Modeling Health Insurance Coverage Estimates for Minnesota Counties

Joint Statistical Meetings

Miami Beach, Florida

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- **www.health.state.mn.us/healtheconomics**

MINNESOTA
MDH
DEPARTMENT of HEALTH

Outline

- **Background**

- **Research Objective**

- **Methodology**

- **Results**

Background

- **Minnesota Health Access Survey (MNHA)**
  - Telephone survey conducted every 2 years
  - Provides MN and regional estimates, including estimates for select populous counties and cities

- **County level estimates are frequently requested data**

U.S. Census Bureau County Level Uninsurance Estimates

- **American Community Survey (ACS)**
  - 1-year estimates: 12 Minnesota counties (Available)
  - 3-year estimates: 47 Minnesota counties (Fall 2011)
  - 5-year estimates: 87 Minnesota counties (Fall 2013)

- **Small Area Health Insurance Estimates Program (SAHIE)**
  - 2007 estimates (most recent year) for all 87 Minnesota counties
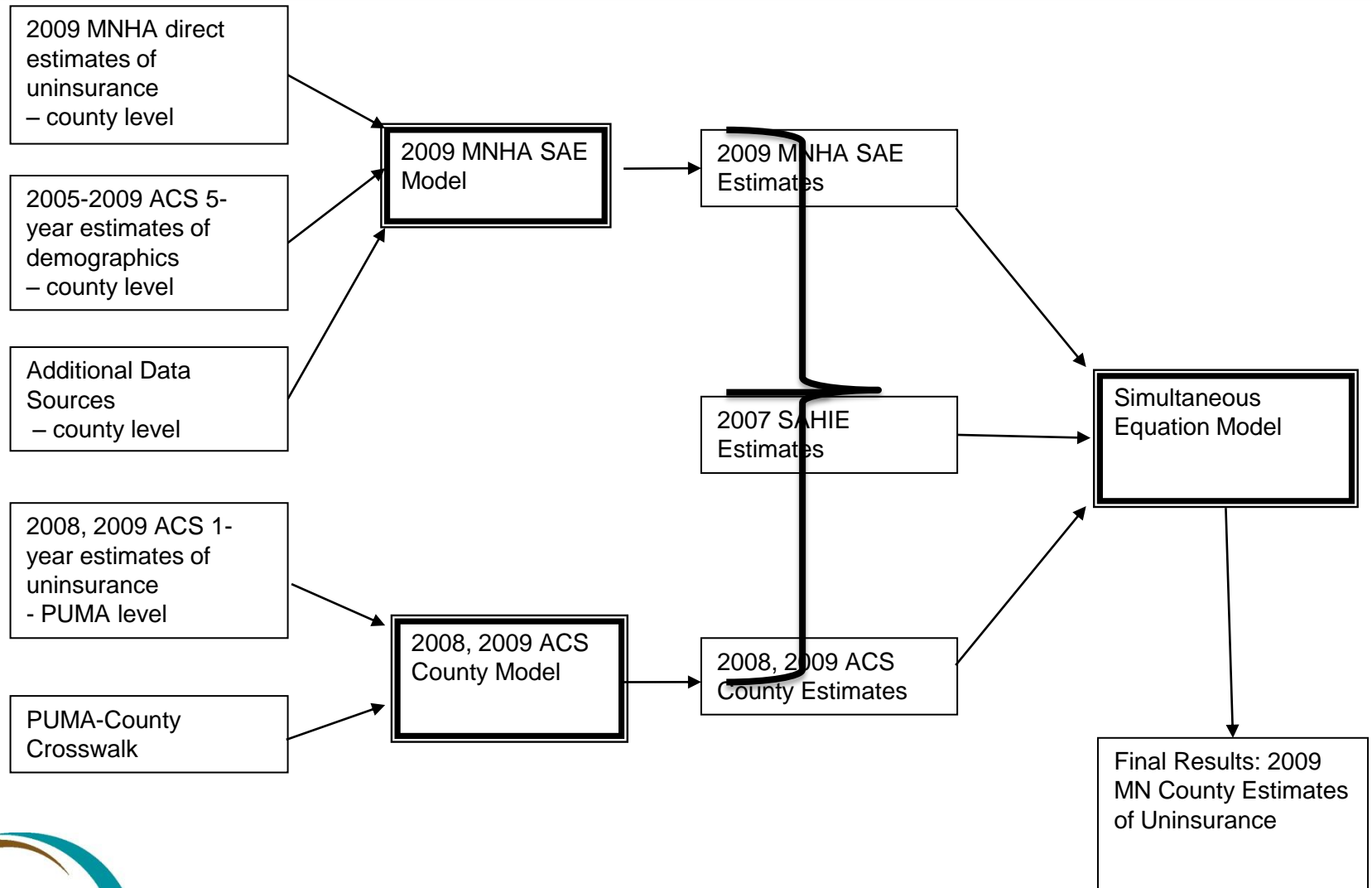 - Release of 2008 and 2009 estimates planned for Fall 2011

Research Objective

Produce Minnesota uninsurance rates by county for 2009

- Use the Minnesota Health Access Survey (MNHA)
- Use other sources of uninsurance estimates
- Include estimates of uncertainty
- Allow for future input sources
- Use methods accessible to Minnesota Department of Health staff
- Use methods that can be applied to other states

Methodology

- **Hierarchical Bayesian Small Area Estimation (SAE) Model**
  - Spatial Conditional Autoregressive (CAR) errors
- **ACS county level estimates**
- **Hierarchical Bayesian Simultaneous Equation Model (SEM)**
  - 2009 MNHA
  - 2009 ACS
  - 2008 ACS
  - 2007 SAHIE

Methodology Overview

2009 MNHA direct estimates of uninsurance – county level

2005-2009 ACS 5-year estimates of demographics – county level

Additional Data Sources – county level

2009 MNHA SAE Model

2009 MNHA SAE Estimates

2008, 2009 ACS 1-year estimates of uninsurance - PUMA level

PUMA-County Crosswalk

2008, 2009 ACS County Model

2008, 2009 ACS County Estimates

2007 SAHIE Estimates

Simultaneous Equation Model

Final Results: 2009 MN County Estimates of Uninsurance

MNHA SAE Model (1)

- **Telephone survey conducted every 2 years**
- **Primarily collects data on one randomly selected member of household (target)**
- **Certain information, such as health insurance coverage, is collected for all household members**
- **Provides MN and regional estimates, including estimates for select populous counties and cities**
- **2009 complete (turned) file of all household members has a sample size of 31,802**

MNHA SAE Model (2)

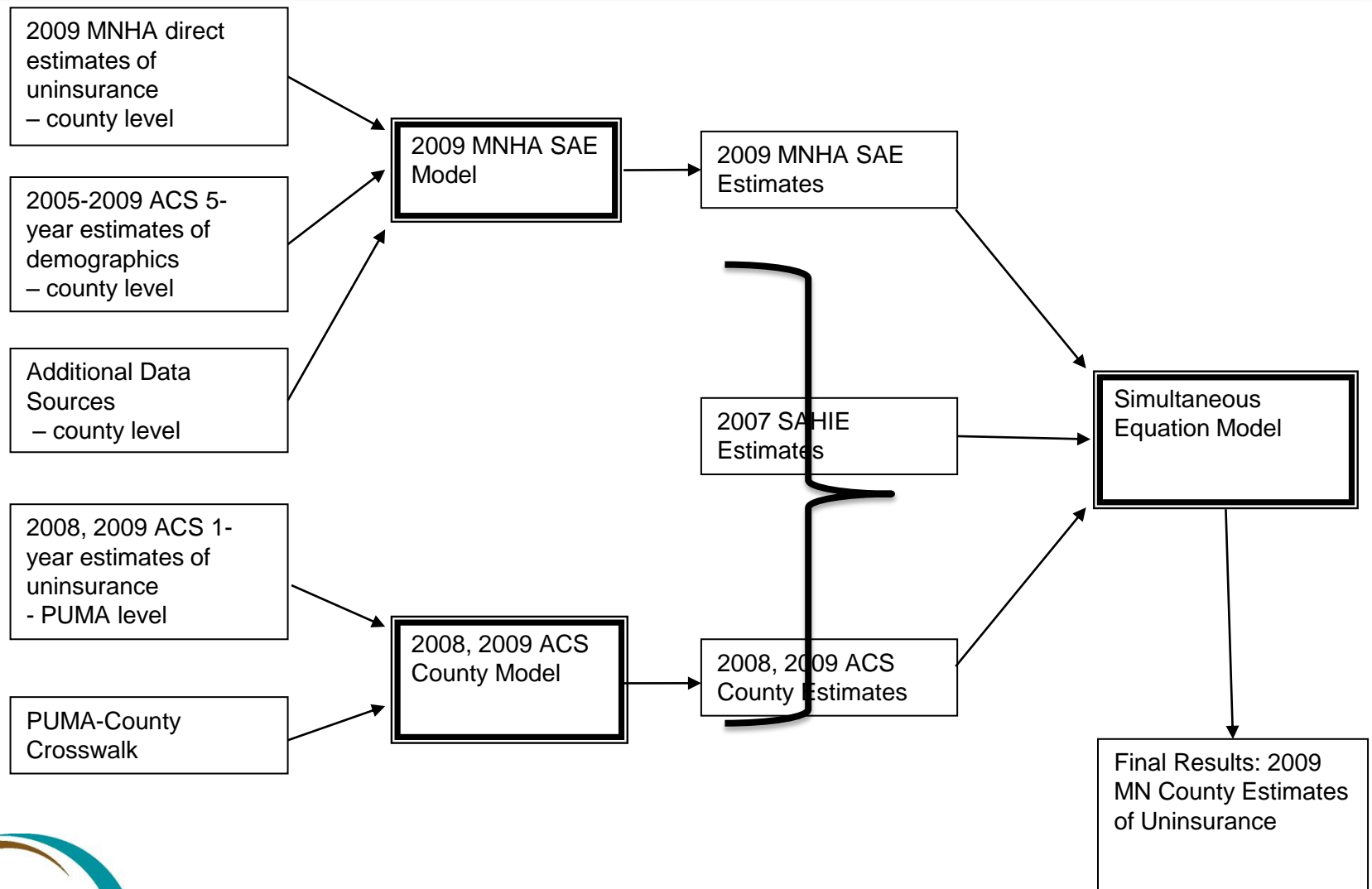- **Area-level spatial conditional autoregressive (CAR) model**

$$y_c^{MNHA-direct} = \alpha + \beta X + v_c$$

- **Covariates X include ACS 5-year data, Census Bureau population estimates, and additional sources including administrative records. For example:**
  - Quarterly Census of Employment and Wages (QCEW)
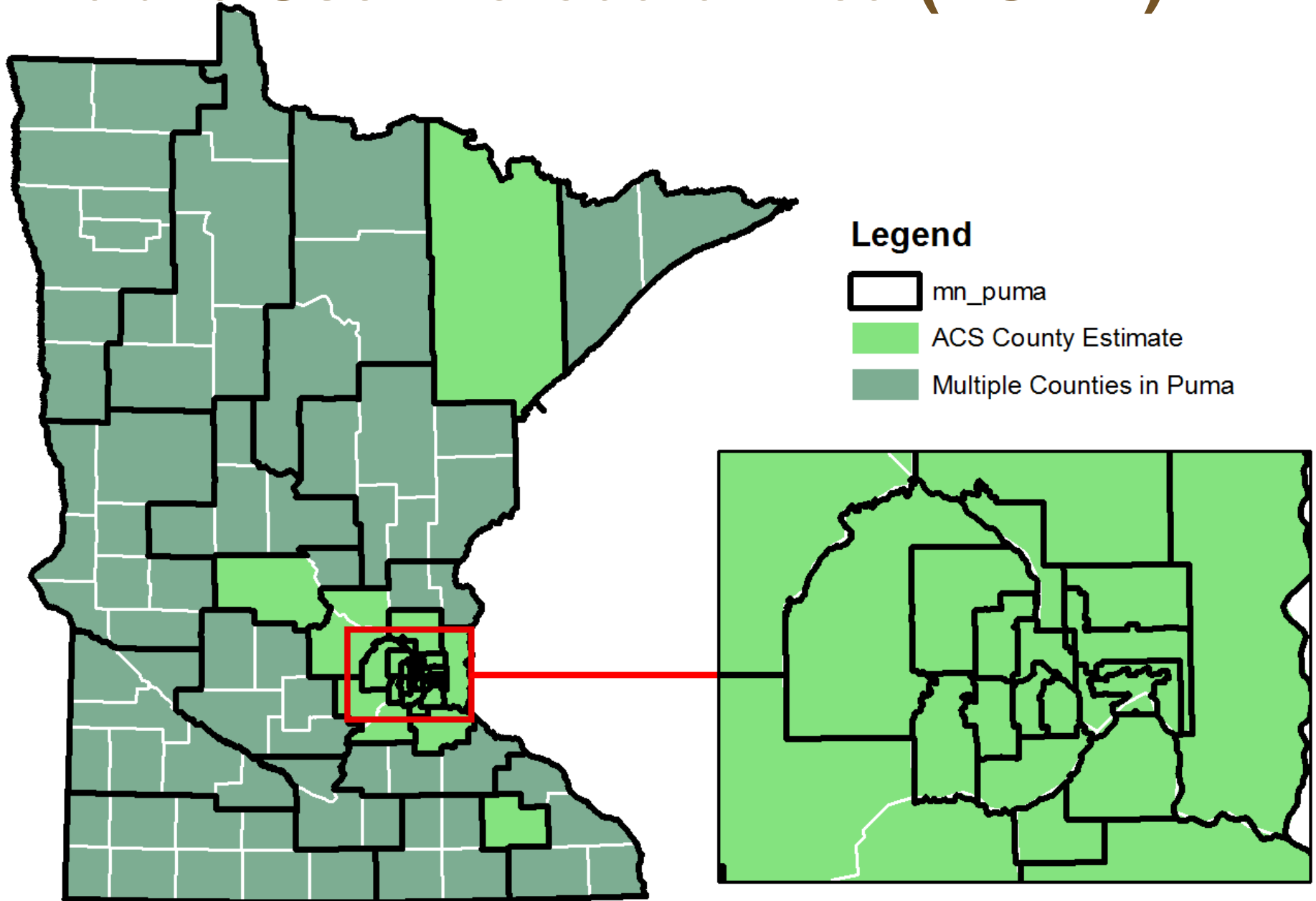 - Local Area Unemployment Statistics (LAUS)

MNHA SAE Model (3)

- **Variables predicting the direct estimate of uninsurance in the MNHA survey:**
  - Immigration Rate, 2000-2009 (Population estimates)
  - Percent Employed Working in Retail, 2009 (QCEW)
  - Percent Moved into State, 2005-2009 (ACS)
  - Weekly Wage, 2009 (QCEW)
  - Percent White, 2005-2009 (ACS)
  - Percent Land in Farms, 2007 (USDA)
  - Percent 65 and Over, 2005-2009 (ACS)
  - Average Unemployment Rate, 2009 (LAUS)

Methodology Overview – ACS County

2009 MNHA direct estimates of uninsurance – county level

2005-2009 ACS 5-year estimates of demographics – county level

Additional Data Sources – county level

2009 MNHA SAE Model

2009 MNHA SAE Estimates

2007 SAHIE Estimates

Simultaneous Equation Model

2008, 2009 ACS 1-year estimates of uninsurance - PUMA level

PUMA-County Crosswalk

2008, 2009 ACS County Model

2008, 2009 ACS County Estimates

Final Results: 2009 MN County Estimates of Uninsurance

Public Use Microdata Area (PUMA)

Legend

- ☐ mn_puma
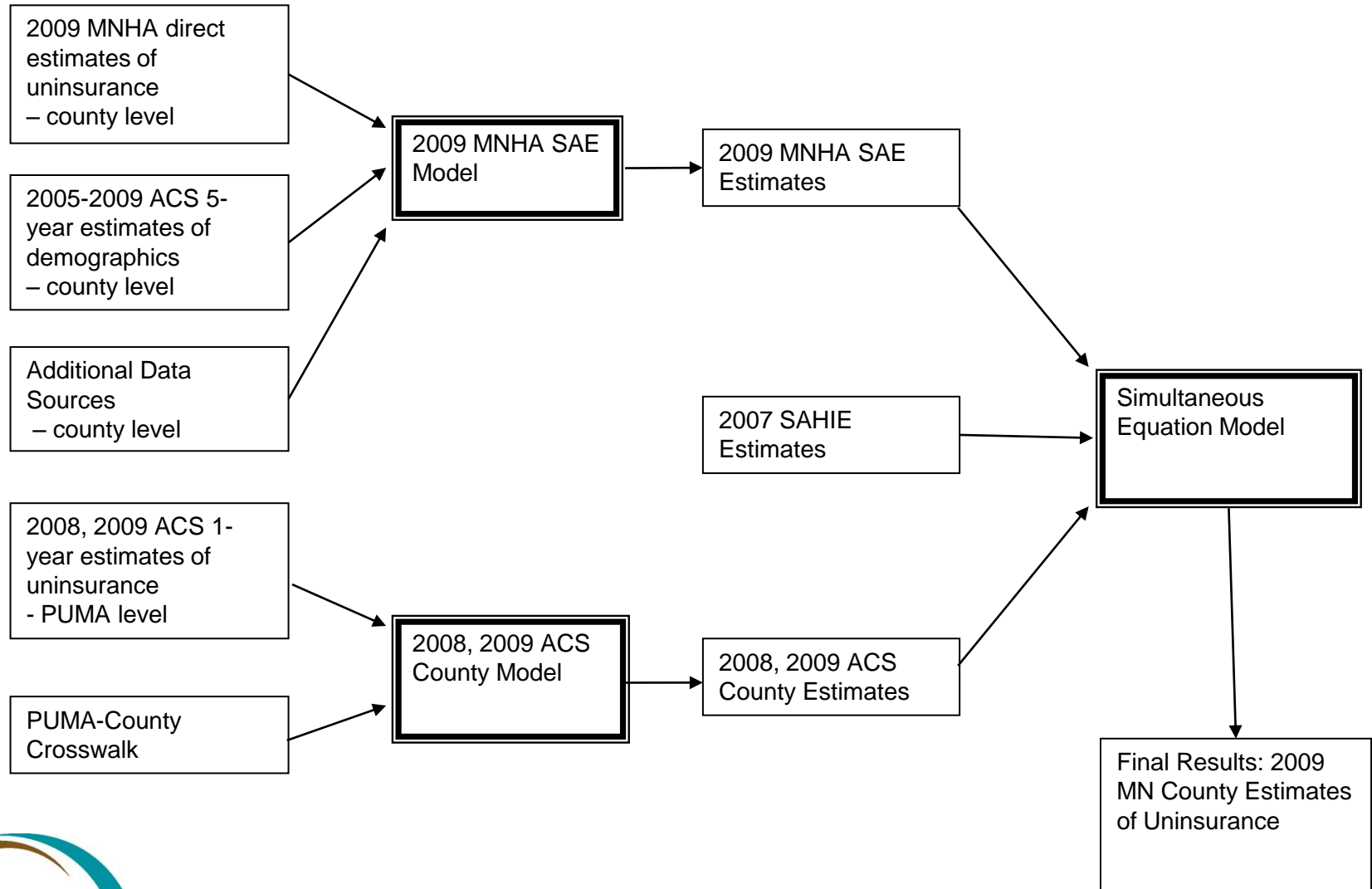- 🟩 ACS County Estimate
- 🟩 Multiple Counties in Puma

ACS County Model

- ## Two types of estimates
  - County estimate exists in 1-year ACS (12 counties)
    - Estimate and SE used directly
  - County is a subset of PUMA (75 counties)
    - Estimate from PUMA
    - SE is the PUMA estimate times the ratio of the PUMA poverty SE divided by the county poverty SE

$$SE_{County}^{Unin} = SE_{PUMA}^{unin} \left(\frac{SE_{County}^{pov}}{SE_{PUMA}^{pov}} \right)$$

Methodology Overview – SAHIE

2009 MNHA direct estimates of uninsurance – county level

2005-2009 ACS 5-year estimates of demographics – county level

Additional Data Sources – county level

2008, 2009 ACS 1-year estimates of uninsurance - PUMA level

PUMA-County Crosswalk

2009 MNHA SAE Model

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Simultaneous Equation Model

Final Results: 2009 MN County Estimates of Uninsurance
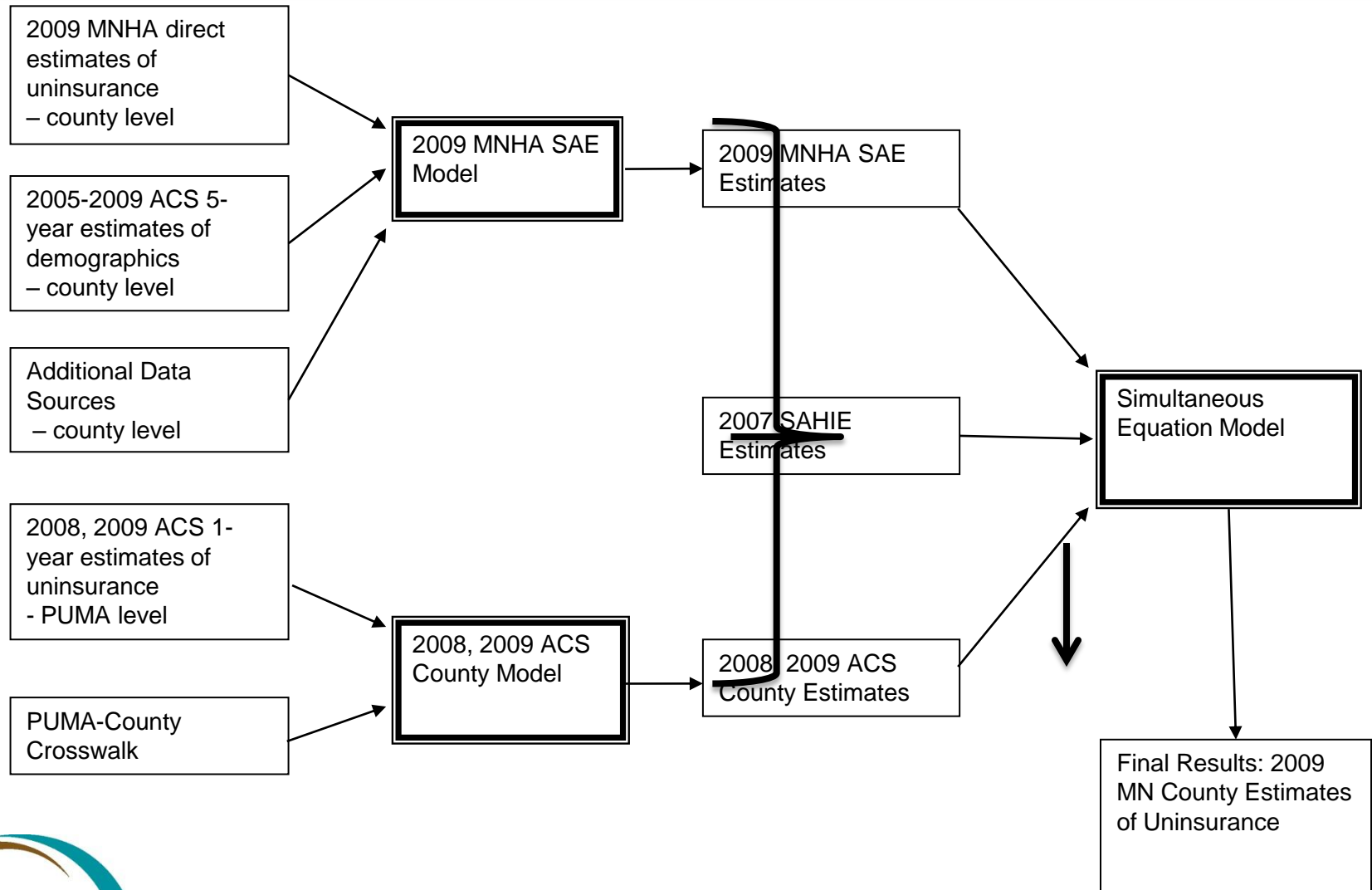
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SAHIE Estimates

- **Census Bureau's Small Area Health Insurance Estimates (SAHIE) program produces model-based estimates of health insurance coverage**
  - State estimates by age/sex/race/income categories
  - County estimates by age/sex/income categories
- **Estimates are for 0-64 so we need to make a correction to use in our all ages model**

$$Unin_{All}^{SAHIE} = Unin_{under65}^{SAHIE} - Unin_{under65}^{SAHIE} * Unin_{under65}^{SAHIE} + Prop65over^{ACS5year} * Unin_{65over}^{CPS}$$

Methodology Overview – SEM Model

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2005-2009 ACS 5-year estimates of demographics – county level

Additional Data Sources – county level

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Simultaneous Equation Model

Final Results: 2009 MN County Estimates of Uninsurance

Simultaneous Equation Model (SEM)

$$y_c^{MNHA} = \alpha_c County_c + \beta_1 MNHA + u_{1c}$$

$$y_c^{ACS\_2009} = \alpha_c County_c + \beta_2 ACS09 + u_{2c}$$

$$y_c^{ACS\_2008} = \alpha_c County_c + \beta_3 ACS08 + u_{3c}$$

$$y_c^{SAHIE\_2007} = \alpha_c County_c + \beta_4 SAHIE07 + u_{4c}$$

Model

$$y_c^{SEM} = \alpha_c County_c + \beta_2 ACS09$$

Prediction

Limitations/Enhancements

- **MNHA SAE model could include more advanced variable selection and transformations**

- **MNHA SAE model could take advantage of information outside the state**

- **Multi-staged methodology removes non-parametric errors**

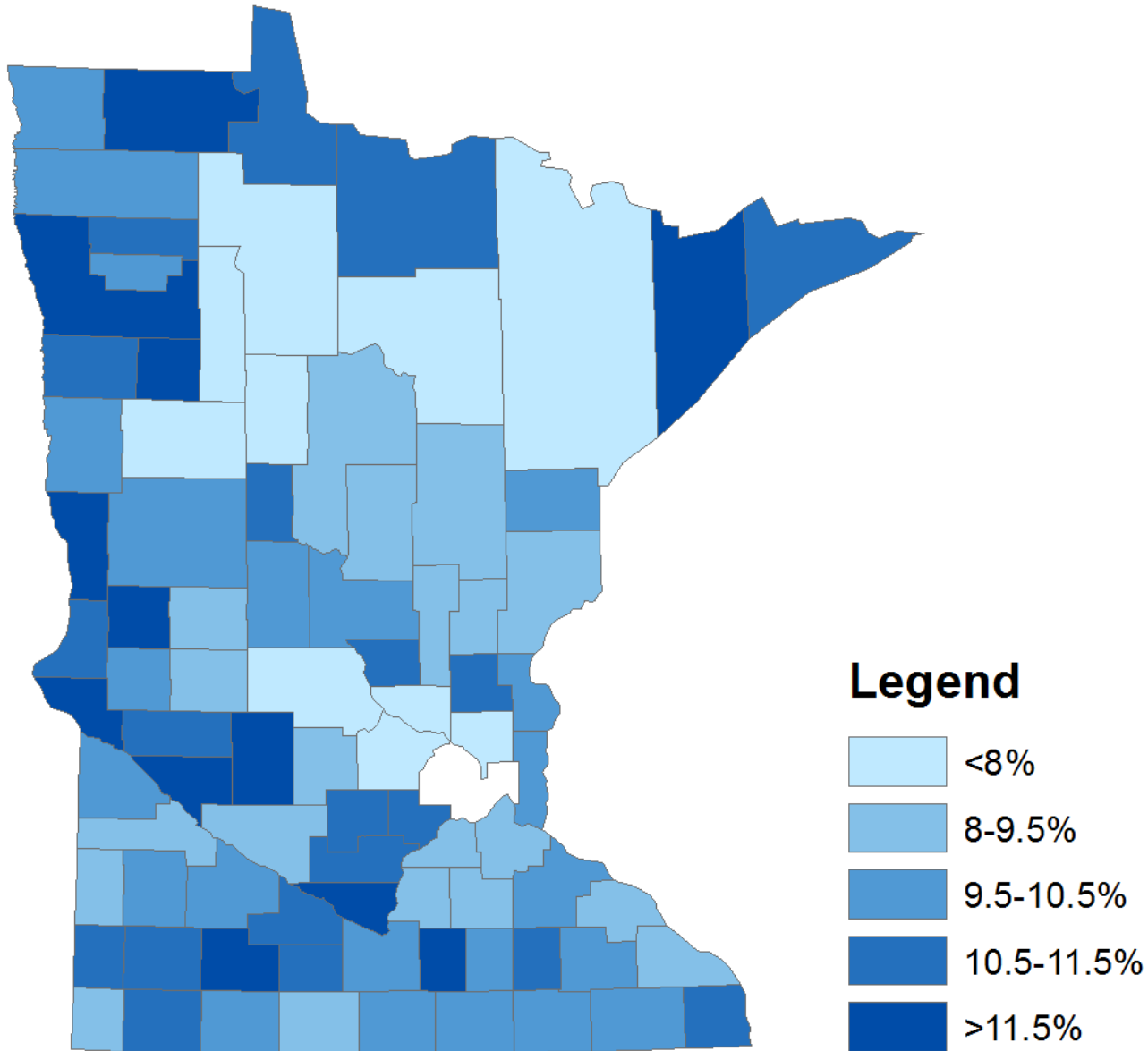 – Integrated model could propagate errors more accurately

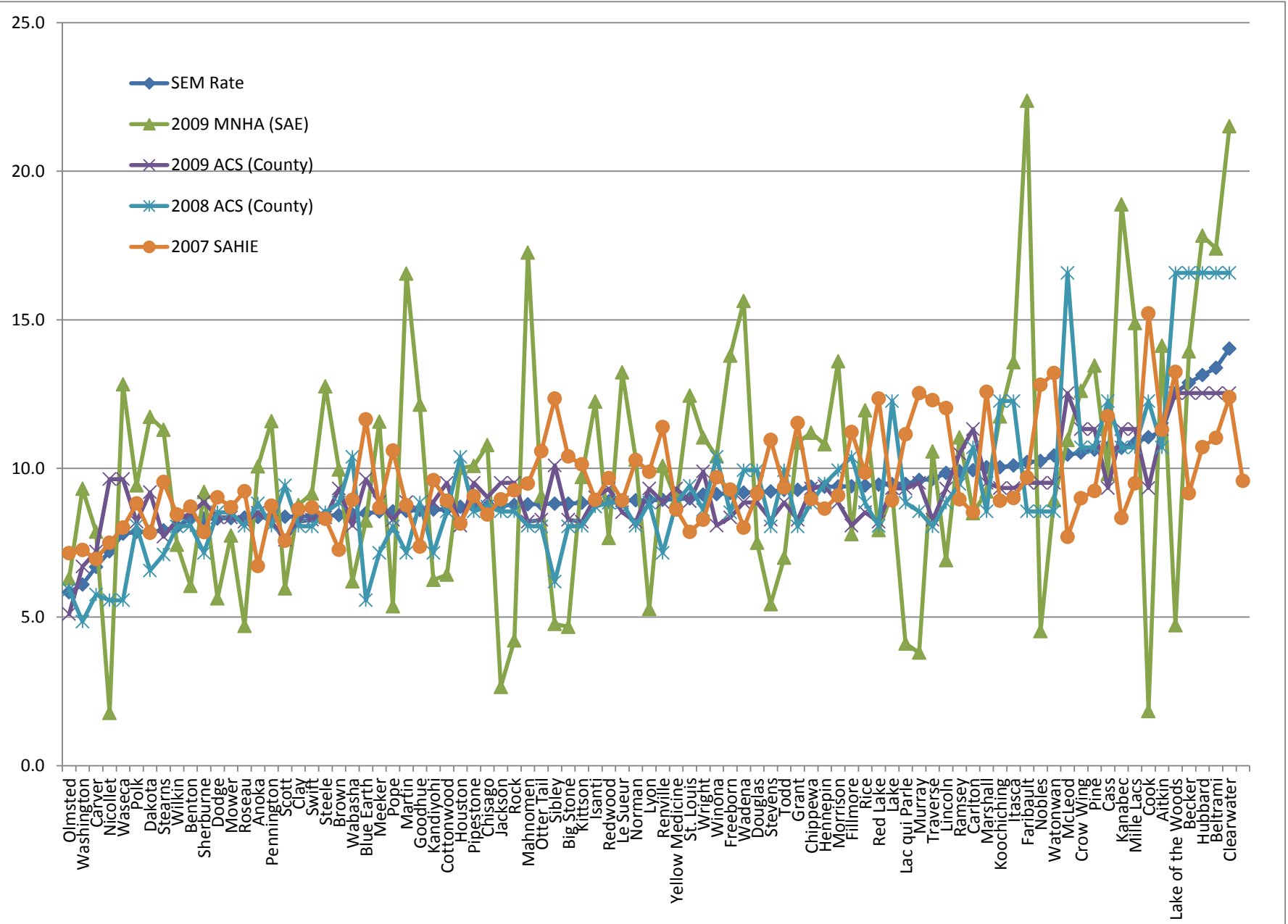# SEM Model Results - Percent Uninsured

Legend

	<7.5%
	7.5-9%
	9-10%
	10-11.5%
	>11.5%
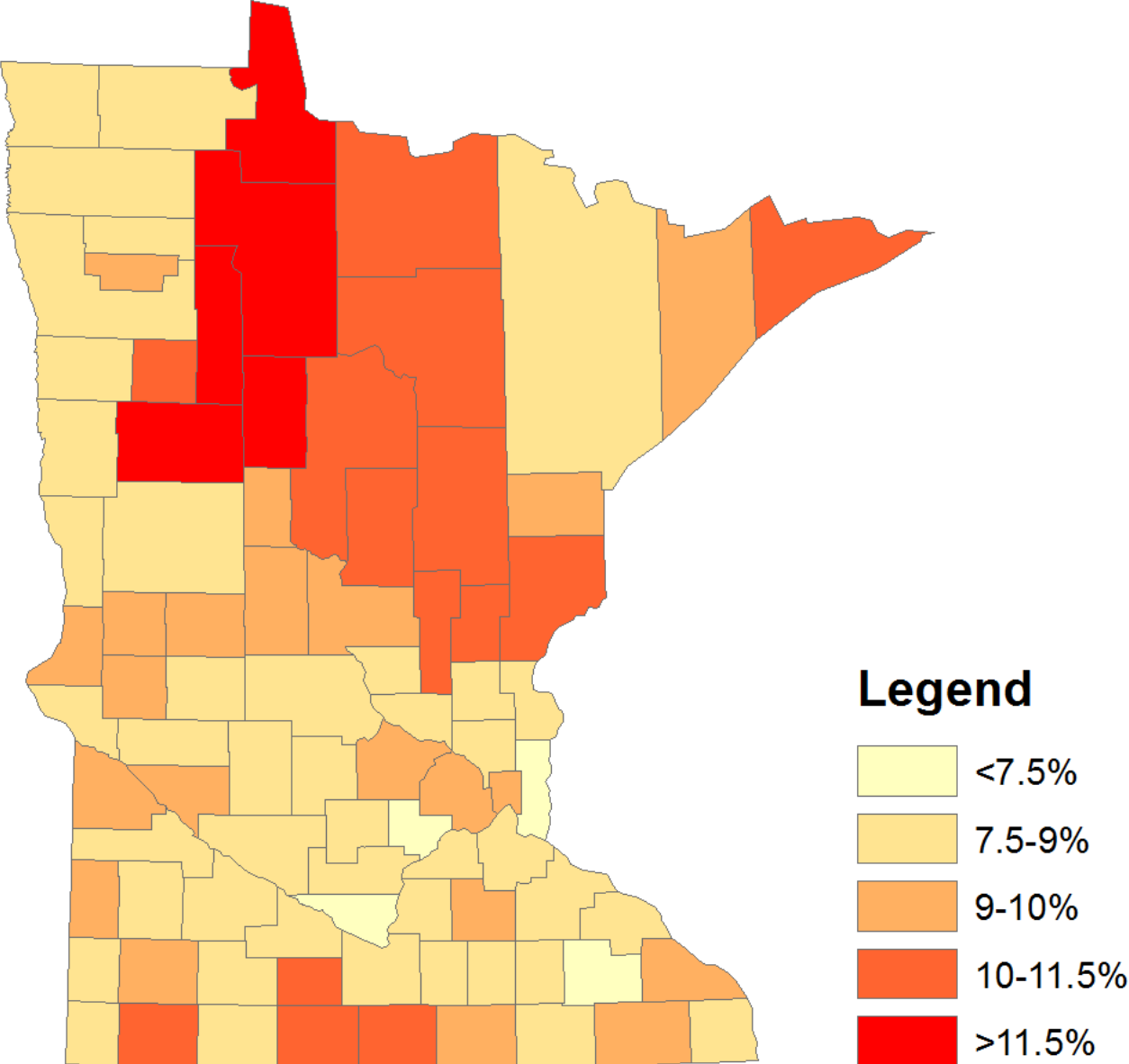
SEM Model Results - Precision

- **Standard Deviation from SEM model ranges between (0.5-1.3)**

- **Coefficient of Variation (CV)**
  - CV=Standard deviation/Estimate
  - Used as threshold for release by Census/NCHS
    - >30% CV estimates are unreliable
  - Ranges between (5.7%-14.4%)

SEM Model Results - CV

Legend

(lightest blue)	<8%
(light blue)	8-9.5%
(medium blue)	9.5-10.5%
(dark blue)	10.5-11.5%
(darkest blue)	>11.5%

SEM Model Results - Source Comparison

Conclusions

- **Produced uninsurance estimates and estimates of uncertainty using a state survey and multiple outcomes**

- **Methodology is accessible and can be applied to other states**

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