



Analyzing ILINet Data for Increased Spatial Resolution

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Objective

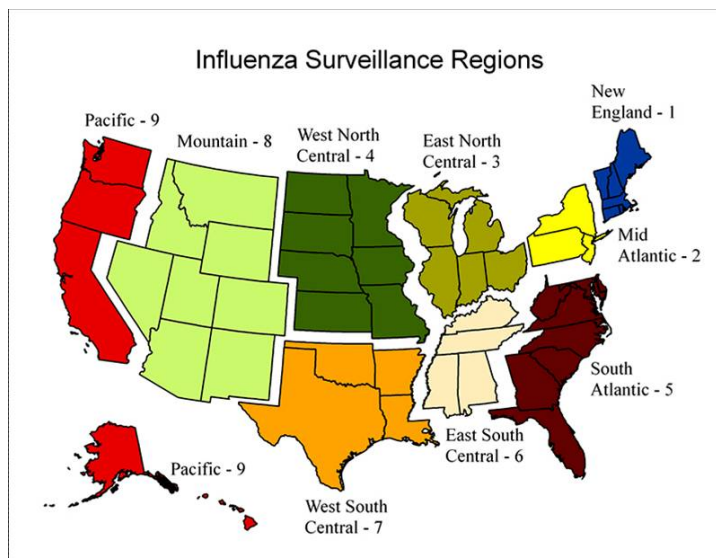
- Derive a statistic for analysis of ILINet influenza-like-illness (ILI) data that can be applied at the CBSA (or city, state) level.
- Requested to enable finer scale visualization of nationwide ILINet data.
- Method must be robust to high variability in the number of sentinel providers reporting from week to week.

Background

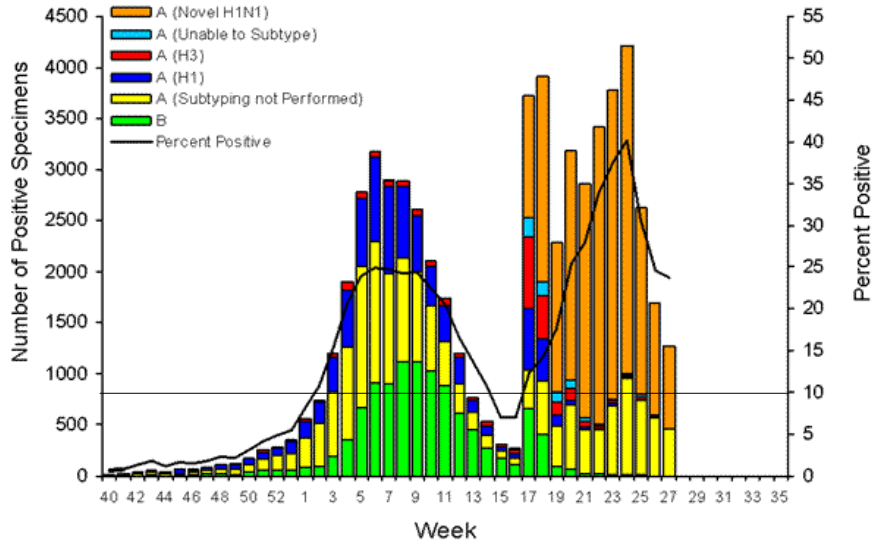
CDC ILINet collects data each week from sentinel care providers across the United States.

- Over 2,700 providers from all 50 states during the 2008-09 influenza season.
- Each week, providers report total nr. patient visits & nr. ILI-related visits by age group.
- About 60% of providers send data every week, some intermittently
- Provider base generally expanding with occasional dropouts.
- A provider may be a physician practice, a health center, or as large as a group of hospital emergency departments.
- Previous aggregation into 9 census regions for analysis and presentation.
- Requirement: allow stable weekly surveillance at the level of core-based statistical areas (CBSAs) while adjusting for small-scale variability.

Census Regions for Baseline Calculations

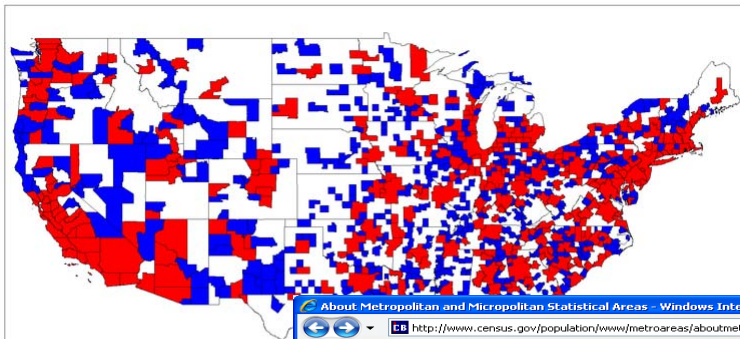


Influenza Positive Tests Reported to CDC by U.S. WHO/NREVSS Collaborating Laboratories, National Summary, 2008-09



Core-Based Statistical Areas

<http://www.census.gov/population/www/metroareas/aboutmetro.html>



Windows Internet Explorer browser window showing the U.S. Census Bureau website page: "About Metropolitan and Micropolitan Statistical Areas". The page title is "U.S. Census Bureau Metropolitan and Micropolitan Statistical Areas". The page content includes a navigation menu with "Metro and Micro Areas Main", "Overview", "Current Definitions", and "Metro and Micro Area". The main text begins with "About Metropolitan and Micropolitan Statistical Areas" and states: "The United States Office of Management and Budget (OMB) defines metropolitan and micropolitan standards that are applied to Census Bureau data. The general concept of a metropolitan area is a substantial population nucleus, together with adjacent communities having..."

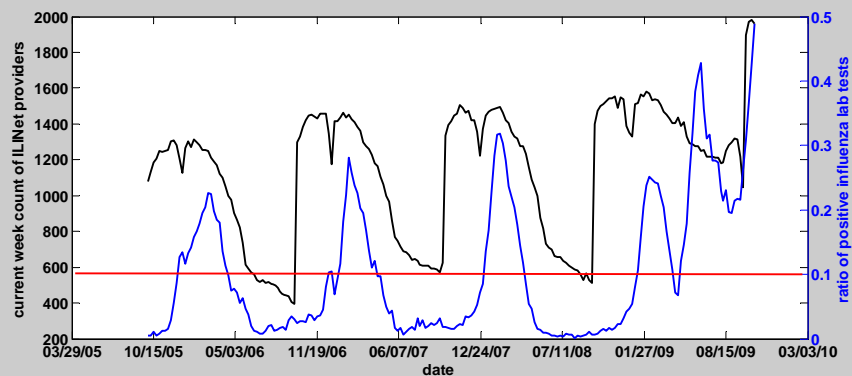
Region-Based Method

Statistic used for regional surveillance has been:

$(\text{observed ILI ratio} - \text{baseline ILI ratio}) / (\text{baseline std. dev.})$

- Observed ILI ratio: current week's nr. ILI cases / total nr. visits.
- Baseline ILI ratio: same ratio over those weeks in the past 3 years for which fewer than 10% of influenza lab tests had positive results for region of interest.
- Anomalies presented as nr. standard deviations above baseline mean without assuming a fixed probability distribution.

ILINet Provider Weekly Participation History

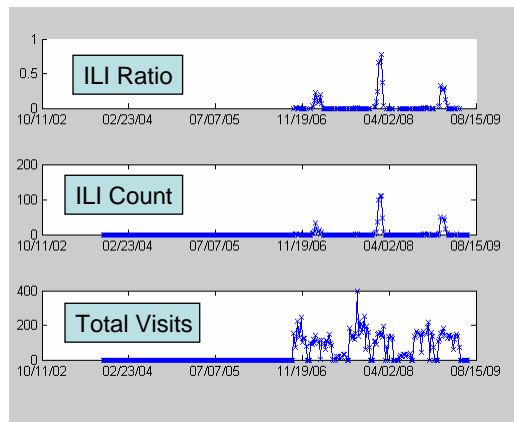


Occasional Erratic Reporting (among > 1600 “regular” providers)

Various issues:

- Some zeros indistinguishable from missing reports
- Pandemic: about 100 new providers in some weeks
- Rounding of ili and total visits
- Catch-up reporting
- Reporting in spurts

Sample ILINet Provider Data



Provider-Adjusted Statistic, I

Statistic = $(\text{Weekly CBSA Ratio} - \text{CBSA baseline ratio}) / (\text{CBSA standard error})$

Weekly CBSA ratio: $(\sum \text{ili counts} / (\sum \text{all visits}))$ for all CBSA providers

Computation of baseline ratio:

- CBSA baseline ratio: weighted sum of baseline ratios of currently participating providers
- Weighting according to the total nr. current visits reported
- Provider baseline ratios:
 - For “trusted” providers: ILI counts / visits for regional baseline weeks, ignoring weeks with no ILI reports
 - For remaining (new, sporadic) providers: mean of baseline ratios for trusted providers of the same type

Provider-Adjusted Statistic, II

- CBSA “standard error”: using normal approx. to binomial distribution: $\sqrt{(\text{ratio}) * (1-\text{ratio}) / (N=\text{total visits})}$
 - Requires higher ratios for smaller CBSAs
 - Modified for very large CBSAs: $N = \text{minimum of (total weekly visits) and round}((3.0^2) * \text{ratio} * (1-\text{ratio}) / (0.01^2))$,
 - so that a 3.0-standard error anomaly requires at least a 1% increase above expected

ili	visits	p	p0	expected ili	stat	modified	modified stat
182	13646	0.013	0.010	136	3.40	1184	1.00
	p-p0 threshold						
	0.01	3					

Provider-Adjusted Model Details

Trusted provider conditions:

- at least 10 wks with total visits > 0 in last flu year AND
- at least 10 wks with ili counts > 0 in baseline weeks (flu pos. rate < 10% for the region of that provider)

Reduce the set of provider types to be sure that there are sufficient trusted providers in each type. 6 reduced types:

- 1 'Emergency Medicine'
- 2 'Family Practice', 'Infectious Disease'
- 3 'Internal Medicine', 'OB/GYN', 'Other'
- 4 'Pediatrician'
- 5 'Student Health'
- 6 'Urgent Care'

- Need updated table for all known providers:

provider ID, provider type, cbsa ID, state, census region, HHS region

Provider Type Baseline Statistics

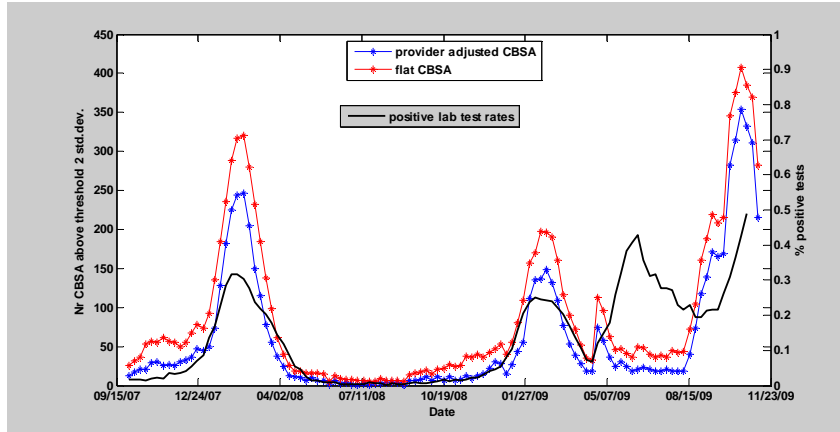
Provider Type	Nr. Providers	Baseline mean	Baseline Std. Dev.
Pediatrics	519	0.0263	0.0315
Emergency Medicine	308	0.0201	0.0129
Urgent Care	143	0.0153	0.0097
Community Health	14	0.0167	0.0125
Family Practice	1299	0.0084	0.0121
Infectious Disease	44	0.0088	0.0075
Internal Medicine	276	0.0042	0.0079
OB/GYN	3	NaN	NaN
Other	242	0.0048	0.0094
Rural Health	1	NaN	NaN
Student Health	239	0.0049	0.0085

Example

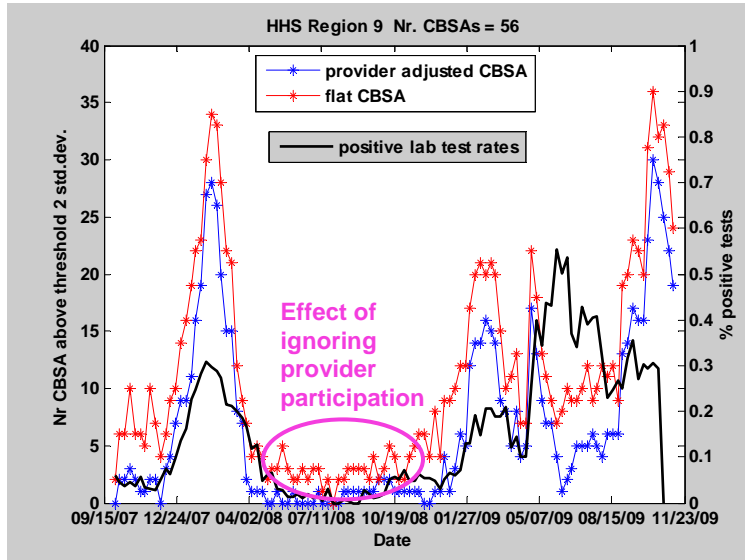
- CBSA has 2 providers: pediatric, community clinic
 - Mean rate from pediatric provider: 0.025
 - Mean rate from community provider: 0.010
- 1000 cases from pediatric provider, 300 cases from community provider
- Expected rate for cbsa, this week:
 - Exp. rate = $(1000 (0.025) + 300 (0.010)) / 1300$
 - For poorly represented providers, use mean and std. dev. for provider type



Effect of Provider Adjustment

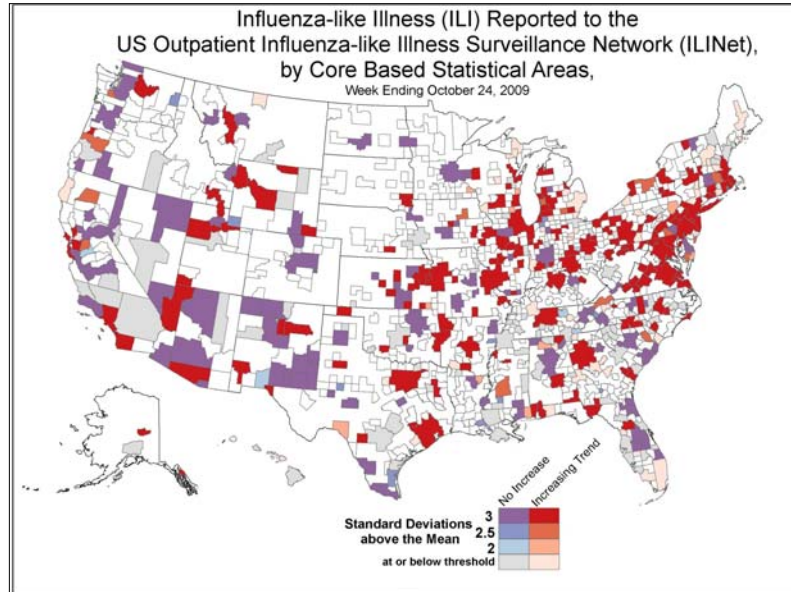


Regional Adjustment Effect





Sample Bivariate Color Map: Level & Trend



Conclusions and Future Steps



- The provider adjustment gives a representative picture of weekly ILI activity below regional spatial resolution, given available provider information
- Currently applied at state and CBSA levels
- High provider-level fluctuations during fall portion of pandemic, as predicted; anecdotal validation
- Working on estimation of age group totals to stratify analysis by age group
- Related analyses: effect of local spring H1N1 activity on fall disease burden