# Disaster Mortality Surveillance in Kentucky

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**CSTE Disaster Epidemiology Workshop**
**May 11, 2022**

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# Objectives

- Discuss methods for mortality surveillance
- Learn from real-life examples advantages and disadvantages of different ways of collecting mortality data
- Discuss “best practices” for mortality surveillance
- Discuss how different methods of collecting mortality data will differ depending on the disaster

# Disaster Mortality Surveillance Methods

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# Mortality Surveillance in Kentucky

- Several pathways of conducting mortality surveillance
  - Death certificates – traditional method
  - Direct reporting from the field – public health, healthcare, coroners, medical examiners
    - Immediate reports of deaths
    - Further investigation of deaths
    - Useful, and likely critical, in rapid or mass casualty situations
  - Ad hoc methods – syndromic surveillance, public, other government activities, internet searches
- Different methods may be useful or work in tandem in disaster situations
- What method takes primacy might depend on the disaster
  - Can choose the same method for all PH disasters
  - But choosing what to use for a particular situation will likely give more desirable results

# Disaster Mortality Primary Methods

- Death certificates (DC)
  - The “gold standard” for many reportable diseases and conditions
  - Likely to be quicker now than it was historically due to electronic death registration systems
  - Tends to be delayed for some deaths in any situation but can be modified to increase timeliness during disasters
    - Alert coroners, ME’s, clinicians to submit death certificates immediately for disaster-related deaths
  - Not as useful for immediate death tallies in natural disaster responses (tornadoes, winter storms, hurricanes)
- Direct reporting from the field
  - Reports solicited from
    - Regional Epidemiologists/Preparedness Coordinators
    - Coroner/medical examiner network
    - Clinicians can be alerted to (and how to) report disaster-related deaths immediately
    - Coroner Liaison Officer in State Emergency Operations Center (EOC)
  - In Kentucky, deaths entered into stand-alone mortality data system by Regional Epidemiologists
    - Reviewed and approved by Mortality SME
    - Included in final data set once confirmed as disaster-related
  - The “people network,” is as important as the data system
  - Vetting process makes this most effective in mass casualty situations

# Direct Mortality Reporting System in Kentucky

- Mortality Data Management System (MDMS) currently used by Kentucky Department for Public Health
  - Mortality identification system developed in early 2000's for mass casualty events (e.g., plane crashes, 9/1/1 type attacks)
  - Modified for disaster mortality surveillance use case in Kentucky around 2007
  - Used for many large-scale mortality events since then
    - H1N1: 2009-2010
    - Hurricane: 2009
    - Ice Storm: 2009
    - Tornados: 2012, 2021
    - COVID-19: 2020-22
    - Seasonal Influenza 2014 to present
  - Managed by KDPH with assistance from software creator
- When Disaster occurs
  - Event created in MDMS
  - Coroners, medical examiners and regional epidemiologists alerted
    - Seek out disaster-related deaths
    - Investigate to determine circumstances
  - Regional epidemiologists and/or coroners enter individual deaths into MDMS
  - Administrator evaluates each death to determine if it is disaster-related

# Kentucky COVID-19 Mortality Surveillance

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# Kentucky COVID-19 Mortality Review Process

- Two-prong process to detect possible COVID-19 deaths
  - Direct reporting
    - MDMS initially but replaced by REDCap database for direct data entry
    - Regional Epidemiologists/Local Health Departments report
  - Death certificate search
    - Weekly electronic search of all death certificates
    - January 2020 – present
      - First KY COVID-19 case March 6, 2020 – first death March 15, 2020
      - Now restricted to January 2021 – present
    - Based on Key Word and ICD-10 Code search
      - Key words: COVID, SARS, covid-19, sars-cov-2, cov2, sars-coronavirus, cov-2, cov-19, sars-cov
      - ICD-10: U07.1
      - Primary or contributing cause of death or ICD code field
- Successive review process to determine if death is COVID-related:
  - Collect data – epi team makes clear-cut determinations immediately
  - Gather additional data on unclear cases – make decision if becomes definitive
  - Refer to Mortality Review Group (MRG) for more difficult determinations

# Mortality Team Process

- Mortality Team composition
  - Three FTE epidemiologists
  - 1-3 part-time epidemiologists
  - COVID Data team members who process data requests and run the weekly DC searches
- Mortality Team review process
  - Initial review and declaration
    - Death within 6 weeks of positive test
    - Nothing unusual noted through case investigation
    - May be declared quickly if symptoms match
  - Secondary review if indicated
    - Death >6 weeks from initial positive test for most recent illness
    - Symptom profile doesn't match (e.g., noted as asymptomatic or mild symptoms only)
    - Another major cause(s) of death indicated in case investigation
    - Death certificate available but does not report COVID-19 as a primary or contributing cause of death
  - Access all available information – Regional Epi/LHD investigation, NEDSS
  - Make determination COVID vs. non-COVID
  - Refer to Mortality Review Group (MRG) for all difficult cases

# Kentucky Mortality Review Group (MRG)

- MRG composition
  - 1-3 physicians
  - 1-2 nurse consultants
  - 1-2 senior epidemiologists
  - 1-2 Mortality Team Leads
  - Administrative specialist
- Meeting rhythm
  - Weekly for 1-1.5 hours
  - Sufficient for regular workload
  - During surge, met additional 1-3 hours/week
    - Physician (Deputy Commissioner) and Chief Nurse pre-screened deaths
    - Cleared “easier” determinations
- Try to process all deaths within 2-weeks to 1 month from referral to MRG
  - Sometimes takes longer to finalize difficult cases – very young, very complicated

# KY Mortality Review Group Process

- MRG Process
  - Mortality Team Leads present data on each case
  - MRG reviews each death individually
  - Additional information often requested
    - Hospital discharge notes
    - LTCF/hospice notes
    - Coroner notes
    - Search KY Health Information Exchange (KHIE) and NEDSS for additional information
  - Final determination made
    - Based on clinical and epidemiologic judgment considering all available information
    - Will be reviewed in subsequent meeting if information needed
    - *Agree with DC if nothing available to refute*
- MRG usually processes
  - Deaths >6 weeks from positive test
  - Deaths that look like COVID but DC doesn’t specify COVID in any way
  - Deaths where DC specifies COVID but other data directly contradicts this or it is unclear
    - Particularly when time since infection is very long
    - “History of COVID-19” is listed on DC

# Does Case Definition Make a Difference?

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# CSTE Interim Mortality Surveillance Guidance

**CRITERIA FOR USE WITH CONFIRMED CASES:**

1. The case meets the confirmed COVID-19 surveillance case definition, AND at least ONE of the following criteria is met:

   a. A case investigation determined that COVID-19 was the cause of death or contributed to the death.

   b. The death certificate indicates COVID-19 or an equivalent term as one of the causes of death, regardless of the time elapsed since specimen collection of the confirmatory laboratory test used to define the case.

   c. The death occurred within (and including) 30 days of specimen collection for the confirmatory laboratory test used to define the case and was due to natural causes (e.g., the Manner of Death is coded as “natural” on the death certificate.)

**CRITERIA FOR USE WITH PROBABLE CASES:**

1. The case meets the probable COVID-19 case definition AND a case investigation determined that COVID-19 was the cause of death or contributed to the death.

   OR

2. The case meets the probable COVID-19 surveillance case definition based on presumptive laboratory evidence AND death occurred within (and including) 30 days of specimen collection and was due to natural causes (e.g., the Manner of Death is coded as “natural” on the death certificate.)

   OR

3. The case meets the probable COVID-19 surveillance case definition based on epidemiologic linkage and meeting clinical criteria, AND death occurred within (and including) 30 days of symptom onset and was due to natural causes (e.g., the Manner of Death is coded as “natural” on the death certificate.)

   OR

4. The case meets the probable COVID-19 surveillance case definition based only on vital records criteria (i.e. a deathc ertificate that lists COVID-19 disease or SARS-CoV-2 or an equivalent term as an underlying cause of death or a significant condition contributing to death and there is no confirmatory or presumptive laboratory evidence.)

| Criteria for identifying COVID-19 associated deaths among COVID-19 cases | 2020 Additional deaths (% of total new deaths) | | 2021 Additional deaths (% of total new deaths) | |
|---|---|---|---|---|
| 1b. Confirmed COVID case and DC indicates COVID | 99 | (4.1%) | 471 | (19.5%) |
| 1c. Confirmed COVID case, death occurred within 30 days of specimen collection, and "Natural Causes" indicated on DC | 471 | (19.5%) | 490 | (20.3%) |
| 2. Probable COVID case based on presumptive laboratory evidence and death occurred within 30 days of specimen collection | 37 | (1.5%) | 87 | (3.6%) |
| 3. Probable COVID case based on epidemiologic linkage and meeting clinical criteria, and death occurred within 30 days of symptom onset | 4 | (0.2%) | 22 | (0.9%) |
| 4. Probable case based only on vital records criteria (excluding "Hx of COVID" on DC) | **207** 165 | (8.6%) | **529** 397 | (21.9%) |
| **Total Reported COVID deaths for Kentucky: 12,255**<br>**2,417 additional deaths using CSTE mortality definition (19.7% ⇧)** | | | | |

# Criteria 1b: Confirmed COVID case and DC indicates COVID--Additional deaths included by increasing time limits from specimen collection date to death.

| Time between DOD and most recent confirmatory lab | 2020 | 2021 |
|---|---|---|
| 2 months | 69 | 178 |
| 3 months | 14 | 57 |
| 4 months | 7 | 45 |
| 5 months | 3 | 21 |
| 6 months | 2 | 20 |
| >6 months | 4 | 150 |
| Total additional COVID deaths | 99 | 471 |

# Criteria 4: Probable Case Based on Death Certificate Alone

| Evaluation Criteria | 2020 | 2021 |
|---|---|---|
| Deaths identified through DC search (including Hx of COVID) | 4629 (vs. 4914 KY reported)<br><br>285 fewer reported deaths | 7877 (vs. 7341 KY reported)<br><br>536 additional reported deaths |
| Deaths identified through DC search (excluding Hx of COVID) | 4465 (vs. 4914 reported)<br><br>449 fewer reported deaths | 7731 (vs. 7341 reported)<br><br>396 additional reported deaths |
| Reported COVID deaths without COVID listed on DC | 550 | 504 |

# KY COVID Mortality Surveillance Take-Homes

- Death certificates, direct reporting, and mortality review process combined to yield more accurate counts of COVID-related mortality
  - Labor intensive
- Different mortality case definitions can produce different results
  - CSTE Mortality definition would increase Kentucky 2020-21 case counts by 19.7%
  - Death certificates alone showed variable results compared to KY's process
- Using a standard mortality case definition nationwide could be a good idea
  - May reduce workload if more automated
  - Could increase or decrease reported deaths substantially based on criteria
  - Data can help determine most effective model
- Death certificates alone may come closer to reality
  - Will misclassify some deaths wrong both ways – COVID vs. Non-COVID
  - Caveat – exclude "History of COVID" cases
  - Adding reporting mechanism to catch deaths not noted on DC advisable

# 2021 Tornado Response Mortality Surveillance

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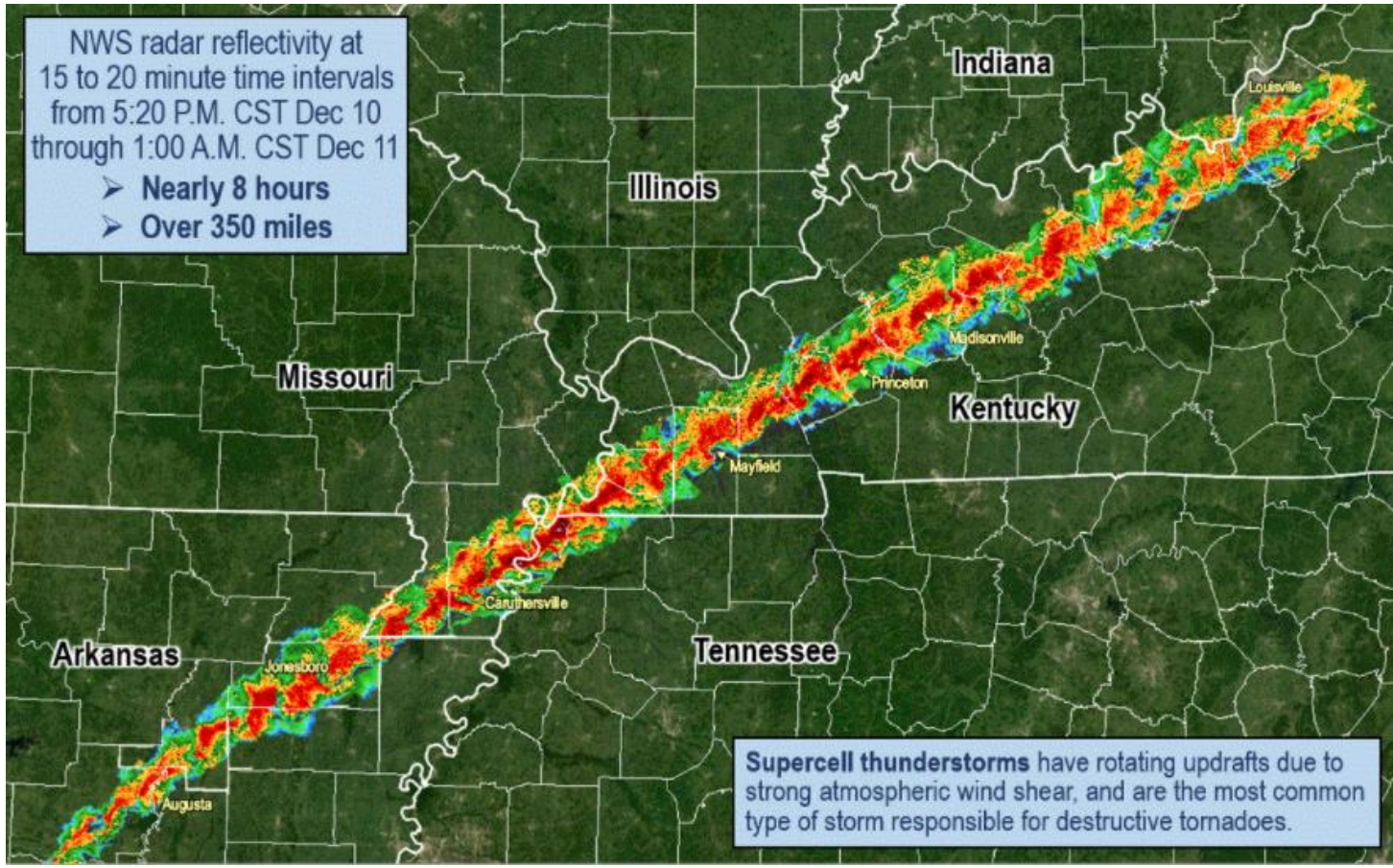
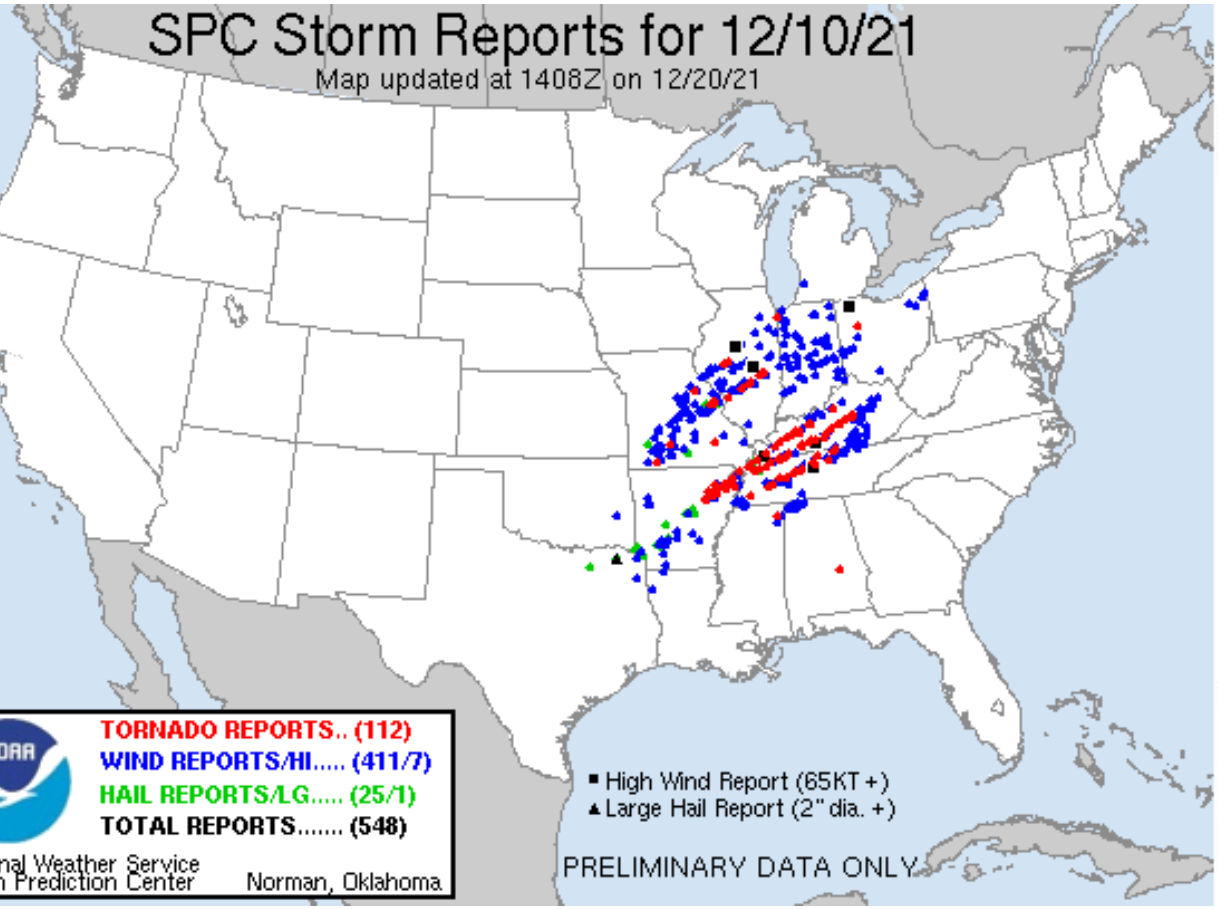
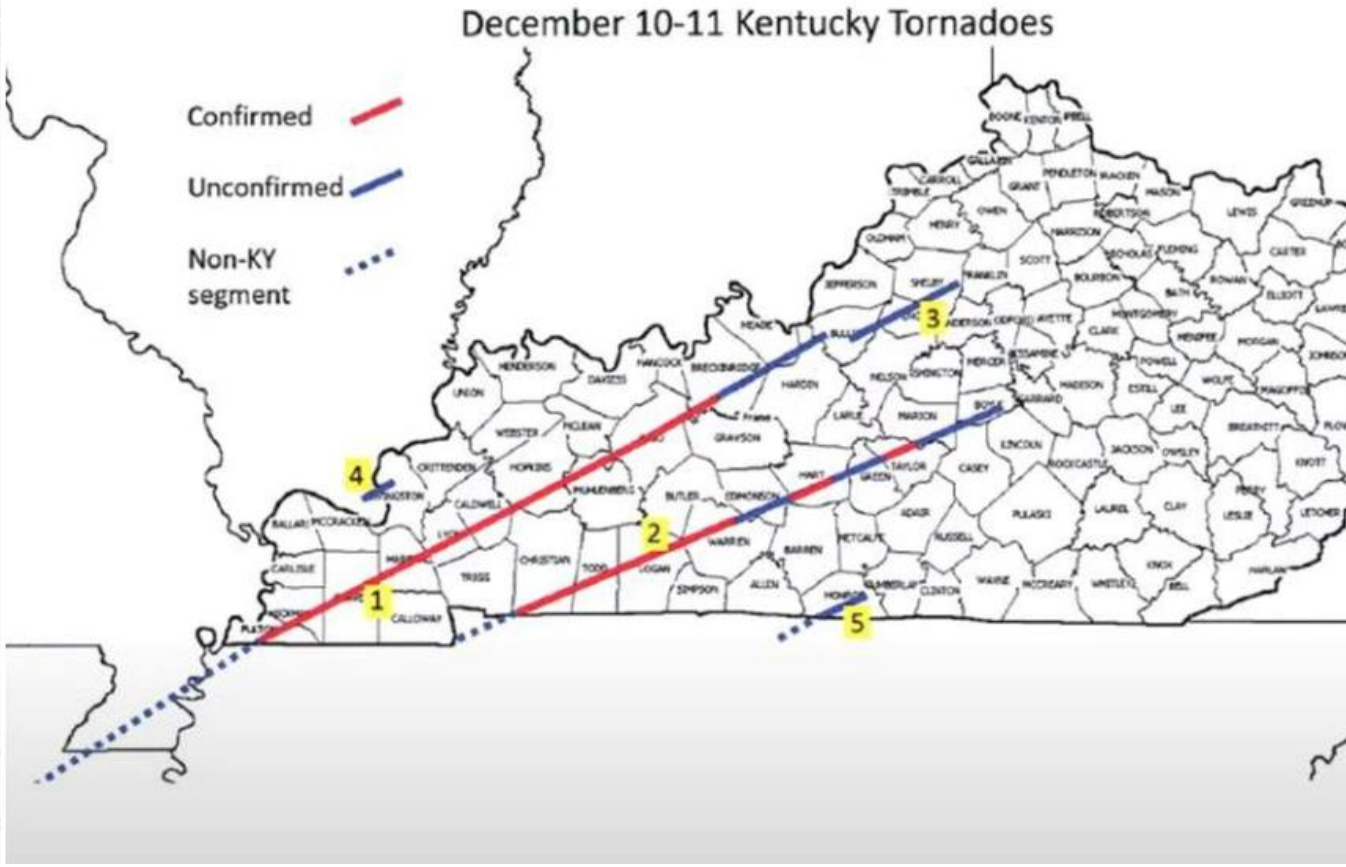
# December 10-11, 2021 Tornadoes

- Deadly, late-season tornado outbreak occurred in several southern states
  - NWS confirmed 66 tornadoes December 10-11, 2021
  - Eight states reported tornadoes
  - Most significant damage occurred in Arkansas, Tennessee, Missouri and Kentucky
  - Two supercell thunderstorms each traveled well over 100 miles
- Overall storm track about 265 miles
- Dubbed the “Quad-State Tornado”

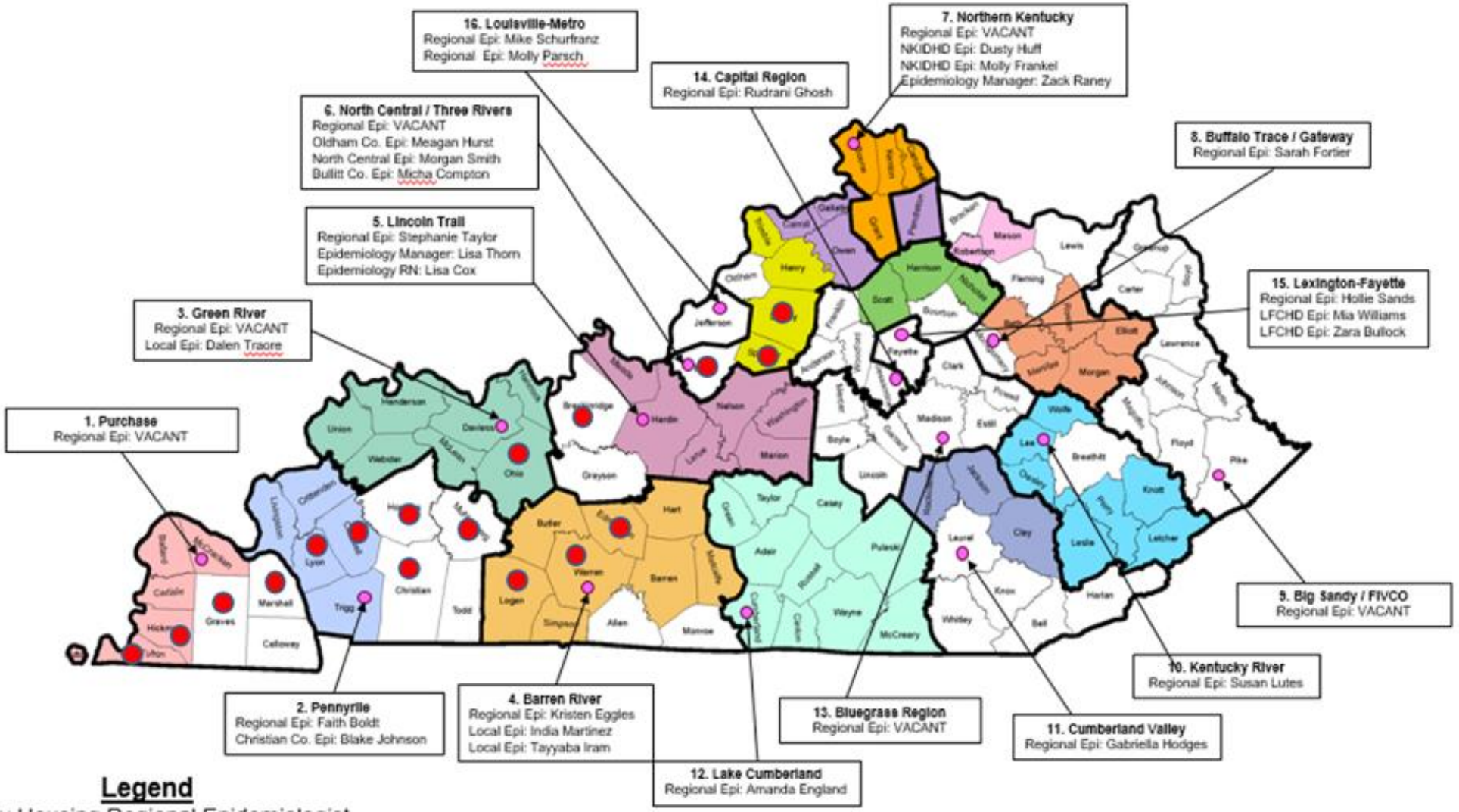


# Storm Tracks – National Weather Service (NWS)



# Kentucky Local and Regional Epidemiologists Map*



# Kentucky Progression

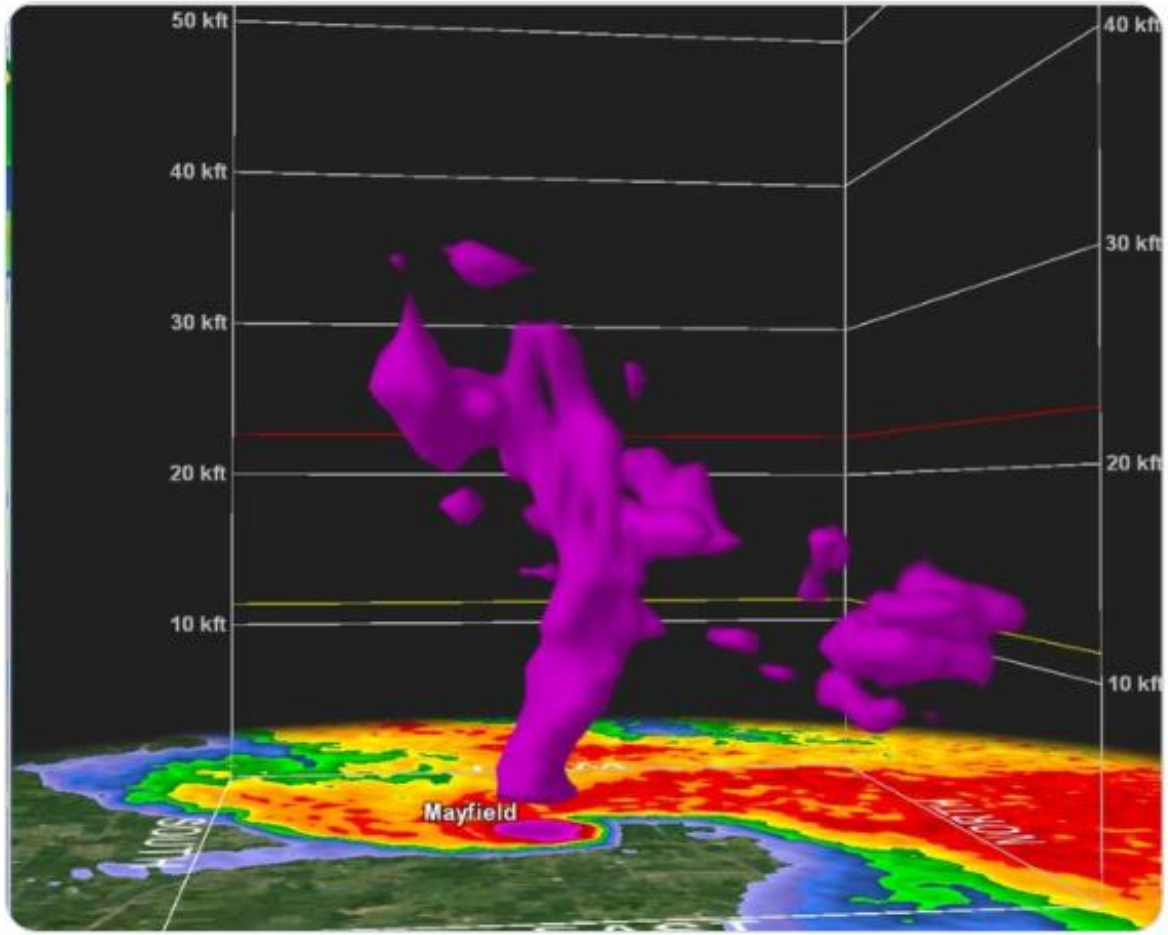
- Began about 9:00 pm in Fulton County, Kentucky
- Ended around midnight, Rough River Dam State Park
- Significant/catastrophic damage: Cayce, Mayfield, Benton, Dawson Springs, Princeton, Breman

# Quick Facts

- The primary tornado was on the ground for nearly three hours, tracking 165.7 miles (266.7 km) from Woodland Mills to Rough River Dam State Resort Park
- Storm spotters say that debris were thrown 30,000 feet into the air.
- The path was the ninth longest in recorded history.
- It was rated high-end EF4, with an estimated peak wind speed of 190 mph (310 km/h)
- Several communities destroyed in different counties

# Extreme Effects

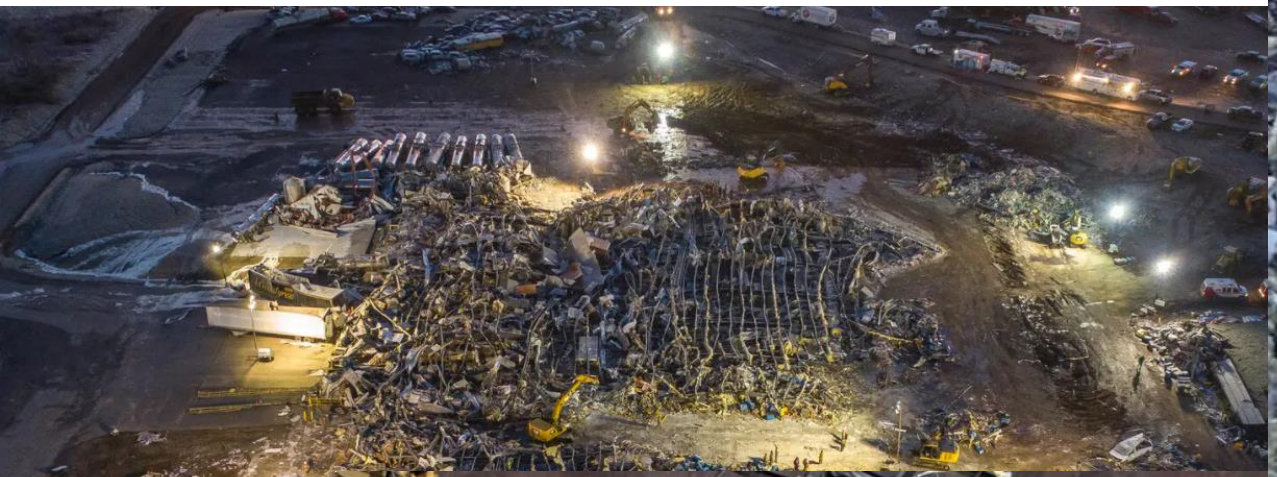
Not really the kinds of records you want to see broken. The Mayfield, KY tornado has lofted debris over 30,000 feet into the air. That's among the most intense ever record.




11:34 PM · Dec 10, 2021 · Twitter Web App

# Mayfield, Kentucky

# Mayfield Candle Factory



# Mortality Surveillance Process

- MDMS activated, event created Saturday morning, December 11
- Coroner liaison officer established at State Emergency Operations Center
- Regional Epidemiologists meet at noon to receive guidance/training
- Data entered by regional epidemiologists and MDMS administrator
- Administrator worked to curate data
  - Identify and combine duplicates
  - Verify facts associated with deaths
  - Finalize and officially report deaths
- Back and forth with coroners and regional epi's
  - Verify identification of decedents
  - Gather more data on circumstances
  - Went on from days to weeks in many cases

# Phase 2 – Seeking Additional Deaths

- Death certificates offered free of cost to families of decedents
- Different groups tasked with seeking additional deaths
  - Emergency Management
  - Fire departments
- Burial expenses offered for tornado-related fatalities
- Ongoing tracking of hospitalized patients, particularly in other states
- Learned of additional deaths through each of these routes
- Syndromic surveillance searches to look for undocumented deaths
- Total of 81 people confirmed as direct (78) or indirect (3) deaths due to tornados
  - Indirect deaths were 2 heart attacks (one during event, one during cleanup) and one drowning due to responder driving to event and hit flash flood waters
  - Last two deaths were “Direct” due to severe injuries but died ≅ 2 months later

# Mortality Surveillance Challenges

For this particular response, several challenges arose

- Extent of disaster
  - Difficult to get clear information on the night of the event
    - Communications systems interrupted
    - Travel into areas problematic
  - Media circulating stories right away
    - Ex: Candle Factory
- Multiple groups trying to/tasked with assessing mortality
  - Public Health/ESF-8
  - Coroners
  - Emergency management
  - Fire Departments
  - Public Protection Cabinet
    - Funeral expenses authorized and free death certificates for all deaths
  - Higher numbers repeatedly reported than confirmed

# Mortality Surveillance Challenges (continued)

- Extent of damage to bodies
  - Many with no immediately identifiable information
    - Took days and in some cases longer to identify
  - Some bodies (parts) in multiple locations
    - Led to duplicate reports of death
- Duplicate reporting of deaths
  - Chaos of situation
  - Bodies transported from injury site to other locations
  - Some deaths reported at time locally but later from county coroner of decedent's residence
- Several transported to different states (Tennessee, Indiana) where we had difficulty tracking
- Delays in death
  - Several people died well beyond the event – last 2 deaths February 7 & 15, 2022

# Final Words on Mortality Surveillance

- Advance preparation critical
  - Network of reporters in place
  - Data system in place to track mortality
    - MDMS has been our solution since 2005 BUT
      - Not built for actual mortality surveillance so not the best fit
    - Planning to shift to REDCap shortly
      - More adaptable for individual variable creation
      - Can be managed in-house
      - But will use same model
- Educating about roles and responsibilities and traditional public health framework
  - People change (Governor, EOC leadership, Emergency Mgt personnel)
  - If a gap is perceived, it will quickly be filled in a disaster
  - PH best suited to handle data collection processes
    - ESF-8 responsibilities
    - Has data structure in place
    - Has reporting network in place
- Having experienced people in the field and at HQ very helpful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# Thank you!

**May 12, 2021**

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