

**Analysis of seasonal influenza in the  
United States: A look at laboratory  
confirmed cases and sentinel provider  
reporting from 1997-98 to 2006-07**

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# Background

- Epidemiologist – Virginia Department of Health
- Assuring the Future of Public Health Systems Research Grant
  - University of Kentucky School of Public Health

# Seasonal Influenza

- Contagious respiratory illness caused by influenza viruses
- 5-20% of US population annually
- Major cause of morbidity and mortality
  - 200,000 hospitalizations
  - 36,000 deaths

Source: CDC web site

# Influenza Impact

- Vaccine (Molinari, 2007)
  - 610,660 life-years lost
  - 3.1 million hospitalized days
  - 31.4 million outpatient visits
  - Direct medical costs = \$10.4 billion annually
  - Lost earnings due to illness and loss of life = \$16.3 billion
  - Total economic burden = \$87.1 billion annually (projected statistical life values)

# Study Goal

- Understand seasonal influenza and identify implications for planning and administration.

# Data Source

- Database located in the Public Health Systems Research (PHSR) subset of the National Library of Medicine – Health Services Research Resources (HSRR)

# Influenza Surveillance

- Two types
  - National Respiratory and Enteric Virus Surveillance System (NREVSS) Collaborating Laboratories – (flu data)
  - United States Influenza Sentinel Physician Surveillance Network – (ILI data)

# NREVSS

- National Respiratory and Enteric Virus Surveillance System (NREVSS) Collaborating Laboratories
  - Collect actual laboratory confirmed cases of influenza including type (A or B) and subtype for Influenza A (H3N2)
  - Begins week 40 (first week in October) through week 20 (mid May)

# United States Influenza Sentinel Physician Surveillance Network

## ■ Sentinel Provider

- Reports weekly visits for Influenza-Like-Illness (ILI)
- Use CDC case definition
  - 100°F or higher and cough or sore throat
- Reporting
  - Local HD to State HD to CDC

# Mortality Surveillance

- Reported through the 122 Cities Mortality Reporting System
  - Tracks percentage of deaths reported to be caused by pneumonia and influenza in 122 cities in the United States
  - Not a case-fatality rate for influenza

# Objective One

Compare ILI visits with laboratory confirmed influenza tests for each flu season (week 40 to week 20) from 1997-2007

# Methods

## Objective One

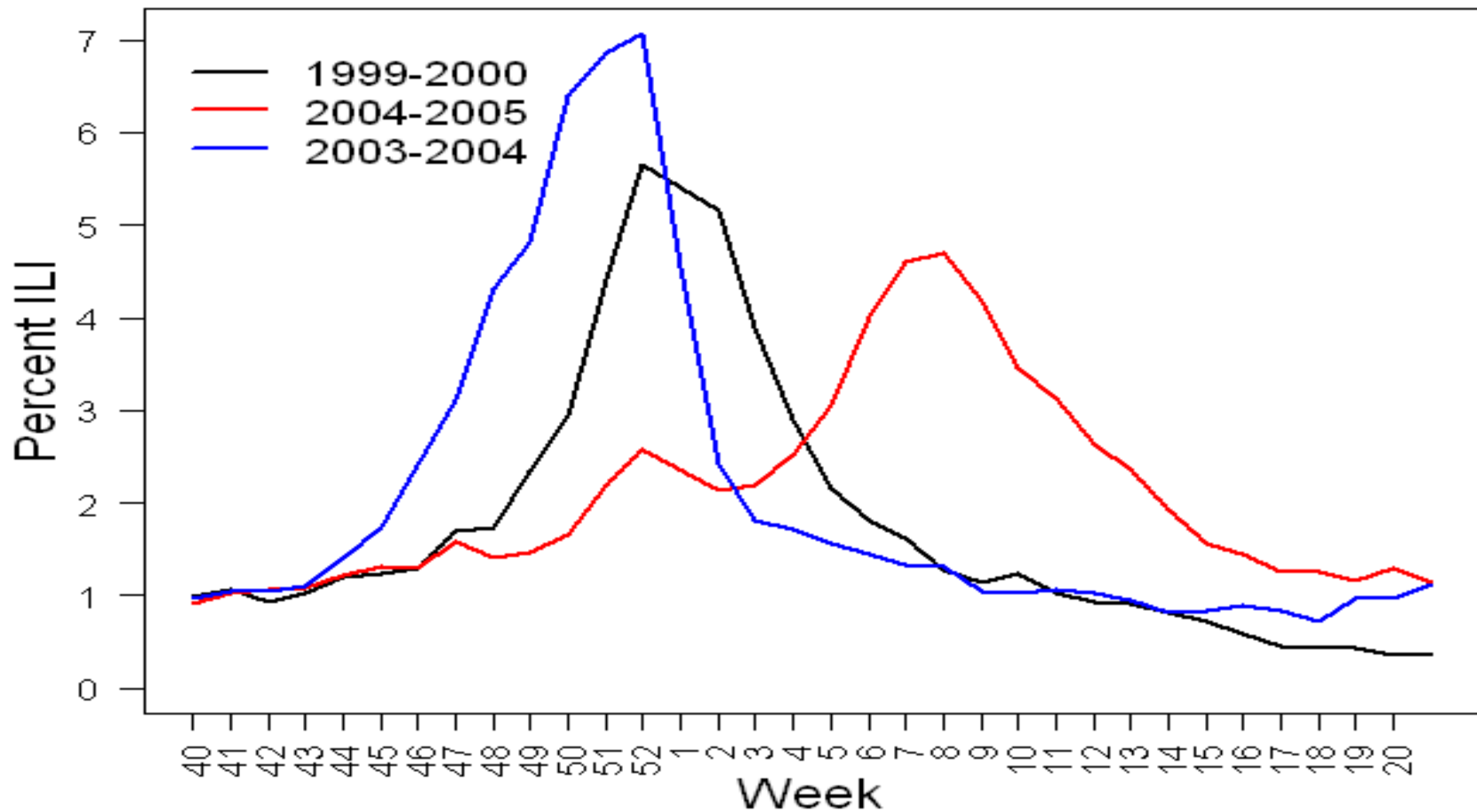
- Extracted data from national database
- Entered into Excel
- Analysis done in “R” software
- Correlations of ILI and flu cases
- Graphical depictions of ILI and flu cases
- Rate of change in ILI and flu

# Correlations

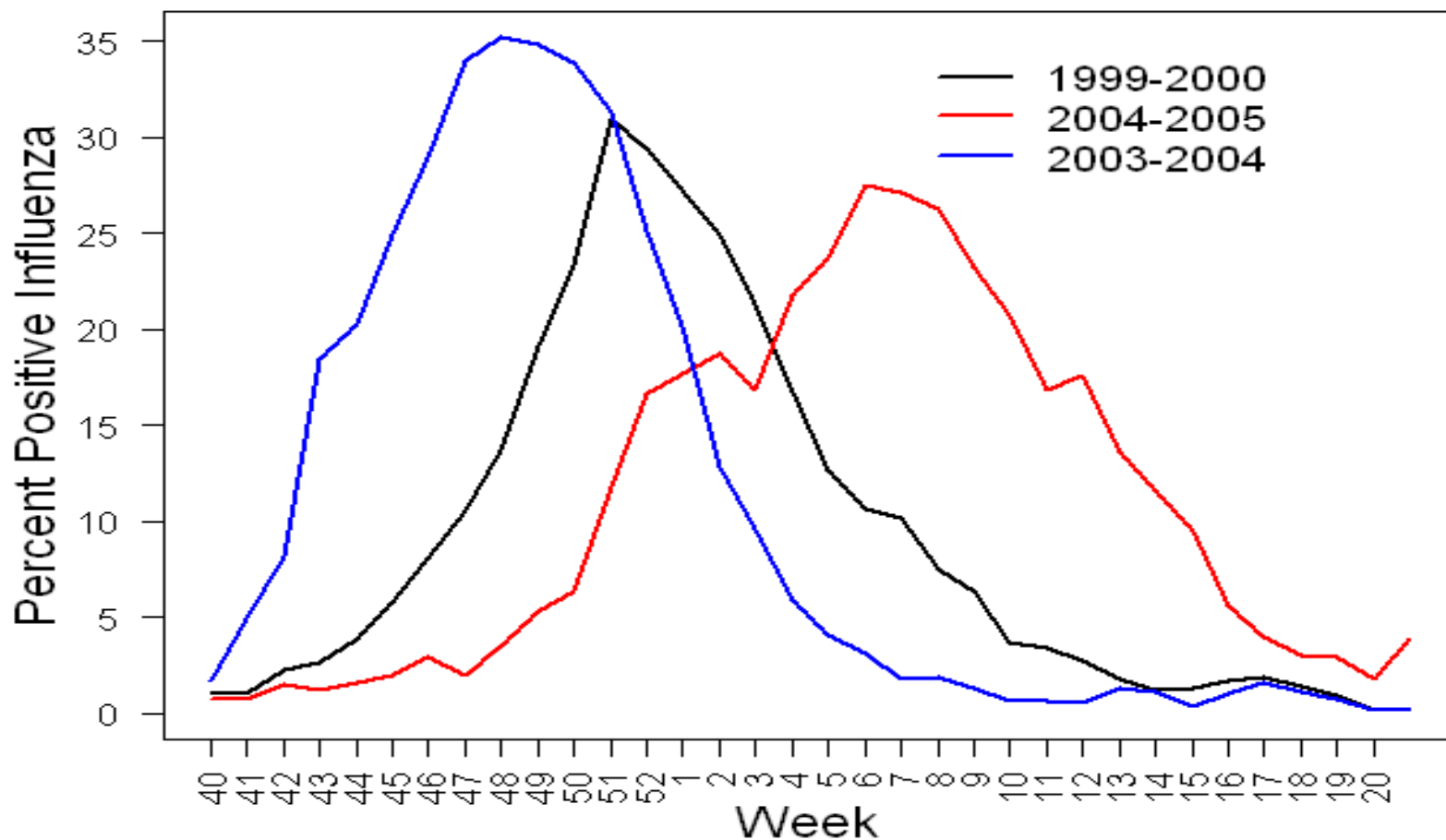
## ILI and Flu cases

Year	r
1997-98	0.94
1998-99	0.96
1999-00	0.95
2000-01	0.96
2001-02	0.77
2002-03	0.85
2003-04	0.80
2004-05	0.94
2005-06	0.80
2006-07	0.84

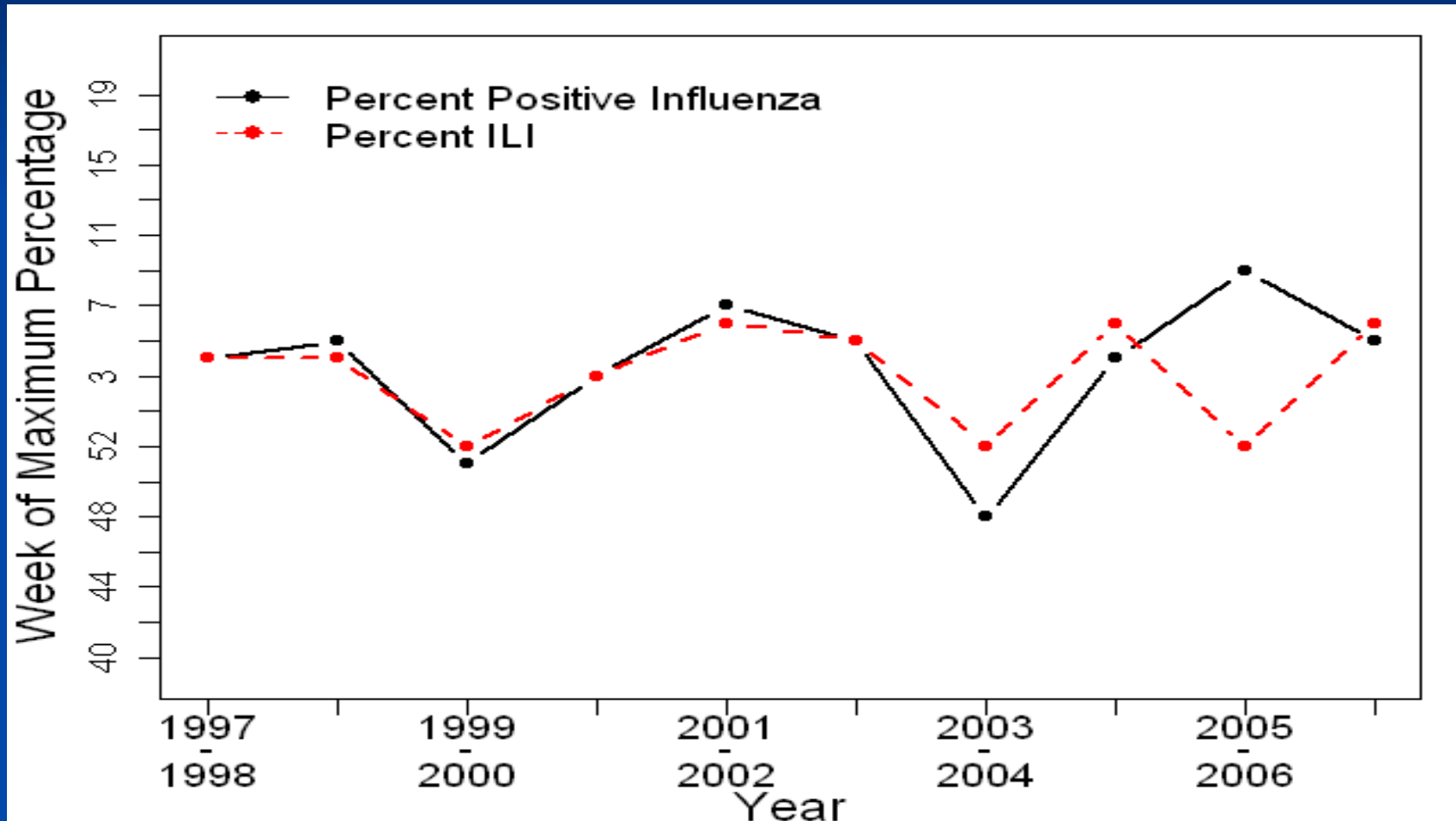
# Week of Maximum ILI visits Three Patterns



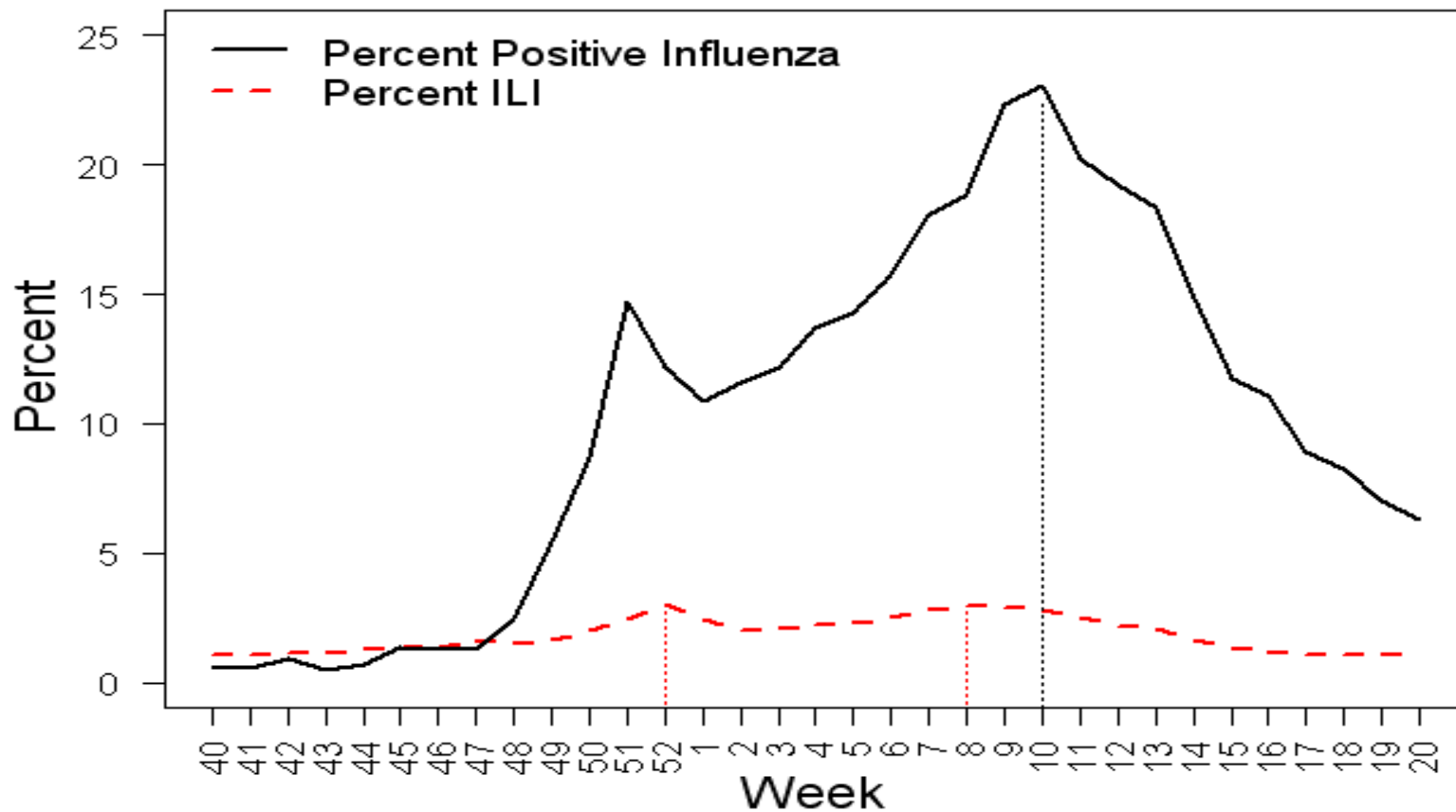
# Week of Maximum Flu Three Patterns



# ILI and Flu 1997-98 to 2006-07



# Double Peaks in ILI 2005-06



# Results

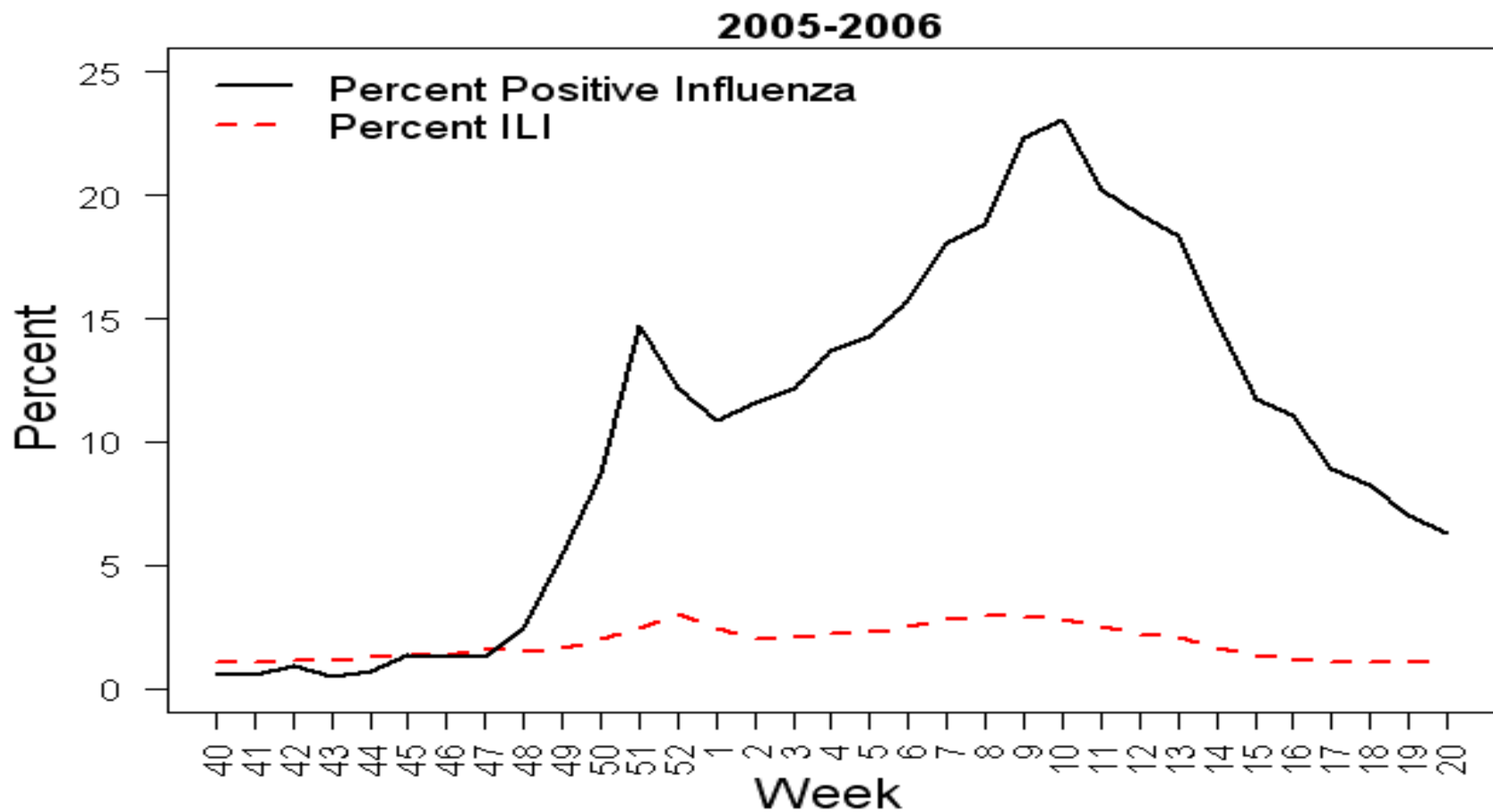
## Objective One

- Week of maximum ILI is a good predictor of week of maximum flu
- At 95% confidence level, it is plausible that on average there is no delay in the week of maximum ILI and flu
- Cannot use rate of change in ILI to predict week of flu maximum

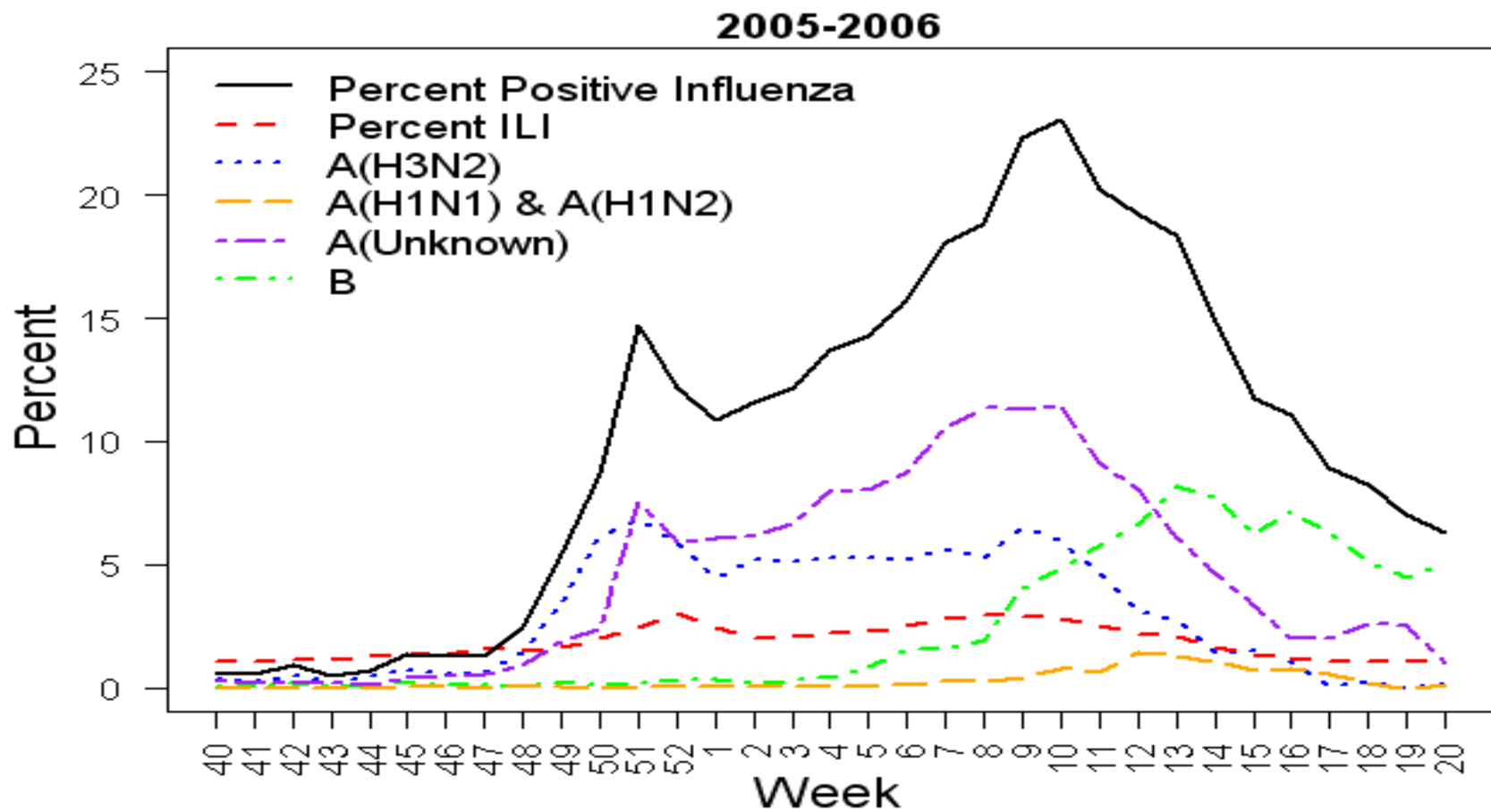
# Objective Two

Analysis of the contribution of types and strains to weekly flu cases

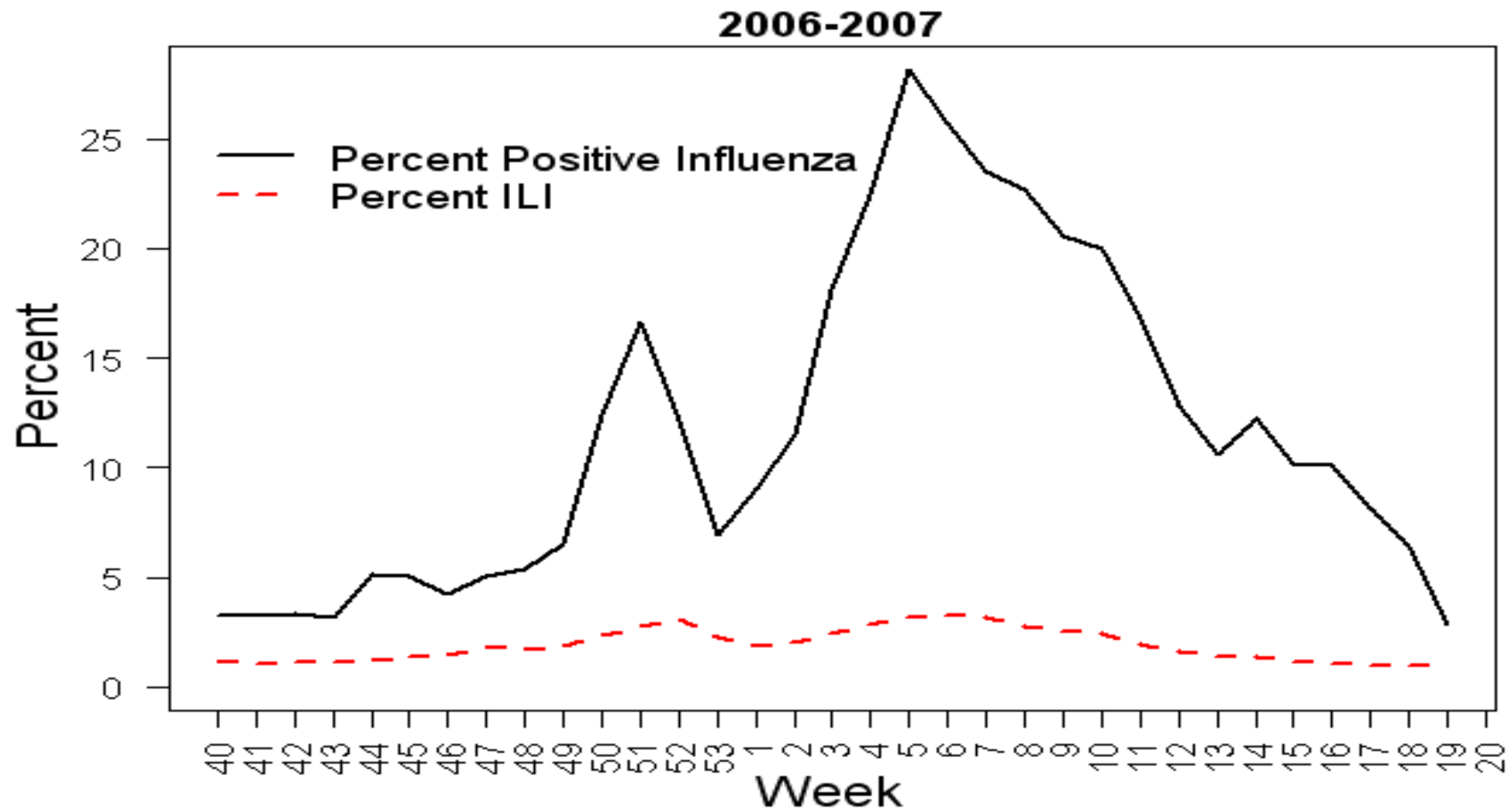
# ILI and Flu 2005-06



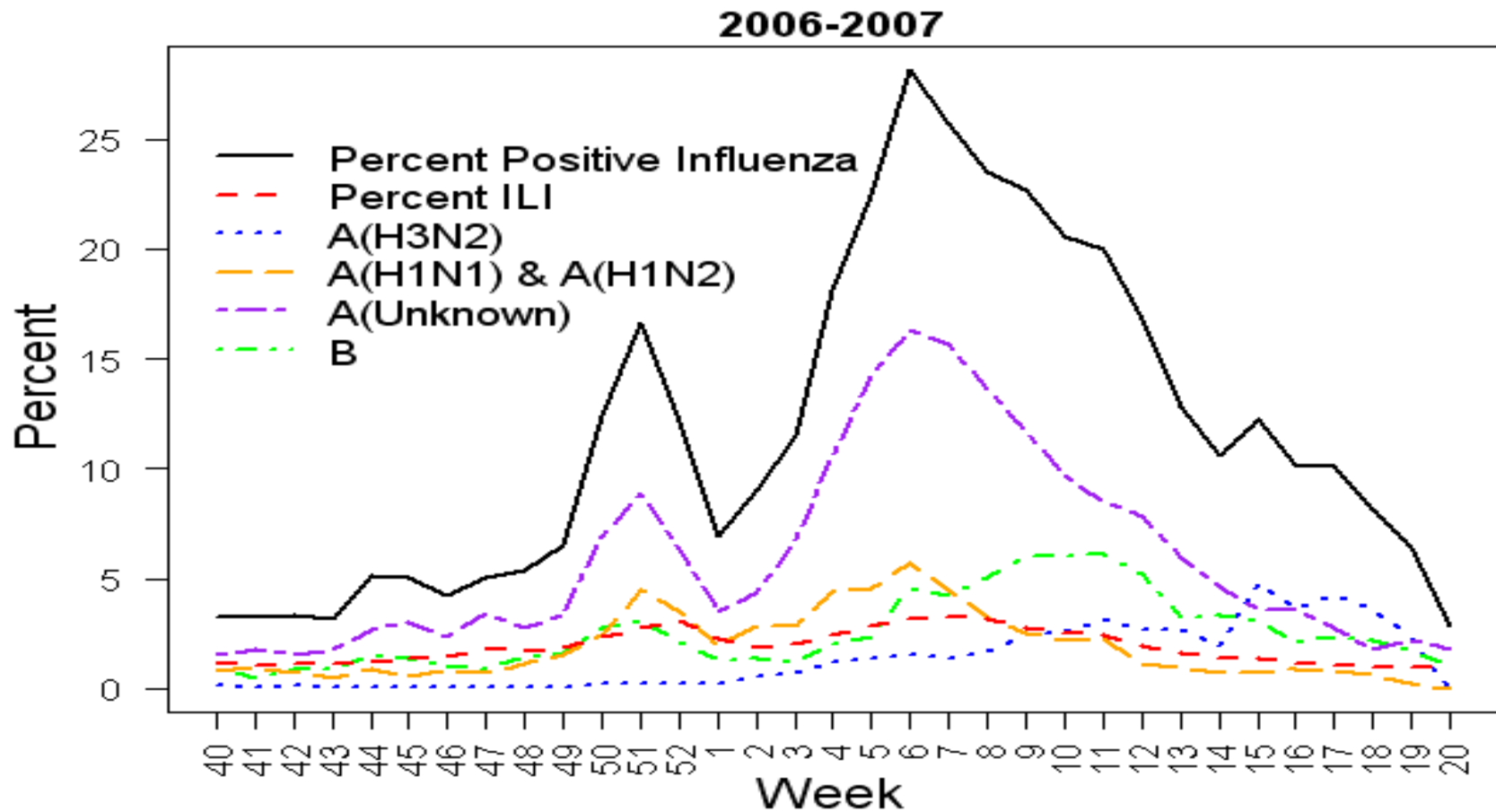
# Strain Effects on Flu



# ILI and Flu 2006-2007



# Strain Effects on Flu 2006-07



# Results

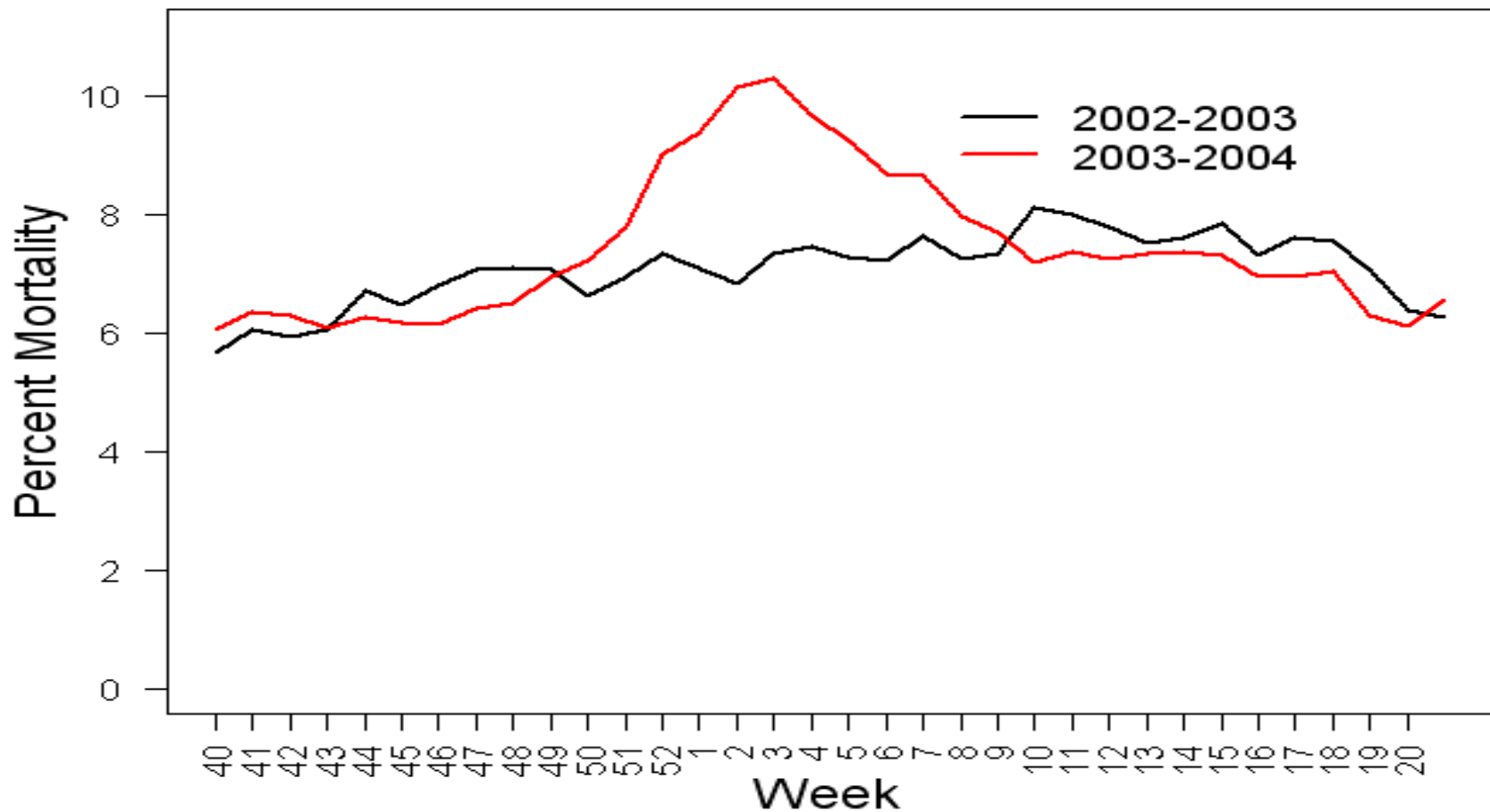
## Objective Two

- 2005-06 and 2006-07 – double peaks in ILI and flu
- For both ILI and flu (in both years) one peak was short in time length and one long in time length
- Double peak caused by different strains
- Too much variability in flu patterns over years.

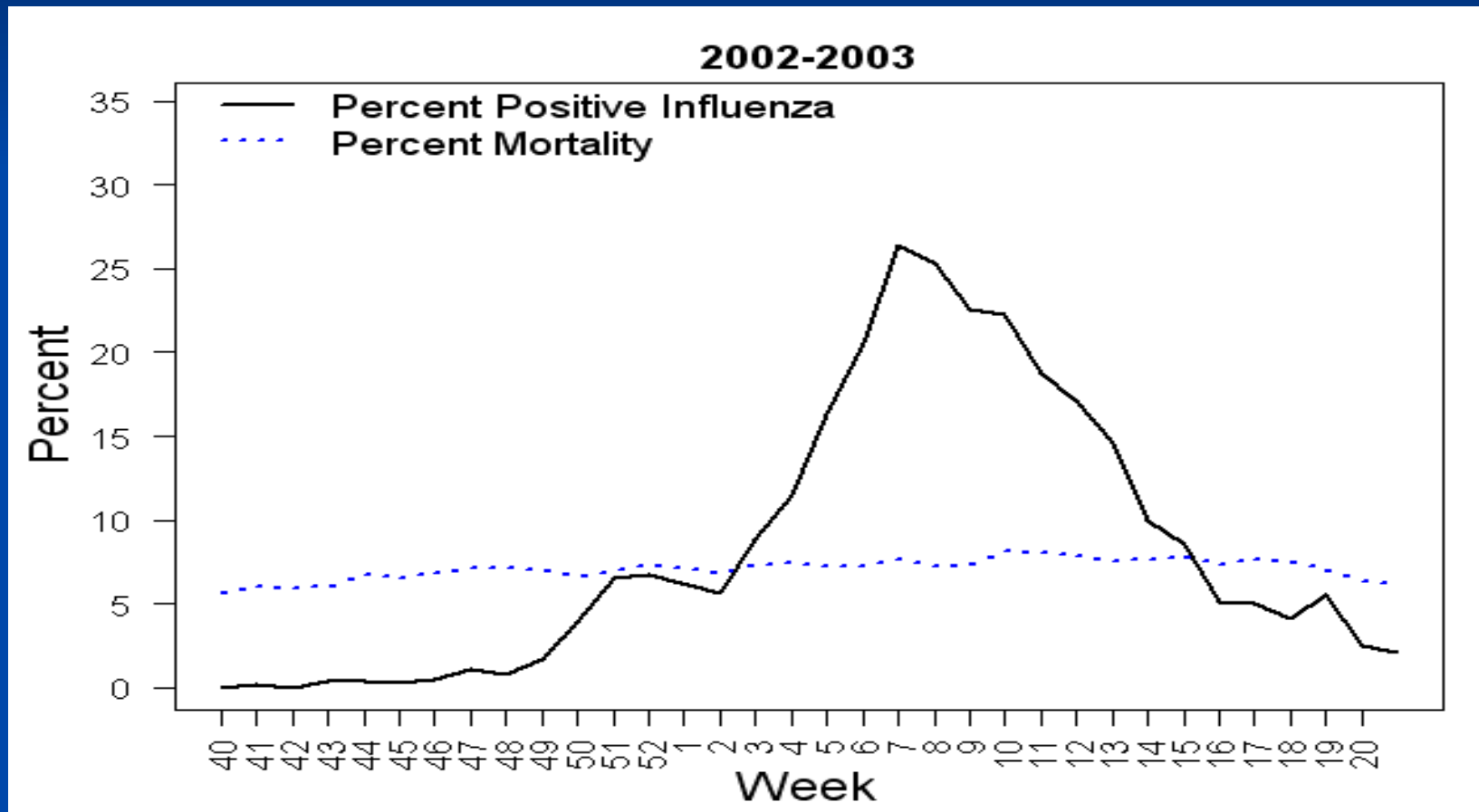
# Objective Three

Comparison of mortality data with  
ILI and confirmed influenza cases

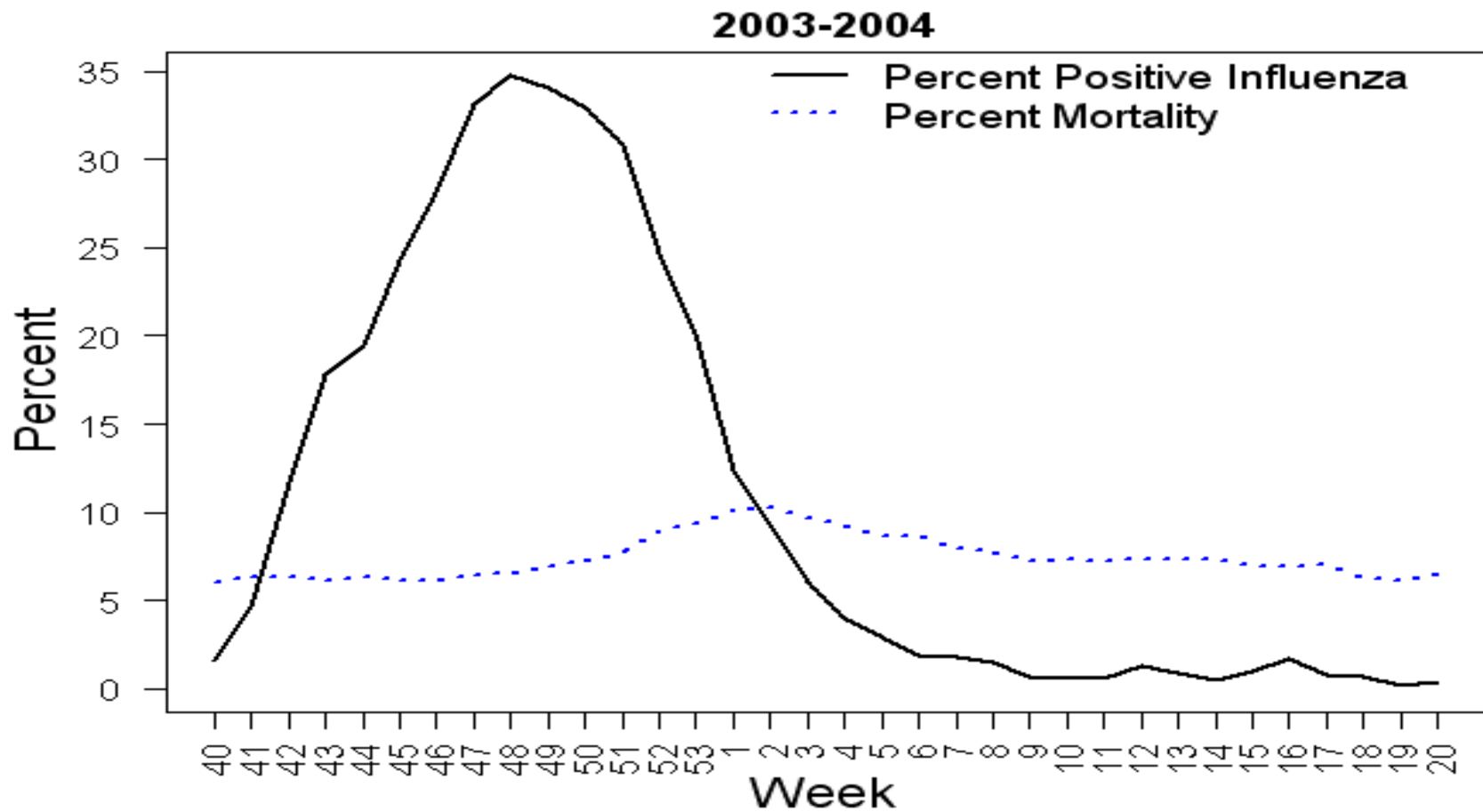
# Mortality Patterns



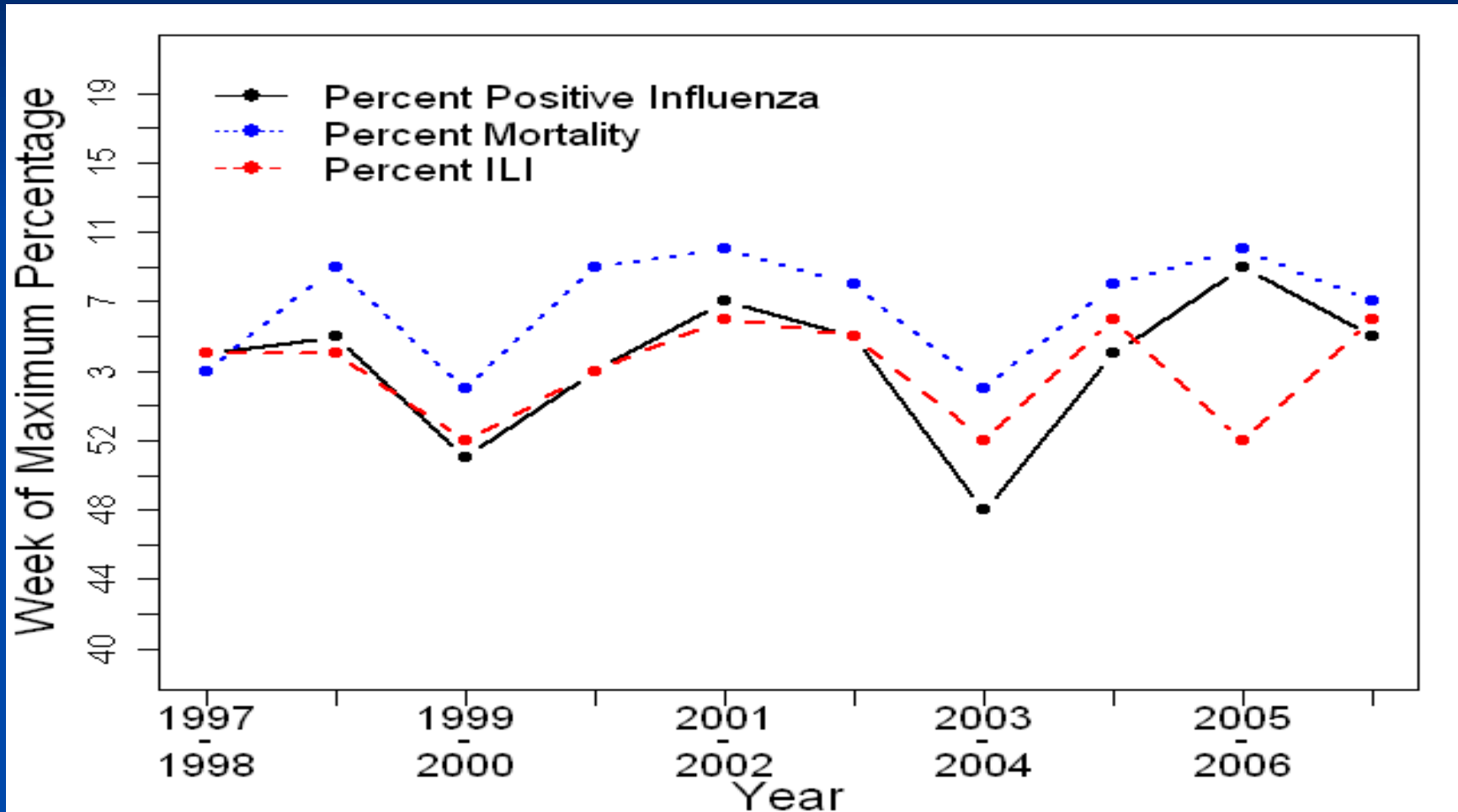
# Relatively Stable Mortality



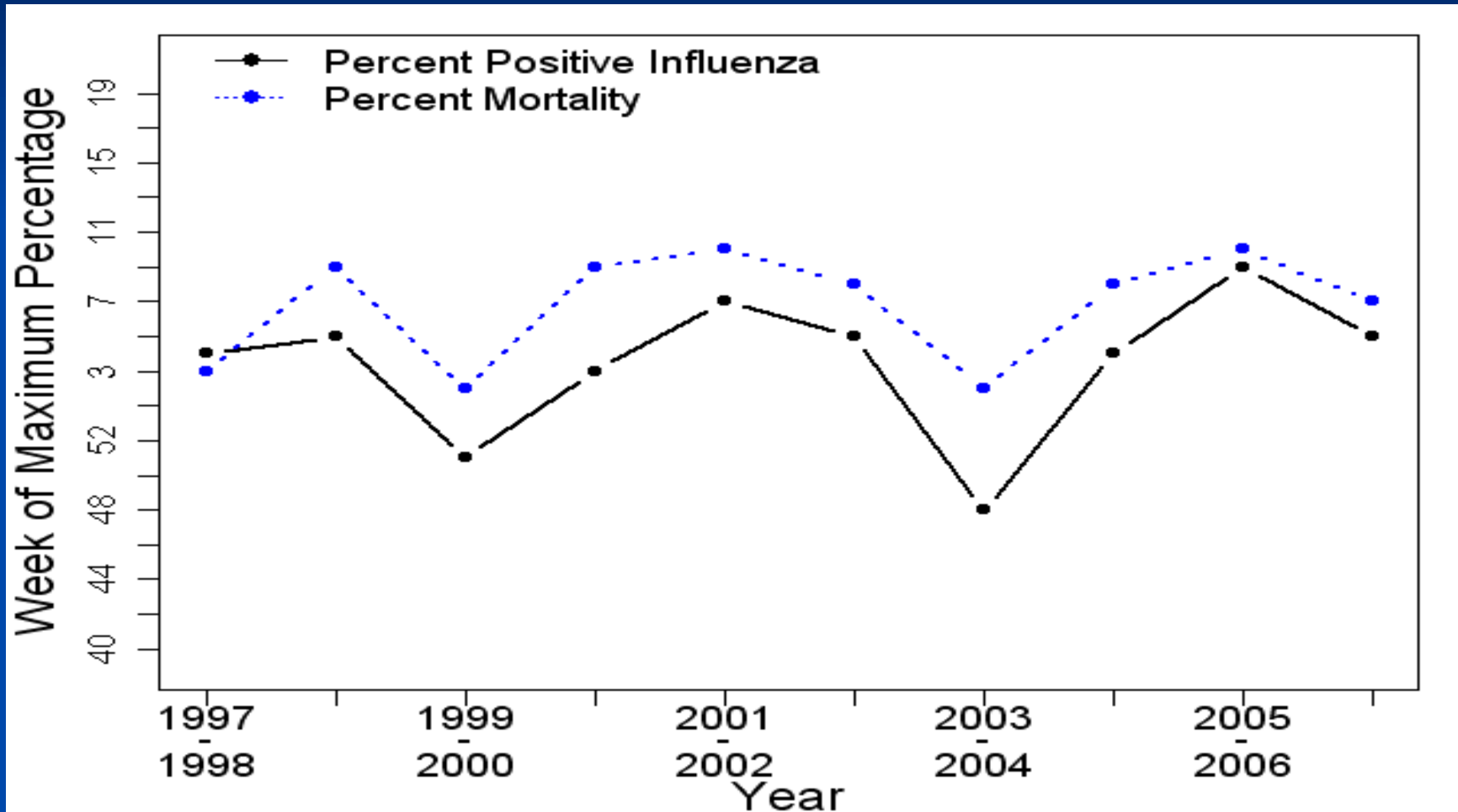
# Variable Mortality



# ILI, Flu and Mortality



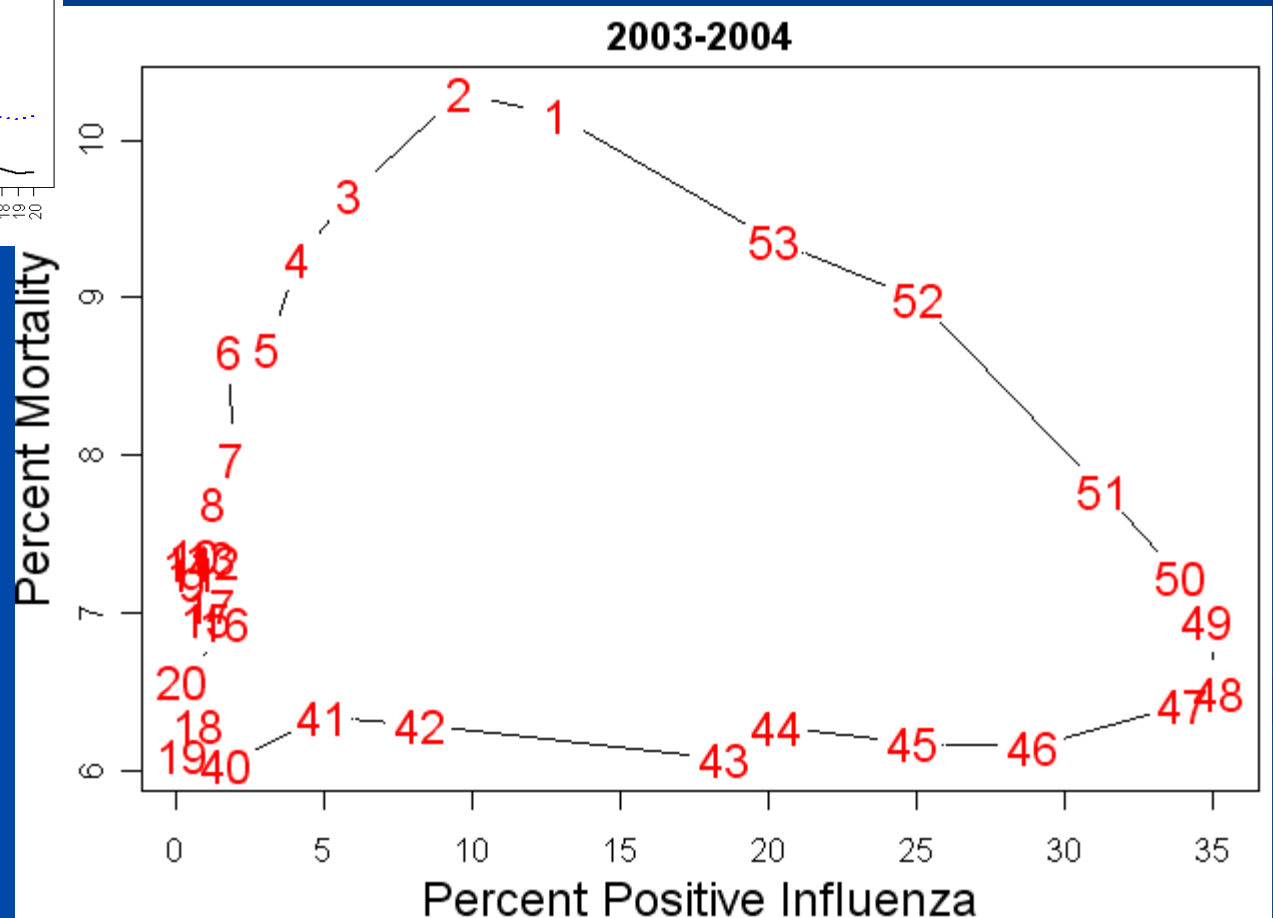
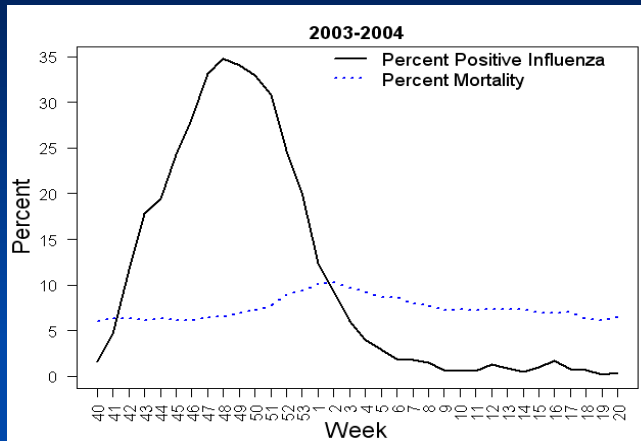
# Flu and Mortality



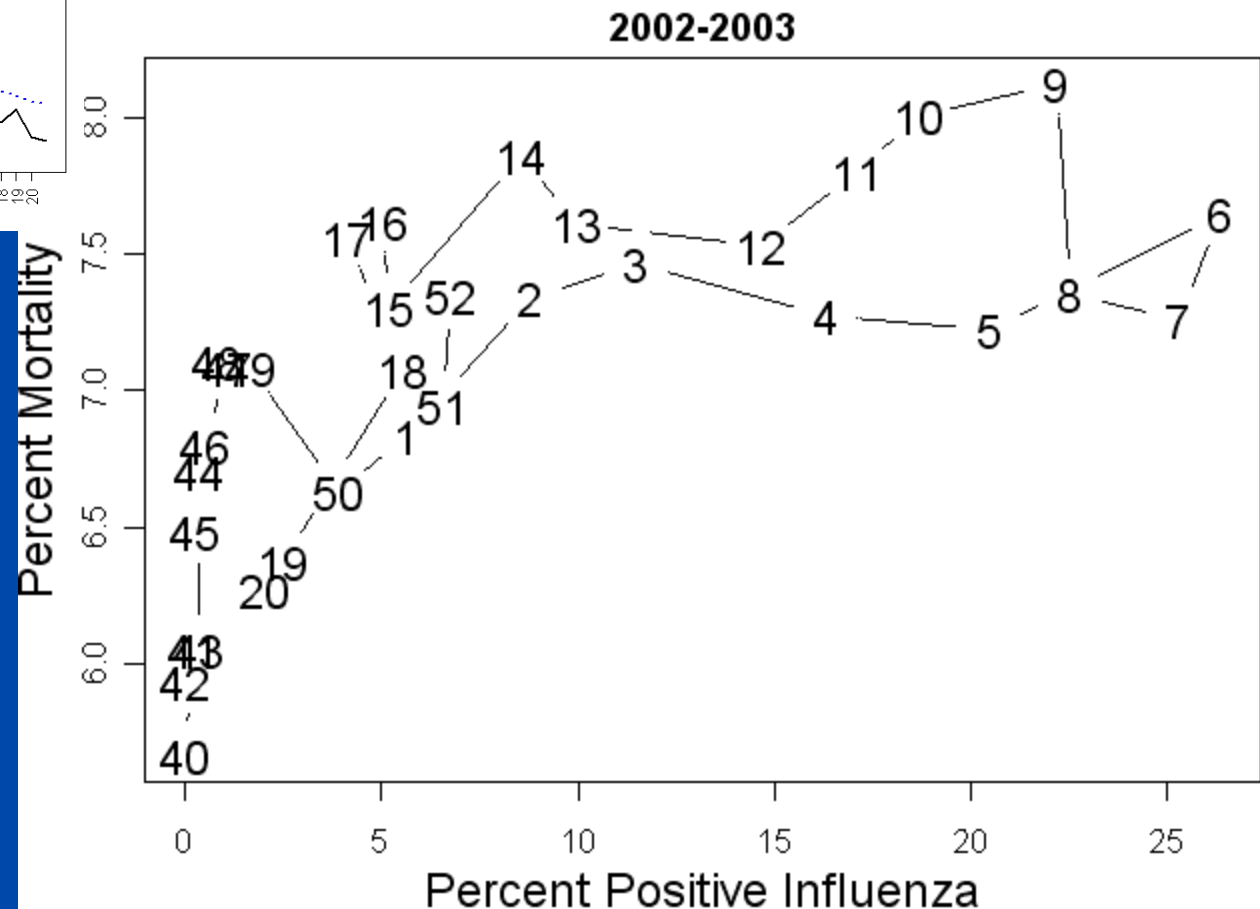
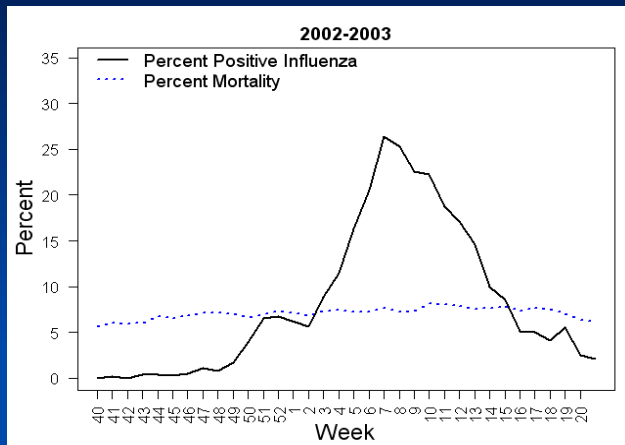
# Flu and Mortality

- At the 95% confidence level, on average the week of maximum mortality will be 1.65 - 4.95 weeks after the week of maximum flu.

# Flu and Mortality in 2003-4



# Flu and Mortality in 2002-3



# Conclusions

- Flu strains follow a pattern each year with patterns changing over the seasons
- Rise in ILI is related to a rise in flu cases
- Week of maximum ILI does not give advance warning of week of maximum flu
- Rate of change of ILI cannot be used to predict week of maximum flu due to variability across seasons
- Understanding week of maximum flu depends on understanding contributions of flu strains
- Predicting the flu pattern next season is difficult due to variability within and between seasons
- Based on the 10 years of data, you can predict that from week of maximum flu that mortality will peak on average 2-5 weeks later

# Implications

- Knowing ILI does not help give advanced warning of flu since they peak at the same time (on average), however,
- ILI and flu cases are strongly associated so increasing ILI rates will signal increasing flu cases and it seems ILI is a reasonable monitor of flu.
- Strain data is important in understanding peaks each flu season
- Can predict that mortality will peak on average 2-5 weeks after flu which may help to initiate control measures

# Questions

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