



Estimating U.S. national vaccination coverage using IIS Sentinel Site data

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Disclaimer

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.



Outline

- Background
- Methods
- Results and discussion
- Future directions



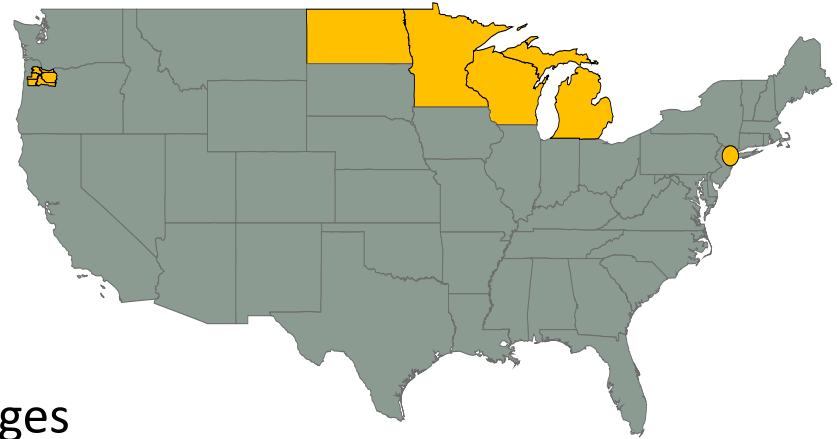
Background

Nationally Representative Surveys

- **Current methodology for US vaccination coverage**
 - Strengths
 - Consistent methodology across states
 - Nationally representative
 - Limitations
 - Response rates
 - Timeliness
 - Examples: National Immunization Survey (NIS) family, Behavioral Risk Factor Surveillance System, National Health Interview Survey, etc.

IIS Sentinel Site Project

- **Six Sites (2013-2017): MI, MN, ND, NYC, OR, WI**
- **IIS Sentinel Site data**
 - Strengths
 - Provider-submitted
 - Population-based
 - Timely
 - Containing data for all pediatric ages
 - Limitation
 - May not be generalizable



Factors Associated with Vaccination

- **Maternal characteristics**
 - Age, education, gestational age, marital status, etc.
- **Poverty/neighborhood income**
- **Birth location (hospital vs other)**
- **Family mobility**
- **Household size**
- **Birth order**
- **Urban/rural residence**

Objective

- **To explore methodologies to estimate national vaccination coverage rates**
 - Using IIS Sentinel Site data
 - Among children aged 19–35 months

Methods

Approaches

- **Crude approach**

- Pooled vaccination coverage for the entire Sentinel Site area
- Census denominators

- **Direct standardization**

- IIS data linked to vital statistics from 3 Sentinel Sites
- Mother's race, Mother's education

- **Model-based approach**

- Negative binomial regression
- County characteristics from Area Health Resource File (AHRF)
- IIS data with county code: 5 Sentinel Sites

Negative Binomial Regression

- Number of vaccinated children in US counties was predicted using county-level socioeconomic covariates
- Sum of number of vaccinated children in all counties served as numerators for estimating national vaccination coverage
- Census data were used as national denominators
- Modeled rates by including an offset parameter

County-level Characteristics

- **Counties from Sentinel Sites: 234**
- **Covariates in model**
 - Health Insurance and Poverty, education, urban influence code, single family household status, population loss topography

Cohort and Vaccination Metrics

- **Cohort**

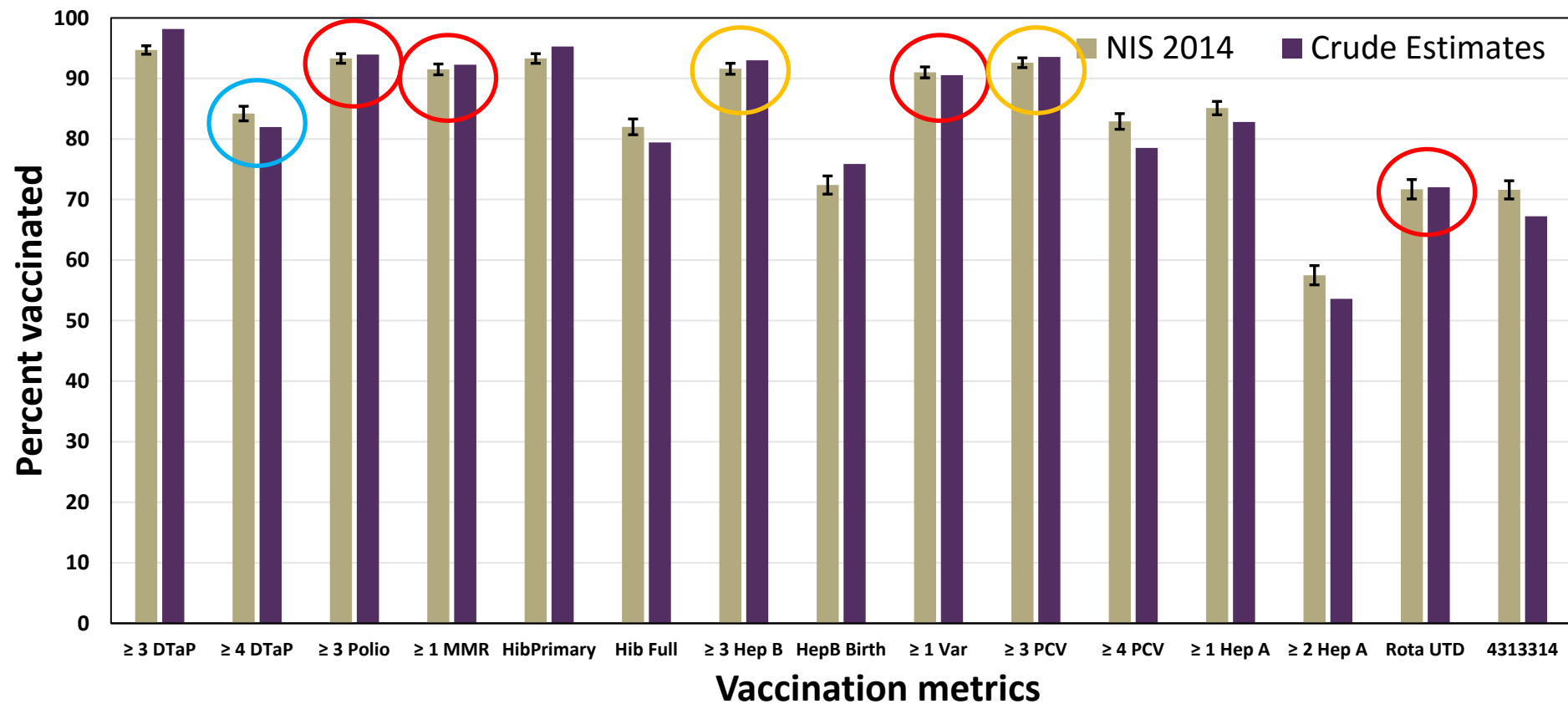
- Children aged 19–35 months on 7/1/2014

- **Vaccination metrics**

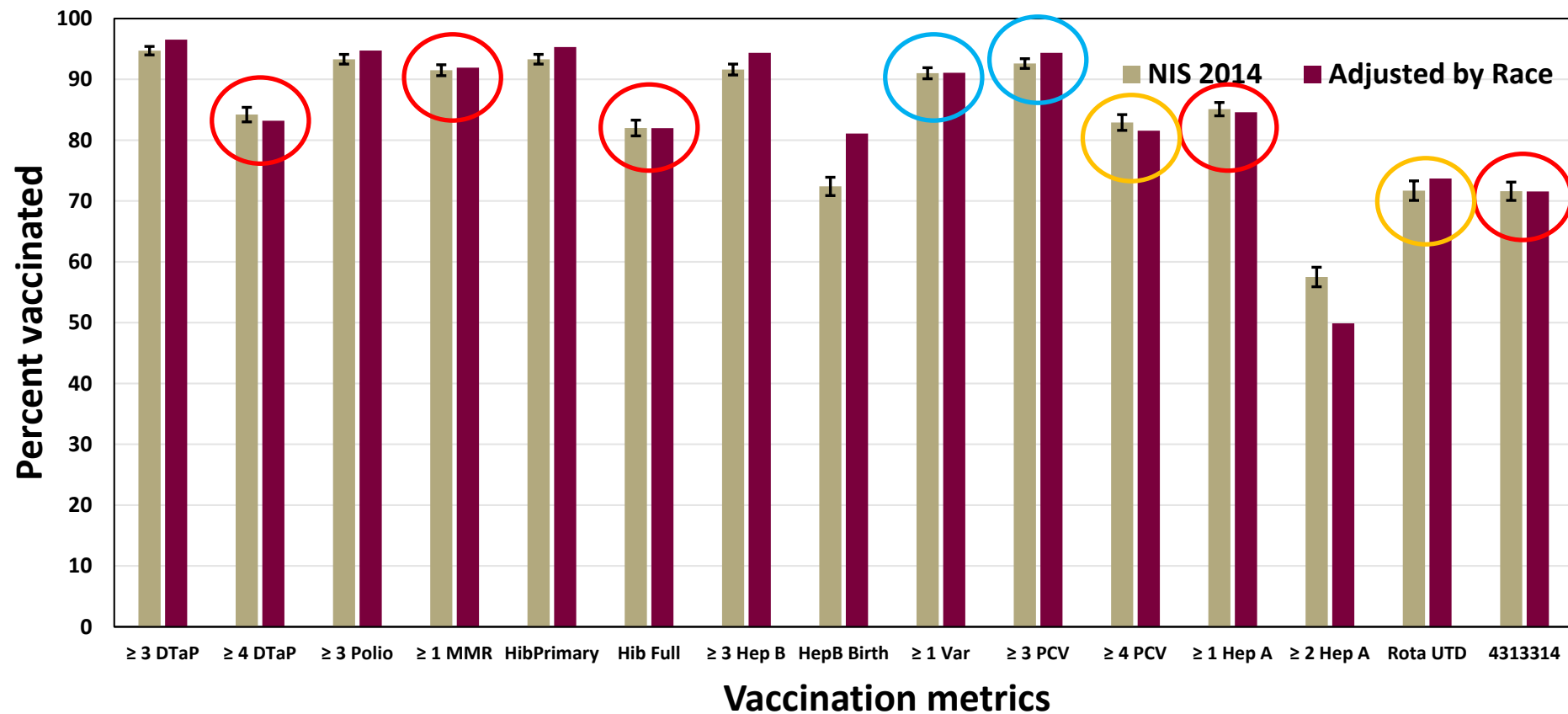
- 3+DTap, 4+DTap, 3+polio, 1+MMR, primary and full Hib series, birth dose and 3+Hep B, 1+varicella, 3+PCV, 4+PCV, 1+Hep A, 2+Hep A, Rotavirus up-to-date, and the 4:3:1:3:3:1:4 series (4+DTaP, 3+Polio, 1+Measles-containing vaccine, 3+Hib, 3+HepB, 1+Varicella, 4+PCV)

Results and Discussion

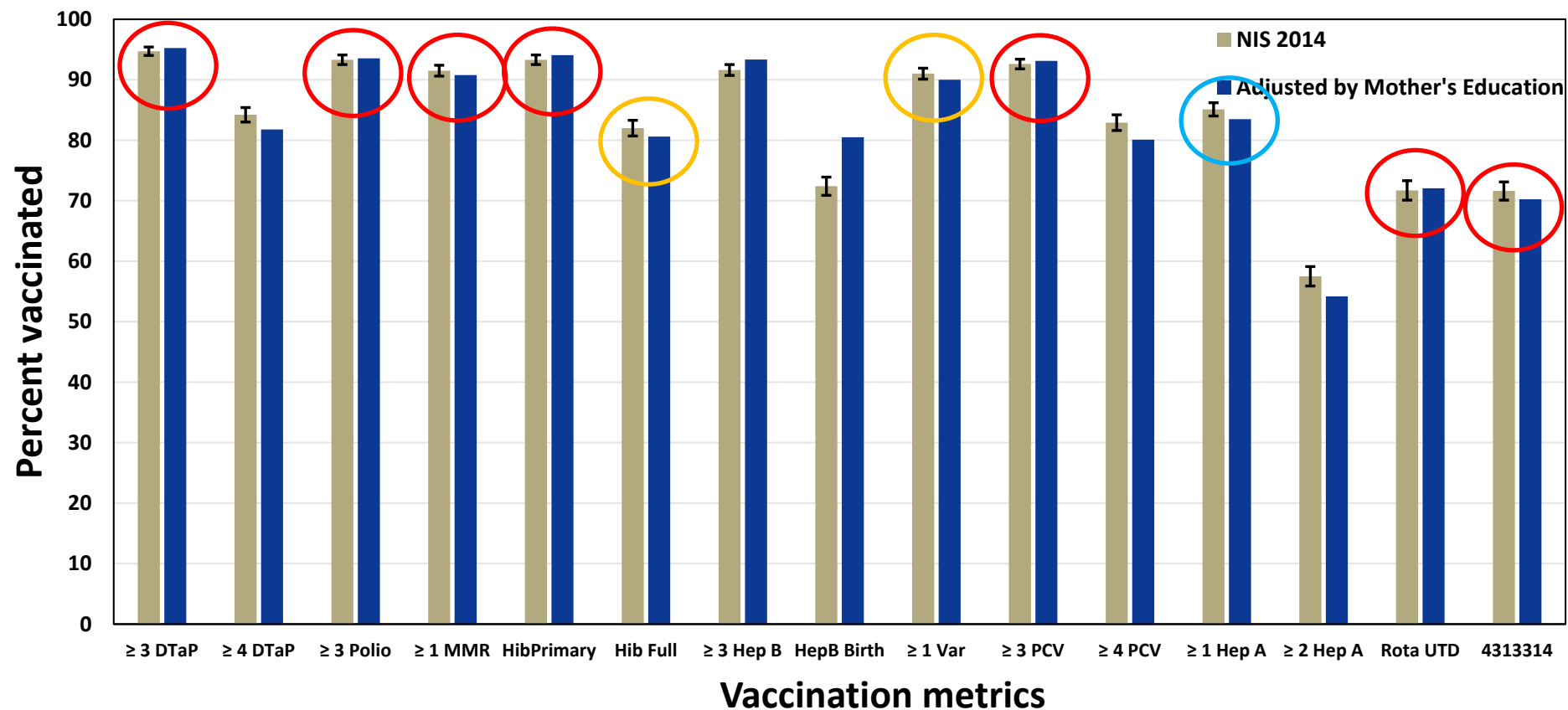
National Vaccination Coverage Estimates by Crude Approach



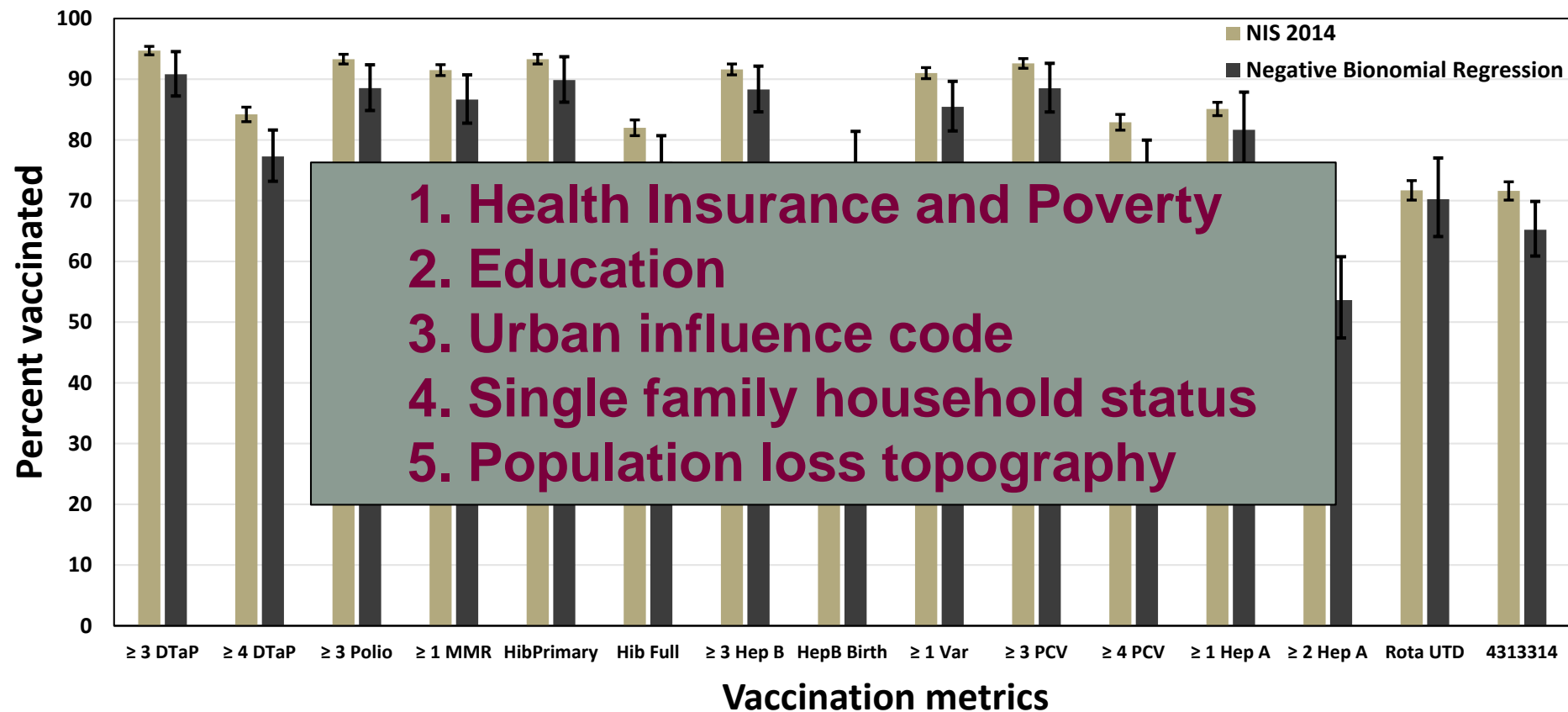
National Vaccination Coverage Estimates by Standardization



National Vaccination Coverage Estimates by Standardization



National Vaccination Coverage Estimates by Regression Model



Summary

Sentinel Site Crude Coverage

- ✓ Maybe useful
- ✓ Data accessible

Direct Standardization

- ✓ Maybe useful
- X Data not easily accessible

Model-based Approach

- Not yet useful - consistent underestimation except HepB birth dose
- Wide CI's
- ✓ Public data source

- All approaches require high quality and completeness of IIS data

Limitations

- **Limited data**

- Direct Standardization: only 3 states
- Model-based approach: 234 counties (<8% of all US counties)
- Limited county-level data from AHRF that are associated with vaccination



Future Directions

Future Directions

- **Direct standardization**

- Feasibility of IIS Sentinel Site data

- **Model-based approach**

- NCHS county-level natality data: mother's race, ethnicity, and education, birth place, live birth order, and delivery method

- **Replicates of all approaches**

- Multiple years
 - Other age groups



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Questions?

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Supplemental Slides

County-level Characteristics

- **Counties from Sentinel Sites: 234**
- **Covariates in model**
 - Health Insurance, working status, education, urban influence code
single family household status, poverty, population loss topography,
retirement destination code, farming code

National Vaccination Coverage Estimates by Regression Model

