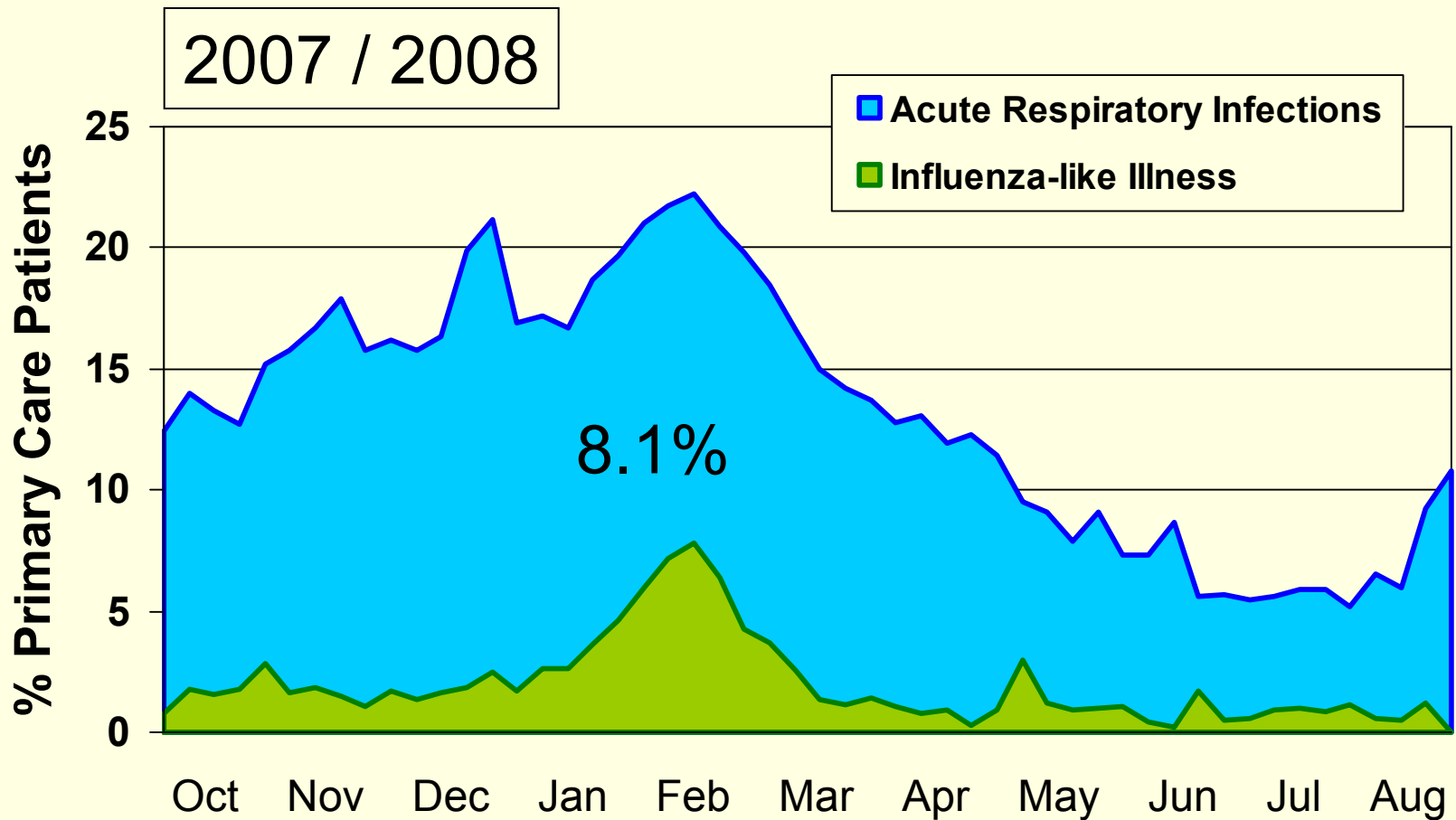


EHR Surveillance for Seasonal and Pandemic Influenza in Primary Care Settings

**Jonathan L. Temte, MD/PhD
Chuck Illingworth**

University of Wisconsin School of Medicine and Public Health
Department of Family Medicine
Clinical Data Warehouse Project

Acute Respiratory Infections are Common in Primary Care Practice



Influenza hides within the constellation of Acute Respiratory Infections (ARI)

- CDC Definition of ARI

- Two or more of the following:

- Fever
 - Cough
 - Sore Throat
 - Rhinorrhea
 - Nasal Congestion

- CDC definition of Influenza-Like Illness (ILI)

- Age \geq 2 years: fever and (cough or sore throat)
 - Age $<$ 2 years: fever and any respiratory symptom

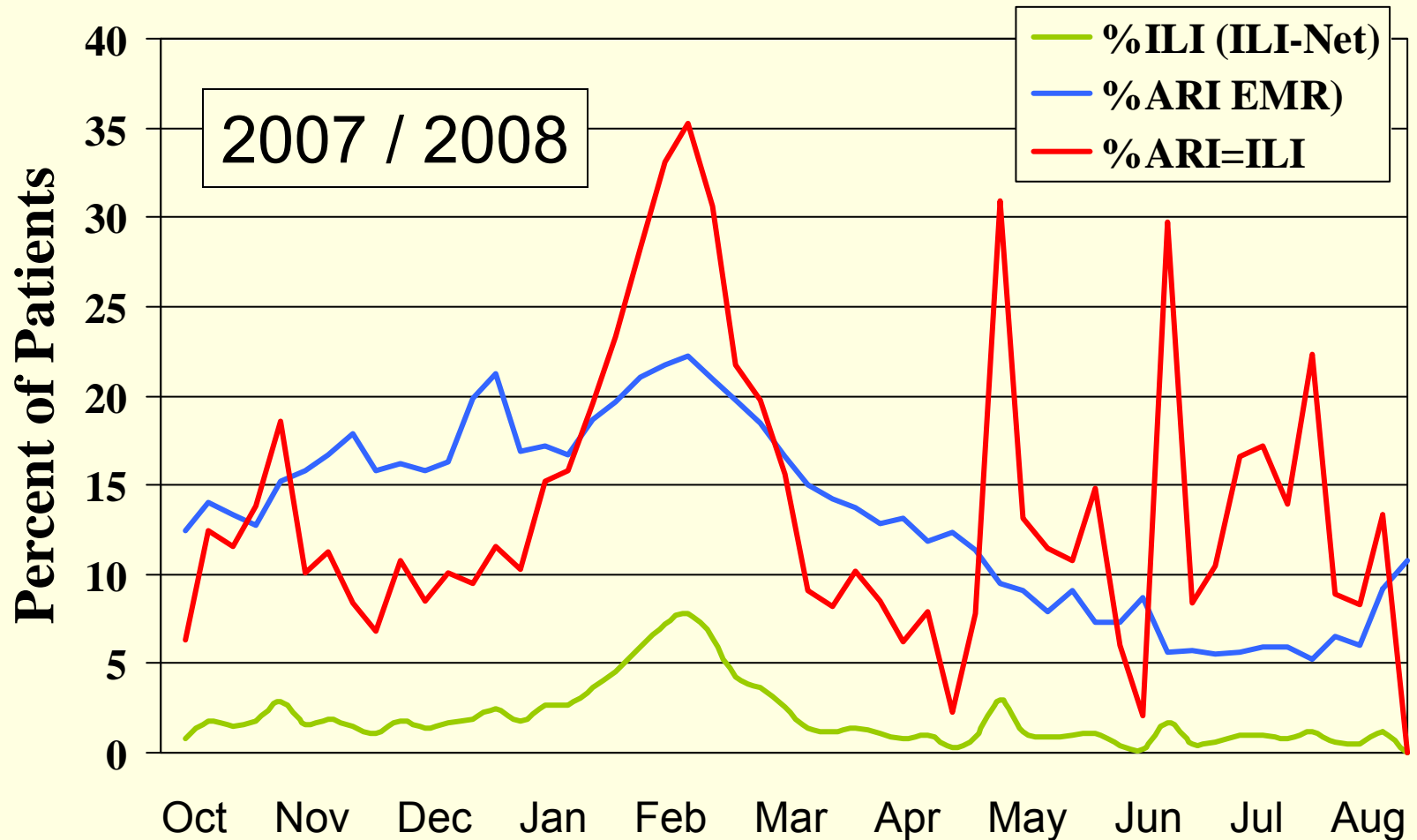
Influenza Surveillance

- P+I mortality Index
- Virological Surveillance
- Assessment of State and Territorial Epidemiologists
- ILI–Net (Sentinel Surveillance)
 - Primary care sentinels through the US
 - Weekly reporting of ILI cases in 4 age groups
 - Weekly reporting of all patient seen

Objective:

- Determine whether a simple EMR algorithm can reliably identify influenza outbreaks in a primary care population
- Background
 - Experience in monitoring ARI from the UW-DFM Clinical Data Warehouse
 - Combining EMR data with ILI-Net data from Wisconsin provided evidence that ILI/ARI may be a good signal

Combining data produced some interesting and strong signals...



Methods

■ Data Period

- July 1, 2006 through April 10, 2010
 - 3 seasonal influenza epidemics
 - 2 waves of pandemic influenza

■ Electronic Data

- UW Dept. of Family Medicine Clinical Data Warehouse
- Extensive universe of primary care data
 - Approximately 176,624 unique patients
 - 3.2% of Wisconsin's total population
 - Demographic information
 - ICD-9 codes
 - CPT codes
 - EPIC EMR Data
- Approximately 16,500 patient encounters per week

Methods

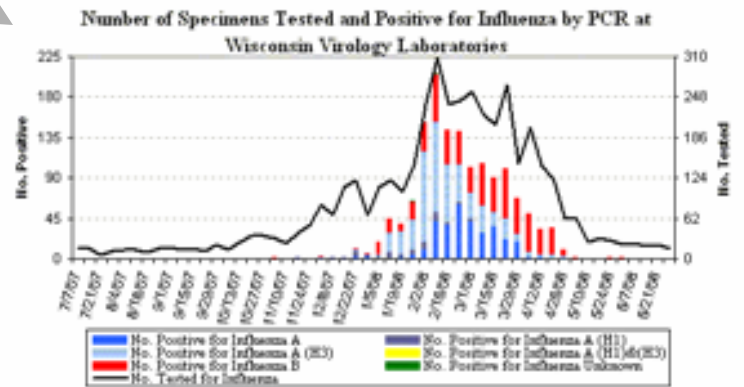
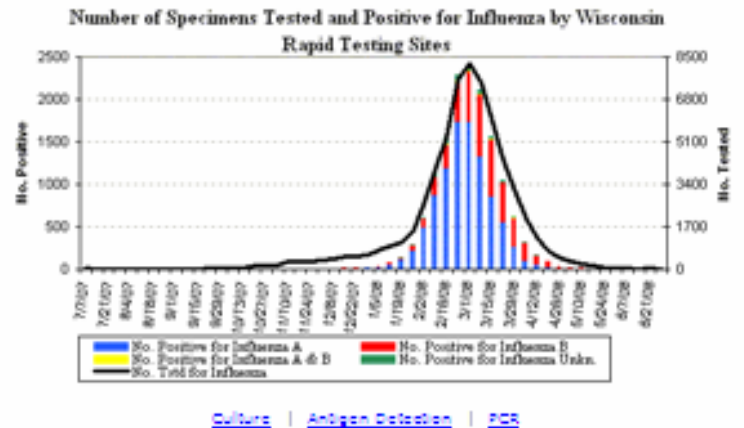
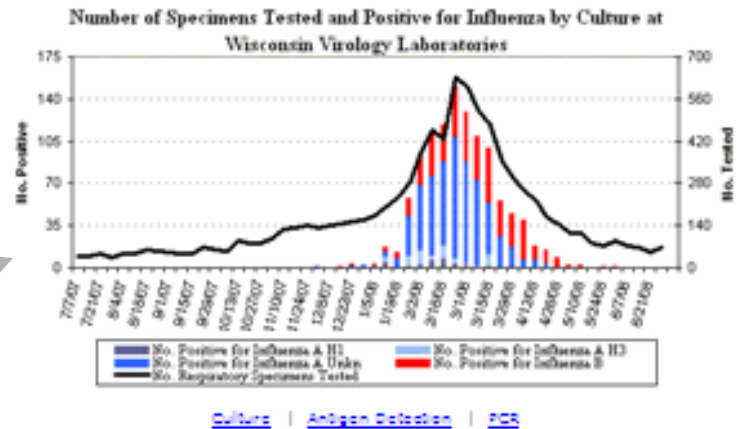
- Assess the percentage of visits per week
 - “all-cause” Acute Respiratory Infections (ARI)
 - ICD-9: 381-382.9: “nonsuppurative otitis media and eustachian tube disorders” and “suppurative and unspecified otitis media”
 - ICD-9: 460-466.99: “acute respiratory infections”
 - ICD-9: 480-488.1: “pneumonia”, “influenza”, and “H1N1”
 - Influenza-like Illness (ILI)
 - ARI diagnosis code and measured temperature $\geq 100^{\circ}\text{F}$
- Calculate the ratio ILI to ARI (%)

Methods

- Compare ILI/ARI signal to an external measure of influenza prevalence
 - Wisconsin State Laboratory of Hygiene
 - Public Health Surveillance of influenza
 - Culture
 - Rapid testing network
 - PCR
- Calculate sensitivity, specificity, PPV and NPV
 - Peak influenza weeks
 - Outbreak weeks

WSLH data

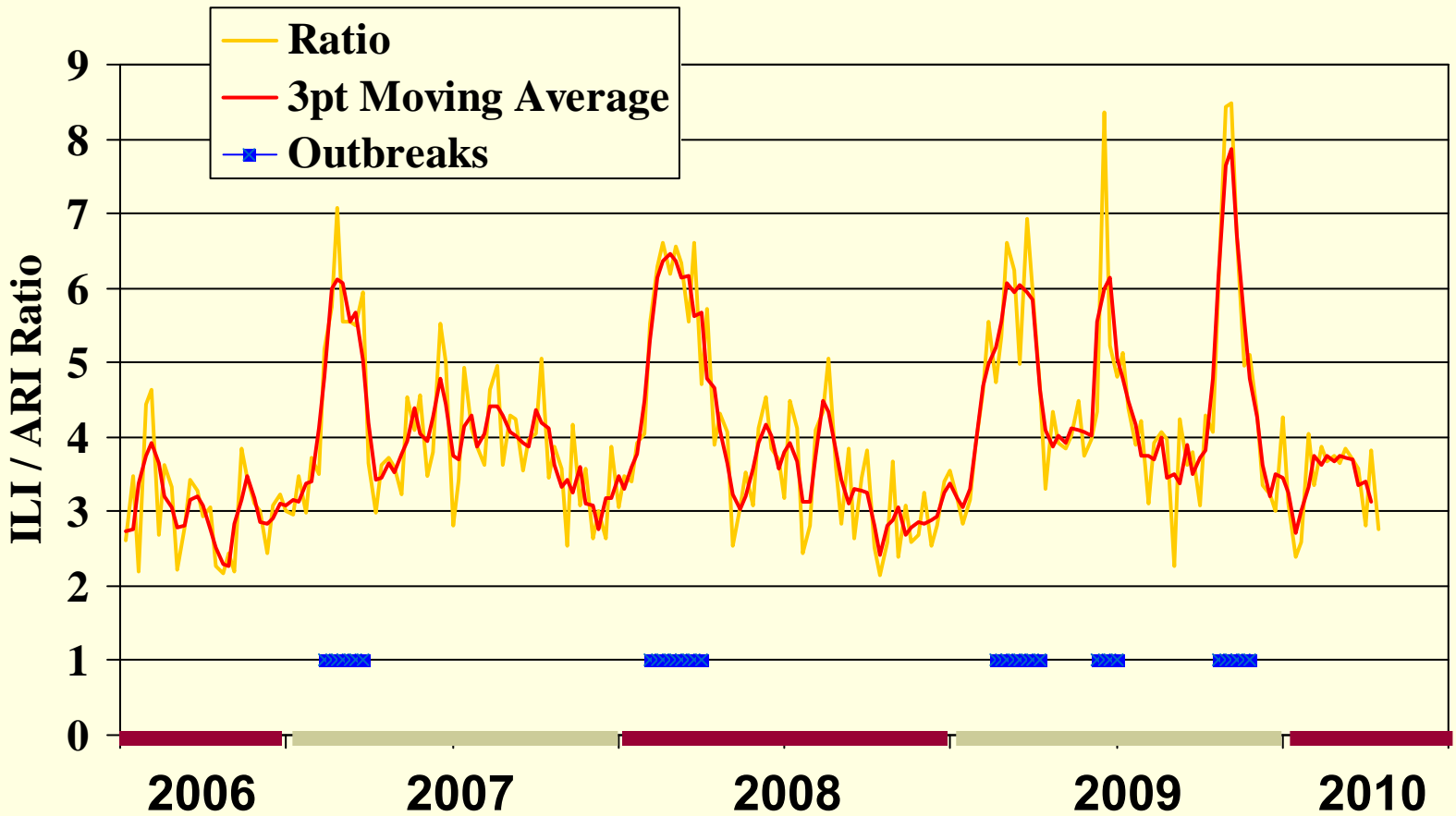
- Weekly data
 - Culture
 - Rapid testing
 - PCR
- Available at:
 - www.slh.wisc.edu



Influenza Activity in Wisconsin

Outbreak	Start	End	Weeks
Seasonal #1	2/04/2007	3/24/2007	7
Seasonal #2	1/27/2008	3/29/2008	9
Seasonal #3	2/08/2009	4/04/2009	8
Pandemic 1st wave	5/31/2009	6/27/2009	4
Pandemic 2nd wave	10/11/2009	11/21/2009	6

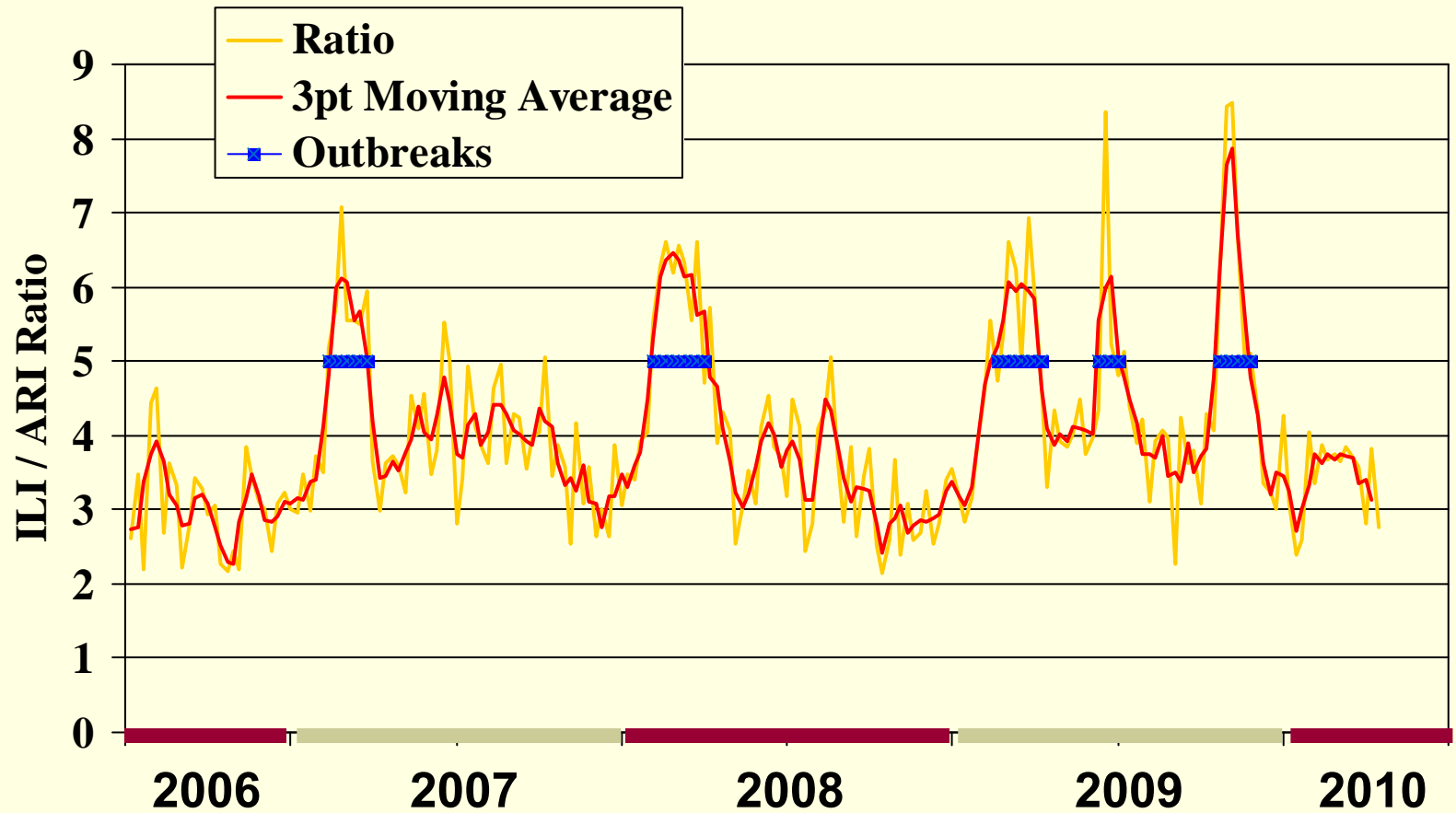
ILI / ARI ratio



Proposed 5% ILI/ARI ratio

- Based on occurrence of five definite peaks
- Threshold level
- Simplicity

ILI / ARI ratio



Performance

	Outbreak (+)	Outbreak (-)	
≥ 5% ILI/ARI	31 weeks	0 weeks	31 weeks
< 5% ILI/ARI	3 weeks	162 weeks	165 weeks
(using 3-pt MA)	34 weeks	162 weeks	196 weeks

- Sensitivity

- 31/34 = 91.2%

- Specificity

- 162/162 = 100%

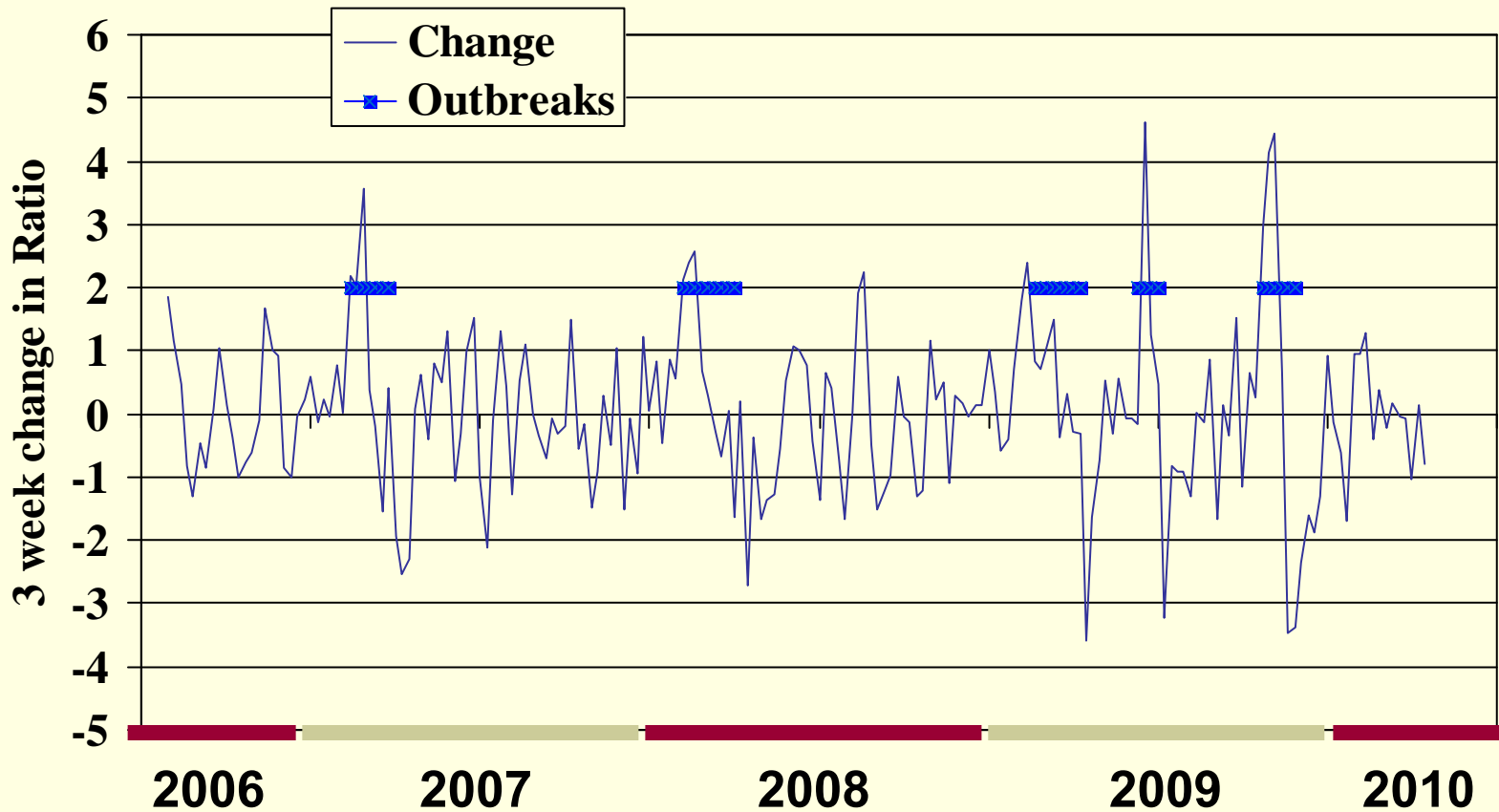
- PPV

- 31/31 = 100%

- NPV

- 162/165 = 98.2%

An increase in the ILI/ARI ratio of 2% over 3 weeks also predicts outbreaks



Validity of Results

■ Strengths

- Primary care based data
- Large population size
- Wide inclusion of “umbrella” diagnoses
- Simplicity

■ Limitations

- Lack of “*a priori*” hypothesis
- No clear definition of influenza outbreak
 - Lack of definite “gold standard”
- Nuances of practice, EMR and practice style

Conclusions

- Influenza outbreaks can be reliably detected by EMR data
- A very simple algorithm performs well
 - unselected ARI cases compared to cases filtered using a 100°F criteria
 - Use of a 3-point moving average would delay outbreak detection by one week
 - A marked rise in ILI/ARI ratio may provide additional support for outbreak occurrence
- Additional evaluations are warranted

