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THE RELATIONSHIP OF SOCIOECONOMIC AND RACIAL FACTORS, BOTH INDIVIDUAL & COMMUNITY-LEVEL, TO INFANT BIRTHWEIGHT

CATHERINE KOTHARI PhD student
Western Michigan University, Interdisciplinary Health Sciences PhD Program
Western Michigan University, School of Medicine
catherine.l.kothari@wmich.edu (269) 501-4149

LUZ CARMEN SWEEZY MA MPA
Kalamazoo Health & Community Services Department

JAMES WILEY PhD
University of California, San Francisco, School of Medicine

KATHLEEN BAKER PhD
Western Michigan Univ, Geography Department

ARTHUR JAMES MD
Ohio State University, Dept of Obstetrics & Gynecology

RAJIB PAULPhD
Western Michigan Univ, Statitics Department

BEN DORMITORIO PhD student
Western Michigan Univ, School of Medicine

AMY CURTIS PhD MPH
Western Michigan Univ, Interdisciplinary Health Sciences

Background

- **Exact causal pathways between race, poverty and health remain unclear**
- **Health disparities have been linked with:**
  - Availability, organization and utilization of resources
  - Community culture and physical environment
  - Individual stressors, coping mechanisms and behaviors
- **Birth outcomes are considered one of the most sensitive health indicators**
- **Individual factors have been the primary focus, to date.**

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Handler A, Kennelly J, Peacock N (eds). *Reducing Racial/Ethnic Disparities in Reproductive and Perinatal Outcomes*. New York, NY: Springer Press. 2010.

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Research Questions

1. What is the coocurrence and spatial distribution of race, poverty and birth outcomes within a single county across urban and rural areas?

2. What is the relative strength of race and poverty, at the individual and the community-level, to predict birth outcomes?

Methods

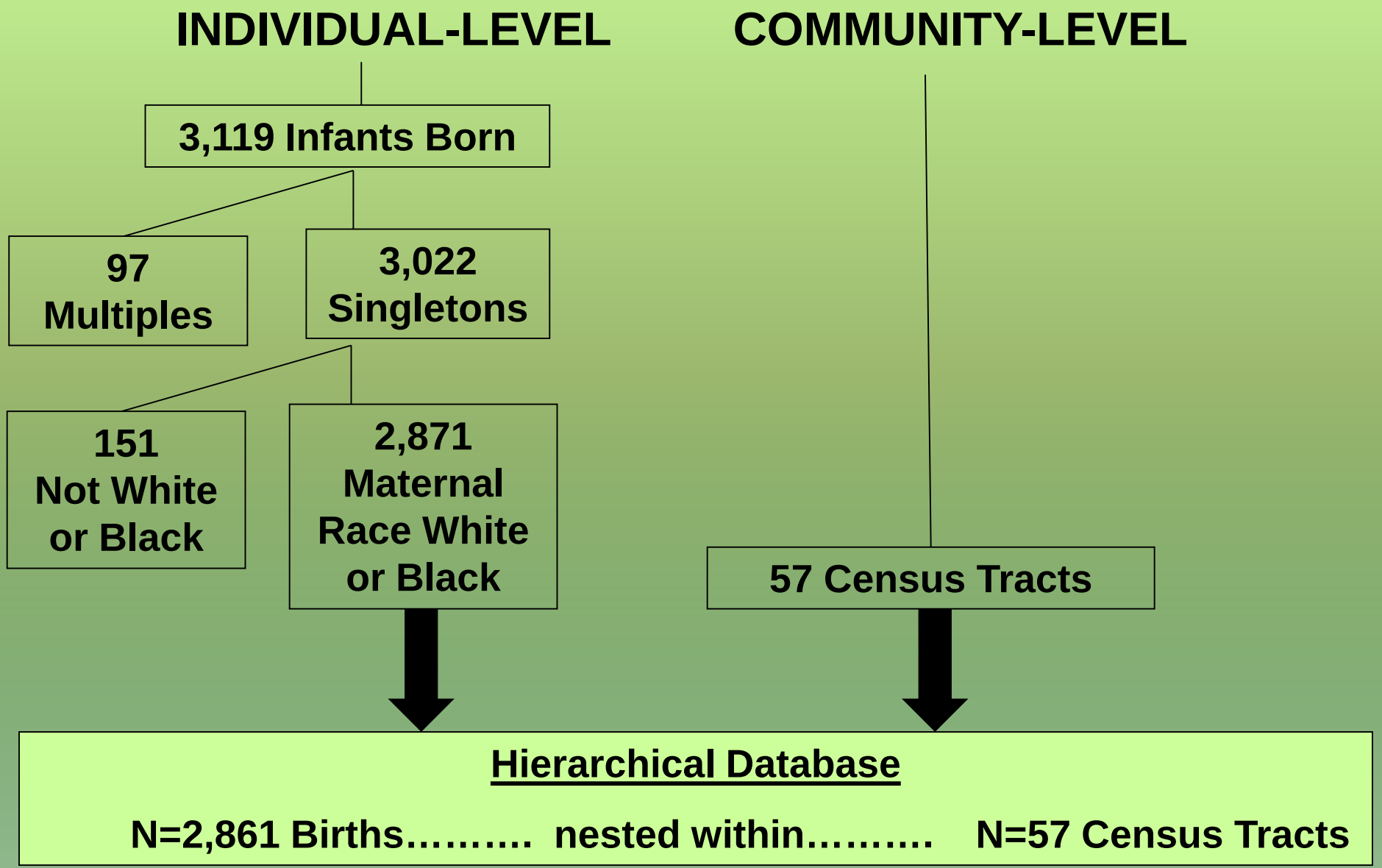
- **Secondary Data Analysis**
  - Individual-level: 2010 birth certificate data
  - Community-level: 2010 U.S. Census data (census tracts)

- **Kalamazoo County, Michigan, U.S.**
  - Census tract shapefile downloaded from Michigan Geographic Data Library (**http://www.mcgi.state.mi.us/mgdl/**)

- **ArcGIS 10.0**
  - Geo-coded individual-level birth records using maternal address
  - Then linked to census tract data through a spatial join
  - Generated maps illustrating interrelationship of race, poverty and health

- **Analysis**
  - Spatial: Bayesian Spatial Modelling with Conditional Autoregressive Priors (using R package)
  - Linear Regression: Hierarchical Modelling (using SPSS v21)
  - Significance: Two-sided, significance level set at $p<.05$

Study Populations



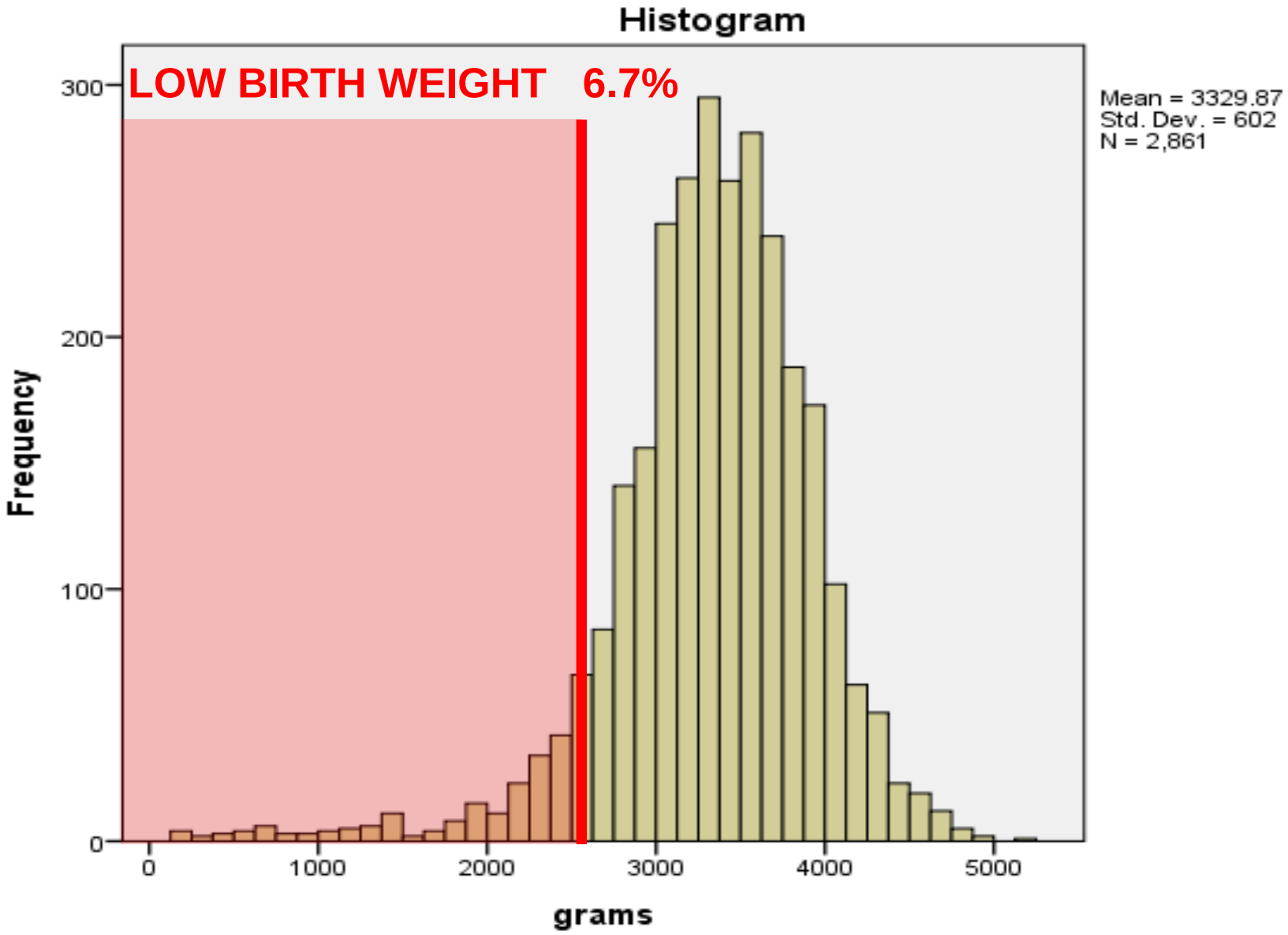
Kalamazoo Compared to State & Nation

		Kalamazoo County Births, 2010 (3,119) %	Michigan Births (114,531)* %	National Births (3,999,386)** %
Race	White	76.8%	76.2	76.7
	Black	18.4	19.7	15.9
Medicaid-paid Birth	Public, Medicaid	47.8	44.0	41.0
Low Birth Weight (<2,500 grams)	Total	8.1	8.4	8.1
	Black	12.7	13.9	13.2
	White	7.0	7.0	7.1
	Disparity (Bl-Wh)	5.7	6.9	6.1

*Michigan Department of Community Health, Division for Vital Records and Health Data Development, Live Birth File.
**National Vital Statistics Report “Births: Final Data for 2010”, vol. 61 no. 1. August, 2012

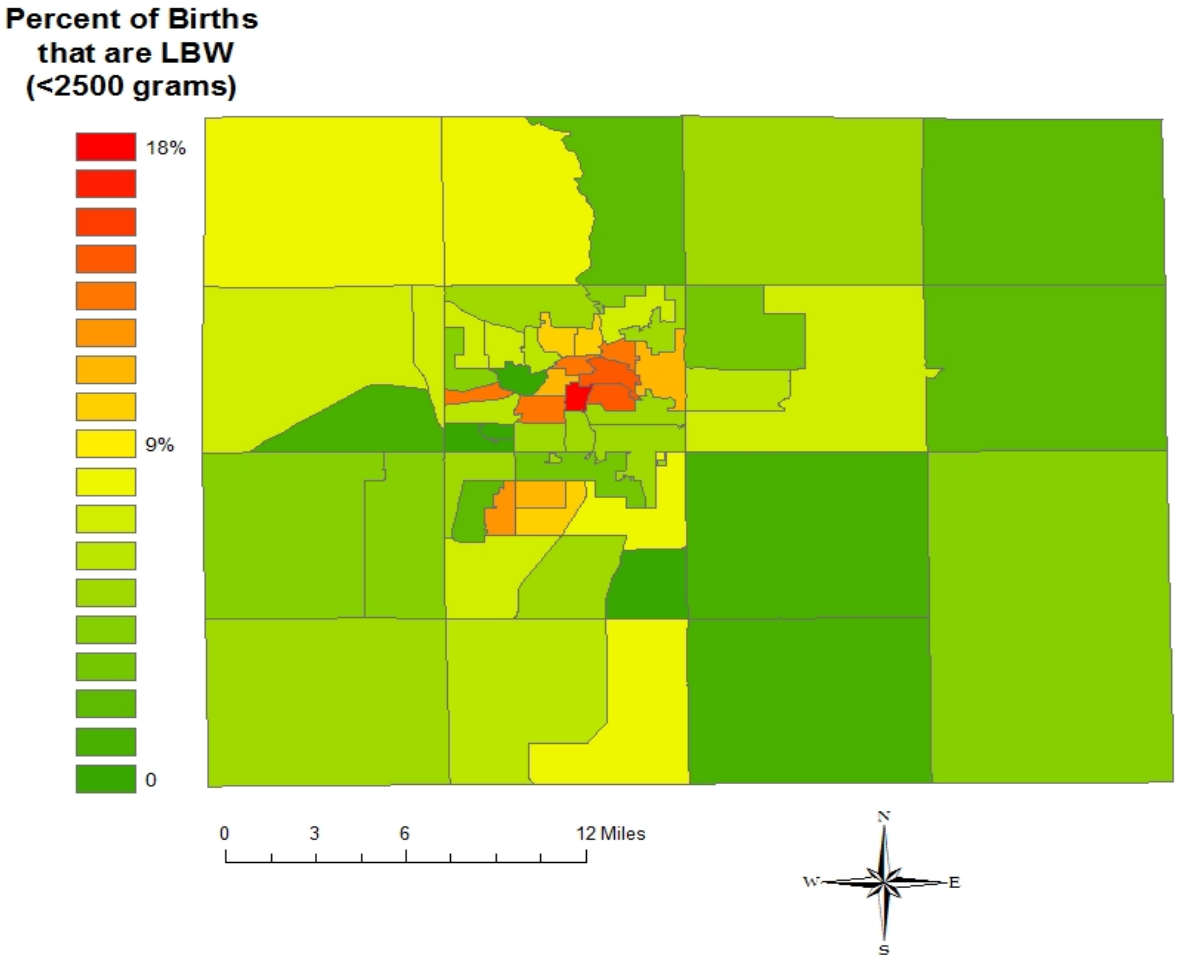
RESULTS

Birth Weight – Individual (N=2,861)



Mapping LBW:

Prevalence of Low Birth Weight Infants, Kalamazoo County MI Census Tracts, 2010



Datum
North American Datum,1983

Geographic Coord. System
GCS North American, 1983

Sources:
Michigan Center for Geographic Information
Michigan Depart. of Community Health, Vital Records

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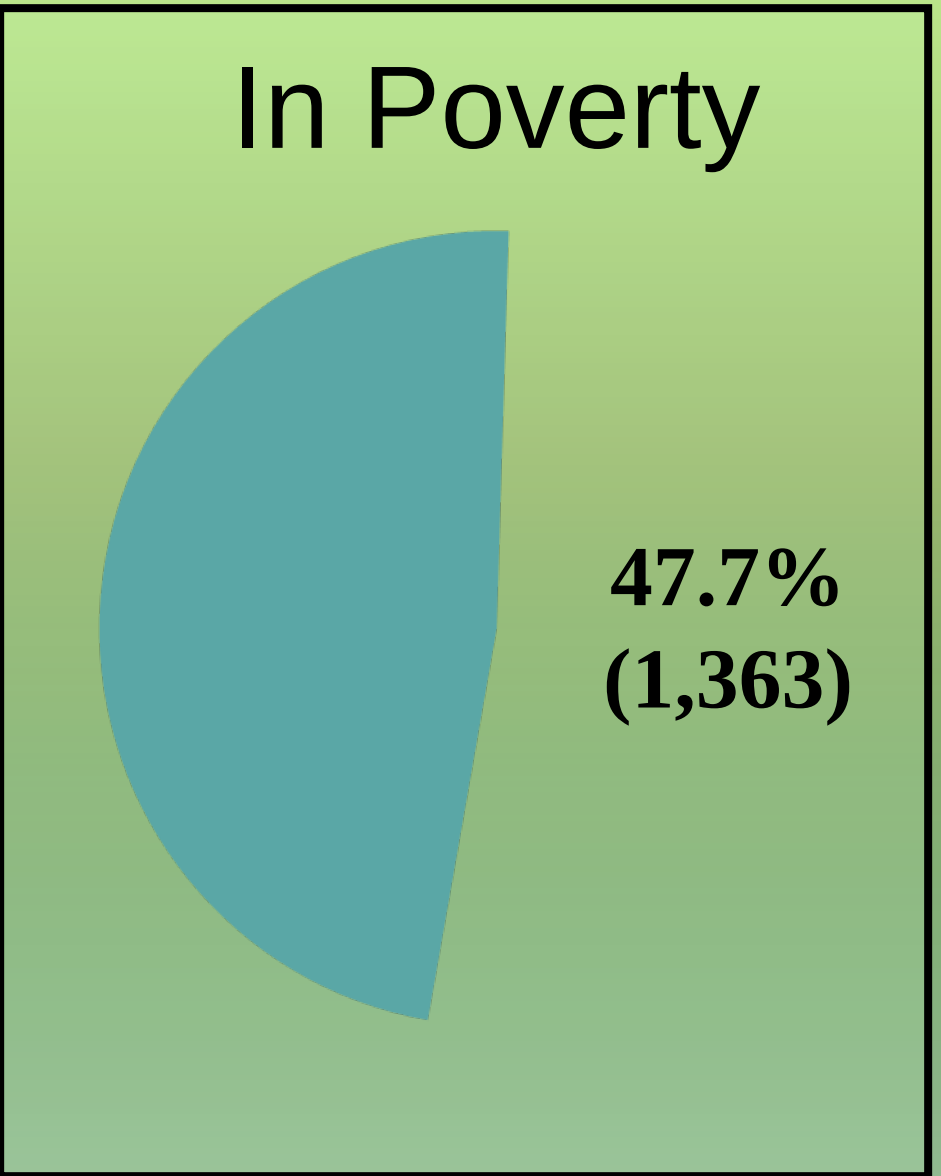
7-4-13

Poverty - Individual
(n=2,861)



Poverty & Race - Individual
(n=2,861)

In Poverty

47.7%
(1,363)

Black Race

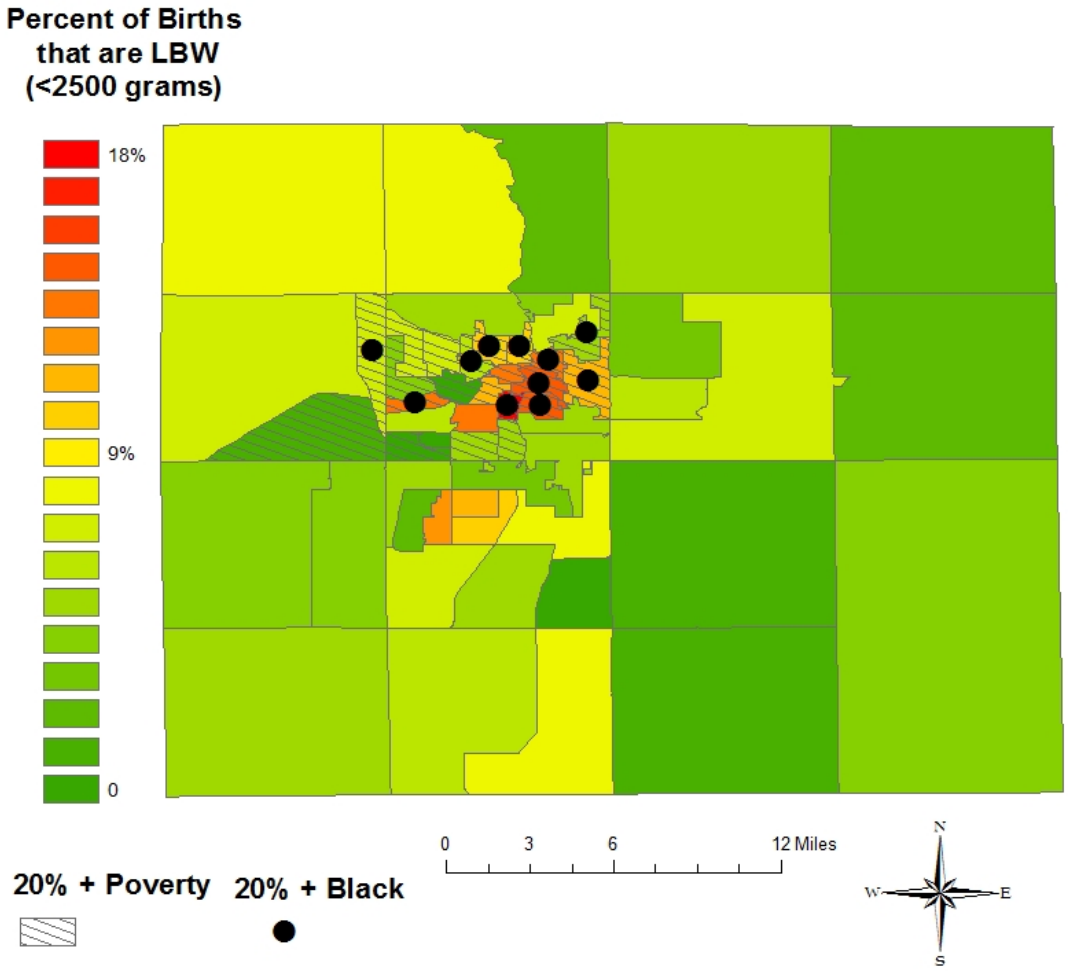
19.2%
(550)

Poverty & Race - Individual
(n=2,861)

Black & Poor

Mapping LBW with Poverty and Black Race:

Prevalence of Low Birth Weight Infants, Kalamazoo County MI Census Tracts, 2010



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U.S. Census Bureau, 2010

Created by Cathy Kothari
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RESULTS: Predicting Birth Weight

Hierarchical Linear Modelling of Individual Birth Weight

		Null
Intercept		3,330
Fixed Effects: Community	CT-High Black CT-High Poverty	
Fixed Effects: Individual	Indiv – Black Race Indiv - Poverty	
Random Effects	Commun variance	3,400
	Individual variance	359,137**
Model Fit	AIC	44,733

HLM – Adding Community Predictors

		Null	Model 1
Intercept		3,330	3,216
Fixed Effects: Community	CT-High Black		-114**
	CT-High Poverty		-33
Fixed Effects: Individual	Indiv – Black Race		
	Indiv - Poverty		
Random Effects	Commun variance	3,400	911
	Individual variance	359,137**	358,555**
Model Fit	AIC	44,733	44,694

HLM – Adding Individual Race to Community Race

		Null	Model 1	Model 2
Intercept		3,330	3,216	3,100
Fixed Effects: Community	CT-High Black		-114**	-64**
	CT-High Poverty		-33	
Fixed Effects: Individual	Indiv – Black Race			-222**
	Indiv - Poverty			
Random Effects	Commun variance	3,400	911	0
	Individual variance	359,137**	358,555**	352,786**
Model Fit	AIC	44,733	44,694	44,641
				No conv.

HLM – Adding Individual Poverty

		Null	Model 1	Model 2	Model 3
Intercept		3,330	3,216	3,100	3,184
Fixed Effects: Community	CT-High Black		-114**	-64**	-73**
	CT-High Poverty		-33		
Fixed Effects: Individual	Indiv – Black Race			-222**	
	Indiv - Poverty				-167**
Random Effects	Commun variance	3,400	911	0	0
	Individual variance	359,137**	358,555**	352,786**	353,487**
Model Fit	AIC	44,733	44,694	44,641	44,601
				No conv.	No conv.

HLM – Adding Both Individual Race & Poverty

		Null	Model 1	Model 2	Model 3	Model 4
Intercept		3,330	3,216	3,100	3,184	3,099
Fixed Effects: Community	CT-High Black		-114**	-64**	-73**	-30
	CT-High Poverty		-33			
Fixed Effects: Individual	Indiv – Black Race			-222**		-174**
	Indiv - Poverty				-167**	-127**
Random Effects	Commun variance	3,400	911	0	0	0
	Individual variance	359,137**	358,555**	352,786**	353,487**	349,804**
Model Fit	AIC	44,733	44,694	44,641	44,601	44,561
				No conv.	No conv.	No conv.

RESULTS: Predicting Birth Weight & Assessing Spatial Clustering

Spatial-Adjacency Regression

(Bayesian Spatial Modeling with Conditional Autoregressive Priors)

Predictors of Census Tract LBW

	Median	Confidence Interval
Blacks >20%	0.71	0.05, 1.45*
Poverty > 20%	-0.15	-0.93, 0.40
tau	0.85	0.01, 2.79
rho	0.45	0.03, 0.93

*Statistically Significant at 95% confidence level

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tau	0.85	0.01, 2.79
rho	0.45	0.03, 0.93

*Statistically Significant at 95% confidence level

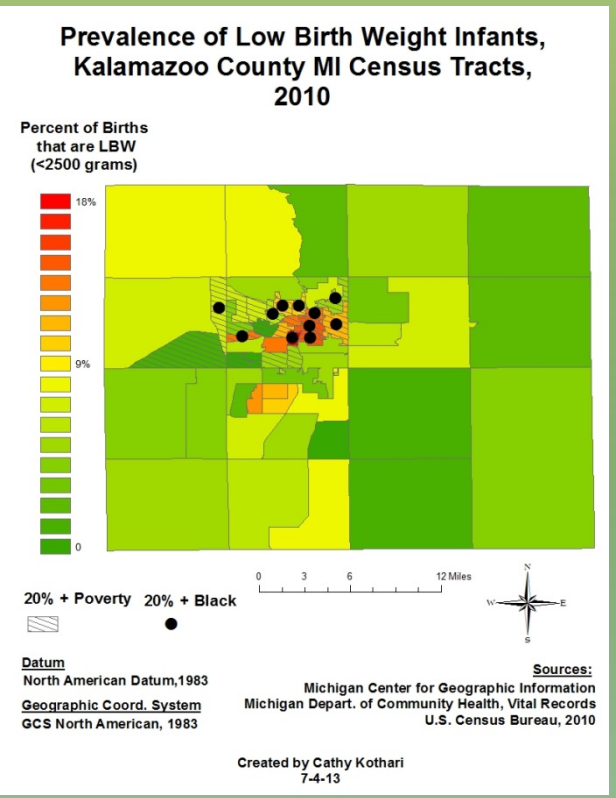
Acceptance rate: 35.7%

Study Limitations

- **Unit of analysis may not represent meaningful community boundaries**
- **Small census tract sample size**
- **Predictor measures are very broadly defined**
- **May be missing variables that confound or mediate the relationship between race, poverty and health**
- **Individual and community-level race (and poverty) may be too interrelated to tease apart their independent contributions to health**

Summary

- **Black race, poverty and low-birth-weight are highly correlated**
  - Within individuals and within communities
  - Illustrated by spatial clustering as well as statistical significance
    - With the tightest, strongest cluster in the urban core of the county
    - But a potential second cluster of LBW communities in areas marked by neither poverty nor higher black residency



Summary - Tentative

- Race appears to be a better predictor of LBW than poverty
- An individual's own circumstances (i.e., their race and their poverty) more strongly predicts LBW than the characteristics of the community in which they live
- Living in a more concentrated Black community is associated with additional LBW risk, when considered with either individual race or poverty alone
    - But an individual's race and poverty-status, together outweigh any community risk
- Given how deeply intertwined these risk factors are at the individual and community level, it is very difficult to isolate relative risk of race and poverty, at the individual or the census tract levels

THANK YOU!!!

QUESTIONS ?