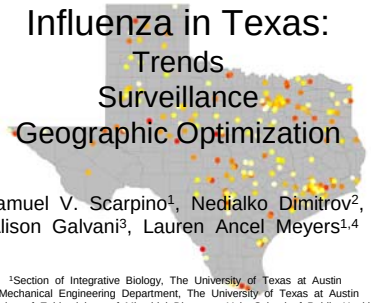
Influenza in Texas:
Trends
Surveillance
Geographic Optimization



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[4]The Santé Fe Institute

Objectives

- Understand the pattern of influenza illness, hospitalization, and death in Texas.
- Outline how data from the DSHS flu surveillance network relates to hospitalizations and deaths due to influenza and viral pneumonia in Texas.
- Understand what properties of ILI-Net are most important for tracking flu dynamics.

Continuing Education Disclosures

- **Requirements for Successful Completion:**
  - **Complete registration form.**
  - **Sign in.**
  - **Attend entire educational activity.**
  - **Complete evaluation.**

Continuing Education Disclosures

- **Commercial Support**
  - **This educational activity received no commercial support.**
- **Disclosure of Conflict of Interest**
  - **The speakers and planning committee members have disclosed no conflict of interest.**
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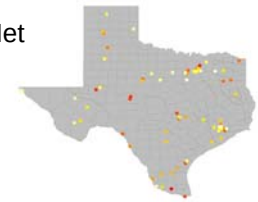
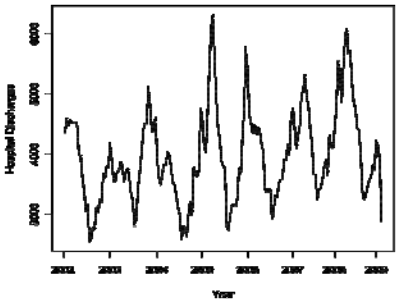
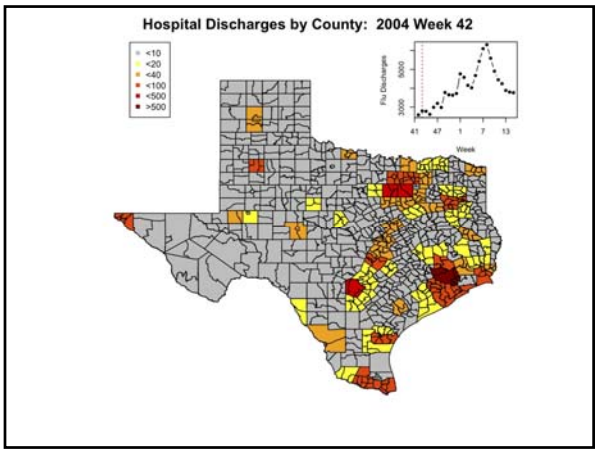
  - **Accredited status does not imply endorsement by the Department of State Health Services, Continuing Education Services, Texas Medical Association, or American Nurses Credentialing Center of any commercial products displayed in conjunction with an activity.**
- **Off Label Use**
  - **If applicable, speakers will clearly delineate any off label use of FDA drugs or devices.**

- What does flu do in Texas?
- How do we track flu in Texas?
- Performance of ILI-Net
- Optimizing ILI-Net



Influenza in Texas




Hospital Discharges by County: 2004 Week 42
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<20
<40
<100
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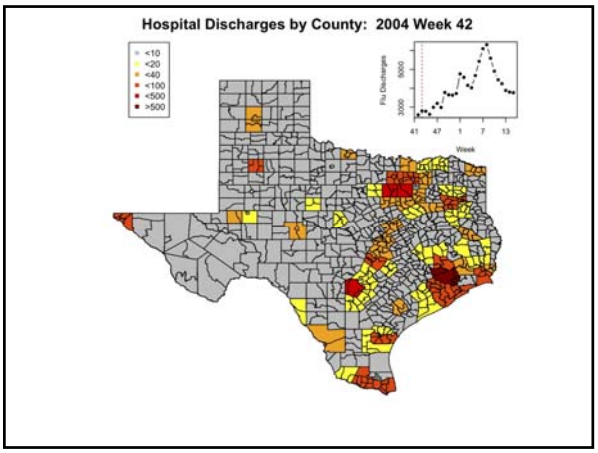
Flu Discharges
3000
5000
41
47
1
7
13
Week


Hospital Discharges by County: 2004 Week 42
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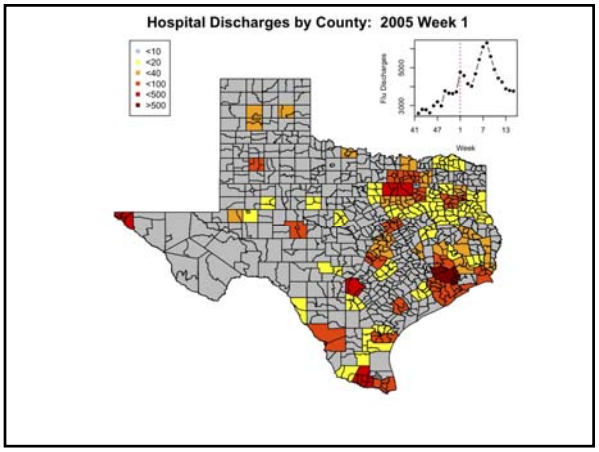
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Flu Discharges
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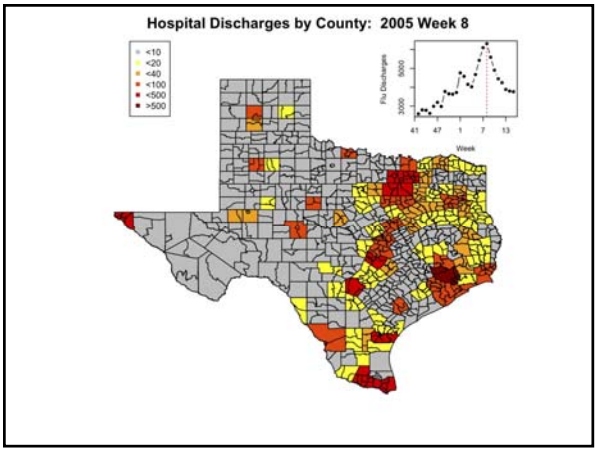
Week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1
7
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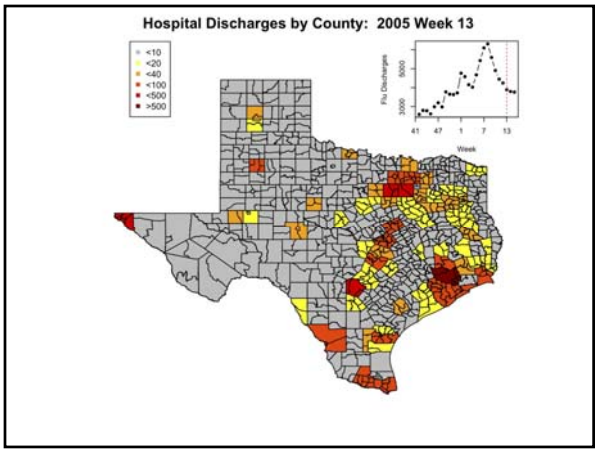
Week


Hospital Discharges by County: 2005 Week 13
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Flu Discharges
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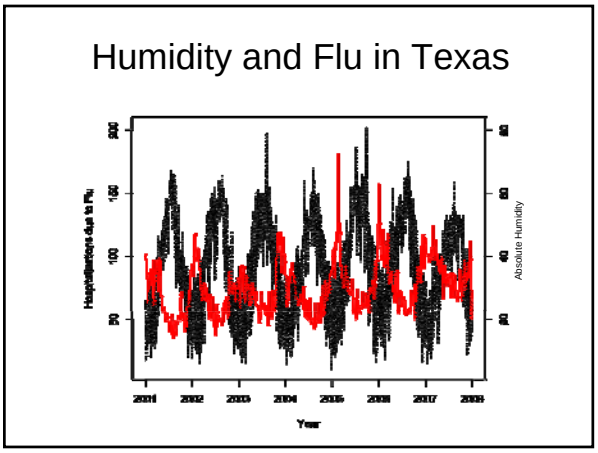
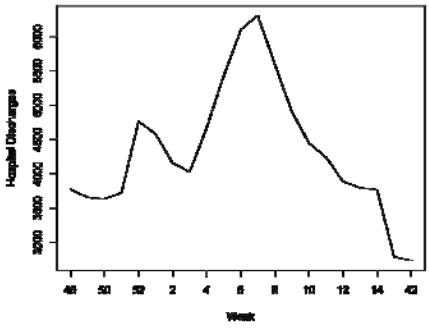
1
7
13
Week


Humidity and Flu in Texas
Hospitalizations due to Flu
Absolute Humidity
Year

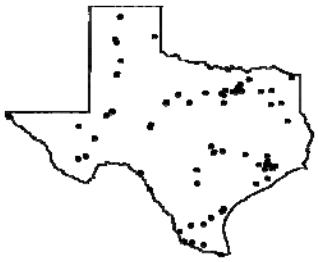
School Calendar (2005)



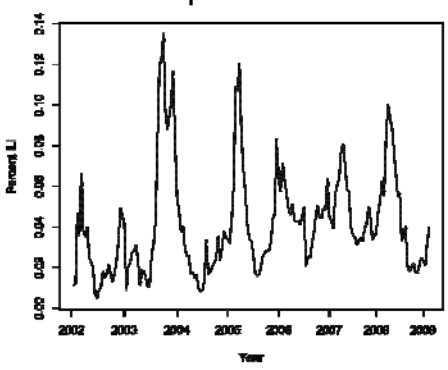
ILI-Net in Texas

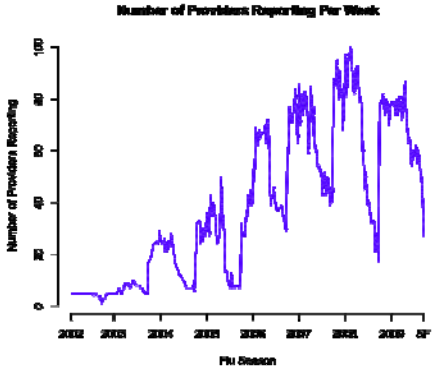
- Started in 2001
- A network of primary healthcare providers
- ~80 providers regularly reporting by 2008
- Weekly reports of patients with ILI

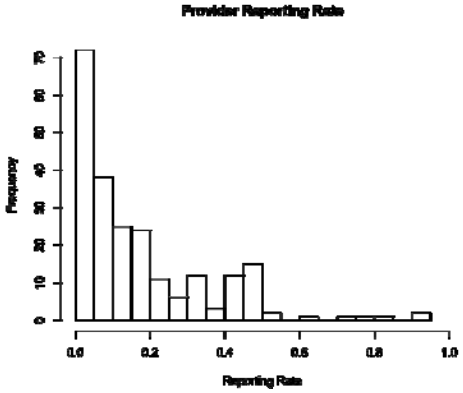
ILI-Net in 2008



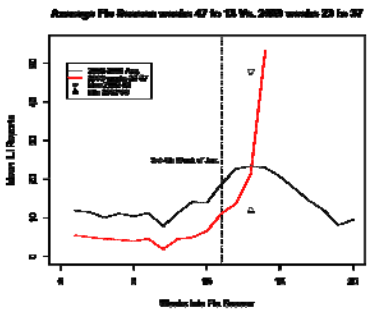
ILI-Net Reports 2002-2009



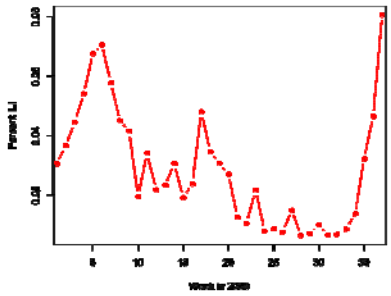




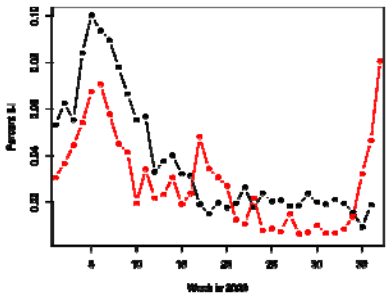
SO-H1N1



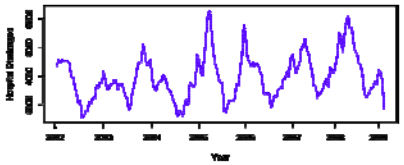
2009

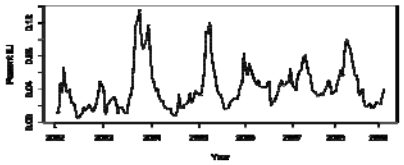


2009 and 2008

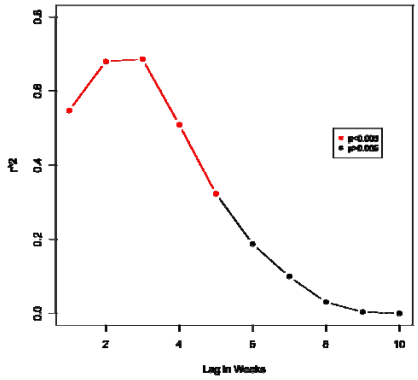


ILI-Net and Influenza Hospitalizations

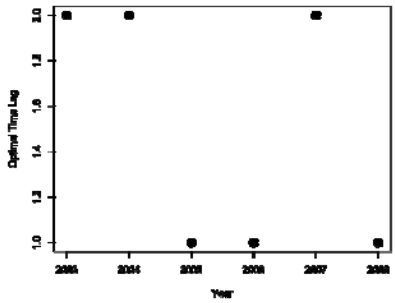




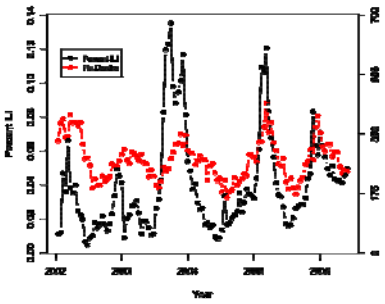
2004 - r^2 and Lag in Weeks (ILI & Discharges)



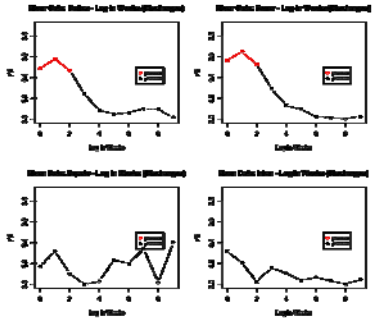
Optimal Time Lags



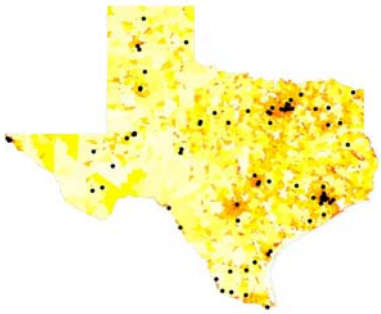
ILI and Flu Deaths



Urban Vs. Rural



ILI Net and Population Density



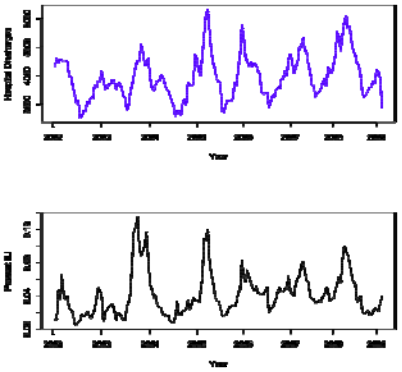
Provider Network Optimization

- How well is the current network performing?
- Can the network be improved? …How?
- What would the “ideal” network look like?

Optimization

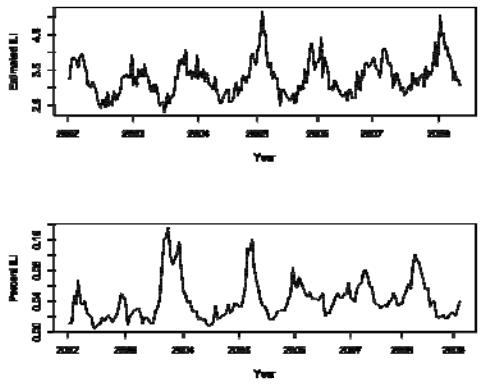
- Use a model to simulate mock ILI time series.
- Evaluate the performance of these mock time series.
- Select the ones that do the best.

ILI-Net and Influenza Hospitalizations



Mock Providers

1. Estimate the percent of ILI in a zip code.
   a. Hospitalization time-series
   b. Estimate of hospitalization rate
   c. Population size of the zip code
2. Assume mock providers contain perfect information.
3. Assume a 2 week time-lag.



Optimization Routine

1. Generate a population (P) of mock providers.
1. Iterate over all providers in (P) not yet in provider set (S) and evaluate the objective function.
1. Add the best provider to the set of providers (S).
1. Repeat until the set of providers (S) equals either (P) or the desired size.

Time t=0

Provider population (P)

Provider	R^2 from objective function
78712	0.54
78705	0.34
78704	0.55
78710	0.49

Provider set (S)

Provider	Model R^2

Time t=2

Provider population (P)

Provider	R^2 from objective function
78712	0.74
78705	0.75
78710	0.72

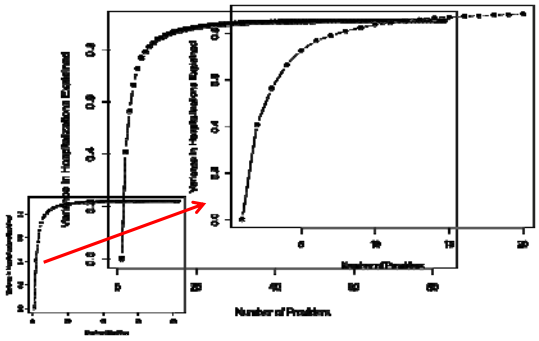
Provider set (S)

Provider	Model R^2
78704	0.55
78710	0.72

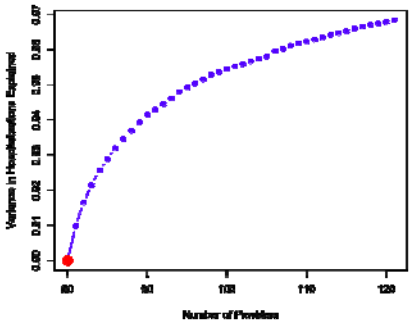
Scenarios

1. Population of providers constrained to zip codes in the actual 2008 network.
2. The addition of 40 providers to the 2008 network.
1. The optimal provider network of size 200 using the entire population of zip codes in Texas.

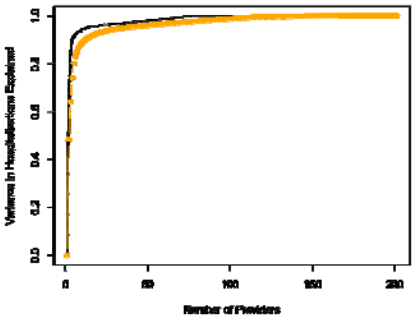
Scenario 1 – ILI-Net 2008



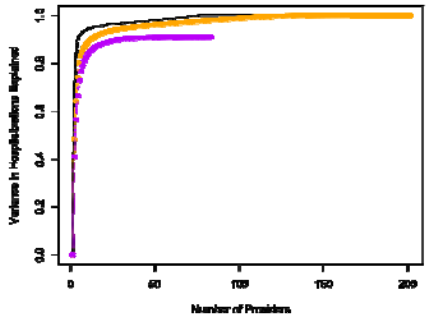
Scenario 2 – Add 40

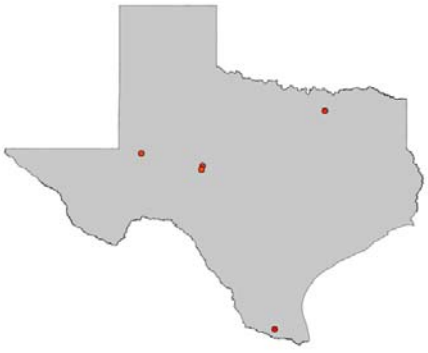


Scenario 3 – 200 Best



Scenario 3 and Scenario 1 (2008)





Conclusions

- ILI-Net is able to predict hospitalizations and deaths due to influenza.
- Influenza epidemics are synchronized in the large cities of Texas.
- It is possible to use ILI-Net to make intervention decisions.

Questions for you

- Is State Hospitalization the best criteria from optimization?
- If it is the best, are there others worth investigating?
- What resources would help in making intervention decisions?

Acknowledgements

- Meyers Lab
- Texas Department of State Health Services
  - Marilyn Felkner & Jeff Taylor
- NSF Graduate Research Fellowship
- NIH MIDAS

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