

And the Oscar for Timely Use of SyS Data Goes To...

12:45 PM EST | December 7th, 2022 | 2022 SyS Symposium

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Council of State and Territorial Epidemiologists



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InductiveHealth Informatics LLC





Successes, Solutions, and Similarities: Ways to Maximize Use of Timely Data

12/07/2022

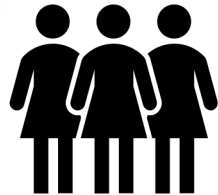
Agenda

- Review examples illustrating data in action
- Identify patterns across examples
- Elicit and discuss best practice

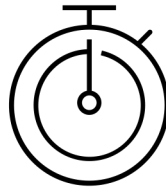
Strengths of Syndromic Surveillance



Tracks
geographic
spread



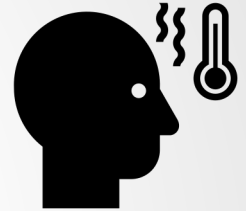
Identifies high-
risk groups



Allows for
timely public
health
intervention



Informs policy
decisions



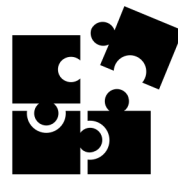
Demonstrates
symptom
development or
changes



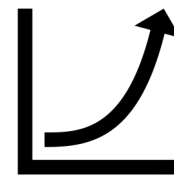
Monitors
individual cases
of reportable
diseases



Validates or
refutes
suspicion of
outbreaks



Supports
traditional
surveillance



Detects peaks
and assesses
magnitude



Often the only
available
resource

Modern Examples of Timely Syndromic Surveillance Methods in Action

Disclaimer: The following examples are publicly available and /or provided by fellow colleagues. We would like to thank them for their work and are proud to highly their efforts in this presentation.

Example 1: Rocky Mountain Spotted Fever (RMSF)

- Brown Dog Tick on reservation
- Limited Medical Resources
- Hx of Missing Dx Created an ESSENCE
- Alert To Catch Potential RMSF Situations & reviewed daily

Local epidemiologists identified a patient who met criteria and was transferred

Medical records indicated the patient had improved on doxycycline but was scheduled for discharge without completing the recommended treatment

Local epidemiologist identified this gap and recommended treatment plan be updated accordingly before discharge.

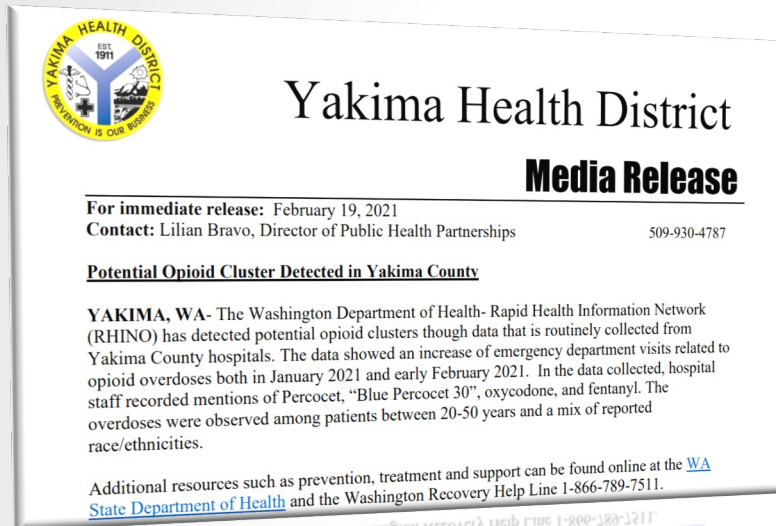


**RMSF is not
locally-acquired in
Maricopa County,
thus not
immediately
suspected**

Example 1: Rocky Mountain Spotted Fever

- ✓ **Trained the system to alert on known situation that needed action**
- ✓ **Developed Protocol for when alerted**
- ✓ **Followed the protocol**
- ✓ **Took swift action to use timeliness as advantage**

Example 2: Opioid Overdose in Yakima County, WA



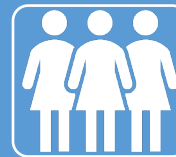
The Washington Department of Health-Rapid Health Information Network detected potential opioid clusters through data that is routinely collected from Yakima County hospitals.



Increase of emergency department visits related to opioid overdoses both in January 2021 and early February 2021.



Hospital staff recorded mentions of Percocet, "Blue Percocet 30", oxycodone, and fentanyl.



The overdoses were observed among patients between 20-50 years and a mix of reported race/ethnicities.



A press release was distributed to inform the community and requested pharmacies to dispense Narcan to patrons at risk.

Example 2: Opioid Overdose in Yakima County, WA



Trained the system to alert on known situation that needed action



Validated cluster and characterized those most at risk



Developed Protocol for when alerted



Followed the protocol



Communicated with partners and community

Example 3: Synthetic Marijuana in the Midwest, 2018



**Poison
Control
Notification**



**Syndrome
Definition
Development and
Utilization**



**Spatial
Cluster
&
Symptom
Identification**



**Follow-Up &
Partnerships**



**Public
Health
Intervention**

Example 3: Synthetic Marijuana in the Midwest, 2018



Public Health Intervention

- Syndromic was most valuable early on as hospitals weren't aware, thus not reporting
- Allowed HD to review line lists and properly communicate with the hospitals and set up more traditional reporting methods.
- Eventually had the product tested and found brodifacoum (chemical in rat poison)
- Treatment is long term and expensive – Vitamin K
- Put out alerts for the public and had product removed

Synthetic Cannabinoids

Synthetic cannabinoids are human-made, mind-altering chemicals.
 Sometimes misleadingly called "K2/Spice" or "fake weed."

K2/Spice is DEADLY

Recently, synthetic cannabinoid users have experienced **SEVERE BLEEDING** resulting in deaths.

Symptoms include coughing up blood, blood in the urine, severe bloody nose, and bleeding gums.

K2/Spice is UNSAFE

- BRAIN**
Suicidal thoughts
Violent behavior
Paranoia
Hallucinations
- HEART**
Rapid heart rate
- STOMACH**
Nausea and vomiting

You never know what chemicals have been added to synthetic cannabinoids making them DEADLY, UNSAFE, and UNPREDICTABLE.

K2/Spice is UNPREDICTABLE

They are not natural, legal, or safe.
 They have brand names such as K2, Spice, Black Mamba, Bombay Blue, Genie, and Zohai.

Shredded, dried plant material + Man-made chemicals = Synthetic cannabinoids (K2/Spice)

If you experience any of these symptoms after using synthetic cannabinoids... CALL 9-1-1

SYNTHETIC CANNABINOIDS ALERT

If you have purchased any synthetic cannabinoids in the past month, DO NOT USE THEM.

What Are They?

Synthetic cannabinoids are human-made, mind-altering chemicals

Sometimes misleadingly called "synthetic marijuana" or "fake weed"

They have brand names such as K2, Spice, Black Mamba, Bombay Blue, Genie, and Zohai

Examples of synthetic cannabinoid brands and packaging

Why Worry?

Individuals are reporting **severe bleeding** after using synthetic cannabinoids.

Synthetic cannabinoids are not natural, legal, or safe.

The health effects from using synthetic cannabinoids can be unpredictable, harmful, and deadly.

What Can You Do?

Alert friends not to use the product.

Do not donate blood or plasma if you have used synthetic cannabinoids.

If you experience any severe, unexplained bleeding or bruising after using synthetic cannabinoids, **have someone take you to the hospital immediately or call 911.** Do not walk or drive yourself.

IDPH
 For more information, visit the Illinois Department of Public Health website at doh.illinois.gov

NYC Health NEW YORK CITY DEPARTMENT OF HEALTH AND MENTAL HYGIENE

2018 Advisory #7

Cluster of synthetic cannabinoid (K2)-related adverse events and emergency department visits, New York City

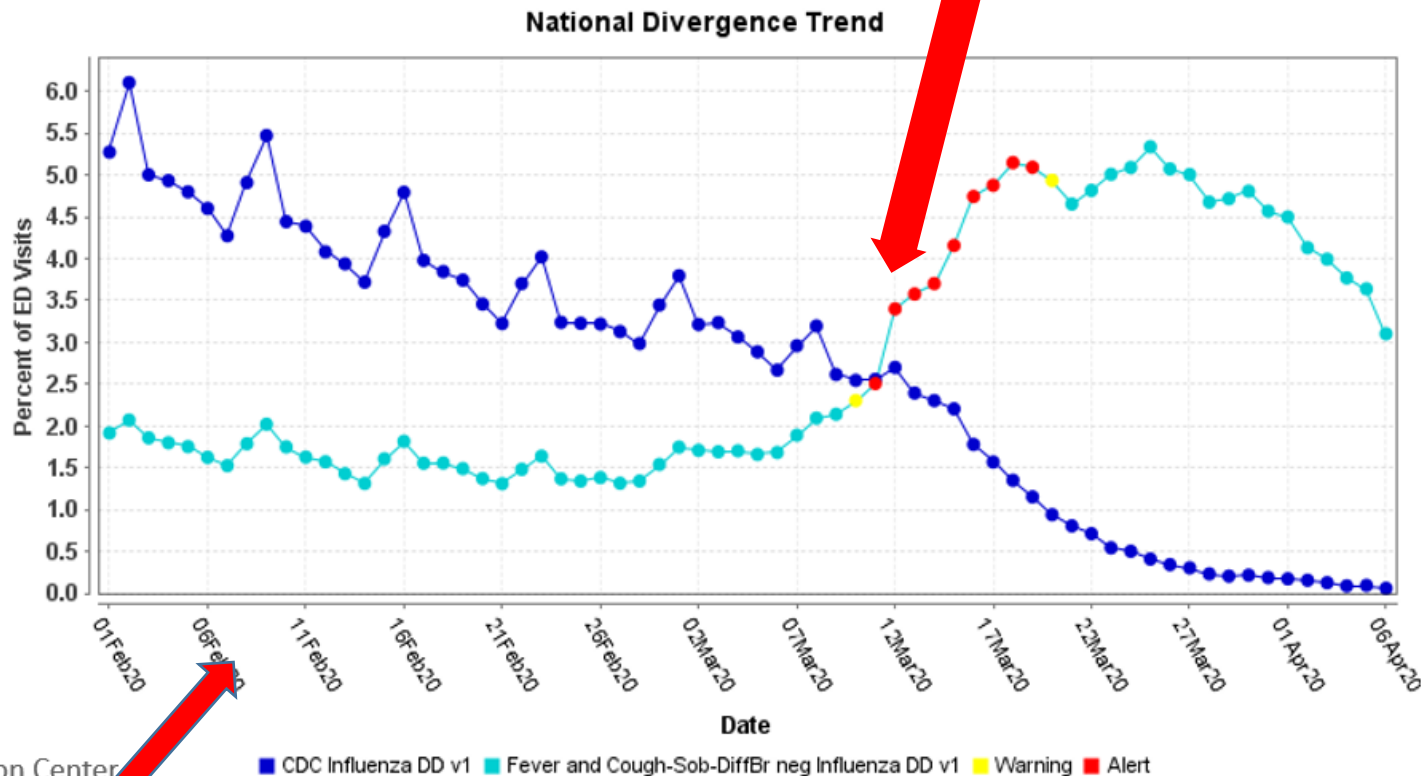
May 22, 2018

Example 3: Synthetic Marijuana in the Midwest, 2018

- ✓ **Confirmed suspicion of wider problem**
- ✓ **Alerted hospitals**
- ✓ **Developed more traditional reporting from sys information**
- ✓ **ID'd probable cases**
- ✓ **Characterized who was at risk**
- ✓ **Put out communications to community and partners**
- ✓ **Took products off the shelves**

Example 4: COVID

Used the CLI definition and a influenza diagnosis-based definition to show divergence between flu and CLI.



Epis used an overlay of symptom-based queries (difficulty breathing, loss of taste and smell, etc.) with Flu ICD codes. When flu dx decreased, but symptoms stayed – it was likely COVID

Beginning of the pandemic - tests not widely available

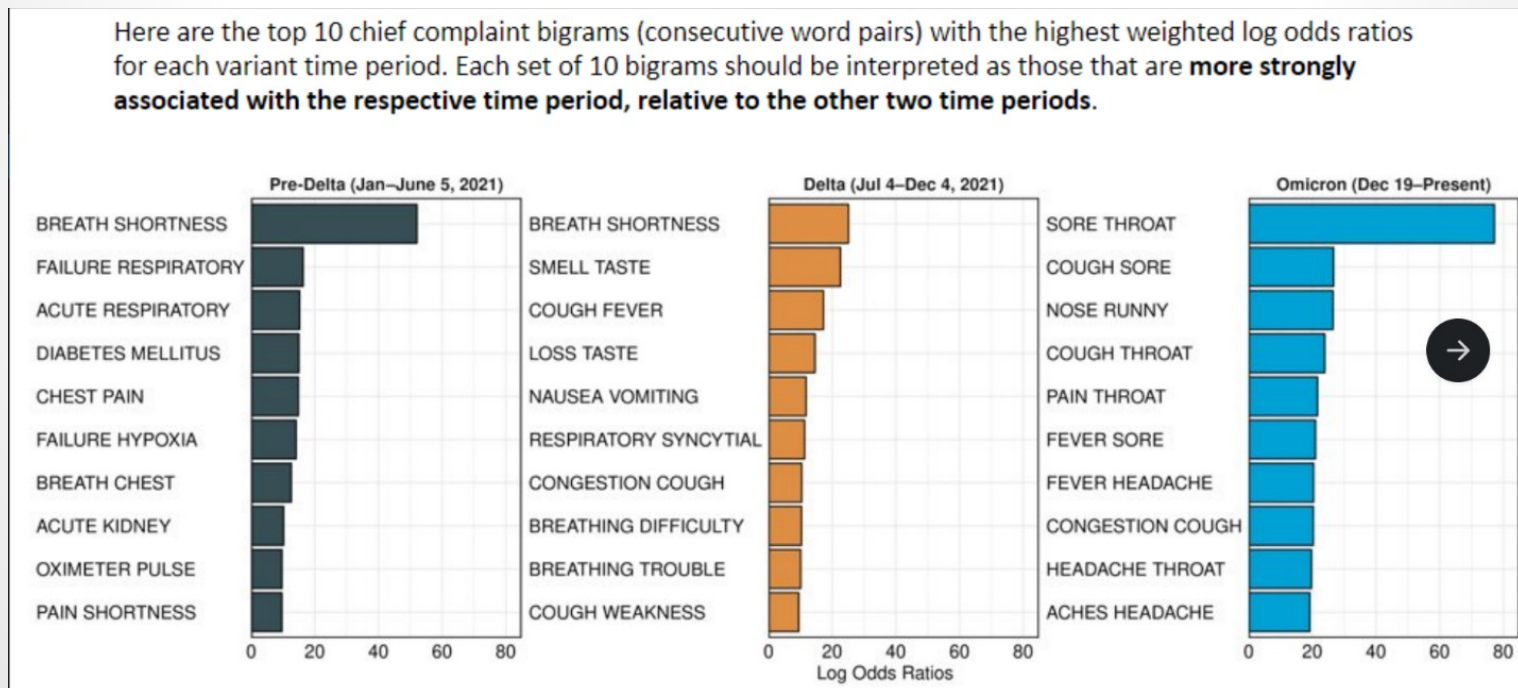
Example 4: COVID



**With little to no other data available,
Creatively used information that was available to develop deeper understanding**

Example 4: COVID

In subsequent surges, we were trying to inform severity, opening society, and mask rules. NSSP staff were able to show changes in severity of language in Chief Complaints using near real time data along with historical data. Confirming anecdotal thoughts about the changing severity.



Example 4: COVID



Applied novel analysis techniques

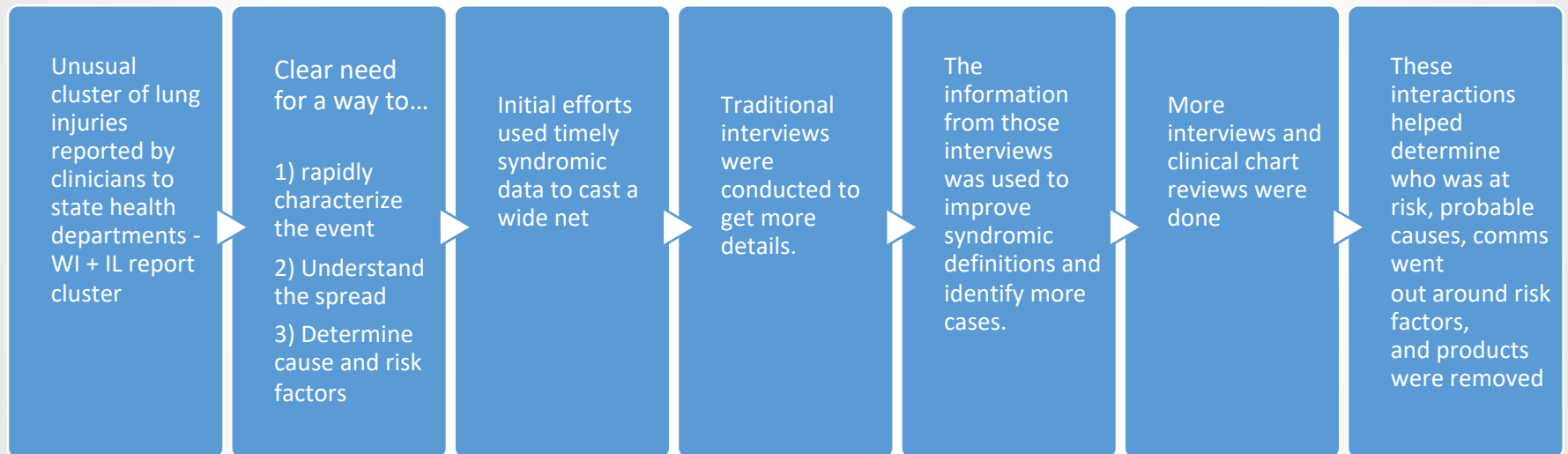


Used flexible text to better understand characteristics



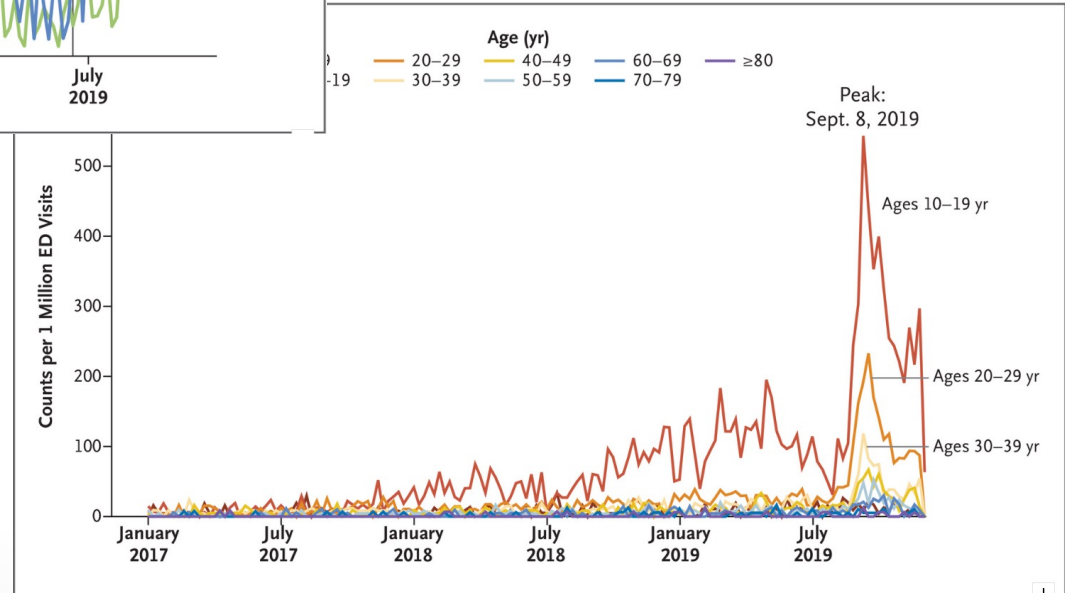
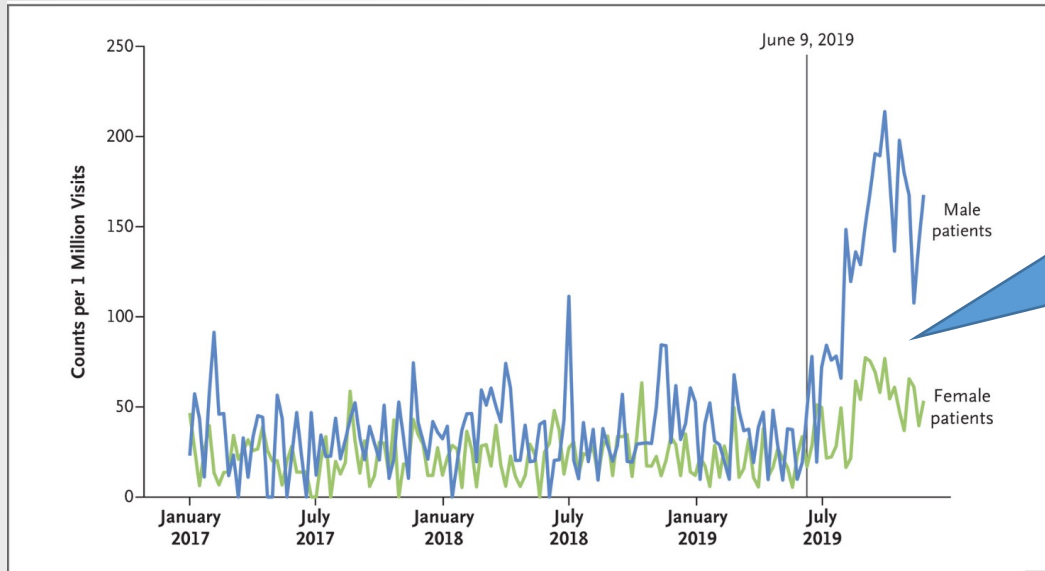
Informed understanding of severity – implications for policies

Example 5: **E**-cigarette/**V**aping, product use **A**ssociated **L**ung **I**njury - **EVALI**



Example 5: EVALI

WI + IL report clusters of severe respiratory illnesses among young adults/adolescents, who reported recent use of electronic e-cigarettes/vapes



Example 5: EVALI



Used available data to rapidly characterize



Used in conjunction with more traditional interview techniques to understand spread and risk factors



Continued to refine definitions as interview information became available



Communicated with community and partners

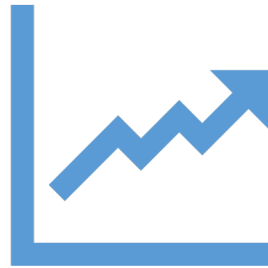


Took product off the shelves

Example 6: Boston, MA Bike Accidents



In 1998, **1200 pedestrians**
transported to local
hospitals
(~3 incidents per day)



Observed **122%** increase in
accidents between 2007-
2009



1,411 bike-related injuries
visits including outside of
Boston zip codes

VS.

768 Bike-related injuries
visits for Boston zip code

Example 6: Boston, MA Bike Accidents

BOSTON
PUBLIC
HEALTH
COMMUNITY
RESPONSE

Boston Public Health Commission
Communicable Disease Control Division

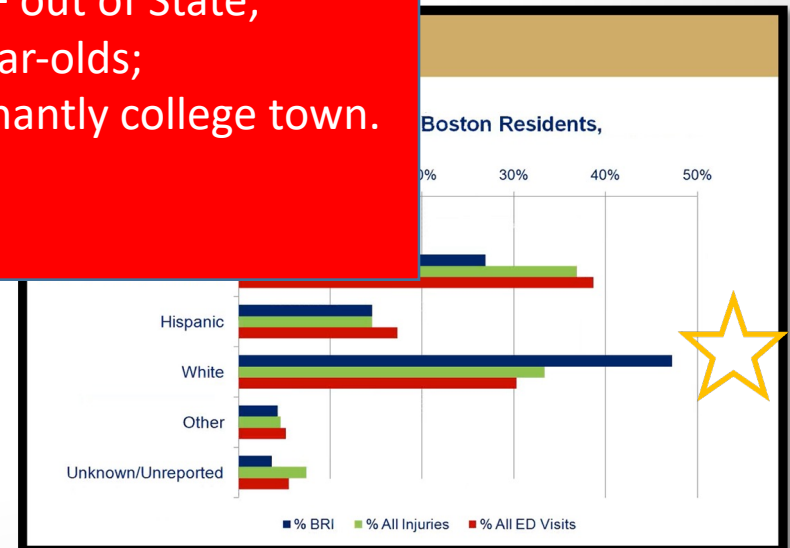
Rate of BRI Visits by Age Group and Boston Neighborhood, 2010

Neighborhood	Age group										Total
	<5	5-9	10-17	18-24	25-29	30-39	40-49	50-59	60+		
Allston/Brighton	4.1	6.7	12.9	38.4	19.2	9.1	11.7	13.0	2.5	16.8	
Back Bay/ Beacon Hill/ West End	0.0	19.9	0.0	8.7	10.6	24.0	24.3	27.2	5.6	14.4	
Charlestown	6.2	23.6	34.0	0.0	10.5	4.6	4.3	10.0	8.9	9.3	
East Boston	0.0	13.4	22.3	2.5	3.4	4.4	4.9	4.2	0.0	5.0	

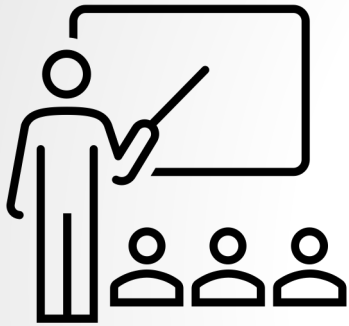
What does this all tell us?

Bike injuries were highest among:

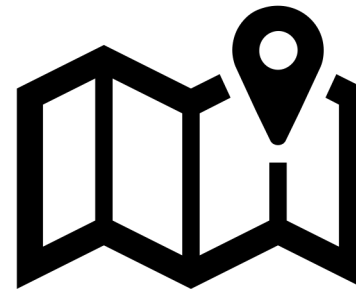
- 1) among out of Boston + out of State;
- 2) white, 18-24-year-olds;
- 3) Allston/Brighton – a predominantly college town.



Example 6: Boston, MA Bike Accident



Data indicated which population was most at risk, thus education efforts were targeted towards college towns



Data identified which intersections to focus redesign efforts

These targeted interventions can be attributed to the timely and smart use of data in combination that didn't exist before the use of ED Syndromic methods.

Example 6: Boston, MA Bike Accident



Worked collaboratively with EMS and Community partners



Combined data sets and used all available data (i.e. race and other demographics) to better characterize risk factors



Communicated with community and partners



Identified and worked with partners to change problematic intersection

Example 7: Chlorine Gas Exposure in GA Swimming Pools

May 19, 2018

- 7 patients, aged 10-12 visited 2 different EDs within a 24 min period
- Patients reported breathing issues and their parents suspected chemical exposure

May 21, 2018

- GA DPH SyS coordinator noticed anomalies in Sys and notified the county's Board of health
- The Board of Health epi determined patients had exposure to an unknown gas during a local swim meet
- The epi notified the EH county supervisor who followed up with the pool company's vice president

May 22, 2018

- During an inspection, it was found that there was exposure to chlorine gas and the pool was immediately closed

Follow-up

- Staff ensured corrective action was taken by pool company prior to reopening
- EH staff educated the pool company on proper and safe management according to county code

Example 7: Chlorine Gas Exposure in GA Swimming Pools



Used alerting to identify cluster



Worked across silos across state and local health departments

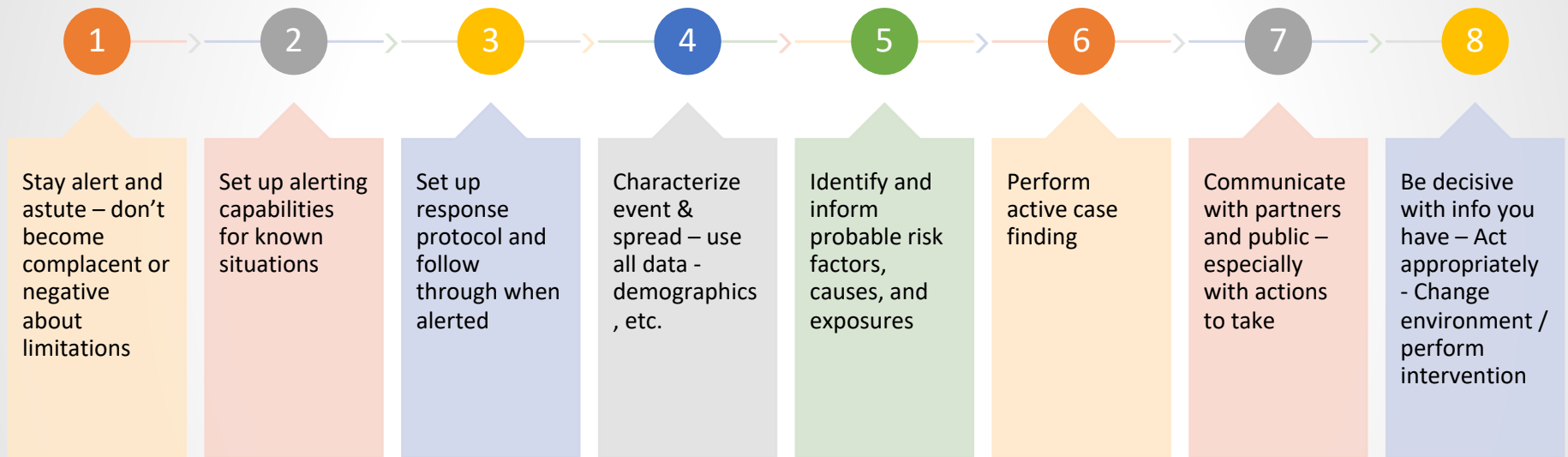


Performed an investigation



Educated pool owner and all other pool operators

The examples highlight key best practices...



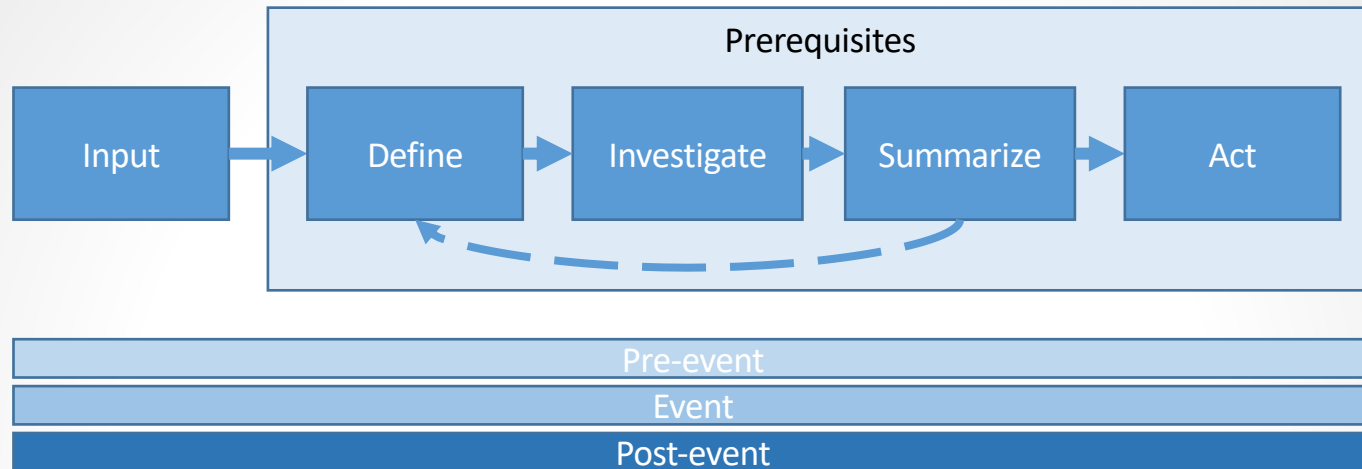
Summary

I was recently asked – what can we do to help health departments take action?

I'm hoping that these types of reviews of where action was taken will be helpful.

We as public health professionals should guard against watching data go up and down and ask ourselves, “so what?” or “so what now?” – what can be done about what you see in the data?

Final Word



- Don't let perfection paralyze you
- Be curious
- Work iteratively
- Be creative
- Think about how syndromic can support/integrate
- Look for gaps that you may be able to fill

Additional Examples

Example 4: COVID

Non-exhaustive ways syndromic has been used for COVID

Identified/ fill-in hospital information

Tracked severity in different populations

Fill in missing case info (e.g., race and ethnicity, occupation, contact information)

Tracked trends

Identified clusters/outbreaks

Tracked ED and hospital utilization

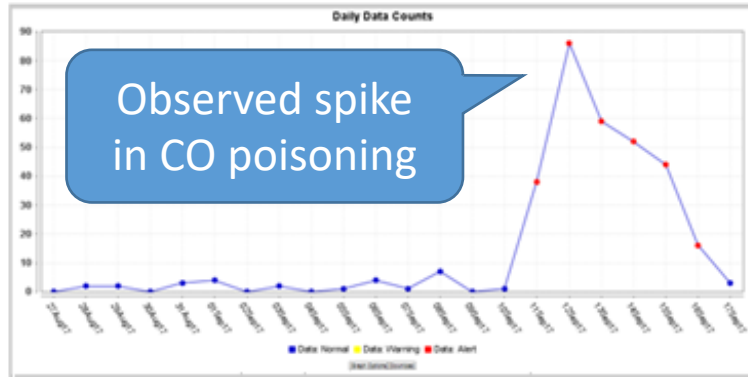
Investigated hospitalizations

Investigated impacts of COVID on mental health and other conditions (e.g.,s MIs)

Tracked, investigated, and identified COVID VAE

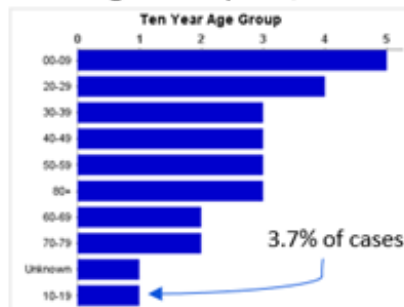
Example: Hurricane Irma Carbon Monoxide (CO) Poisoning

Hurricane Irma Carbon Monoxide (CO) Poisoning

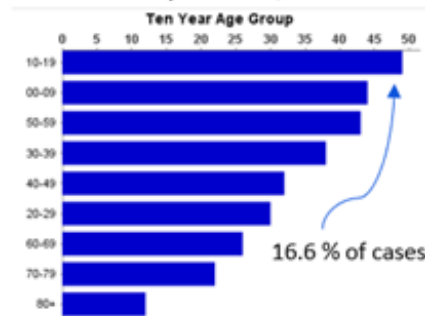


CO poisoning disproportionately affecting 10-19 age group

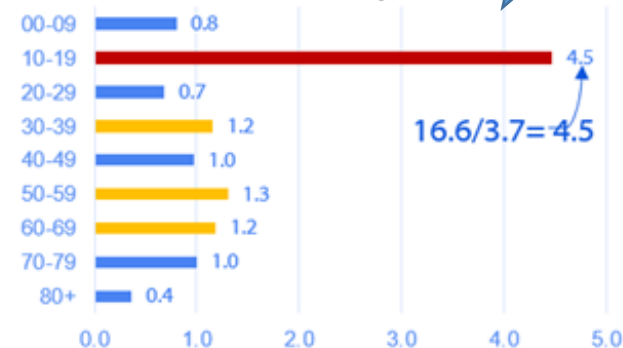
Aug 27 – Sept 10, 2017



Sept 11-16, 2017

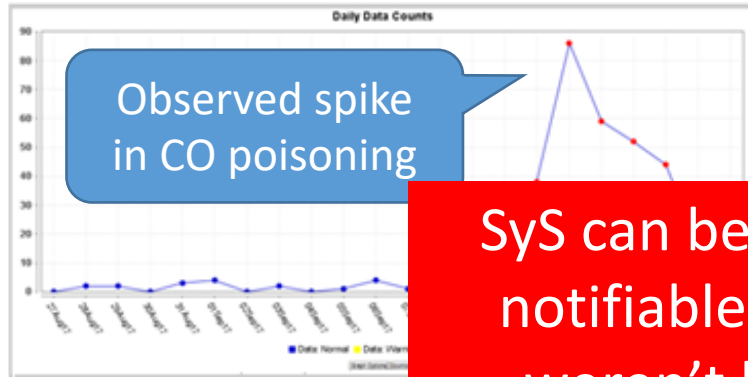


Ratio of % Exposed



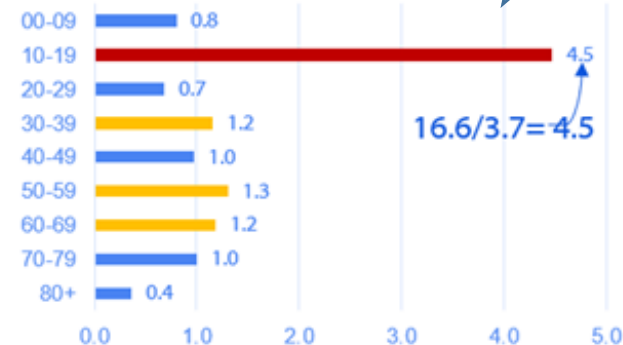
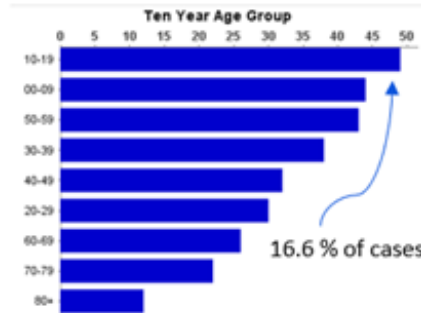
Example: Hurricane Irma Carbon Monoxide (CO) Poisoning

Hurricane Irma Carbon Monoxide (CO) Poisoning



SyS can be used to identify notifiable conditions that weren't being reported

CO poisoning disproportionately affecting 10-19 age group



Additional SyS Examples Than Time to Describe

Lead Poisoning
surveillance in KS

Electric Scooter
surveillance in Austin,
TX

Firearm Injury
surveillance in VA

Monitoring Hurricane
Displaced People in
TN

Wildfire surveillance
in WA

Agriculture Worker
Injury surveillance in
KS

Heat Dome
surveillance in OR

Follow-up Exposure to
Bats in multiple states

Identifying
Unreported
Reportable Conditions
in multiple states

<https://ojphi.org/ojs/index.php/ojphi/article/view/7695> ; <https://communityimpact.com/austin/central-austin/transportation/2019/05/02/cdc-releases-results-of-scooter-study-finds-nearly-half-of-injuries-are-severe/> ; <https://www.vdh.virginia.gov/surveillance-and-investigation/syndromic-surveillance/firearm-injury-surveillance/> ; <https://www.cdc.gov/nssp/success-stories/TN-Population-Changes.html> ; <https://knowledgerepository.syndromicsurveillance.org/syndromic-surveillance-monitor-wildfire-events> ; <https://www.cdc.gov/nssp/success-stories/KS-Agricultural-Workers.html> ; <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5676512/> ; <https://www.cdc.gov/nssp/success-stories/ks-rabies.html> ;



Matthew P. Fallico, MSW
New York Department of Health



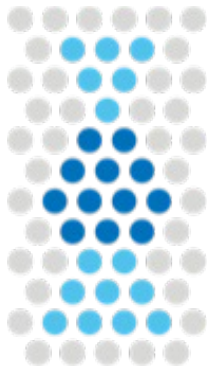


**Department
of Health**

Using Syndromic Surveillance to Identify Gaps in Referrals to Medication for Opioid Use Disorder from Emergency Departments in New York State (Excluding New York City)

NYSDOH – AI Office of Drug User Health
Bureau of Surveillance and Data Systems
Division of Epidemiology

Putting Data to Action Through Syndromic Surveillance



MATTERS

Medication for Addiction Treatment & Electronic Referrals



**Department
of Health**

WHAT IS IT?

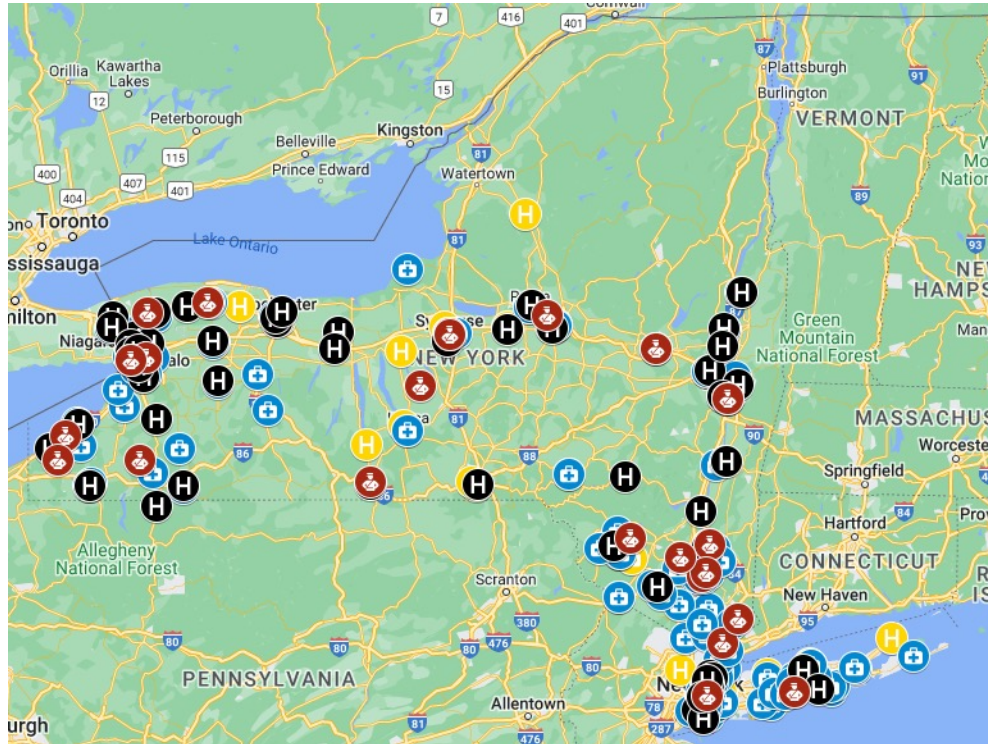
New York MATTERS is a collection of resources to initiate care and quickly link patients to appropriate treatment. It utilizes an electronic platform (hosted by the New York State Department of Health) to efficiently refer patients with opioid use disorder to community-based clinics from emergency departments along with OB/GYN offices, correctional facilities, inpatient units, pre-hospital settings, etc.



newyorkmatters.org



NY MATTERS Network: Current and Future Partners



Clinics *177



Hospitals *70



Future Partners (Hospitals & Clinics)
*32



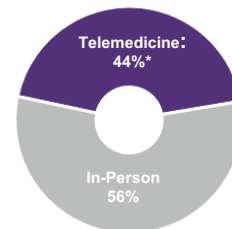
Criminal Justice Settings
(Jails, Prisons, Courts and
Probation) *32



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of Health

1,478
referrals

Including **169**
relinkages to
care



Telemedicine referrals
have been made for
patients from **all 10 NYS**
regions

* Telemedicine referrals are primarily supported by Erie County Medical Center and Kaleida Virtual Emergency Rooms.



Referring Hospitals

70 live
hospitals



Other Referring Sites

68 other referring sites
18 correctional settings (25 referrals)
14 court systems (1 referral)



Receiving Clinics

177 live
clinics
1 telemedicine clinic
(REACH Medical) → **42 patients from 9 of the**
10 NYS regions have been
referred to REACH Medical

35% of hospitals and **38% of clinics** are in zip codes where more than 40% of residents identify as American Indian/Alaska Native, Asian, Black/African American, Native Hawaiian/Pacific Islander, Some Other Race, or Multiple Races.

Initial data suggests **about half (49.2%)** of referred patients **attend their first clinic visit.**



341 **naloxone**
kits provided at
the time of
referral



563 connections
to **peer support**
services



119
medication
vouchers
redeemed

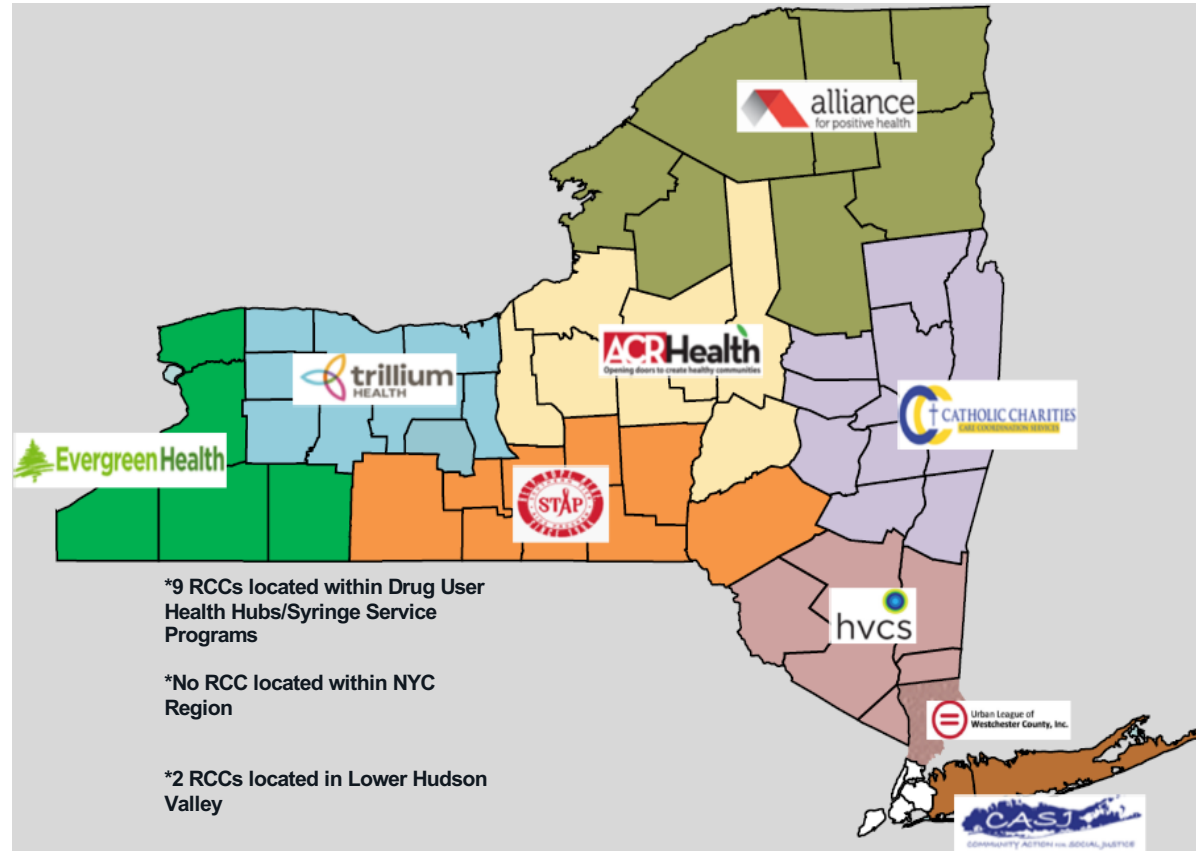


13 **transportation**
vouchers
redeemed

Regional Care Coordinators (RCC)

Primary Responsibilities

- Lead the expansion efforts to further integration of the MATTERS platform to various agencies within the region.
- Ensure follow-up for individuals referred through the MATTERS platform.
- Arrange connection to peer support, transportation, assure transfer documentation completion, monitoring pharmacy voucher submissions, care coordination and confirm arrangements and appointments.
- Providing technical and troubleshooting issues.



Emergency Department Syndromic Surveillance for Overdose Surveillance

- Used as an early detection method for overdose outbreaks
- Daily review to capture overdose spikes and investigate
- Communication sent to LHDs in the event of a CuSum alert or SatScan cluster

Output/Reports

- **CuSum Reports**
- **SaTScan Reports**
- **EDSA Reports**

Cusum Analysis

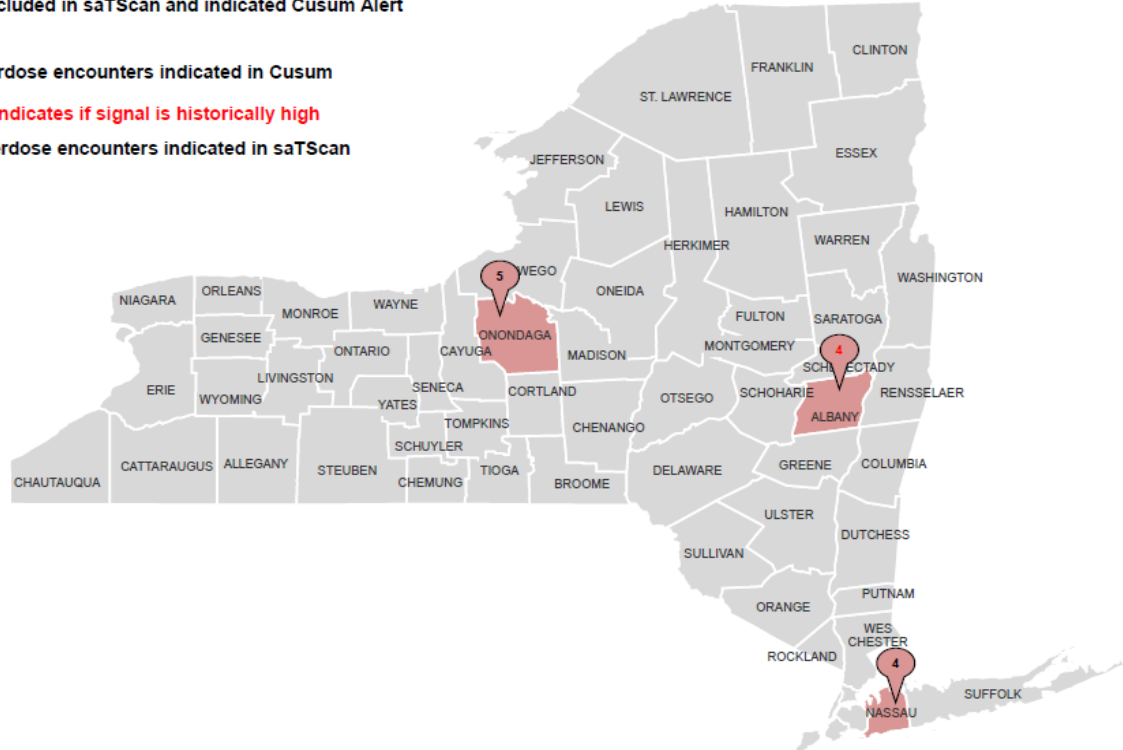
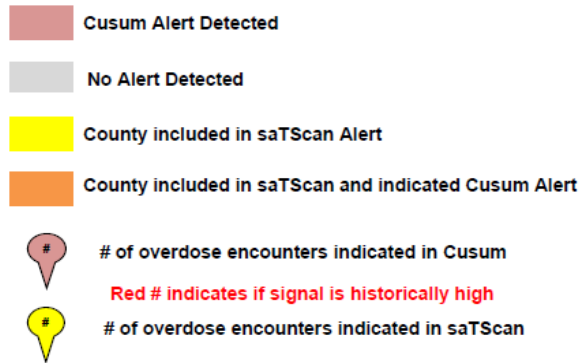
- Used to identify daily counts higher than the 28-day baseline
- 3 reports generated
 - Counts for past 10 days
 - Short-term graph
 - Long-term graph

SaTScan/Cluster Reports

- Report indicating high density of drug overdoses during a period of time.
- Counts are measured by zipcode, so the cluster areas can include several parts of different counties

Emergency Department Surveillance Alerts (EDSA)

- NYSDOH Emergency Department Surveillance Alerts (EDSA) reports include syndromes that pertain to Drug Overdose, Heroin Overdose and Opioid Overdose
- EDSA Reports include Hospital, County, Date of Spike and # included in the Spike
- NYSDOH staff determine NY MATTERS utilization data from facility and communicate with RCCs and NY MATTERS team for targeted outreach/engagement



New York City not included

County	Hospital(s)	# of encounters indicated in facility or county	Date(s) of Spike	Cusum or Satscan Report	Zip Codes included in Cluster	Live in MATTERS (Y/N)?	# of Referrals Made on Date(s) of Spike	# of Referrals Made in the Last 30 Days from Date of Alert	Notes
Nassau	[REDACTED]	4	10/10/2022	Cusum	[REDACTED]	N	0	0	Facility is not a live referral site on NY MATTERS.
Onondaga	[REDACTED]	5	10/14/2022	Cusum	[REDACTED]	N	0	0	Facility is not a live referral site on NY MATTERS.
Albany	[REDACTED]	4	10/14/2022	Cusum	[REDACTED]	Y	0	0	Facility is a live referral site on NY MATTERS. Last referral sent through the platform was on 7/8/2021

*saTScan cluster alerts are based on both location (at the patient's residential zip code level) and time. The cluster detection parameters are set to identify any grouping of overdose cases that are significantly larger than expected in a maximum geographic radius of 20 kilometers and a maximum time span of 21 days.

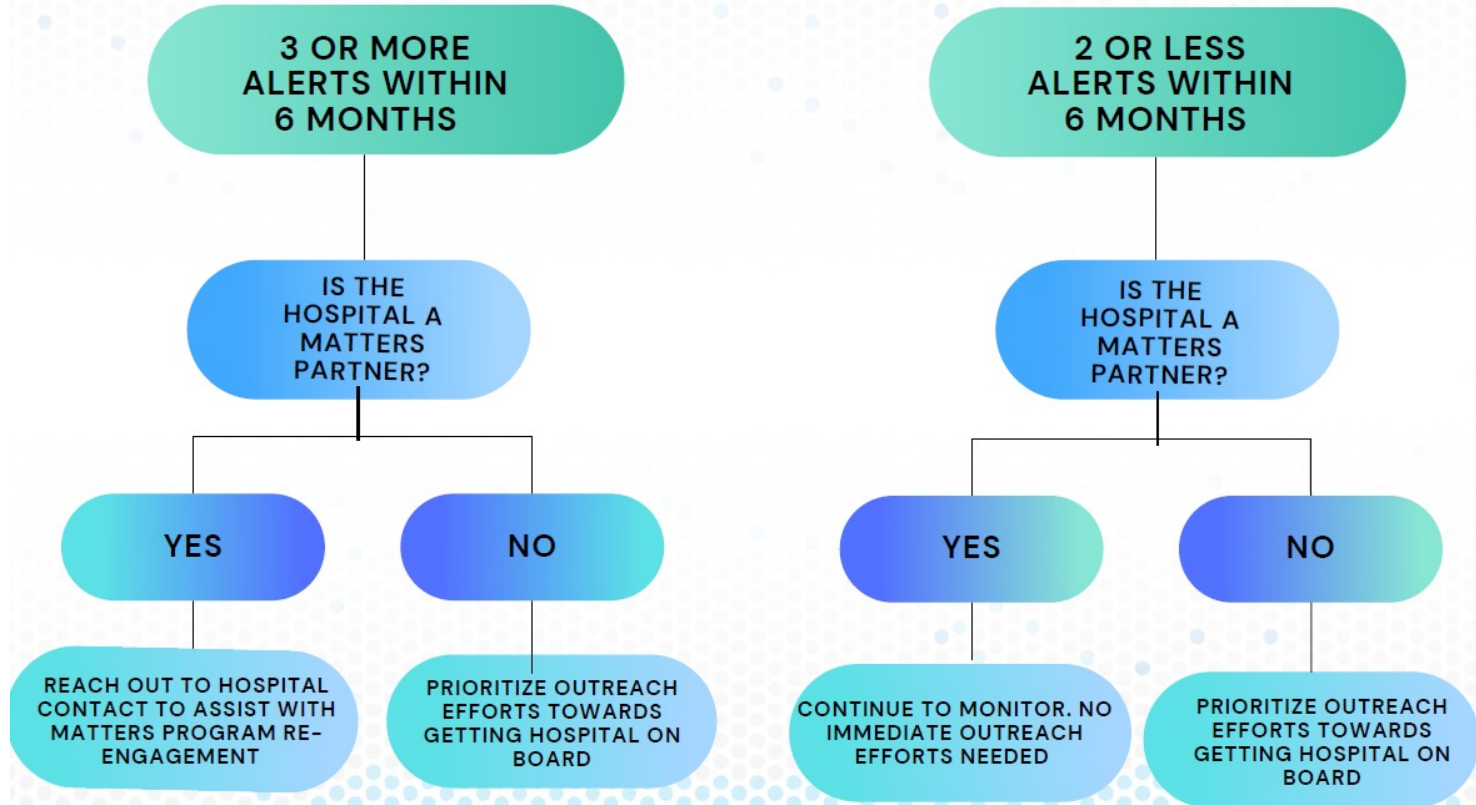
*Cusum cluster alerts compare the "daily counts" of the different types of overdoses seen at a facility or county to a baseline, which is the average of the previous 28 days of data. If a daily count is sufficiently above this baseline average, a signal alert is generated.



Department
of Health



SYNDROMIC SURVEILLANCE GUIDANCE



Outcomes

- 18 EDSA reports sent out to RCCs since June 2022
- 14 **non-live** facilities included in the EDSA reports and engaged by the RCCs
- Southern Tier Regional Care Coordinator

“After the 3rd alert, I got a meeting set up with ED director, COO, CEO and hospital Publicist to discuss NY Matters again. They are very counselling, and abstention minded, but I felt this very noninvasive, “ someone is paying attention” attitude got them to the table after only a few reports.”

What's Next?

- Enhance follow-up response with the Regional Care Coordinators
- Integrate NY MATTERS and the EDSA reports to support rapid response initiative
- Expand syndromic surveillance reporting to include emerging substances captured during encounter (i.e. Xylazine).



Andrew Farrey, BA, MPH
Kentucky Injury Prevention Research
Center (KIPRC)



Rapid Development and Deployment of Two Disaster-Related Syndrome Definitions in Kentucky

Andrew Farrey, MPH

2022 Syndromic Surveillance Symposium
December 7, 2022

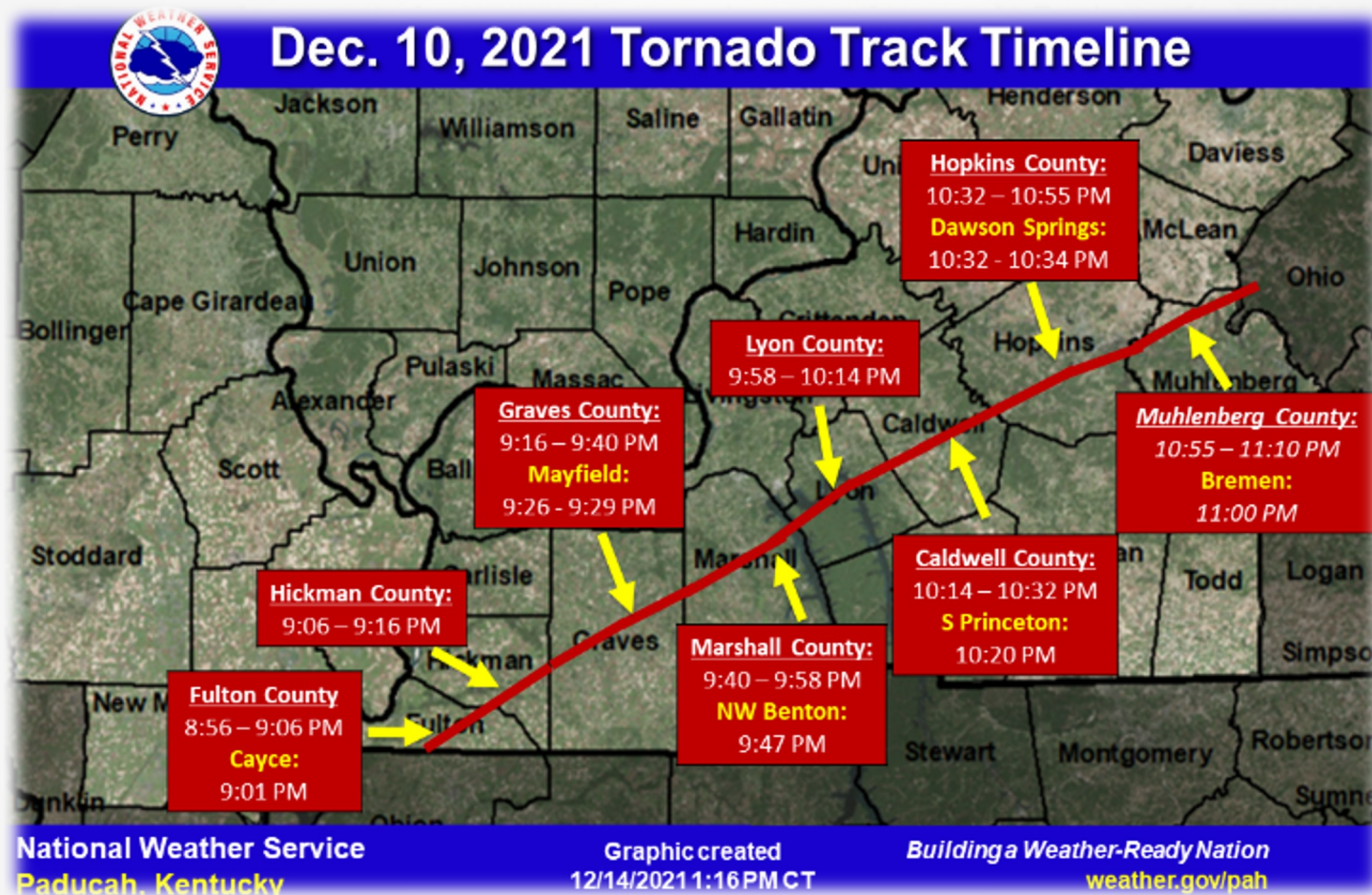
Query Development & Response

2021 WESTERN KENTUCKY TORNADOES

Background of Tornadoes

- On the night of December 10, 2021, an EF-4 (Enhanced Fujita [scale]) tornado touched down in Obion County in northwest Tennessee and continued through 11 counties in western Kentucky. The same night, a second EF-3 tornado touched down in Dyer County, Tennessee, and continued through two Kentucky counties.
- The EF-4 tornado traveled 165.7 miles across Tennessee and Kentucky, making it the ninth longest-tracked tornado in recorded history, with peak winds reaching approximately 190 miles per hour (mph). The EF-3 tornado also covered considerable ground, with a path length of 122.8 miles, with peak winds reaching approximately 160 mph.
- The EF-4 tornado caused 57 deaths and approximately 500 injuries, and the EF-3 tornado contributed an additional 13 injuries.
- Property damage was profound, with the tornadoes resulting in approximately \$3.5 billion dollars of damage combined. The city of Mayfield, Kentucky, was hit especially hard, with more than 3,778 residences, 183 commercial properties, and 103 other buildings damaged or destroyed (weather.gov, 2022).

Path of EF-4 Tornado on December 10, 2021



Timeline of Query Development & Tornado Injury Surveillance

- At approximately 12:30 PM on Sunday, December 12, 2021, the Kentucky Department for Public Health (KDPH) reached out to the Kentucky Injury Prevention and Research Center (KIPRC) for assistance with developing a tornado-specific injury query to rapidly assess the tornado injury burden using NSSP ESSENCE.
- An initial draft of a tornado-specific injury query was developed by midnight on Monday, December 13, 2021, and a report generated in R Markdown was sent out.
 - The initial query consisted of: **^tornado^,or,!tornado!^,or,[;/]88644004^,or,[;/]X37.1^,or,[;/]X371^,or,candle factory/^** (applied to the triage note, discharge diagnosis, CCDD, clinical impression, and admit reason combo fields)
- By Tuesday, December 14, 2021, the query had been expanded and consisted of:
^tornado^,or,!tornado!^,or,rubble^,or,building collapse^,or,[;/]88644004^,or,[;/]X37.1^,or,[;/]X371^,or,candle factory^,or,[;/]X379^,or,[;/]X37.9^
- Tennessee agreed to share data on Kentucky residents treated in Tennessee hospitals to improve coverage of injury surveillance, as Kentucky residents are sometimes treated for life-threatening injuries in Tennessee hospitals due to proximity and/or trauma capability.
- The Rnssp R package was utilized to pull injury counts after initial query development in ESSENCE (Azondekon and Sheppard, 2021).

Timeline of Query Development & Tornado Injury Surveillance

- Beginning Monday, December 13, 2021, a daily injury report summarizing injury counts and injury burden by county and hospital facility was sent out to state partners. The report was in a simplified, easy-to-read Microsoft Word document format.
- Injuries continued to climb over time, as shown on the following slides. The initial report from December 13, 2021, is on the left, and the final report from January 3, 2022, is on the right. Note the increase in patient encounters meeting the syndrome definition as patient encounter information has populated ESSENCE over time.
- Cold Exposure and Unintentional Carbon Monoxide encounters were also monitored throughout surveillance efforts.
- The final injury report, sent on January 3, 2022, identified 300 tornado-related injuries in Kentucky resident emergency department visits.
- False positive injuries were removed using a record-level review, but given how limited the query was, there were not many false positives.

Timeline of Query Development & Tornado Injury Surveillance

Preliminary Report of Injuries Associated with December 2021 Multi-State Tornado Treated in Kentucky Hospitals as of December 13, 2021

Summary – Talking Points

From the ESSENCE syndromic surveillance feed, 138 emergency department encounters for treatment associated with tornado-related injury have been identified in Kentucky and Tennessee syndromic surveillance data.

89 injury encounters were patients from Kentucky counties with tornado touchdown.
94 injury encounters were patients from Kentucky counties with disaster declaration.
35 injury encounters were patients from other Kentucky counties.
3 injury encounters were patients from other states.

These estimates of tornado-related injuries are preliminary as ESSENCE data does not fully populate until up to 96 hours after the treatment encounter date. Additional encounters are likely to be identified.

These counts do not include minor injuries that may have been treated in the field by emergency medical services.

Emergency Department Encounters for Tornado-related injuries by Emergency Department in Kentucky Counties with Tornado Touch Down, December 2021

Hospital	County	Kentucky Residents	Non-residents
Breckinridge Memorial Hospital	Breckinridge	Unavailable	Unavailable
University of Louisville-Medical Center South	Bullitt	0	0
Cumberland Hall Hospital	Christian	Unavailable	Unavailable
Jennie Stuart Medical Center	Christian	0	0
Baptist Health Madisonville	Hopkins	21	0
St. Elizabeth	Kenton	0	0
Logan Memorial Hospital	Logan	0	0
Ohio County Hospital	Ohio	0	0
University of Louisville Health-Shelbyville	Shelby	0	0
University of Louisville – Jewish Hospital Shelbyville	Shelby	0	0

Preliminary Report of Injuries Associated with December 2021 Multi-State Tornado Treated in Kentucky (and Tennessee) Hospitals As of 9:30 PM, 1/3/2022

Summary

From the ESSENCE syndromic surveillance feed, 300 emergency department encounters for treatment associated with tornado-related injury on the night of December 10th, 2021 and morning of December 11th, 2021 have been identified in Kentucky and Tennessee syndromic surveillance data.

- 242 injury encounters were patients from Kentucky counties with tornado touchdown and/or disaster declaration.
- 51 injury encounters were patients from other Kentucky counties.
- 7 injury encounters were patients from other states.
- 49 of 300 injury encounters required inpatient hospitalization (16.33%).

Additional tornado-related injury encounters are likely to be identified, as ESSENCE data are often updated for days or weeks after the actual patient encounter.

Note: these counts **do not** include minor injuries that may have been treated in the field by emergency medical services.

Emergency Department Encounters for Tornado-related injuries by Emergency Department in Kentucky Counties with Tornado Touchdown or Disaster Declaration, December 2021

Hospital	County	Kentucky Residents	Non-residents
Breckinridge Memorial Hospital	Breckinridge	Unavailable	Unavailable
University of Louisville-Medical Center South	Bullitt	0	0
Caldwell Medical Center	Caldwell	Unknown	Unknown
Cumberland Hall Hospital	Christian	Unavailable	Unavailable
Jennie Stuart Medical Center	Christian	0	0
Jackson Purchase Medical Center	Graves	69	0
Twin Lakes Regional Medical Center	Grayson	Unavailable	Unavailable
The Medical Center at Caverna	Hart	0	0
Baptist Health Madisonville	Hopkins	27	0
Logan Memorial Hospital	Logan	0	0
Marshall County Hospital	Marshall	Unavailable	Unavailable
Owensboro Health Muhlenberg Community Hospital	Muhlenberg	Unavailable	Unavailable
Ohio County Hospital	Ohio	5	0
University of Louisville Health-Shelbyville	Shelby	0	0
University of Louisville – Jewish Hospital Shelbyville	Shelby	0	0
Taylor Regional Hospital	Taylor	14	0
Greenview Regional Hospital	Warren	10	0
The Medical Center at Bowling Green	Warren	31	0

Timeline of Query Development & Tornado Injury Surveillance

Emergency Department Encounters for Tornado-related injuries by Emergency Department in Kentucky Counties with Emergency Declaration, December 2021

Hospital	County	Kentucky Residents	Non-residents
Caldwell Medical Center	Caldwell	Unknown	Unknown
Jackson Purchase Medical Center	Graves	■	■
Marshall County Hospital	Marshall	Unavailable	Unavailable
Owensboro Health Muhlenberg Community Hospital	Muhlenberg	Unavailable	Unavailable
Taylor Regional Hospital	Taylor	12	■
Bowling Green Warren County Community Hospital	Warren	Unavailable	Unavailable
Greenville Regional Hospital	Warren	7	0
The Medical Center at Bowling Green	Warren	0	0

Emergency Department Encounters for Tornado-related injuries by Other Emergency Department in Kentucky, December 2021

Hospital	County	Kentucky Residents	Non-residents
St. Elizabeth Edgewood Acute	Kenton	■	0
Baptist Health Paducah	McCracken	24	■
Mercy Health - Lourdes Hospital	McCracken	26	0
Frankfort Regional Medical Center	Franklin	■	0
Georgetown Community Hospital	Scott	■	0
Owensboro Health Regional Hospital	Daviess	5	0
Norton Children's Hospital	Jefferson	■	0
Baptist Memorial Hospital – Union City	Obion (TN)	6	Unknown
Vanderbilt Children's Hospital	Davidson (TN)	■	Unknown
Vanderbilt University Medical Center	Davidson (TN)	18	Unknown
West Tennessee Healthcare Volunteer Hospital	Weakley (TN)	■	Unknown

Data limitations:

1. Edmonson, Fulton, Hickman, Lyon, and Spencer counties do not have an emergency hospital facility in the county.
2. Encounters treated at Breckinridge Memorial Hospital, Cumberland Hall Hospital, Marshall County Hospital, Bowling Green Warren County Community Hospital, Owensboro Health Muhlenberg Community Hospital, and Crittenden Community Hospital, and The Medical Center at Scottsville are not included in this data as these facilities do not participate in syndromic surveillance.
3. "Unavailable" denotes that hospital does not participate in syndromic surveillance.
4. "Unknown" denotes that a hospital participates in syndromic surveillance but is not currently submitting encounter data, or that only data on Kentucky residents was available (for out of state hospitals).

Emergency Department Encounters for Tornado-related injuries by Other Emergency Department in Kentucky, December 2021

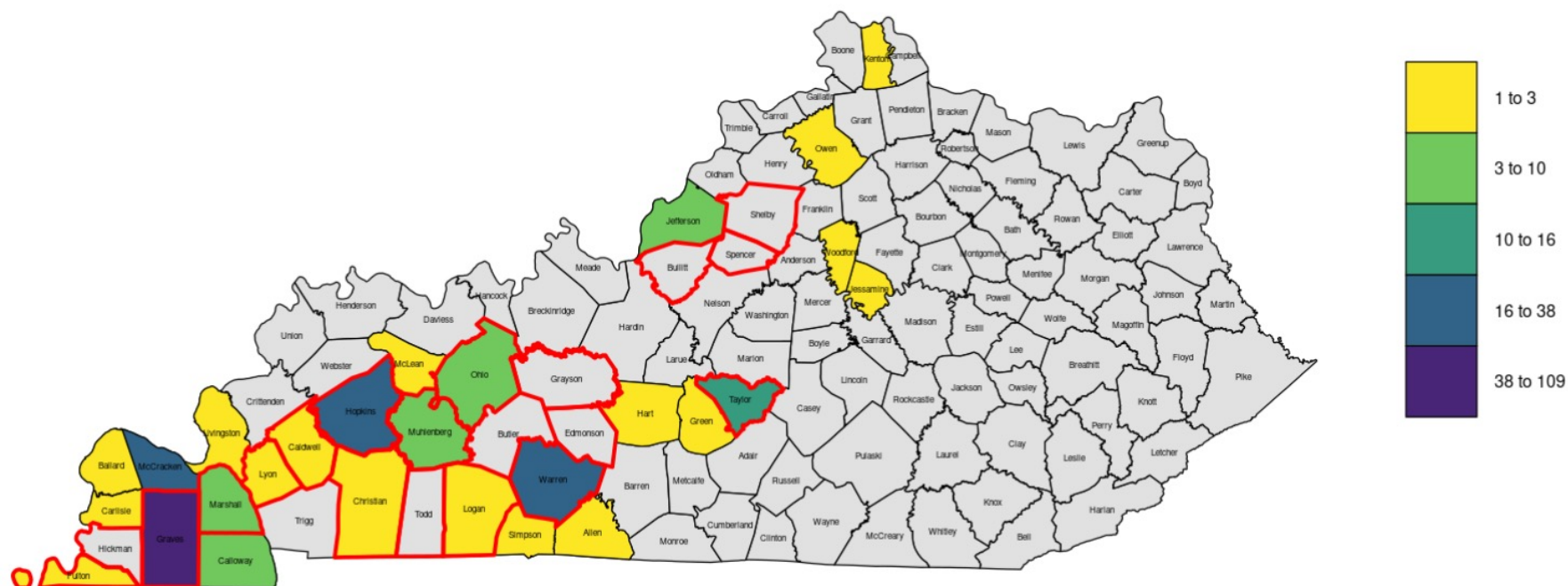
Hospital	County	Kentucky Residents	Non-residents
Baptist Health - Louisville	Jefferson	■	0
Baptist Health - Paducah	McCracken	32	■
Community United Methodist Hospital	Henderson	■	
Mercy Health - Lourdes Hospital	McCracken	31	0
Springview Hospital	Marion	■	0
Frankfort Regional Medical Center	Franklin	■	0
Lake Cumberland Regional Hospital	Pulaski	■	0
Murray – Calloway County Hospital	Calloway	16	■
Owensboro Health Regional Hospital	Daviess	6	0
Norton Children's Hospital	Jefferson	5	0
University of Louisville Hospital	Jefferson	■	0
Baptist Memorial Hospital – Union City	Obion (TN)	8	Unknown
Methodist Le Bonheur Germantown Hospital	Shelby (TN)	■	Unknown
Vanderbilt Children's Hospital	Davidson (TN)	■	Unknown
Vanderbilt University Medical Center	Davidson (TN)	19	Unknown
West Tennessee Healthcare Volunteer Hospital	Weakley (TN)	5	Unknown

Data limitations:

1. Edmonson, Fulton, Hickman, Lyon, and Spencer counties do not have an emergency hospital facility in the county.
2. Encounters treated at Breckinridge Memorial Hospital, Cumberland Hall Hospital, Marshall County Hospital, Owensboro Health Muhlenberg Community Hospital, Crittenden Community Hospital, and The Medical Center at Scottsville are not included in this data as these facilities do not participate in syndromic surveillance.
3. "Unavailable" denotes that a hospital does not participate in syndromic surveillance.
4. "Unknown" denotes that a hospital participates in syndromic surveillance but is either not currently submitting encounter data (i.e., Caldwell County Hospital), or that patient encounter data is only available for Kentucky residents seen by that hospital (for out of state hospitals).

Tornado Injury Counts by County

Kentucky Tornado Injury Counts by County



Summary

- KIPRC developed a tornado injury syndrome definition containing tornado-specific ICD-10-CM codes, Systematized Nomenclature of Medicine—Clinical Terms (SNOMED-CT) codes, and chief complaint search terms based on record-level review and affected structures (e.g., “candle factory”); began conducting surveillance; and began distributing a tornado injury morbidity report to state stakeholders within 72 hours of the tornadoes touching down.
- The tornado injury morbidity reports were utilized to provide preliminary injury counts to the Office of the Governor and state emergency management stakeholders.

Challenges/Lessons Learned

- Identifying injuries related to the tornado without a mention of “tornado” in the chief complaint/admit reason fields or diagnosis code field (trauma-related injuries in the area would likely be due to the tornado, but more difficult to assess with certainty).
 - I recommend using the general injury subsyndrome definition present in ESSENCE limited to the geographic regions of interest to supplement any highly specific query definitions.
- Consider including **chief complaint history** and **discharge diagnosis history** in free-text queries. Message updates can push the chief complaint or discharge diagnosis you’re searching for out of the encounter fields that ESSENCE queries.
- Syndromic surveillance is useful for assessing injury morbidity; however, it should be utilized alongside EMS data to obtain a clearer picture of injury burden.

Query Development & Response

2022 EASTERN KENTUCKY FLOODING

Background of Flooding

- From July 25, 2022, through July 30, 2022, a series of thunderstorm complexes unleashed between 14–16 inches of rain in the heaviest hit areas and between 6–10 inches of rain in a much wider radius throughout eastern Kentucky.
- The heavy rainfall led to significant increases in water levels and flash flooding along rivers and creeks in the area, including the main stem and several forks of the Kentucky River, the Red River, and the Licking River.
- 13 flood warnings were issued; three were upgraded to Flash Flood Emergencies.
- The rainfall totals from July 25 through July 30 were 600% higher than normal rainfall levels and led to dozens of bridges being damaged, roads being washed away, and widespread property damage (weather.gov, 2022).
- The flooding led to 43 deaths, 2 deaths due to health complications sustained during the flooding, and one person is still missing (CNN.com, 2022).

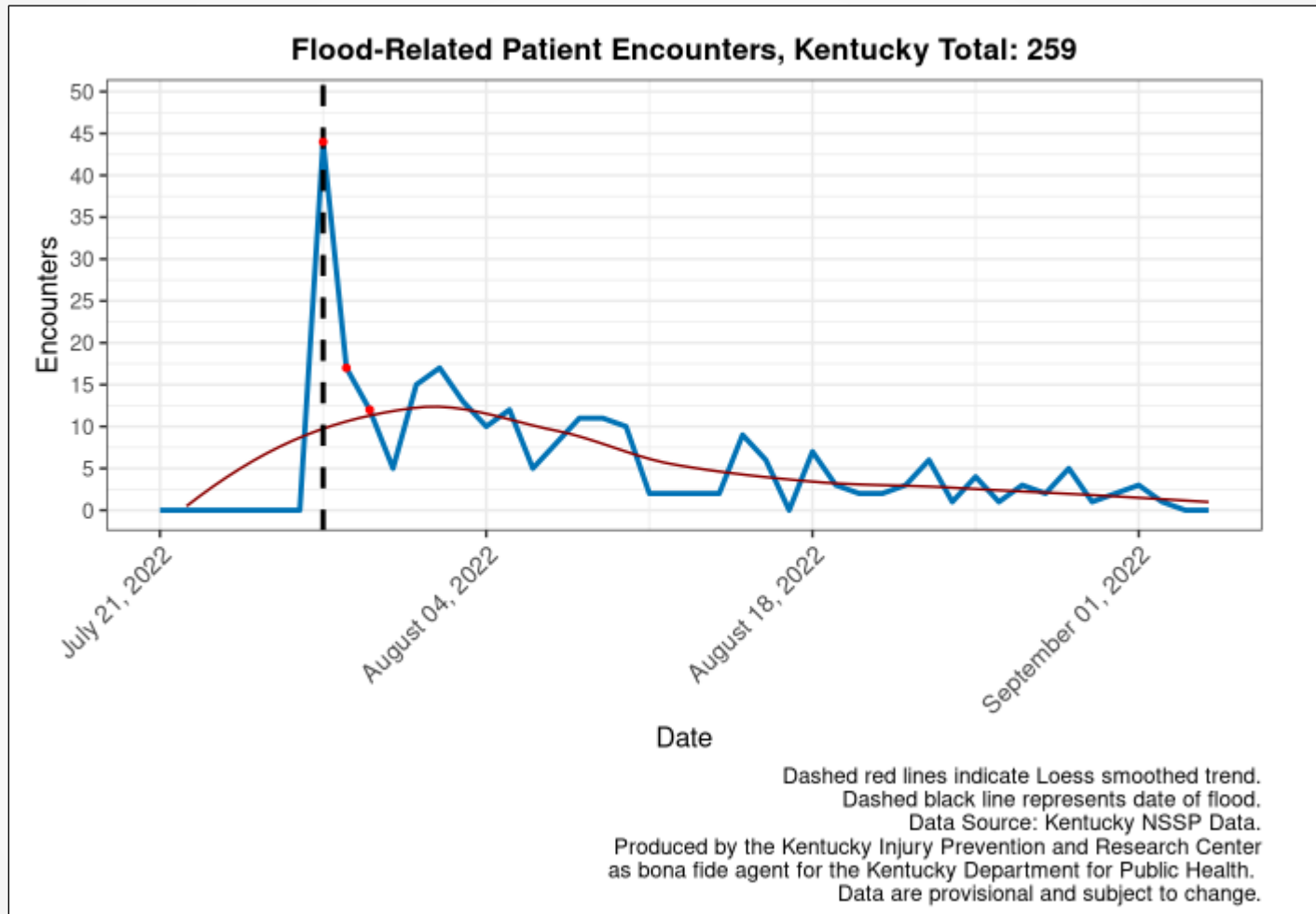
Timeline of Query Development & Flood Injury Surveillance

- At approximately 9:30 AM on Friday, July 29, 2022, the KDPH reached out to KIPRC for assistance with developing a flood-specific injury query to rapidly assess the tornado injury burden using NSSP ESSENCE.
- An initial draft of a flood-specific injury query was developed by midnight on Saturday, July 30, 2022, and a report generated in R Markdown was sent out.
 - The initial query consisted of: `^flood^,OR,^submerge^,or,^flash flood^,OR,^[;/]X3[678]^,OR,^[;/]W16.[134]^,OR,^[;/]W16[134]^,OR,^[;/]W69^,OR,^[;/]W73^,OR,^[;/]W74^,OR,^[;/]T75.[01]^,OR,^[;/]T75[01]^,OR,^[;/]37933009^,OR,^[;/]111056004^,OR,^trapped^,OR,^swept^,OR,^storm^,ANDNOT,((,^thyrstorm^,),OR,^stormi^,OR,^stormy^,OR,^storming out^,)`
- By Tuesday, December 14, 2021, the query had been expanded to consist of: `^rescued^,OR,^stranded^,OR,^drown^,OR,^evacuated^,OR,!flood!,OR,^flood^,OR,^submerge^,OR,^[;/]X3[678]^,OR,^[;/]W16.[134][12]XA^,OR,^[;/]W16[134][12]XA^,OR,^[;/]W7[34]XXXA^,OR,^[;/]W7[34].XXXA^,OR,^[;/]W69^,OR,^[;/]420101009^,OR,^[;/]217727002^,OR,^[;/]242555000^,OR,^[;/]37933009^,OR,^[;/]111056004^,OR,^trapped^,OR,^swept^,ANDNOT,((,^felt like drowning^,),OR,(^felt like [he|she|] was drowning^,),OR,^swimming pool^,OR,^bathtub^,OR,^bath tub^,OR,^[;/]W6[57]^,)` (applied to chief complaint, triage notes, discharge diagnosis, CCDD, clinical impression, and admit reason combo fields)
- The Rnssp R package was utilized to pull injury counts after initial query development in ESSENCE (Azondekon and Sheppard, 2021).

Timeline of Query Development & Flood Injury Surveillance

- Beginning Saturday, July 30, 2021, a daily flood injury report summarizing injury counts and injury burden by county and hospital facility was sent out to state partners. This report was an R Markdown report generated on the KIPRC RStudio Workbench utilizing the Rnssp package to pull ESSENCE data and the blastula package to send out the emails containing the report (Azondekon and Sheppard, 2021).
- Initially, injuries were reported slowly due to power and internet connectivity issues in the area. The first report, which was limited to emergency department visits, detected only 36 patient encounters. The query was expanded to include all patient class encounters and all facility types, which helped to improve detection, as did repair of power and internet utilities.
- Injuries continued to climb over time, as shown on the following slides. Injury surveillance continued until September 4, 2022, with 259 total flood-related patient encounters detected.
- The report also included a section displaying patient encounter counts using several default ESSENCE subsyndrome definitions including “Exposure,” “GI (Gastrointestinal Illness),” “Injury”, and “Heat” subsyndromes. False positive encounters were removed through a line level review, indicating additional refinement of the query would be necessary for long-term utilization.

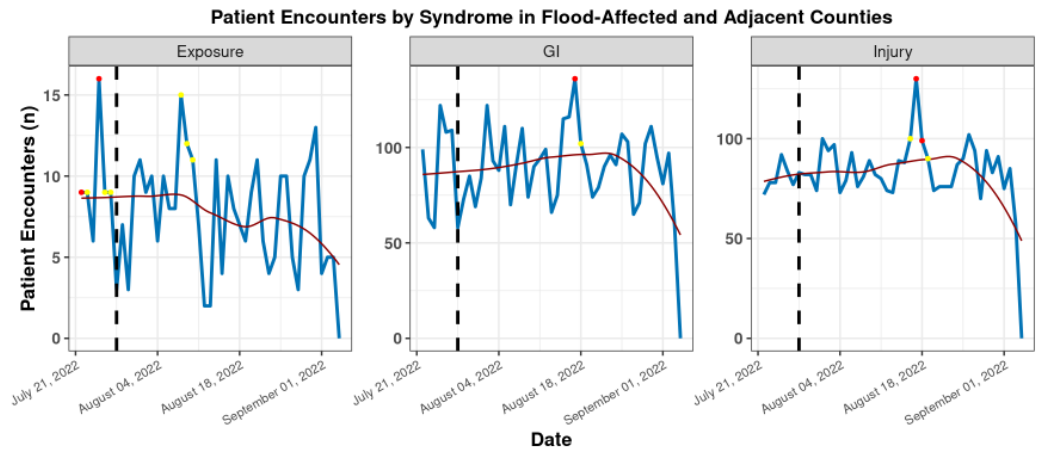
Examples of Metrics Included in Flood Injury Report



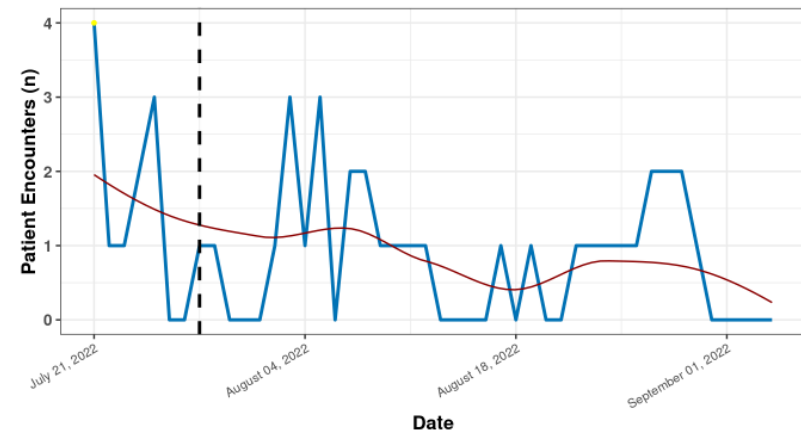
Examples of Metrics Included in Flood Injury Report

Statewide Flood-Related ED Visits By Age Since 7/28/2022

Age Group	Total Flood-Related ED Visits
Ages 0 through 4	18
Ages 5 through 17	14
Ages 18 through 44	45
Ages 45 through 64	58
Ages 65+	64



Heat Injury Patient Encounters by Syndrome in Flood-Affected and Adjacent Counties



Red lines indicate Loess smoothed trendline.
 Data Source: Kentucky NSSP Data.
 Produced by the Kentucky Injury Prevention and Research Center
 as bonafide agent for the Kentucky Department for Public Health.
 Data are provisional and subject to change.

Summary

- KIPRC developed a flood injury syndrome definition containing tornado-specific ICD-10-CM codes, Systematized Nomenclature of Medicine—Clinical Terms (SNOMED-CT) codes, and chief complaint search terms based on record-level review; began conducting surveillance; and began distributing a flood injury morbidity report to state stakeholders within 72 hours of the request.
- The flood injury morbidity reports were utilized to provide preliminary injury counts to the Office of the Governor and state emergency management stakeholders.

Challenges/Lessons Learned

- Identifying injuries related to flooding without a mention of “flood” in the chief complaint/admit reason fields or diagnosis code field is difficult.
 - Using general subsyndrome definitions present in ESSENCE limited to the geographic regions of interest is useful for supplementing free-text query definitions.
- Consider including **chief complaint history** and **discharge diagnosis history** in free-text queries. Message updates can push the chief complaint or discharge diagnosis you’re searching for out of the encounter fields that ESSENCE queries.
- Syndromic surveillance is very useful for assessing injury morbidity; however, it should be utilized alongside EMS data to obtain a clearer picture of injury burden.

Thank You!

Additional questions:
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