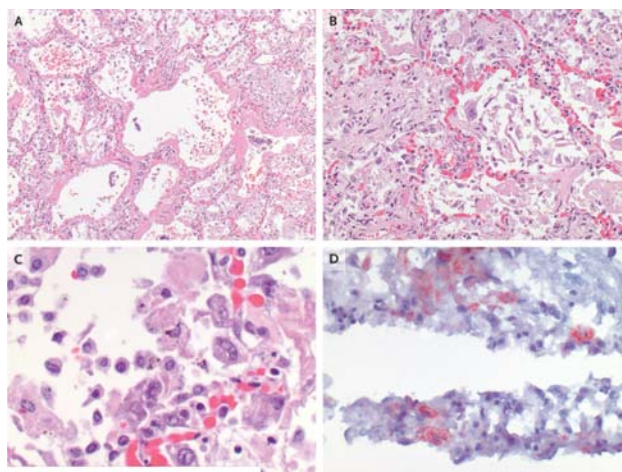
For question please contact: Noel Stanton 608-224-4251 Noel.Stanton@lsph.wisc.edu Moshel Lange 608-224-4428 Moshel.Lange@lsph.wisc.edu

Continuing work...

Animal studies to understand pathophysiology of VEA inhalation

Pathology studies to understand mechanism of lung injury

What about the 10% of cases reporting **only nicotine use**?



Continuing work...

Lots of questions about **policy** and **regulation** of vaping industry...



**Marijuana
legalization**

Tobacco 21

Flavor ban

FDA testing

Harm reduction

Acknowledgements

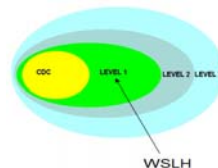
Wisconsin Department of Health Services
Wisconsin State Lab of Hygiene
U.S. Centers for Disease Control and Prevention
U.S. Food and Drug Administration
Children's Hospital of Wisconsin





LRN-C – The Laboratory Response Network for Chemical Events

- Chemical Threat Response
- Responder support, unknown substances
- Clinical testing for exposure to WMD & threat agents
 - E.g. nerve agents, vesicants, CN, metals, volatiles, amanitin, ricin & abrin, others
- Labs classified by level
 - WSLH is a level 1 response lab
- CDC surge capacity lab
 - ASAP testing of 1000 patients
 - Development of tests to address chemical exposures, e.g. brodifacoum



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Thanks!



Novel Coronavirus (2019-nCoV) from Wuhan China



- 2019 – nCoV is a newly emerging respiratory virus with >300 new infections and 6 deaths. Cases have been identified in 5 countries, including the US.
- If you have a suspect patient, contact our State Epidemiologists at the Division of Public Health (DPH) for information, testing approval, and for a PUI form.
 - Tom Haupt or Anna Kocharian
 - ❖ [608-267-9003](tel:608-267-9003) main line
 - ❖ [608-258-0099](tel:608-258-0099) after hours
- Testing is available at the CDC.
 - Check their website for the most up to date guidance.
 - Samples for testing must:
 - ❖ Have DPH approval
 - ❖ Have PUI form
 - ❖ Be sent through WSLH
- If you have questions about how to submit samples for testing, contact WSLH Customer Service.
 - [1-800-862-1013](tel:1-800-862-1013)