

Partnering to Identify a New Public Health Threat: EVALI

WCLN Webinar 1/22/20

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Wisconsin Department of Health Services

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Vaping-Associated Lung Injury

Wisconsin, 2019

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Epidemic Intelligence Service

Centers for Disease Control and Prevention

Wisconsin Department of Health Services



WISCONSIN DEPARTMENT
of HEALTH SERVICES

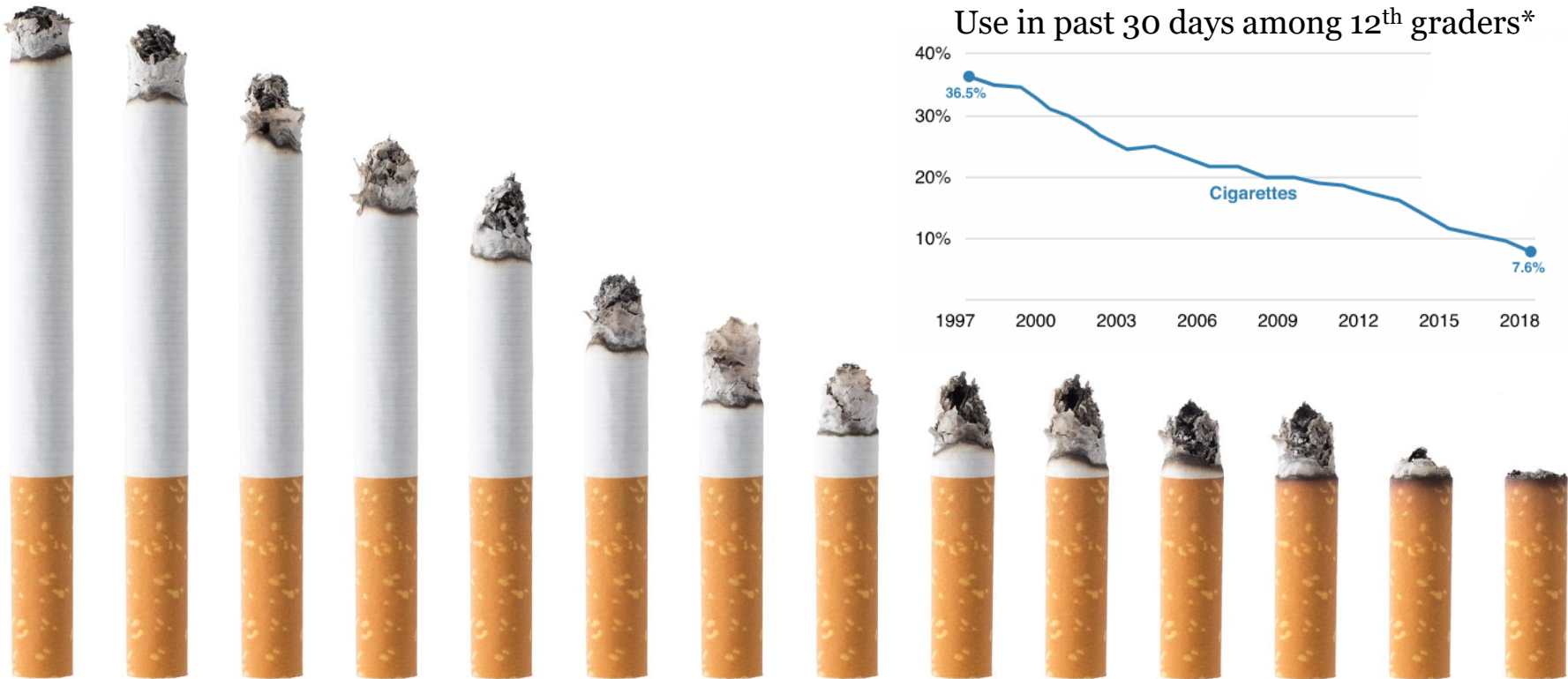
Vaping



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

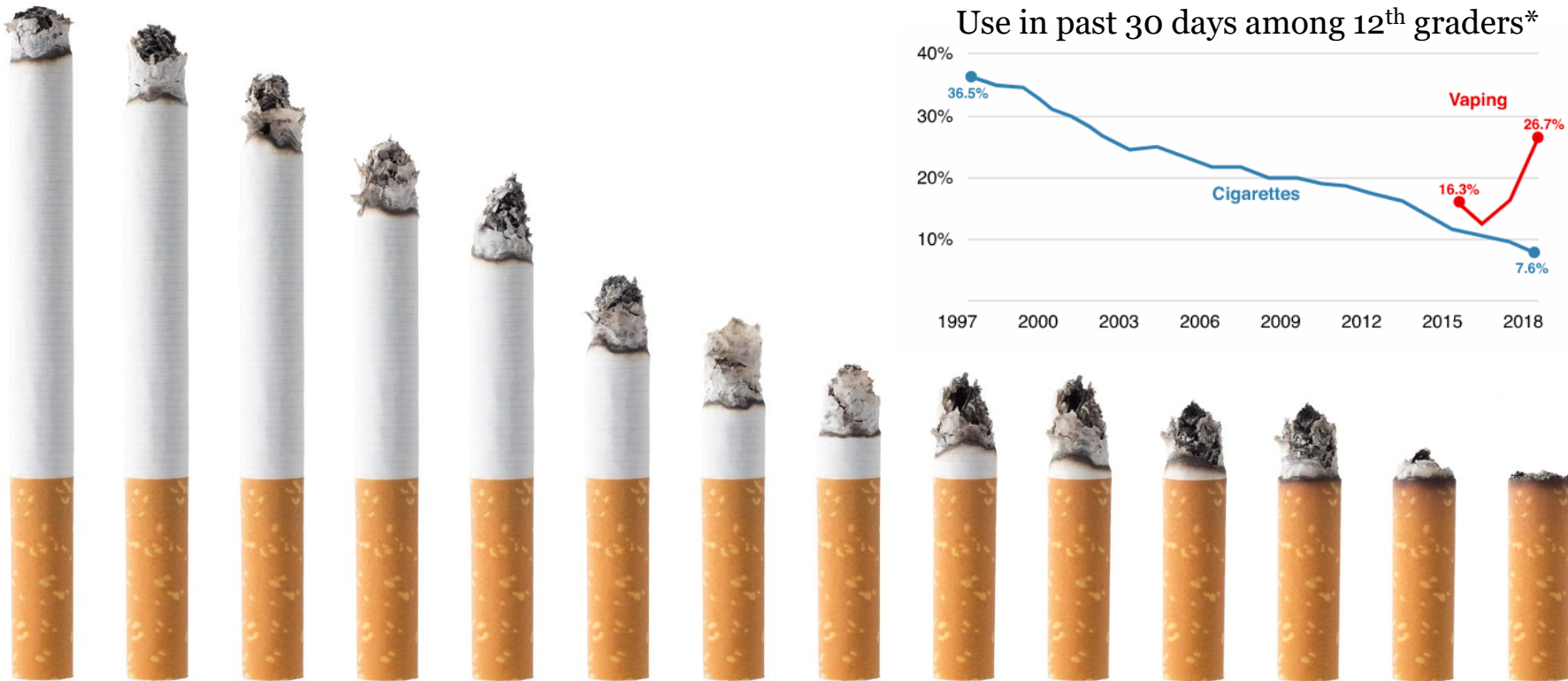
*2018, CDC

Vaping



*National adolescent drug trends, NEJM

Vaping

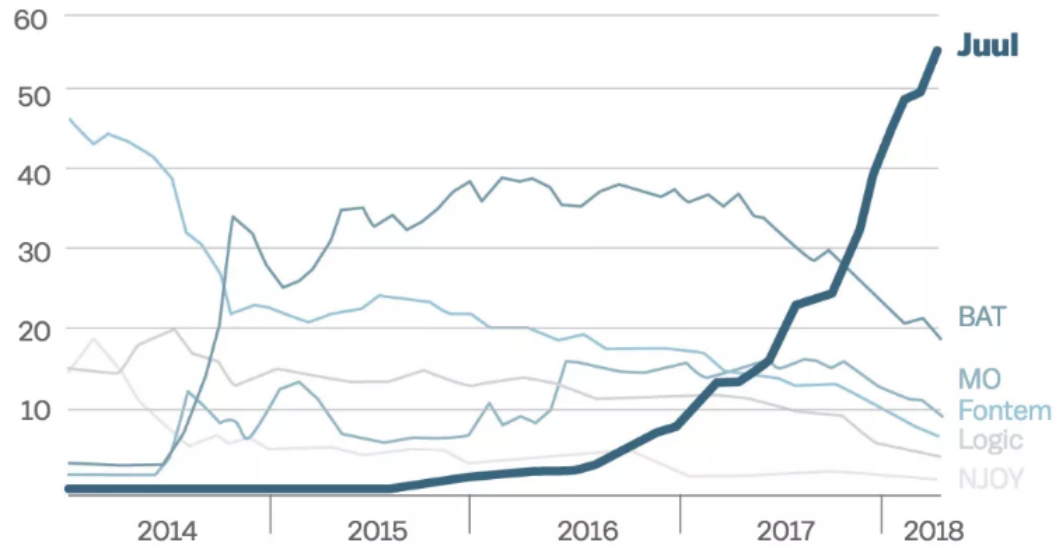


*National adolescent drug trends, NEJM

Vaping

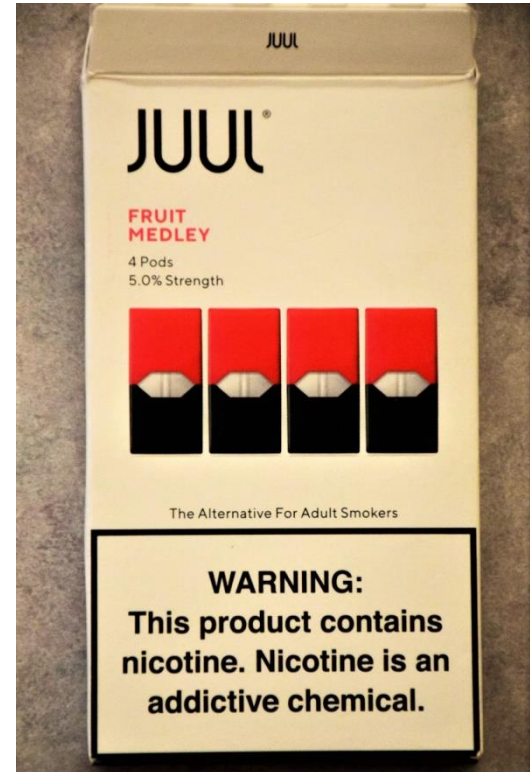
Juul sales are booming

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

Vox



Marijuana

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

7% of college student vape
non-nicotine products²

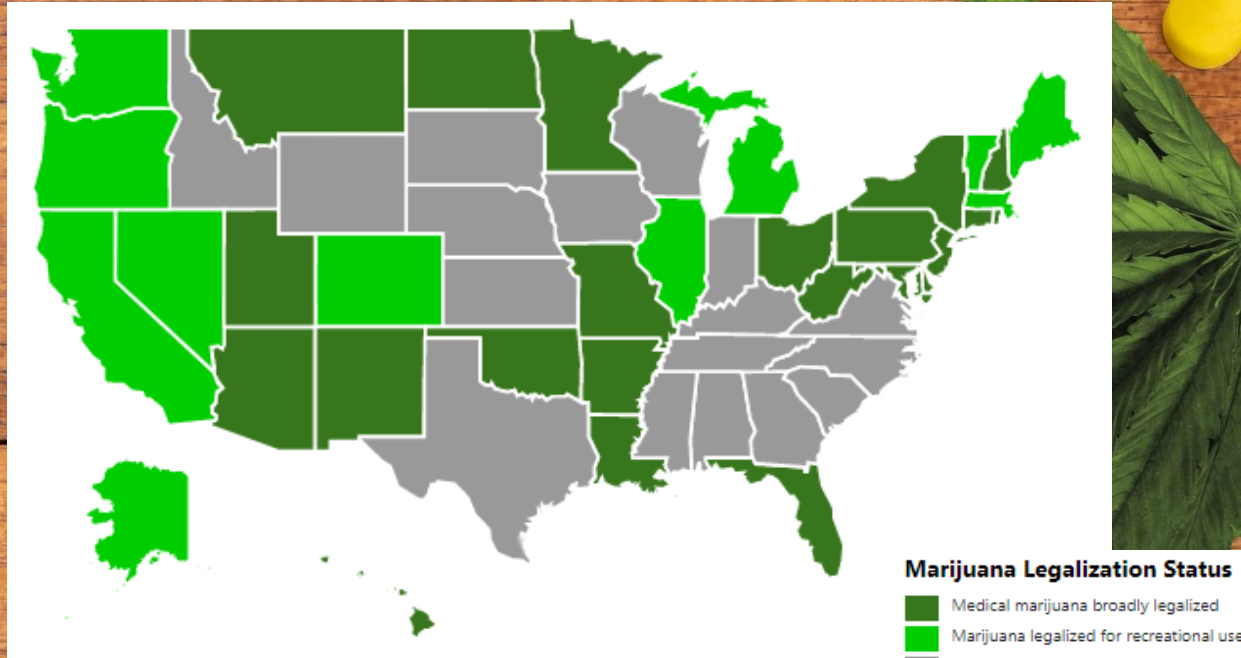


¹JAMA Pediatrics, 2018

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

The background of the slide is a photograph of the Children's Hospital of Wisconsin building. The building is a multi-story, modern structure with a curved facade and many windows. The name "Children's Hospital of Wisconsin" is visible on the building's facade, along with a logo of two stylized figures. The sky is blue with some white clouds, and there are some green trees in the foreground.

- 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



Children's Hospital of Wisconsin



- Diffuse bilateral infiltrates
- “Ground-glass” opacities

July 10 – Children's Hospital of Wisconsin

A photograph of the Children's Hospital of Wisconsin building, a large, modern, multi-story structure with a curved facade and many windows. The building is set against a blue sky with white clouds. The text "Children's Hospital of Wisconsin" is visible on the building's facade.

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

Initial Investigation

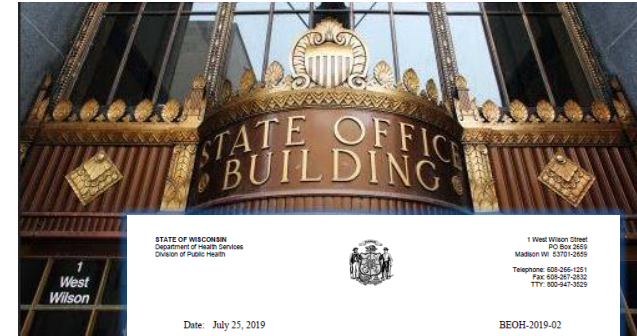
1. Develop a **case definition**

- ✓ 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**



STATE OF WISCONSIN
Department of Health Services
Division of Public Health



1 West Wilson Street
PO Box 2659
Madison WI 53701-2659
Telephone: 608-266-1211
Fax: 608-261-2032
TTY: 608-947-3523

Date: July 25, 2019

BEOH-2019-02

To: Wisconsin Healthcare Providers, Infection Preventionists, Local Health Departments, and Tribal Health Agencies

From: Jonathan Meiman, MD
Chief Medical Officer and State Occupational and Environmental Disease
Epidemiologist, Bureau of Environmental and Occupational Health (BEOH)

Severe Pulmonary Disease Among Adolescents who Reported Vaping

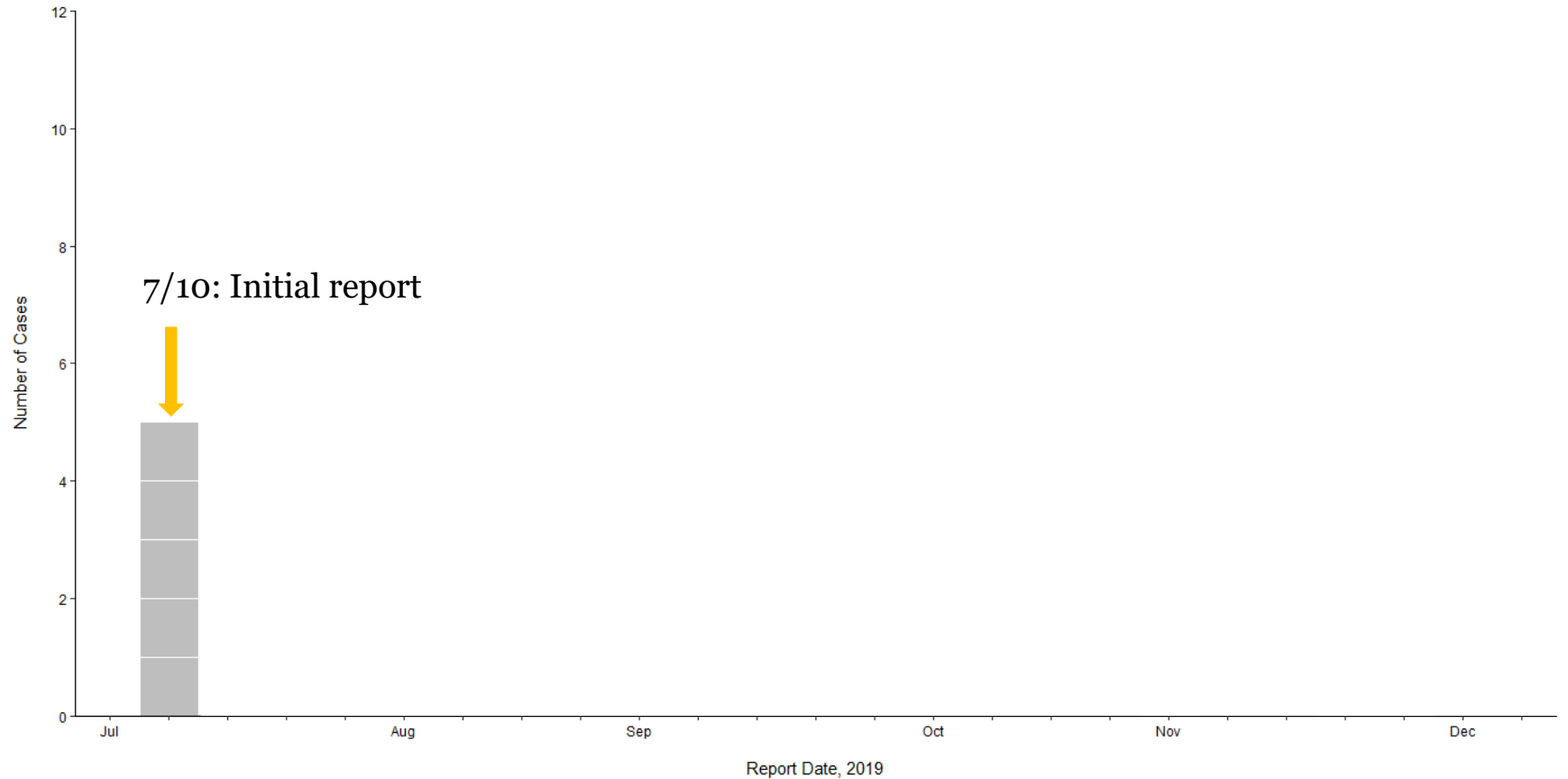
PLEASE DISTRIBUTE WIDELY

During July 2019, 8 cases of severe pulmonary disease among adolescents were reported to the Wisconsin Department of Health Services (DHS). Patients resided in the counties of Milwaukee, Waukesha, and Winnebago and presented with respiratory symptoms including cough, shortness of breath, and fatigue. Symptoms worsened over a period of days or weeks before admission to the hospital. Other symptoms reported by some patients included fever, anorexia, pleuritic chest pain, nausea, and diarrhea. Chest radiographs showed bilateral opacities, typically in the lower lobes, and CT imaging of the chest showed diffuse ground-glass opacities, often with subpleural sparing. Evaluation for infectious etiologies was negative in all patients. Some patients had progressive respiratory compromise requiring endotracheal intubation but subsequently improved with systemic steroids.

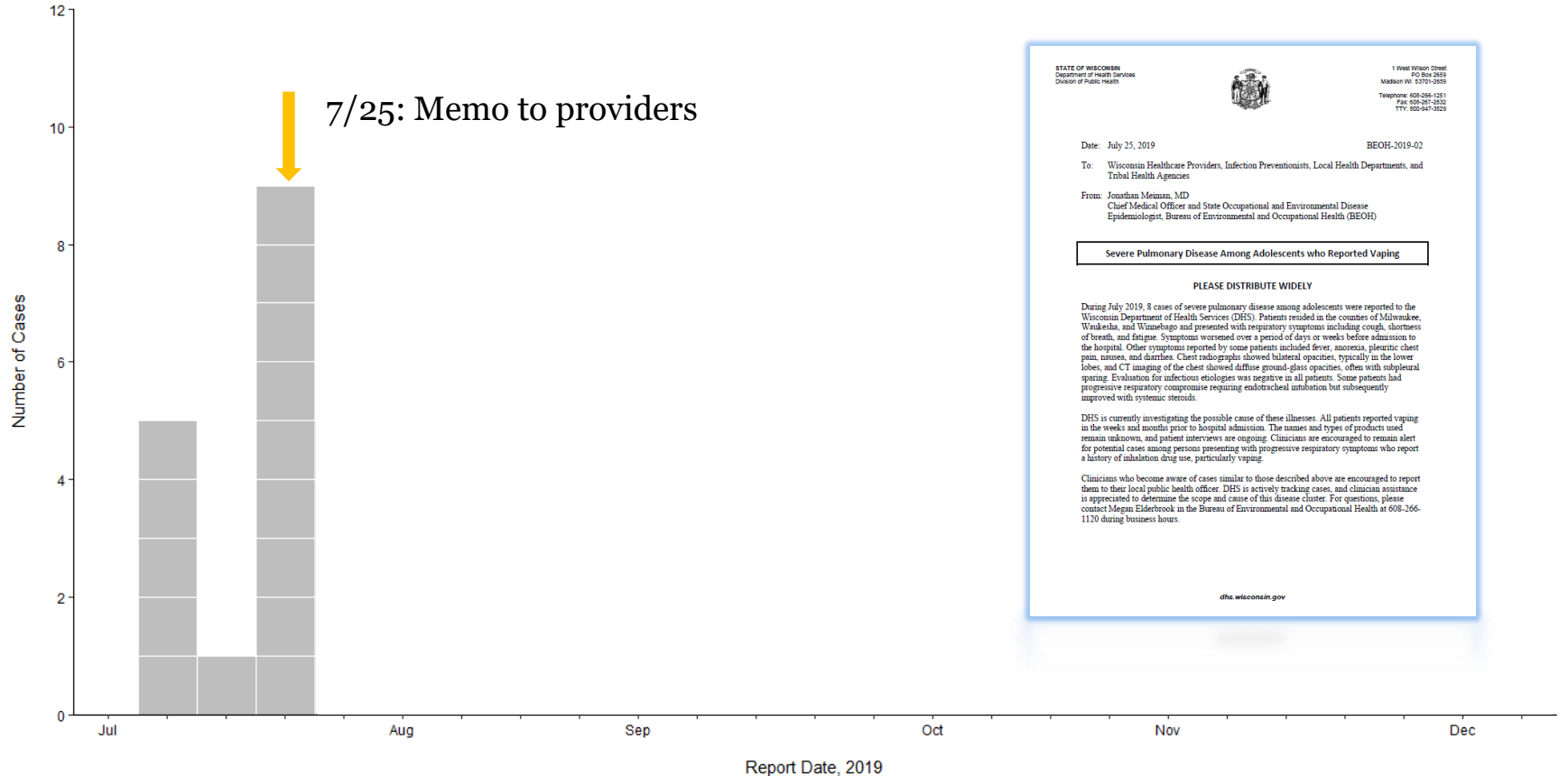
DHS is currently investigating the possible cause of these illnesses. All patients reported vaping in the weeks and months prior to hospital admission. The names and types of products used remain unknown, and patient interviews are ongoing. Clinicians are encouraged to remain alert for potential cases among persons presenting with progressive respiratory symptoms who report a history of inhalation drug use, particularly vaping.

Clinicians who become aware of cases similar to those described above are encouraged to report them to their local public health officer. DHS is actively tracking cases, and clinician assistance is appreciated to determine the scope and cause of this disease cluster. For questions, please contact Megan Elderbrook in the Bureau of Environmental and Occupational Health at 608-266-1120 during business hours.

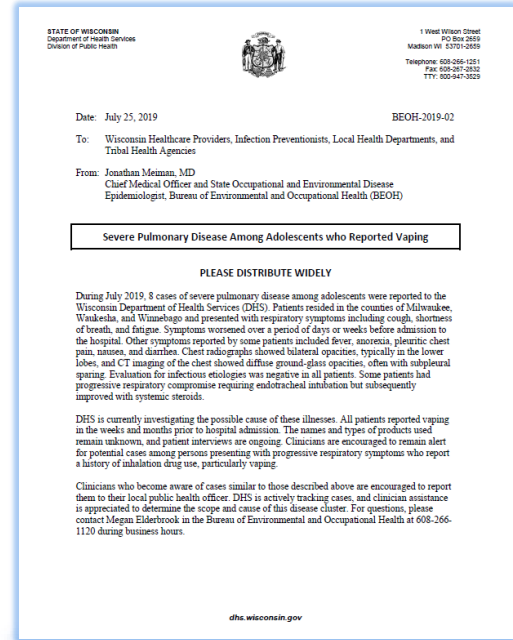
Timeline



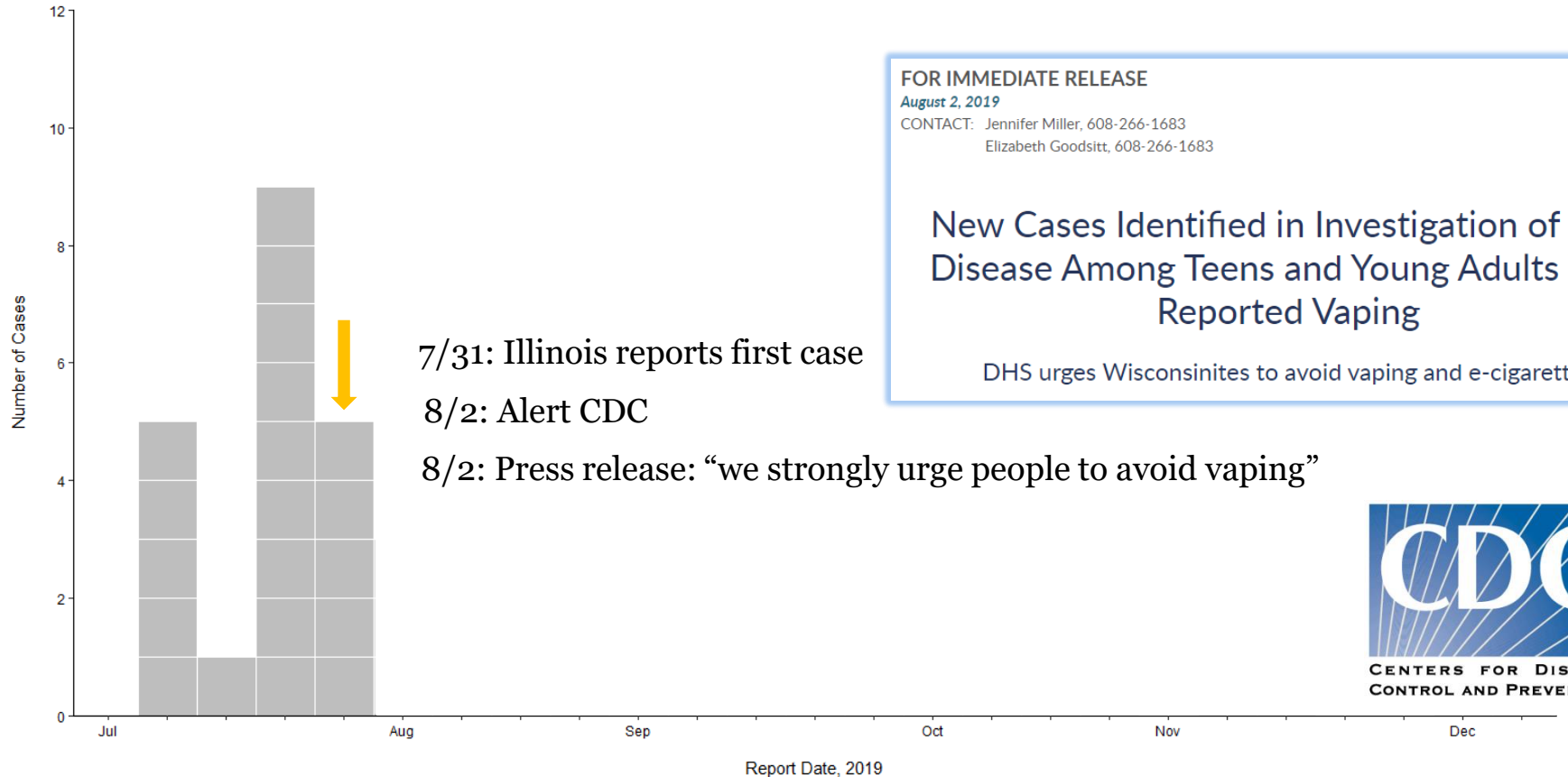
Timeline



7/25: Memo to providers



Timeline



FOR IMMEDIATE RELEASE

August 2, 2019

CONTACT: Jennifer Miller, 608-266-1683

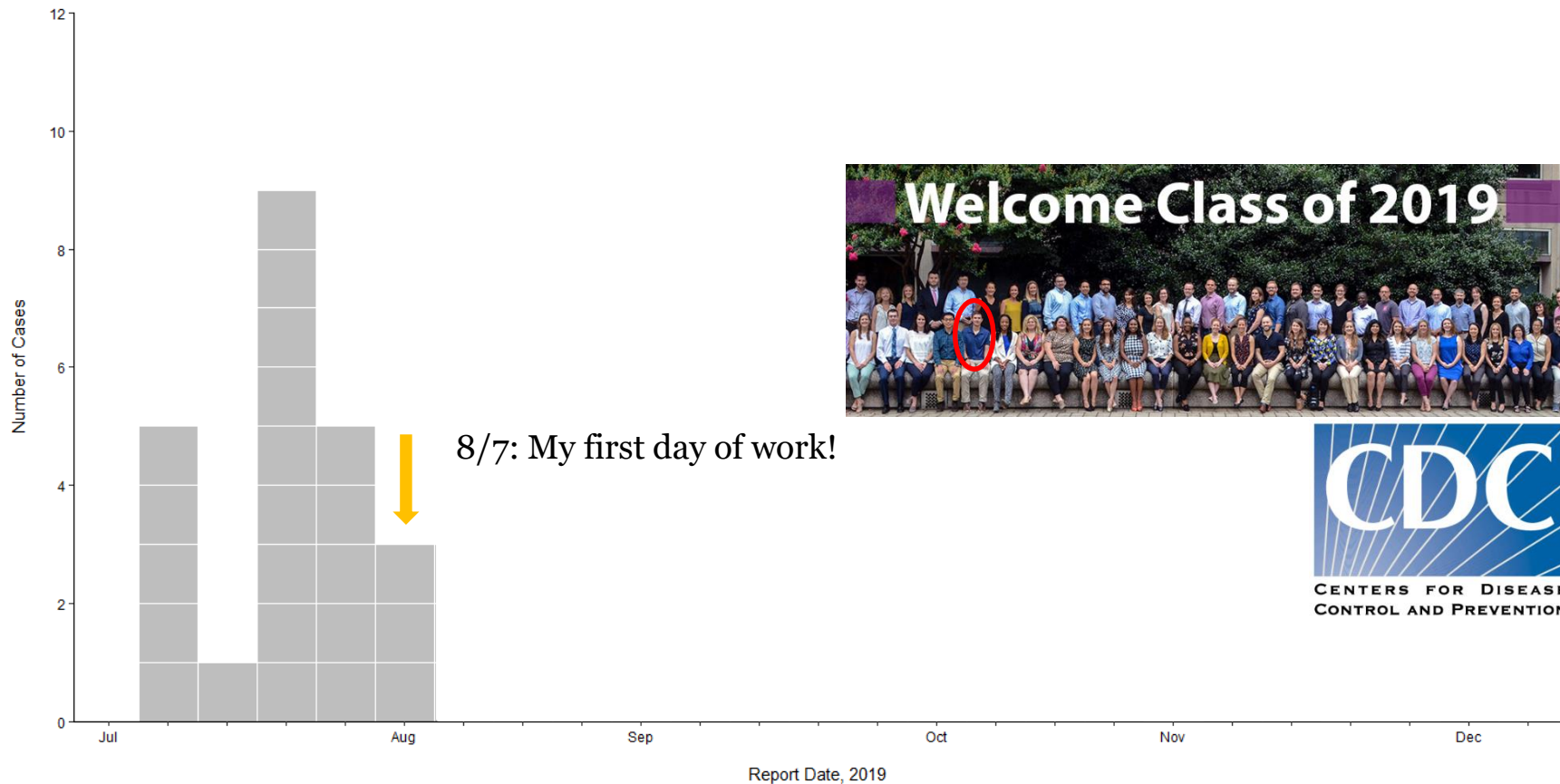
Elizabeth Goodsitt, 608-266-1683

New Cases Identified in Investigation of Lung Disease Among Teens and Young Adults Who Reported Vaping

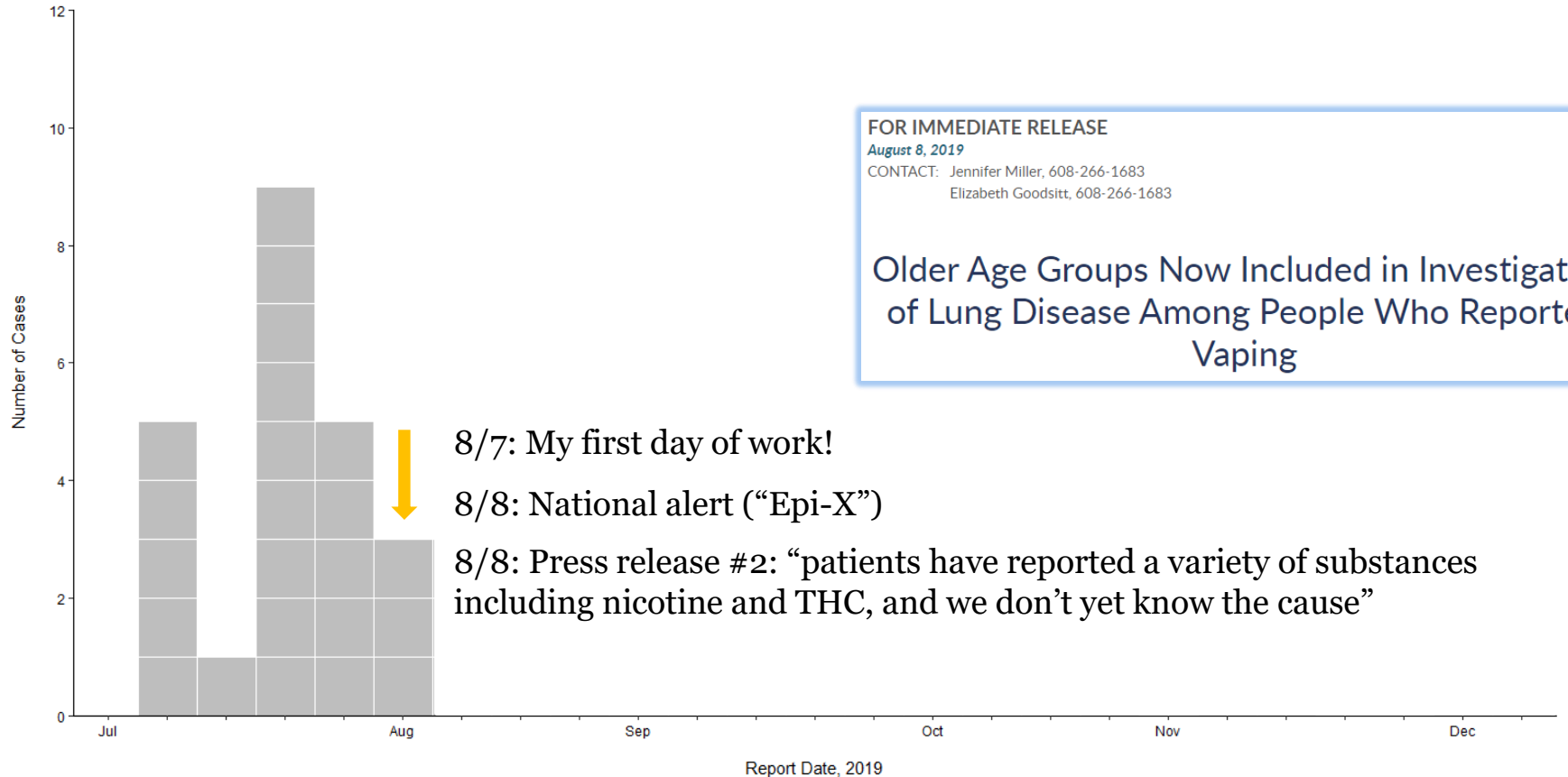
DHS urges Wisconsinites to avoid vaping and e-cigarettes



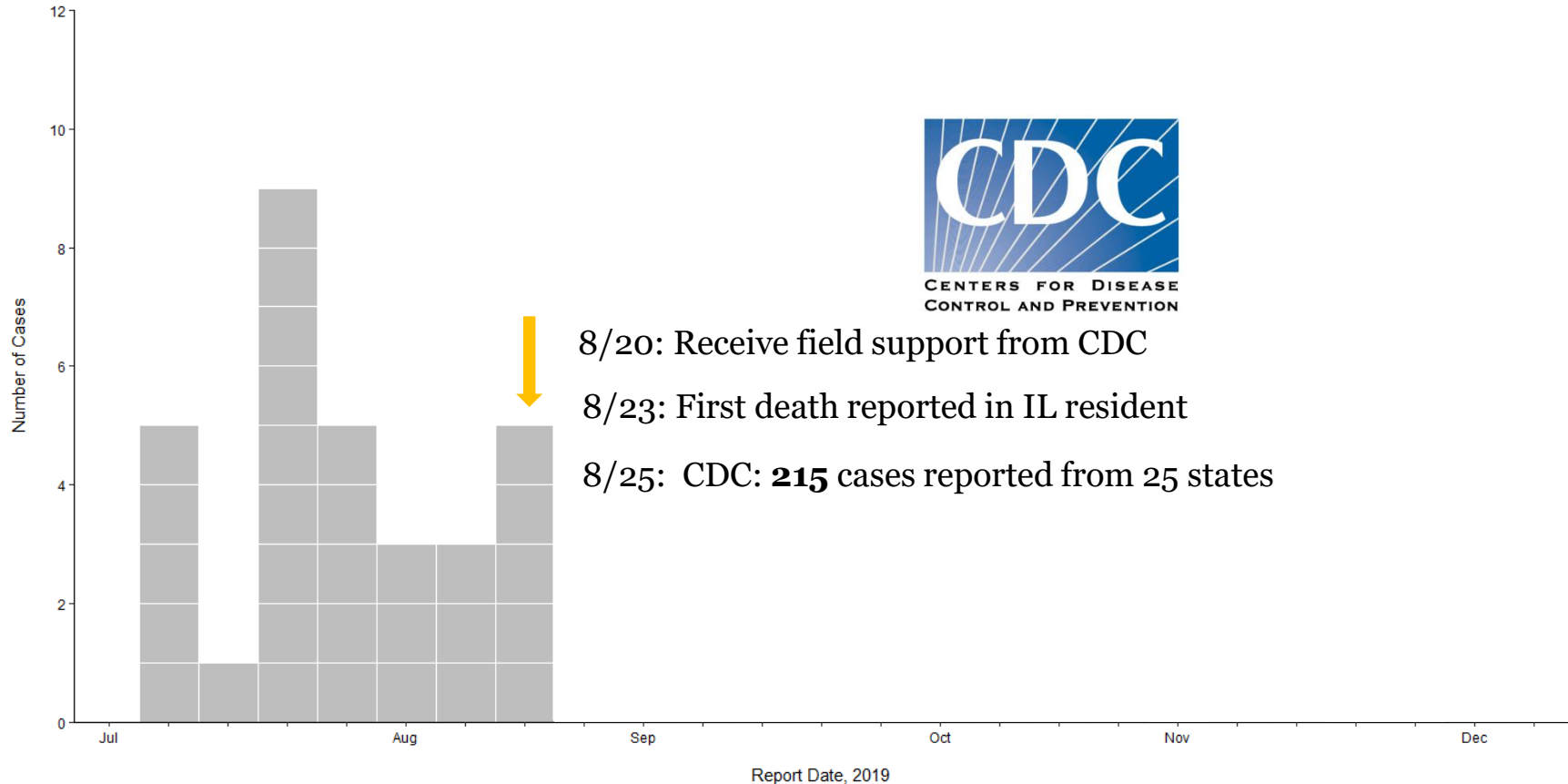
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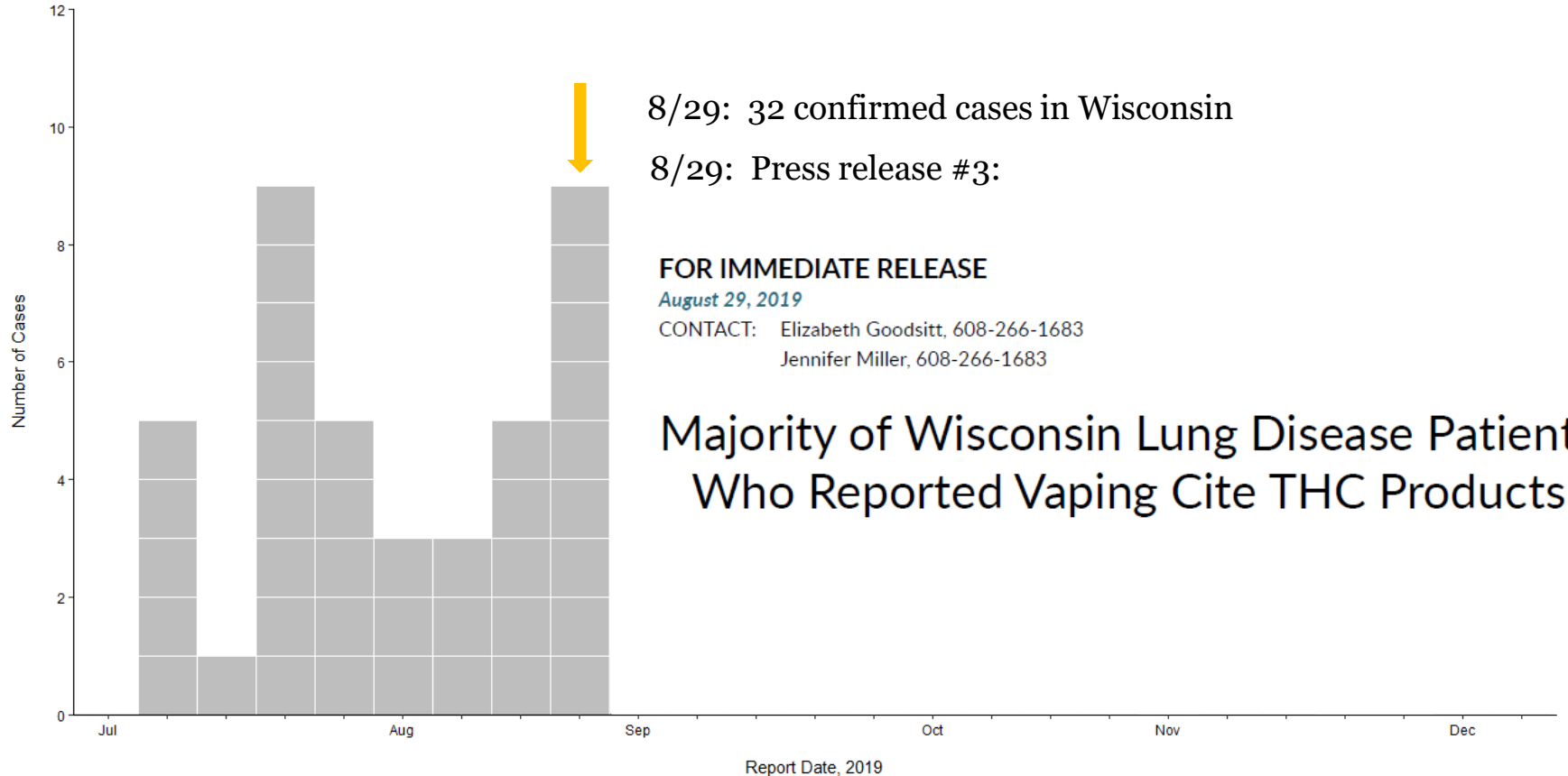
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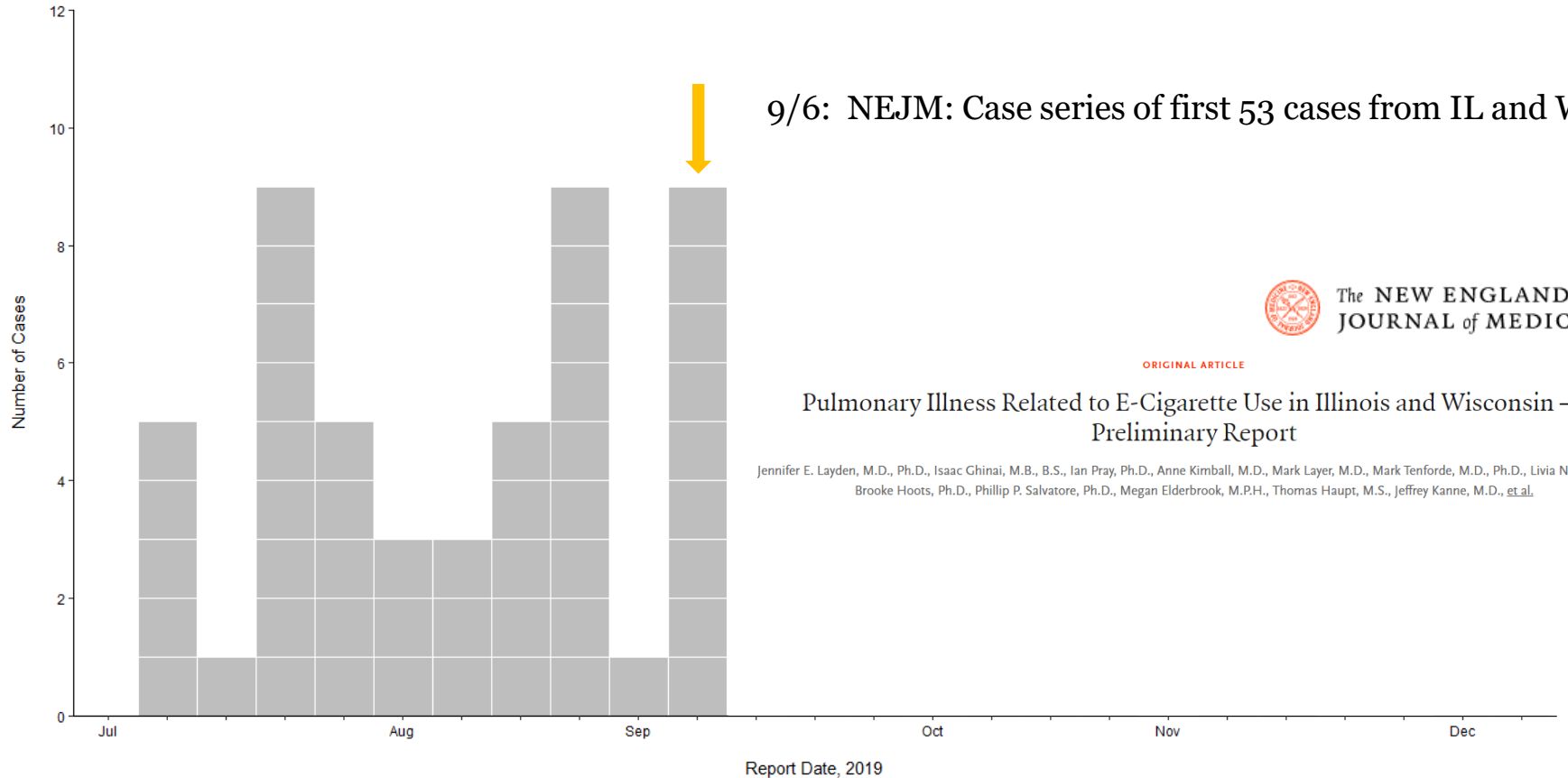
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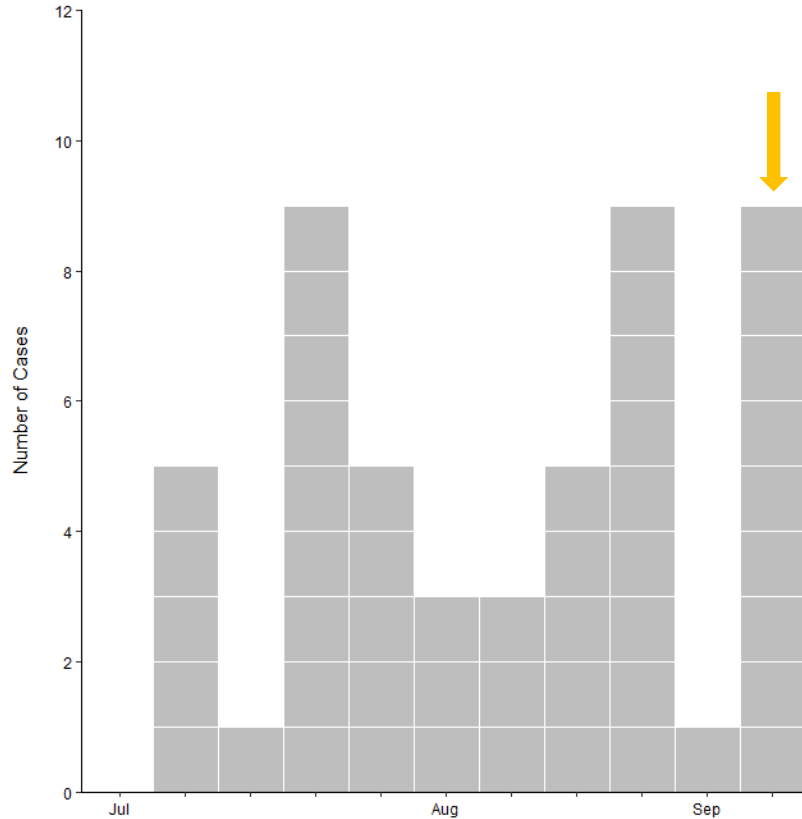
Timeline



Timeline



Timeline

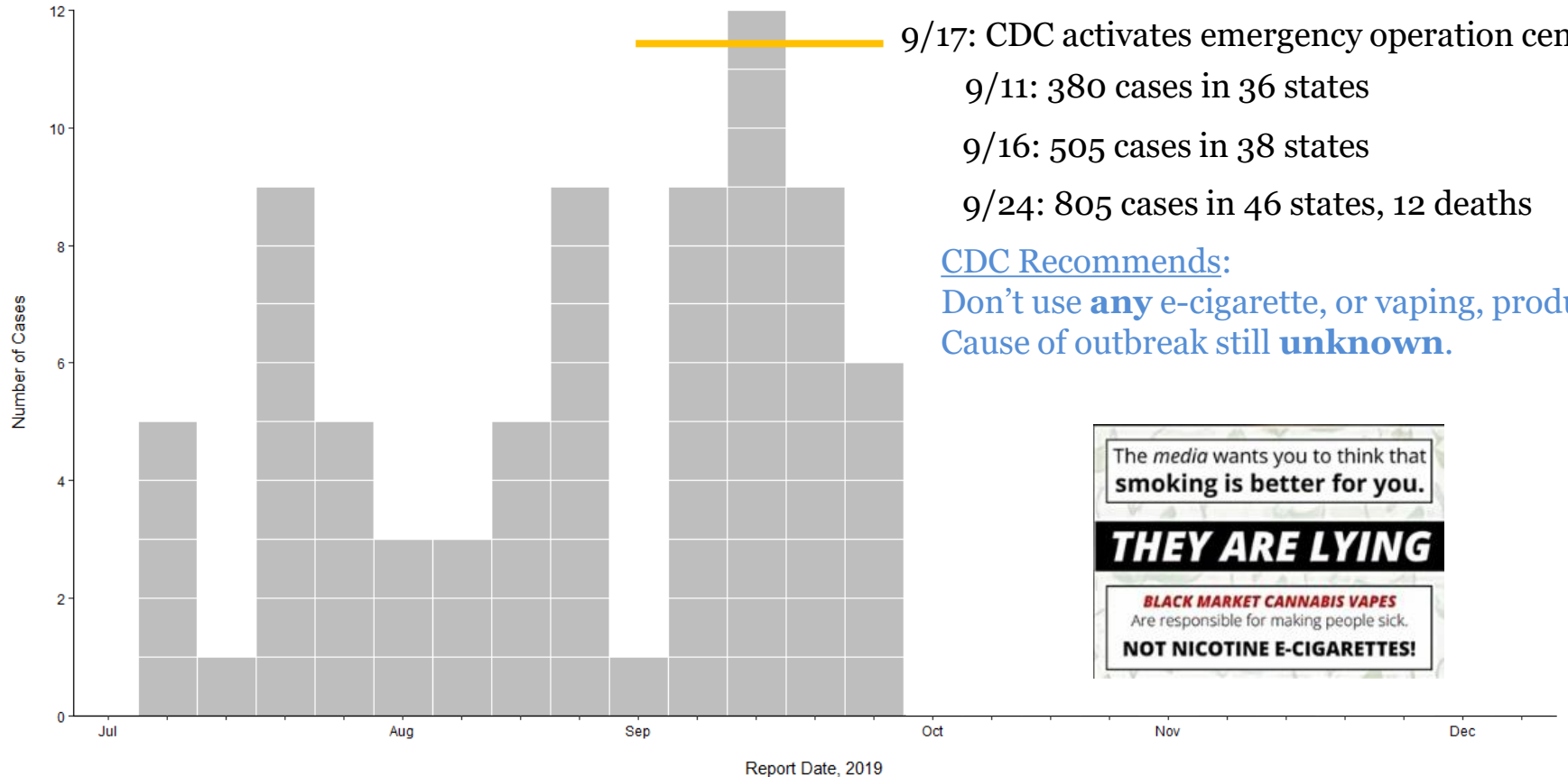


9/11: Massive drug bust in Kenosha, WI

Brothers arrested after \$1.5 million THC cartridge operation discovered in Kenosha County



Timeline

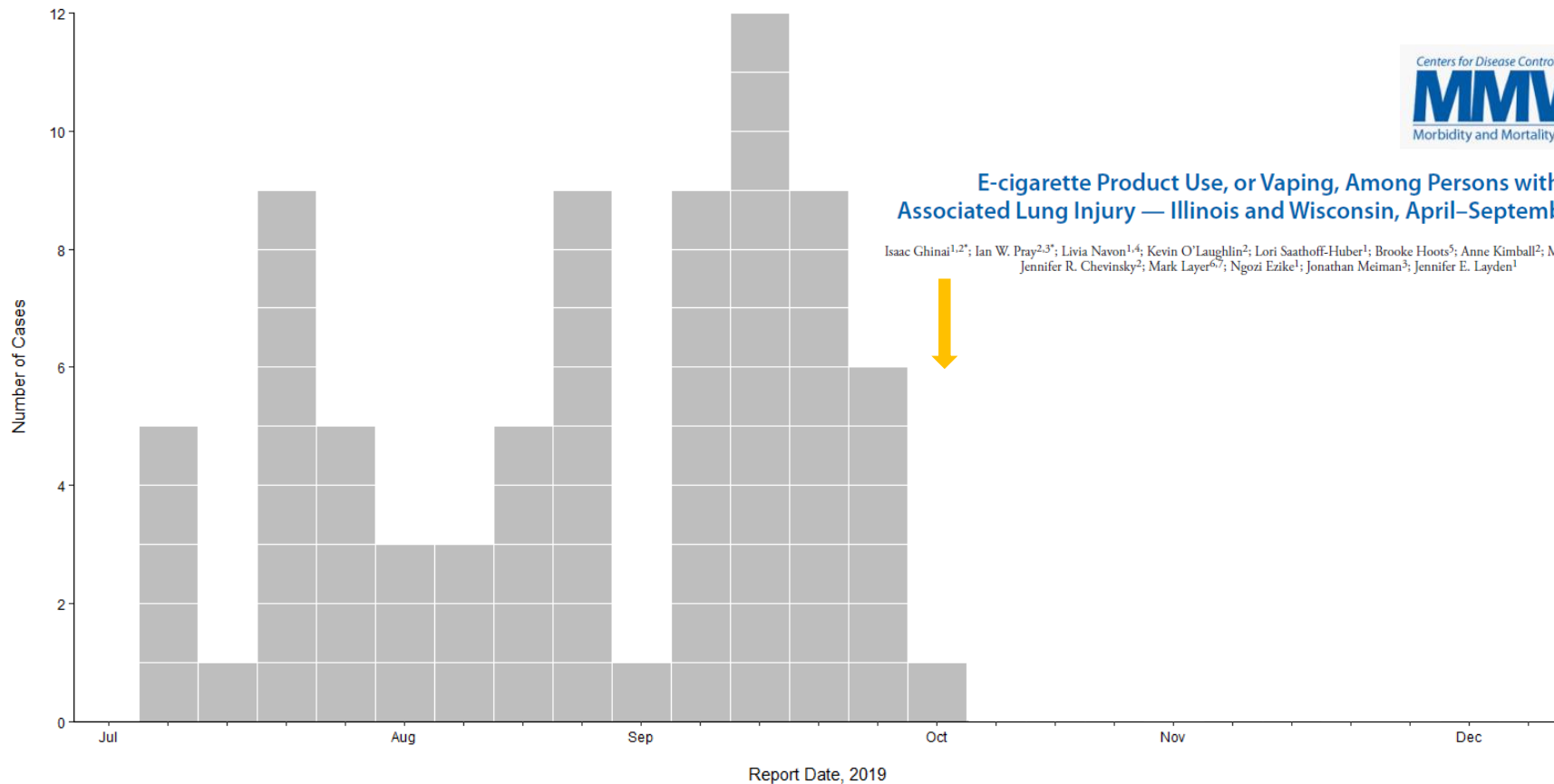


Timeline



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

Isaac Ghinai^{1,2*}; Ian W. Pray^{2,3*}; Livia Navon^{1,4}; Kevin O’Laughlin²; Lori Saathoff-Huber¹; Brooke Hoots⁵; Anne Kimball²; Mark W. Tenforde²; Jennifer R. Chevinsky²; Mark Layer^{6,7}; Ngozi Ezike¹; Jonathan Meiman³; Jennifer E. Layden¹



Results

86 patient interviews complete

79% male

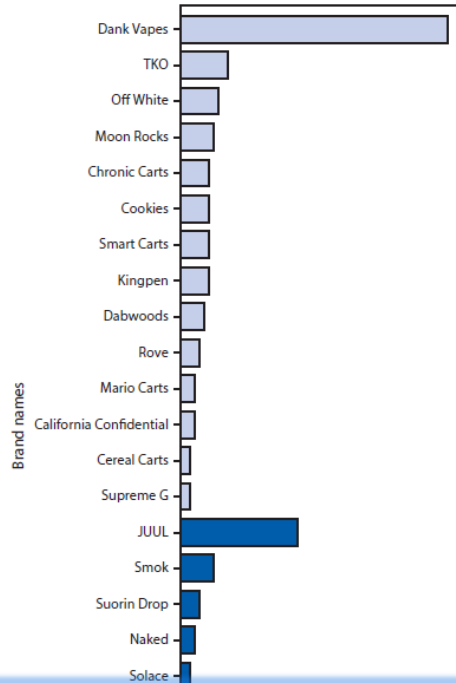
Median age: **21 years old**
(15-53)

87% used THC cartridges

89% of cartridges purchased from “informal sources”

66% used Dank Vapes

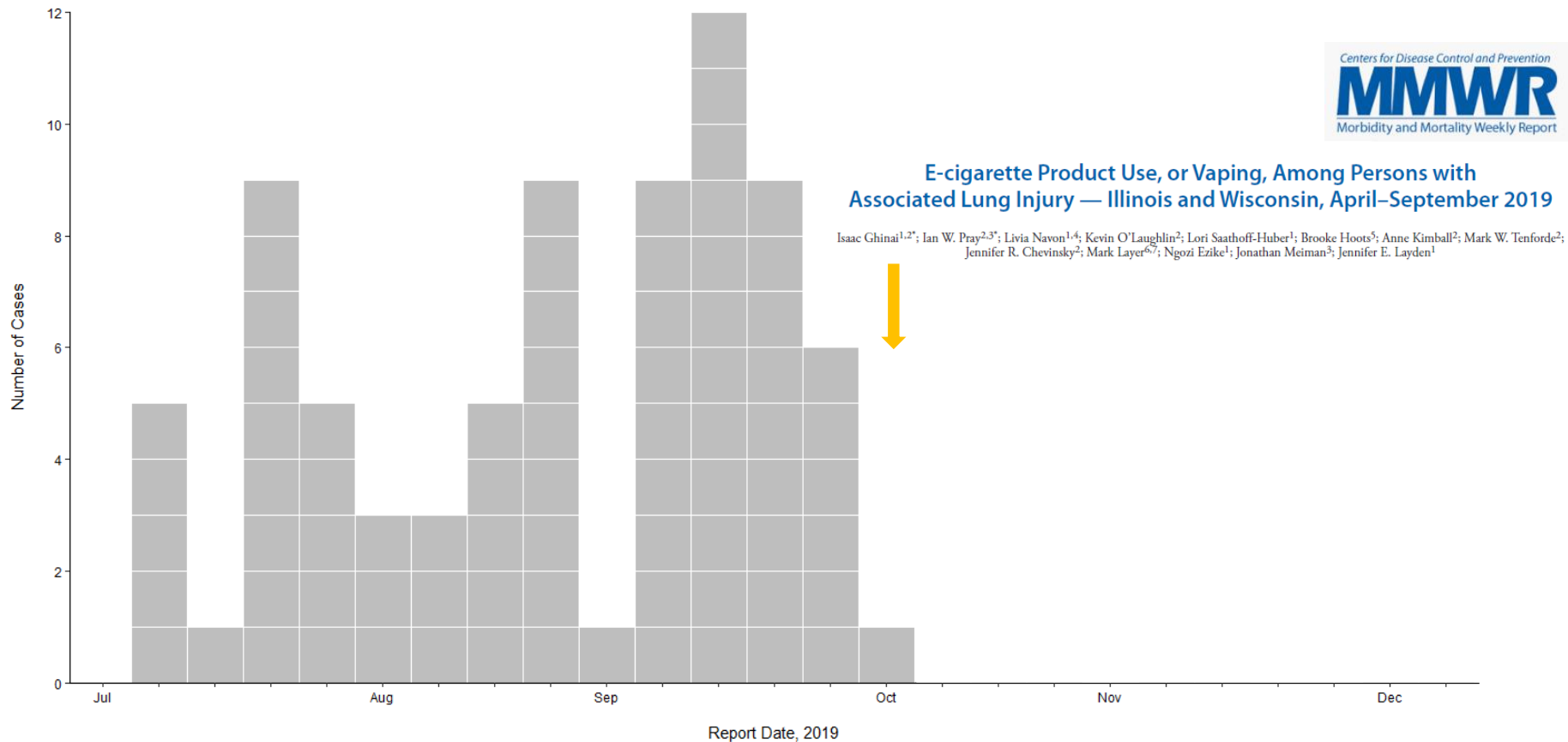
13% used *only* nicotine



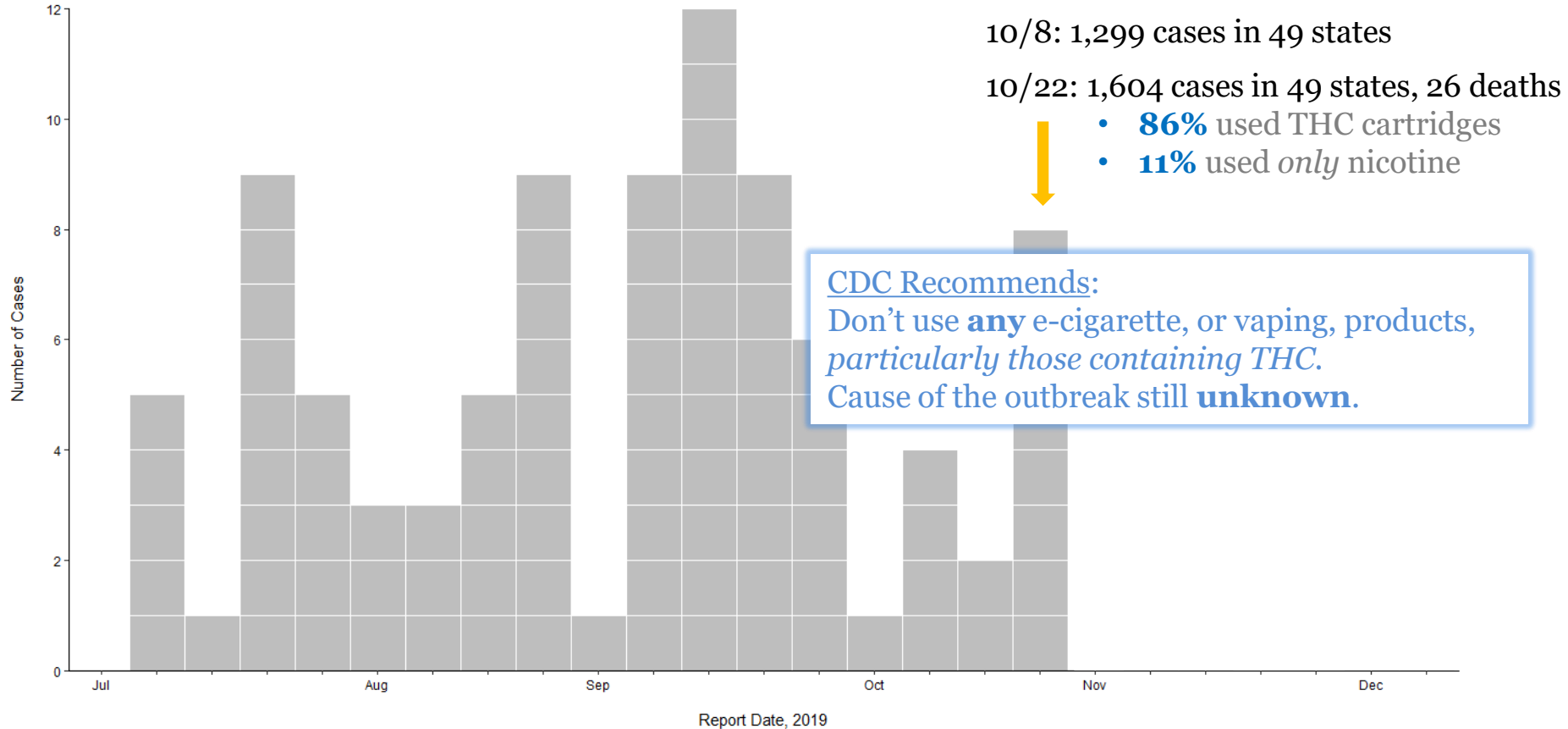
CDC Recommends:

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

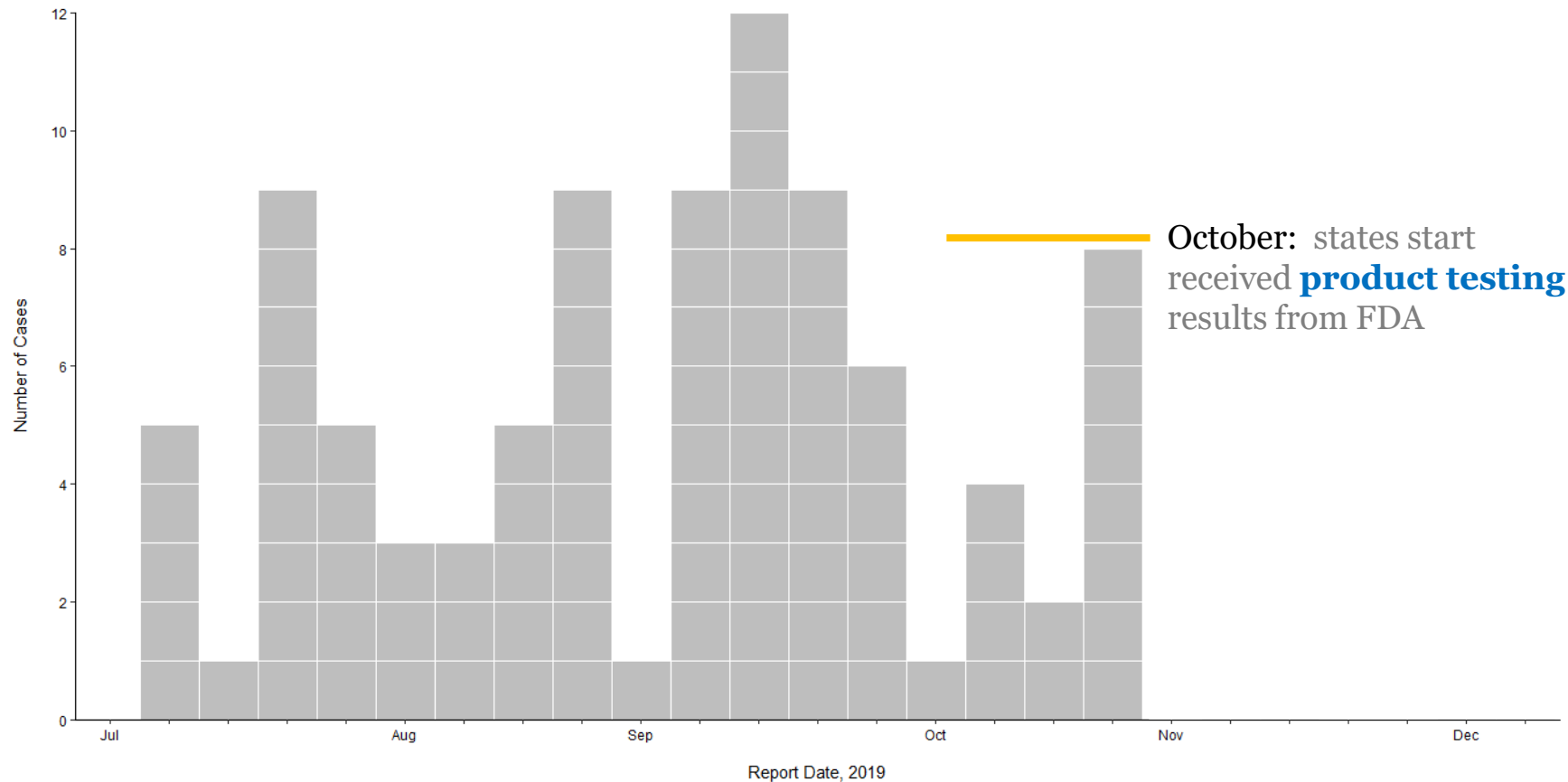
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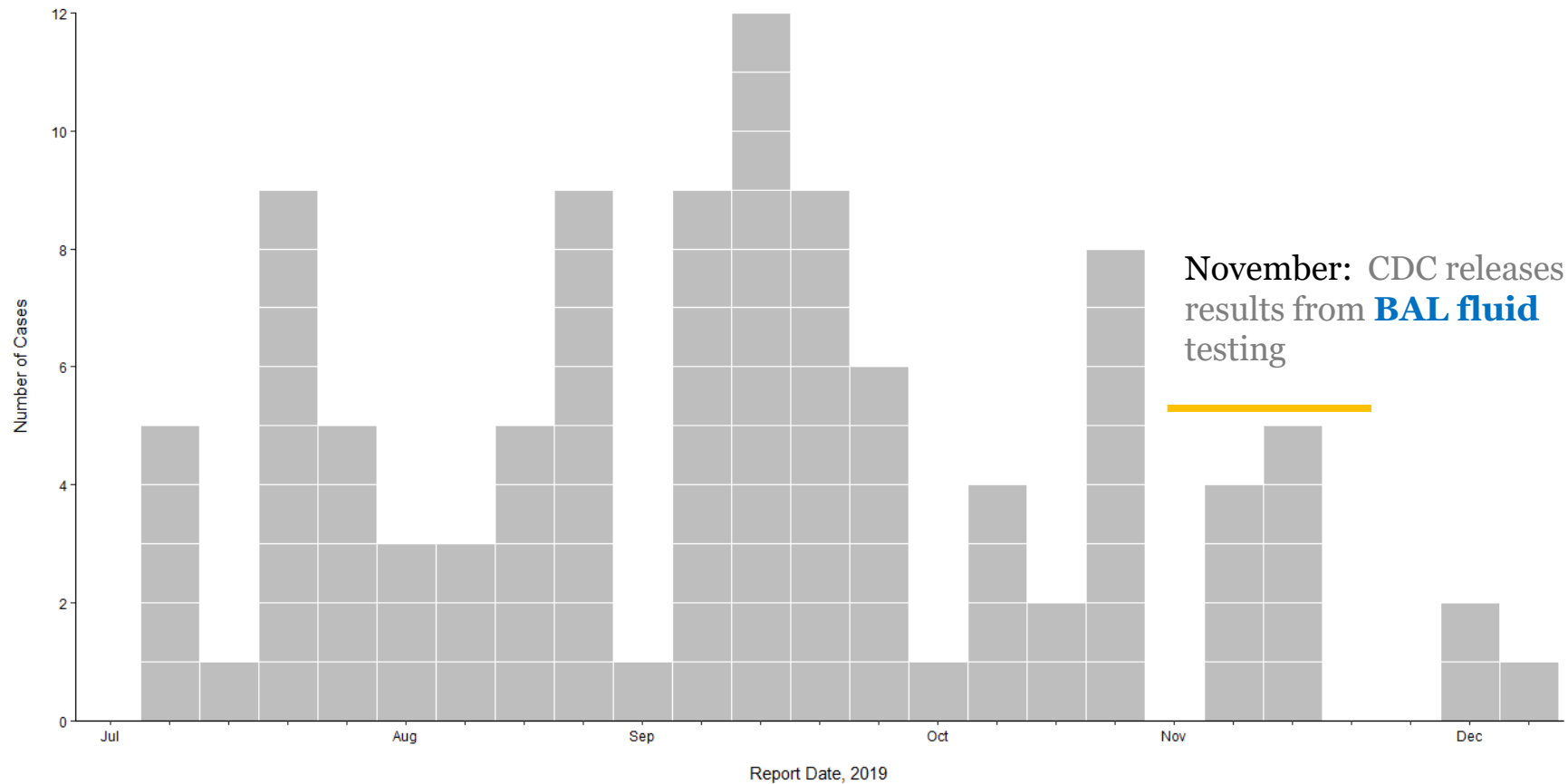
Timeline



Timeline



Timeline



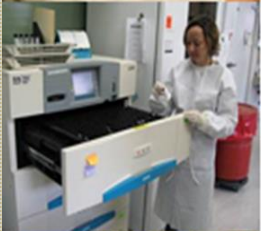
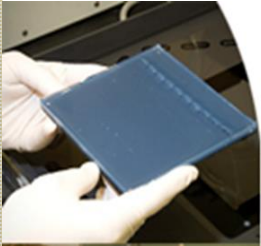
Finding the cause: Laboratory evidence





So Where is WSLH in the EVALI RESPONSE?

Finding the cause: Laboratory evidence





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





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



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





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

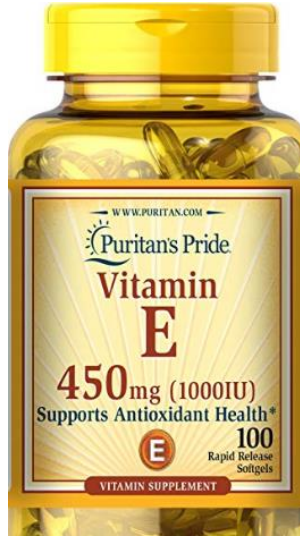
77% of cases had product with vitamin E acetate

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

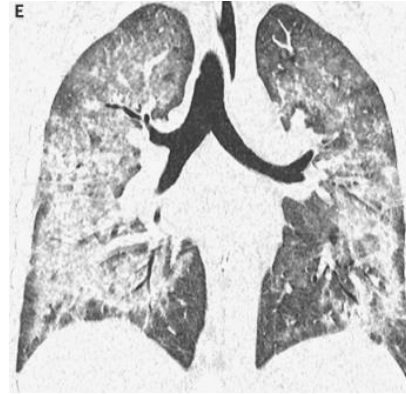
What is Vitamin E acetate??



Finding the cause: Laboratory evidence



?

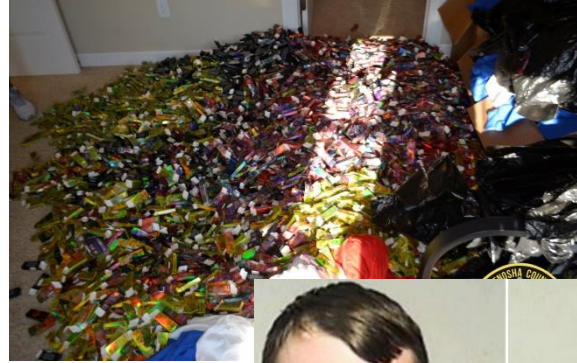


Finding the cause: Laboratory evidence

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*

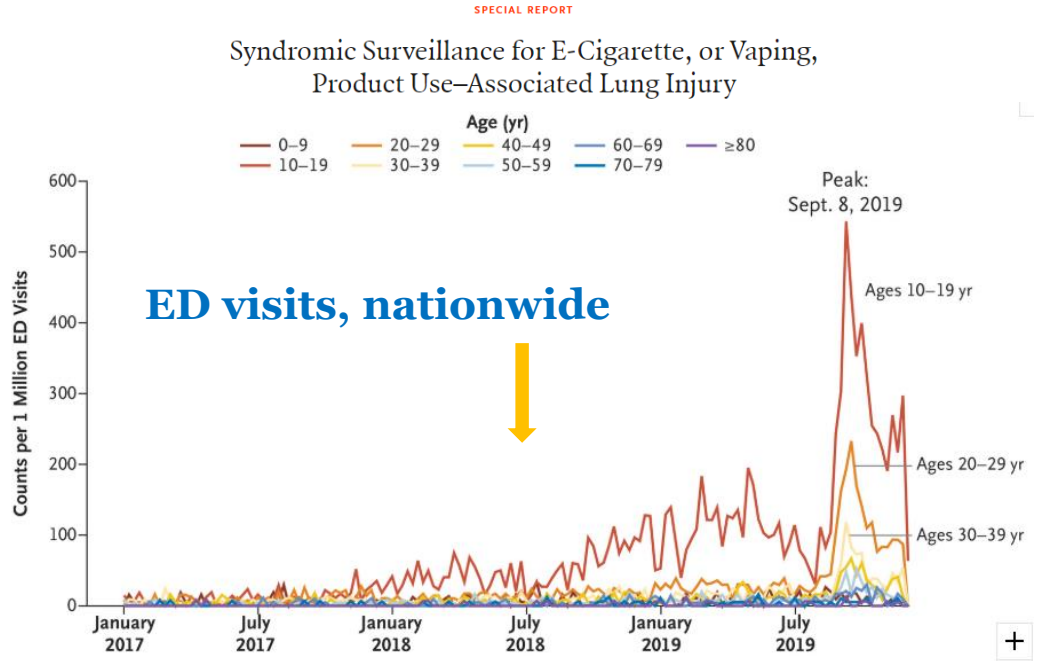
*Leafly.com - <https://www.leafly.com/news/health/toxic-vaping-vapi-evali-lung-injury-rise-and-fall-of-vitamin-e-oil-honey-cut>

Finding the cause: Laboratory evidence



Vitamin E acetate

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

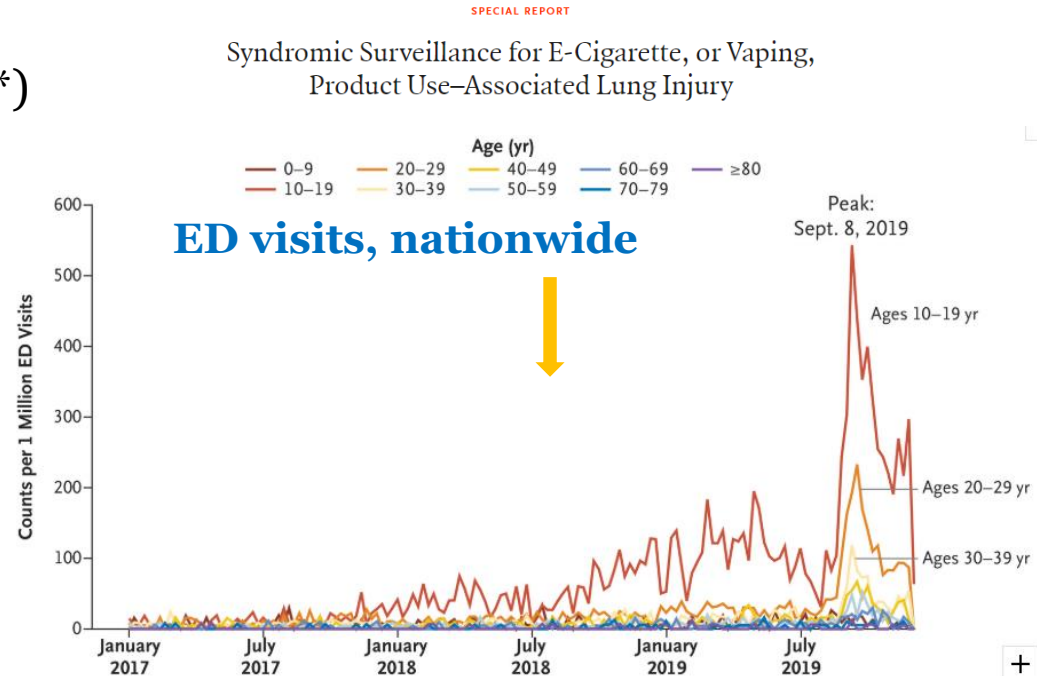


*Leafly.com - <https://www.leafly.com/news/health/toxic-vaping-vapi-evali-lung-injury-rise-and-fall-of-vitamin-e-oil-honey-cut>

Finding the cause: Laboratory evidence

Law enforcement seizures (WI / MN*)

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



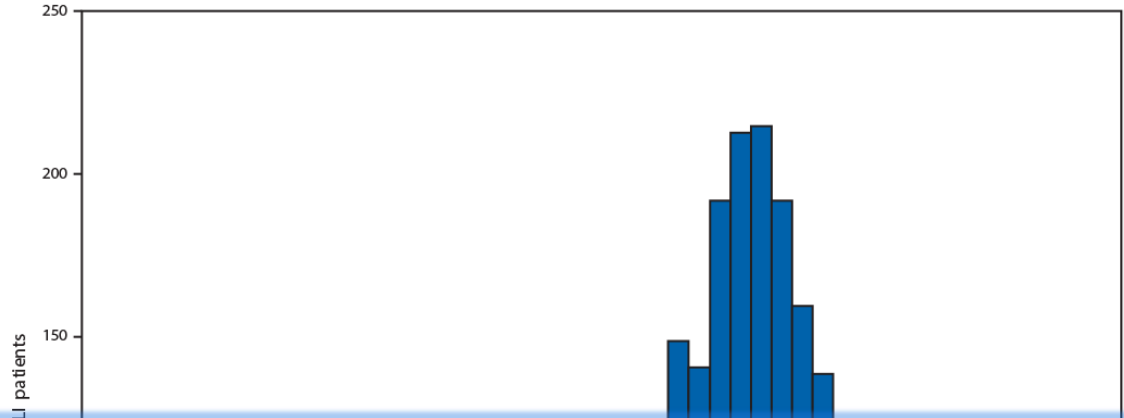
Winding down...

In the U.S.

As of 1/22:

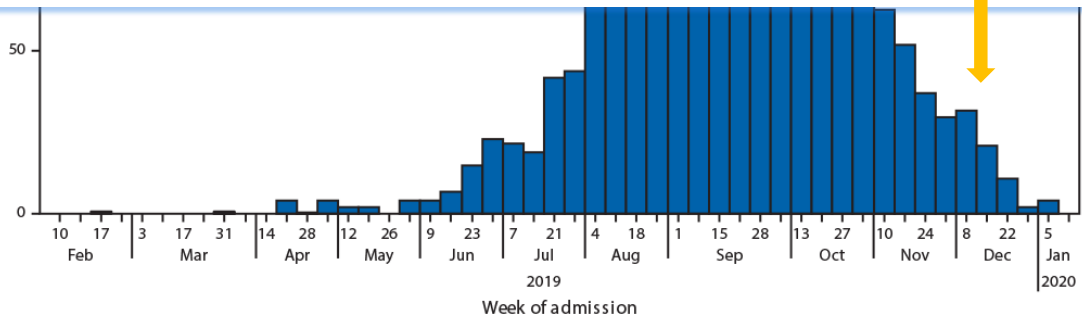
2,668 cases

60 deaths



CDC Recommends (12/13/2019):

- The specific cause of EVALI is **unknown**
- VEA** has been detected, but more than one compound could be causing EVALI
- Continue to refrain from use of **all** e-cigarette or vaping products



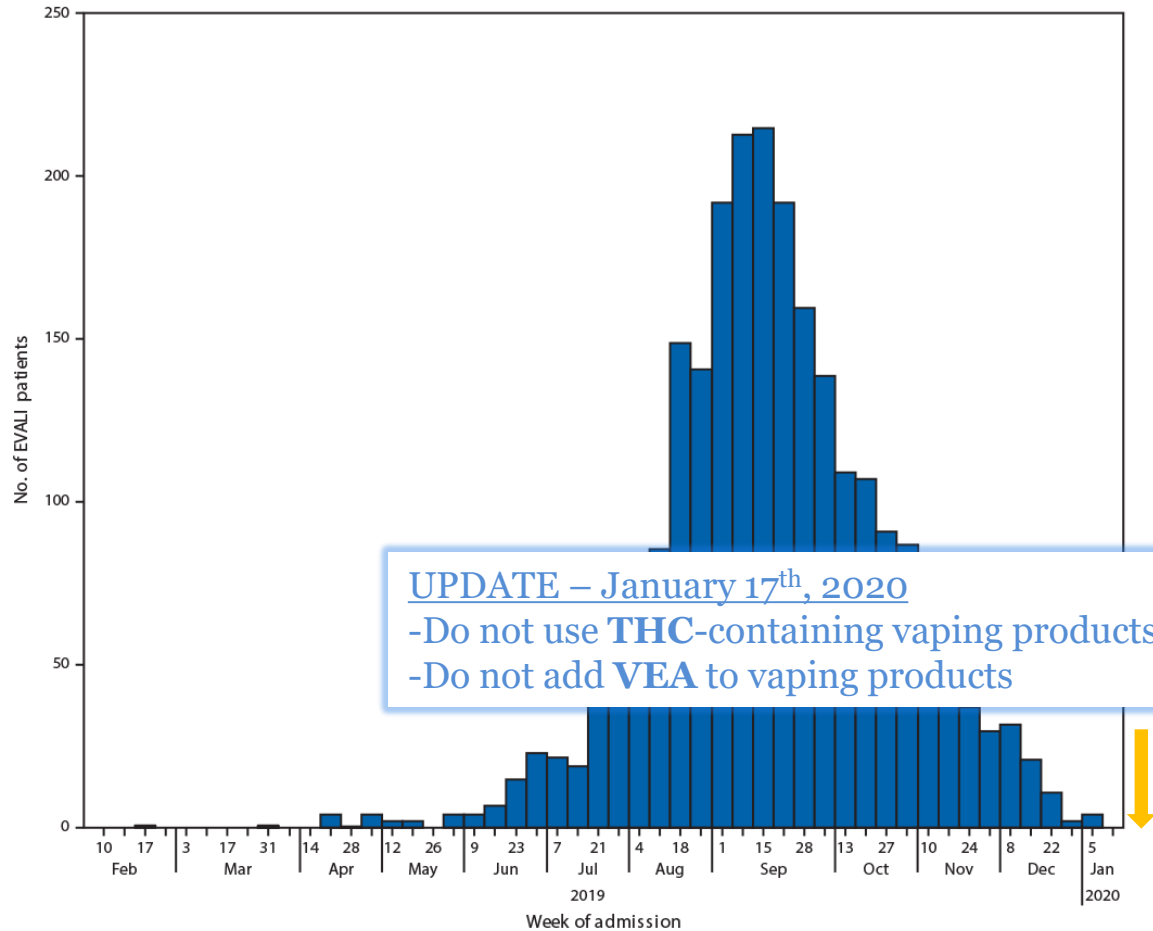
Winding down...

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. Schauer, Ph.D., Director
D.E.I. Kutyrev, M.D., Medical Director
2601 Agriculture Drive
Madison WI 53707-7996

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 / Meshel Lange
Chemical Emergency Response Dept.
2601 Agriculture Dr.
Madison WI 53718

For questions please contact: [Noel Stanton
\(608\) 224-6251
Noel.Stanton@slh.wisc.edu](mailto:Noel.Stanton@slh.wisc.edu) [Meshel Lange
\(608\) 263-6428
Meshel.Lange@slh.wisc.edu](mailto:Meshel.Lange@slh.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**”



Wisconsin State
Laboratory of Hygiene
UNIVERSITY OF WISCONSIN-MADISON

Prof. James J. Schauer, Ph.D., Director
D.E.I. Kurycz, M.D., Medical Director
2601 Agriculture Drive
Madison WI 53707-7996

Wisconsin State Laboratory of Hygiene Vaping solution sample submission form	
Patient Name (if available):	Submitter:
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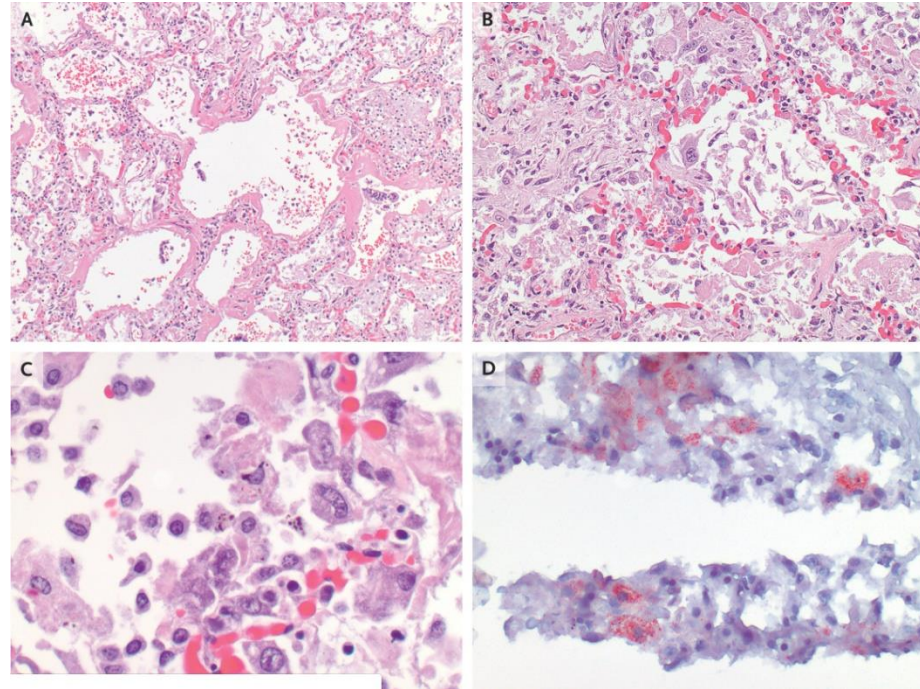
[Meshel Lange
\(608\) 263-6428
Meshel.Lange@shl.wisc.edu](mailto:Meshel.Lange@shl.wisc.edu)

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



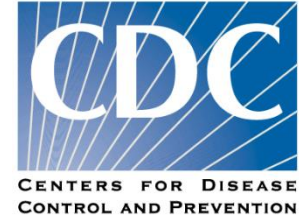
Flavor ban

FDA testing

Harm reduction

Acknowledgements

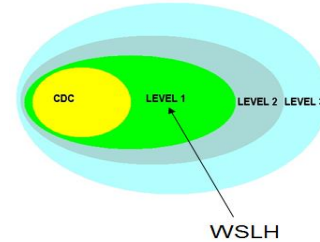
Wisconsin Department of Health Services
Wisconsin State Lab of Hygiene
U.S. Centers for Disease Control and Prevention
U.S. Food and Drug Administration
Children's Hospital of Wisconsin





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





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)