Utilizing Syndromic Surveillance to Monitor Carbon Monoxide Exposures/Poisonings Following Weather Related Events

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Purpose and Objectives

- The purpose of this webinar is to demonstrate how two states are using syndromic surveillance to monitor for CO exposures/poisonings
- Objectives:
  1. Identify methods to monitor CO exposure/poisoning using syndromic surveillance
  2. Describe how syndromic surveillance was useful in rapidly detecting CO exposure/poisoning after a severe weather event caused widespread power outages
  3. Identify strengths and limitations of using syndromic surveillance for CO exposure/poisoning

Michigan Syndromic Surveillance System (MSSS)

- MDHHS has been monitoring trends in syndromic presentation since 2003
- MSSS is monitored for aberrations in syndromes that may indicate an outbreak, emerging disease, or act of bioterrorism
- MSSS is monitored routinely during the influenza season for situational awareness
- MSSS is used to identify negative outcomes associated with severe weather for situational awareness and to guide public health messaging

MSSS

- Based on Real-Time Outbreak Detection System (RODS) developed at the University of Pittsburgh
- Virtual Private Network HL7 is used to exchange data in real-time between participants and MDHHS
- Each message consists of:
  - Patient age, sex, home ZIP code
  - Visit date and time and facility
  - Self-reported chief complaint
- Users include MDHHS epidemiologists, local health departments, and hospitals
- Hospital participation is voluntary

MSSS

Number of Facilities

96

Number of Users

184

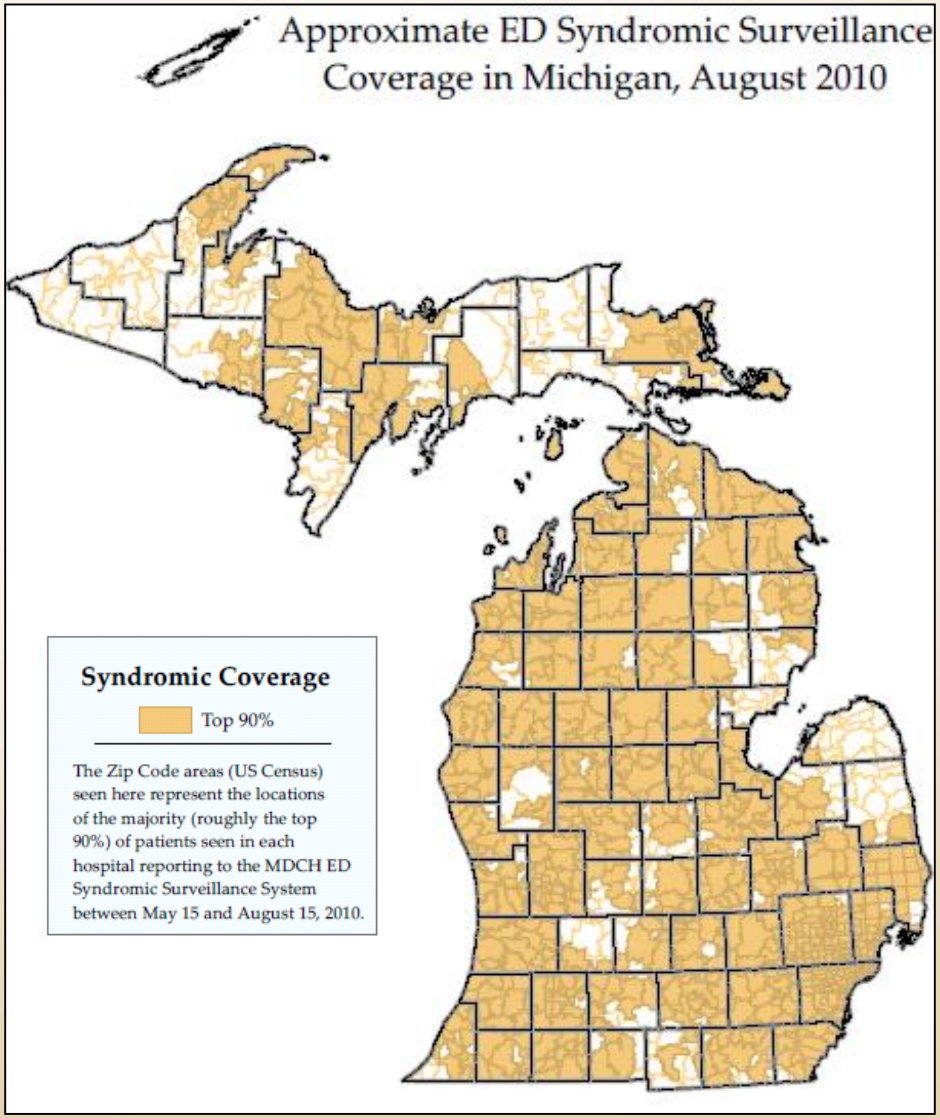
Number of Referrals/Day

Statewide

~12,500

(10,000-14,000)

Poison Control Center also enrolled



MSSS

- Chief complaints classified into 1 of 9 syndromic categories that can be aggregated for review and analysis (Figure 1)
- Detection algorithms runs every hour on county and state level data
- An alert is generated if aberration is detected
- Users have the ability to create Ad Hoc searches (Figure 2)

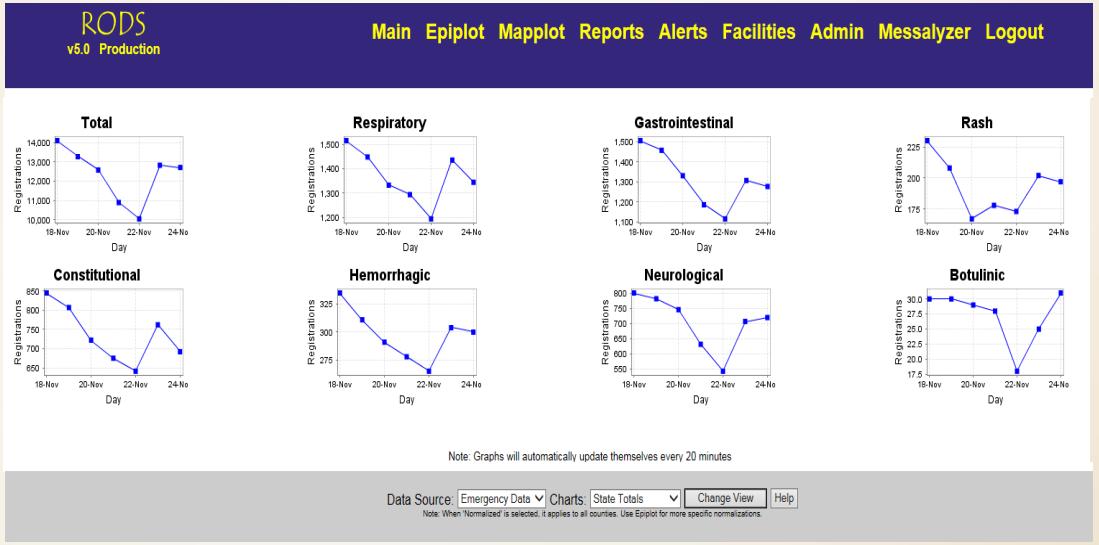


Figure 1: Main Screen

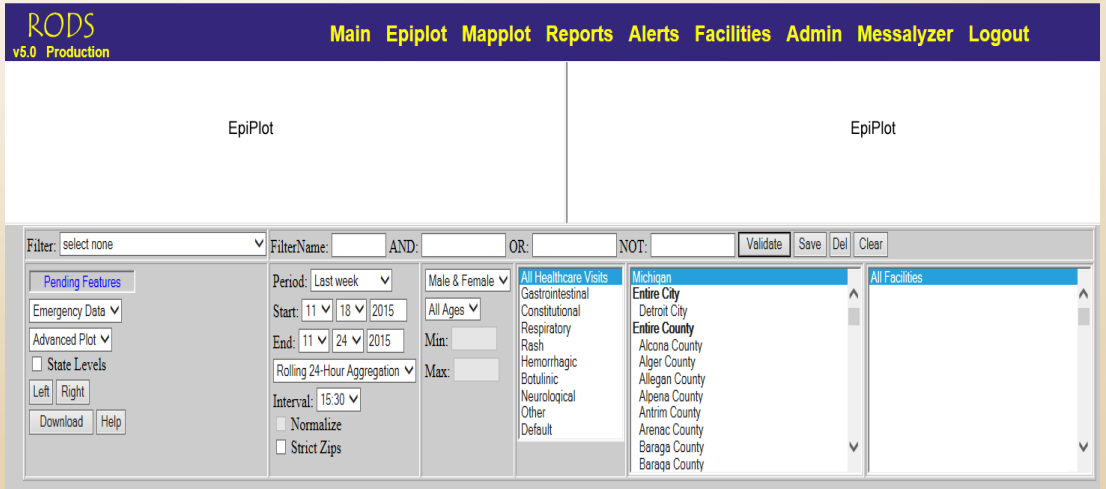


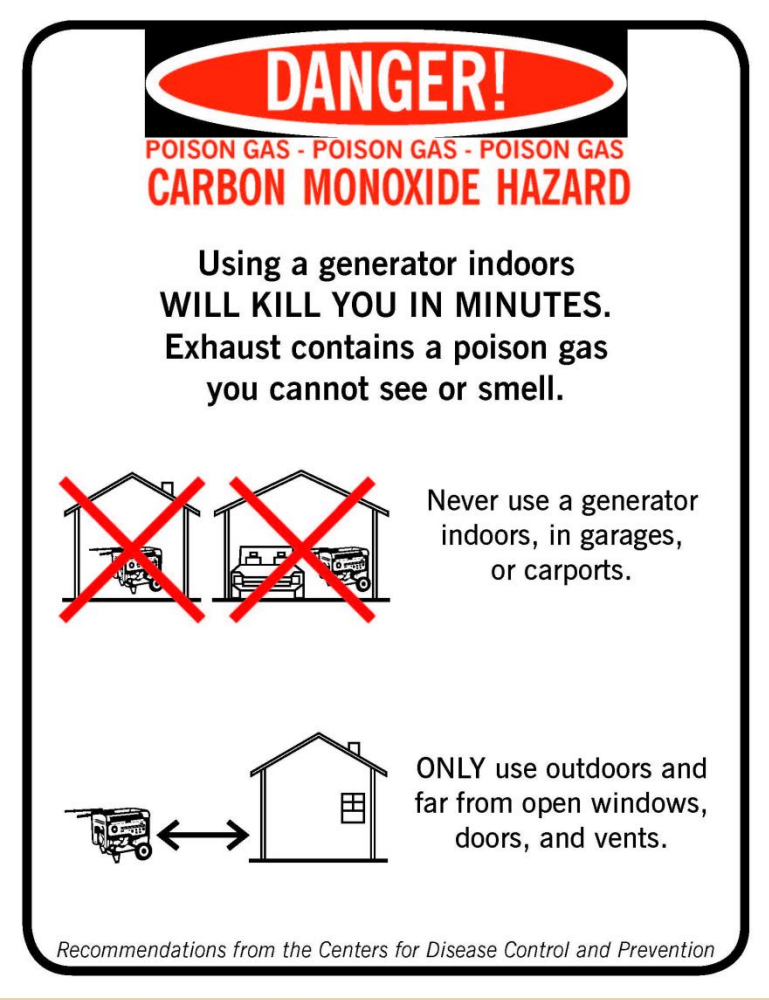
Figure 2: Epiplot Function

Syndromic Surveillance Categories

Syndrome	% of Visits	Example	Sample Text (not inclusive)
Gastrointestinal	9-13%	"Stomach Pain"	Abdominal, stomach, gastric, enteritis, diarrhea, vomiting, nausea, n, v, abdomen, abd, gastroenteritis, nvd
Respiratory	8-16%	"Difficulty Breathing"	Cough, sore throat, congestion, wheezing, asthma, croup, respiratory, strep, cold, bronchitis, pneumonia, asthma, sob, sinus, uri, dyspnea, dib
Constitutional	7-10%	"General weakness"	Fever, weakness, dizziness, dizzy, temp, temperature, flu, light headed, chills, lethargy, fatigue, sweating, lethargic, febrile
Neurological	6%	"Confusion"	Migraine, headache, disoriented, syncope, fainted, paralysis, tingling, seizure, stroke, cva, convulsion, loc, mental, vertigo, meningitis, numb, confusion, dizzy, unconscious
Hemorrhagic	3%	"Nose bleed"	Epistaxis, bleeding, hemoptysis, hematuria, hematemesis, blood, bleed, hematochesia, hemorrhagic, hemorrhaging
Rash	1.5-2.5%	"Hives and itching"	Rash, hives, bumps, petechiae, purpura, ivy, dermatitis, pox, scabies, spots, shingles
Botulinic	<0.5%	"Slurred Speech"	Slurred, diplopia, dysphagia, photophobia, dysarthria, speaking, swallowing, blurred
Other	12-19%	"Right foot injury"	Laceration, injury, mva, broken, sprain, bite, abrasion, wound, suture, concussion, sunburn, pressure, fall, sugar, gsw, monoxide
Default	40-44%	"Med Refill"	Everything else (default category) – if complaint contains none of the recognized keywords – e.g. "assault/neck", "jumped from moving vehicle"

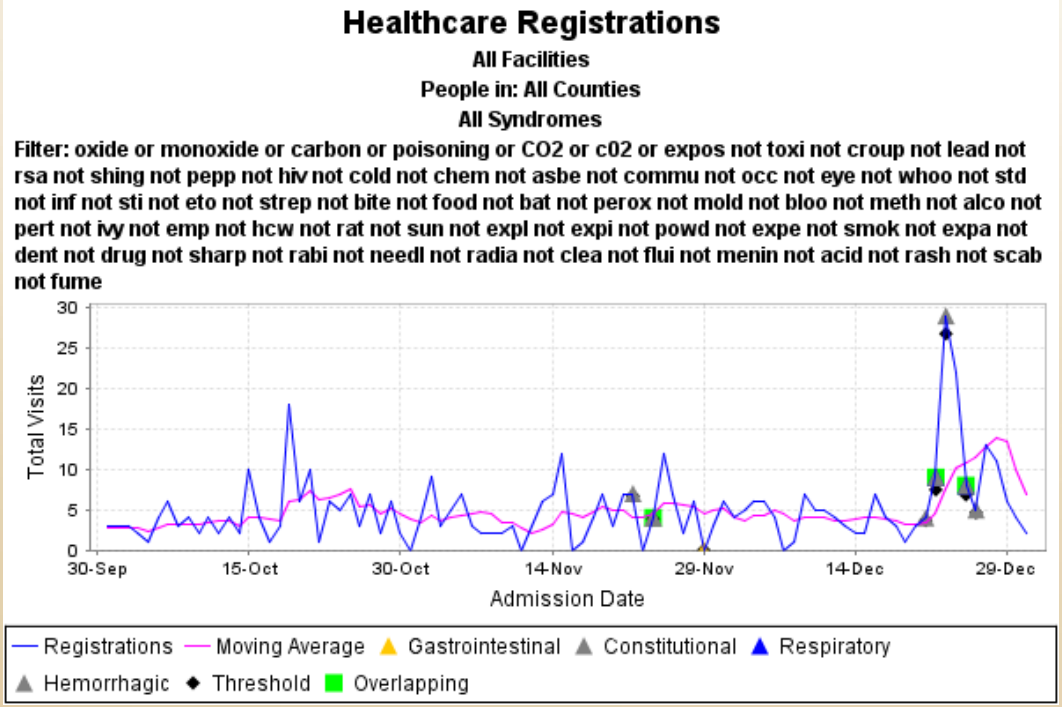
Carbon Monoxide Exposure

- During a power outage, risk of CO poisoning increases with use of alternative sources of heat or electricity
  - Generators
  - Grills
  - Camp stoves
  - Other fuel burning devices in or near homes



Carbon Monoxide Exposure Surveillance in MSSS

- MSSS is queried to identify ED visits with primary complaints of "carbon monoxide" or "CO" including "exposure" and "poisoning" complaints and excluding other exposures
- Routine surveillance during winter months include monitoring for CO exposure events along with other cold weather related injuries



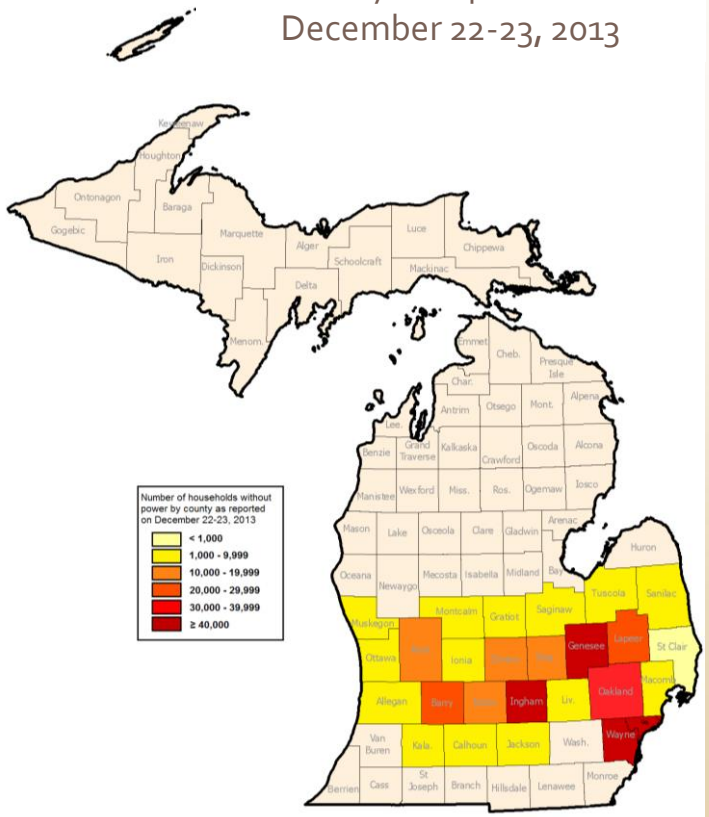
December 2013 Ice Storm

- An ice storm affected the lower portion of Michigan's lower peninsula from December 21 to 22, 2013
- Nearly 400,000 households lost power
- Some households experienced prolonged outages
- Descriptive analyses were performed on ED data from the 9-day period in which sustained power outages occurred

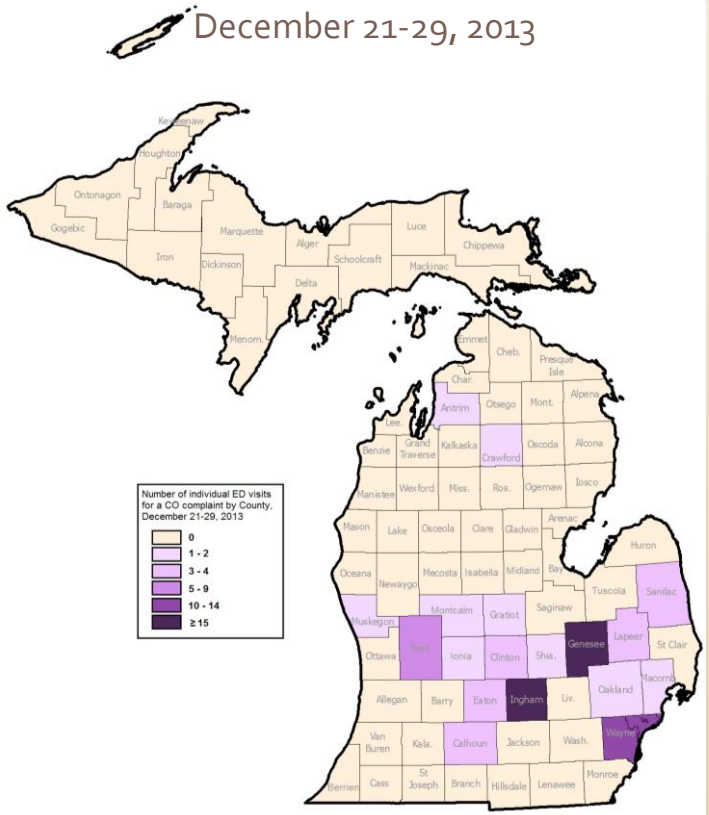
Carbon Monoxide Exposure Surveillance

- From December 21 to 29, 2013, power outages were identified in 25 Michigan counties
- CO poisoning/exposure visits were identified in 18 Michigan counties

Household power outages by county as reported on December 22-23, 2013

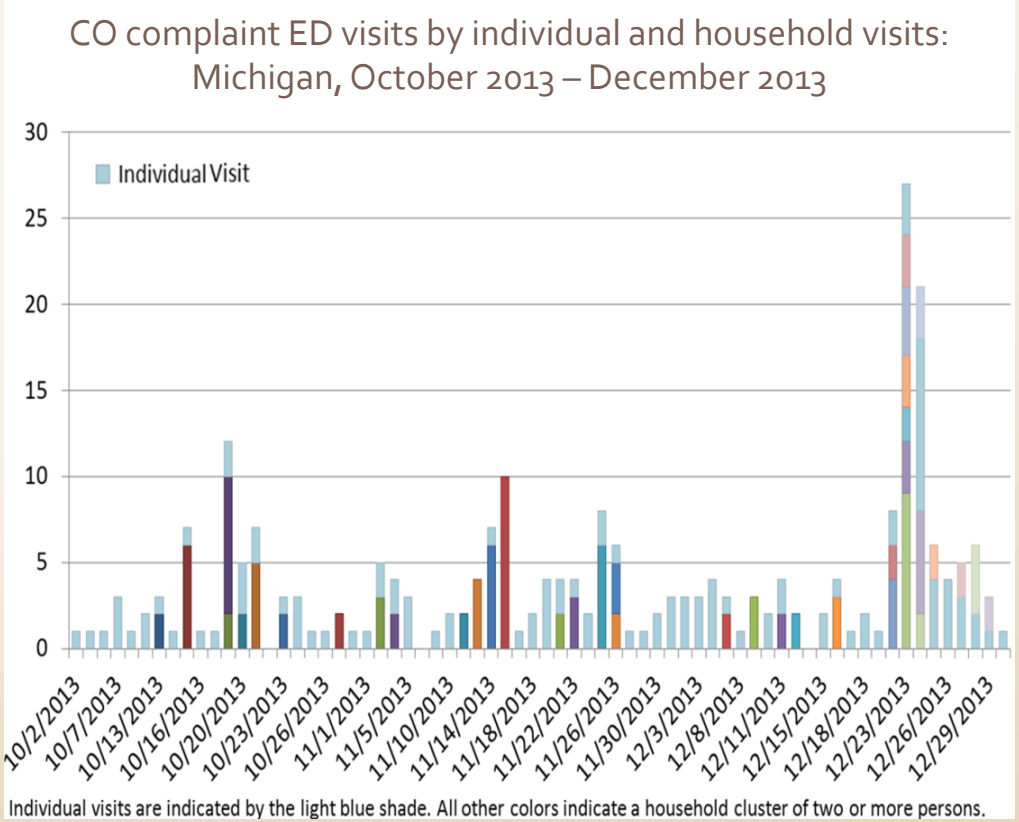


CO chief complaint ED visits by county of residence December 21-29, 2013



Carbon Monoxide Exposure Surveillance

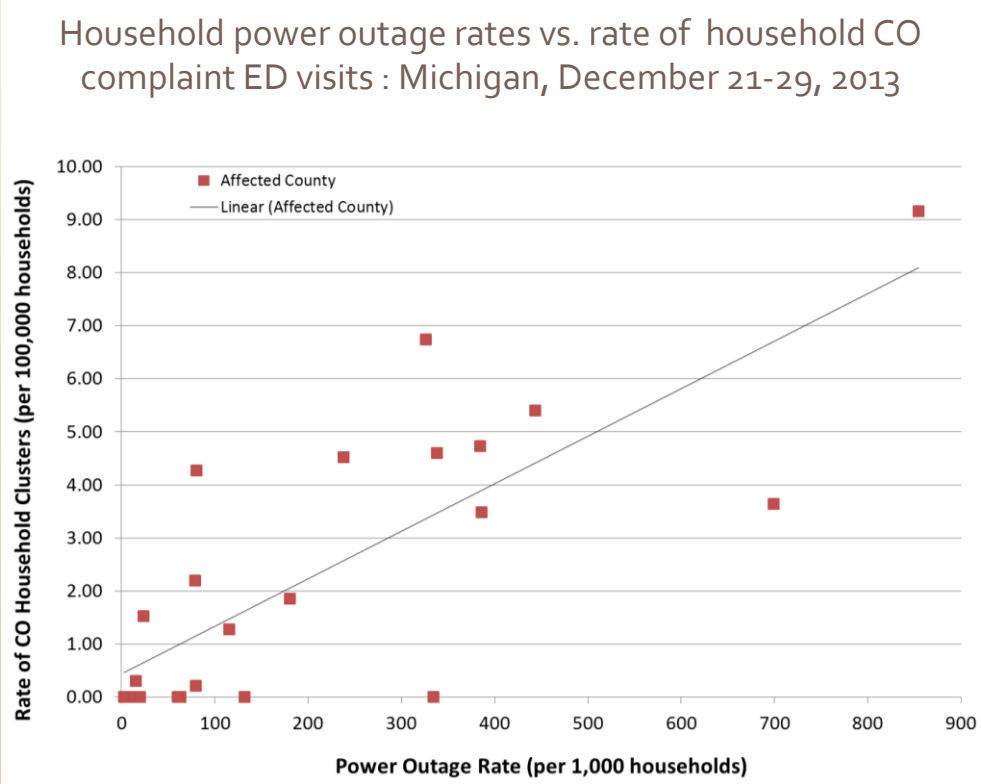
- 81 ED visits were reported in MSSS representing 44 households* where CO was included in the chief complaint
- A 360% increase in visits and a 150% increase in households compared to baseline



*A household was defined as a cluster of two or more persons from the same zip code presenting at the same time to the same facility with the same CO exposure symptoms or an individual presenting without indication of other ill companions

Carbon Monoxide Exposure Surveillance

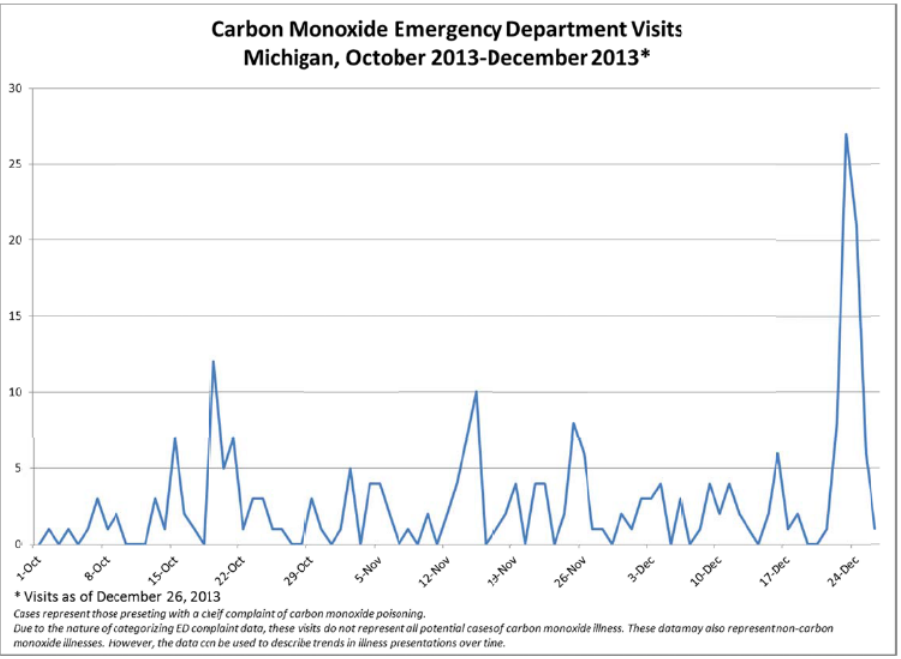
- A strong statistically significant positive correlation (R=0.7818, one-tailed p<0.001) was found between the rate of household power outages by county and the rate of household ED visits with a CO exposure/poisoning complaint by county



Carbon Monoxide Exposure Surveillance

Do not disseminate. For internal use only.

Figure 1: Carbon Monoxide ED Visits, October 2013 – December 2013 (to date)



* Visits as of December 26, 2013

Cases represent those preseting with a cielf complaint of carbon monoxide poisoning.
Due to the nature of categorizing ED complaint data, these visits do not represent all potential casesof carbon monoxide illness. These datamay also representnon-carbon monoxide illnesses. However, the data ccn be used to describe trends in illness presentations over tine.

Table 1: Carbon Monoxide ED Visits by Region

	Michigan Total Cases (# of Households*)	Cases by Michigan Public Health Preparedness Region Total Cases (# of Households*)							
		1	2N	2S	3	5	6	7	8
November 17-19	7 (7)	2 (2)	1 (1)	0 (0)	1 (1)	0 (0)	3 (3)	0 (0)	0 (0)
December 21- 26	64 (31)	25 (9)	1 (1)	5 (5)	23 (9)	3 (1)	6 (5)	1 (1)	0 (0)

* A Household is defined as one or more people presenting with the same symptoms at the same hospital at approximately the same time indicating a common exposure

Note: Regions 1 and 3 had the greatest number of Carbon Monoxide ED visits. Within those regions, the highest burdened counties were Ingham County with 16 visits (5 households) and Genesee County with 17 visits (6 households). The remaining counties had 5 or fewer visits.

- On December 23, 2013 MDHHS issued a press release warning about CO poisoning risks
- On December 26, 2013 CO information was disseminated to counties in the affected Public Health Preparedness regions

Michigan Department of Health & Human Services

MDHHS

Michigan Department of Health & Human Services

RICK SNYDER, GOVERNOR | NICK LYON, DIRECTOR

FOR IMMEDIATE RELEASE: After Weekend Ice Storm, Residents Warned About Carbon Monoxide Poisoning Risks

Michigan Department of Health and Human Services sent this bulletin at 12/23/2013 04:34 PM EST

Press Release

FOR IMMEDIATE RELEASE: December 23, 2013

CONTACT: Angela Minicuci, (517) 241-2112

After Weekend Ice Storm, Residents Warned About Carbon Monoxide Poisoning Risks

LANSING – This past weekend's storm has left more than 400,000 residents in Michigan without power. As families make preparations to heat their homes, the Michigan Department of Community Health (MDCH) is urging residents affected by the power outages to be aware of the dangers of carbon monoxide poisoning and what steps can be taken to protect against it.

Carbon monoxide is an invisible, tasteless, and odorless gas formed when fuel is burned, that can build up to deadly levels within minutes in enclosed spaces. Symptoms of carbon monoxide poisoning are headaches, nausea,

Discussion

- Frigid temperatures during this time period increased the probability that households experiencing extended power outages would use risky alternative energy sources for heating
- Syndromic data were limited due to incomplete coverage in the MSSS system which could have resulted in missed cases
- Due to the use of chief complaint data, these visits do not represent all potential cases of carbon monoxide illness and may also represent non-carbon monoxide illnesses, however, the data can be used to describe trends in illness presentations over time
- Individuals in identified clusters were not confirmed to be members of one household
- Potential unidentified clusters are possible if ill members from one household visit different EDs
- The small number of visits may affect the reliability of the rates

Conclusion

- Syndromic surveillance using ED chief complaints data were useful in providing situational awareness in rapidly detecting 'outbreaks' in CO exposure/poisoning after a severe weather event caused widespread power outages
- Stratifying analysis of ED visits by county and region allows targeting public health messaging to areas at highest risk
- This data is more timely than other data sources such as death certificate data
- Based on the results of this surveillance, National Weather Service offices in the major metropolitan areas of Michigan now include a message about the risk of CO when they issue severe ice or wind storm alerts