# Carbon Monoxide and Environmental Public Health Tracking

*EPHT Brown Bag*

*June 26, 2006*

# CO poisoning: an important public health issue

- CO is an odorless, colorless gas
  - Produced by combustion engines
- CO poisoning can occur:
  - During routine activities
    - Domestic, occupational and recreational
  - In the wake of large-scale disasters
    - Morbidity and mortality

# CO: An important public health issue

- In US, recognized burden of unintentional, non-fire-related CO poisoning:
  - 15,200 treated annually in EDs[1]
    - Likely underestimated
  - 800 deaths annually [2]
- Estimated persistent neurological injury
  - 10 - 40% of CO poisoning survivors severe poisoning

1. CDC. Unintentional non-fire-related carbon monoxide exposures – United States, 2001-2002. MMWR: Jan.21 2005 / 54(02);36-39

2. Cobb N, Etzel RA. Unintentional carbon monoxide-related deaths in the Unites Staets1979 through 1988. JAMA 1991;266:659-63

3. Ernst A, Zibrak JD. Carbon monoxide poisoning. N Engl J Med. 1998 Nov 26;339(22):1603-1608

# CO: An important public health issue

- Evidence based prevention strategies
  - Correct installation/ maintenance potential CO emitting devices
  - CO detectors
  - Legislation/regulation
    - CO emissions
    - CO detectors
- Why AREN'T we conducting public health surveillance?

# CO: an important EPHT work area

- Demonstrated links between health and environment
- Feasible to track
  - Measurable and trackable
  - Data sources available in most states
  - Can track in real-time
- Tied to public health objectives
  - Useful and understood
  - Informative

# CO: an important EPHT work area

- Established EPHT interest
- The National Workgroup on Carbon Monoxide Surveillance
  - Formed in April 2005
  - Membership:
    - EPHT grantees
    - Academic and other CDC partners

# National Workgroup on CO Surveillance

**Goals:**

1. Build a system for CO surveillance
   - National
   - Sustainable
2. Standardize methodology CO surveillance
3. Promote programs for prevention/education of CO poisoning.

# National Workgroup on CO Surveillance

**Accomplishments:**

- Produced:
  - *Carbon Monoxide: A Model Environmental Public Health Indicator*
- Collaborating with CDC
  - Evaluation of national case definitions
  - Planning a national conference
    - July 12-13th, 2006
- CO surveillance at CSTE (June 2006)
  - Conducted a session
  - 2 roundtable discussions

# National Workgroup on CO Surveillance

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# EPHT Branch Monthly Brown Bag -- Carbon Monoxide Poisoning

Presentations:

Judith Graber, Maine

*Making the Best of What's There: Building a State-Based Surveillance System for CO Poisoning*

Kathleen Wheeler, New York City

*Preventing CO Poisoning: Tracking the Impact of Legislative and Regulatory Changes in New York City*

Brian Toal, Connecticut

*Comparison of Three CO Databases in Connecticut*

# *Making the best of what's there: Building a state-based surveillance system for carbon monoxide poisoning*

Judith M. Graber, M.S.

Andrew E. Smith, Sc.D.

Maine Department of Health and Human Services

# *Maine, January 1998 ice storm*

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CO poisonings excess January 1998:

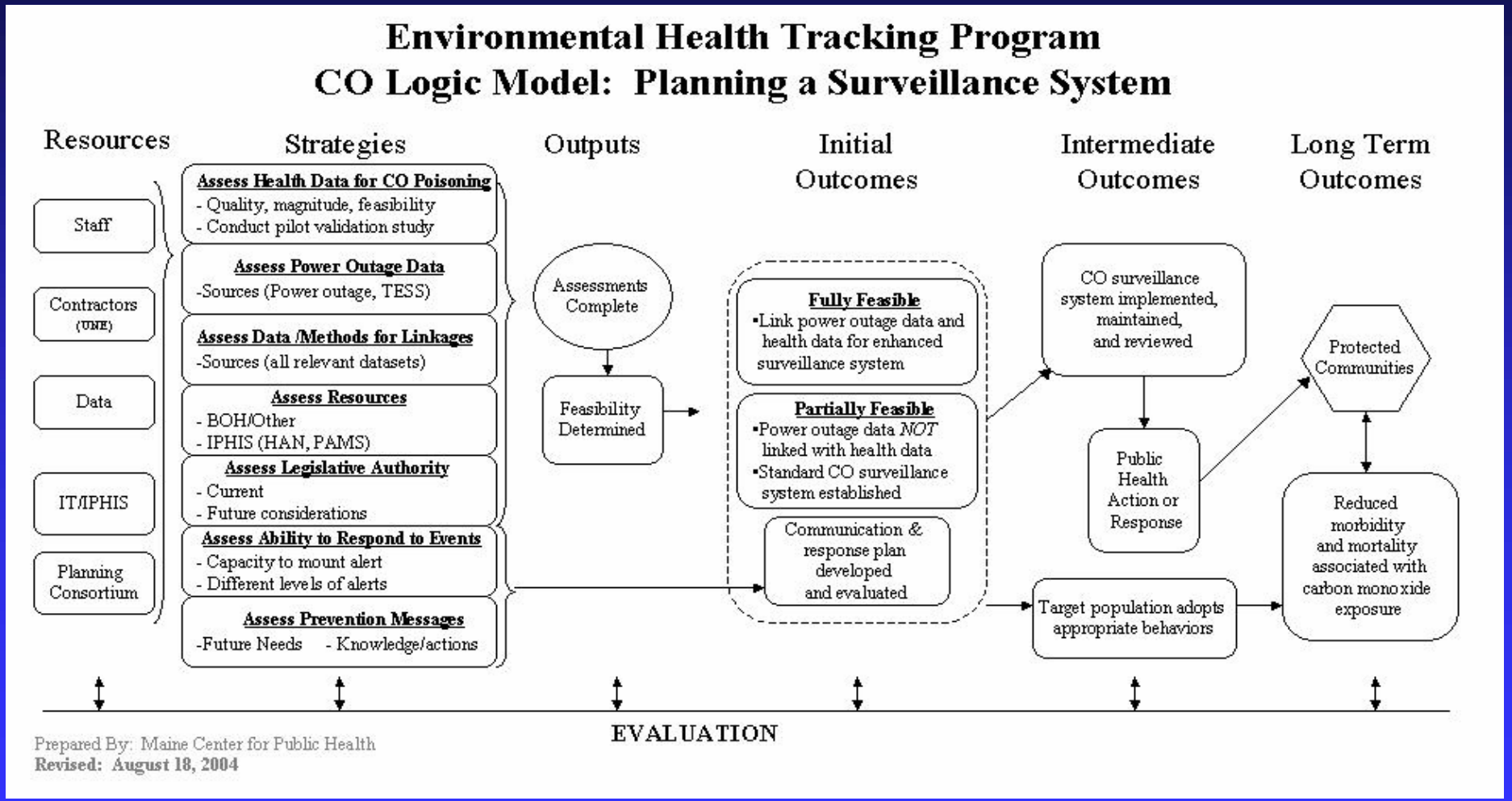
- Outpatient settings
  - January 1998 = 289
  - *January 1999 = 20*
- Hospitalizations
  - January 1998 = 14
  - *January 1999 = 1*
- Deaths
  - January 1998 = 2
  - *All of 1999 = 0*

# Maine's Surveillance System for Carbon Monoxide Poisoning

# Outline

- A statewide system for unintentional, non-fire-related CO poisoning in Maine
  - Approach
  - Data sources
  - Analysis/results
  - Dissemination
  - Use of data for public health action
- Limitations, next steps

# CO Surveillance Logic Model



# Data Sources

1. Morbidity
   - Maine hospital visits data
2. Mortality
   - Death certificate files
3. Knowledge and prevention behaviors
   - BRFSS
4. Qualitative information
   - Newspaper search engine

# Data Sources: 1. Hospital visits

- Hospital billing records available electronically
  - Hospital discharge data
  - Emergency department
  - Hospital-based outpatient
- Reported quarterly
  - 12-18 month delay

# Data sources: Hospital visits

## DATA ELEMENTS INCLUDED:

| Demographics | Diagnosis | Hospitalization |
|---|---|---|
| Age / DOB | Principal diagnosis [1] | Admission date |
| Sex | Admitting diagnosis [1] | Payer |
| Zipcode (Res.)* | Secondary diagnoses(1-9)[1] | Source of admission |
| County (Res.) | | Discharge Date |
| Encrypted medical record number | | |

## DATA ELEMENTS NOT INCLUDED:

Name
Street address
Race or ethnicity

# Case Definition

- 1998 CSTE definition, for CO included:
  - Confirmed and probable cases
  - Maine residents

- We then excluded cases with E-codes indicating:
  - Fire-related
  - Intentional injury

# Data Analysis

1. Measures of person, place and time

2. Methods to estimate work-place exposure

   Verification using a newspaper search

3. Comparison

   Disaster vs. non-disaster-related cases

# Maine Hospital Visits Data, 1999 – 2003

- Total 740 cases identified;
  - 47 (6.4%) hospitalized
  - 693 (93.6%) in an outpatient setting
  - Subset of both seen in ED

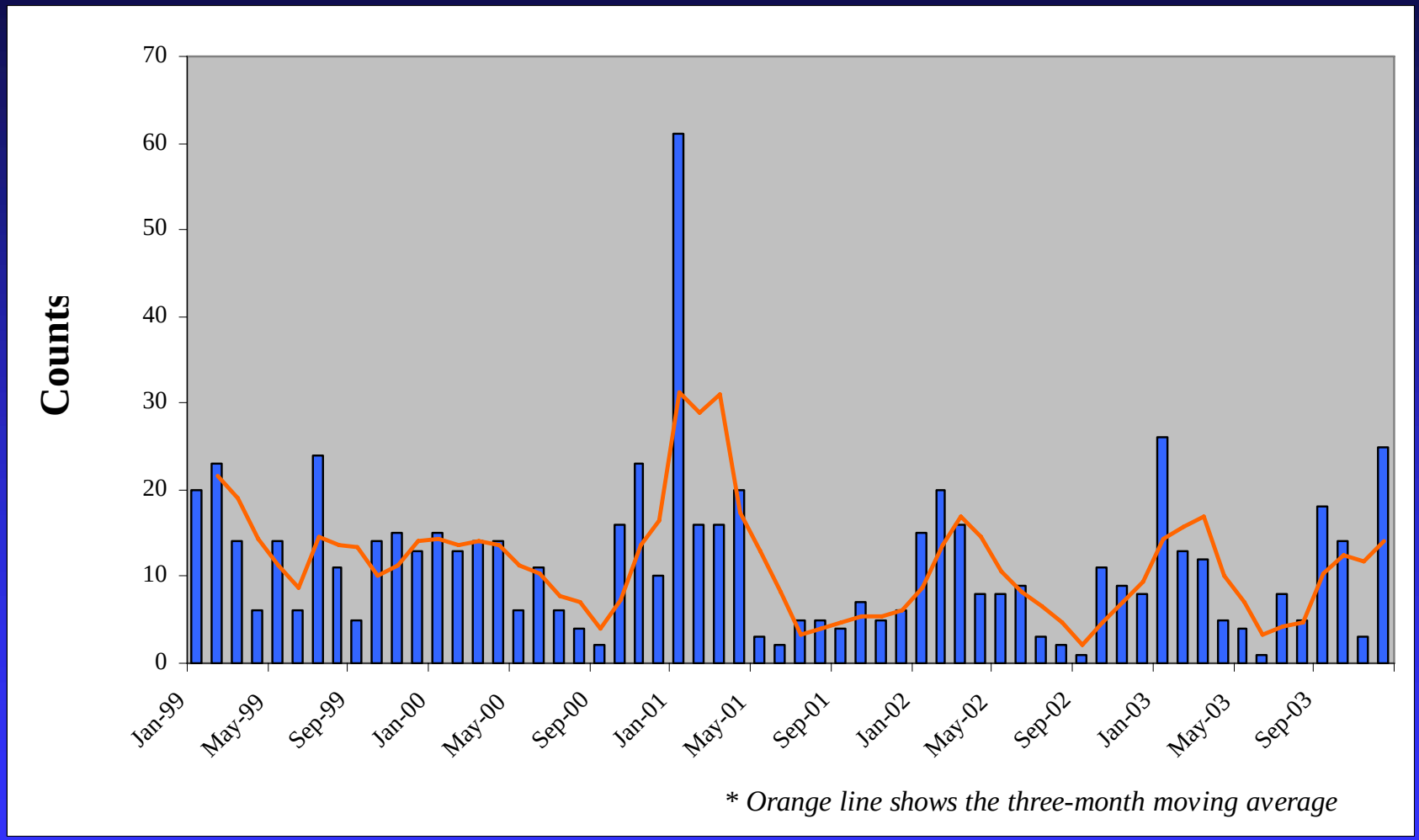
    = 442 (60%)

# Demographic Characteristics; 1999 – 2003

## Average annual rates / 100,000

| | OUT PATIENT | | | HOSPITALIZATIONS | | |
|---|---|---|---|---|---|---|
| | N | Crude Rate | 95% CI * | N | Crude Rate | 95% CI ** |
| All | 693 | 10.8 | (10.0 - 11.6) | 47 | 0.7 | (0.5 - 1.0) |
| **BY AGE GROUP** | | | | | | |
| 0-17 | 140 | 9.6 | (8.0 - 11.2) | 0 | . | . . |
| 18-34 | 233 | 17.4 | (15.2 - 19.6) | 9 | 0.7 | (0.3 - 1.3) |
| 35-64 | 290 | 10.8 | (9.6 - 12.0) | 25 | 0.9 | (0.6 - 1.4) |
| >=65 | 30 | 3.3 | (2.1 - 4.5) | 13 | 1.4 | (0.7 - 2.4) |
| **BY SEX** | | | | | | |
| Male | 380 | 11.5 | (10.3 - 12.7) | 33 | 1.0 | (0.7 - 1.4) |
| Female | 313 | 10 | (8.9 - 11.1) | 14 | 0.4 | (0.2 - 0.8) |

# CO Poisoning – Maine Outpatient data 1999 – 2003



# CO Poisoning – Characterizing Exposure Source

| Frequency of Carbon Monoxide Exposure-related E-codes<br>Accidental poisoning by…. | OUT PATIENT | | HOSPITALIZATIONS | |
|---|---|---|---|---|
| | N | (%) | N | (%) |
| Any CO-related E-code | 435 | (62.8) | 27 | (57.5) |
| E868.2 : Motor vehicle gas exhaust | 132 | (19.1) | 11 | (23.4) |
| E868.3 : CO domestic fuel | 85 | (12.3) | 4 | (8.5) |
| E868.8 : .CO other sources | 90 | (13.0) | 8 | (17.0) |

# CO Poisoning – Setting

# (Included those aged 16 and older)

| Source of Setting Description | N = 577 | (%) |
|---|---|---|
| **E-code for Place of Occurrence (E849)** | | |
| Residence | 100 | (17.3) |
| Work | 77 | (13.3) |
| Other (Specified) | 37 | (6.4) |
| Missing | 363 | (62.9) |
| **Payer Code** | | |
| Worker's Compensation | 77 | (13.3) |
| Other | 500 | (86.7) |
| **Combined Payer Code And E-Code** | | |
| Work | 133 | (23.1) |
| Other | 444 | (77.0) |

# Using E-codes to Identify Work-related Cases – Is it valid?

- Online newspaper search
  - *ProQuest Information and Learning Company [Copyright © 2005]*
- Searched for occupational exposure events
  - Search criteria:
    - Major Maine newspapers
    - Articles with the words “carbon monoxide” in the text
    - 1999 through 2003

# Using E-codes to Identify Work-related Cases – Is it valid?

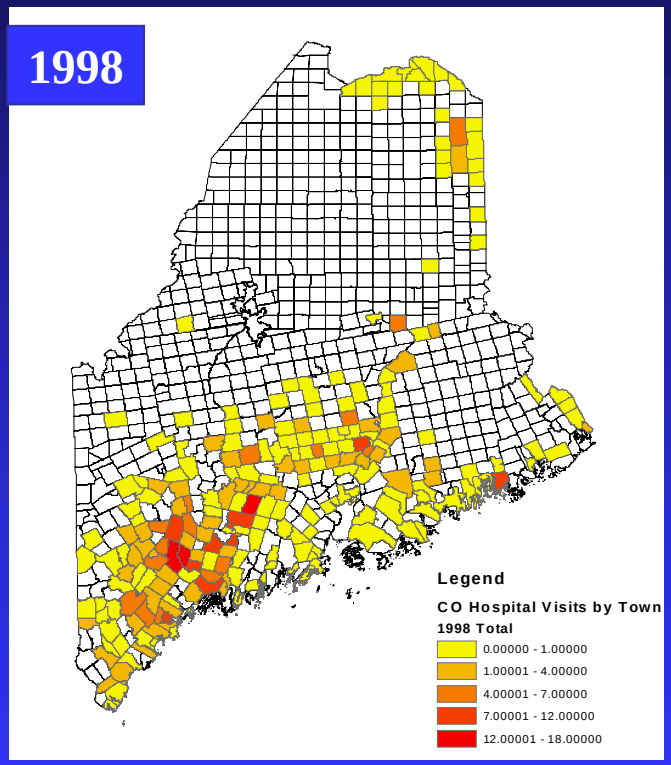
- 3 occupational exposure events
- Searched hospital visits data for corresponding records
  - Time – 5-day window around the date
  - Place – facility within HSA
  - Patient age >=16

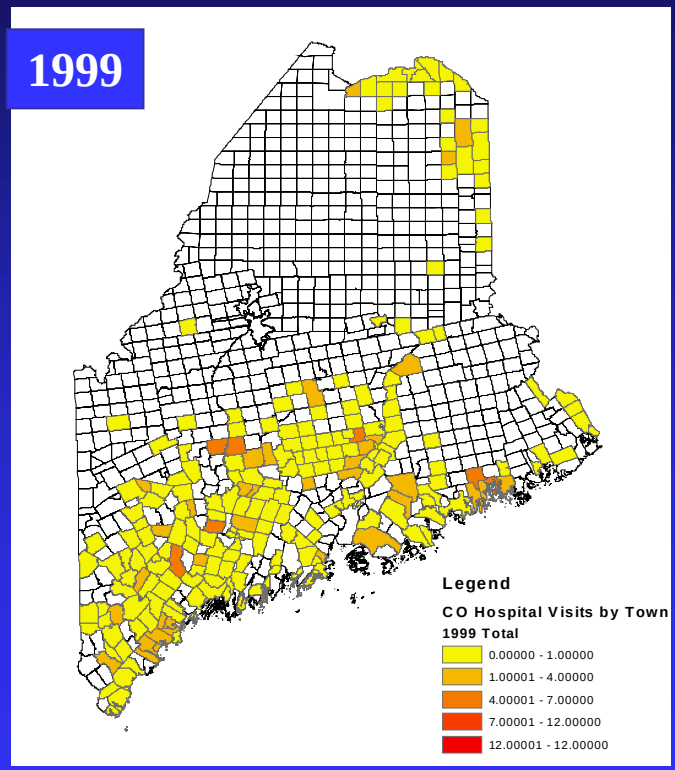
# Case Verification for Approach

- Found cases in ED visits database
  - Range: 7 to 29 people / event
- Payer code for Worker's Compensation:
  - 5% to 14%
- E-code for place (*Industrial place/premises*)
  - 58% to 96%

# *Maine, January 1998 ice storm*

# Outpatient visits for CO poisoning:
## *RATE/1,000*



# Disaster vs. Non-disaster-related cases
## *Comparison of Case Characteristics*

| | Ice Storm 1/7 - 1/27/1998 | Non-ice storm 1999-2003 |
|---|---|---|
| Age group | N % | N % |
| <17 | 64 (23.3) | 140 (20.2) |
| 18-34 | 69 (25.1) | 233 (33.6) |
| 35-64 | 109 (39.6) | 290 (41.9) |
| >=65 | 33 (12.0) | 30 (4.3) |
| Total | 275 | 693 |
| Sex: Female | 170 (61.8) | 313 (45.2) |

*All P-values are <0.0001 based on CMH Chi-square tests*

# Disaster vs. Non-disaster-related cases
## *Comparison of Exposure Characteristics*

| | Ice Storm 1/7 - 1/27/1998 | Non-ice storm 1999-2003 |
|---|---|---|
| Exposure Setting: Work place* | 4 (1.8) | 133 (23.1) |
| Motor vehicle exhaust | 17 (6.2) | 132 (19.1) |
| Domestic fuel | 78.0 (28.4) | 85.0 (12.3) |

*All P-values are <0.0001 based on CMH Chi-square tests*

# BRFSS

- BRFSS – random digit dial survey
- 9 questions Module
  - CO monitor presence in household (3)
  - Generators (6)
    - Use
    - Placement
    - Ownership

# BRFSS: Generator use

- Ever use a generator during a power outage?

  25.1% *(95% CI: 23.2-26.9)*

- Where was the generator usually placed when it is running?
  - Risk = in an attached or detached structure
  - Women were more likely then men
    - P= <0.0206
  - Especially during rain or snow
    - P= <0.0001

# BRFSS: CO Detector in Household

- Have a CO detector in the household?
  - 33.0%
  - > 95% have a smoke detector
- **Less** likely to have a CO detector: *(P =<0.001)*
  - Older - 65+
  - Lower income
  - Female head of household
  - Not married or living as a couple
- **More** likely to have a CO detector: *(P =<0.001)*
  - Have children
  - Own a generator

# Limitations

- Lack of national standards for surveillance
  - National Workgroup on CO surveillance
- Data sources not designed for this use
- Health outcome only
- Comparability with other states
  - 90% of states have hospitalization
  - 50% ED
  - Few have other outpatient visits

# Conclusions

- Conducting EPHT for CO poisoning is:
  - Feasible
  - Useful
  - Fills an existing PH gap
- Can track/describe person, place time
  - Conduct other useful analyses
- Can detect specific exposure events
  - Type and place of exposure event

# Next Steps: Maine

- Incorporate poison control data
- Broader dissemination of results
- Educate public / policy makers
- Apply to prevention and control
  - Legislative CO detectors
  - Make CO a reportable condition
  - Issue health alerts to clinicians
    - During large-scale power outage

# Next Steps: Nationally

- Continue working on surveillance standards
- Consider developing model legislation
  - Requirement for CO detectors
    - Residences
    - Work places
- Improve labeling on potential CO emitting devices
  - e.g. generators, boat engines