Detection of Carbon Monoxide Poisoning in Chief Complaint Data
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OBJECTIVE
To assess the ability to identify cases of carbon monoxide (CO) poisoning from chief complaints (CC) in hospital emergency department (ED) records submitted daily to the New York State (NYS) Department of Health (DOH) Electronic Syndromic Surveillance System (ESSS).

BACKGROUND
Carbon monoxide: each year in the U.S.
- > 15,000 people are treated in EDs for unintentional, non-fire-related exposure to CO
- > 500 deaths per year
- 64.3% of exposures occur in homes, from appliances such as gas furnaces and heaters, especially during power outages caused by severe winter weather
- > 2 ft snow fell during the night of Oct 13-14, 2006
- > 400,000 homes and businesses (70% of city of Buffalo) lost power
- > 100,000 had no electricity for up to 5 days, some for up to 12 days
- Newspapers reported that EDs received many patients suffering from CO poisoning
- Eventually, 3 deaths were attributed to CO poisoning

Snowstorm in western New York:

RESULTS

Methods
Retrospective review

Study period:
- data obtained for Sep 11 - Nov 15, 2006
- data shown for Oct 13-26, 2006

Data sources:
- Chief Complaint (CC) data from 12 hospitals in Erie (10) and Niagara (2) counties (see Figure 1) reporting emergency department data to NYSDOH’s Electronic Syndromic Surveillance System (ESSS)
- CC case definition: text strings such as ‘CARBON’ or ‘CO POISONING’ (including incorrect spellings or abbreviations, such as ‘CO2 EXP’) or references to gas appliances
- Statewide Planning and Research Cooperative System (SPARCS) data from same 12 hospitals
- SPARCS cases defined by ICD-9 codes in the primary or first 3 supplemental diagnosis fields:

<table>
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<th>Code</th>
<th>Description</th>
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<td>429.3</td>
<td>Exposure by other than intentional or self-inflicted means</td>
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<tr>
<td>992</td>
<td>Intentional self-inflicted injury or poisoning by CO from incomplete combustion</td>
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<td>Poisoning by other CO, unintentional whether by direct or indirect method</td>
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Comparison of ED visits identified as CO-related by chief complaint (CC) and those with CO-related diagnostic codes (ICD-9):

- ED records from ESSS and those from SPARCS were matched by medical record number (MRN) and then by date of birth
- Records with either CC-related Coder or CC-90s codes were examined

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Figure 1. Ten Erie County and two Niagara County hospitals with emergency departments were reporting chief complaint data to NYSDOH’s Electronic Syndromic Surveillance System in October 2006.

NYS DOH’s Electronic Syndromic Surveillance System (ESSS):
- daily submission of electronic ED records to NYSDOH
- currently, 134 of 144 hospitals in upstate NY (exc. NYC) report in October 2006, 12 hospitals in the storm area were reporting (see Figure 1)
- data includes medical record number (MRN) plus patient’s age, sex, Zip Code of residence, and chief complaint (CC) text (patient’s stated reason for visit, usually recorded by triage nurse, who may add comments; patients may report more than one reason or symptom)
- each CC searched for text strings indicating symptoms in one or more of 6 syndromes — asthma, fever, gastrointestinal (GI), neurological, respiratory, rash

Figure 2. Number of ED visits identified as CO poisonings or by ICDO-9 code or by mention of CO exposure in CC in 12 hospitals in Erie and Niagara counties, October 8-21, 2006.

DISCUSSION

This study demonstrates that Chief Complaint data from hospital EDs can provide valuable information regarding health hazard events. Submitted daily (or with short delays) through syndromic surveillance systems, this data is more readily available than other data sources, such as SPARCS (submitted after several months). Another advantage is the availability of medical record numbers, which hospitals can use to trace patients for investigation or follow-up.

The usefulness of CC data depends on:
- the availability of the data (which may be interrupted by power outages, staff shortages, etc.); automatic systems for both data creation and submission should be encouraged
- the use of appropriate search terms (‘EXPOSURE TO CO’ was the most common complaint recorded; symptoms like headache, nausea, etc., were used less often)

Once a problem is identified, patients or ED staff may refer it to CO text and leave out actual symptoms. Because CCs may be influenced by common knowledge or media coverage of an event (disease outbreak, storm, environmental hazard), searching for terms from news reports may help identify cases:
- locations (NEAR OIL TANK EXPLOSION)
- flight numbers
- events (‘SLEPT IN ROOM WITH GAS HEATER’)

After an event-related health hazard, we must also consider the “Bill Clinton effect”:
- 42 patients who reported CO exposure in the CC were NOT diagnosed with CO poisoning (25 of these records had no matched SPARCS records)
- Their exposure may have been insufficient to cause harm
- Or, some patients may have responded to news stories with extra caution; during event-related surveillance, some people may seek emergency care because of media influence rather than severity of symptoms

ED records also submitted to Statewide Planning and Research Cooperative System (SPARCS):
- include MRN and diagnostic codes assigned after evaluation of the patient (but not CCs)
- due within 30 days of each calendar quarter

Table 1. Number of ED records and all CO-related ED records, by source of data.

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<td>6842</td>
<td>18977</td>
<td>8000</td>
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<tr>
<td>6752</td>
<td>18777</td>
<td>226</td>
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Table 2. Number of ED visits identified as CO poisonings or by ICDO-9 code or by mention of CO exposure in CC; 69% of visits had both CC and diagnostic indicating CO exposure.

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Table 3. Symptoms mentioned as chief complaints (CC) by ED patients with CO-related ICD-9 diagnoses (ICD-9); symptoms were mentioned by only 24 of the 260 patients whose CCs also indicated CO exposure (CC1). Chief complaints may include more than one symptom.