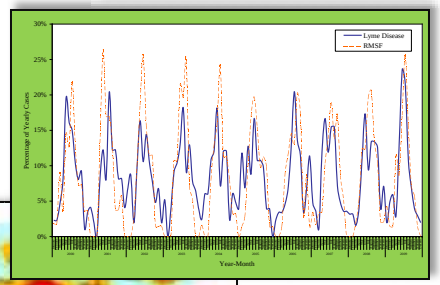

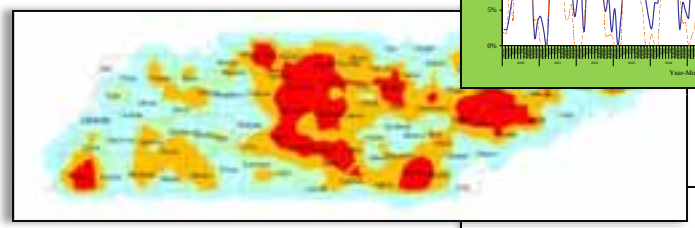

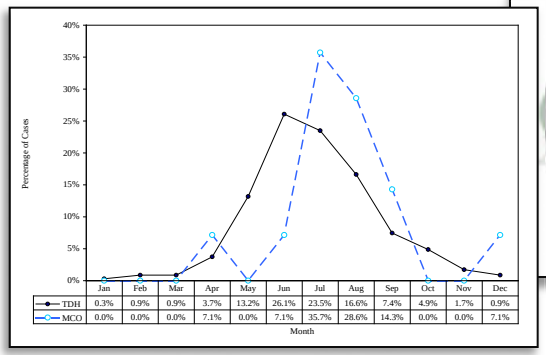

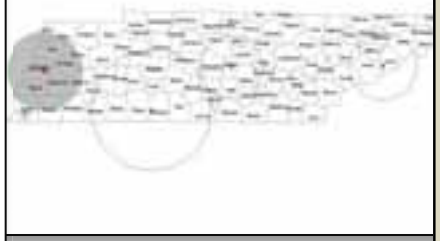

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Using administrative medical claims data to estimate underreporting of infectious zoonotic diseases

Stephen G. Jones, PhD
Senior Research Scientist
BlueCross BlueShield of TN

Introduction

Zoonoses (zoonotic diseases) - Infectious diseases that can be transmitted from/through animals to humans

- Account for ~75% of emerging infectious diseases
- Significant public health concern
- Arthropods act as vectors for transmission of disease

- Many zoonotic diseases are considered “Notifiable” or “Reportable” by the CDC for tracking purposes
  - Significant underreporting exists in passive surveillance system
  - Limited in ability to comprehensively track disease incidence over space and time at a meaningful scale

Role of Health Plans in Improving Monitoring

Managed Care Organizations (MCO) = Health Plan = Health Insurance Company

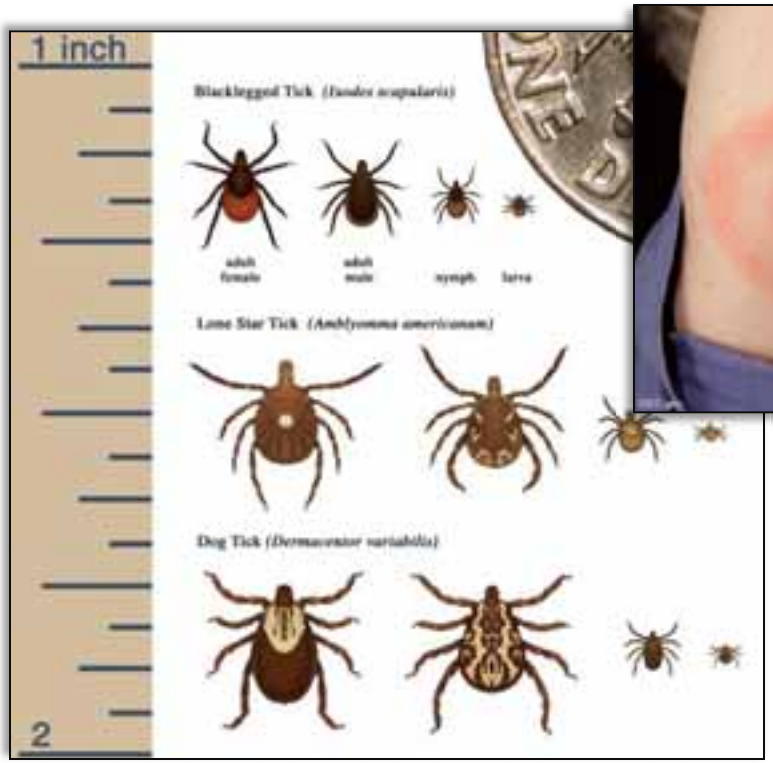
- Can play a major part in disease monitoring
- Large data warehouses contain important disease case information

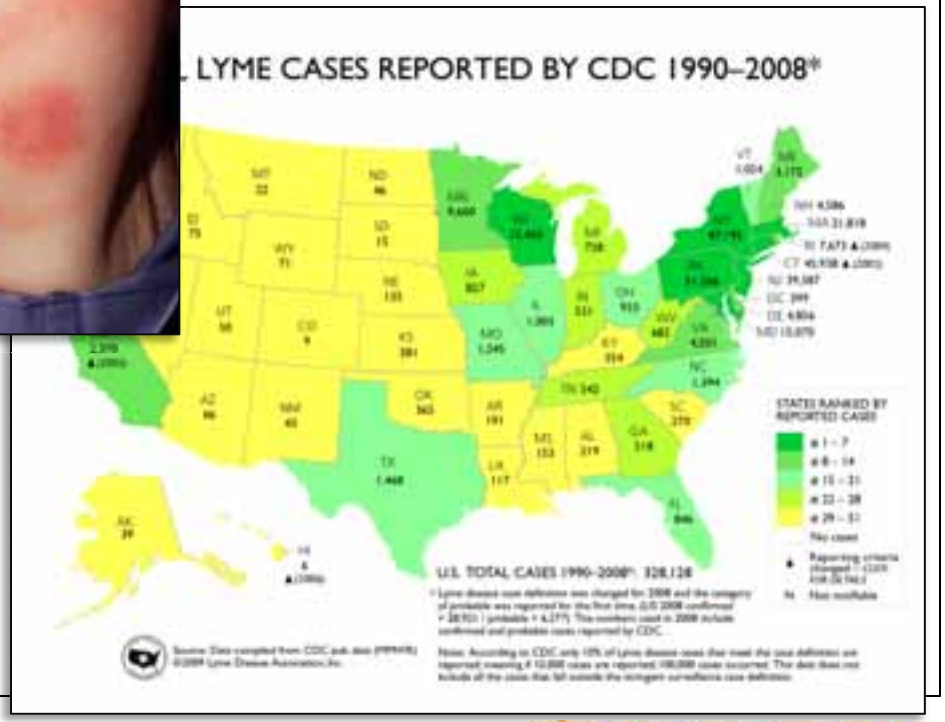
Intent of study – Introduce administrative medical claims as a new source of data for analyzing and monitoring of arthropod-borne zoonotic diseases

Patient ID	Patient Age	Date of Service	Diagnosis Code	Diagnosis Desc	County Residence
A12884	Female	12/15/2005	088.81	Lyme disease	Hamilton
A25587	Male	5/22/2001	066.4	West Nile virus	Knox
A557845	Male	7/25/2006	082.41	Ehrlichiosis	Knox

Borreliosis - Lyme disease

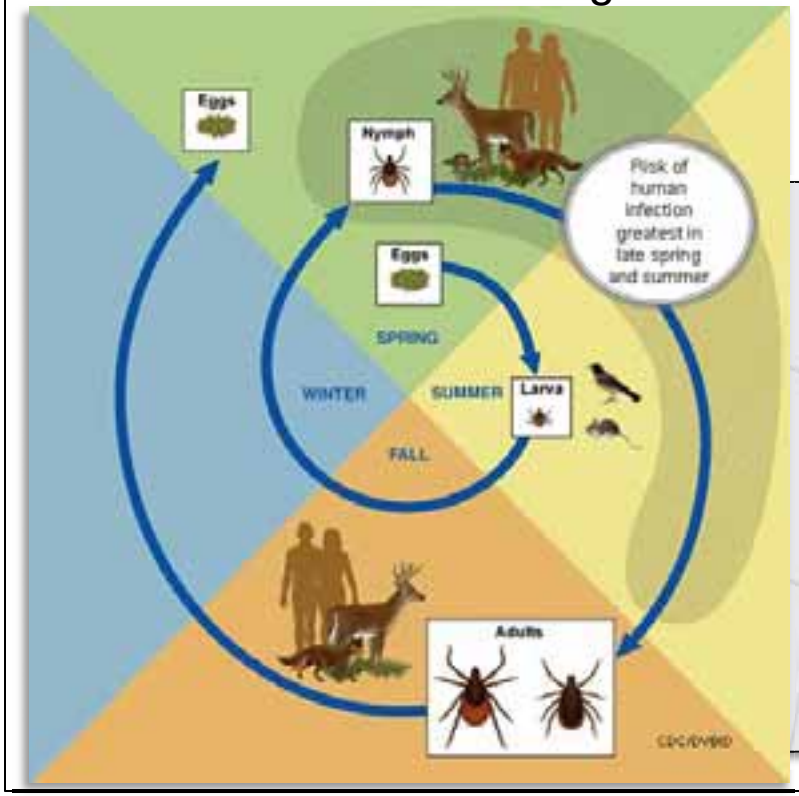
- Most frequently reported vector-borne disease in the US
- Caused by Borrelia *burgdorferi* bacterium
- Blacklegged or deer tick (*Ixodes scapularis*) is vector
- Symptoms include a characteristic “bulls-eye rash” within 2 weeks after exposure, fever, headache, and fatigue





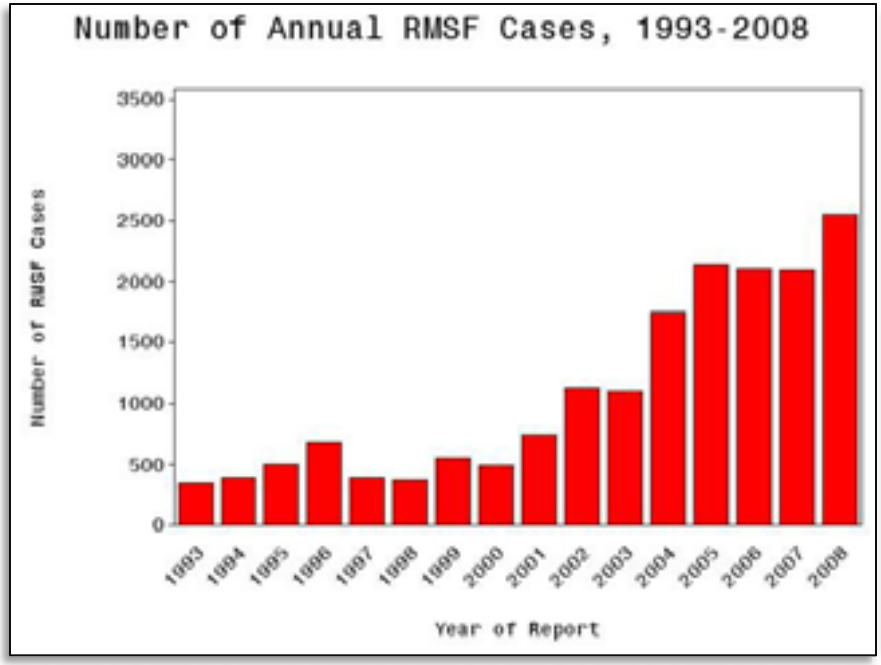
Babesiosis

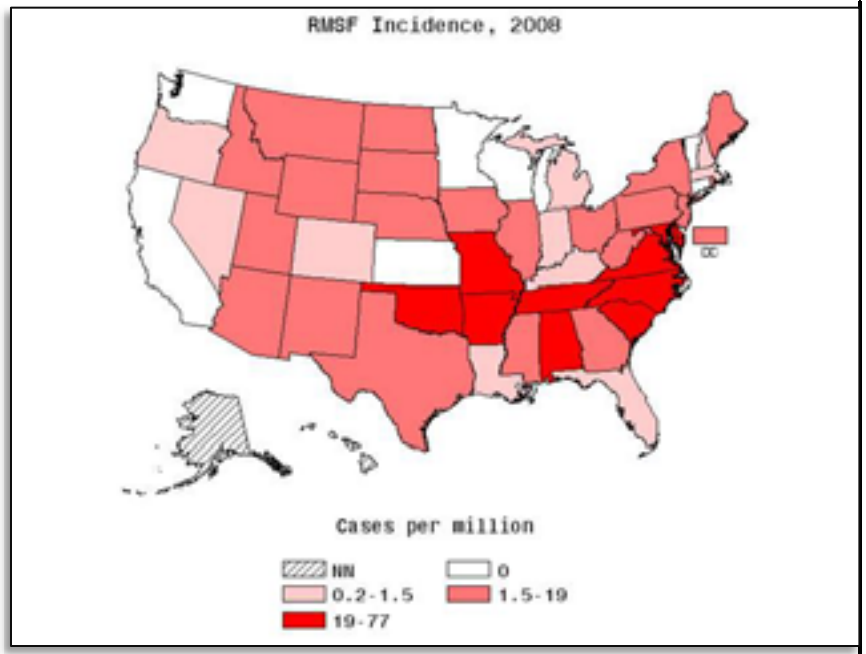
- Uncommon tick-borne malaria-like illness
- Caused by *Babesia microti* organism
- Blacklegged or deer tick (*Ixodes scapularis*) is vector
- Asymptomatic or mild fevers and anemia to malaria-like and can be life-threatening



Rickettsiosis – Rocky Mountain spotted fever

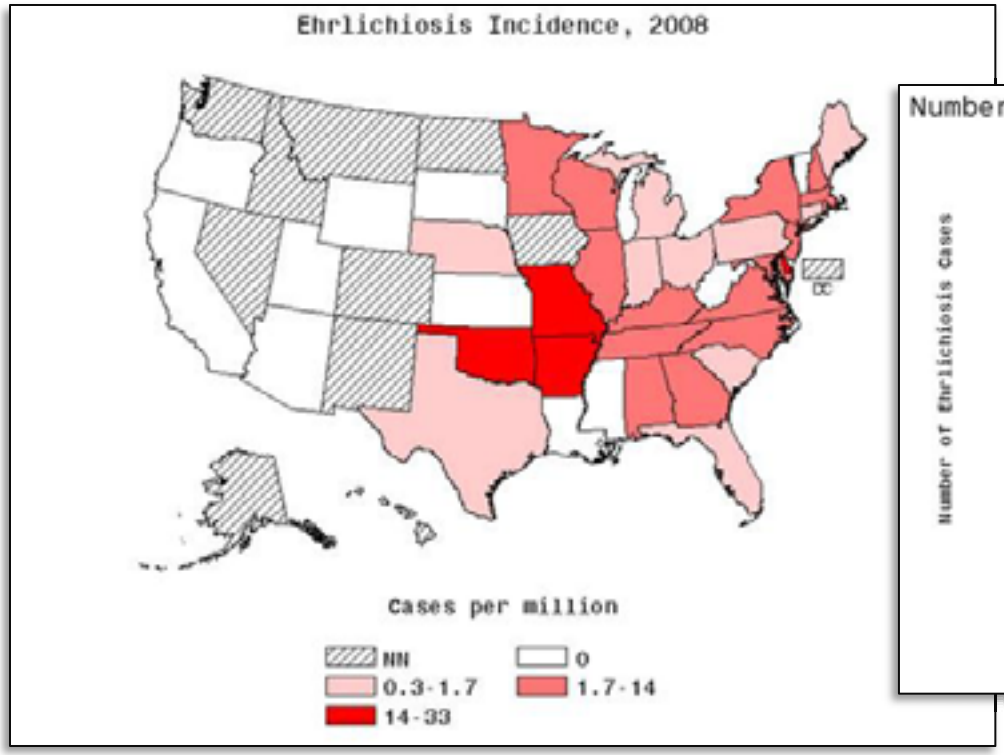
- Most severe tick-borne rickettsial illness in the US
- Caused by the *Rickettsia rickettsii* bacterial organism
- American Dog tick (*Dermacentor variabilis*)
- Rash within 2 to 4 days after the onset of fever, and can be non-descript or mimic other illnesses with headache, muscle pain, nausea, and lack of appetite

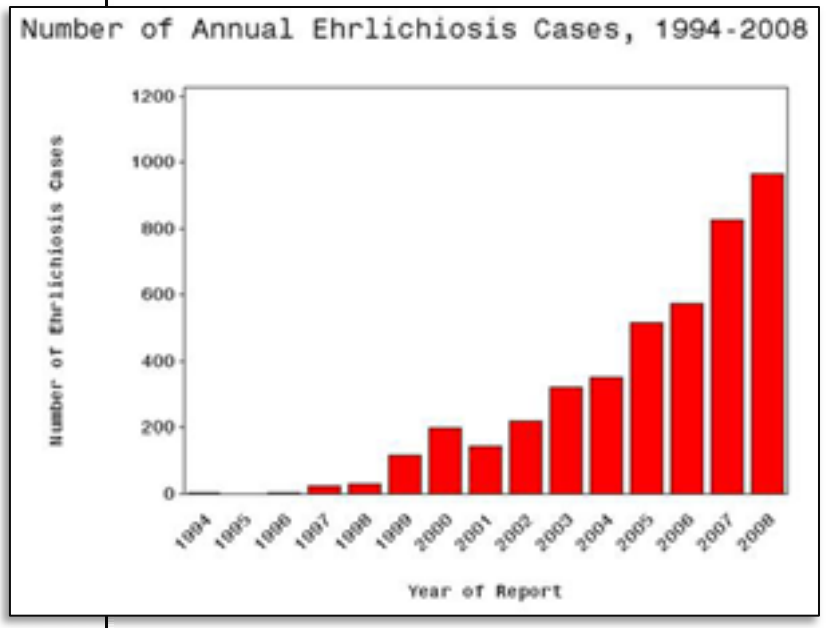




Ehrlichiosis – human monocytic ehrlichiosis, Ehrlichia chaffeensis

- Number of diagnosed cases have risen steadily from 1999 – 2006
- Lone Star tick (*Amblyomma americanu*)
- Characterized by acute onset of fever and headache, malaise, anemia, nausea, vomiting, and/or a rash

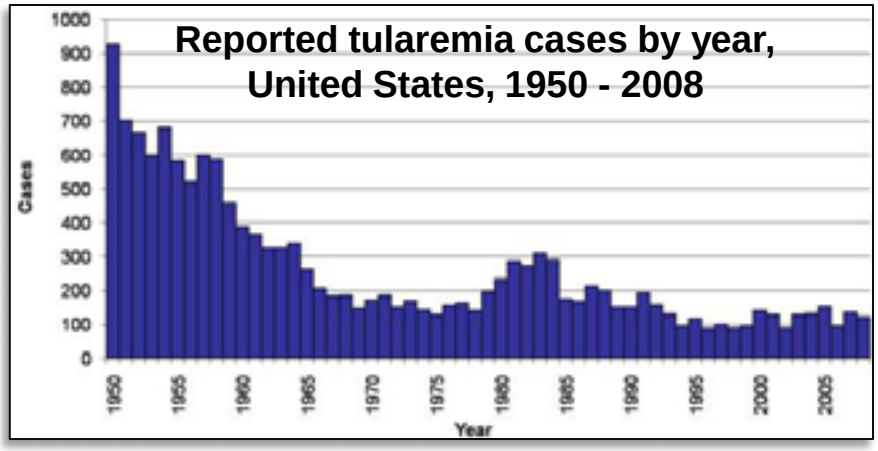




Tularemia

- Uncommon but potentially fatal infectious disease most common in the south central US, Pacific Northwest, and Massachusetts
- Handling of infected animal carcasses, consuming contaminated food or water, or breathing in the bacteria
- Sudden fever onset, chills, headache, diarrhea, muscle and joint pain, dry cough, difficulty breathing, and progressive weakness

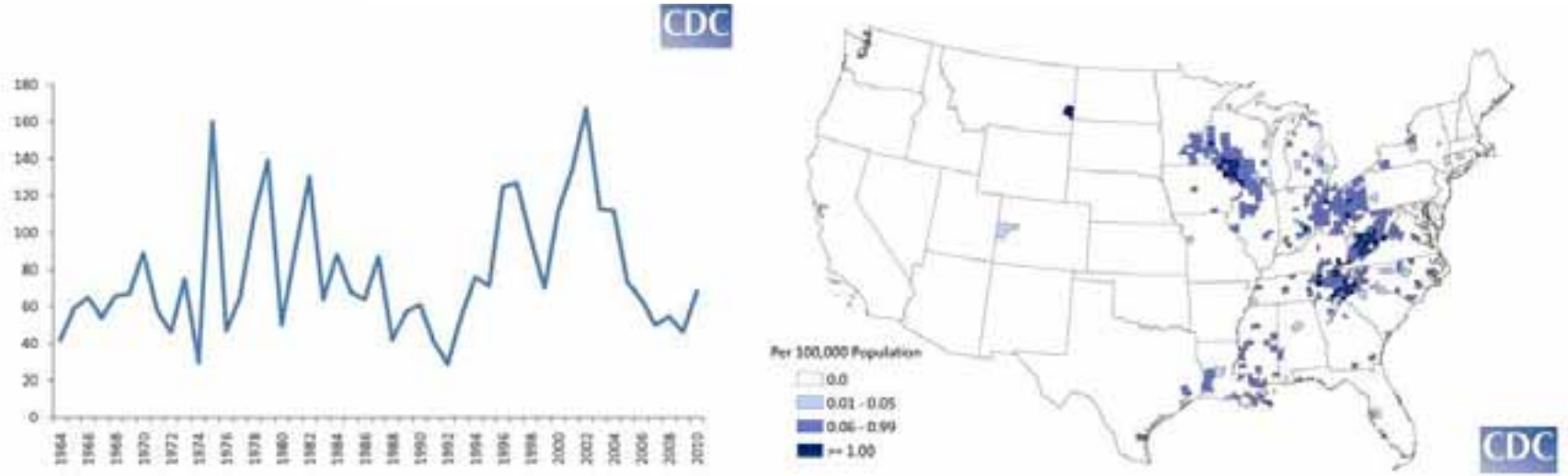
Reported cases of tularemia, United States, 2000-2008



La Crosse viral encephalitis

- Uncommon viral illness transmitted to humans by the bite of an infected *Aedes Triseriatus* mosquito
- Most often asymptomatic, if symptoms do occur they include fever, headache, nausea, vomiting, and general malaise.
- Encephalitis can form and can include seizures, coma, and paralysis. In rare cases, long-term disability or death can result.

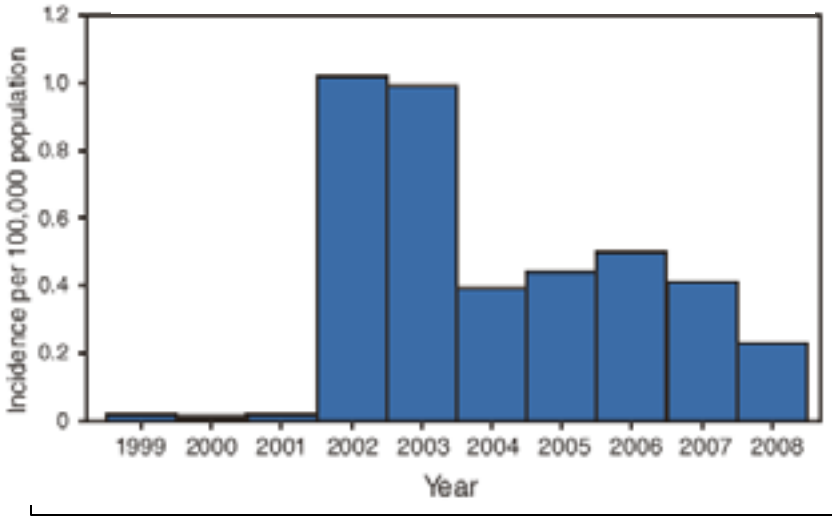
California Serogroup Virus Neuroinvasive Disease* Cases Reported by Year, 1964-2010



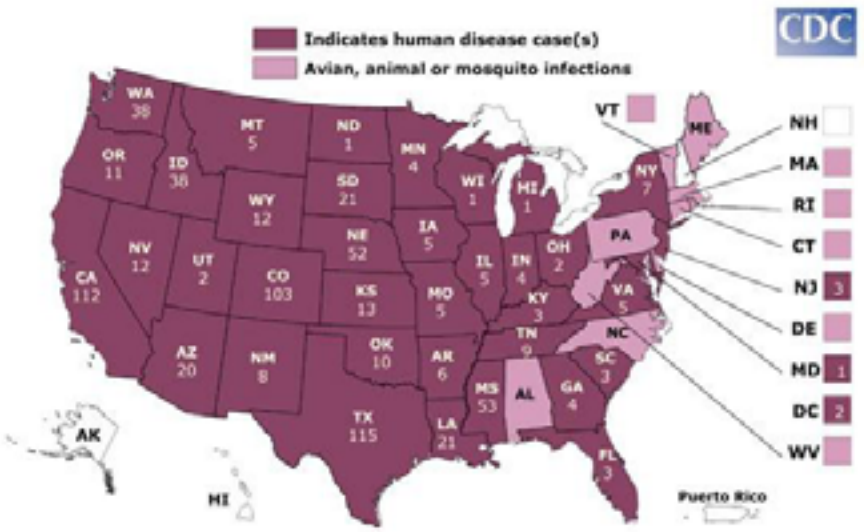
West Nile virus

- First detected in the US in 1999 and became notifiable in 2002
- Spread to humans through *Culex pipiens* mosquito
- Neuroinvasive disease incidence remained low until 2002 when large outbreaks in the Midwest and Great Plains occurred
- Approximately 80% of people infected are asymptomatic

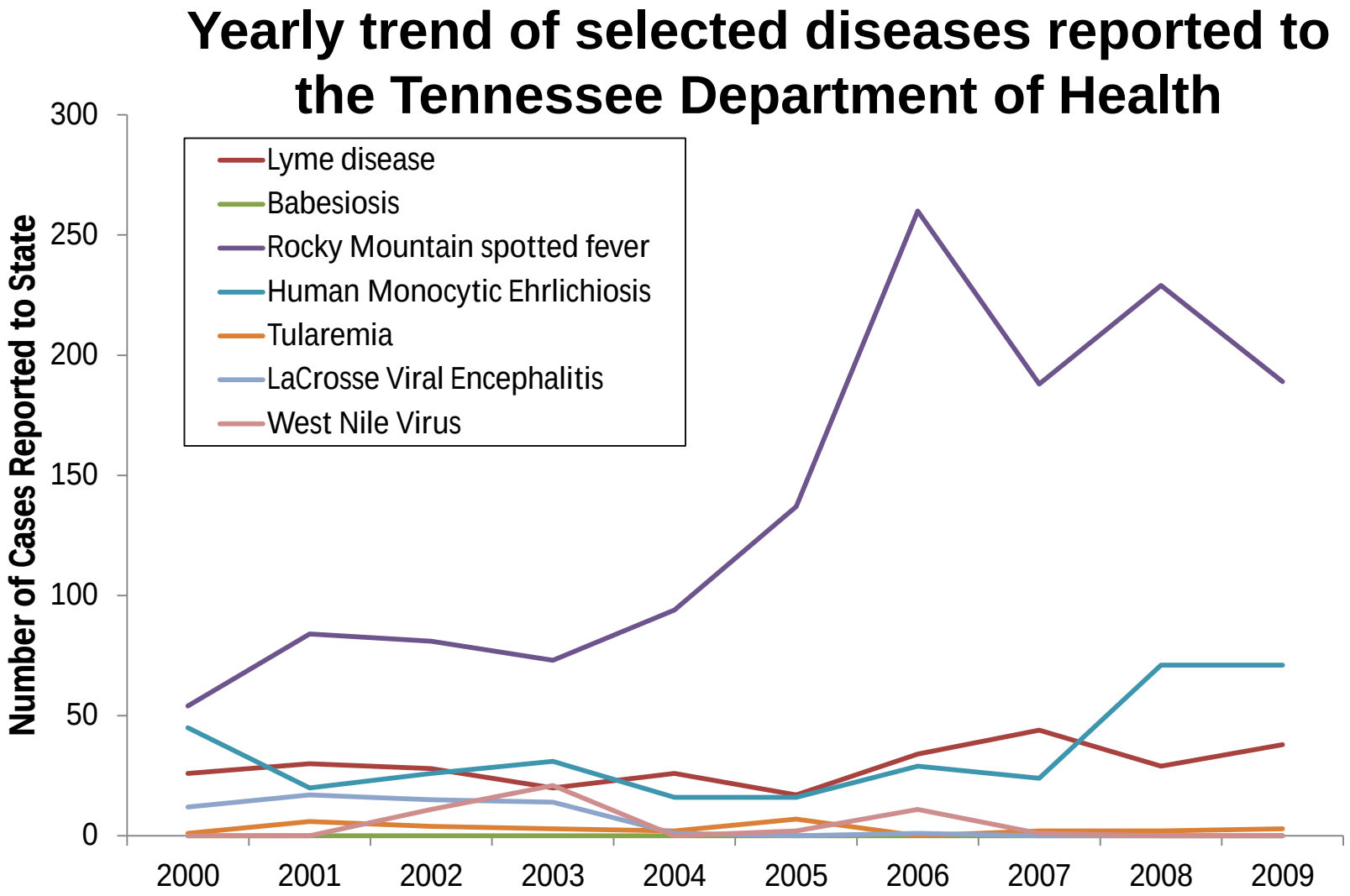
West Nile Virus Activity in the United States 1999-2008



2009 West Nile Virus Activity in the United States



Disease case volume from 2000-09



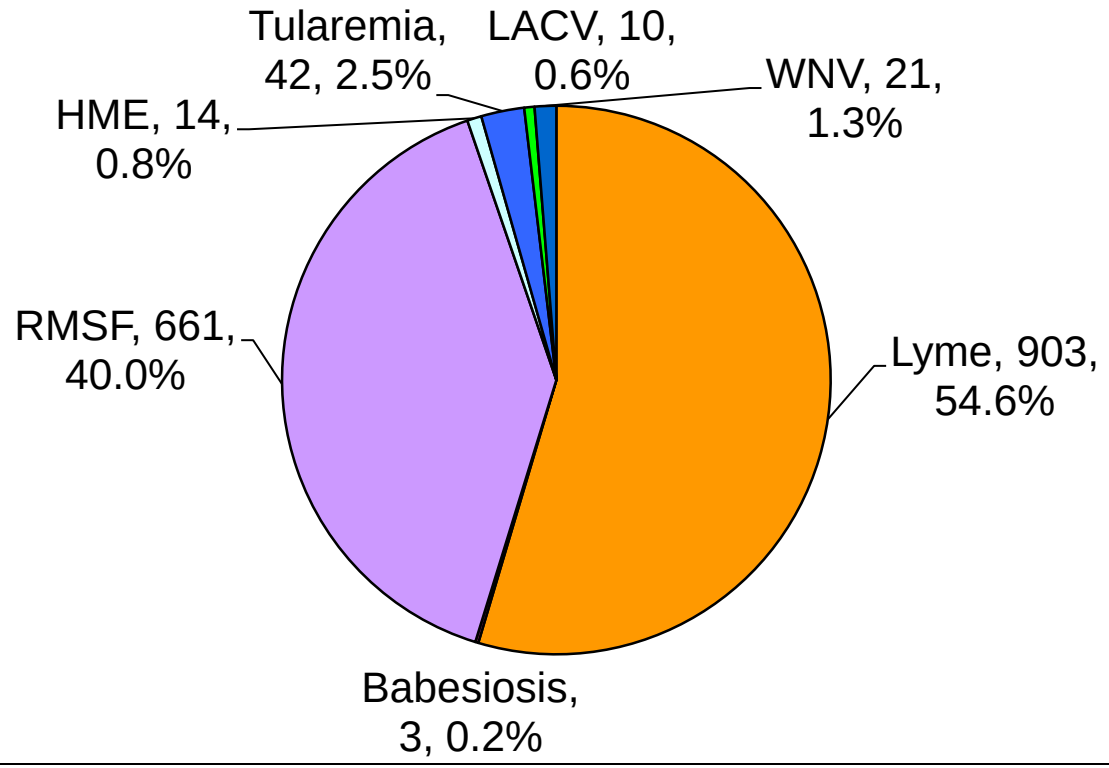
Methods

Study Period: Jan 1, 2000–Dec 31, 2009
Study Area: state of Tennessee

- Disease data collected from 2 sources:
  1. Administrative medical claims data collected from BlueCross BlueShield of TN (MCO)
  2. Tennessee Dept. of Health (TDH) disease registry system
- Case volume was aggregated per county per year separately for TDH and MCO data
- Used randomized control block design within a generalized linear mixed model to compare case counts (adjusted for population)

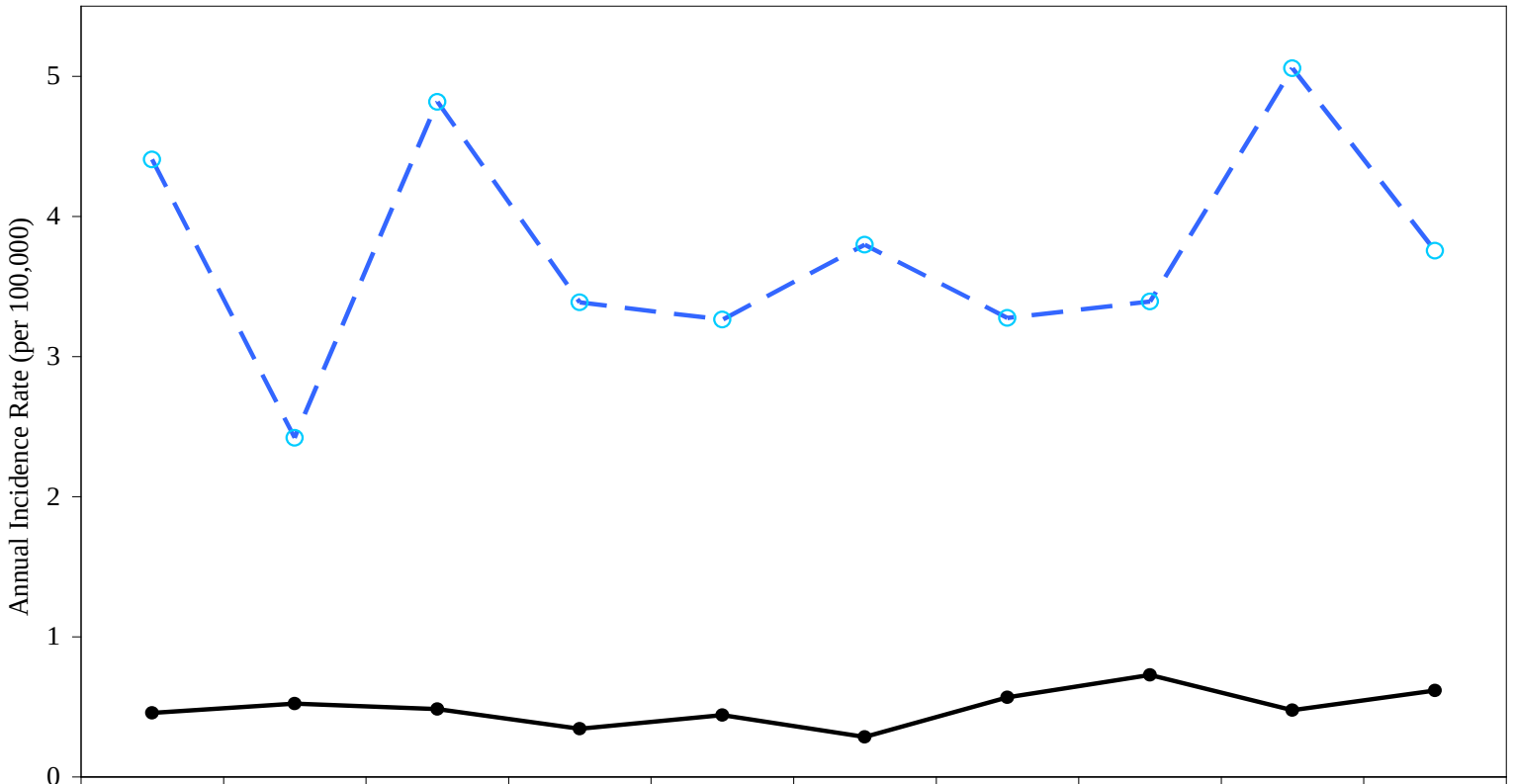
Results

- 58,385,858 medical claims filed during study period
- 1,654 cases distributed across the 7 diseases
- LD and RMSF values were statistically different
- Significant temporal interaction with data source



Results – Temporal trend comparisons between data sources

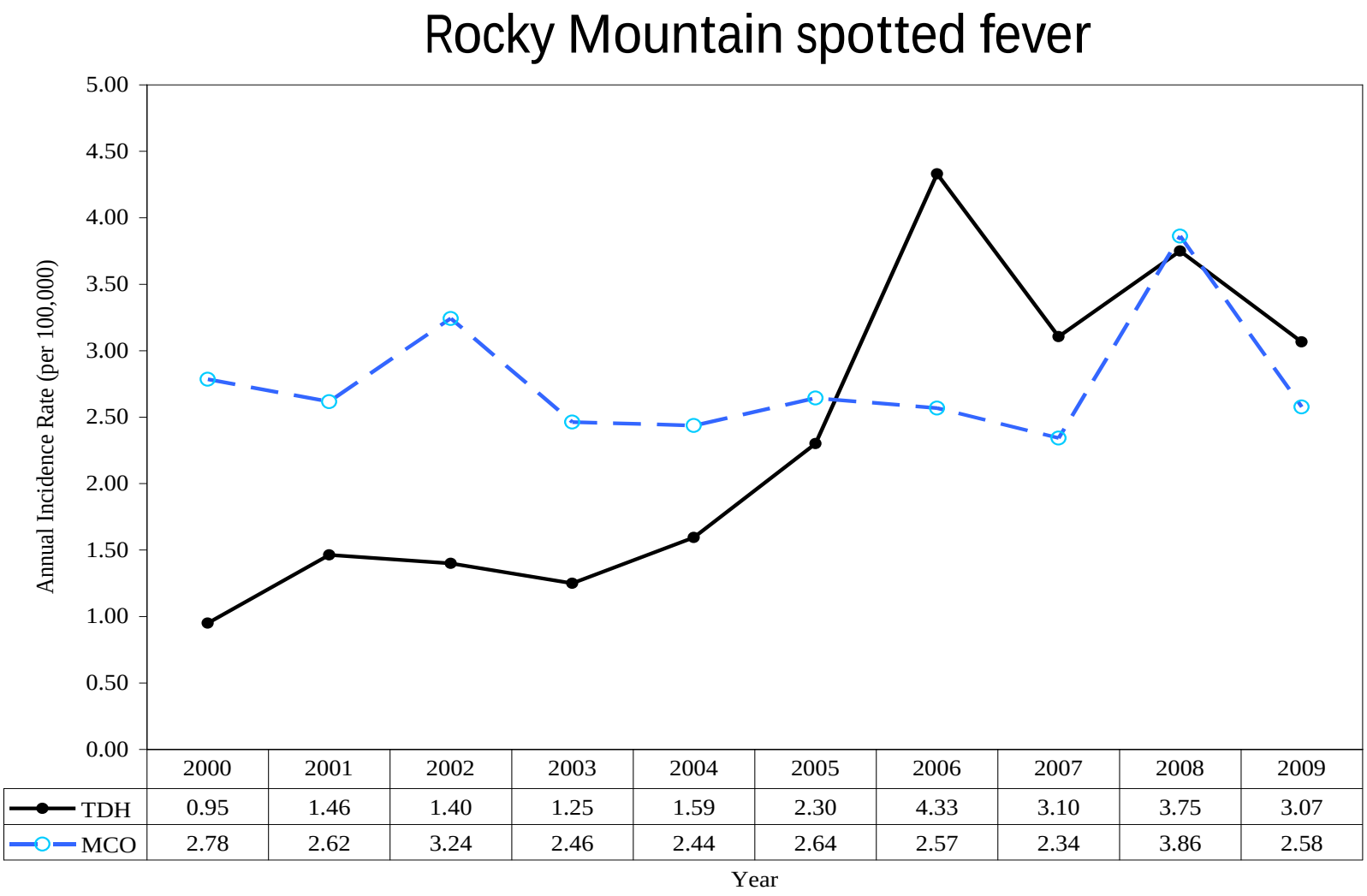
Lyme Disease



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
TDH	0.46	0.52	0.48	0.34	0.44	0.29	0.57	0.73	0.47	0.62
MCO	4.40	2.42	4.81	3.38	3.26	3.80	3.27	3.39	5.06	3.75

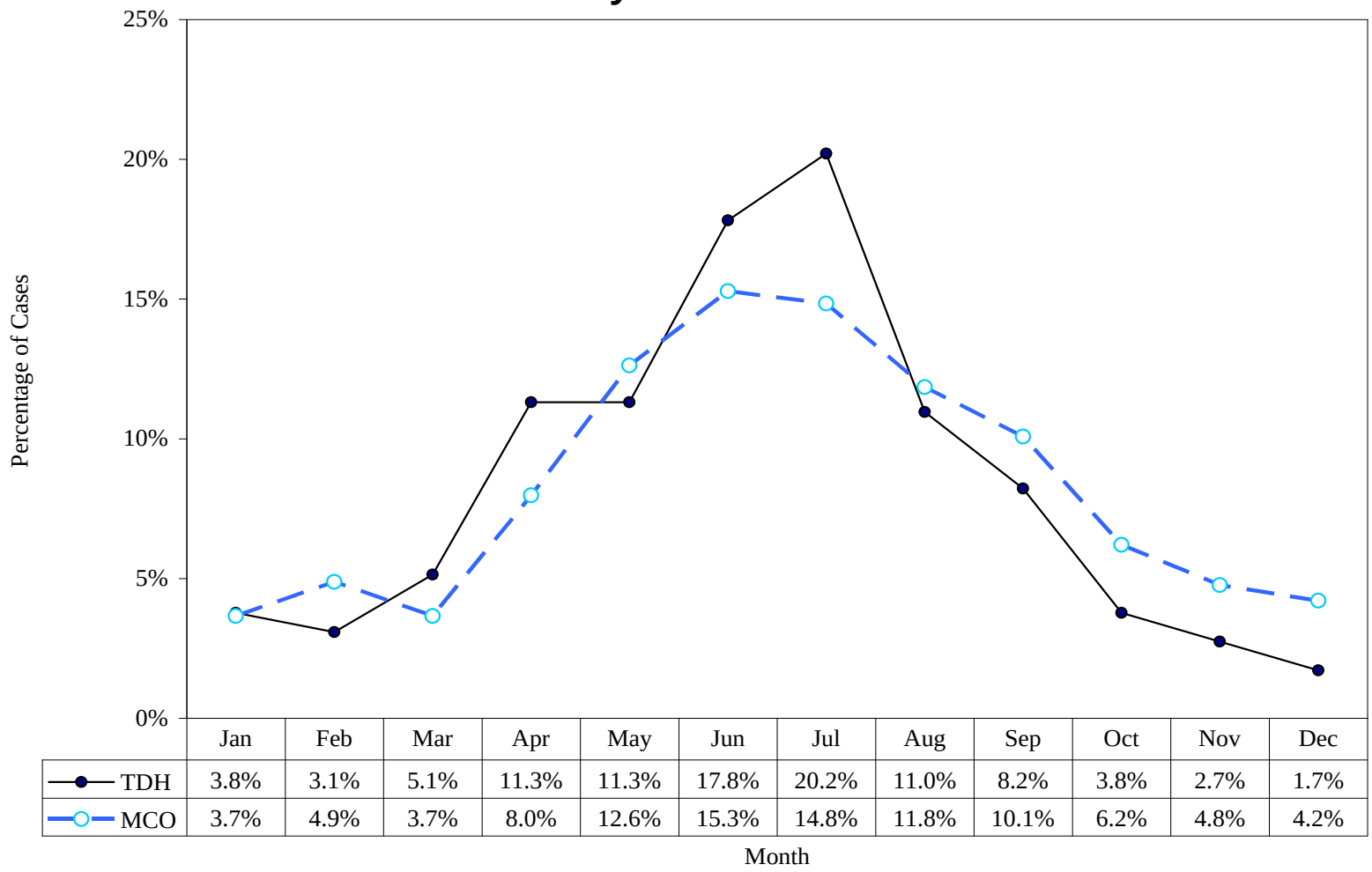
Year

Results – Temporal trend comparisons between data sources



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
TDH	0.95	1.46	1.40	1.25	1.59	2.30	4.33	3.10	3.75	3.07
MCO	2.78	2.62	3.24	2.46	2.44	2.64	2.57	2.34	3.86	2.58

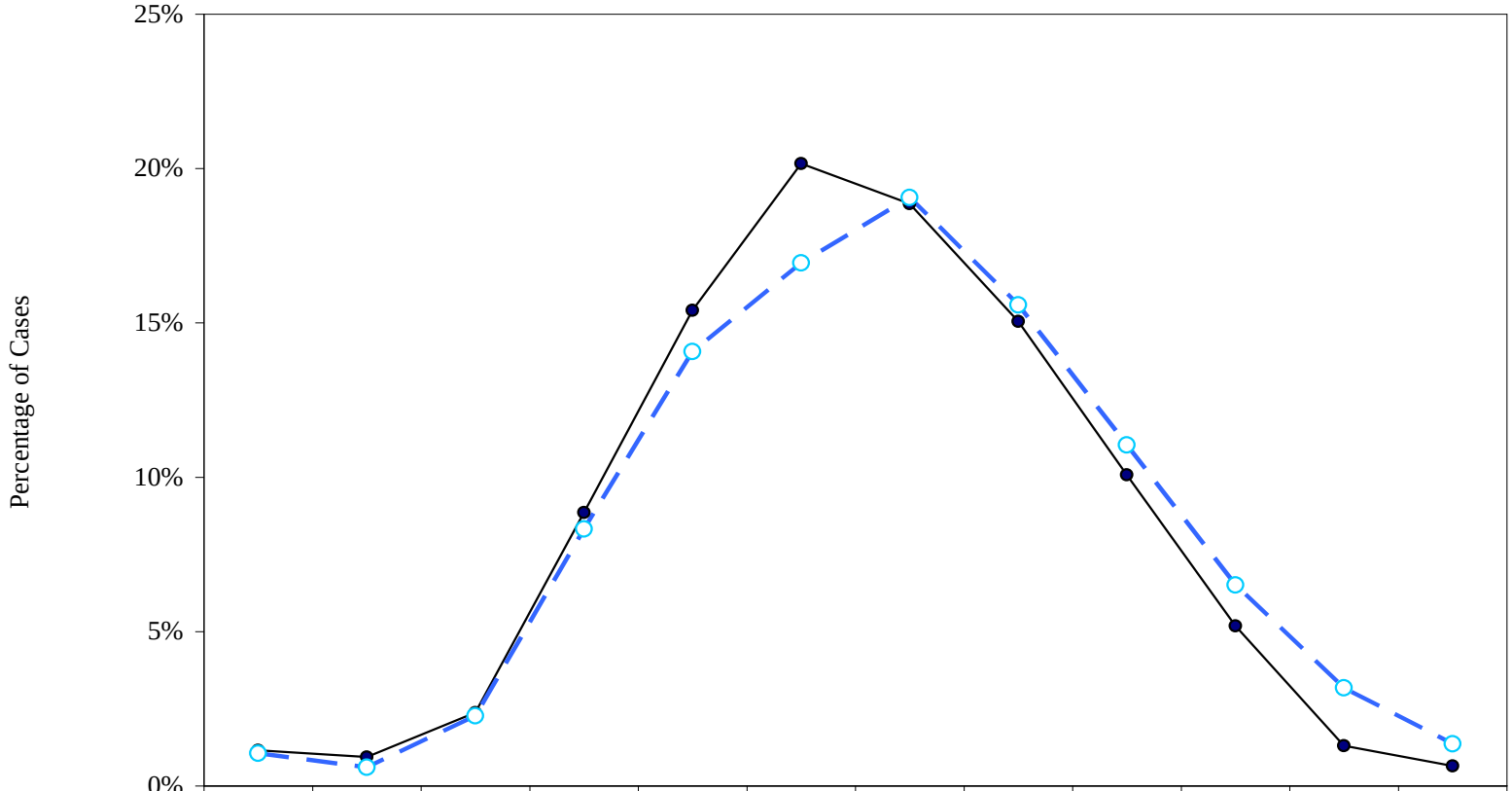
Results – Seasonal distribution comparisons (exposure vs. treatment)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TDH	3.8%	3.1%	5.1%	11.3%	11.3%	17.8%	20.2%	11.0%	8.2%	3.8%	2.7%	1.7%
MCO	3.7%	4.9%	3.7%	8.0%	12.6%	15.3%	14.8%	11.8%	10.1%	6.2%	4.8%	4.2%

Results – Seasonal distribution comparisons (exposure vs. treatment)

Rocky Mountain spotted fever

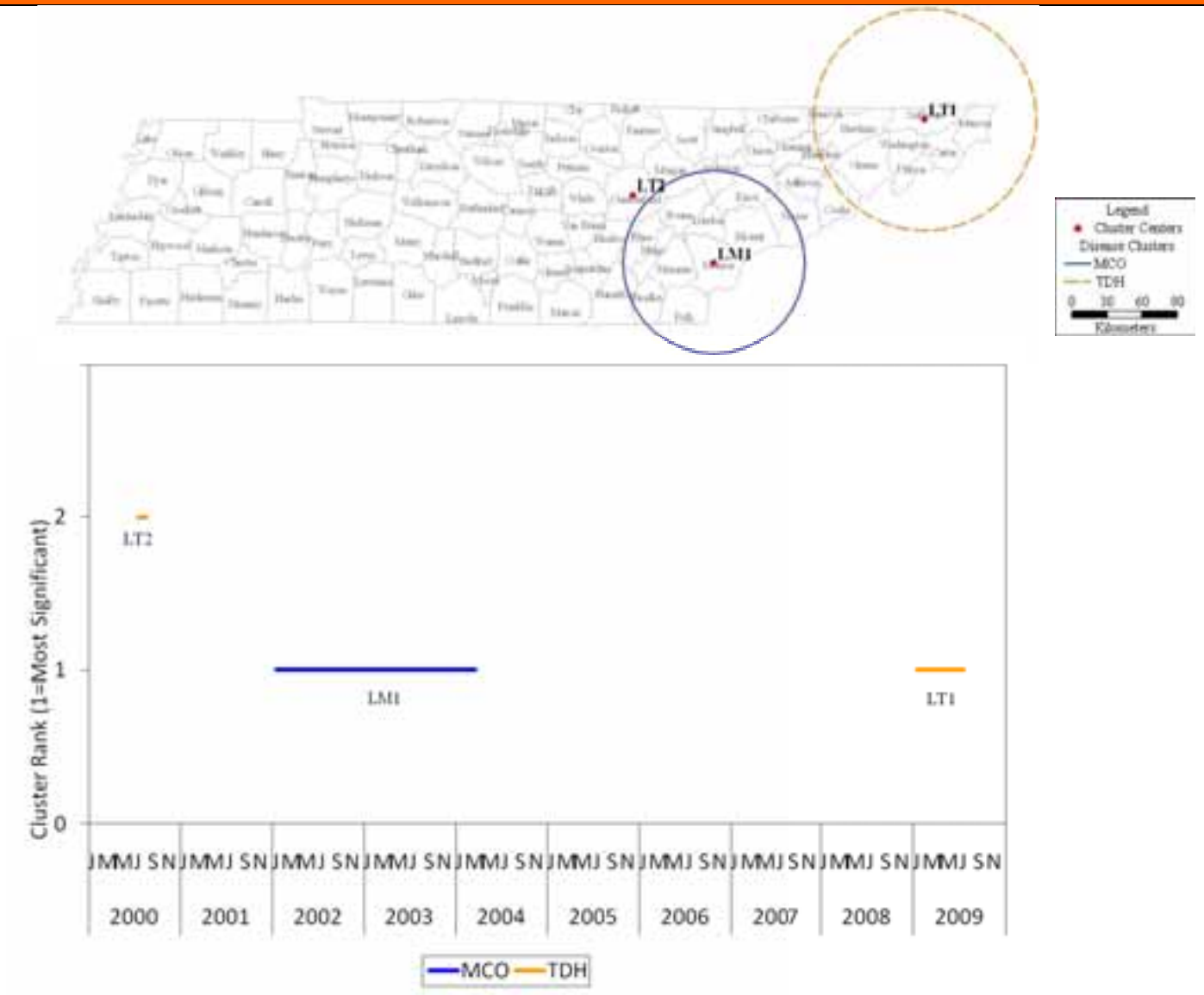


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TDH	1.2%	0.9%	2.4%	8.9%	15.4%	20.2%	18.9%	15.0%	10.1%	5.2%	1.3%	0.6%
MCO	1.1%	0.6%	2.3%	8.3%	14.1%	16.9%	19.1%	15.6%	11.0%	6.5%	3.2%	1.4%

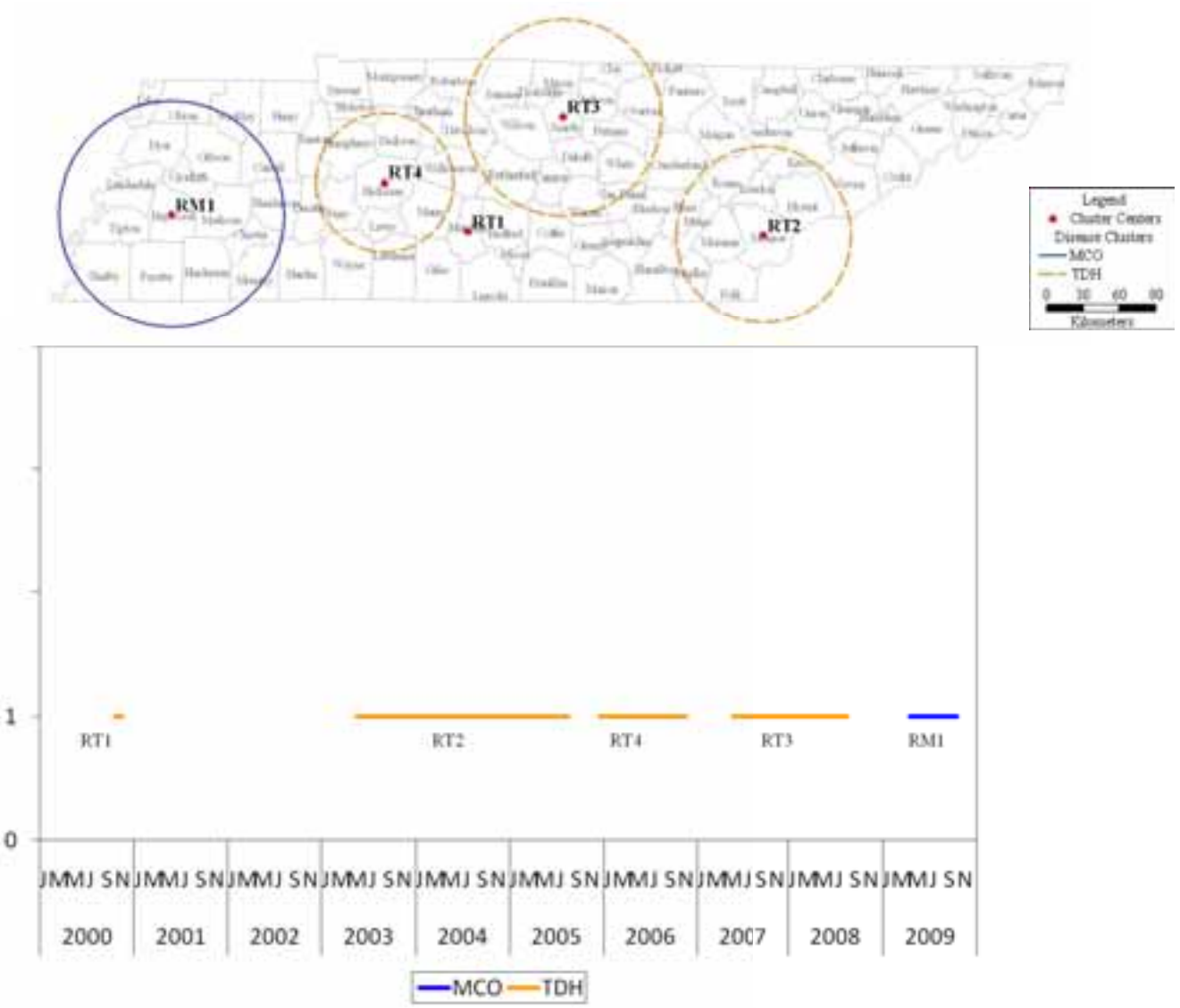
Methods

- Disease clusters occur when abnormally high (or low) incidence rates are detected in a given area
- Conducted a retrospective space-time permutation analysis to determine if significant space-time disease clusters were similar for state registry data compared to MCO administrative data
- SaTScan™ software v9.0.1 was used for all cluster detection analysis
    - Moving cylindrical window and generalized likelihood ratios are calculated
- Maps of significant clusters were generated using Maptitude™ v5.0 GIS software

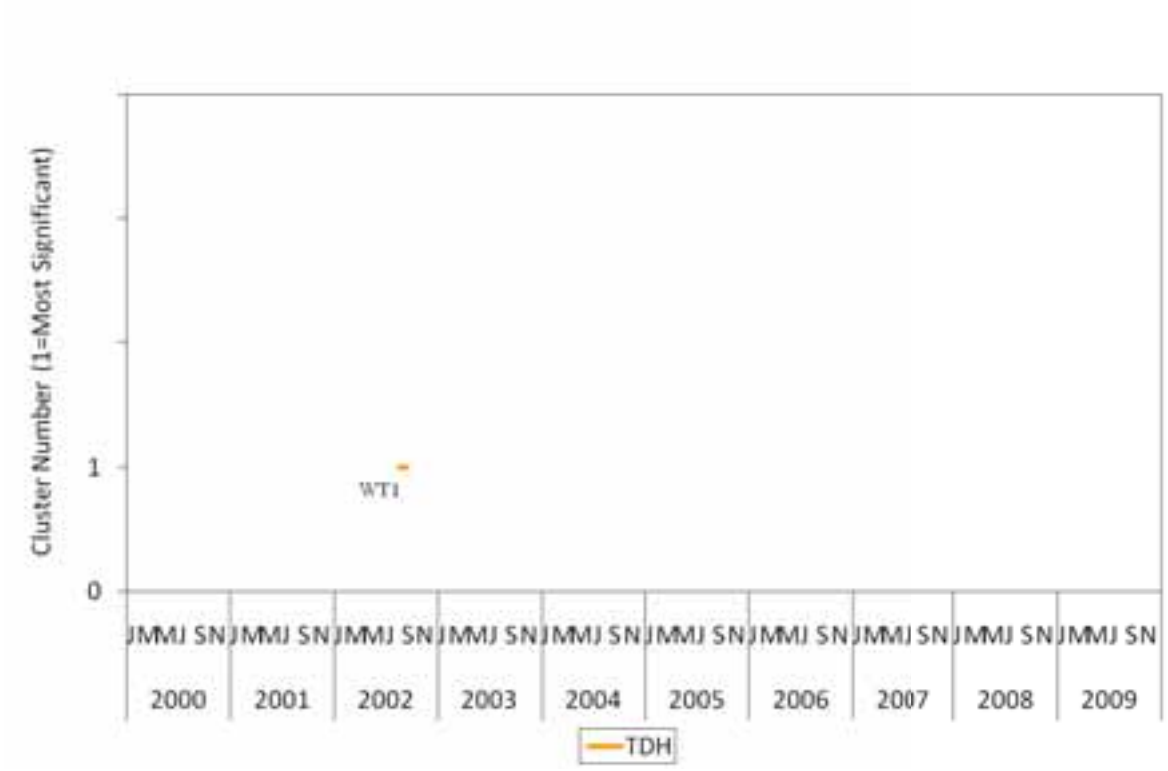
Results – Lyme disease significant spatial and temporal clusters



Results – RMSF significant spatial and temporal clusters



Results – WNV significant spatial and temporal clusters



Challenges

"*The public health departments won't be able to process all of the data they receive, let alone speed up investigations or turn the data into actionable plans*"

Public health departments unprepared to receive, handle EHR reports

February 14, 2012 — 11:14pm ET | By Marla Durben Hirsch - Contributing Editor

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It's hard enough for providers to implement electronic health records. It's even worse for public health departments, whose lack of infrastructure to handle the torrent of reports expected from providers will create a "crisis."

That's the scoop from a recent study from researchers at the University of Utah School of Medicine, published in the March issue of the *American Journal of Public Health*.

Public Health Surveillance and Meaningful Use Regulations: A Crisis of Opportunity
Leslie Lenert and David N. Sundwall
American Journal of Public Health 2012
102:3, e1-e7

Conclusions

- Administrative medical claims data could provide a valuable supplement to the current reporting system
- Zoonotic diseases in Tennessee, particularly LD and RMSF, may be significantly underreported
- Claims data may offer information not available or recorded in state reported data
- Each data source provides unique information that may be more valuable combined

Stephen G. Jones, PhD

Senior Research Scientist

BlueCross BlueShield of Tennessee

stephen_jones@BCBST.com

Special Thanks to Dr. Steve Coulter, Dr. Inga Himelright, and Dr. William Conner

Jones SG, Coulter S, Conner W. Using administrative medical claims data to supplement state disease registry systems for reporting zoonotic infections. *Journal of the American Medical Informatics Association.* 2012 Jul. 18

Jones SG, Conner W, Song B, Gordon D, Jayakaran A. Comparing spatio-temporal clusters of arthropod-borne infections using administrative medical claims and state reported surveillance data. *Spatial and Spatio-temporal Epidemiology.* 2012 Sep;3(3):205-13