

Syndromic Surveillance

New York City Department of Health
Communicable Disease Program

July 18, 2002



Definitions

- **Traditional Surveillance**
 - Relies on etiologic diagnosis
- **“Syndromic” Surveillance**
 - Surveillance for non-specific mild illness
 - “Prodromic”– when harbinger of more severe illness



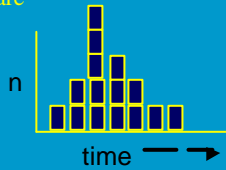
Why use Syndromic Surveillance?

- **When timeliness/early detection are critical**
 - Biologic terrorism
 - Outbreaks
- **When making diagnosis is difficult or time-consuming**
 - Viral gastroenteritis
 - New and emerging pathogens
 - Consequences of events



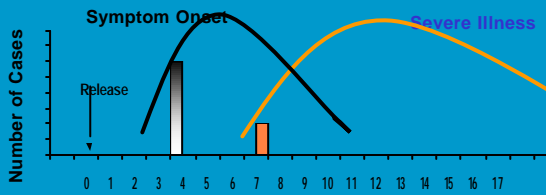
Assumptions

- BT release acts like point source outbreak
- Prodromal cases seek early care
- Visits made to EDs
- Geographic clustering
- Early detection is beneficial



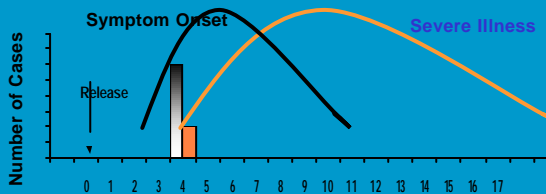
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Rationale for Syndromic Surveillance



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Small difference between detection of symptoms and diagnosis



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Attributes of an Ideal Syndromic Surveillance System

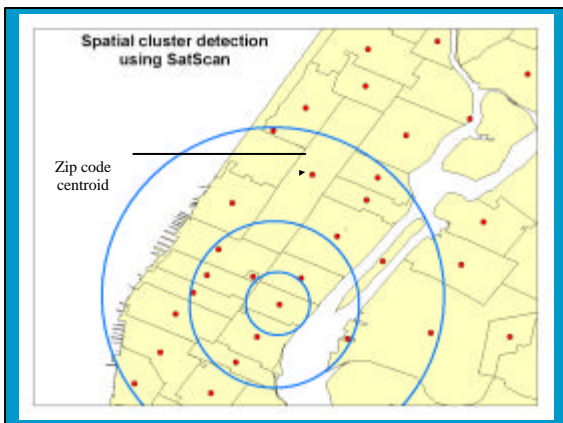
- Timely
 - Data in “real time” (12 hours max)
- Sensitive
 - Syndrome-specific
 - Space/time clustering
- Sustainable/Reliable
 - Routinely collected for other purposes
 - Electronic format & transfer
- Flexible
 - “Dual use” can focus on asthma or other emerging priorities



Spatial Scan Statistic (SaTscan)

- Flexible windows in time and space
- Calculates Log Likelihood Ratio $[(O/E)^{O_{in}} * (O/E)^{O_{out}}]$
- Probability through Monte Carlo simulations
- Designed for cancer cluster detection— Modified to estimate expected count through past history



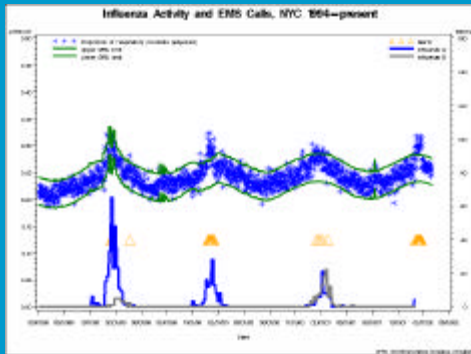


Syndromic Data Sources

- **In Daily Operation**
 - Ambulance Dispatch
 - ED Visit Logs
- **In Production**
 - Subway Worker Absenteeism
 - Pharmacy Chain Sales

- **Potential Future Sources**
 - HMO/Nurse's Hotline
 - School Absenteeism
 - Laboratory submissions & results

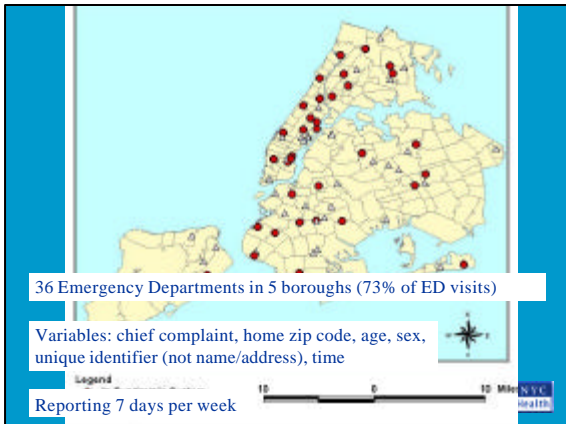


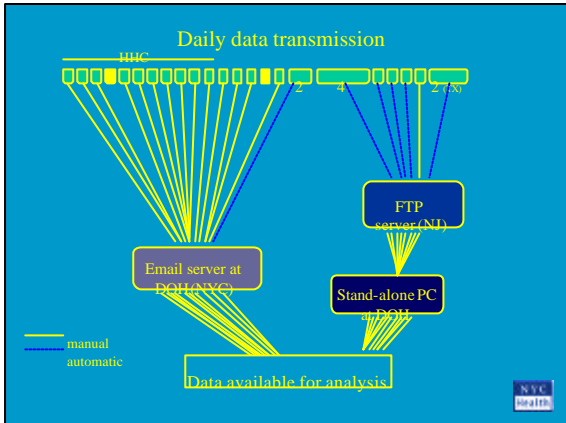


ED log background

- EIS officers Sept. 13 - Oct. 8
- Fax system
 - faxed ED logs each morning
 - Hand coded & data entry
 - Application of statistical methods
- Electronic system started Oct. 18
 - Daily email of previous day's 24-hr log
 - Whatever file format hospital could provide
 - HHC came on as group







Electronic ED logs

Example 1

Admission List For 01/28/2002 to 01/28/2002

AGE	SEX	TIME	CHIEF COMPLAINT	ZIP
15	M	01:04AM	ASSAULTED YESTERDAY, RT EYE REDDENED.	11691
1	M	01:17AM	FEVER 104 AS PER MOTHER.	11455
42	F	03:20AM		11220
4	F	01:45AM	FEVER, COUGH, LABORED BREATHING.	11507
62	F	02:51AM	ASTHMA ATTACK.	10013
48	M	03:04AM	SOB AT HOME.	10027
26	M	06:02AM	C/O DIFFICULTY BREATHING.	
66	M	07:01AM	PT. MOTTLED AND CYANOTIC.	10031

Automatic coding with SAS

```
IF INDEX(CC, "FEV") > 0  
  
OR INDEX(CC, "HIGH TEMP") > 0  
  
OR INDEX(CC, "NIGHT SWEAT") > 0  
  
OR (INDEX(CC, "CHILL") > 0 AND  
INDEX(CC, "ACHILLES") = 0)  
  
OR INDEX(CC, "780.6")  
  
etc.  
  
THEN FEVER=1;
```



Key syndromes of interest

Age 13+

- Respiratory** cough, shortness of breath, URI, pneumonia
excludes: cold symptoms
- Fever** fever, chills, body aches, flu, viral syndrome
excludes: cold

All ages

- Diarrhea** diarrhea, gastrointestinal, GI
excludes: abdominal pain alone, nausea alone
- Vomiting** *excludes:* diarrhea



Six Month Summary

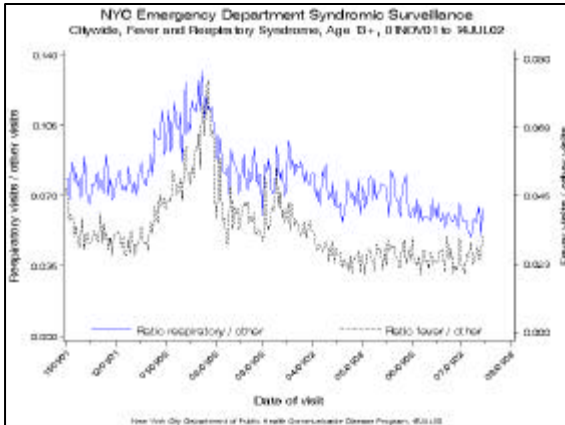
(November 15, 2001-May 15, 2002)

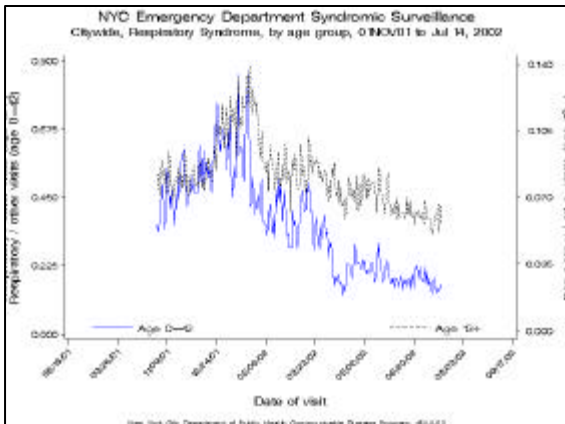
- Total ED visits:** 1.2 million
- Mean daily visits:** 6,552
- Reporting %:** 96%
- Data quality:** 96%

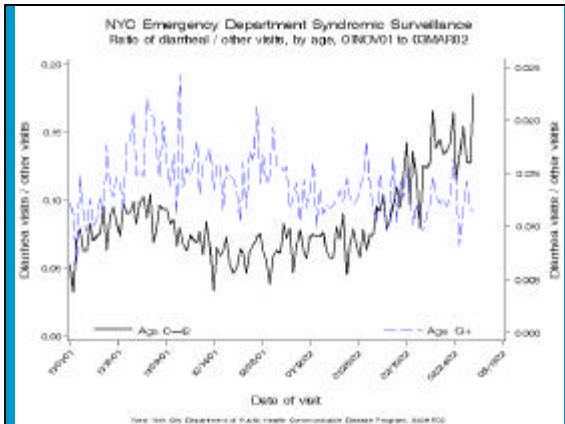


Statistically significant spatial signals (p<0.01)

Analysis/syndrome	Number of signals	Mean Observed cases in Signal	Mean Expected cases in Signal	Mean excess cases in Signal
Citywide temporal analysis				
Respiratory age 13+	19	793	697	96
Fever age 13+	14	439	368	71
Diarrhea	8	373	299	73
Vomiting	10	523	440	88
Hospital spatial analysis				
Respiratory age 13+	5	75	48	28
Fever age 13+	8	32	15	17
Diarrhea	7	23	10	13
Vomiting	9	34	18	16
Zip code spatial analysis				
Respiratory age 13+	7	51	27	23
Fever age 13+	5	18	6	12
Diarrhea	9	16	5	11
Vomiting	4	19	6	13









Evaluating Syndromic Surveillance

- Retrospective “detection” of influenza (EMS, ED log)
- Prospective detection of city-wide outbreaks in NYC (influenza, GI)
- More rigorous testing needed
 - Chief complaint, chart reviews
 - Data simulation
 - Mock event

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Operational challenges

- System setup
 - Building relationships with emergency departments, infection control departments
 - Assessing data availability and transfer methods
 - Establishing computer algorithms for data processing, coding, analysis, and output
- System maintenance
 - Interpreting public health significance of statistical alarms
 - Developing sustainable and useful response protocols
 - Troubleshooting (daily) data transfer problems
 - Expanding network of hospitals



Operational challenges (cont.)

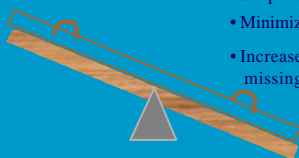
- Deciding on the type of system
- Methodology
- Negotiations
- Code
- Electronic transfer
- Converting file formats
- Population based
- Daily runs
- Troubleshooting ...

...is the easy part



Choosing a Threshold

Favor specificity



- Set p value low (0.001)
- Minimize false alarms
- Increase probability of missing a real event



Choosing a Threshold

Favor sensitivity

- Set p value high (0.05)
- Decrease probability of missing a real event
- Many false alarms



Challenges in responding to “alarms”

Distinguishing between...

- Natural variability in data
- Seasonal events
- True outbreaks
- BT illness

Determining appropriate level of response...



Guidelines for evaluating alarms

More concerning

- Sustained or increasing visit rate
- Multiple hospitals involved
- Dual syndromes in same area
- High number of cases
- Other surveillance systems alarming
- Strong geographic clustering

Less concerning

- One-day increase
- Single hospitals involved
- Low number of cases
- No other evidence
- Diffuse increase across city



Response Options

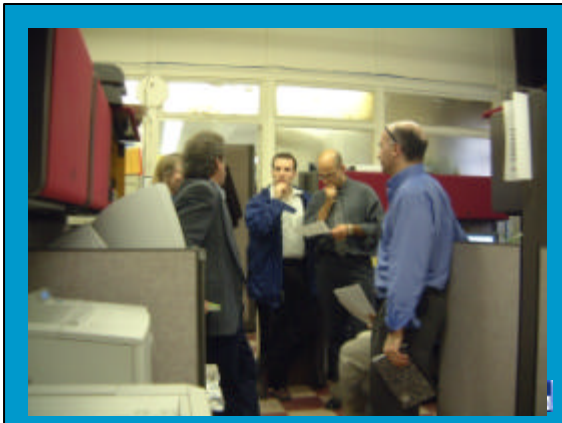
Level 1

- Age distribution
- Line list of CC
- Review other systems
- Get electronic 12 hour log(s)
- Fill in missing data
- Call EDs
- Broadcast alert

Level 2

- Retrieve & code paper log(s)
- Review charts
- Call EDs, ICNs, ICUs, ID, Chief residents...
- Call local uninvolved hospitals
- Augment lab testing
- Call patients (Clin/Epi)
- Dispatch response teams





Fever Cluster, February 2-5, 2002

	<u>Obs/Exp</u>	<u>P value</u>	<u>Hospitals</u>
Feb. 1	44/20	0.001	LEN, MET, MTS, RSV, STL, STV
Feb. 2	31/14	0.007	BIP, LEN, RSV, STL, STV
Feb. 3	11/2	0.001	BIP
Feb. 4	41/23	0.011	BIP, LEN, MTS, RSV, STL, STV
Feb. 5	12/3	0.008	BIP



Fever Cluster, February 2-5, 2002

Investigational steps:

1. Request 12 hour interim log (s)
2. Calls to EDs, ICUs, etc.
3. Review medical records
4. Call patients re: clinical status
5. Request diagnostic testing
6. Clinical and epi patient interviews
7. Station medical/epi teams in EDs



Costs

- Time
 - 7 days / week system
 - Data processing / analysis: 2-3 hours/day
 - Review and interpretation: 0.5- 1 hour/day
 - Response
 - none: 0 hours; verification only: 1-2 hours; more intensive: 3-6 hours
- Personnel (7 day staffing)
 - Data manager/analyst
 - Medical epidemiologist
 - Consultant epidemiologists as needed
 - Surveillance staff (field-based teams) as needed
 - System coordinator



Next steps

- **VALIDATION**
 - Intensive investigation of alarms to document epidemiologically linked cases within clusters
 - Simulation datasets
 - Sensitivity / specificity of chief complaint for “actual” clinical condition
- **OPTIMIZATION**
 - Refine syndrome definitions
 - Refine calculation of “expected” values (e.g. control for day-of-week effect)



Next steps (cont.)

• EXPANSION

- Add hospitals
- Add different reporting sources (e.g. school absenteeism, outpatient clinics)

• APPLICATION TO OTHER OUTCOMES

- Asthma surveillance
- Injury



SUMMARY

- ≈ Clear goals for system
- ≈ Existing data sources
- ≈ Electronic data transmission (Automate)
- ≈ Statistical expertise
- ≈ Balance sensitivity/ specificity
- ≈ Hierarchical response
- ≈ Field response Epi Teams
- ≈ Syndromic surveillance is evolving



Acknowledgements

NYCDOH Syndromic Surveillance Team:

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	Field teams
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