Public Health Surveillance: A local health department perspective

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### Public Health Surveillance: A local health department perspective

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### Abstract

### Subject Terms

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### Number of Pages
39
Objectives

• Current public health surveillance
• Characteristics of the ideal surveillance system
• Boston’s enhanced surveillance system for bioterrorism and mass casualty events
• Future plans
Types of Surveillance

- Notifiable disease reporting
- Active surveillance
- Laboratory based surveillance
- Population based surveillance
Notifiable Disease Reporting

• Health care providers are required by law or regulation to notify public health about:
  – Named pathogens
  – Specified diagnoses
  – Outbreaks or clusters of illness

• Usually a passive system, but can use enhanced passive technique

• Reporting requirements differ among states
Notifiable Disease Reporting: Why it’s incomplete

- Unaware of the requirement to report
- Confused about the mechanics of reporting
- Concern about confidentiality
- Someone else’s job
- Unconfirmed case (wrong diagnosis, no lab)
- Forgot to do it
Active surveillance

• Public health staff review records and other data on site (for example, at a hospital)
• Provides fairly complete data
• Very labor intensive and requires a sustained effort - resources become a problem
Laboratory based surveillance

• Laboratories are required to report certain positive test results to public health
• Isolated laboratory data are incomplete
  – False positives, false negatives
  – Skewed testing (publicity, specific signs and symptoms)
• Molecular microbiologic techniques enhance epidemiologic investigations
Population Based Surveillance

- Illness in closed communities (such as incarcerated populations)
- Absenteeism rates
- Insurance claims data
- Sales of specific products (such as anti-diarrheal medications)
The Ideal Surveillance System

Fast, cheap, and easy...
The Problem

• Traditional surveillance systems based on the reporting of specific diseases have limited potential for early detection of mass casualty events such as bioterrorism or pandemic influenza.
Milwaukee: Cryptosporidium Infection Related to the Public Water Supply

- Estimated 400,000 people had outbreak associated diarrhea.
- 285 laboratory confirmed cases.
- Recognition of the outbreak was delayed:
  - Non-specific nature of the symptoms
  - Limited laboratory testing
  - Infrequent use of the health care system by people with diarrhea
Identification of the Outbreak

• Shortages of over the counter anti-diarrheal medications
  – pharmaceutical sales data impacted by sales & is unlikely to detect small case numbers

• Retrospective data indicated changes in health care utilization patterns prior to identification of the outbreak
Agents of Concern: CDC Category A

- *Bacillus anthracis* (anthrax)
- *Clostridium botulinum* toxin (botulism)
- *Yersinia pestis* (plague)
- variola major (smallpox)
- *Francisella tularensis* (tularemia)
- Viral hemorrhagic fever
Agents of Concern: CDC Category B

- *Coxiella burnetti* (Q fever)
- *Brucella* species (brucellosis)
- *Burkholderia mallei* (glanders)
- ricin toxin from *Ricinus communis* (castor beans)
- epsilon toxin of *Clostridium perfringens*
Agents of Concern: CDC Category C

• Nipah virus
• hantaviruses
• tickborne hemorrhagic fever viruses
• yellow fever
• multidrug-resistant tuberculosis
Bioterrorism Events in the United States

• 1984, The Dalles, Oregon
  – Salmonella in salad bars
  – 751 ill (45 hospitalized)

• 1996, Dallas, Texas
  – Shigella in micro-lab donuts
  – 12 ill (4 hospitalized)
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The Ideal Surveillance System

- Sensitive (with enough specificity to make it workable)
- Timely
- Provides complete data
- Cost effective
- Linked to an effective follow-up system to interpret initial signals
Enhanced Surveillance in Boston

- Emergency department visits
- Urgent care visits
- Boston EMS calls
- Death certificates
- Poison Control Center
Enhanced Surveillance in Boston: Hospitals

- Every 24 hours volume data is electronically sent by SFTP to the Boston Public Health Commission (BPHC)
- Threshold data for each site based on historical data has been calculated
- If threshold is exceeded an initial assessment is automatically sent to an onsite contact
Calculations

Binomial distribution: adjust for month and day of the week

Number of events = average daily volume by month
n = Boston population (1990 census)
p = number of events/n

Upper CI = p + ((1 - ?)(sqrt(p)(1-p)/(n))))
Upper threshold = Upper CI(n)
Enhanced Surveillance in Boston: Hospitals (Cont’d)

• If a cluster or any unusual cases of illness are identified on initial assessment, BPHC nurses/epidemiologists investigate further

• Data are typically available within 12 hours after the close of a 24 hour period
Enhanced Surveillance in Boston: Other Sites

- Poison Control Center: daily volume data being sent, thresholds being adjusted
- Boston EMS: type of calls of interest selected, automatic data transfer being developed
- Death Certificates: database developed; timeliness of data input being addressed
Enhanced Surveillance in Boston
Preliminary Findings

• System detected morbidity associated with a heat wave (retrospective)
• Volume data corresponded well with influenza activity in 1999 and 2000
• System identified changes in health seeking behavior post September 11
Volume data and influenza

- In 2000 there were 103 episodes of a site exceeding threshold.
- However, 3 or more sites simultaneously exceeded threshold on only 4 days and 2 sites on 17 days.
- Most of the time (N=54), only one site exceeded threshold on a given day.
Daily volume by site
December 1, 1999 - January 31, 2000

Days exceeding threshold
Peak influenza activity in the U.S. (12/26 to 1/15/00)
Volume Surveillance - 12/4 to 12/9/00

- Exceeded threshold

1st flu isolate in MA
Volume data: Findings from 9/11/02 -11/11/02
Daily volume by site
September 11, 2001 - November 11, 2001

Days exceeding threshold. No infectious disease clusters identified.
How many times did multiple sites exceed threshold on a given day?

- There were 22 episodes of a site exceeding threshold in the time period.
- For most (n=17) only a single site exceeded threshold on a given day.
- On two days, two sites simultaneously exceeded threshold.
- On one day, four sites simultaneously exceeded threshold.
Follow-Up with sites exceeding threshold and Boston Public Health Commission’s (BPHC) Response

- Persons seeking nasal swabs and antibiotics for anthrax resulted in increased activity on 10/15
- No anthrax cases or anthrax contaminated environmental specimens were identified in Massachusetts
- The BPHC posted information on anthrax including updates to BPHC’s website (www.bphc.org)
- Clinical advisories on anthrax were emailed to health care providers throughout the city
Enhanced Surveillance in Boston

**Strengths**
- Adjusts for site case mix
- Adjusts for seasonal changes
- City wide coverage
- Electronic

**Weaknesses**
- Non-specific for BT events
- Changes influenced by the business of health care
Conclusions

• Volume based surveillance is a feasible method for the early identification of a mass morbidity event
• A rapid follow-up system is a critical component to understanding initial signals
• Data from this system can be used to create educational messages for both health care providers and the public
• Additional research is needed to define the sensitivity of the individual or combined measures being used and the optimal combination to detect significant activity
Enhanced Surveillance in Boston: Lessons Learned

- Systems must be electronic
- Add on systems will not be sustainable
- Computers system go down (even for days)
  - Develop back up plans
- Don’t abandon case reporting
  - No one system is perfect
- The more complex data - the harder it will be to retrieve it manually
- Build communication networks into the surveillance system
Enhanced Surveillance in Boston: Future Plans

• Capture more granular data
  – Chief complaint data
  – Natural language programming
  – Minimize human contact
• Add additional populations and types of health care sites
• Enhance the surveillance feedback loop
• Syndromic surveillance
Syndromes That May Be Associated With Bioterrorism

• Pulmonary
  – Fever
  – Cough
  – Myalgias
  – Hypoxia
• GI
  – Fever
  – Nausea/vomiting
  – Diarrhea (+/- bloody)
• Rash and fever
  – Vesicular
  – Petechial
• Neurologic
  – cranial nerve palsies, HA, fever, confusion
• Septic Shock
  – DIC
  – Organ failure
Syndromic Surveillance

• ICD-9 code data or chief complaints to identify potential BT-related syndromes
  – How much is to much
  – Follow-up is critical
  – Real time data is limited
  – Sustainability
  – Validity of chief complaint data - How do different populations describe illness
Questions?