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Social and Economic Determinants of Infant Ill Health in 159 Georgia Counties: A Comparison Study

Angela Peden

Jiann-Ping Hsu College of Public Health
Georgia Southern University

ⁱ Alison Scott

Jiann-Ping Hsu College of Public Health
Georgia Southern University

John G. Peden

Department of Hospitality, Tourism, and
Family & Consumer Sciences
Georgia Southern University

ABSTRACT

Prematurity and low birth weight (LBW) are important causes of infant morbidity in Georgia and the United States. Georgia county-level data were used to explore the relationships between prematurity and LBW and two social and economic determinants of health: race and poverty status. Spearman rank correlations and Friedman and Wilcoxon signed rank tests were used. Prematurity and LBW were positively associated with poverty status and the presence of large African American populations. While causation cannot be inferred from correlative data, this analysis highlights the need to consider the role of social and economic factors in infant morbidity. It also highlights the need to target interventions and services to geographic areas most in need.

INTRODUCTION

Prematurity and low birth weight (LBW) are major causes of infant morbidity and mortality in Georgia and the United States (MacDorman & Mathews, 2008). Prematurity was defined as a birth before 37 weeks gestation (Boatright, 2008; Martin, Hamilton, Sutton, Ventura, Menacker, Kirmeyer, & Mathews, 2009), and LBW is defined as a birthweight less than 2,500 grams, or approximately 5.8 pounds (Boatright, 2008; Martin et al., 2009). Premature birth is the leading cause of death in the first month of life in the U.S., and LBW infants are 40 times more likely to die than full-term infants (Gaylord, Greer, & Botti, 2008; March of Dimes, 2008). Prematurity and LBW also are associated with numerous health complications in infants including cerebral palsy, autism, mental retardation, vision and hearing impairments, and other developmental disabilities (U.S. Department of Health and Human Services [USDHHS], 2000). In addition, these conditions in infancy have been associated with increased risk of health problems later in life, including coronary artery disease, chronic hypertension, type II diabetes mellitus, obesity, and increased cholesterol (Gaylord et al., 2008).

Despite medical advances, prematurity and LBW are on the rise. The 2008 National Vital Statistics Report (NVSR) revealed a national LBW rate of 8.3% , the highest level in four decades (Martin et al., 2009). This document also reported that 12.8% of U.S. births were premature, up by 20% since 1990 (Martin et al., 2009) and not reaching the *Healthy People 2010* goal of 7.6% (USDHHS, 2000). This statistic has earned the U.S. a "D" grade on the March of Dimes *Premature Birth Report Card* (2008), which uses NVSR data in conjunction with *Healthy People 2010* goals to assign national and state 'grades' with regard to prematurity. The State of Georgia received an "F" on this report card with a preterm birth rate even higher than the national rate. Fourteen percent of Georgia babies were born premature in 2006, ranking Georgia 39th in the U.S. (OASIS, 2009, March of Dimes, 2008). Georgia had a LBW rate of 9.6%, 1.3 percentage points higher than the national rate (OASIS, 2009). These statistics

highlight the need to understand factors related to prematurity and LBW, and to develop innovative strategies to reduce prematurity and LBW in Georgia and the U.S. as a whole.

This study examined the associations of race and poverty with prematurity and LBW in Georgia. The analysis was informed by a *social determinants of health* theoretical perspective, which posits that social categories, conditions, and experiences shape the health of communities and community members (Marmot & Wilkinson, 2006). In this case, ecological data at the county level were used to assess associations of poverty and race with infant morbidity. Specifically, it was asked whether race and poverty are associated with 1) infant prematurity and 2) low birth weight in Georgia counties. Also of interest was whether low birth weight and prematurity rates vary significantly by race within Georgia counties. Answering these questions could provide information about the distribution of prematurity and LBW amongst social and economic groups within Georgia. This analysis asks: Are counties that are poorer and that have higher proportions of minority residents suffering a disproportionate burden of infant morbidity?

BACKGROUND

Previous studies have shown infant morbidity to be affected by a number of social and economic factors, including race, educational attainment, insurance status, poverty status, and access to prenatal care (Colen, Geronimus, Bound, & James, 2006; Gaylord et al., 2008; Guillory, Samuels, Probst, & Sharp, 2003; Kaufman, Dole, Savitz, & Herring, 2003; MacDorman & Mathews, 2008). These factors act in concert; therefore, studies often simultaneously researched multiple factors and their effects on infant morbidity measures (Guillory et al., 2003; Kaufman et al., 2003; Savitz et al., 2004). For example, Luo, Wilkins, and Kramer (2006) found that both lower levels of maternal education and neighborhood income were associated with elevated risk of preterm birth.

This study focused on the factors of poverty and race status. It consistently has been found that low-income women have premature and LBW infants at higher rates than higher-income women (Finch, 2003; Teberg, 1989). Astone, Misra, and Lynch (2007) found that low maternal socioeconomic status (SES) across the lifespan, as well as during pregnancy, had a negative effect on birthweight. In an additional poverty exposure study, Collins, Wambach, David, and Rankin (2008) reported that lifelong residence in low-income neighborhoods was a risk factor for low birth weight among non-Latino White and African-American women independent of age, education, parity, and prenatal care usage.

Racial disparities in birth outcomes have been found consistently as well (Colen et al., 2006; Martin et al., 2009). The most recent NVSR found 2006 LBW rates for Non-Hispanic Blacks to be 11.85%, over twice the rate of Non-Hispanic Whites (5.37%) (Martin et al., 2009). Preterm birth rates for Non-Hispanic Blacks in 2006 were 18.5% versus 11.7% for Non-Hispanic Whites (Martin et al., 2009). Effects of race may function independently of SES. Colen et al. (2006) studied black and white women who grew up in poverty. White women who experienced upward socioeconomic mobility had a 50% decreased risk of having a low birth weight baby; black women did not exhibit the same beneficial effects of an increase in SES (Colen et al., 2006). An additional study found an association between neighborhood poverty and very preterm births for blacks, but not for whites or Hispanics (Reagan & Salsberry, 2005).

This study examined whether race and poverty status of Georgia county residents is correlated to county levels of prematurity and LBW. Such an ecological analysis provides insight into the distribution of infant morbidity amongst Georgia counties, and social and economic factors that may play a role.

METHODS

All data except prematurity data by race were obtained from the 2008 *Georgia County Guide* (GCG) (Boatright, 2008). The prematurity by race data were collected from the Online Analytical Statistical Information System (OASIS) maintained by the Georgia Department of Human Resources (OASIS, 2009). The GCG is a compilation of data from a variety of primary sources, gathered and organized by The University of Georgia Cooperative Extension. The GCG contains agricultural, economic, demographic, and public health data for the state of Georgia as well as its 159 counties. Data were reported at the county level. The GCG is intended as a reference for planners, developers, and policy makers and the author encourages public use of the data. As such, this study was reviewed by the Georgia Southern University Institutional Review Board and found to be exempt from human subjects review.

LBW and prematurity data were found in the Vital Statistics section of the GCG. Both were defined according to standard definitions and statistics were reported as counts, rates, and percentages for each county. Natality information in the GCG was collected from the Georgia Vital Statistics Reports, 1996-2005, and the OASIS Web Query maintained by the Georgia Department of Human Resources (GDHR), Division of Public Health. Data were reported in counts and percentages and also collected by the GDHR. Race data were found in the Population section and reported in counts and percentages. Poverty status data were found in the Economic Section and defined as the number of families in a county living below the 2004 average poverty threshold for a family of four (\$19,307). Data were reported in counts and percentages. Both race and poverty data were collected by the U.S. Census Bureau.

Data were entered into an Excel spreadsheet and then uploaded into SPSS, Version 16.0 for analysis. Nonparametric testing was used due to the non-normal distribution of the data. Spearman Rank Correlations were used to determine associations between the infant morbidity measures (LBW and prematurity) and the social and economic determinants (race and poverty status). The Friedman and the Wilcoxon Signed Ranks Tests were used to determine if rates of LBW varied significantly by race.

RESULTS

All 159 Georgia counties were included in this study; GCG data was collected between 2004 and 2006. On average, one in seven births in each Georgia county was premature (a mean of 14.8% with a standard deviation of 4.2%). The mean rate of LBW by county was 9.93% (with a standard deviation of 3.51%), meaning that in the average Georgia county one in eleven infants was born LBW. Means and standard deviations of the social and economic determinants studied are reported in Table 1. On average, Georgia counties had roughly one-sixth of their residents living below the poverty line. On average 70% of county residents were white.

Table 1: Mean proportions of Georgia County Residents by Race and Living Below the Poverty Line

	Mean (%)	Standard Deviation (%)
Race: White	70.1	17.2
Race: Black	27.8	17.2
Race: Hispanic	4.59	4.80
Poverty status	16.6	4.78

Spearman rank correlations between race and prematurity within the State of Georgia were conducted. Whites and Hispanics exhibited a negative association, while the correlation between Blacks and prematurity was positive (Table 2). In other words, counties with a higher proportion of African American residents tended to exhibit higher levels of prematurity; counties with higher proportions of whites and Hispanics tended to have lower prematurity rates. Poverty status exhibited a significant positive association with prematurity, indicating that counties with large numbers of poor residents also experienced high rates of infant prematurity (Table 2). All correlations were significant at $\alpha \leq .05$.

Table 2: Spearman Rank Correlations between 1) Race and 2) Poverty Status and Prematurity

	Black	White	Hispanic	Poverty status
Prematurity	.514**	-.497**	-.228**	.523**

**Correlation is significant at the 0.01 level (2-tailed).

Spearman rank correlations also were used to examine associations between the social determinants and LBW. Correlations between race and rates of LBW in the state of Georgia were significant at $\alpha \leq .05$ (Table 3). The results were similar to those seen above. Whites and Hispanics exhibited a negative association, while the correlation between blacks and LBW was positive. This association is significant at the 0.01 level among whites and blacks and significant at the 0.05 level among Hispanics. Therefore, counties with large African American populations were likely to have high rates of LBW, whereas white and Hispanic populaces translated to lower LBW rates. Once again, poverty status was positively correlated with infant morbidity; LBW increased as poverty levels increased (Table 3).

Table 3: Spearman Rank Correlations between 1) Race and 2) Poverty Status and LBW

	Black	White	Hispanic	Poverty status
LBW	.554**	-.545**	-.179*	.435**

**Correlation is significant at the 0.01 level (2-tailed).

*Correlation significant at the 0.05 level (2-tailed).

The Friedman test revealed a significant difference between rates of prematurity by race in the State of Georgia. Wilcoxon signed ranks tests between comparison groups were significant at $\alpha \leq .05$. Prematurity percentages were significantly higher among blacks than whites. However, prematurity percentages were significantly lower among Hispanics than both blacks and whites (Table 4).

Table 4: Wilcoxon Signed Ranks Test Examining Prematurity by Race

	Ranks	Mean Rank	Sum of Ranks	Z	P
Prem. B – Prem. W	Negative Ranks	62.25	1743.00	-	.000
	Positive Ranks	67.64	7035.00	6.010 ^a	
Prem. H – Prem. W	Negative Ranks	48.87	2932.00	-	.000
	Positive Ranks	31.12	809.00	4.571 ^b	
Prem. H – Prem. B	Negative Ranks	45.03	3467.00	-	.000
	Positive Ranks	23.50	188.00	7.184 ^b	

a. Based on negative ranks.

b. Based on positive ranks

The Friedman test revealed a significant difference between rates of LBW by race in the State of Georgia. Wilcoxon signed ranks tests between comparison groups were significant at $\alpha \leq .05$. LBW rates were significantly higher among blacks than whites. However, LBW rates were significantly lower among Hispanics than both blacks and whites (Table 5).

Table 5: Wilcoxon Signed Ranks Test Examining LBW by Race

	Ranks	Mean Rank	Sum of Ranks	Z	P
LBW B – LBW W	Negative Ranks	65.13	1693.50	-7.901 ^a	.000
	Positive Ranks	81.75	10709.50		
LBW H – LBW W	Negative Ranks	81.50	9372.00	-6.342 ^b	.000
	Positive Ranks	63.39	2409.00		
LBW H – LBW B	Negative Ranks	80.41	10775.50	-8.898 ^b	.000
	Positive Ranks	52.92	1005.50		

a. Based on negative ranks.

b. Based on positive ranks.

DISCUSSION

This study found that in 2005 in the average Georgia County almost 15% of all births were premature, 2% higher than the national average. Almost 10% of births were LBW in the average county, 1.6% higher than the national average.

This study found significant associations between race and both measures of infant morbidity, which is consistent with national data showing racial inequalities in prematurity and LBW (Colen et al., 2006; Martin et al., 2009). Counties with larger African American populations were found to

have higher rates of prematurity and LBW, in concordance with the latest NVSR national data (Martin et al., 2009). White and Hispanic populations were associated with lower rates of both prematurity and LBW. This is in disagreement with state and national data reporting higher rates of LBW among Hispanics than whites (Boatright, 2008; Martin et al., 2009), and recent increases in LBW and prematurity amongst Hispanics (Martin et al., 2009). The GCG reported a LBW rate of 0.0 for Hispanics in 74 counties; in addition, OASIS had a significant number of counties (58) for which null data was reported for Hispanics, implying that fewer than four cases had been reported. This may be the result of small Hispanic populations and numbers of births in these counties, or of unreported cases. This may have impacted the validity of this piece of the analysis.

Significant positive associations were found between poverty status and both measures of infant morbidity. In other words, counties with larger populations of those living below the poverty line exhibited significantly higher rates of prematurity and LBW. This is in agreement with other studies that have shown that poor women are more likely to have poor birth outcomes (Dobie et al., 1998).

Limitations of this study include the use of ecological data, which does not allow inference at the individual level; however, county-level analysis is useful for policymaking and planning measures, as well as for targeting interventions, and can demonstrate important relationships amongst social groups and health issues. Second, the analyses conducted here were correlative, so causative relationships cannot be assumed. Further work is needed to tease out the complex pathways linking poverty, race, and poor birth outcomes in Georgia. Third, this study relied upon secondary data analysis of the GCG and OASIS; gaps in surveillance and reporting cannot be ruled out. Fourth, this study focused on only two social indicators: race and poverty status. The importance of other factors such as education, maternal age, access to and quality of prenatal care, and physician to patient ratios should be investigated as well.

Despite new and improved public health programming, infant morbidity rates continue to rise. Focusing on social determinants of prematurity and LBW in Georgia is a holistic approach for examining the conditions that create risk. This is in line with a *lifelong* approach to prenatal care. Gaylord et al. (2008) argued that focusing only on a nine-month pregnancy to reduce infant morbidity “cannot erase the influence of years of social, economic and emotional distress and hardship” (p. 94). Research is elucidating the links amongst poverty, race, and poor health outcomes like premature delivery and LBW. Many researchers have argued that “weathering” effects of chronic stress related to poverty, discrimination, and other social experiences contribute to multiple morbidities (Spence & Eberstein, 2009). Physiological pathways between social and economic stressors and ill health have been elucidated (Leonard, 2006; Johnson & Rn, 2006). Prematurity and LBW are complex issues with a complex array of causes, and these causes are social as well as individual. In Georgia, the Division of Public Health supports programs such as *Babies Born Healthy* and *Babies Can’t Wait* (Georgia Department of Human Resources [GDHR], 2009a). *Babies Born Healthy* provides prenatal care for low income, uninsured, and underinsured women (GDHR, 2006); the *Babies Can’t Wait* program focuses on early intervention for children with complications due to poor birth outcomes, such as developmental delays or disabilities (GDHR, 2009b). These programs work with pregnant women to minimize the impact of poor birth outcomes. A better understanding of the social determinants of infant morbidity will help Public Health professionals address premature birth and LBW long before a baby is at risk.

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ⁱ COORESPONDING AUTHOR: Jiann-Ping Hsu
College of Public Health, Georgia Southern University, P.O. Box 8015, Statesboro, GA 30460-8015. VOX: 912-478-5079; FAX: 912-681-5811; e-Mail: ascott@georgiasouthern.edu