



# Carbon Monoxide (CO) Poisoning



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# Presentation Topics

- Background
- Health effects
- Epidemiology
- Surveillance
- CO poisoning during disasters
- Prevention
- Recommendations



# Carbon Monoxide (CO)



- ❑ Colorless, odorless gas
  
- ❑ Produced due to incomplete combustion of hydrocarbons
  
- ❑ Non-occupational sources include:
  - Heating and cooking appliances
  - Motor vehicle exhaust
  - Generators and gasoline powered equipment



# Pathophysiology

- ❑ Has higher affinity for hemoglobin
- ❑ Causes tissue hypoxia and direct tissue damage
- ❑ Can impact systems vulnerable to lack of oxygen



# Health Effects



- ❑ Non-specific flu-like symptoms (e.g., fatigue, dizziness, headache, confusion, nausea, vomiting)
- ❑ Collapse, coma, cardio-respiratory failure, and death
- ❑ 15–49% develop neuro-cognitive sequelae



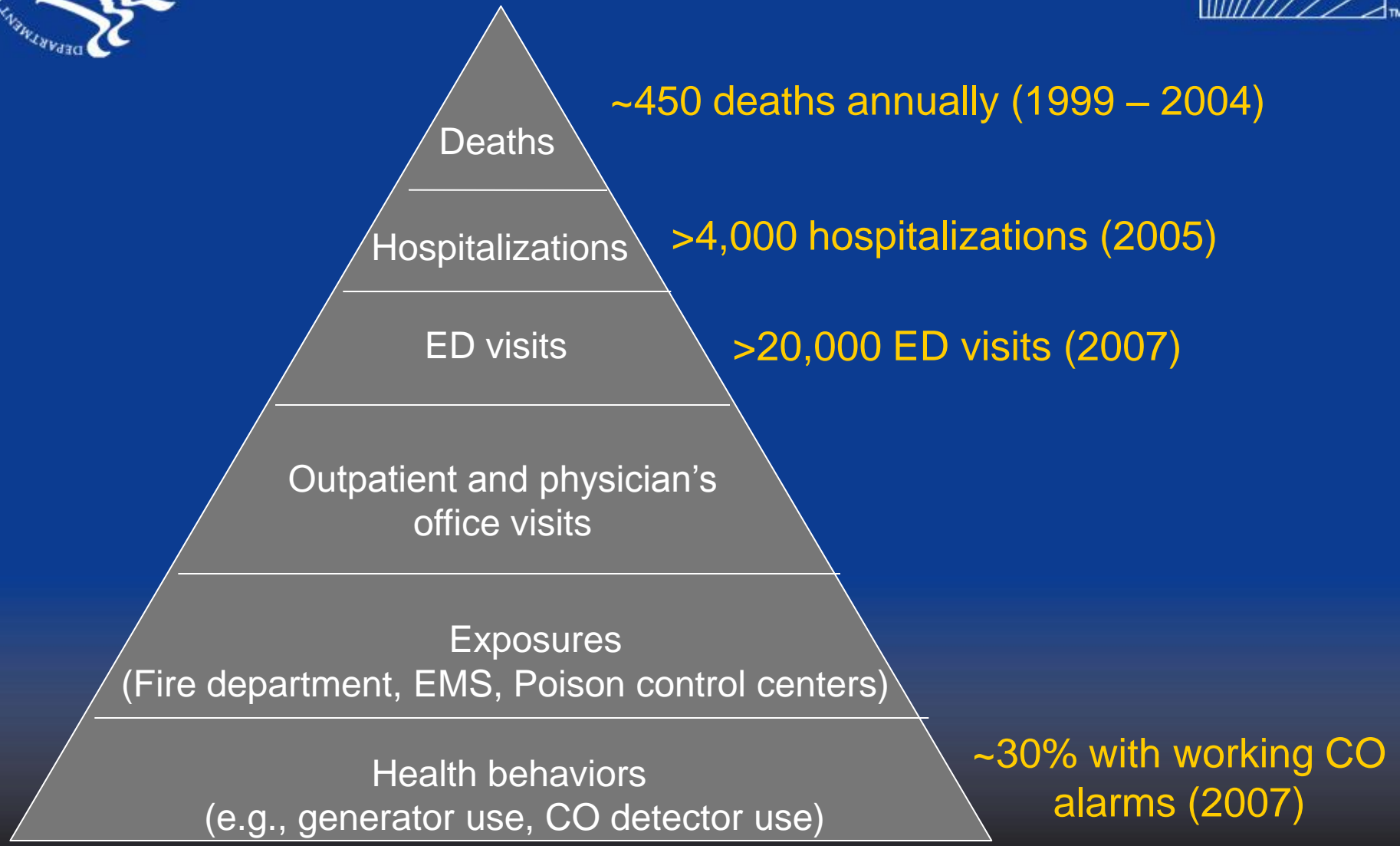
# Epidemiology



- ❑ Exposures
  - o Non-fatal : Children (<5 years), Females
  - o Severe and Fatal : Elderly (>65 years), Males
- ❑ Season: Winter
- ❑ Region: Midwest, Northeast
- ❑ “Outbreaks”: Natural disasters

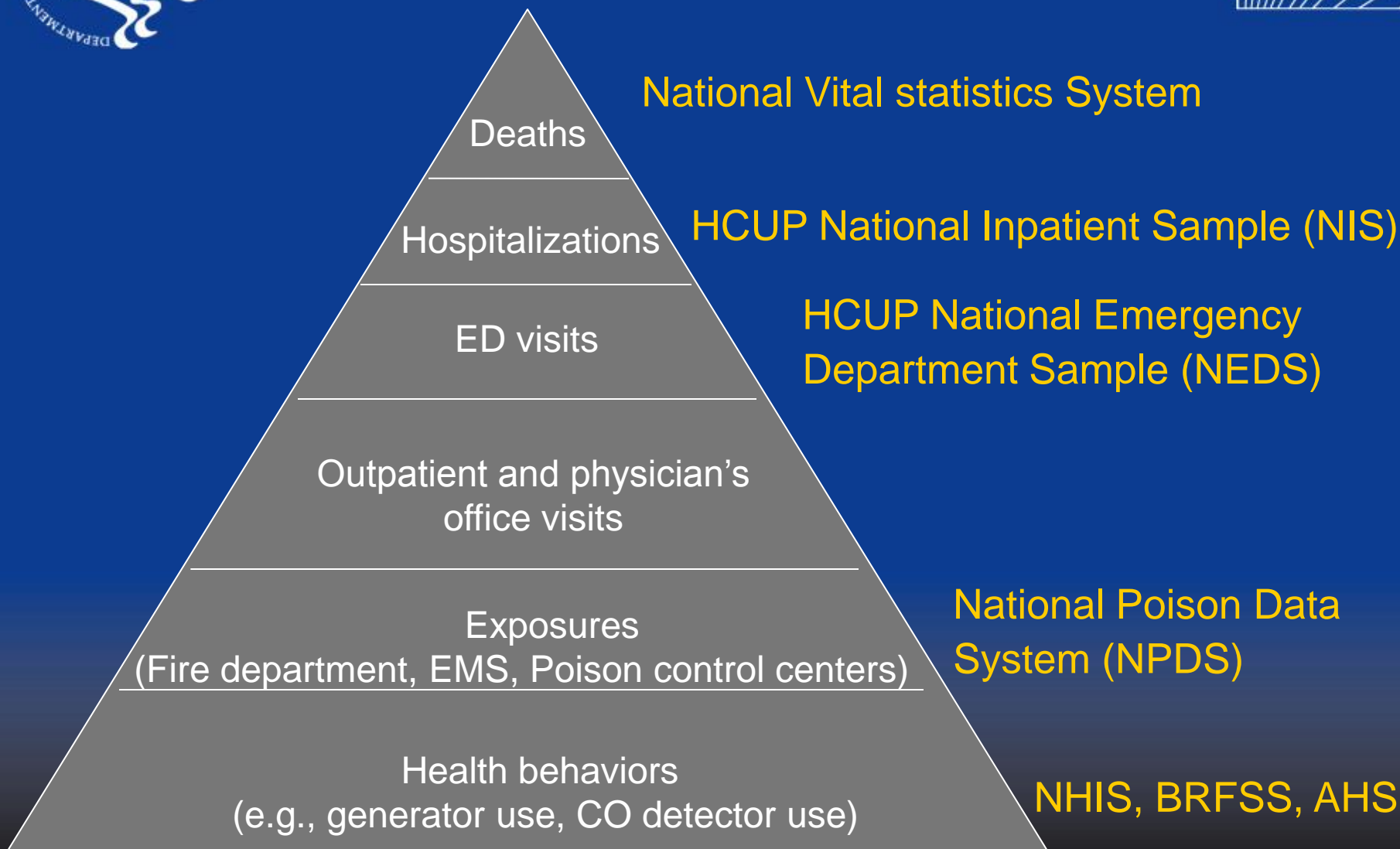


# Surveillance Estimates





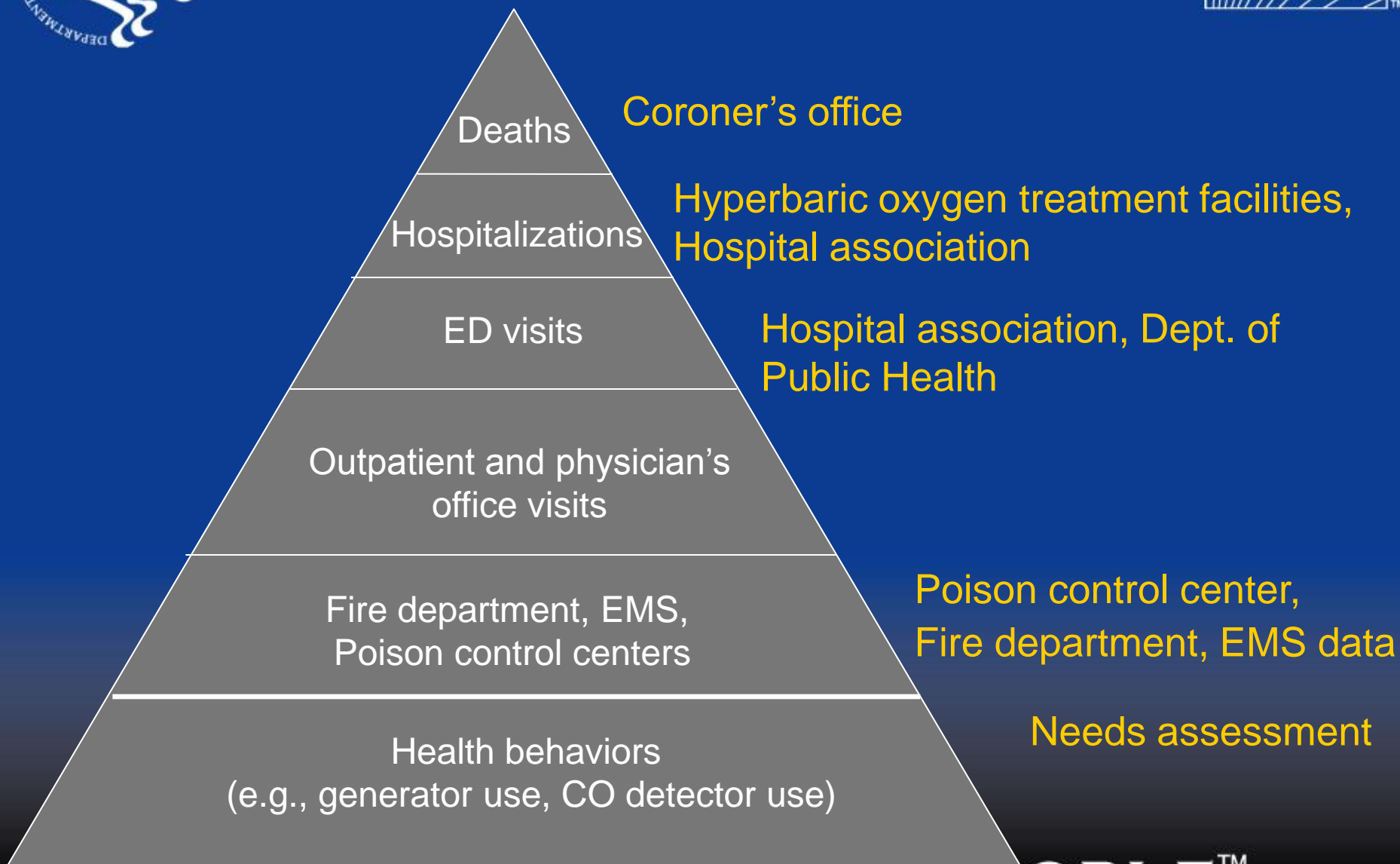
# Surveillance Data Sources







# Surveillance Data Sources in Disasters





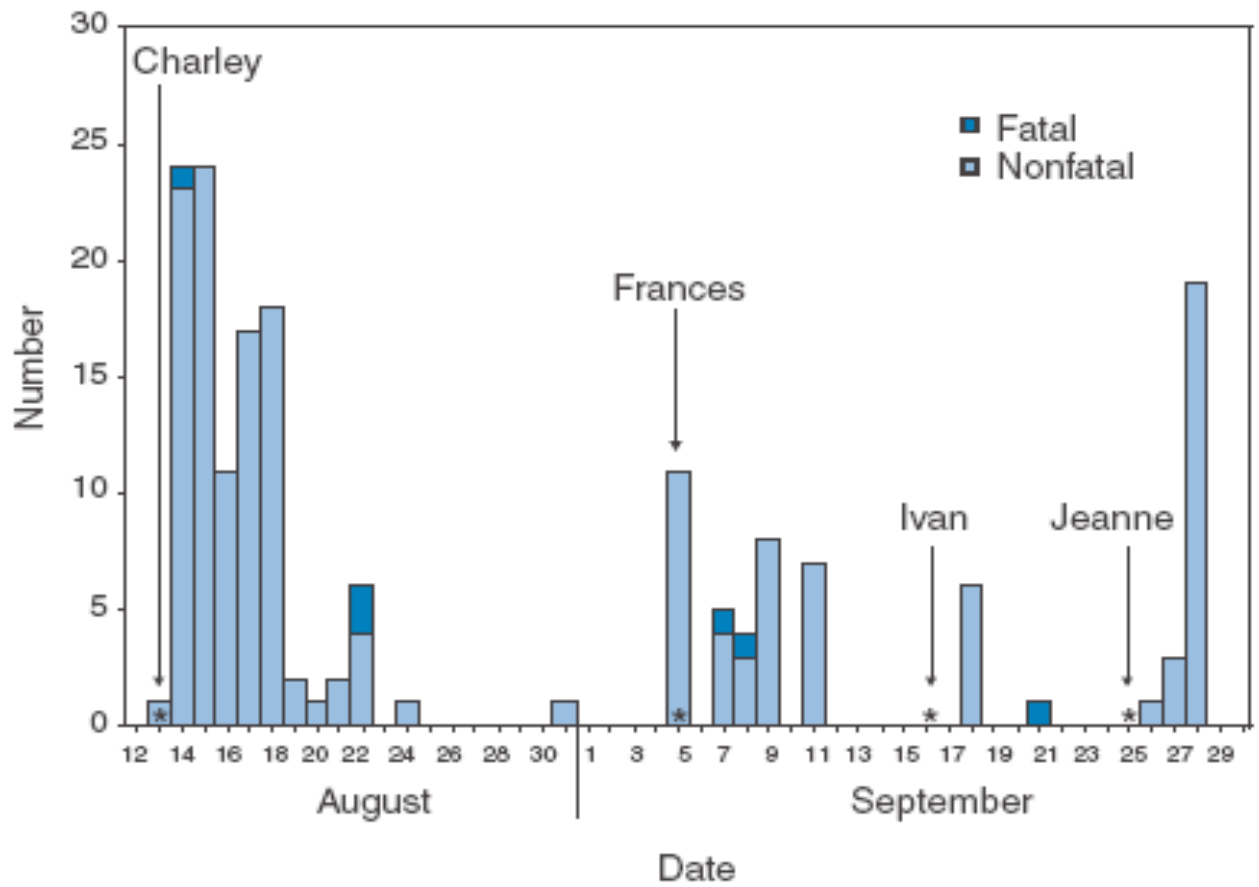
## Examples: Exposures, outcomes, and sources



<i>Event</i>	<i>Exposures</i>	<i>Persons</i>	<i>Source of CO</i>
Ice storm NC 2002		176 (1 death, 3 Hosp, 173 ED)	Another report: 7 deaths and 48 cases 17 from charcoal fire/ indoor grill
4 major hurricanes FL 2004	51	167 (6 deaths, 77 HBOT, 13 Hosp, 81 ED )	Generator 96% (5 out of 6 deaths)
Hurricanes Katrina & Rita AL, TX 2005	27	88 (10 death, 24 HBOT, 10 hosp., 44 ED)	Generator 93% (3 out of 4 deaths)
Hurricane Ike TX 2008		7 deaths 58 – PCC 34 – HBOT	Generators >82% of all exposures; Majority were residential exposures



**FIGURE 1. Number of cases of fatal (n = six) and nonfatal (n = 167) carbon monoxide poisoning, by date of exposure — Florida, August–September 2004**

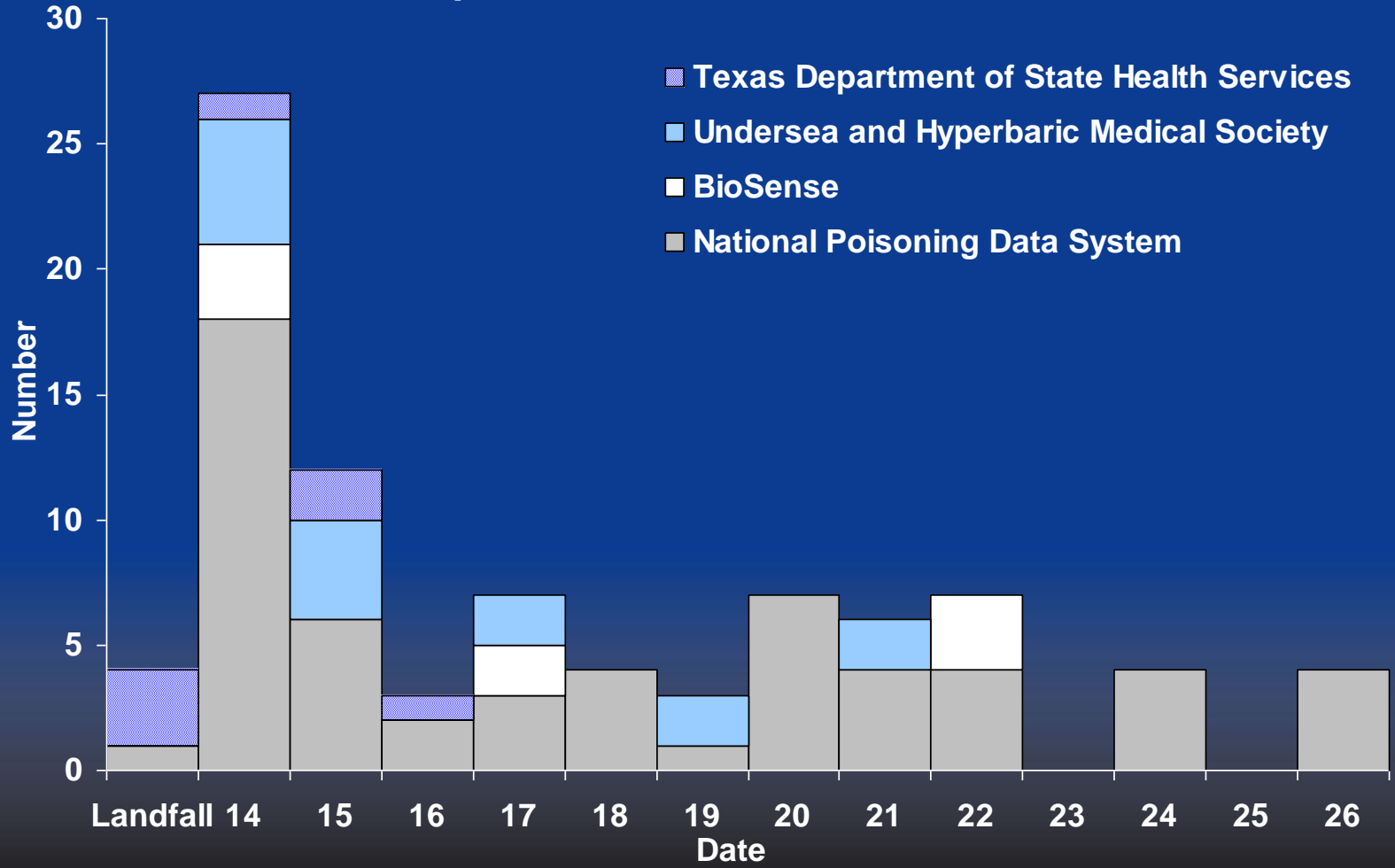


\* Landfall dates for Hurricanes Charley (August 13), Frances (September 5), Ivan (September 16), and Jeanne (September 25), respectively.

MMWR 2005; 54(28): 697-700



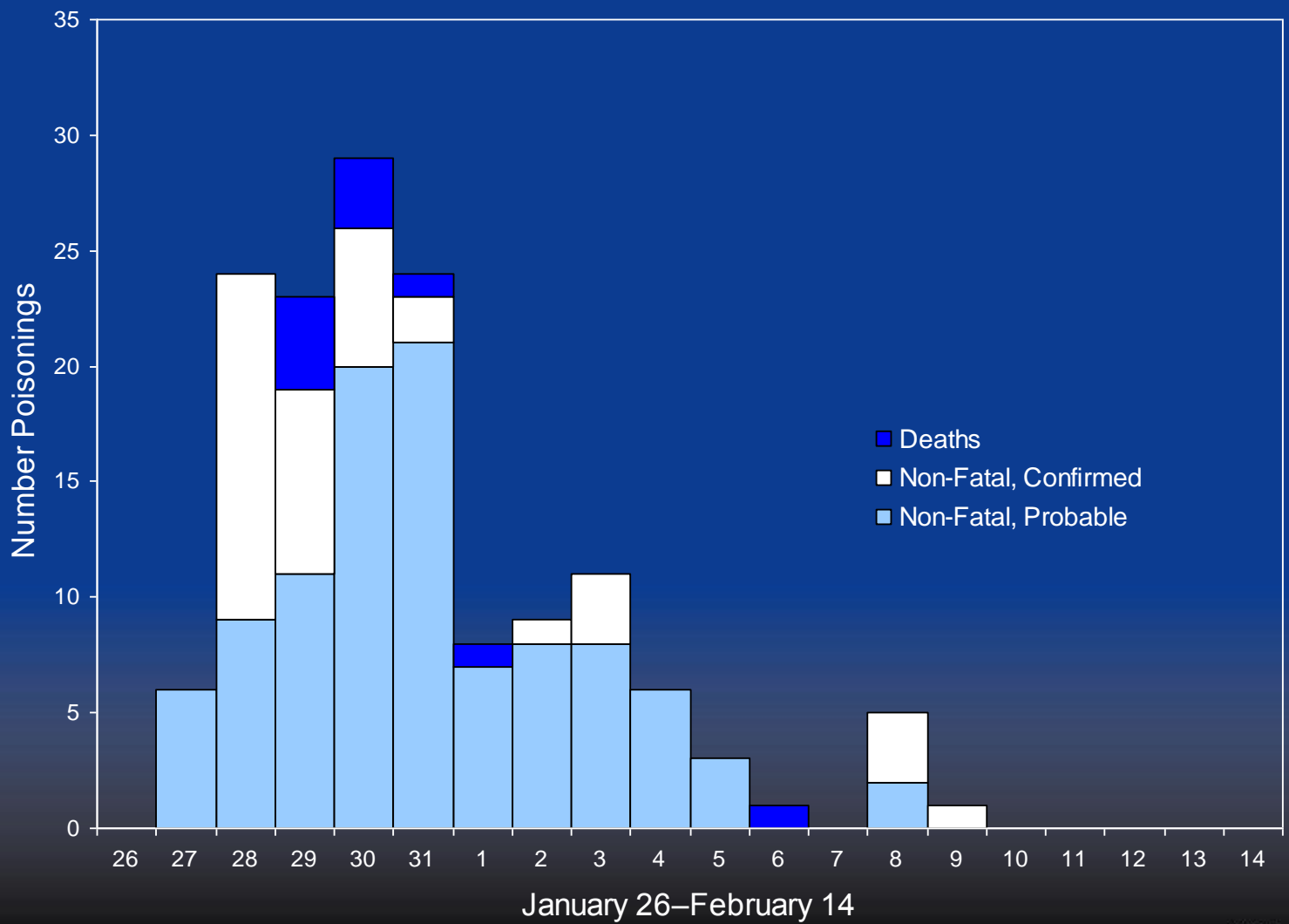
# Carbon monoxide exposures in the wake of Hurricane Ike by date and data source--September 2008\*



\* Counts should not be summed as cases from various data sources were not reconciled



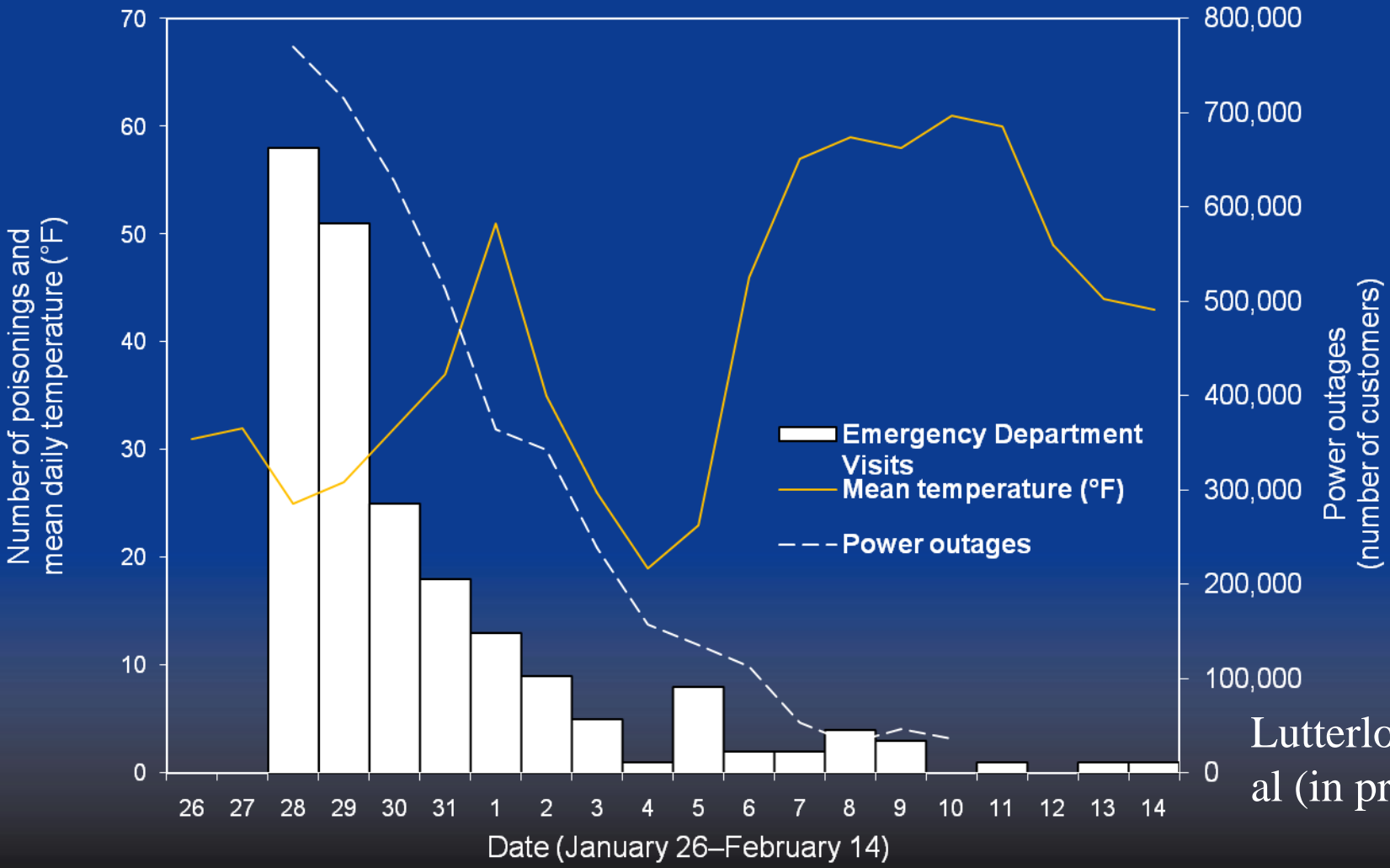
Figure 1. Number of reported carbon monoxide cases — Kentucky, January 26–February 14, 2009



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**FIGURE 2. Emergency Department visits for carbon monoxide (CO) poisoning, with power outages and mean daily temperature — Kentucky, January 26–February 14, 2009**



Lutterloh et al (in prep.)



# CO Poisoning During Disasters



- ❑ Leading cause of morbidity and mortality
- ❑ Common sources (excluding motor vehicles):
  - Gasoline-powered generators
  - Charcoal grill/briquette
  - Kerosene heater
  - Pressure washer
  - Gas stove
- ❑ Pre-disaster communication is critical



# Communication Media : Pre and Post Disaster



- Traditional
  - TV, Radio, Newspaper (e.g., IA flood)
  - Websites, email list serve
  - Pamphlet / flyers
  - Occupational groups, community organizations
- Electronic social media
  - Text messages (e.g. KY ice storm)
  - Facebook
  - Twitter





## Perception: “I am not dead yet..”



- ❑ 2005 & 2006 *HealthStyles* survey:
  - o ~50% - Okay to run generators in basement with window open or in garage with doors open
  - o Most believed – Do not require a CO detector with a new furnace or while running a generator
  - o >50% did not have a CO detector
  - o Most believed – Annual inspections of heating system is important
  
- ❑ <2% of population in FL considered CO poisoning to be a serious health risk after 4 major hurricanes in 2004



## Health Behavior Data

- ❑ Working CO detectors at home : ~30%
  - More in owner-occupied (37%) vs. renter-occupied (22%) and in newer houses (33%)
  
- ❑ Use of generators after disasters: 18%–31%



# Prevention

- ❑ Primary prevention
  - Maintenance of home heating systems
  - Proper placement of generators
  
- ❑ Secondary prevention
  - Installation of battery-operated or battery back-up CO detectors



# Prevention Strategies



- ❑ Education and communication
  - Season, region, weather event, target population
- ❑ Product safety regulations
  - More conspicuous public health messages on generators
  - CO detectors provided with generator purchase
- ❑ Engineering solutions
  - Auto shut-off, higher combustion, weatherization, etc.
- ❑ CO detector legislation
  - Example: Mecklenburg County, NC



# Recommendations



- Findings from recent studies
  - Generator placement
    - CO exposure even when placed 25 ft away
    - Depends on wind direction and other factors
  - Adherence to CO detector ordinance
    - 67% reported having working CO detector at home in Mecklenburg County, NC
- Other CDC recommendations
  - Website: [www.cdc.gov/co](http://www.cdc.gov/co)



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Thank you!



*Disclaimer: “The findings & conclusions in this presentation are those of the author (s) & do not necessarily represent the official position of the Centers for Disease Control & Prevention (CDC).”*

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