Syndromic Surveillance in a Managed Care Setting

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Health plans are like public health organizations

- Defined populations
- Information
  - the people,
  - their health status,
  - their care in most locations,
  - the outcomes of care.
- Responsibility for members' overall care, including prevention.
- Can intervene to improve care.

Principals

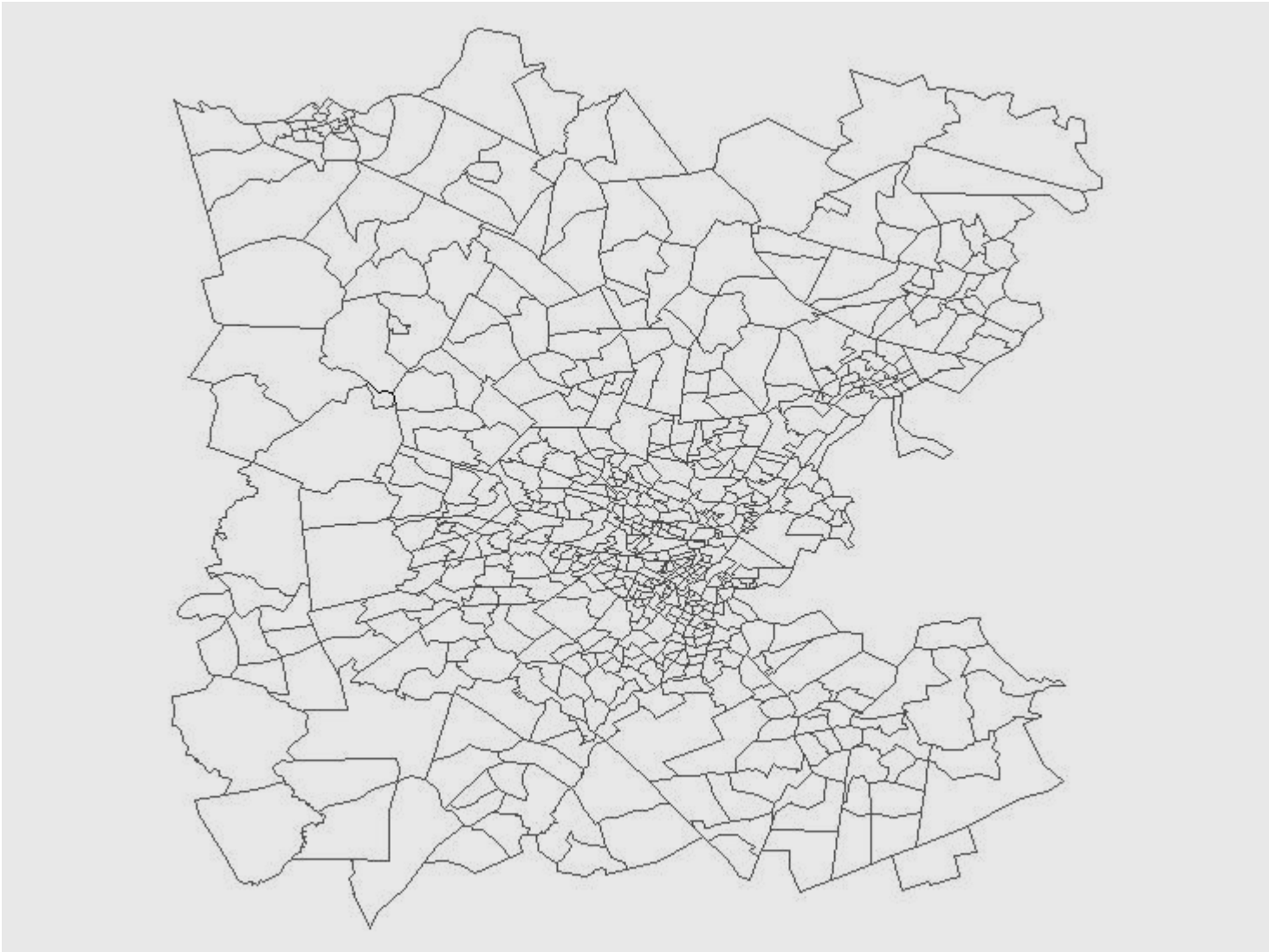
Health Plan

- Ross Lazarus
- Ken Kleinman
- Inna Dashevsky
- Courtney Adams
- Ben Kruskal
- Richard Platt

Massachusetts DPH

- Al DeMaria
- Pat Kludt

A special activity of the CDC bioterrorism preparedness cooperative agreement with Mass DPH



Bioterrorism Surveillance

Boston Bioterrorism Surveillance Daily Reports

Massachusetts Department of Public Health
Daily Public Surveillance Report of Office Visits
With Diagnoses Corresponding to Infection Syndromes

Click on a date (eg **Thursday, 21 March, 2002**) to see a Summary report.
Click on an individual syndrome colored rate bar for a detailed syndrome report and map.
URI=Upper Respiratory Infection, LRI=Lower Respiratory Infection, UGI=Upper Gastrointestinal Infection, LGI=Lower Gastrointestinal Infection

Date	Syndrome Rate Bar Graph URI = , LRI = , UGI = , LGI = , Other =	ALL Rate/1000
Thursday, 21 March, 2002		1.468
Wednesday, 20 March, 2002		1.321
Tuesday, 19 March, 2002		1.511
Monday, 18 March, 2002		1.658
Sunday, 17 March, 2002		0.516
Saturday, 16 March, 2002		0.541
Friday, 15 March, 2002		1.179
Thursday, 14 March, 2002		1.339
Wednesday, 13 March, 2002		1.296
Tuesday, 12 March, 2002		1.480
Monday, 11 March, 2002		1.579
Sunday, 10 March, 2002		0.455
Saturday, 09 March, 2002		0.510

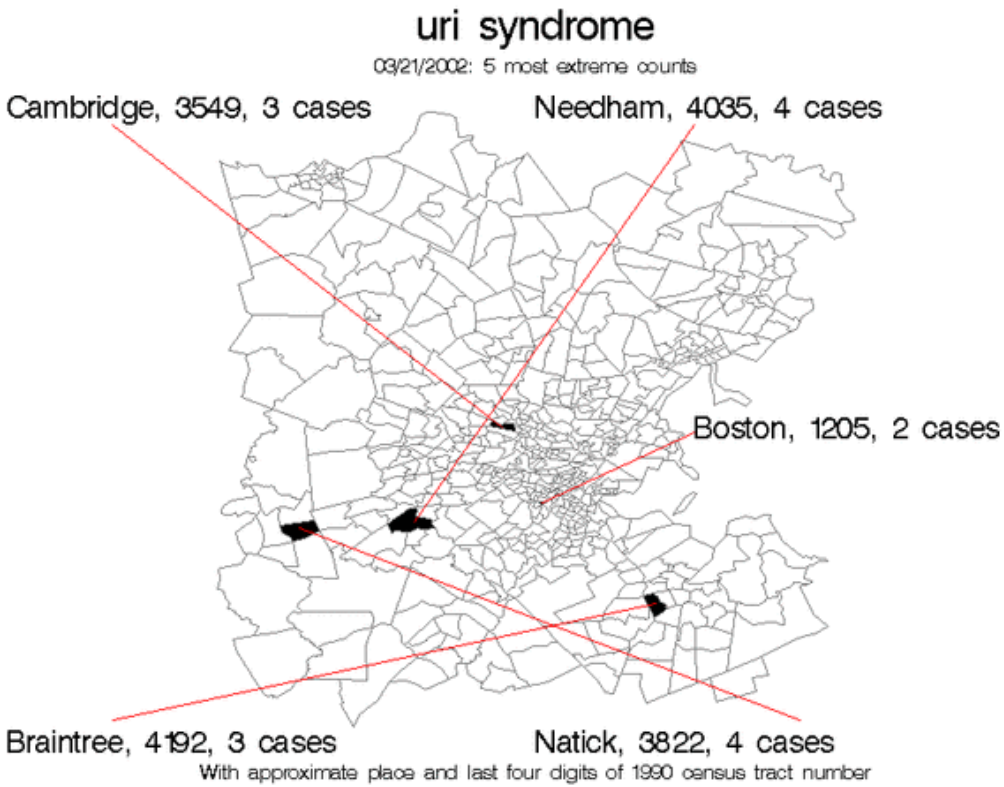
Massachusetts Department of Public Health
Daily Public Surveillance Report of Office Visits With Diagnoses
Corresponding to Infection Syndromes
Data for Thursday, 21 March 2002 ***

Rates per 1,000 Health Plan Members [Number of Visits]
(Repeated visits within 6 weeks excluded)

Syndromes	Thursday, 21 March 2002	Probability **	1999 average for this weekday in the same month	2000 average for this weekday in the same month
All SYNDROMES COMBINED	1.468 [239]	.	1.562	1.495
UPPER RESPIRATORY (detail)	0.805 [131]	0.999	0.945	0.859
LOWER RESPIRATORY (detail)	0.289 [47]	0.999	0.300	0.322
UPPER GASTROINTESTINAL (detail)	0.098 [16]	0.999	0.074	0.084
LOWER GASTROINTESTINAL (detail)	0.190 [31]	0.999	0.172	0.138
CNS/NEUROLOGICAL	0.000 [0]	.	0.003	0.001
DERMATOLOGICAL	0.031 [5]	.	0.022	0.016
SEPSIS/FEVER	0.006 [1]	.	0.045	0.074
INFLUENZA LIKE ILLNESS	0.049 [8]	.	0.000	0.000
Codes for CDC Bioterrorism CATEGORY A AGENTS *	0.000 [0]	.	.	.

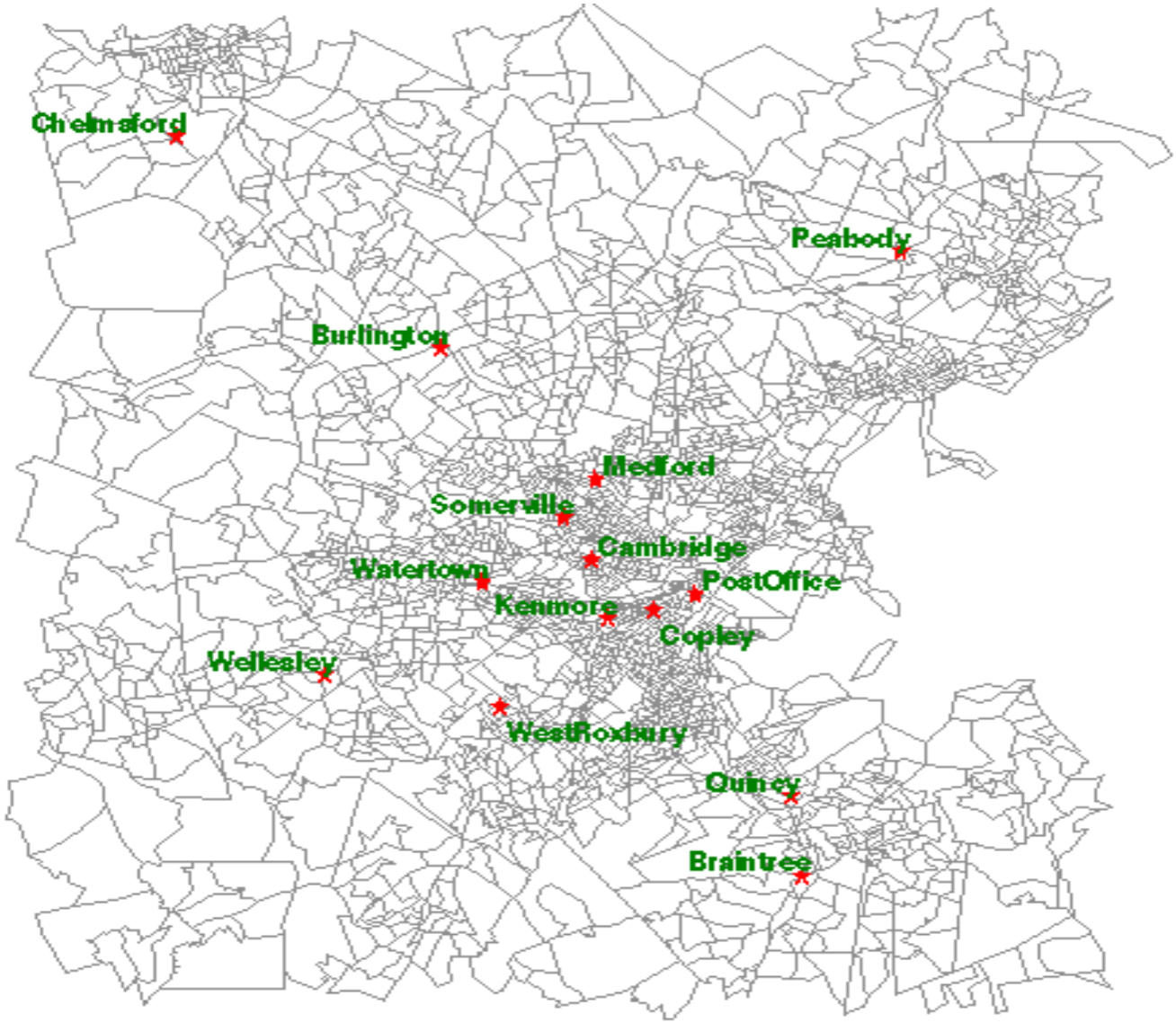
uri syndrome by census tract
Thursday, 21 March 2002
Tracts with most extreme counts compared
to their own history.*

Town or City	Census tract code	Cases in tract	Denominator in this tract	Number of years between counts this extreme^
Needham	250214035	4	531	0
Natick	250173822	4	537	0
Cambridge	250173549	3	698	0
Braintree	250214192	3	622	0
Boston	250251205	2	289	0



* The 5 most extreme tracts are shown, plus all with counts not expected to occur more than once per month.
^ Estimated number of years between daily counts this extreme in
any of the 529 census tracts, adjusting for this tract's unique characteristics as well as month, day of week, holidays
and secular trend. 100 indicates 100 or more years.
0 indicates events that happen more than once each day

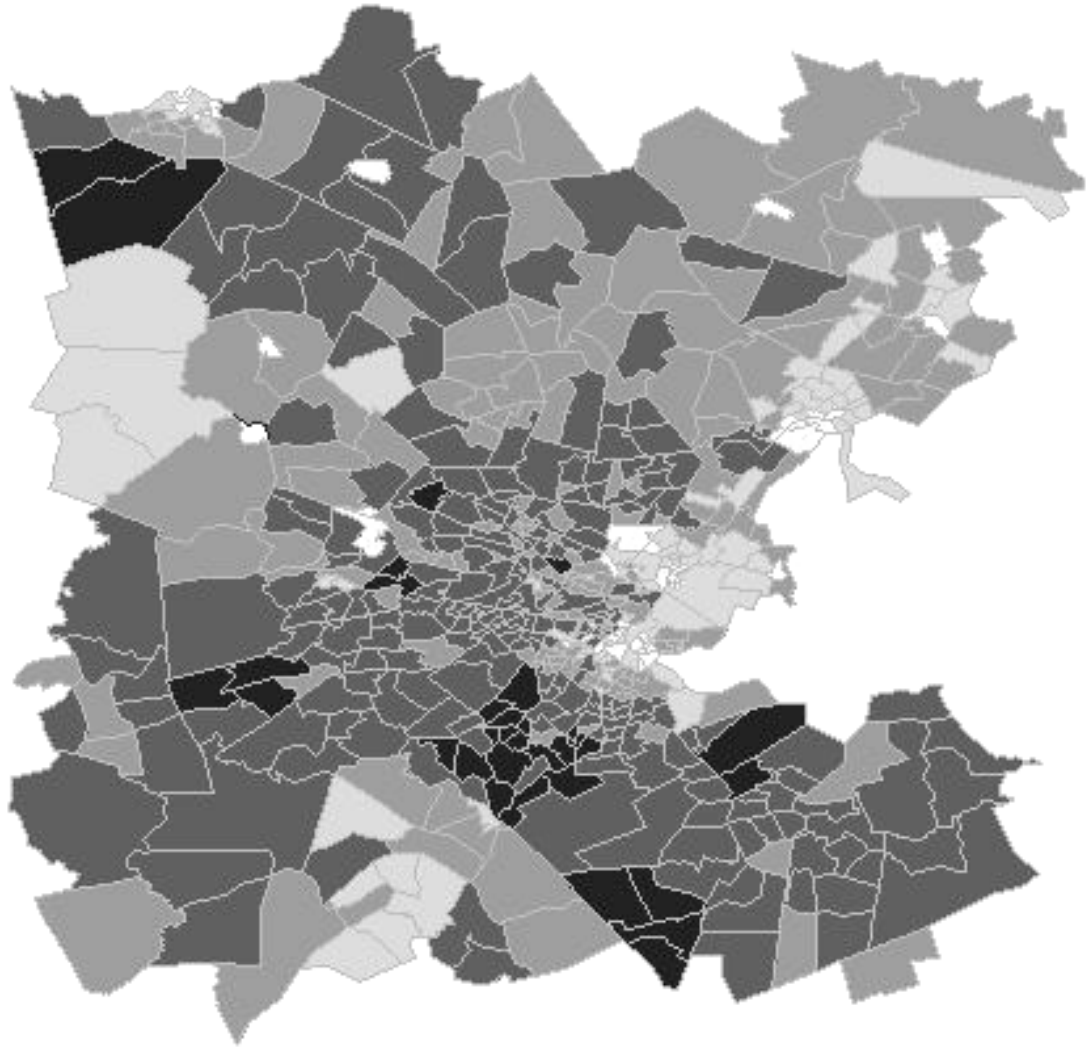
Harvard Vanguard Medical Associates



The clinical setting

- Multi-specialty group practice with 14 centers.
- Automated ambulatory medical records.
- ~250,000 members are ~10% of eastern Massachusetts population.
- Everyone assigned to home census block.

Coverage by census tract



Insured

0 — 10

10 —100

101 — 200

201 — 400

401 — 1000

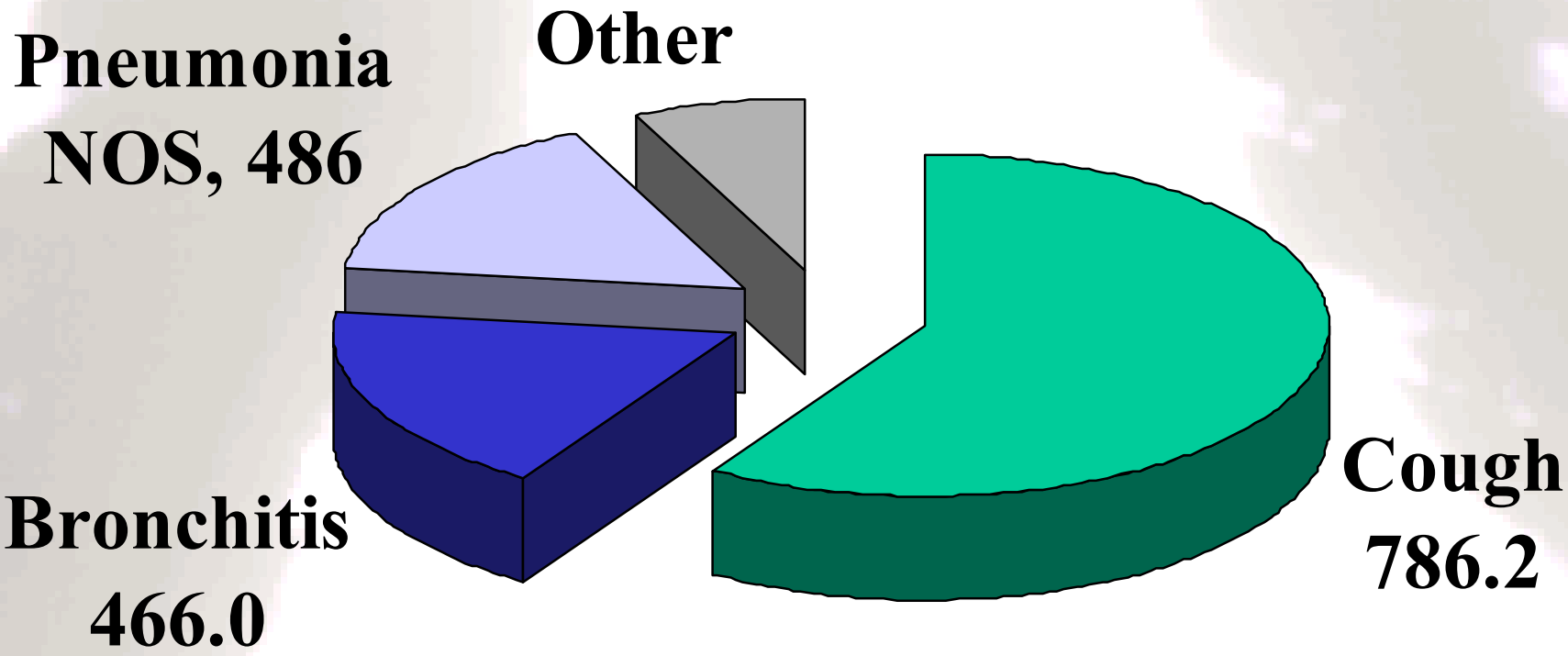
1001 +

As of October 31, 1999

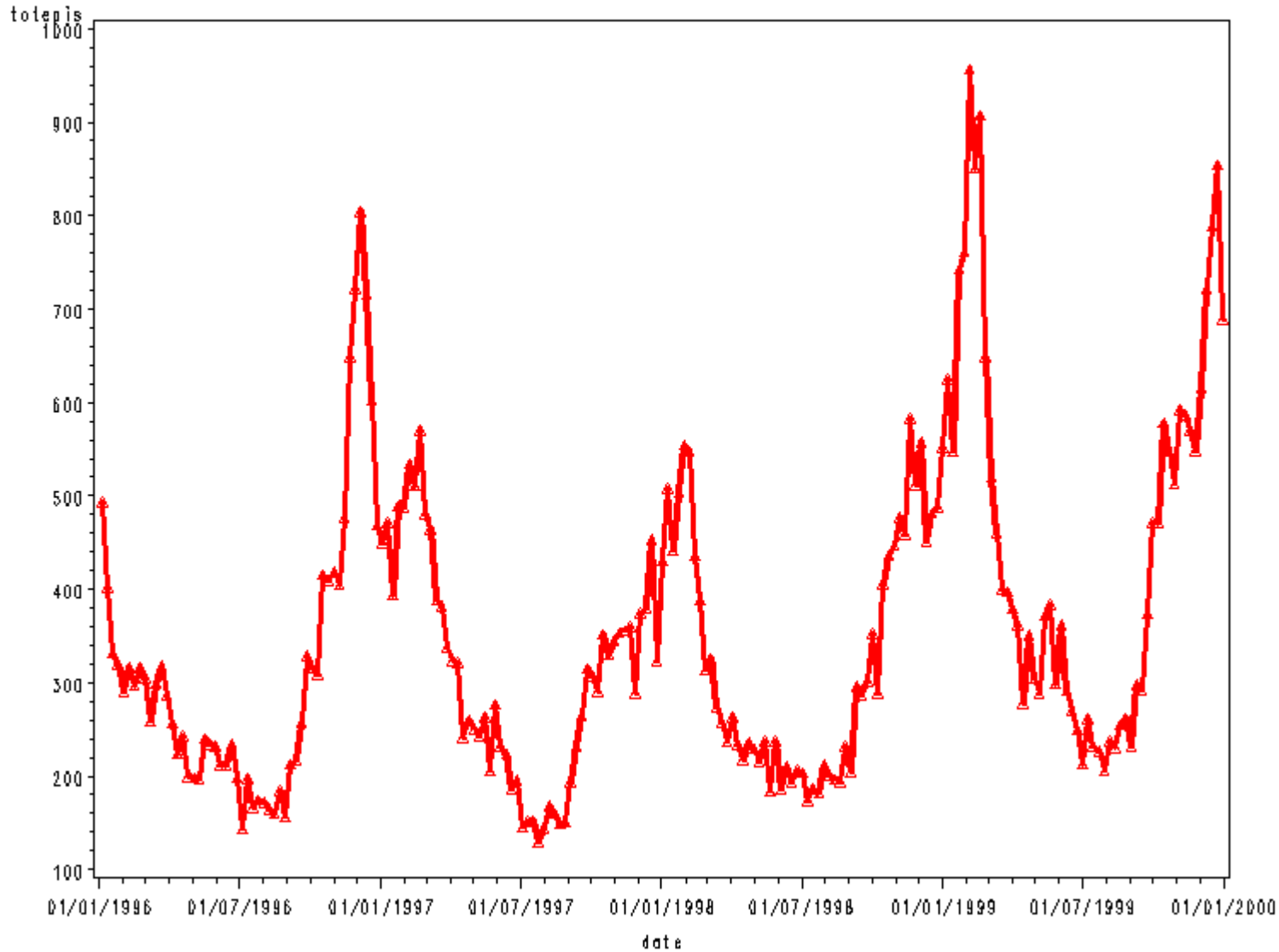
Lower respiratory infection, 1996-1999

- Identified ambulatory visits with 1st or 2nd diagnosis code on list of 119 ICD-9 codes (from Department of Defense Global Emerging Infection System).
- 118,557 LRI visits.
- 73,752 LRI episodes.

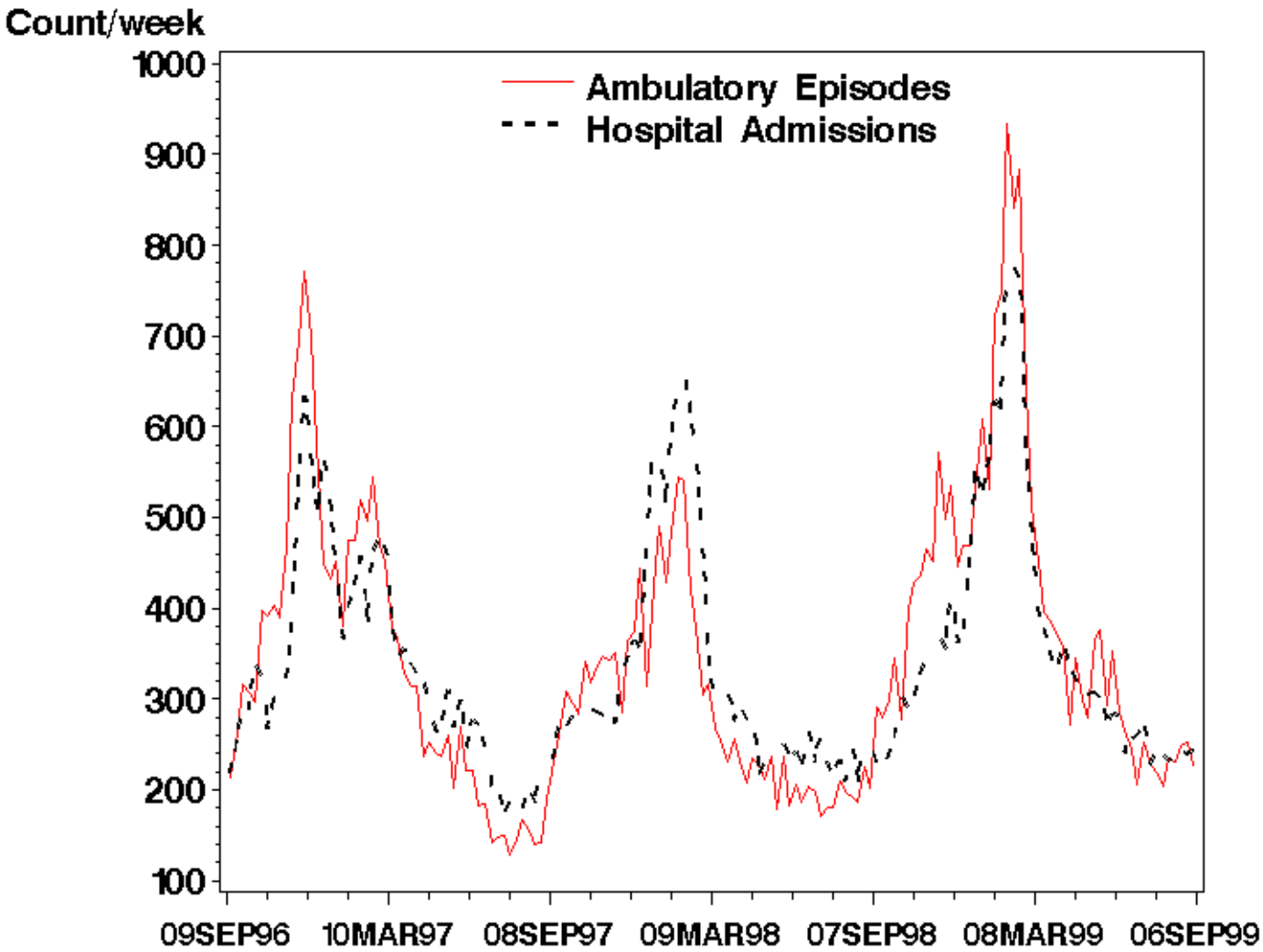
Lower respiratory infection, 1996-1999

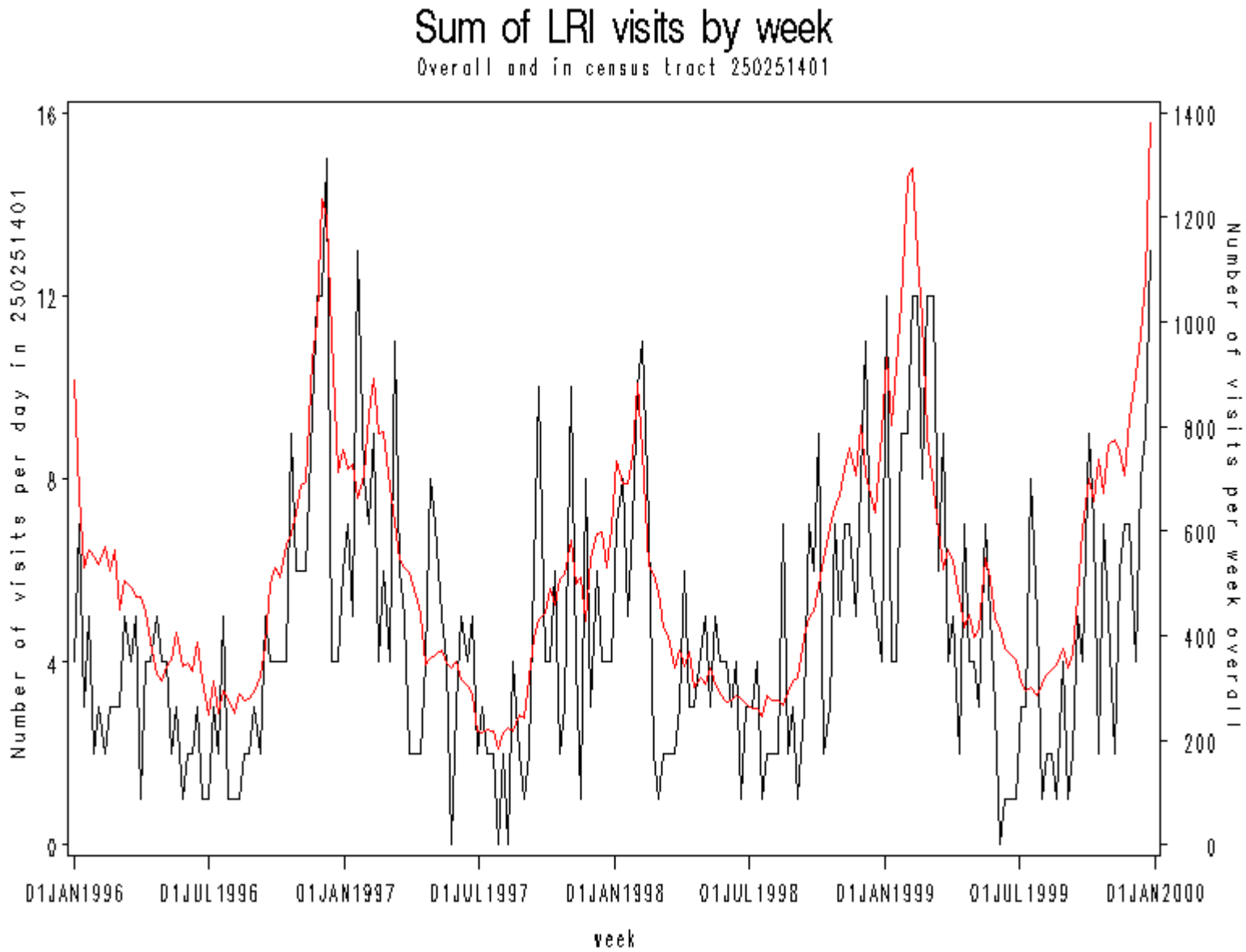


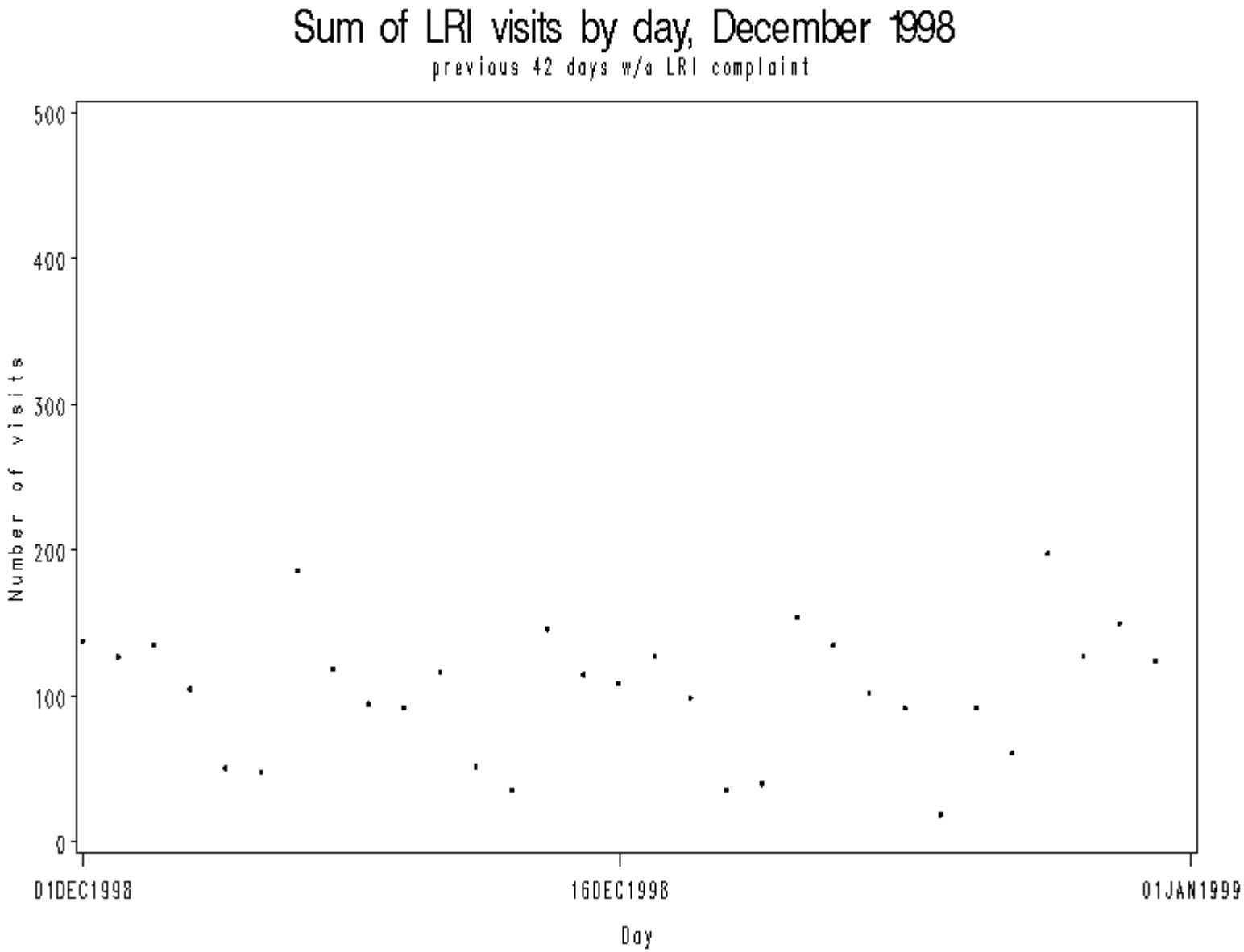
Weekly HPHC/Vanguard Lower Respiratory Infection Syndrome Episodes, 1996–1999



Ambulatory vs hospital lower respiratory episodes




Sum of LRI visits by week
Overall and in census tract 250251401
Number of visits per day in 250251401
Number of visits per week overall
0
4
8
12
16
0
200
400
600
800
1000
1200
1400
01JAN1996
01JUL1996
01JAN1997
01JUL1997
01JAN1998
01JUL1998
01JAN1999
01JUL1999
01JAN2000
week


Sum of LRI visits by day, December 1998
previous 42 days w/o LRI complaint
Number of visits
500
400
300
200
100
0
01DEC1998
16DEC1998
01JAN1999
Day

Modeling to identify potential clusters

- Use the Generalized Linear Mixed Model approach to logistic regression, controlling for month, day of week, holiday.
- This treats the count of syndrome visits for each day in each census tract as a daily observation of the tract's rate.
- The denominator in each census tract is the eligible population.

Lower Respiratory Infection prediction model

	Odds Ratio
March	0.7
June	0.4
September	0.5
December	1
Monday	3.2
Wednesday	2.5
Friday	2.3
Saturday	1
Holiday	0.4
Census tract effect	

All p=values <.0001

Identifying hot spots

- Every day, for each census tract, we calculate the probability of seeing at least the observed number cases on that day.
- Tracts are ordered from lowest to highest probability.
- We compute the expected interval between observations at least, adjusting for multiple comparisons.

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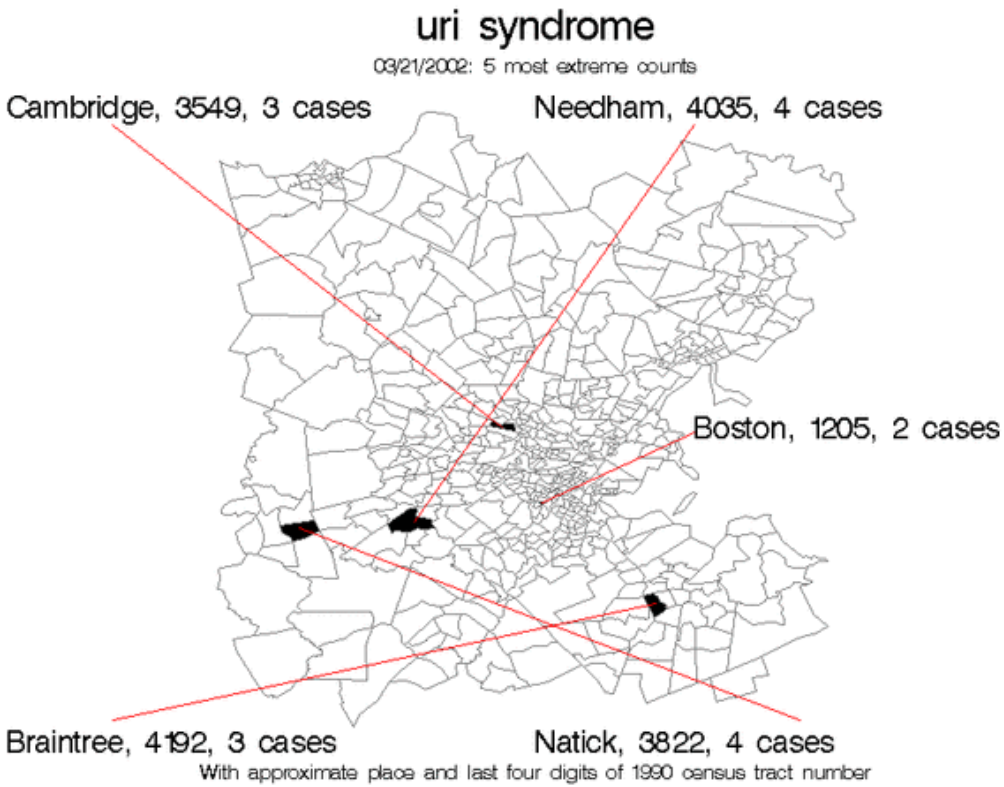

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Conclusions

- Routinely collected health plan data can supplement traditional surveillance for bioterrorism and other illness clusters.
- The marginal cost is small.
- Even a few events can signal unusual clusters.
- Most clusters are comprised of “routine” cases.
- A signal in ambulatory settings may occur earlier than in hospital admissions.

Resources required

- Automated data with symptoms or diagnoses.
- Same day availability:
  - Electronic medical records
  - Nurse call centers
  - Financial claims data
- Defined population with known location.
- Modest data processing capacity.

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Boston Bioterrorism Surveillance Daily Reports

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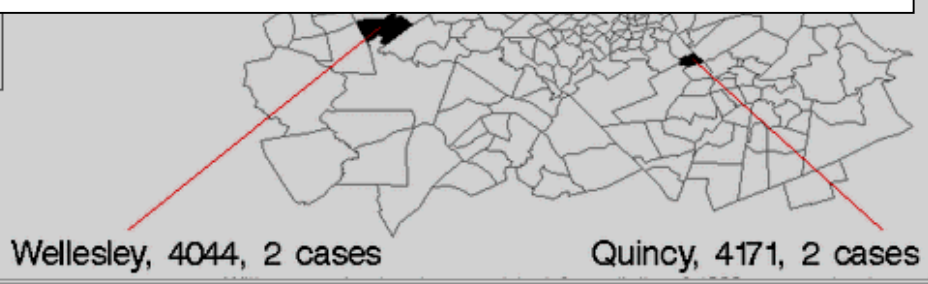
lri syndrome by census tract
Thursday, 15 November 2001
Tracts with most extreme counts compared
to their own history *

lri syndrome

Town or City	Census tract code			
Swampscott	25009202			
Quincy	25021417			
Swampscott	25009202			
Arlington	25017356			
Wellesley	250214044	2	650	0

* The 5 most extreme tracts are shown, plus all with counts not expected to occur more than once per month.
^ Estimated number of years between daily counts this extreme in



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