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STILLBIRTHS IN THE STATE OF GEORGIA:
A STUDY OF THE SOCIAL AND ECONOMIC DETERMINANTS OF
THE OCCURRENCE OF STILLBIRTHS
IN GEORGIA COUNTIES FROM 1994 TO 2006

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An abstract of
A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
in partial fulfillment of the requirements for the degree of
Master of Science in Public Health
in Epidemiology
2011

Abstract

STILLBIRTHS IN THE STATE OF GEORGIA: A STUDY OF THE SOCIAL AND ECONOMIC DETERMINANTS OF THE OCCURRENCE OF STILLBIRTHS IN GEORGIA COUNTIES FROM 1994 TO 2006

BY ROBERT A. BROWN

PURPOSE: To examine the effects of area-level social and economic factors upon the occurrence of stillbirths in the counties of the state of Georgia from 1994 to 2006.

METHODS: The study is an ecological, over time study of fetal death and birth data of the counties in Georgia. Fetal death and live births data were requested from the Office of Health Indicators for Planning of the Department of Community Health, Georgia Department of Human Resources, Division of Public Health. These data were merged with census and racial residential segregation data from census data sources and the Population Studies Center of the University of Michigan. Stillbirths were selected from the fetal death data, having gestation of greater than or equal to twenty weeks. Non-Hispanic black and white mothers were selected for analysis from the fetal death and live births data. Multivariate logistic regression was used to estimate the odds of having a stillbirth among the black and white mothers of Georgia counties, controlling for their individual-level attributes. The study examined 1,419,767 birth outcomes (12,114 stillbirths and 1,407,653 live births) from the counties of the state of Georgia.

RESULTS: The study sample included 4,748 stillbirths among white mothers and 7,366 stillbirths among black mothers. The results of the logistic regression revealed a twofold (aOR=2.05; 95% CI: 1.969, 2.143) higher odds of having a stillbirth among Georgia black mothers than the odds of having a stillbirth among Georgia white mothers. Residential segregation above the median was significantly associated with a decreased risk of stillbirth, after controlling for individual-level and other ecological variables.

CONCLUSIONS: This study revealed the much higher odds (OR: 2.05 to 2.07) of having a stillbirth among black mothers than the odds of having one among white mothers, controlling for other individual-level and contextual factors. These results speak to the enduring nature of race in shaping African Americans’ life chances, specifically for this study with regard to the viability of black infants.

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Infant mortality is generally regarded as a major indicator of the health of a nation's population. Infant mortality rates (IMRs) are commonly defined as the number of deaths of infants (one year of age or younger) per 1,000 live births in a geographic area. In the words of the pediatrician, William Nersesian, IMRs are "a barometer for the extent of economic and medical development in a country and how equitably all citizens share in that development (Nersesian, 1988: 373).[1]" For the United States, IMRs are an uncomfortably telling indicator, challenging its self-perception as the world's most developed democracy with the world's most influential and dynamic economy that provides equality and opportunity for all of its citizens. IMRs for the U.S. are considerably higher in comparison to other comparably developed nations: the US had an IMR of 6.3 infant deaths per 1,000 births in 2009, a rate which ranks it 45th out of the 224 nations surveyed in the CIA World Factbook.[2]

One of the main reasons underlying the relatively poor performance of the U.S. in the world rankings for IMRs is its historic strength in the economic, racial, ethnic, and geographic diversity of its population yet one that has been a challenge due to the inequitable treatment of many racial and ethnic groups throughout its history.[3] As shown by the following figure, IMRs for the major racial and ethnic groups have varied considerably for some time, with African

[1] Nersesian, W. Infant mortality in socially vulnerable populations. *Annual Review of Public Health*. 1988. 9:361-77.

[2] Singapore has the world's lowest IMR for any nation, at 2.31 infant deaths per 1,000 births in 2009. Central Intelligence Agency. Rank Order – Infant mortality Rate. The 2008 World Factbook. Washington, DC: Central Intelligence Agency, 2009. (https://www.cia.gov/library/publications/the-world-factbook/rankorder/2091rank.html). (Accessed April 8, 2009).

[3] (3A) Hogue, C. Class, race, and infant mortality in the United States. *American Journal of Public Health*. 1993(1):9-11; (3B) Wise, P. The anatomy of a disparity in infant mortality. *Annual Review of Public Health*. 2003. 24:341-62.

Americans experiencing IMRs consistently double those of non-Hispanic whites from 1995 to 2004:[4]

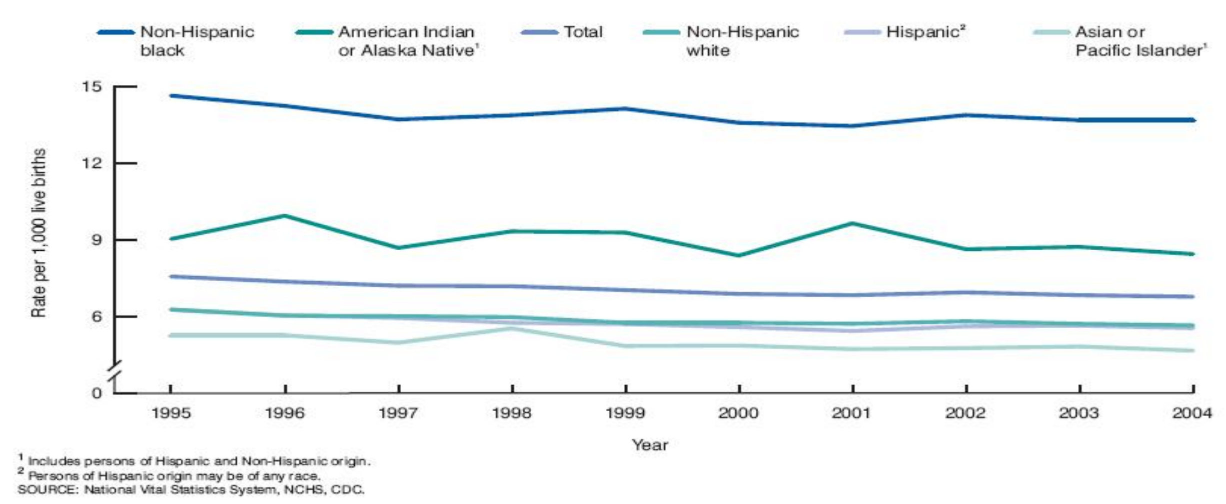

Figure 1. Infant mortality rates by race and ethnicity, 1995–2004

The United States also exhibits considerable variation in IMRs among its constituent states, as displayed by the following figure:[5]

[4] Mathews TJ, Menacker F, MacDorman MF. Infant mortality statistics from the 2002 period linked birth/infant death data set. National vital statistics reports; vol 53 no 10. Hyattsville, Maryland: National Center for Health Statistics. 2004. (http://www.nber.org/perinatal/2002/docs/lfrpt.pdf). (Accessed March 4, 2009).

[5] Ibid.

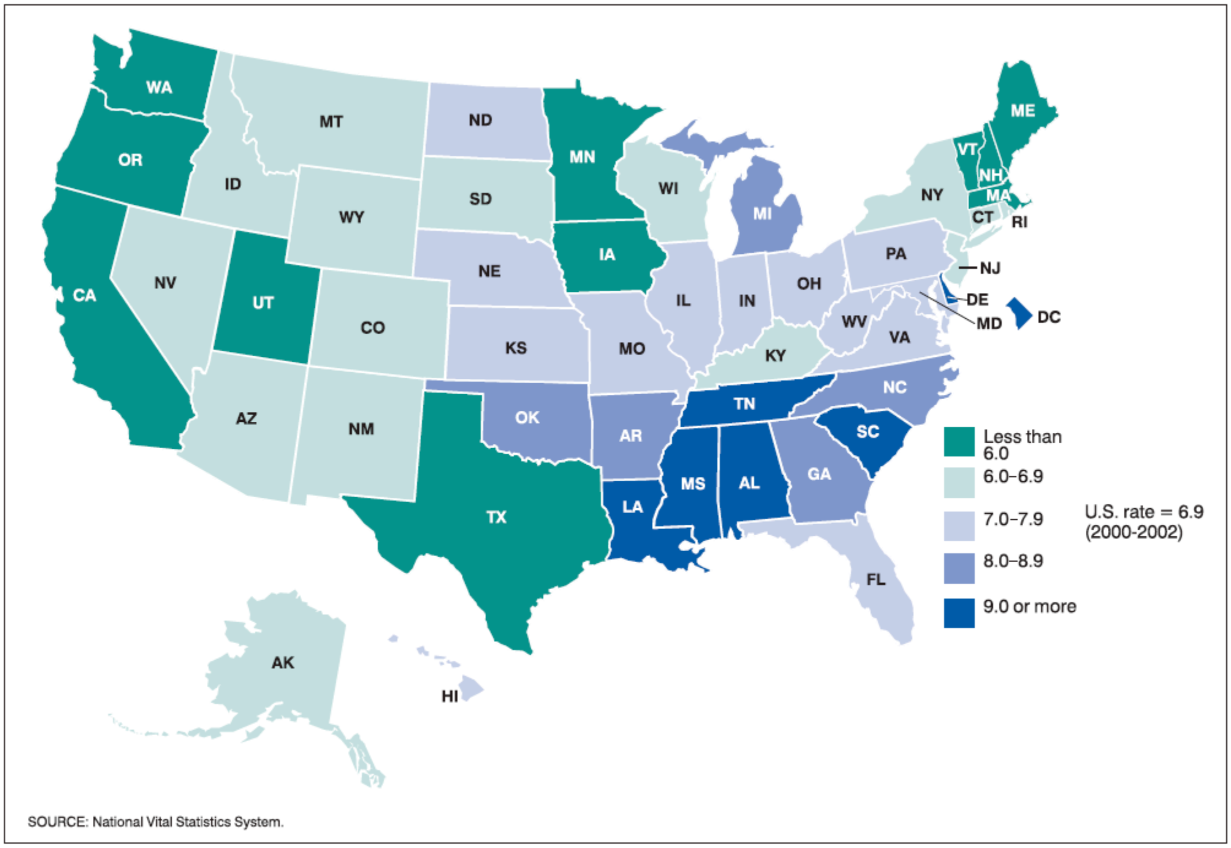

Figure 2. Infant mortality rates by State, 2000–2002

The southeastern region has the highest IMRs in the nation, in comparison to the nation's other regions. Unfortunately, IMRs in the South have been increasing among Whites and non-Whites over the past several years, as indicated by a graphic from the New York Times in the following citation (graphic removed from this thesis due to copyright regulations and inability to get permission): Eckholm E. In turnabout, infant deaths climb in the south. *New York Times*. April 22, 2007. (http://www.nytimes.com/2007/04/22/health/22infant.html?_r=1&sq=infant%20mortality&st=nyt&scp=19&pagewanted=all). (Accessed March 4, 2009).[6]

[6] Eckholm E. In turnabout, infant deaths climb in the south. *New York Times*. April 22, 2007. (http://www.nytimes.com/2007/04/22/health/22infant.html?_r=1&sq=infant%20mortality&st=nyt&scp=19&pagewanted=all). (Accessed March 4, 2009).

For this thesis, I intend to examine and analyze infant mortality (neonatal and postneonatal deaths) in the constituent counties of the state of Georgia from 1994 to 2006. Georgia has the seventh highest infant mortality rate among all of the states of the nation (8.5 infant deaths per 1,000 live births in 2004), with broad variation across its counties, from the lowest rate in Cherokee County (an IMR of 2.3 per 1,000 in 2006), to the highest one in Pierce County (an IMR of 18.2 per 1,000 in 2006).[7] It is interesting to note that Georgia with these figures has a range of IMRs rivaling Thailand (its IMR was 18.23 in 2008 and ranked 118th out of 222 by the CIA World Factbook) and Singapore (its IMR was 2.30 in 2008 and ranked the world's lowest out of 222 nations by the CIA World Factbook).[8] Racial background in Georgia makes quite a difference: White Georgians have an IMR of 7 deaths per 1,000 births in 2004, while Black Georgians have an IMR of 14.0 deaths per 1,000 births in 2004.[9]

RESEARCH OBJECTIVES, PROPOSED STUDY QUESTION, AND NULL HYPOTHESES

The specific research objectives of this study are:

(1) to ascertain whether socioeconomic and/or social factors determine stillbirths (fetal deaths with gestation equal to or greater than twenty weeks) for African Americans and white

[7] (7A) Georgia Department of Human Resources. Office of Communications. *Infant Mortality Fact Sheet*. February 2008. (http://www.dhr.georgia.gov/DHR/DHR_FactSheets/Infant%20Mortality%20Fact%20Sheet%202008.pdf). (Accessed March 4, 2009);
(7B) The Annie E. Casey Foundation. CLIKS: Community-Level Information on Kids. Infant Mortality Rankings for Georgia Counties, 2006. (http://www.kidscount.org/cgi-bin/cliks.cgi?action=rank_results&subset=GA&areatype=county&indicatorid=2000&expand=0&previewid=&year=2006&areaid=&Update+Ranking=Update). (Accessed March 4, 2009).

[8] Central Intelligence Agency. Rank Order – Infant mortality Rate. The 2008 World Factbook. Washington, DC: Central Intelligence Agency, 2009. (https://www.cia.gov/library/publications/the-world-factbook/rankorder/2091rank.html). (Accessed March 4, 2009).

[9] Georgia Department of Human Resources. Office of Communications. *Infant Mortality Fact Sheet*. February 2008. (http://www.dhr.georgia.gov/DHR/DHR_FactSheets/Infant%20Mortality%20Fact%20Sheet%202008.pdf). (Accessed March 4, 2009).

residents of the constituent counties of the state of Georgia and the racial disparity in infant mortality as well, and

(2) to ascertain whether socioeconomic and/or social factors determine stillbirths for the constituent counties of the state of Georgia.

In this study, I intend to examine how the exposure of various social and/or economic factors affects the occurrence of stillbirths (births=0; deaths=1) for African Americans and European Americans in all Georgia counties from 1994 to 2006, controlling for various confounding factors that might constitute alternative explanations.

My null hypotheses are as follows (from the following models):

H(null): B(SES*ij*)=0

H(null): B(SOCIAL*ij*)=0

Stillbirths (Birth=0; Stillbirths=1)*ij* = B(SES*ij*) + B(SOCIAL*ij*) + B(CONTROLS*ij*) + E*ij*[10]

My Theoretical Expectations:

1) Such economic factors as median household income for a county will be negatively associated with the occurrence of stillbirths for both Blacks and Whites across the counties and will be positively associated with greater disparities between the IMRs for the two groups.
2) Social factors such as a high index of racial residential segregation for a county will be positively associated with higher occurrence of stillbirths for both Blacks and Whites across the counties.

[10] Had to take out formal mathematic equation of the representation of the model, because of formatting issues in the submission of this thesis.

Infant mortality rates in the United States have decreased substantially over the past fifty years (see Figure 3 below on page 30), although they continue to be high relative to other developed nations, as I noted in the Introduction. For the United States, low birthweight is a major risk factor for infant mortality.[11] Yet, preterm birth continues to be "the most frequent cause of infant death in the United States, accounting for at least one third of infant deaths in 2002."[12] According to the classification scheme of the National Center for Health Statistics, the leading causes of infant mortality in the United States, were the following causes, according to percentage of all infant deaths: 1985 -- congenital anomalies, SIDS, RDS, short gestation, and maternal complications; 1991 -- congenital anomalies, SIDS, short gestation, RDS, and maternal complications; and 1996 -- congenital anomalies, short gestation, SIDS, RDS, and maternal complications.[13] However, as I also explained earlier (pages 4-5 of the Introduction), the relatively high infant mortality rate for the U.S. is probably due to the great diversity of Americans, with regard to race, ethnicity, geography, and socioeconomic status. Among the thirty member nations of the Organization for Economic Co-Operation and Development (OECD) including Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea, Luxembourg, Mexico,

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[11] Congressional Budget Office. CBO Staff Memorandum. Factors contributing to the infant mortality ranking of the United States. Washington, D.C.: Congressional Budget Office; 1992. (http://www.cbo.gov/doc.cfm?index=6219&type=0). (Accessed April 4, 2010), p. 2.

Additionally, the memorandum points out that "most of the decline in neonatal mortality (deaths of infants less than 28 days old) in the United States since 1970 can be attributed to increased rates of survival among low-birthweight newborns." It also notes that "comparisons with countries for which data are available suggest that low birthweight newborns have better chances of survival in the United States than elsewhere" (p. 2).

[12] Callaghan W, MacDorman M, Rasmussen S, et al. The contribution of preterm birth to infant mortality rates in the United States. *Pediatrics.* 2006; 118: 1566-1573.

[13] Sowards, K. What is the leading cause of infant mortality? A note on the interpretation of official statistics. *American Journal of Public Health*. 1999; 89(11): 1752-1754.

the Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Turkey, United Kingdom, and the United States of America -- a group of the world's major developed nations committed towards democracy and the market economy, the United States has consistently had the highest inequality level and poverty rate from the 1970s to the current time period, excepting Mexico and Turkey (See Figure 4 on page 31 below for a line graph comparing the Gini coefficient for the U.S. and the average Gini coefficient for OECD nations and a bar graph comparing the poverty rate for the U.S. and the average poverty rate for OECD nations).[14] The graphs clearly show that these economic indicators are considerably higher and worse for the United States in comparison with other OECD nations. And it can be plausibly concluded that these relatively poor economic indicators are related to the U.S.'s poor relative standing in infant mortality (see Figure 5 on page 31 below; the U.S. rate appearing just below the darkened arrow): the U.S. had an infant mortality rate of approximately 7 deaths per 1,000 live births in 2006, a rate about double the infant mortality rates of the general range from 1 to 3 deaths per 1,000 live births for most of the OECD nations, excepting Turkey, Mexico, Romania, Bulgaria, Latvia, and Chile.[15]

Given this general comparison between the United States and other developed nations, it is reasonable to examine how social factors influence infant mortality *within* the United States. Indeed, there is a very extensive research literature examining how social factors

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[14] Organization for Economic Co-Operation and Development. "Country Note: United States." Growing Unequal?: Income Distribution and Poverty in OECD Countries. © OECD, 2008, p. 1 (http://www.oecd.org/dataoecd/47/2/41528678.pdf) (Accessed April 25, 2011). These graphs are cited according to the following specifications: (http://www.oecd.org/document/56/0,3746,en_21571361_33915056_34508792_1_1_1_1,00.html) (Accessed April 25, 2011).

[15] Organization for Economic Co-Operation and Development. Social Policy Division. Directorate of Employment, Labour, and Social Affairs. "CO1.1: Infant Mortality." © OECD, 2010, p. 1. (http://www.oecd.org/dataoecd/4/36/46796773.pdf) (Accessed April 25, 2011).

(socioeconomic, demographic, and racial ones) influence infant mortality in the United States. An approach for discussing such a wide-ranging literature is to organize and categorize the literature into the following groups: socioeconomics-based; general analyses with groups of social variables; racially-based; racially-based analyses, focusing on racial residential segregation. A common feature of the general socially-based epidemiological literature examining the influence of social factors upon infant mortality and various important pregnancy outcomes associated with a higher risk of infant mortality (i.e., low birth weight, preterm birth, being small for gestational age) is an effort to use ecologically-based variables to measure how detrimental social factors create a harmful environment for expectant mothers.[16]

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[16] The notion of an urban miasma is a powerful metaphor for describing the harmful environment shaping the lives and health statuses of many mothers of color (See "Ghetto Miasma: Enough to Make You Sick" by Helen Epstein. New York Times. October 12, 3003. (http://www.nytimes.com/2003/10/12/magazine/ghetto-miasma-enough-to-make-you-sick.html?pagewanted=all) (Accessed April 1, 2010).

Epstein describes predominantly minority, urban environments in which the residents experience such major chronic diseases as asthma, heart disease, hypertension, diabetes at alarmingly higher rates – and often many diseases concurrently -- than the general American population. Additionally, Epstein writes, "Poor urban blacks have the worst health of any ethnic group in America, with the possible exception of Native Americans (p.1)."

Much of this literature appears to follow the major research effort in urban poverty scholarship examining "neighborhood effects" [See *Consequences of Growing Up Poor* (New York: Russell Sage Foundation; 1997) and *Neighborhood Poverty*, volumes I and II (New York: Russell Sage Foundation; 2000) edited by Jeanne Brooks-Gunn (http://ccf.tc.columbia.edu/jgbbio.html), Greg Duncan (http://www.northwestern.edu/ipr/people/duncan.html), and J. Lawrence Aber (http://steinhardt.nyu.edu/faculty_bios/view/J._Lawrence_Aber)] that occurred after the publication of the sociologist William Julius Wilson's very influential book, *The Truly Disadvantaged* (Chicago, IL: University of Chicago Press; 1987), which introduced his concept of social isolation – the idea that the urban poor has been socially isolated from mainstream American society and the socializing effect of its norms because of racial and economic segregation(p. 60). Social Isolation, as Wilson defines it, is "the lack of contact or of sustained interaction with individuals and institutions that represent mainstream society"(p. 60).

Wilson's idea of concentration effects is very relevant to this thesis, because of its idea that many societal ills and disadvantages are concentrated in the areas that many poor citizens live in. According to Wilson, his idea is a concept that reflects:

Socioeconomics-Based Analyses

The power of socioeconomics-associated variables is arguably with their interaction and association with other socially harmful variables (such as violent crime). Masi et al. use several measures together to measure economic disadvantage (percent with no high school education; presence of public housing; percent unemployed; median income below poverty line for a family of four in 1989), but discover that violent crime rate accounted for most of the negative association between economic advantage and birth weight.[17] Although economic disadvantage was a significant predictor of pregnancy outcomes, the authors conclude that "exposure to violent crime is a more proximal predictor of pregnancy outcomes than economic disadvantage."[18]

There have been at least two comprehensive critical reviews of the larger research literature examining the relationships between various economics-based measures (class, socioeconomic context, education) and health outcomes that have found articles discovering statistically significant relationships between a measure of socioeconomic context and pregnancy outcomes. Pickett and Pearl suggest that their 2001 review is the first comprehensive review to examine systematically the effects of local area-based socioeconomic measures upon health, asserting "to date the existing evidence has not been systematically reviewed." In their review of 25 studies, Pickett and Pearl cite two studies in which the authors found significant relationships

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> . . . The differences in the experiences of low-income families who live in inner-city areas from the experiences of those who live in other areas in the central city today, . . . The social transformation of the inner city has resulted in a disproportionate concentration of the most disadvantaged segments of the urban black population, creating a social milieu significantly different from the environment that existed in these communities several decades ago (Wilson, 1987; p. 58).

[17] Masi C, Hawkey L, Piotrowski Z, et al. Neighborhood economic disadvantage, violent crime, group density, and pregnancy outcomes in a diverse, urban population. *Social Science & Medicine.* 2007; 65(2007): 2440-2457.

[18] Ibid., p. 2450.

between socioeconomic variables (such as per capita income, unemployment rate, economic hardship, median rent, and education) and low birth weight.[19] In a review of thirteen studies that met their inclusion criteria of being published from 1990 to October, 2003 and of being studies examining the relationship between neighborhood effects and the health outcomes of children within high-income countries (such as Western European nations, the USA, Canada, and Australia), Sellstrom and Bremberg found four articles that focused on infants.[20] In a study of African American and White mothers, Sellstrom and Bremberg write that the authors found that among the African American mothers, mean birth weight decreased 13.1 g for each standard deviation increase in neighborhood economic disadvantage; there was a similar effect for White mothers but it was insignificant.[21] In another study that Sellstrom and Bremberg cite, their summary of the study's results noted, "The relationship between birth weight financial capacity category was inversely U-shaped, with the lowest birth weight in the most deprived and most wealthy local communities." The two other studies examining neighborhood effects and infant health outcomes reported the following results: violent crime was significantly related to birth weight (1 SD increase in violent crime was associated with 10.4 gram decrease in birth weight); women in areas with low per capita income had a significantly higher risk of having low-birth-weight children than did women in areas with high per capita income (OR=1.11).[22]

There have been several relatively recent studies that have specifically examined and found significant relationships between area-based, socioeconomic measures and unfavorable infant outcomes. Kruger, Munsell, Turner, and Franks examined the relationship between

[19] Pickett K and Pearl M. Multilevel analyses of neighborhood socioeconomic context and health outcomes: a critical review. *Journal of Epidemiology and Community Health.* 2001; 55: 111-122.

[20] Sellstrom E and Bremberg S. The significance of neighborhood context to child and adolescent health and well-being: a systematic review of multilevel studies. *Scandinavian Journal of Public Health.* 2006; 34: 544-554.

[21] Ibid., p. 547.

[22] Ibid.

deteriorated neighborhood structures and the density of premature and low birth weight births in Flint, Michigan; the authors used Geographical Information Systems to calculate the proportional densities of highly deteriorated residential structures, pre-mature (<37 weeks) singleton births, and low birth weight (<2500g) singleton births. Their analysis indicated the correlation between structural deterioration and pre-maturity was a little higher for Blacks (0.354) than it was for Whites (0.228); a similar comparison was apparent in the correlation between structural deterioration and low birth weight was a little higher for Blacks (0.336) than it was for Whites (0.026). Additionally, they concluded that Black births were overrepresented in areas with high structural deterioration: examining the births in their sample by area levels of deterioration, the authors found that 49% of the Black births were in the top 25% of areas with high structural deterioration and 20% of the Black births were in the top 5% of areas with high structural deterioration. For Whites, 22% of the births were in the 25% of areas with high structural deterioration while only 6% of the births were in the top 5% of areas with high structural deterioration.[23]

Noting that much of the past research examining low birth weight has tended to focus on individual-level risk factors rather than macrolevel social factors, O’Campo, et al. conducted a study using individual-level factors and such census-tract level social factors as the ratio of home owners to renters, unemployment rate, rate of housing violations, per capita crime rate, average wealth, and per capita income to examine two questions relevant to this study: “1) Are neighborhood-level variables directly related to an increase or decrease in risk of low birthweight?; and 2) Do individual-level risk factors for low birthweight behave differently

[23] Kruger, DJ, Munsell, MA, Turner, TM, and Franks, M. Building a healthy baby: neighborhood structural deterioration and birth health outcomes [PowerPoint presentation]. Presented at the Annual Meeting of the American Public Health Association, Philadelphia, PA, November 10, 2009.

depending on the characteristics of the neighborhood in which a woman resides?" [24] Their results reveal that women residing in census tracts with per capita income of less than $8,000 had a significantly higher risk of having a low birthweight baby than did women living in tracts with a per capita income of greater than $8,000.[25] Additionally, some census tract social variables were significant effect modifiers upon the relationships between the individual-level variables and the risk of having a low birthweight baby: for example, "the increased risk of low birthweight for women with low levels of education (OR = 1.15 in neighborhoods with average crime rates) is stronger (+) in high-crime than in low-crime neighborhoods."[26]

The effort to assess the effects of individual-level and area-level measures of socioeconomic status in some of the research examining the relationship between socioeconomic status and pregnancy outcomes is especially compelling because the research seeks to determine the important social and economic factors harmful to pregnancy outcomes – the factors associated with mothers as individuals versus those associated with where they live. In research over twenty years ago, Collins and David found that 1980 median income of a mother's census tract (their measure of "environmental deterioration") was associated with the proportion of low birthweight (LBW) babies in 1982 and 1983, with residence in low-income areas being associated with a greater risk of having a LBW baby. Their analysis revealed that the Black-to-White relative risk of having a LBW was consistently significant and just over 2.0 across all income categories, with the exception of the highest income category of median income greater than $40,000 per year in a census tract.[27] Collins and David write of the powerful influence of

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[24] O'Campo, P, Xue X, Wang M, and Caughy, MO. Neighborhood risk factors for low birthweight in Baltimore: a multilevel analysis. *American Journal of Public Health.* 1997; 87(7):1113-1118.
[25] Ibid., p. 1115.
[26] Ibid., p. 1116.
[27] Collins, J, David, R. The differential effect of traditional risk factors on infant birthweight among blacks and whites in Chicago. *American Journal of Public Health* 1990; 80(6): 679-681.

residence in resource-poor environments and the need to recognize it as an important risk factor for pregnancy outcomes in the following passage:

> Our data suggest that residential environment is an important risk factor that researchers need to take into account when examining the relation between race and neonatal outcome. Residing in a very low-income urban neighborhood is such a strong proxy of low birthweight for Blacks that traditional indicators of favorable outcome (education, age, marital status) fail to identify clearly a low risk subgroup. The intense concentration of extreme poverty combined with the related issues of disintegrating social networks, substance abuse, poor nutrition, smoking, and inadequate prenatal care may produce such a powerful negative force that isolated changes in the classical risk factors do not dramatically reduce the high percentage of low birthweight infants.[28]

An important distinction in the research examining the relationships between socioeconomic disadvantage and pregnancy outcomes is whether the authors included individual-level measures of socioeconomic status or area-level of socioeconomic factors. In a broad analysis of the fifty American states and their infant, neonatal, and postnatal mortality rates, Bird and Baumen discovered that a model of such structural variables as the proportion of a state's population that is Black in 1990, the education variables (the percentage of persons 25 years of age and over who were high school graduates or higher in 1990; the percentage of persons 25 years and over who had a bachelor's degree or higher in 1990), residential segregation as measured by five measures for 1990, the ratio of male to female median earnings in 1979, and the proportion of each state's population that was female was significantly associated with the 1989 infant mortality rate, the 1989 neonatal mortality rate, and the 1989 postneonatal mortality rate.[29] Additionally, their structural model accounted for a substantially higher proportion of the variation (R^2s from 0.506 to 0.645) in these rates than did a health services model (R^2s from 0.267 to 0.315) including such variables as the numbers each of

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The authors suggest that Black RR appeared to be eliminated at the highest income category (> $40,000: 0.98(95% CI: 0.13, 7.29), because of the small number of Blacks (200, or 0.4 percent) in their study.
[28] Ibid., p. 680.
[29] Bird, S, Bauman, K. The relationship between structural and health services variables and state-level infant mortality in the United States. *American Journal of Public Health* 1995; 85: 26-29.

physicians, obstetrician-gynecologists, pediatricians, and family practitioners providing care in 1990 per 100,000 civilian population in 1989; percentage of the civilian population under 65 years of age with no health insurance in 1989; proportion of resident live births having received delayed, late, or no prenatal care in 1988;number of abortion providers in 1985 per 100, 000 women of childbearing age; and proportion of the state's general expenditures spent on health, hospitals, and public welfare in 1990.

Bird examines the hypothesis whether there are separate structural models for Black and White infant mortality rates; she specifically tests whether "state-level structural variables relate differentially to states' black and white infant mortality rates."[30] Bird analyzes separate black and white multivariate models of infant mortality across the fifty American states, discovering that a state's proportion Black, a state's percent with bachelor's degree or higher, and a state's percent below poverty, and a state's level of residential segregation each exhibited a significant unique effect upon the black infant mortality model. Furthermore, her analysis reveals that percent with bachelor's degree or higher was the only structural variable that had a significant effect upon the white infant mortality model. She concludes there is a need for race-specific models of infant mortality.

One of the major ways that researchers have examined how race and its negative consequences affect health is by studying the effects of racial residential segregation upon Blacks' health outcomes. There is a very large literature examining these relationships. Kramer and Hogue have conducted probably the most exhaustive recent review of studies that have examined the relationship between residential segregation and health outcomes.[31] One of the very important points they make is that the test of racial residential segregation as an important

[30] Bird, S. Separate black and white infant mortality models: differences in the importance of structural variables. *Social Science and Medicine* 1995; 41(no. 11): 1507-1512.
[31] Kramer, M. and Hogue, C. Is segregation bad for your health? *Epidemiologic Reviews* 2009; 31: 178-194.

measure for epidemiologists is the biologic plausibility for understanding and explaining the negative health outcomes for the residents of highly segregated environments.[32] I believe this is an especially compelling point that links the residential segregation literature to studies examining the relationships between chronic stress, increased allostatic load, and subsequent negative health outcomes.[33] Finally, Arline Geronimus' idea of weathering, or the idea that "people's health reflects the cumulative impact of their experiences from conception to their current age" is a powerful one integrating these factors in attempting to explain the health disparities affecting many African Americans.[34]

I argue that these variables measuring important aspects of the social environment signify a common theme of the socially harmful contexts in which many Black people live, exist, and develop. The idea of an urban miasma (that I noted on page 18) is a powerful one suggesting the harmful environment affecting Black mothers' lives and their ability to bear healthy babies and increasing the prevalence of such chronic diseases as asthma, heart disease, hypertension, diabetes among African Americans. Wilson has pointed out that Blacks and Whites generally live in substantially different economic environments.[35] Blacks have a much higher likelihood of residing in areas of concentrated poverty whereas Whites have a much lower likelihood of living in areas of extreme poverty.[36] Bird examines whether there are different structural models

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[32] Ibid., p. 181.

[33] There is a burgeoning literature examining these connections: Dowd, J., Simanek, A., and Aiello, A. Socio-economic status, cortisol and allostatic load: a review of the literature. International Journal of Epidemiology 2009; 38:1297-1309; Pearlin, L., Menaghan, E., Lieberman, M., and Mullan, J. The stress process. *Journal of Health and Social Behavior* 1981; 22:337-356.

[34] Geronimus, A. and Thompson, J. To denigrate, ignore, or disrupt: racial inequality in health and the impact of a policy-induced breakdown of African American communities. *Du Bois Review* 2004; 1:247-279.

[35] Wilson, *The Truly Disadvantaged* (Chicago, IL: University of Chicago Press; 1987).

[36] Ibid., Wilson writes (p. 46):

> Whereas the total white population in the extreme-poverty areas in the five largest cities increased by 45 percent and the white poor population by only 24 percent, the total black population in these areas increased by 148 percent and the poor black population by 164 percent.

for Black infant mortality rates and for White infant mortality rates.[37] Her analysis reveals that "proportion Black, percent with bachelor's degree or higher, percent below poverty, and the index of dissimilarity each made a unique contribution to the black infant mortality model," while "percent with bachelor's degree or higher was the only measure that made a significant unique contribution to the white infant mortality model."[38] Especially telling are her results that poverty and racial residential segregation significantly affect black infant mortality rates. Wright discusses the idea of "socially toxic neighborhoods" in examining the high prevalence of asthma morbidity in minority neighborhoods and its correlations with high levels of violence and poverty.[39] Finally, Morello-Frosch builds upon the general idea of socially harmful environments with her notion of the "environmental 'riskscape'" The environmental 'riskscape' is a framework for integrating area-level and individual-based factors that serve to create substantial chronic stress for individuals and subsequently cause them to be more susceptible to "the toxic effects of pollution exposures."[40] My main argument is that there are socially harmful environments that have significant health and other (educational, economic, employment, and psychological) consequences for the Black residents living in them due to racial and economic discrimination.

[37] Bird, S. Separate black and white infant mortality models: differences in the importance of structural variables. *Social Science & Medicine.* 1995; 41(no. 11): 1507-1512.

[38] Ibid., p. 1507.

[39] Wright, R. Health effects of socially toxic neighborhoods: the violence and urban asthma paradigm. *Clinics in Chest Medicine.* 2006; 27: 413-42.

[40] Morello-Frosch, R. and Shenassa, E. The environmental "riskscape" and social inequality: implications for explaining maternal and child health disparities. *Environmental Health perspectives*. 2006; 114: 1150-53.

STUDY DESIGN

I developed a dataset of stillbirths in Georgia counties from 1994 to 2006 from data from Dr. Michael Kramer of Emory University and from the Division of Public Health of the Georgia Department of Community Health.[41] I have merged additional variables and data that I have discussed by using the website resource, *Georgia County Snapshots*, and other census, economic, or demographic websites.[42]

The variables to be studied are:

VARIABLE #	VARIABLE NAME	VARIABLE DESCRIPTION	TYPE
OUTCOME VARIABLE			
1	Stillbirths	Black and White, Non-Hispanic Stillbirths and Births for each county	1, 0 VARIABLE: 1= Stillbirth; 0=Birth

[41] Dr. Kramer obtained the data from the Fetal Death Record files for Georgia residents fetal deaths. Georgia Department of Human Resources, Division of Public Health, Office of Health Indicators for Planning of the Department of Community Health. Live Births data for Georgia residents. Georgia Department of Community Health, Division of Public Health.

[42] Georgia Department of Community Affairs. Georgia County Snapshots. 2006. (http://www.dca.state.ga.us/CountySnapshotsNet/default.aspx) (Accessed March 4, 2009).

Racial Residential Segregation Project. Population Studies Center, The University of Michigan. (http://enceladus.isr.umich.edu/race/downcounty.html) (Accessed March 11, 2010).

No.	Variable Name	Description of Variable	Variable Level	Type (Continuous/ Categorical)
Economic Variables (Independent Variables)				
2	MDHHINC	Median Household Income of a County, 1989 Dollars	Area-level	Categorical at the median of the variable: 1 – Higher than the median of $21,574; 0 – Lower than the median of $21,574
3	PCHSGRAD	% Persons in each County who are high school graduates or higher, 1990	Area-level	Categorical at the median of the variable: 1 – Higher than the median of 26.3%; 0 – Lower than the median of 26.3%

SOCIAL VARIABLES				
4	RESSEG00	Residential Segregation of Blacks and Whites in each County, 2000	Area-level	Categorical at the median of the variable: 1 – Higher than the median of 26.3; 0 – Lower than the median of 26.3
5	COUNTY_CAT	County Categories for the Social and Economic Variables	Area-level	Categorical: If the dichotomous variable is =1, then it is ‘high’; if the variable is =0, then it is ‘low’.
	1:'HI – INCOME, HI – SEGREGATION, AND HI -- HIGH SCHL GRAD' 2:'HI – INCOME, LO – SEGREGATION, AND HI -- HIGH SCHL GRAD' 3:'LO – INCOME, HI – SEGREGATION, AND HI -- HIGH SCHL GRAD' 4:'LO – INCOME, LO – SEGREGATION, AND HI -- HIGH SCHL GRAD' 5:'HI – INCOME, HI – SEGREGATION, AND LO -- HIGH SCHL GRAD' 6:'HI – INCOME, LO – SEGREGATION, AND LO -- HIGH SCHL GRAD' 7:'LO – INCOME, HI – SEGREGATION, AND LO -- HIGH SCHL GRAD' 8:'LO – INCOME, LO – SEGREGATION, AND HIGH SCH GRAD – LO'.			

NO.	**VARIABLE NAME**	**DESCRIPTION OF VARIABLE**	**VARIABLE LEVEL**	**TYPE (CONTINUOUS / CATEGORICAL)**
INDIVIDUAL-LEVEL VARIABLES (ATTRIBUTES OF THE MOTHERS AND THEIR BABIES)				
10	BLACK	Mother's racial group: Black or White	Individual-level	Categorical: (1=Black; 0=White)
14	MOM_AGE	Age of the Mother (12 to 48 years)	Individual-level	Categorical: 1 – 15 to 19 years; 2 – 20 to 29 years; 3 – 30 to 39 years; 4 – 40 and up.
15	MARRIED	Marital Status of the Mother	Individual-level	Categorical (1=Married; 0=Unmarried)
15	MARRIED	Marital Status of the Mother	Individual-level	Categorical (1=Married; 0=Unmarried)

ANALYTICAL METHODS

This thesis study is a secondary data analysis of maternal data linked with relevant census or other county-level data. All other data were obtained from State of Georgia websites, the U.S. Census website, and other pertinent websites or sources.

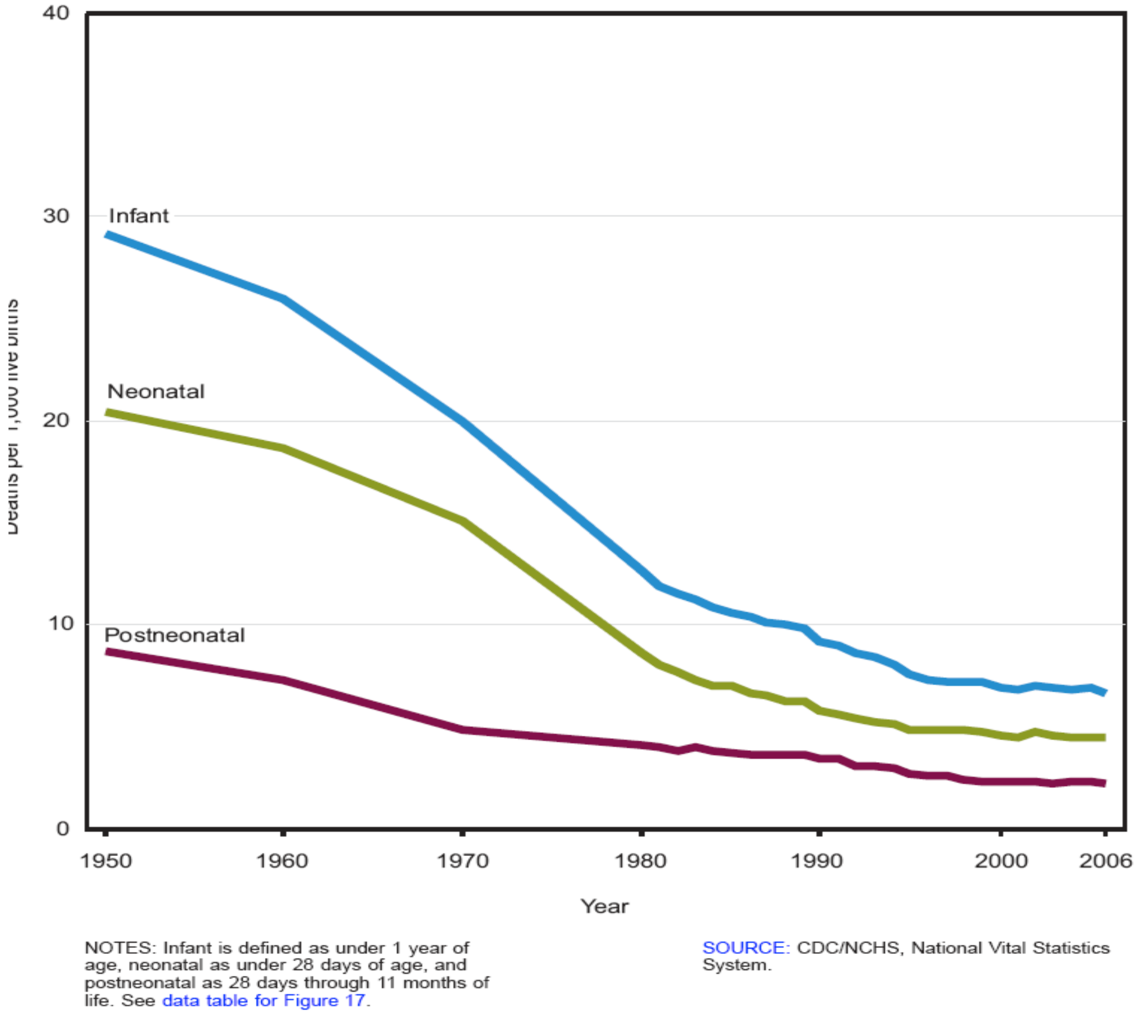
I prepared the data using SPSS 18.0. I performed all statistical analyses using Statistical Analysis Software (SAS) 9.2 at the Rollins School of Public Health, Emory University. The outcome variables are measured annually from 1994 to 2006. Independent variables will generally be time-independent since each birth outcome for each mother will only be measured once; however, there will be some time-dependent variables such as the county-level socio-economic status, social, and health variables. The cluster of the dataset will be the county. I analyzed using logistic regression (PROC LOGISTIC).

DATA LAYOUT

The data was organized as shown by the following table:

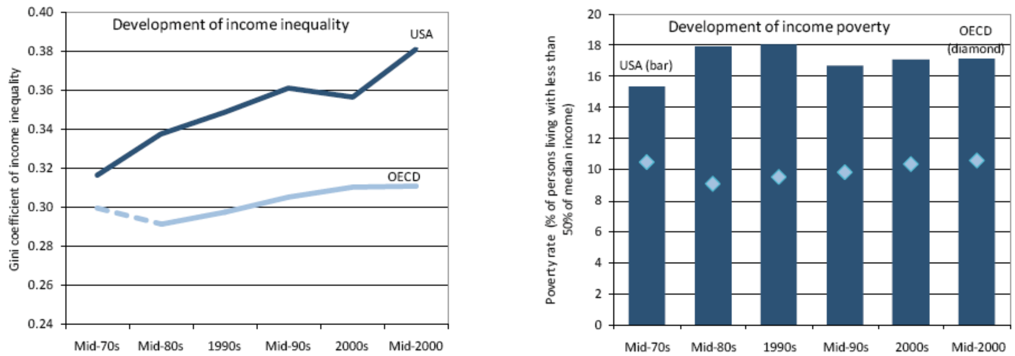
ID #	$YEAR_J$	$COUNTY_I$	$OUTCOME_{IJ}$	$RACE_{IJ1}$	MD_INCOM_{IJ2}	PC_BLACK_{IJ3}
1	**1994**	**DEKALB**	**1**	**BLACK**	**$35,000**	**.45**
2	**1994**	**DEKALB**	**0**	**ASIAN**	**$35,000**	**.45**
3	**1995**	**FULTON**	**0**	**WHITE**	**$44,000**	**.42**
4	**1995**	**FULTON**	**1**	**WHITE**	**$44,000**	**.42**
5	**1996**	**HENRY**	**0**	**BLACK**	**$28,050**	**.37**
6	**1996**	**HENRY**	**1**	**ASIAN**	**$28,050**	**.37**
. . .	**. . .**	**. . .**	**. . .**	**. . .**	**. . .**	**. . .**
7	**2006**	**HENRY**	**0**	**ASIAN**	**$47,000**	**.34**

Figure 3. Infant, Neonatal, and Postneonatal mortality rates, United States, 1950-2006.[43]



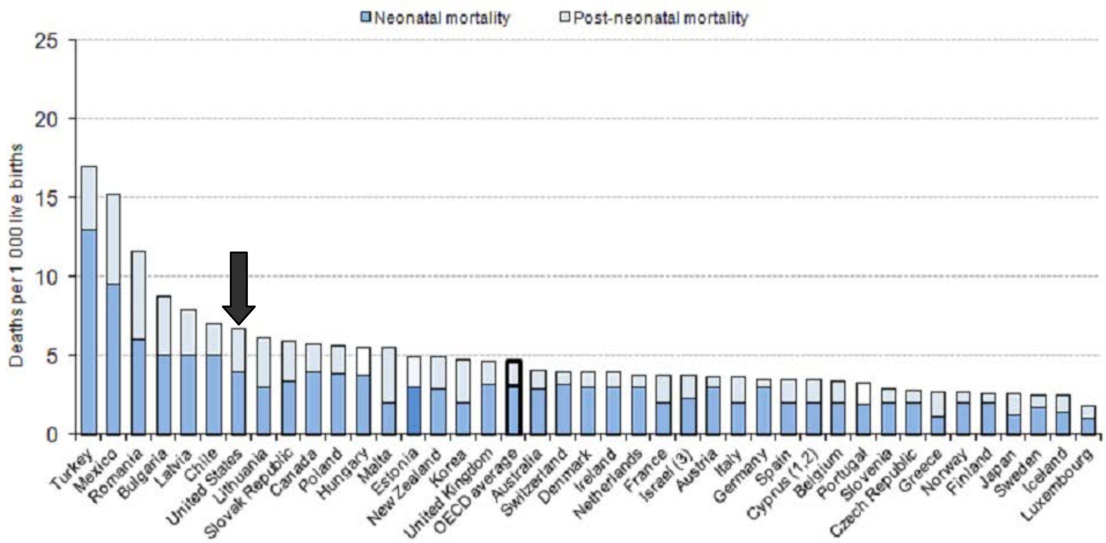
[43] National Center for Health Statistics. Health, United States, 2009: With Special Feature on Medical Technology. Hyattsville, MD. 2010. (http://www.cdc.gov/nchs/hus.htm) (Accessed March 27, 2010).

Figure 4. Line Graph Comparing the Gini Coefficient of the U.S. and the Average Gini Coefficient of the OECD Nations (Left Graph) and Bar Graph Comparing the Poverty Rate of the U.S. and the Average Poverty of the OECD Nations (Right Graph)[44]



Source: Growing Unequal? , OECD 2008. Income is disposable household income adjusted for household size.

Figure 5. Bar Graph Comparing the 2008 Infant Mortality Rate of the U.S. and the Infant Mortality Rates of the OECD Nations (Decomposition on Neonatal and Postneonatal Rates)[45]



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[44] Organization for Economic Co-Operation and Development. "Country Note: United States." Growing Unequal?: Income Distribution and Poverty in OECD Countries. © OECD, 2008, p. 1 (http://www.oecd.org/dataoecd/47/2/41528678.pdf) (Accessed April 25, 2011). These graphs are cited according to the following specifications: (http://www.oecd.org/document/56/0,3746,en_21571361_33915056_34508792_1_1_1_1,00.html) (Accessed April 25, 2011).

[45] Organization for Economic Co-Operation and Development. Social Policy Division. Directorate of Employment, Labour, and Social Affairs. "CO1.1: Infant Mortality." © OECD, 2010, p. 1. (http://www.oecd.org/dataoecd/4/36/46796773.pdf) (Accessed April 25, 2011).

DATA ANALYSIS OF STILLBIRTHS IN GEORGIA

Univariate Analysis

The univariate analysis was conducted using the *frequencies* command in SPSS 18.0 in order to examine the distributions of the individual-level variables, separately. Additionally, the univariate analysis was helpful in developing and recoding the indicator variables that were used for the social and economic data that were merged to the individual birth outcomes data.

Bivariate Analysis

The bivariate analysis was conducted using SAS 9.2 in order to examine their associations with stillbirths, separately. Chi-square analyses were performed to examine the associations between the individual-level variables and the occurrence of stillbirths as well as to estimate odds ratios for these associations.

Multivariate Analysis

The multivariate analysis was conducted using the *PROC LOGISTIC* command in SAS 9.2 in order to model the associations of the individual-level variables with predicting the probability of stillbirths. There are several multivariate analyses in this thesis, attempting to test different ways of examining the effects of social and economic variables upon stillbirths, while controlling for individual-level factors. First, after developing a set of county categories that categorized Georgia counties according to whether they had high or low racial residential segregation, high or low median household income, and high or low educational attainment. After the medians of these contextual variables were estimated, I developed indicator variables (for example, high or low residential segregation: 1=Higher than the median of 26.3; 0=Lower than the median of 26.3) using those medians as the division points for the variables. I used these variables to develop the county categories variables that I included in a logistic regression analysis. After an analysis in which virtually none of these variables were significant, I decided to include the indicator variables that helped to create the county category variables in a logistic regression analysis since they offered a more direct approach for testing the effects of social and economic factors upon stillbirths.

RESULTS

In the state of Georgia, during the years from 1994 to 2006, there was a total of 1,419,767 birth outcomes (stillbirths and live births) in the state, after selection of fetal deaths with gestation greater than or equal to twenty weeks. The following table shows the stillbirths and the births by year for the state of Georgia. There was an average of 932 stillbirths annually in Georgia during this period, along with an average of approximately 108,000 births annually in the state. There is a racial disparity in stillbirths among Black mothers in Georgia as the mean number of stillbirths among Georgia Black mothers is approximately 54% higher (46.3 stillbirths annually across Georgia counties) in comparison to a mean of about 30 stillbirths annually among Georgia White mothers (see Table 2 on pages 40-47).

In the bivariate analyses, the chi square analysis indicates that there is evidence to conclude that there is a statistically significant association between a mother's racial group and her odds of having a stillbirth. The OR is well over 2 (2.49; 95%CI: 2.40, 2.58); Black mothers in Georgia have nearly a 2.5 higher odds of having a stillbirth than White mothers in Georgia of having a stillbirth. Marital status was also statistically significant, as indicated by the chi-square test. Marital status is highly protective against a mother's odds of having a stillbirth; married mothers had a 0.47 (95% CI: 0.46, 0.49) lower odds of having a stillbirth than the odds of having a stillbirth among unmarried mothers. Younger age was also protective in that mothers of ages 15 to 19 years had a 0.814 (95% CI: 0.774, 0.856) lower odds of having a stillbirth than did mothers of ages 20 to 29. Additionally, the odds of having a stillbirth among mothers of ages 20 to 29 were not significantly different than the odds of having one among moms of ages 30 to 39; the chi-square test failed to indicate evidence for concluding that there was a statistically significant difference. The OR was 0.974, but the 95% CI of (0.934, 1.015) included 1, indicating that the odds of having a stillbirth among moms of ages 20 to 29 were similar to the odds of having one among mothers of ages 30 to 39. Finally, the chi-square value of 55.7 with a p-value of <.0001 indicated that there was a statistically significant association between age and the odds of having a stillbirth, among mothers of age 20 to 29 in comparison to those of age 40 and up. Mothers of age 40 and up had a 1.53 (95% CI: 1.37, 1.71) higher odds of having a stillbirth than mothers of age 20 to 29.

In the multivariate analyses, I used logistic regression to estimate models of individual-level variables of Georgia Black and White mothers and contextual variables measuring social and economic factors I have argued influence the occurrence of stillbirths. In the first analysis in Table 7, I included the following variables: race (Black=1; White=0; White was indicated as the reference category in the analysis); mother's age recoded into a categorical variable, age group 20 to 29 was indicated as the reference category in the analysis); marital status (Married=1; Unmarried=0; Married was indicated as the reference category in the analysis), and the eight county categorical variables (explained on page 47; high education_low segregation_high income was indicated as the reference category in the analysis). The results of the analysis indicated that black race was statistically significant and had an OR of 2.07 (95% CI: 1.98, 2.156), controlling for the other variables. Two of the age variables were statistically significant, while one was just barely significant (p-value =0.03), after controlling for other factors. Mothers of ages 15 to 19 had a 0.944 lower odds of having a stillbirth than the odds of having one among moms of age 20 to 29, controlling for other factors. Interestingly, in the multivariate analysis, controlling for the other factors, the odds of having a stillbirth among moms of age 30 to 39 became much more statistically significant with a higher OR of 1.257 (95% CI: 1.203, 1.314) than the OR of 0.974 in the bivariate analysis and indicated that moms aged 30 to 39 had a 1.257

higher odds of having a stillbirth than the odds of having one among mothers aged 20 to 29. Marital status was also statistically significant and indicated that unmarried moms had a 1.67 higher odds of having a stillbirth than the odds of having one among married moms. The county category variables generally failed to be statistically significant. However, there was one exception: the category of high income_high segregation_high education was statistically significant with a p-value of 0.0012 and had an OR of 0.893, indicating that moms residing in counties of high income, high segregation, and high education had a 0.893 lower odds of having a stillbirth than the odds of having one among moms living in counties of high income, low segregation, and high education. This is conceivable in that these counties are probably relatively affluent counties.

Finally, I performed a final logistic regression including the individual-level variables along with the indicator variables for residential segregation, median household income, and percent of residents with a high school diploma or higher. All of the individual-level variable continued to exhibit effects similar in this analysis to the effects they exhibited in the last analysis. Residential segregation was statistically significant (p-value=0.0002)but displayed an effect contrary to my general argument. Residing in a county with a level of racial residential segregation higher than the median for Georgia counties was protective in that moms living in such counties had a 0.905 (95% CI: 0.858, 0.953) lower odds of having a stillbirth than the odds of having one among moms living in counties of lower than the median for Georgia counties. The other two contextual variables failed to reach statistical significance in this analysis.

DISCUSSION

This study revealed the much higher odds (OR: 2.05 TO 2.07) of having a stillbirth among African American mothers in Georgia than the odds of having one among White mothers in Georgia, controlling for other individual-level and contextual factors. These results speak to the enduring nature of racial group in shaping African Americans' life chances, specifically for this study with regard to the viability of black infants. Although the contextual portion of this study failed to hold to initial expectations, it suggests that efforts must be used to think of other ways to develop the multivariate analysis in ways perhaps more conducive to revealing the effect of environment in influencing the occurrence of stillbirths. Additionally, it might be difficult to measure and test for the environmental effects I have suggested in this study with county-level data; these phenomena might be more measurable and present in city-level data. Nonetheless, I will make a continued effort to examine contextual effects upon the occurrence of stillbirths in Georgia. Such research is clearly necessary in a state such as Georgia with the health disparities that exist in this state and many others.

STRENGTHS AND LIMITATIONS

One of the strengths of the study is the comprehensive nature of the birth outcomes data in that it includes all live births and stillbirths for all of the counties in Georgia. Additionally, the effort to merge individual-level data with environmental data is a strong research design, especially when those data are carried over a period of time. The data in this study used data over a period of thirteen years. The results contribute towards research examining the social determinants of health.

A limitation of the study is it might well be difficult to estimate the influence of environment in counties upon health outcomes. Counties are such large diffuse areas throughout the United States.

Table 1.Table of Stillbirths and Live Births

in Georgia annually from 1994 to 2006

YEAR	STILLBIRTHS	LIVE BIRTHS	TOTAL BIRTH OUTCOMES
1994	984	102,354	103,338
1995	1,008	103,001	104,009
1996	905	102,728	103,633
1997	872	105,586	106,458
1998	907	108,766	109,673
1999	914	109,672	110,586
2000	878	111,931	112,809
2001	936	110,318	111,254
2002	1,036	108,276	109,312
2003	927	108,822	109,749
2004	937	109,444	110,381
2005	898	111,036	111,934
2006	912	115,719	116,631
Mean across years	**932**	**108,281**	**109,213**
Total across years	**12,114**	**1,407,653**	**1,419,767**

Table 2. Table of Stillbirths in Georgia from 1994 to 2006

by race across Georgia counties[46]

Georgia Counties	Number of White Stillbirths	Number of Black Stillbirths
1) Appling	14	13
2) Atkinson	12	4
3) Bacon	12	11
4) Baker	1	4
5) Baldwin	25	51
6) Banks	17	1
7) Barrow	49	14
8) Bartow	92	36
9) Ben Hill	16	20
10) Berrien	11	7
11) Bibb	64	272
12) Bleckley	10	8
13) Brantley	10	1
14) Brooks	10	17
15) Bryan	21	10
16) Bulloch	42	40
17) Burke	13	54
18) Butts	21	18

19) Calhoun	2	12
20) Camden	22	13
21) Candler	6	7
22) Carroll	86	46*[47]
23) Catoosa	26	0
24) Charlton	4	4
25) Chatham	132	307
26) Chattahoochee	15	10
27) Chattooga	23	2
28) Cherokee	115	9
29) Clarke	38	54
30) Clay	0	4
31) Clayton	100	342
32) Clinch	8	4
33) Cobb	234	266
34) Coffee	25	27
35) Colquitt	37	23
36) Columbia	98	32
37) Cook	13	18
38) Coweta	79	65
39) Crawford	11	9
40) Crisp	14	30

*[47] **I accidentally selected Carroll County, although it fails to fully satisfy the criterion.**

41) Dade	4	0
42) Dawson	9	0
43) Decatur	23	52
44) DeKalb	133	1,066
45) Dodge	13	16
46) Dooly	5	17
47) Dougherty	23	134
48) Douglas	116	70
49) Early	5	12
50) Echols	0	0
51) Effingham	36	8
52) Elbert	7	22
53) Emanuel	11	22
54) Evans	5	13
55) Fannin	15	0
56) Fayette	44	19
57) Floyd	59	25
58) Forsyth	62	1
59) Franklin	21	5
60) Fulton	275	1,422
61) Gilmer	19	0
62) Glascock	1	1
63) Glynn	38	58

64) Gordon	38	6
65) Grady	27	24
66) Greene	7	22
67) Gwinnett	278	237
68) Habersham	32	3
69) Hall	91	23
70) Hancock	1	19
71) Haralson	28	4
72) Harris	20	15
73) Hart	10	9
74) Heard	14	1
75) Henry	95	69
76) Houston	109	89
77) Irwin	5	13
78) Jackson	38	9
79) Jasper	7	11
80) Jeff Davis	14	7
81) Jefferson	6	24
82) Jenkins	5	20
83) Johnson	4	9
84) Jones	21	12
85) Lamar	10	14
86) Lanier	8	3

87) Laurens	26	42
88) Lee	17	8
89) Liberty	60	93
90) Lincoln	2	9
91) Long	12	3
92) Lowndes	53	103
93) Lumpkin	19	2
94) Macon	7	12
95) Madison	21	4
96) Marion	7	6
97) McDuffie	22	26
98) McIntosh	5	13
99) Meriwether	14	22
100) Miller	1	4
101) Mitchell	10	41
102) Monroe	11	29
103) Montgomery	4	2
104) Morgan	6	12
105) Murray	35	0
106) Muscogee	103	246
107) Newton	53	47
108) Oconee	31	3
109) Oglethorpe	6	5

110)	Paulding	71	10
111)	Peach	14	27
112)	Pickens	17	0
113)	Pierce	19	6
114)	Pike	13	5
115)	Polk	32	16
116)	Pulaski	4	9
117)	Putnam	9	17
118)	Quitman	0	2
119)	Rabun	7	0
120)	Randolph	0	20
121)	Richmond	105	357
122)	Rockdale	41	55
123)	Schley	4	1
124)	Screven	15	23
125)	Seminole	7	10
126)	Spaulding	39	66
127)	Stephens	31	1
128)	Stewart	1	8
129)	Sumter	17	63
130)	Talbot	5	11
131)	Taliaferro	0	7
132)	Tattnall	21	18

133)	Taylor	3	15
134)	Telfair	3	14
135)	Terrell	2	14
136)	Thomas	28	51
137)	Tift	23	29
138)	Toombs	26	21
139)	Towns	3	0
140)	Treutlen	2	9
141)	Troup	38	46
142)	Turner	2	9
143)	Twiggs	8	13
144)	Union	13	0
145)	Upson	23	34
146)	Walker	43	1
147)	Walton	43	24
148)	Ware	30	38
149)	Warren	3	13
150)	Washington	7	19
151)	Wayne	23	12
152)	Webster	2	3
153)	Wheeler	1	3
154)	White	16	1
155)	Whitfield	65	2

156)	Wilcox	5	10
157)	Wilkes	3	13
158)	Wilkinson	3	13
159)	Worth	13	24
Mean across counties		**30**	**46.3**
Total across counties		**4,748**	**7,366**

Counties with slightly darkened rows were selected for analysis because these counties had at least fifty White stillbirths and fifty Black stillbirths. There were sixteen counties that satisfied this criterion: Bibb, Carroll (by accident), Chatham, Clayton, Cobb, Dekalb, Douglas, Fulton, Gwinnett, Henry, Houston, Liberty, Lowndes, Muscogee, and Richmond counties.

Table 3. Table of Individual-Level Variables for Live Births and Stillbirths in Georgia

(After Selection Criteria of Non-Hispanic blacks and Whites with Gestation >= 20 weeks)

Individual-Level Variable	Number of Live Births	Number of Stillbirths
Race of Mother		
Black	549,385	7,366
White	894,534	4,748
Total	**1,443,919**	**12,114**
Marital Status of Mother		
Married	893,079	5,208
Unmarried	550,821	6,874
Missing or Unknown	19	32
Total	**1,443,919**	**12,082**
Age of Mother		
15 to 19	194,911	1,989
20 to 29	748,853	6,219
30 to 39	433,523	3,506
40 and up	25,513	324
Missing	4,853	76
Total	**1,407,653**	**12,114**

Table 4. Bivariate Association (Chi-square and Odds Ratios Analyses) between stillbirths and individual-level variables of Georgia mothers, 1994-2006.

Race: 1= Black; 0= White					
Stillbirths: 1=Stillbirth; 0= Live Birth	**Whites**	**Blacks**	**Totals**	**Chi-square (Value, p-value)**	**Mantel-Haenszel Odds Ratio (Value, 95% CI)**
Stillbirths	4,748	7,366	12,114	2548.65	2.49
Live Births	867,359	540,294	1,407,653	<.0001	(2.40, 2.58)
Totals	872,107	547,660	1,419,767		
Mother's Marital Status: 1= Married; 0= Unmarried					
Stillbirths: 1=Stillbirth; 0= Live Birth	**Unmarried**	**Married**	**Totals**	**Chi-square (Value, p-value)**	**Mantel-Haenszel Odds Ratio (Value, 95% CI)**
Stillbirths	6,874	5,208	12,082	1729.95	0.47
Live Births	540,506	867,131	1,407,637	<.0001	(0.46, 0.49)
Totals	547,380	872,339	1,419,719		

Table 4. Bivariate Association (Chi-square and Odds Ratios Analyses) between stillbirths and individual-level variables of Georgia mothers, 1994-2006, continued.

Mother's Age in Years: cOR of 1 to 2 1= 15 to 19 Years; 2= 20 to 29 Years					
Stillbirths: 1=Stillbirth; 0= Live Birth	**15 to 19 Years**	**20 to 29 Years**	**Totals**	**Chi-square (Value, p-value)**	**Mantel-Haenszel Odds Ratio (Value, 95% CI)**
Stillbirths	1,989	6,219	8,208	33.261 <.0001	0.814 (0.774, 0.856)
Live Births	194,911	748,853	943,764		
Totals	196,900	755,072	951,972		
Mother's Age in Years: cOR of 2 to 3 2= 20 to 29 Years; 3= 30 to 39 Years					
Stillbirths: 1=Stillbirth; 0= Live Birth	**20 to 29 Years**	**30 to 39 Years**	**Totals**	**Chi-square (Value, p-value)**	**Mantel-Haenszel Odds Ratio (Value, 95% CI)**
Stillbirths	6,219	3,506	9,725	1.57 0.21	0.974 (0.934, 1.015)
Live Births	748,853	433,527	1,182,376		
Totals	755,072	437,029	1,192,101		
Mother's Age in Years: cOR of 2 to 4 2= 20 to 29 Years; 4= 40 to Highest in Years					
Stillbirths: 1=Stillbirth; 0= Live Birth	**20 to 29 Years**	**40 to Highest in Years**	**Totals**	**Chi-square (Value, p-value)**	**Mantel-Haenszel Odds Ratio (Value, 95% CI)**
Stillbirths	6,219	324	6,543	55.70 <.0001	1.53 (1.37, 1.71)
Live Births	748,853	25,513	774,366		
Totals	755,072	25,837	780,909		

Table 5. Logistic Regression of the relationship of a Year Variable to stillbirths of Georgia mothers, 1994-2006.

Variable	Parameter Estimate	Degrees of Freedom	Standard Error	Wald X^2	P-value	Odds Ratio	95% Confidence Interval
Intercept	-4.68	1	0.03	33537.84	<.0001		
Year Variable	-0.01	1	0.002	18.13	<.0001	0.990	0.985, 0.994

Response Profile: Probability modeled is Stillbirth=1	N
Stillbirths: 1	12,114
Live Births: 0	1,407,653

Year Variable:

1994=1
1995=2
1996=3
1997=4
1998=5
1999=6
2000=7
2001=8
2002=9
2003=10
2004=11
2005=12
2006=13

Table 6. Table of County Categories before Selection and after Selection

County Categories	Number of birth outcomes in the category	Valid Percent(%)
1=HI – INCOME, HI – SEGREGATION, AND HI -- HIGH SCHL GRAD	1001569	70.5
2=HI – INCOME, LO – SEGREGATION, AND HI -- HIGH SCHL GRAD	126542	8.9
3=LO – INCOME, HI – SEGREGATION, AND HI -- HIGH SCHL GRAD	40,249	2.8
4=LO – INCOME, LO – SEGREGATION, AND HI -- HIGH SCHL GRAD	30,547	2.2
5=HI – INCOME, HI – SEGREGATION, AND LO -- HIGH SCHL GRAD	36,977	2.6
6=HI – INCOME, LO – SEGREGATION, AND LO -- HIGH SCHL GRAD	29,933	2.1
7=LO – INCOME, HI – SEGREGATION, AND LO -- HIGH SCHL GRAD	56,967	4.0
8=LO – INCOME, LO – SEGREGATION, AND HIGH SCH GRAD – LO	81,769	5.8
Missing	15,214	1.1
Total	**1,419,767**	**100.0**

If the selection variable (SELECT=1) is used to select those birth outcomes that are in counties with at least 50 Black stillbirths and 50 White stillbirths, the following occurs. There is a loss of six of the county categories.

County Categories	Number of birth outcomes in the category	Valid Percent(%)
1=HI – INCOME, HI – SEGREGATION, AND HI -- HIGH SCHL GRAD	747,957	97.9
2=HI – INCOME, LO – SEGREGATION, AND HI -- HIGH SCHL GRAD	16,330.0	2.1
Total	**764,287**	**100.0**

Table 7. Logistic Regression of the full model on stillbirths of Georgia mothers, 1994-2006, without Selection of Counties.

Variable	Parameter Estimate	Degrees of Freedom	Standard Error	Wald X^2	P-value	Odds Ratio	95% Confidence Interval
Intercept	-5.24	1	0.04	17685.86	<.0001		
Black	0.73	1	0.02	1114.38	<.0001	2.07	(1.980, 2.156)
Mom's Age: Category 1 vs. Category 2	-0.06	1	0.03	4.53	0.03	0.944	(0.90, 0.995)
Mom's Age: Category 3 vs. Category 2	0.229	1	0.023	103.40	<.0001	1.257	(1.203, 1.314)
Mom's Age: Category 4 vs. Category 2	0.652	1	0.058	126.19	<.0001	1.919	1.713, 2.15
Married	0.513	1	0.023	498.8	<.0001	1.67	(1.596, 1.747)
Year Variable	-0.02	1	0.002	38.17	<.0001	0.985	(0.98, 0.99)
County Category 1 vs. 2	-0.11	1	0.03	10.54	0.0012	0.893	(0.834, 0.956)
County Category 3 vs. 2	-0.03	1	0.062	0.23	0.63	0.971	(0.860, 1.095)

Table 7. Logistic Regression of the full model on stillbirths of Georgia mothers, 1994-2006, without Selection of Counties, continued.

Variable	Parameter Estimate	Degrees of Freedom	Standard Error	Wald X^2	P-value	Odds Ratio	95% Confidence Interval
County Category 4 vs. 2	0.05	1	0.07	0.653	0.42	1.92	(1.71, 2.15)
County Category 5 vs. 2	-0.04	1	0.071	0.316	0.57	0.96	(0.84, 1.10)
County Category 6 vs. 2	0.03	1	0.08	0.20	0.66	1.035	(0.89, 1.20)
County Category 7 vs. 2	-0.10	1	0.06	3.29	0.07	0.902	(0.81, 1.01)
County Category 8 vs. 2	-0.03	1	0.05	0.49	0.48	0.97	(0.88, 1.06)

Response Profile: Probability modeled is Stillbirth=1	N
Stillbirths: 1	11,872
Live Births: 0	1,387,764
Missing Observations: 99	20,131

Table 8. Logistic Regression of another full model on stillbirths of Georgia mothers, 1994-2006, without Selection of Counties.

Variable	Parameter Estimate	Degrees of Freedom	Standard Error	Wald X^2	P-value	Odds Ratio	95% Confidence Interval
Intercept	-5.24	1	0.04	21593.79	<.0001		
Black	0.72	1	0.02	1116.42	<.0001	2.05	(1.969, 2.143)
Mom's Age: Category 1 vs. Category 2	-0.06	1	0.03	4.46	0.03	0.945	(0.896, 0.996)
Mom's Age: Category 3 vs. Category 2	0.23	1	0.023	101.84	<.0001	1.254	(1.200, 1.311)
Mom's Age: Category 4 vs. Category 2	0.65	1	0.058	125.40	<.0001	1.915	(1.709, 2.145)
Married	0.513	1	0.023	499.24	<.0001	1.67	(1.597, 1.747)
Year Variable	-0.02	1	0.002	37.89	<.0001	0.985	(0.98, 0.99)
Residential Segregation, 2000: 1=Higher than the median of 26.3; 0=Lower than the median of 26.3	-0.1	1	0.03	14.02	0.0002	0.905	(0.858, 0.953)

Table 8. Logistic Regression of another full model on stillbirths of Georgia mothers, 1994-2006, without Selection of Counties, continued.

Variable	Parameter Estimate	Degrees of Freedom	Standard Error	Wald X^2	P-value	Odds Ratio	95% Confidence Interval
Median Household Income, 1989: 1=Higher than the median of $21,574; 0=Lower than the median of $21,574	-0.02	1	0.03	0.51	0.48	0.98	(0.913, 1.04)
% Persons in each County who are high school graduates or higher, 1990: 1=Higher than the median of 26.3; 0=Lower than the median of 26.3	0.014	1	0.035	0.16	0.69	1.014	(0.95, 1.09)

Table 9. Descriptives of the area-level social and economic variables used in the analyses of stillbirths of Georgia mothers, 1994-2006, without Selection of Counties.

Descriptive	Residential Segregation, 2000(Numbers of counties or %s)	Median Household Income, 1989(Numbers of counties or %s)	% Persons in each County who are high school graduates or higher, 1990 (Numbers of counties or %s)
1	1,147,078(81.02%)	1,205,938(84.96%)	1,199,306(85.13%)
0	268,791(18.98%)	213,430(15.04%)	209,544(14.87%)
Missing	3,898	399	10,917
Mean	27.9	$23,354	60.4
Median	26.3	$21,574	58.4
Minimum	0.0	$13,709	42.8
Maximum	79.5	$50,167	88.5
Percentiles: 25%	17.9	$19,213	54.5
50%	26.3	$21,574	58.4
75%	36.1	$25,736	64.1