An Overview of Syndromic Surveillance

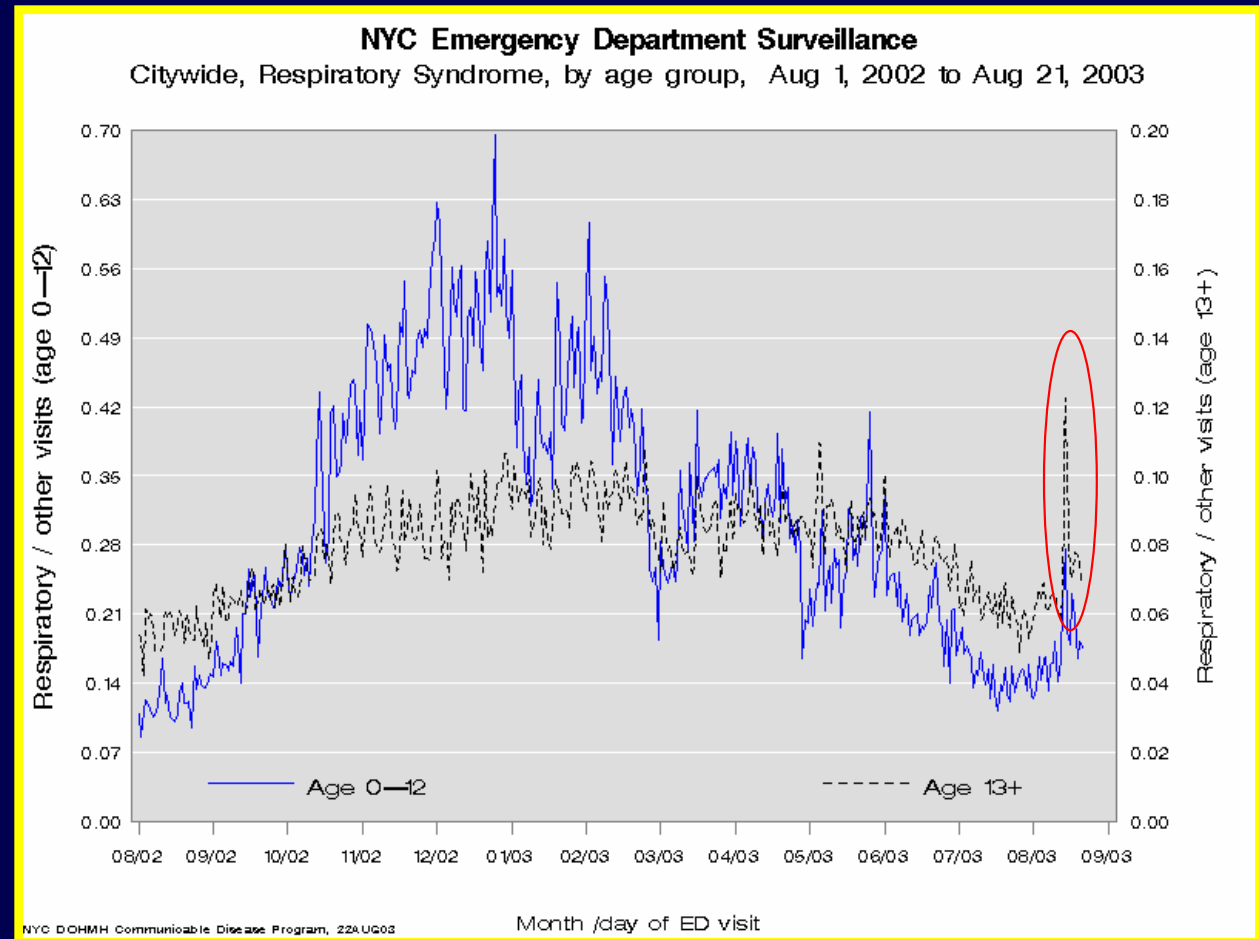NYC Emergency Department Surveillance
Citywide, Respiratory Syndrome, by age group, Aug 1, 2002 to Aug 21, 2003

Community Health Care Association of New York State
Don Weiss, MD, MPH
Bureau of Communicable Disease
New York City Department of Health & Mental Hygiene
March 9, 2007

NYC Health

Disease surveillance:

The ongoing collection, analysis and dissemination of information on health, disease and its determinants, with the ultimate goal of preventing disease and promoting health

Methods:

- Passive vs. active

- Paper vs. electronic

Goals:

- Monitor disease rates & trends

- Risk factors & exposures

eURF

http://www.nyc.gov/html/doh/html/hcp/hcp-urf1.shtml

What is syndromic surveillance?

- Outbreak detection
- Timeliness
- Electronic & automated
- Pre-diagnostic data sources
- Categorization into "syndromes"
- Rapid & continuous analyses

MCHUMOR by T. McCracken

"Off hand, I'd say you're suffering from an arrow through your head, but just to play it safe, I'm ordering a bunch of tests."

NYC Health
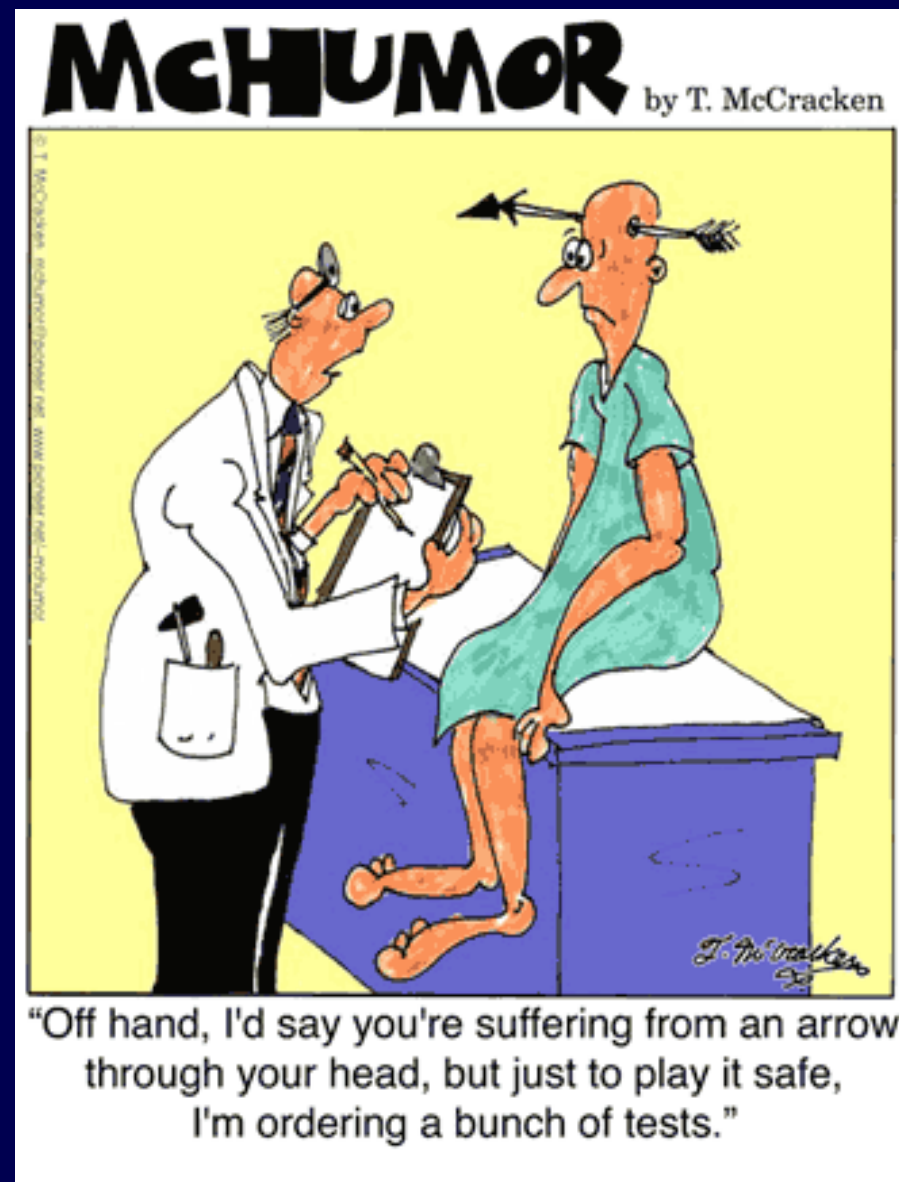
Traditional vs. Syndromic Surveillance

Traditional

- Lab/clinician diagnosis

- Passive, established, slow

- Main ID system

- Same in all states & territories

- Government

- Analyses are simple

- No special funding

Syndromic

- Constellation of symptoms

- Active, new, fast

- Adjunct system

- Sporadic, dissimilar

- Government, academia & for profit

- Analyses more complex

- Federal dollars

NYC Health
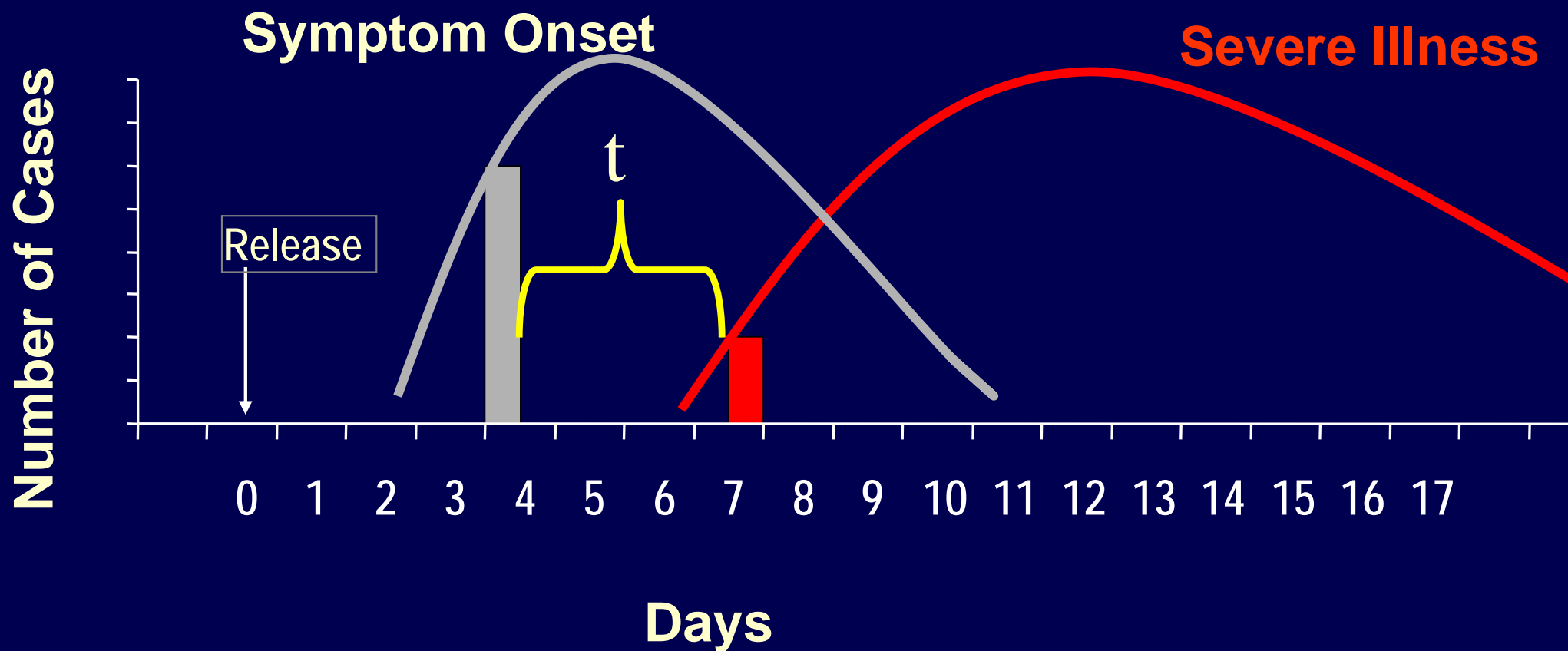
Theory

Theory

[1] Outbreak behavior

  Sharp & sustained upslope of epidemic curve

[2] Health behavior

  Early access to care

[3] Clinical patterns

  Similarity of symptoms

[4] Geographic patterns

  Common exposure

[5] Data collection

  Electronic format
  Busy clinical staff

n

time
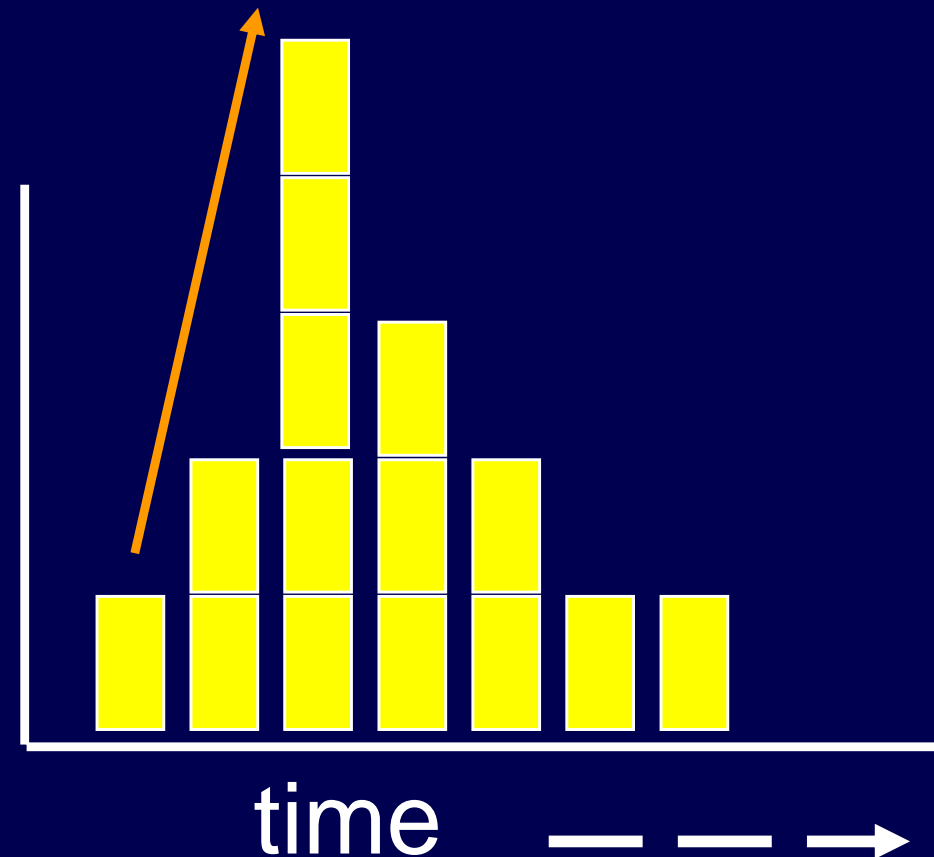
Data sources

Provider encounters

- ED
- Outpatient
- School Nurse

Commercial sales

- OTC medications
- Prescriptions
- Thermometers, diapers

Other health data

- 9-1-1 ambulance dispatch
- Laboratory/radiology
- HMO hotlines
- Worker absenteeism

NYC
Health

Which data sources are best?

A four-quadrant chart plotting data sources by Utility (x-axis) and Availability (y-axis):

- **Yellow quadrant (high availability, low utility):** 9-1-1, School
- **Pink quadrant (high availability, high utility):** ED, OTC, Rx
- **Gray quadrant (low availability, low utility):** Sales, Absenteeism
- **Blue quadrant (low availability, high utility):** OPD, RN hotline, Lab/Xray
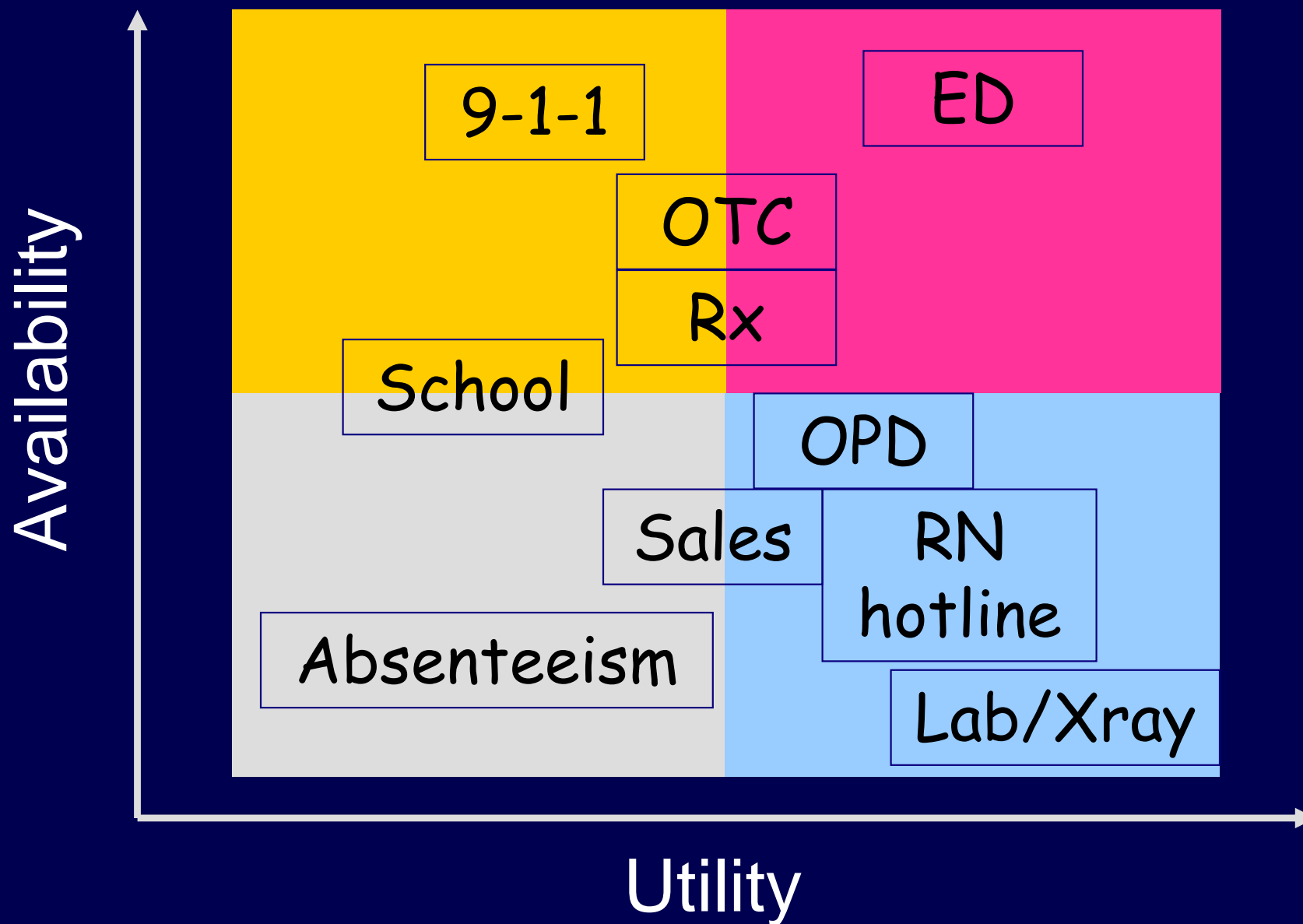
Privacy/Legal

- NYC Health code: detect and investigate outbreaks

- Data files omit name, address, phone

- Need link to patient

- HIPAA allows reporting to public health

- Define "minimum data necessary" to protect the public's health

- Evolving issue

NYC
Health

NYC Systems

- ED
- OTC Pharmacy
- Rx pharmacy
- RODS Pharmacy
- 9-1-1 Ambulance dispatch
- HHC Outpatient
- School Nurse

NYC
Health

Emergency Department Surveillance
New York City, February 2006

H Participating EDs

▲ Other EDs

77% of 62 EDs in NYC
~90% of ED visits
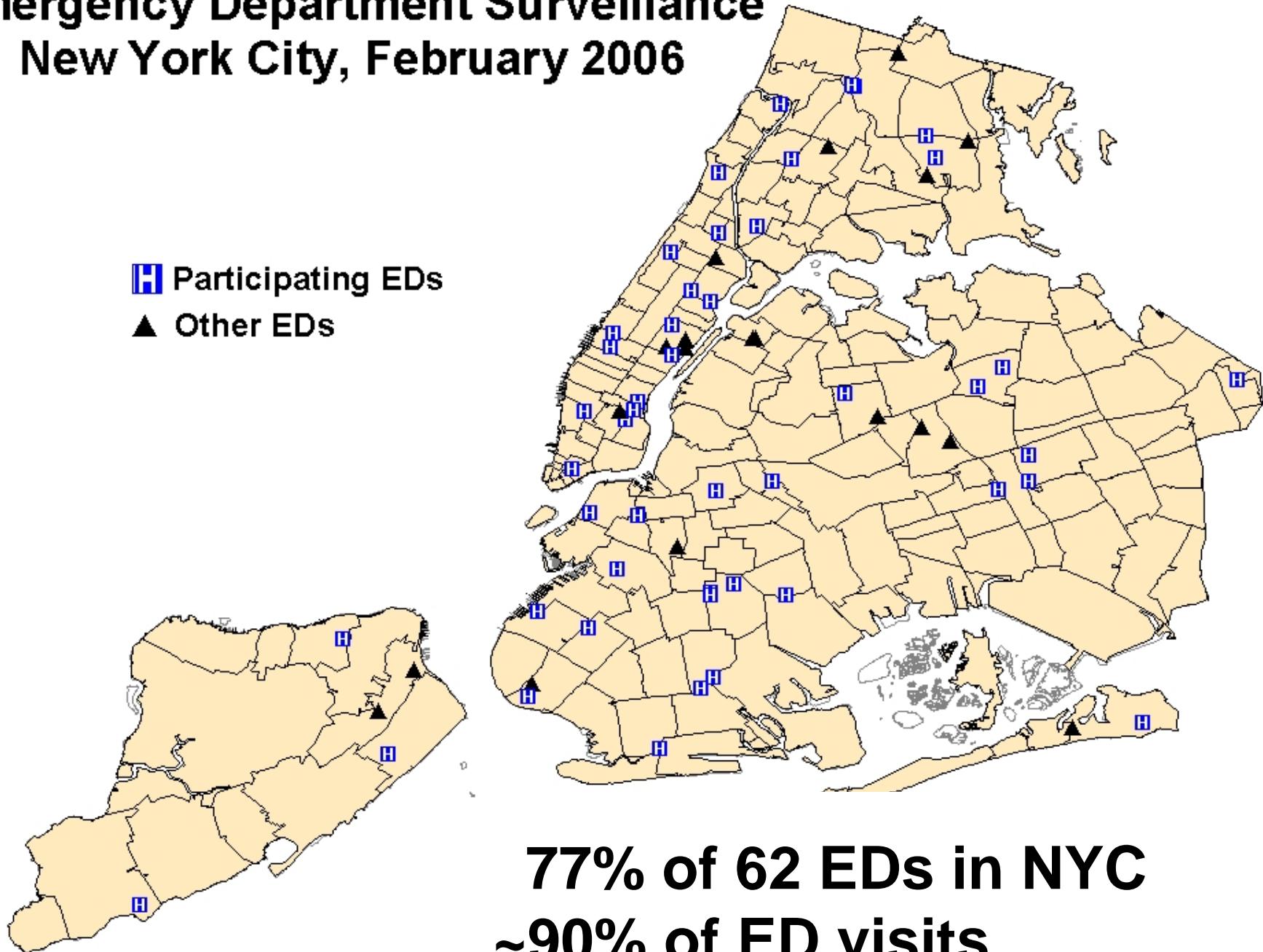
ED Data

Age	Sex	Home Zip	Time	Chief Complaint	Discharge Diagnosis ICD9
15	M	11691	01:04	ASSAULTED YEST	
1	M	11455	01:17	FEVER 104	
42	F	11220	03:20		
9	F	10013	22:51	ASTHMA ATTACK	493.9
48	M	10027	13:04	SOB AT HOME.	
66	M	10031	17:01	PT. CYANOTIC	

NYC Health

Syndrome coding
Based on chief complaint

Respiratory illness

    key words: cough, shortness of breath, URI, pneumonia

    excludes: cold symptoms

Febrile illness

    key words: fever, chills, body aches, flu

Gastrointestinal illness

    key words: diarrhea, vomiting

    excludes: abdominal pain, nausea

Daily statistical analyses

- Citywide temporal aberrations

- Spatial clusters
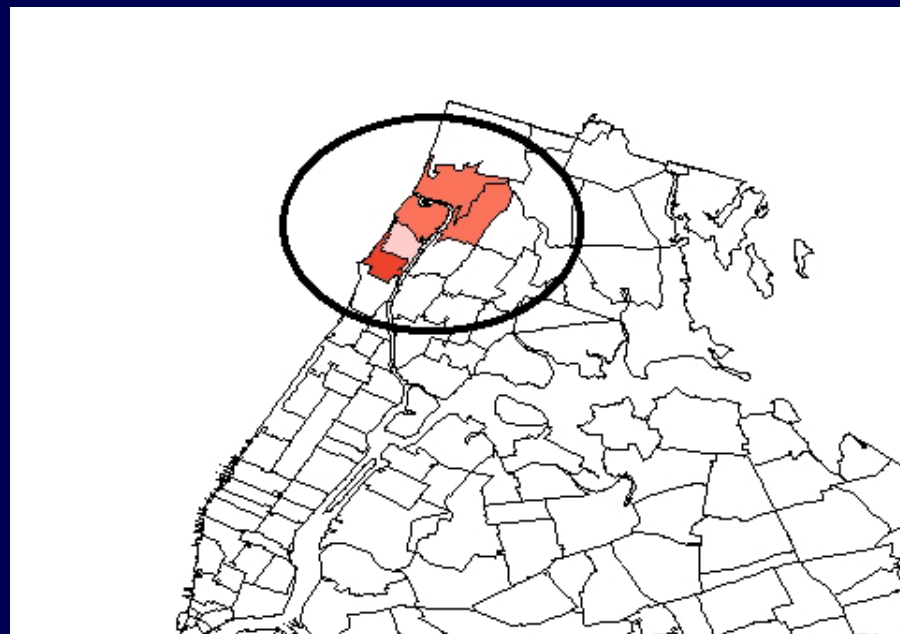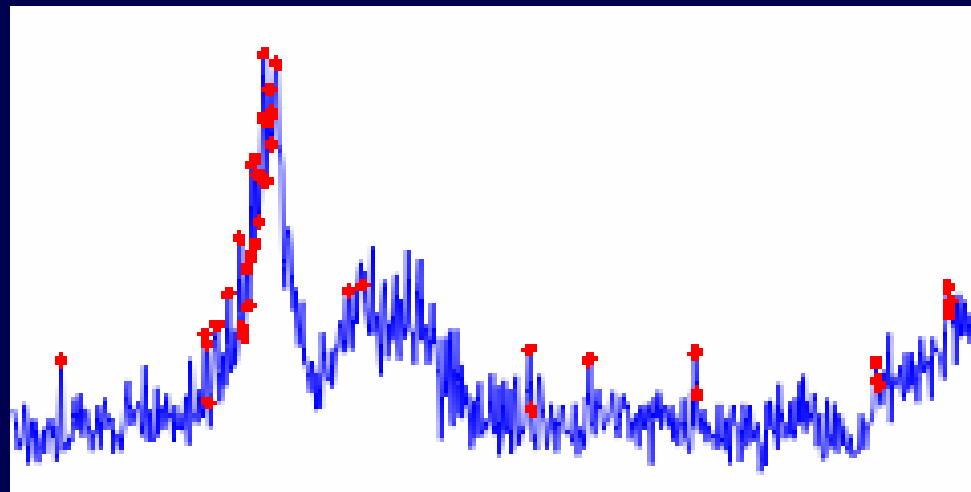
Results

Citywide

Citywide Signals by Syndrome and Year

Count

	year					Total
	2002	2003	2004	2005	2006	
Diar	30	24	43	59	30	186
Fevflu	31	38	51	42	16	178
Resp	36	56	69	69	70	300
Vomit	26	15	38	45	41	165
Total	123	133	201	215	157	829

Spatial

Spatial signals by Syndrome and Year

Count

	year					Total
	2002	2003	2004	2005	2006	
Diar	16	16	11	14	23	80
Fevflu	13	21	7	16	10	67
Resp	11	8	7	4	6	36
Vomit	16	10	4	18	10	58
Total	56	55	29	52	49	241

NYC
Health

GI Syndromes-Citywide trend, 2006-07

NYC Emergency Department Surveillance

Citywide trends in the ratio of syndrome visits to other visits through Feb 25, 2007

Diarrhea Syndrome, All ages, last 18 months

Last 30 days

Vomiting Syndrome, All ages, last 18 months

Last 30 days

Date of ED visit

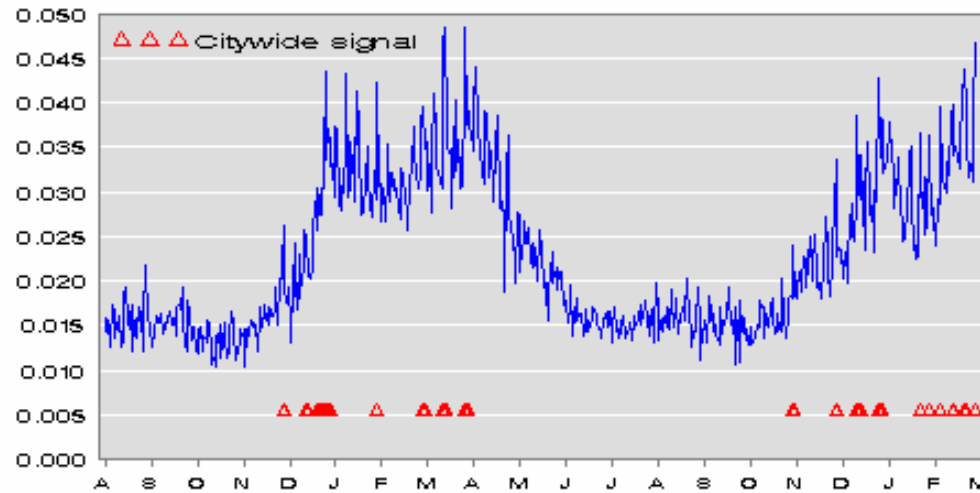NYC DOHMH Bureau of Communicable Disease, 26FEB07
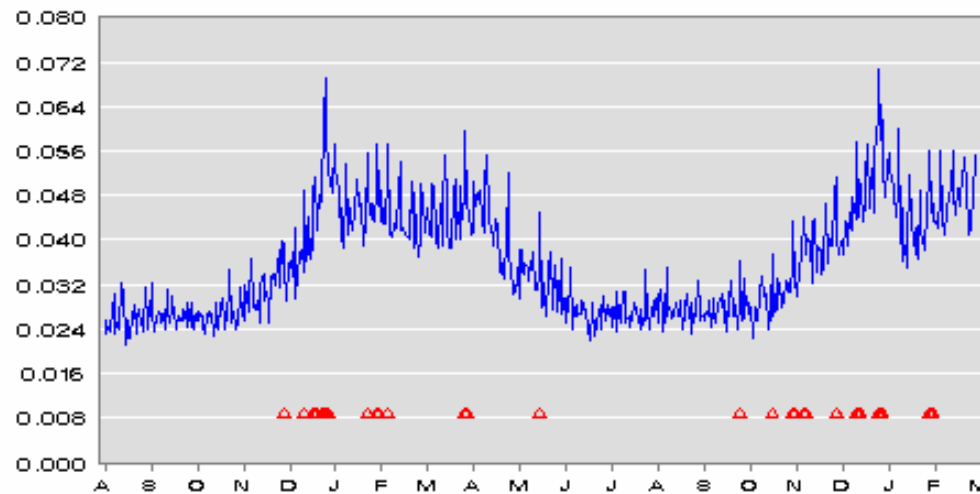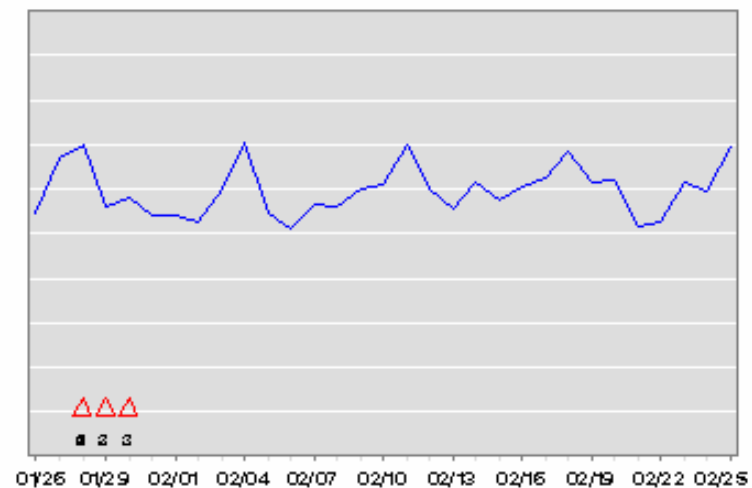
Resp & Fever Syndromes-Citywide trend, 2006-07

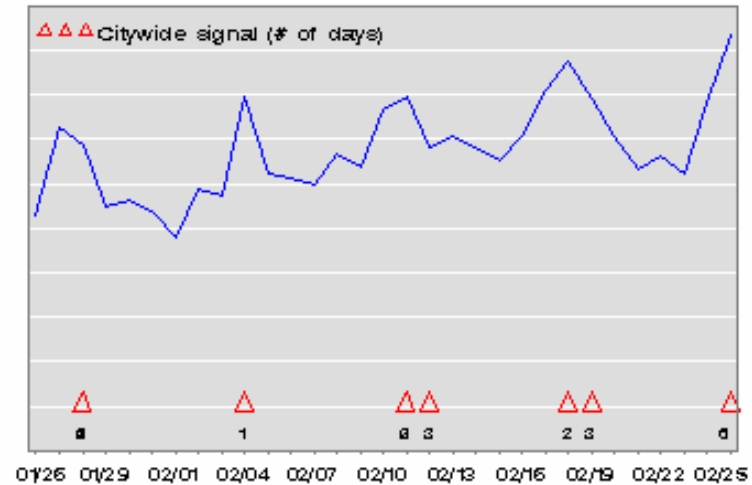**NYC Emergency Department Surveillance**

Citywide trends in the ratio of syndrome visits to other visits through Feb 25, 2007

Respiratory / other, Age 13+ , last 18 months
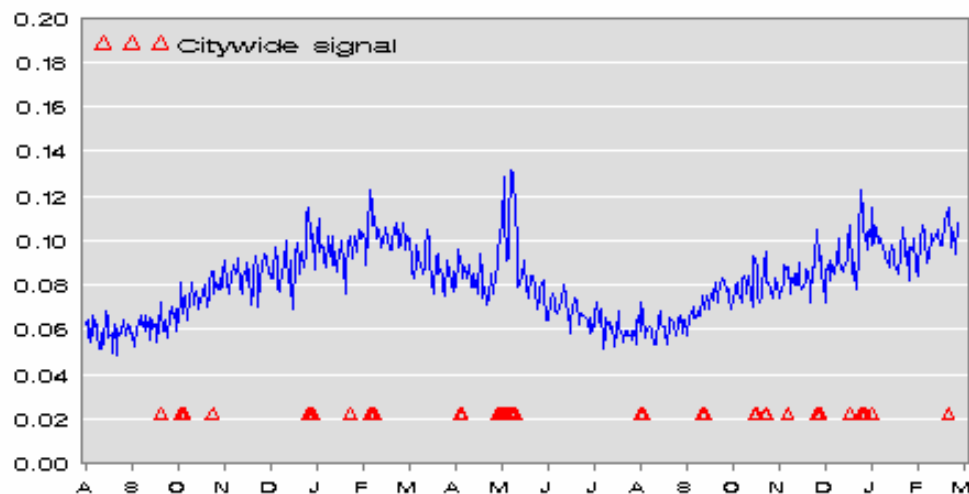
Last 30 days

Fever / other, Age 13+ , last 18 months

Last 30 days

Date of ED visit

NYC DOHMH Bureau of Communicable Disease, 26FEB07
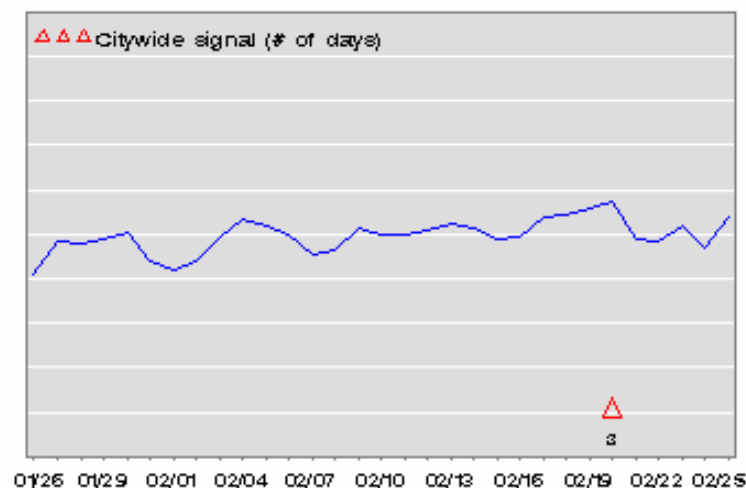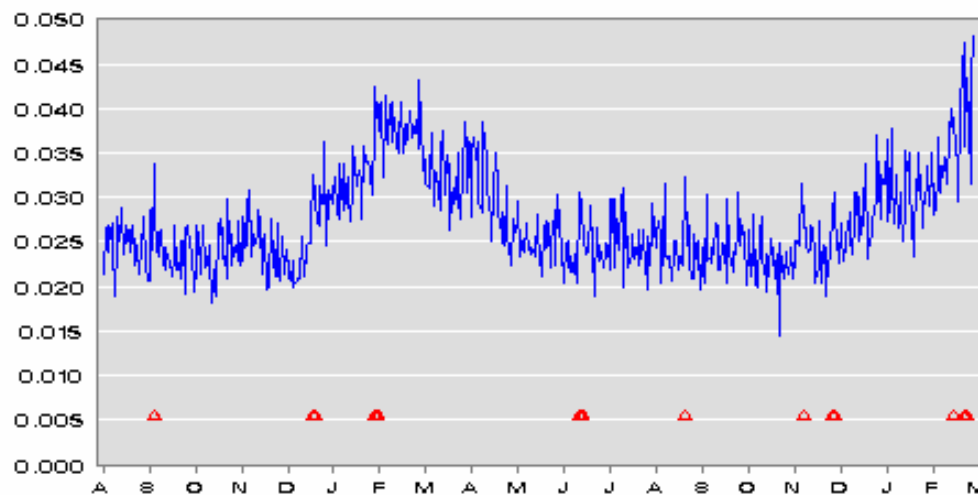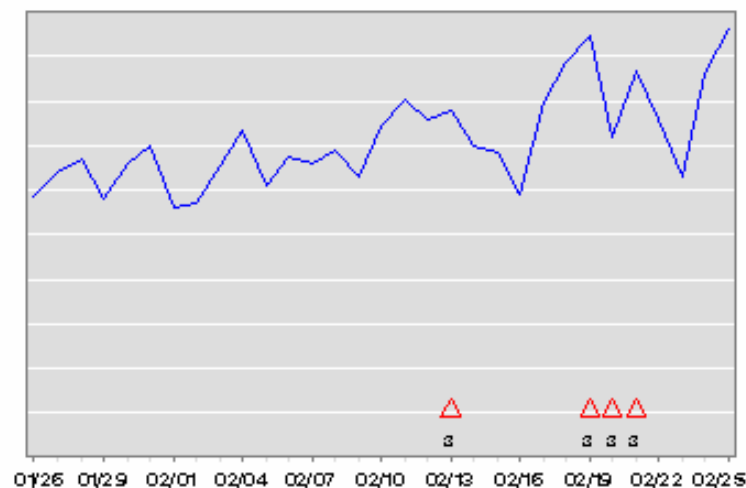
ED
Flu
by age
&
season

Distinct age patterns by circulating strain
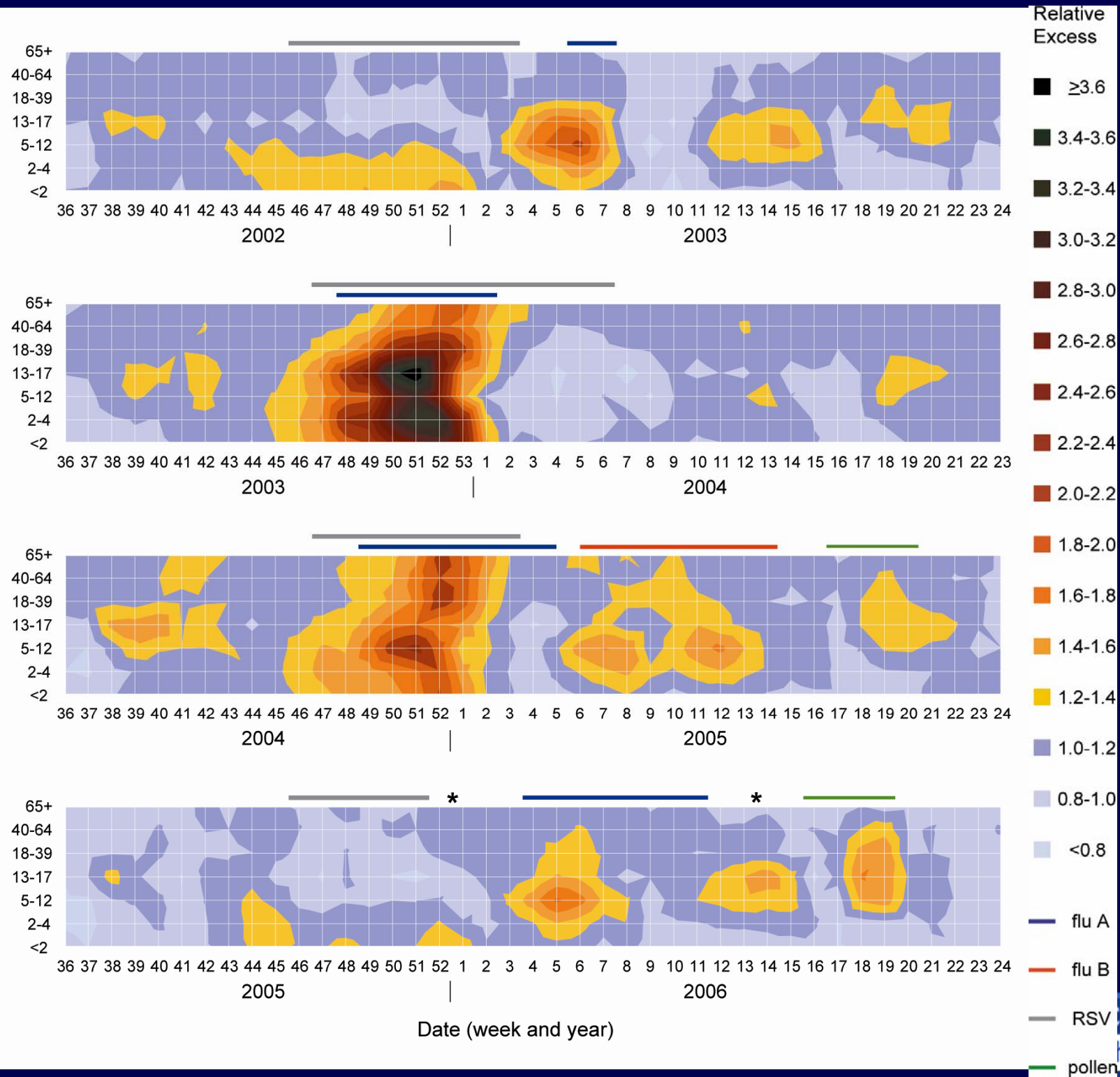
ED Flu by age (2003-04 season)

fever & respiratory ED visits

Legend:
- <2 y
- 2-4 y
- 5-12 y
- 13-17 y
- 18-39 y
- 40-64 y
- 65+ y
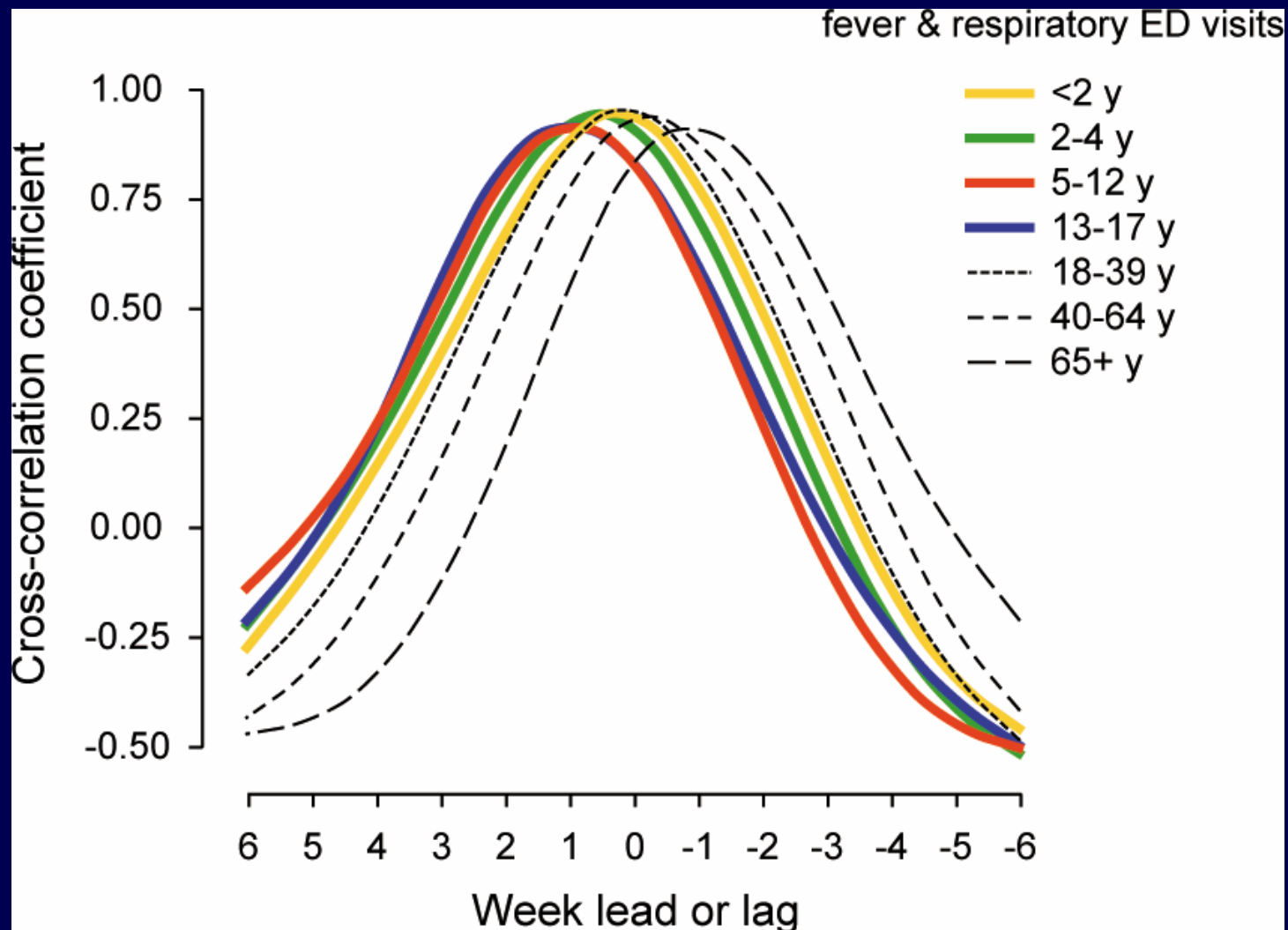
ED Respiratory
July 2003 - June 2004
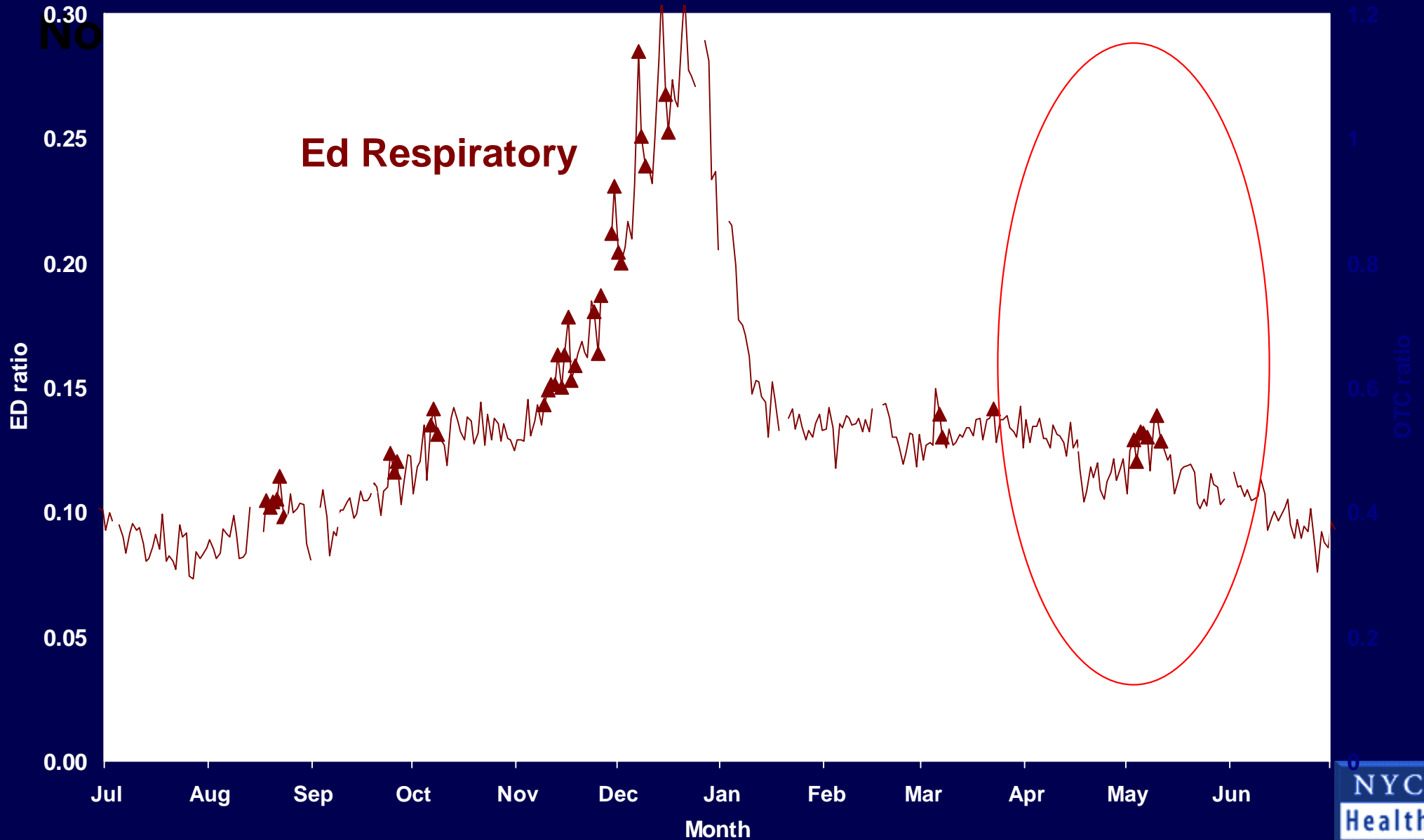
ED Respiratory& OTC Allergy
July 2003 - June 2004

Ed Respiratory

OTC Allergy

NYC Health
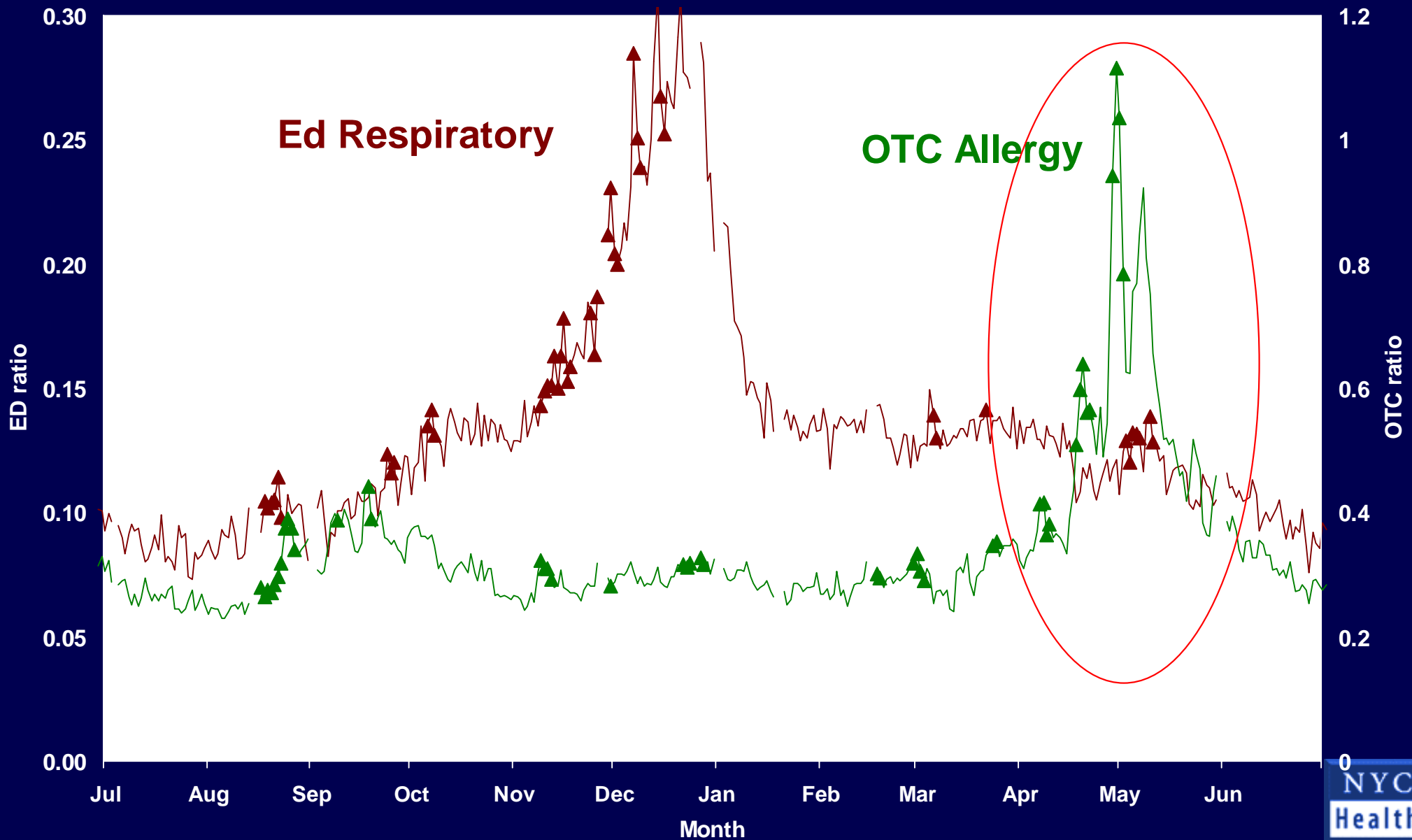
Investigation of signals

- Review line list
- Check complementary systems
- Calls to ED(s)
- Chart reviews
- Patient follow-up
- Augment lab testing

NYC
Health

HHC Outpatient

- **8 facilities (n=17)**
- **> 4000 records/day (deduped)**
- **weekends**
- **ICD-9 codes**
- **ILI, GI & asthma syndromes**
- **Data Lag**
- **Data elements:**

HHC Outpatient Influenza Activity, All Ages, WEEKDAYS ONLY
NYC 31AUG06 – 27FEB07
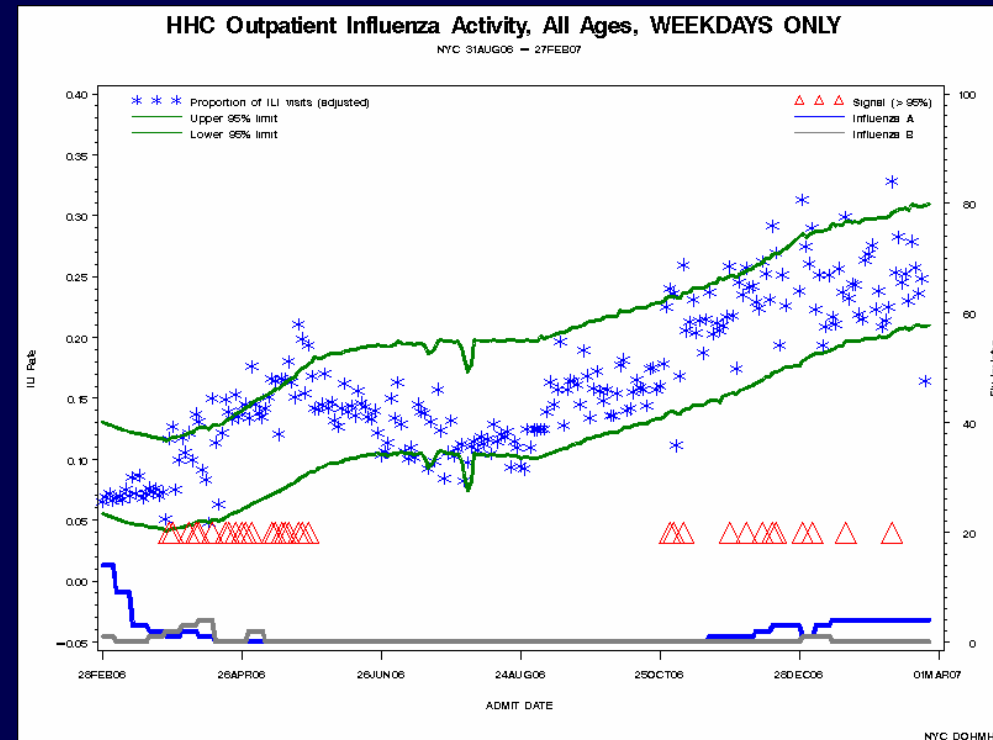
•Medical record number	•Age at visit
•Date of visit	•ZIP
•HHC site	•ICD-9 diagnosis codes
•Gender	•CPT procedure codes
•Race	•Type of clinic

NYC Health

Institute for Urban Family Health

Institute for Urban Family Health

DAILY CUSUM C1 & C3 SIGNALS FOR INCREASES IN GI
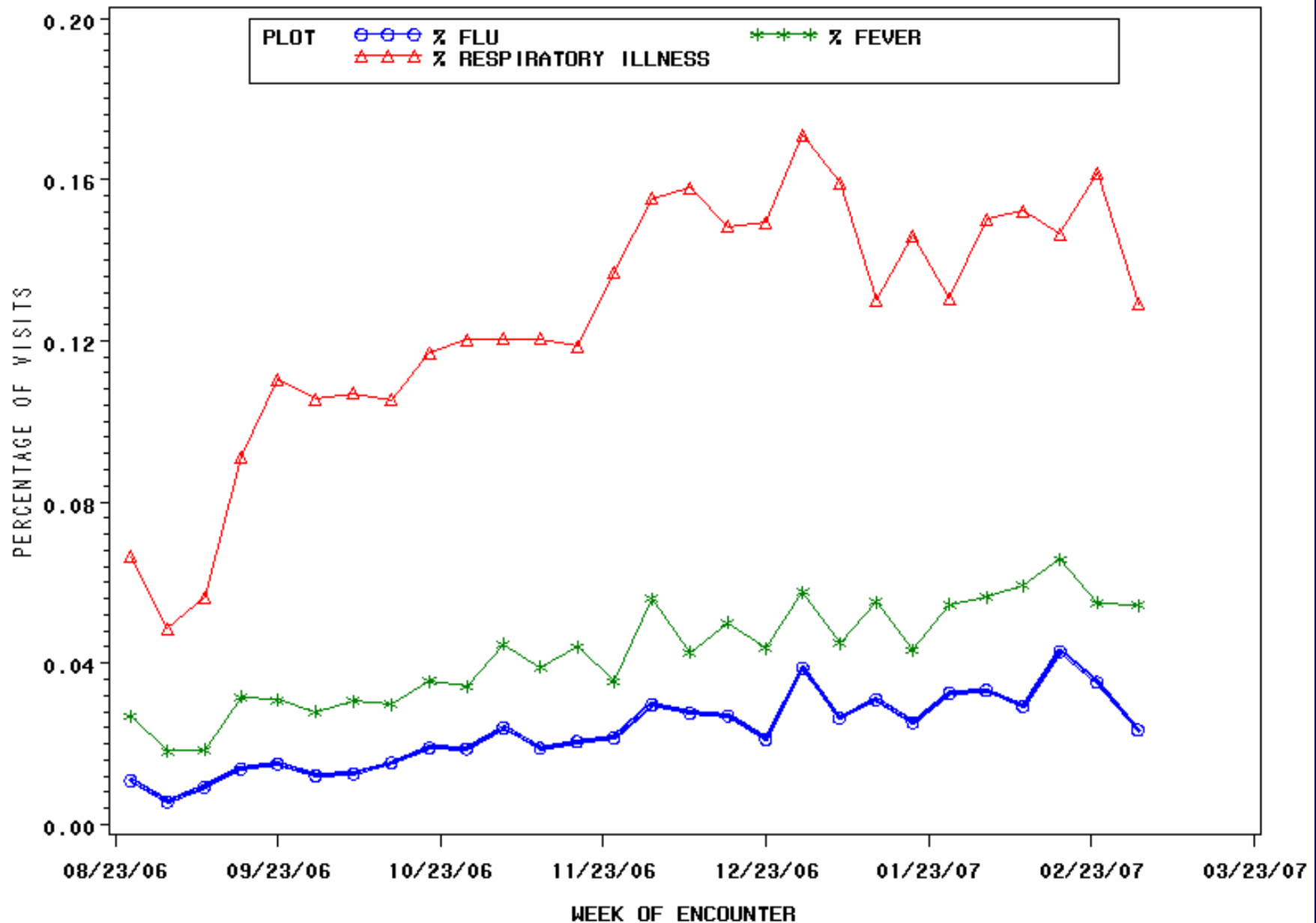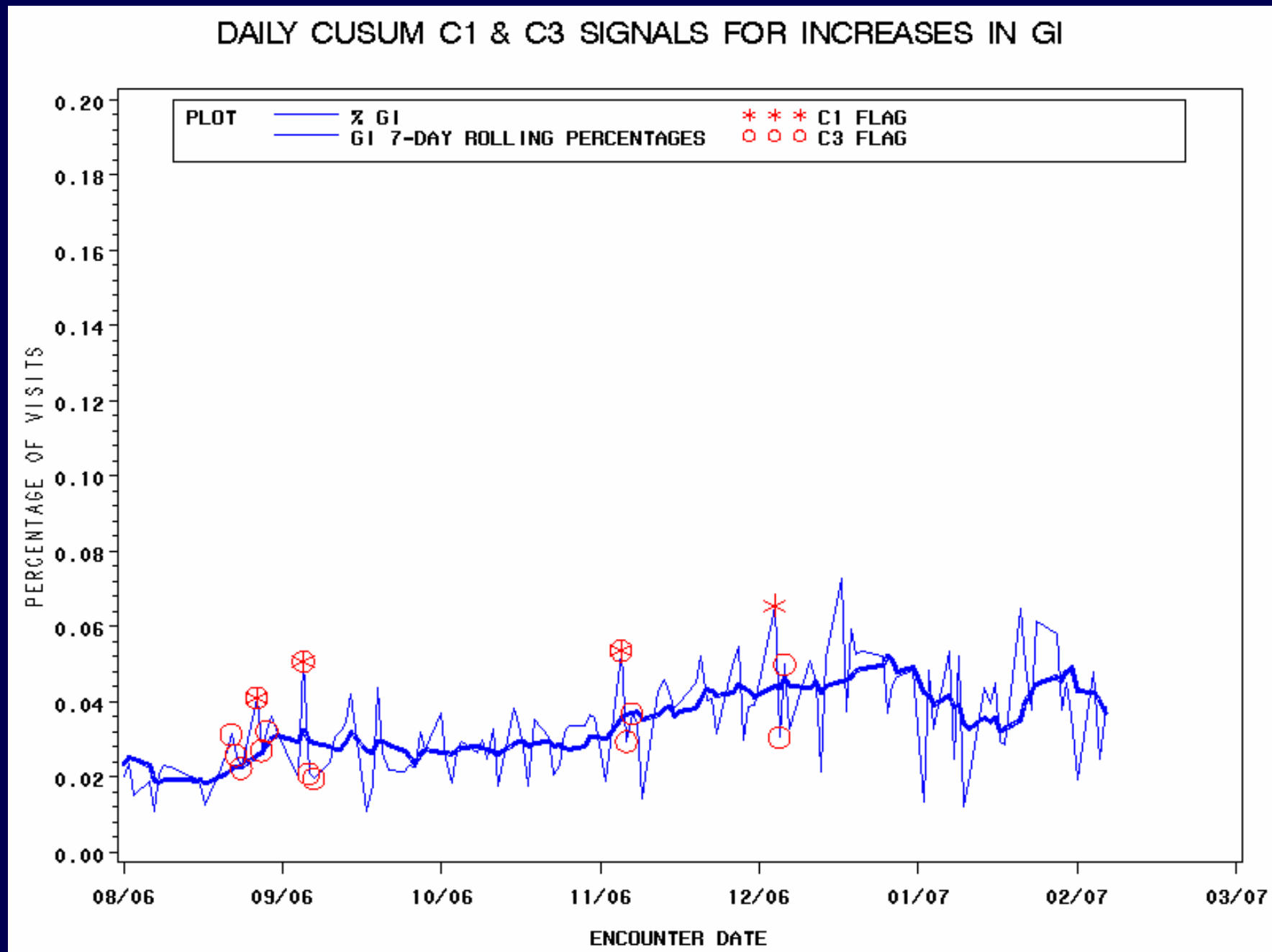
The National Bioterrorism Syndromic Surveillance Demonstration Program

- **CDC funded**
- **EHR data, covers ~ 1.5 million population**
- **Auto extracts encounters, codes & forwards to data center**

HMO data providers:
Denver, CO
Boston area, MA
Minneapolis-St. Paul, MN
Austin, TX
San Francisco Bay area, CA

Normal

Heavy

Very Heavy

12/19/2002

Respiratory Complaints
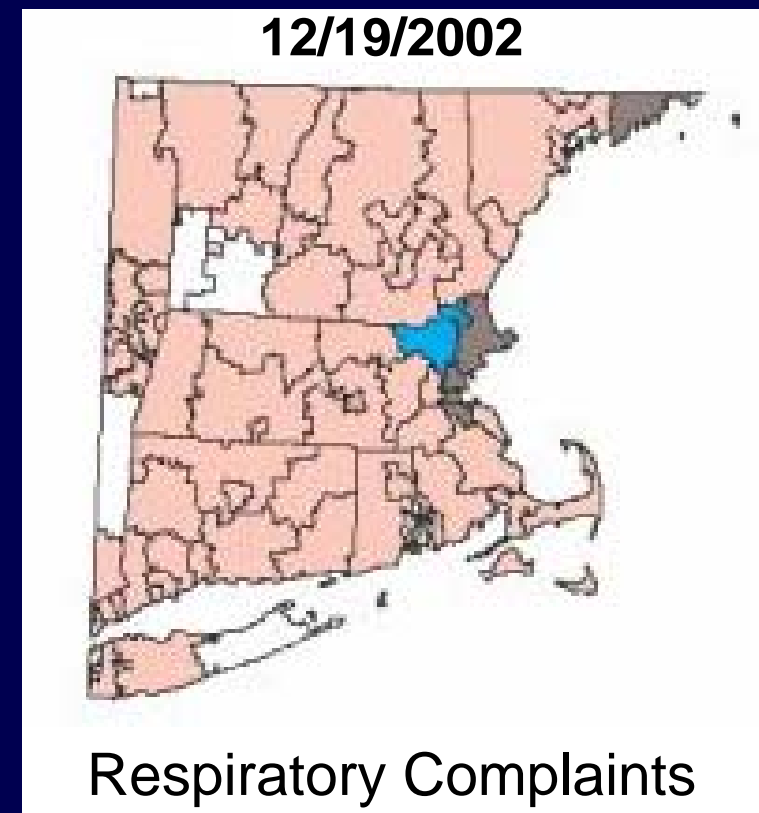
The National Bioterrorism Syndromic Surveillance Demonstration Program

- **Retrospective, 2001-2003**

- **Detected 59 syndromic signals:**
  - ❑ **3 unusual signals**   Concordant yet unrelated
  - ❑ **55 "chance" signals**
  - ❑ **Median 4-9 cases; 1 zip code**
  - ❑ **Chance signals not fully investigated**

- **110 GI outbreaks (MN):**   None detected

- **Health seeking behavior**

Yih et al., Ambulatory-Care diagnoses as potential indicators of outbreaks of gastrointestinal illness-Minnesota. MMWR: 45, supp 157-162.

NYC Health

Public Health Utility
NYC 3-yr ED evaluation study[1]

- 138 spatial GI signals, no outbreaks[1]

- 47 known GI outbreaks, none detected[1]

- Outbreaks detected
  - Blackout (2003)[2]
  - Mosque pot luck (2005)*
  - Irish students (2007)*

- Citywide trends
  - Influenza/RSV
  - Norovirus
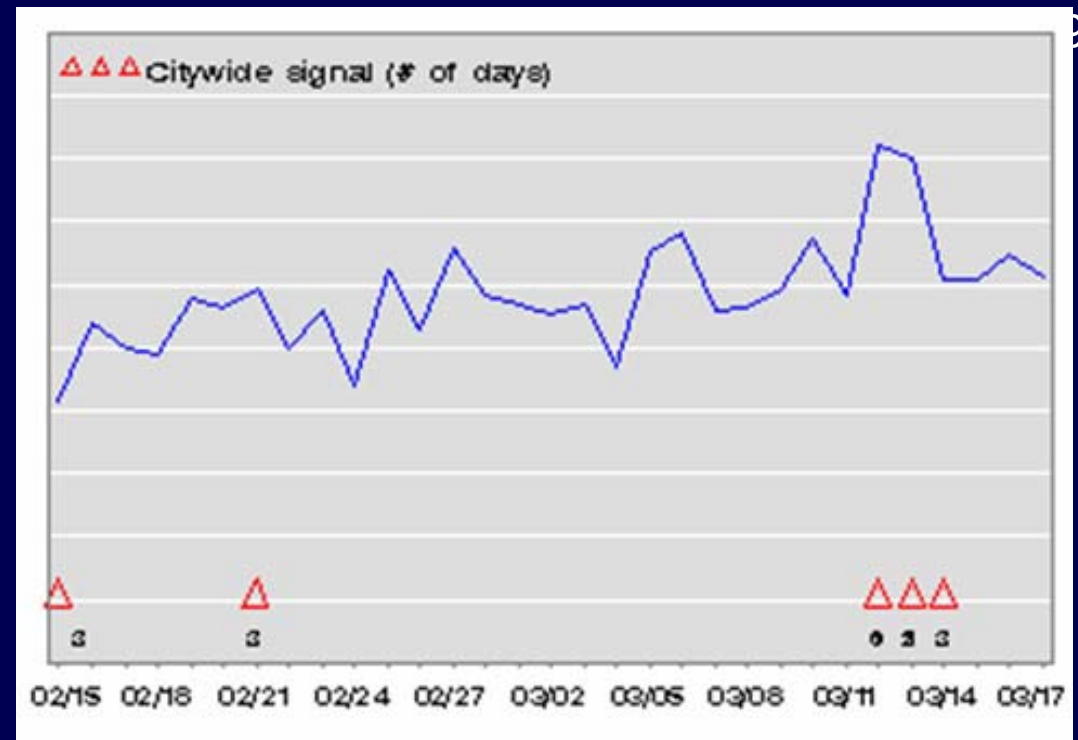 - Rotavirus

- Reassurance — Absence of visits

[1]Balter MMWR 2005; [2]Marx AJPH 2005   *Previously reported

NYC Health

Spatial outbreaks

*Outbreak at a pot
luck dinner*

Citywide Diarrhea
Obs-270   exp-198.3   RR-1.4

△ △ △ Citywide signal (# of days)

△   △   △△△
3   3   0 3 3

02/15 02/18 02/21 02/24 02/27 03/02 03/05 03/08 03/11 03/14 03/17

Zipcode (11XXX)
Obs- 8/Exp- 0.9
p=0.0031

Diarrhea Signal 3-12-05

hospcode	time	sex	agenum	cc
B	19:17	M	3	VOMITTINGAND DIARRHEA
A	21:15	M	27	TRIAGE STS VOMIT DIARRHEA
A	22:23	M	6	C/O OF VOMITING AND DIARRHEA
A	22:32	M	11	C/O OF VOMITING AND DIARRHEA
A	22:41	F	13	C/O OF VOMITING AND DIARRHEA
A	23:05	F	5	C/O OF VOMITING AND DIARRHEA
A	23:13	F	33	C/O OF VOMITING AND DIARRHEA
A	22:53	F	31	C/O OF VOMITING AND DIARRHEA
8	8	8	8	

8

NYC blackout

Respiratory
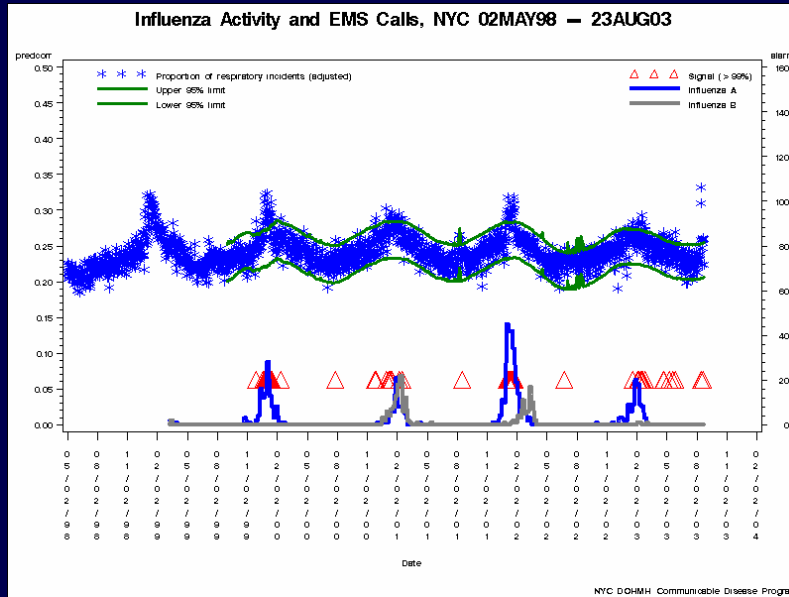
Gastrointestinal
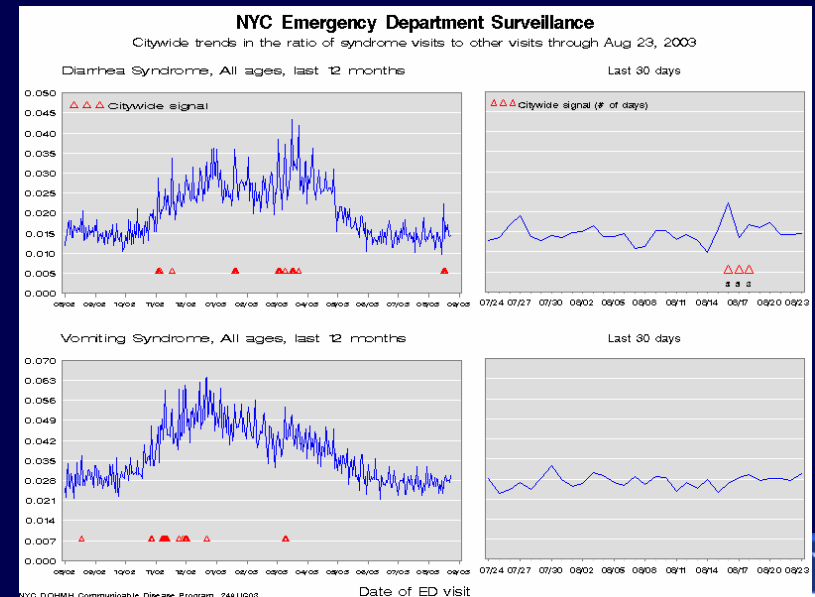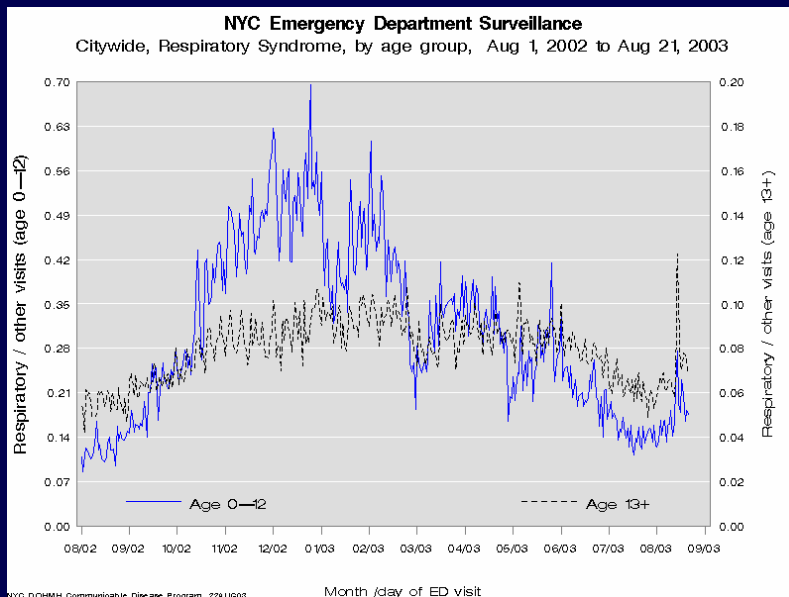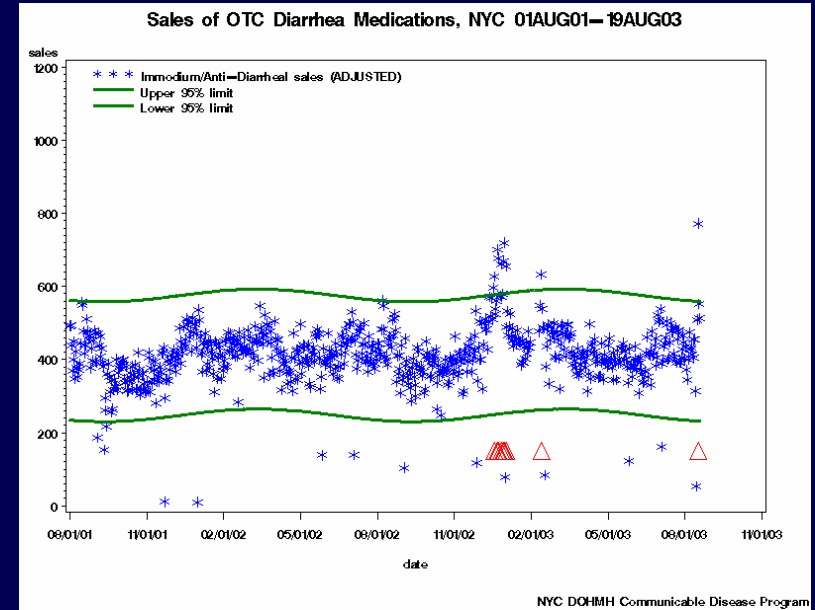
Multi-use systems

- Heat/Cold-related illness

- Asthma trends

- Cigarette sales

- Cipro sales after anthrax

- Fireworks

- Dog bites/rat bites

- West Nile virus spraying

- Suicide attempts

- Overdoses

Case finding:

- Bloody diarrhea

- Jaundice

NYC
Health

Cost

- NYC DOHMH

  ~ $500k per year ½ operations ½ R&D

- UK national nurse call system

  ~ $300k per year

- CDC BioSense system

  ~ $50 million per year

NYC
Health

Summary/Future

Adjunct systems

Two-way provider communication

Specificity vs. timeliness

Signal to noise

Critical evaluation

Large outbreaks

EHR & lab data

NYC
Health

Acknowledgements

NYC DOHMH Syndromic Surveillance Team:

Bureau of Communicable Disease

Bureau of Epidemiology Services

Primary Care Information Project

For more information contact …   **DWeiss @health.nyc.gov**

And special thanks to …

NYC Office of Emergency Management
NYC Hospitals: Emergency Departments, MIS and
Infection Control staff
Martin Kulldorff (Harvard University)
Centers for Disease Control and Prevention (CDC)

NYC
Health