Producing Synthetic Estimates of Children's Health and Well-Being for Local Areas

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PRESENTATION BY **BETH JAROSZ OF THE POPULATION REFERENCE BUREAU**

Acknowledgement

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Overview

- Purpose
- Methodology
  - Data, process, and examples
  - Techniques to reduce error
  - Methods for evaluating the estimates
- Results
- Conclusions

What is a Synthetic Local Estimate?

- When data are available only for larger areas, how do we estimate local conditions?
  - Extend the patterns that exist in a larger region down to the local level
  - Called “estimates” because they are extrapolated (not observed)
  - Called “synthetic” because they are created by combining data for the “parent” geography with local population data

Purpose

- National Survey of Children's Health provides **state-level** estimates of child health and well-being
- Extensive public health planning and policy occurs at the **county**- or **city**-level
- These estimates attempt to bridge that gap

The Broader Context

- Federal, state budgets squeezed
- Demands for better data at lower costs
- Declining response rates / privacy concerns
- Future → Greater reliance on administrative records and model-based estimates

26 Child Health Measures

Obesity & overweight	CSHCN status	Status of child's teeth	Prematurity
EBD problems	Adequacy of insurance	Consistency of insurance	Childcare affecting parental empl.
Preventive medical	Preventive dental	Medical home	Rec'd needed mental health care
Vision screening	Developmental screening	Problems accessing specialist care	School engagement
Grade repetition	Missed school	Adverse Childhood Experience	Parental stress
Supportive neighborhoods	Safe communities	Neighborhood amenities	Resilience (age 0-5)
	Resilience (age 6-17)	Physical activity	

Methodology: Data Sources

- 2011-2012 National Survey of Children's Health (NSCH)
  - State-level prevalence rates
    - 4 racial/ethnic categories
    - 4 family income categories
- 2010-2012 American Community Survey (ACS)
  - Local-level population data
    - 4 racial/ethnic categories
    - 4 family income categories

Methodology: Geography

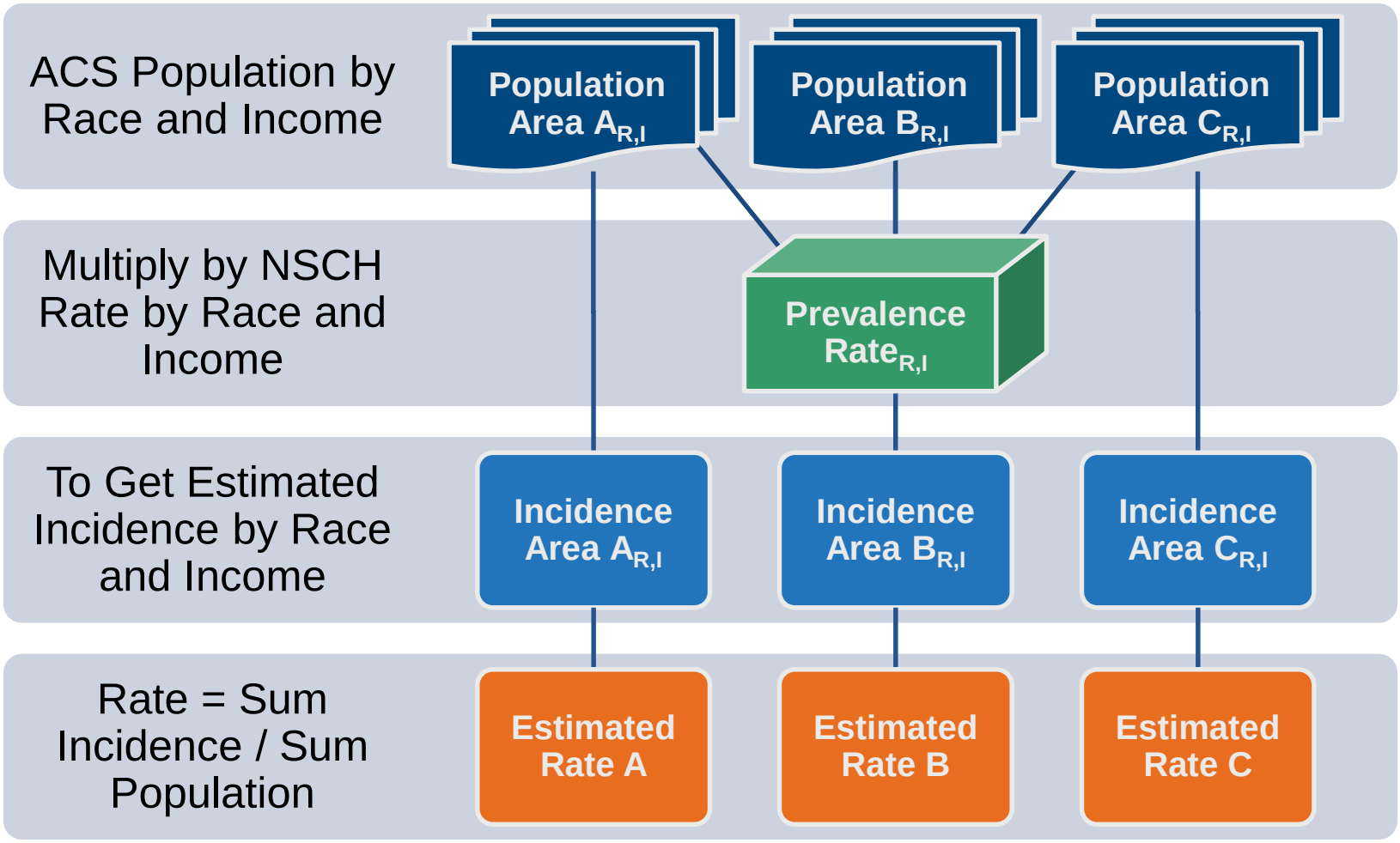
- NSCH prevalence rates for 50 states, District of Columbia, 4 Census Regions

Image source: U.S. Centers for Disease Control and Prevention

Methodology: Geography

- ACS population estimates for cities and counties of population ≥100,000
  - 583 counties
  - 297 cities (excl. 3 college towns)
    - South Bend, IN (Notre Dame University)
    - Edison township, NJ (Rutgers University)
    - Murfreesboro, TN (Middle Tennessee State Univ.)
  - Wyoming special case:
    - No counties or cities met 100,000 population threshold in 2012
    - Combined counties of Albany and Laramie

Methodology: Estimation Process



Methodology: Estimation Formula

$$Local\ estimate = \sum_{r,i=1}^{16} \left(p_{r,i} \frac{NSCHc_{r,i}}{NSCHp_{r,i}} \right)$$

OR

$$Local\ estimate = \sum_{r,i=1}^{16} \left(\frac{p_{r,i}}{P} NSCHrate_{r,i} \right)$$

Where:

$p_{r,i}$ = local population of a given race and income group within the age group of interest

$NSCHc_{r,i}$ = number of cases in parent geography

$NSCHp_{r,i}$ = population of parent geography

Example: Overweight/Obesity in Baltimore, MD

NSCH Prevalence Rate MARYLAND		0-99% FPL	100-199% FPL	200-399% FPL	400% FPL or Higher
Hispanic		50.0%*	45.7%*	36.2%*	23.8%*
White, non-Hispanic		40.9%*	33.6%*	24.1%	18.0%
Black, non-Hispanic		52.7%*	80.2%	36.3%	34.7%
Other, non-Hispanic		37.9%*	35.1%*	35.9%*	20.9%*

ACS Population Est. BALTIMORE	TOTAL	0-99% FPL	100-199% FPL	200-399% FPL	400% FPL or Higher
TOTAL	**54,028**	19,094	14,000	13,959	6,975
Hispanic	2,003	777	463	548	215
White, non-Hispanic	7,838	1,300	1,307	2,348	2,883
Black, non-Hispanic	41,534	16,310	11,532	10,335	3,357
Other, non-Hispanic	2,653	707	698	728	520

Example: Overweight/Obesity in Baltimore, MD

Est. Number of Overweight /Obese BALTIMORE	TOTAL	0-99% FPL	100-199% FPL	200-399% FPL	400% FPL or Higher
TOTAL	**26,564**	9,787	10,149	4,782	1,846
Hispanic	850	388	212	199	51
White, non-Hispanic	2,046	531	439	566	520
Black, non-Hispanic	22,775	8,600	9,253	3,756	1,166
Other, non-Hispanic	883	268	245	261	109

- Baltimore overweight/obesity prevalence rate

  = 26,564 / 54,028

  = 49% overweight or obese

Note: Differs from Maryland statewide rate (31.6%)

Methodology: Reducing the Effect of Sampling Error

- ACS: Drop cases with CV > 60 percent
- NSCH: “Reach up” to larger parent geography (e.g. region, instead of state) when NSCH rate based on fewer than 20 cases

Methodology: Evaluating the Estimates

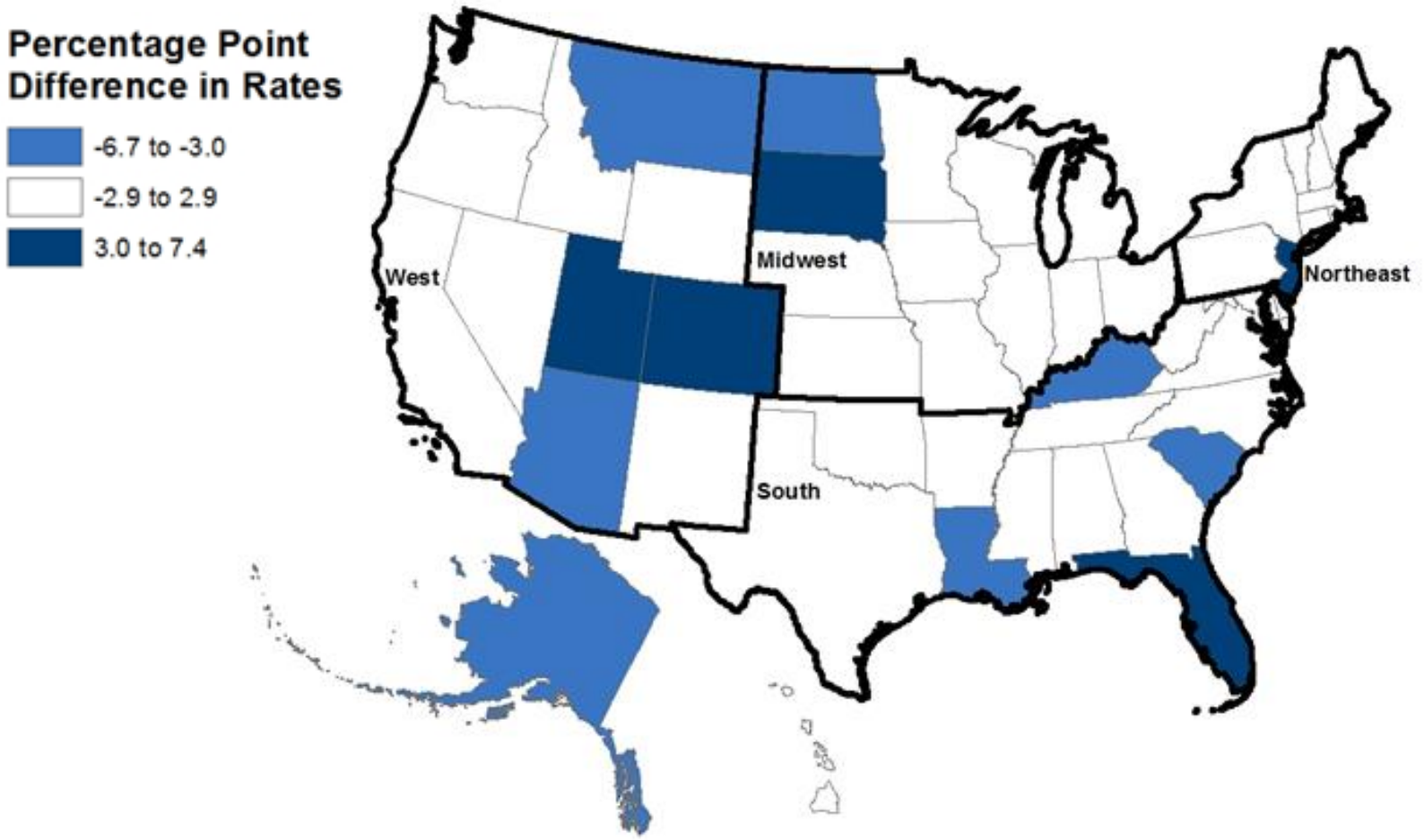
- Proof of Concept #1: test synthetic estimation at the state level
  - Use region-level rates to develop synthetic state estimates
  - Compare with published state-level NSCH
    - Mean Absolute Percent Error (MAPE)
    - Mean Algebraic Percent Error (MALPE)

Evaluation: MAPE and MALPE for Region to State Synthetic Estimates

- 50 states and District of Columbia
- 4 Census Regions
- Synthetic method applied
  - Used Region prevalence rate and state population estimates

	Overweight & Obesity
U.S. Rate	31.3
Range	17.3
High (MS)	39.7
Low (UT)	22.4
MAPE	7.5
MALPE	1.5
Max Underestimate	-6.7
Max Overestimate	7.4
Nmbr States w/i 1pt	13
Percent within 1pt	25.5%

Difference Between Survey and Estimate for Overweight/Obesity



Methodology: Evaluating the Estimates

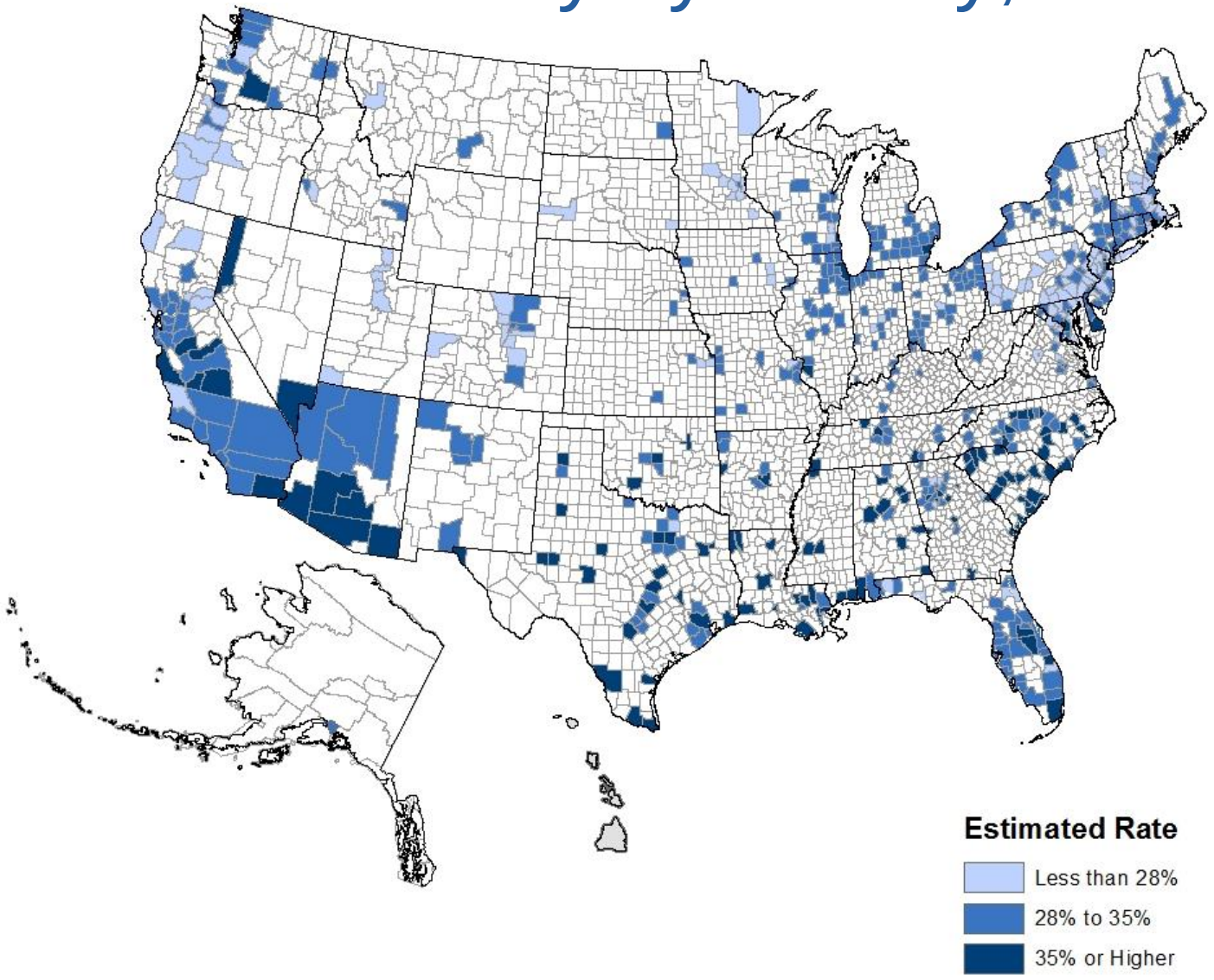
- Proof of Concept #2: Compare NSCH and Synthetic Estimates for Washington, D.C.
  - District of Columbia is a unique case
    - D.C. surveyed and reported as a state in NSCH
    - D.C. also a city and a county in synthetic estimates
  - Results suggest method yields reliable estimates
    - D.C. synthetic estimate incorporates ACS reweighting and state- and region-level NSCH

Evaluation: Compare Estimates for District of Columbia

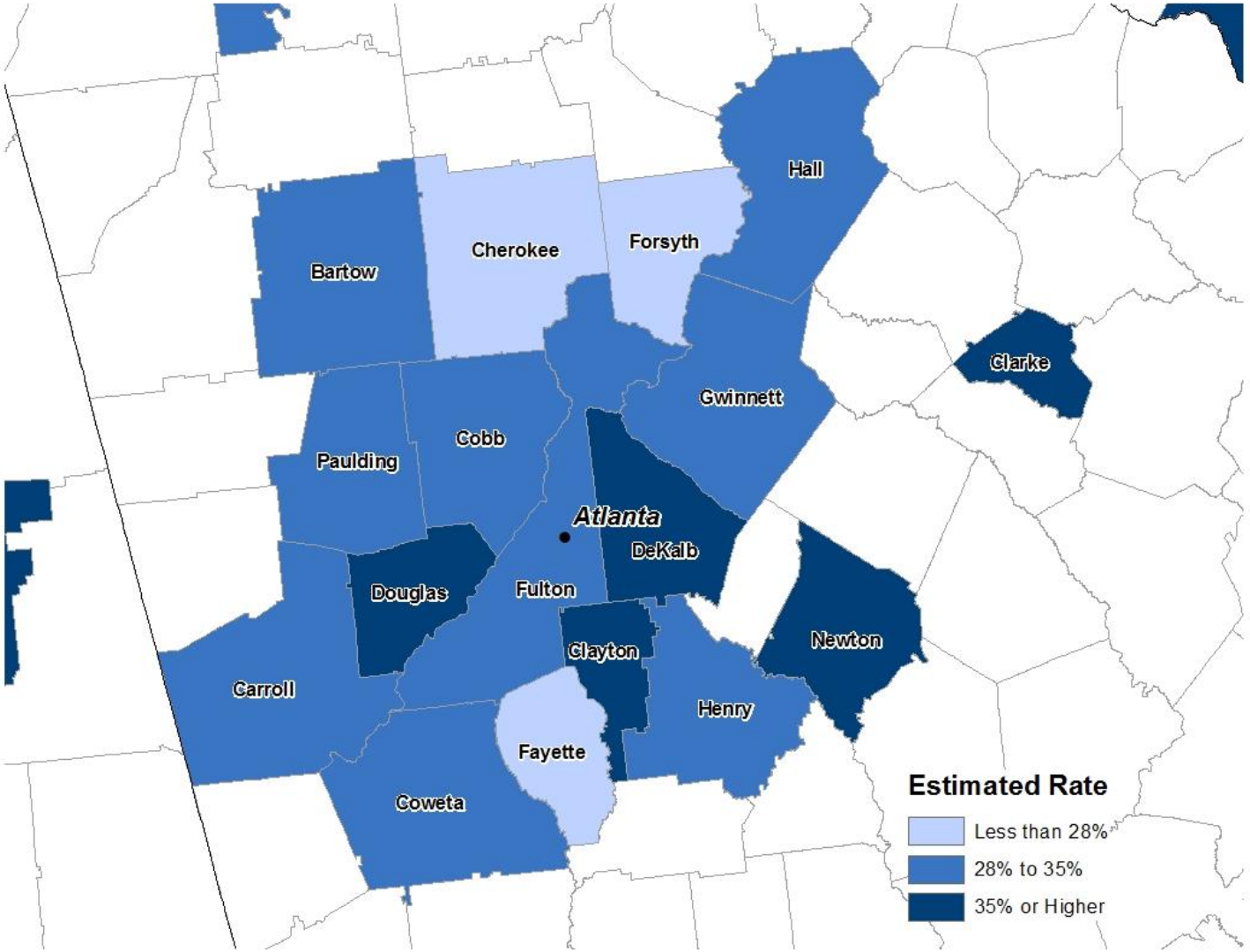
Health Measure	Synth.	Publ.	Diff.
Obesity/overweight	38.3	35.0	3.30
CSHCN status	22.9	20.9	2.00
Status of children's teeth	74	72.6	1.40
Prematurity	91.2	89.6	1.60
EBD problems	8.2	N/A	N/A
Adequacy of insurance	21.2	19.7	1.50
Consistency of insurance	93.6	94.2	-0.60
Childcare affecting employment	84.6	85.0	-0.40
Preventive medical	90.2	89.8	0.40
Preventive dental	17.5	17.7	-0.20
Medical home	48.8	49.7	-0.90
Received needed mental health care	4.2	5.6	-1.40

Health Measure	Synth.	Publ.	Diff.
Vision screening	63.5	63.8	-0.30
Developmental screening	27.5	N/A	N/A
Problems accessing specialist care	9.1	7.7	1.40
School engagement	74.5	73.6	0.90
Grade repetition	85.2	84.4	0.80
Missed school	94.4	94.6	-0.20
ACEs	27.4	24.7	2.70
Parental stress	14.1	14.2	-0.10
Supportive neighborhoods	70.1	71.2	-1.10
Safe communities	72.5	72.6	-0.10
Neighborhood amenities	93.3	92.3	1.00
Resilience 0-5	66.5	N/A	N/A
Resilience 6-17	53.7	N/A	N/A
Physical activity	62.2	59.5	2.70

Results: Obesity by County, U.S.



Results: Obesity by County, Atlanta



Discussion: Model Strengths

- Model based on sound estimation techniques
- Process is clear and replicable
- Method attempts to mitigate effect of sampling error
  - “Reaches up” to larger parent geography when state rate is unstable
  - Focuses on areas with relatively large populations
  - Excludes population groups with large CV

Discussion: Potential Source of Error

- Technique may compound sampling error
- State-level prevalence (by race/income) may not be characteristic of local areas
- Unable to “ground truth” model against county- and city-level data from NSCH or other sources

Conclusions and Next Steps

- Conclusions:
  - Method useful, but has limitations
  - Wide range of possible applications
- Next Steps:
  - Compare synthetic estimates with special tabulation of NSCH data for selected counties
  - Produce data for rural areas

MARK MATHER

Associate Vice President

U.S. Programs

Population Reference Bureau

MMather@prb.org

@MarkSMather

BETH JAROSZ

Research Associate

U.S. Programs

Population Reference Bureau

BJarosz@prb.org

@DataGeekB