

Title: Individual and County-Level Factors Associated with Racial Disparities in Cause-Specific Infant Mortality: Florida, 1980-2000.

Author: Jessica C. Bishop-Royse, Center for Demography and Population Health, Florida State University, Tallahassee, Florida 32306-2240, 850-322-5830 (voice), 850-644-8818 (fax), jbishop@fsu.edu.

Author: Isaac W. Eberstein, Center for Demography and Population Health, Florida State University, Tallahassee, Florida 32306-2240, 850-644-7108 (voice), 850-644-8818 (fax), eberstein@fsu.edu.

The racial disparity in infant mortality has persisted throughout the twentieth century, despite overall improvements in infant mortality rates. One way to examine the pathways leading to differential infant death is by examining cause-specific infant mortality (Binkin et al 1988; Dollfus et al 1990; Song and Frisbie 2007; Sowards 1997). The justification for such an approach lies in its etiology, where maternal characteristics such as age, education and marital status and where community characteristics such as (such as area poverty, rurality and percent of households headed by women) exert differential influence on various causes of death and thus the racial disparity in infant mortality. Therefore, racial differences in the distributions of these characteristics and/or their relationships with specific causes of death are thought to underlie overall racial differentials in infant mortality. The present investigation uses linked birth-infant death files and multilevel statistical models to examine the individual and county level determinants of cause-specific infant mortality by race in Florida at two points in time, 1980 and 2000. Attention is given both to the cross sectional relationships and to the changes in relationships over this period which is characterized by increasingly effective new medical technology and the regionalization of the neonatal health care system within the state. .

Using linked birth and infant death data from Florida cohorts born in 1980 and 2000, we will address the following questions:

1. What are the causes of death that contributed to the racial disparity in infant mortality in 1980? Are these different than those causes associated with the racial gap in infant death in 2000?
2. What are the individual-level socio-demographic characteristics associated with racial differentials in cause specific infant mortality in 1980? How do these relationships change in 2000?
3. What are the county level variables associated with racial differences in cause-specific infant death in 1980? How do these relationships change in 2000?
4. What are the net effects of individual characteristics and county level variables, and what are the changes in these relationships from 1980-2000?

We will employ a series of multinomial logistic regression models to assess not only the individual risk of cause-specific infant mortality but also racial differences in the distribution of infant deaths by cause in 1980 and 2000. We expect to find different relationships among predictors and different causes of death, and also that relationships will vary in magnitude at the two points in time. Multinomial logistic regression will allow tests of these expectations. Interaction terms as well as multilevel models will be used to specify risk estimates

that include the potential effects of maternal county of residence on racial differences in cause-specific infant death.

BACKGROUND

Cause-specific death investigations are useful tools for examining the racial disparity in infant mortality because they allow researchers to allocate different proportions of the racial disparity to some causes of death or others. This is particularly useful in examining the racial disparity over time, because several causes of death occur more widely during some eras than others (e.g. Sudden Infant Death Syndrome prior to 1992 when the “Back to Sleep” initiative was started and SIDS deaths after 1992). Another reason that cause specific investigations are used for examining the racial disparity in infant mortality is that some causes of death are associated with some socio-demographic factors. All other things being equal, populations with higher birth rates to those socio-demographic categories would be expected to have higher infant death rates. For example, infants that die due to external causes (homicide, drowning, motor vehicle accidents, etc.) tend to have younger mothers than infants that die of other causes. All other things being equal, the population with the greater proportion of births to young mothers will have a higher infant death rate than a population with fewer births to young women.

Further, medical treatment and therapies have helped change infant health and survival two significant ways, by influencing when infants die and by affecting the social and demographic characteristics of infants that die. One example is the case of necrotizing enterocolitis. In terms of etiology, necrotizing enterocolitis is an infection that occurs in infants who cannot digest the food that they consume. The inability of the infant to digest consumed food originates in the under development of the infant’s digestive organs, which occurs most often in premature infants. While typically categorized as an infection, the socio-demographic profiles of infants that die of necrotizing enterocolitis are more similar to those that die of prematurity related conditions (meaning that they are similar in age, gestation and birthweight to infants that die of prematurity related conditions than infants that die of infection).

Given that declines in infant mortality have not been observed equally for all causes of death, it is likely that continued racial disparity in infant survival is the product of differential improvements in cause-specific infant mortality. The distributions of some causes of death seem to be shifting differently for whites than for blacks during the last part of the twentieth century. That all causes of death have not declined at the same pace provides support for employing a cause-specific framework in this investigation. Eberstein and Parker (1984) suggested that cause-specific analyses are “potentially a fundamental extension of demographic analyses of racial differences in infant mortality.” Further, they argued that cause-specific investigations may be more indicative than traditional analytical approaches, allowing for conceptual advancements in the understanding of racially disparate infant mortality experiences. At the very least, a cause specific framework helps contribute “to a systematic explanation for observed racial inequalities which is unencumbered by the

conceptual/methodological imprecision of much research in this area” (Eberstein and Parker, 1984).

METHODS

In order to be able to make meaningful comparisons, some researchers have grouped causes of death together on the basis of medical and physiological similarities. The most informative of these is grouping deaths by similar etiologies. Of particular note here is the work by Dollfus et al (1990) and Sowards (1997), which grouped infant deaths into broadly defined “causes” based on similar etiological pathways, such as “prematurity related conditions” and “maternal obstetric conditions”.

For the purposes of this investigation, we employ the cause of death framework originated by Dollfus et al (1990) and modified by Sowards (1997). The purpose in doing so is to allow for meaningful comparisons of deaths due to etiologically similar pathways. For example, Respiratory Distress Syndrome (RDS) and Hyaline Membrane Disease (HMD) are two distinct causes of death. However, both are largely considered conditions associated with prematurity. Rather than considering them separately, here they are grouped together into “Prematurity Related Conditions.” Additionally, causes such as accidental drowning or Shaken Baby Syndrome are different in their causes and consequences, but are considered “external” causes in that the pathways leading to infant death because they are external to the health of the infant. Our only modification to this framework is the inclusion of a residual or “unknown” category of deaths, where there is little evidence to substantiate the etiological pathways of death into one of the existing categories proposed by Dollfus et al (1990) or Sowards (1997).

Cause-specific frameworks also allow for multiple levels of influence beyond what is known regarding the influence of individual level factors. Eberstein (1989) suggested that since demographic research is interested in the diverse linkages between social inequality and mortality, a multi-level perspective is useful, as it allows for the combination of background and proximate factors in infant health. The idea here is that some individual and contextual level variables are associated with some types of infant death.

We will use a series of multinomial logistic regression models to assess not only the individual risk of cause-specific infant mortality but also racial differences in the distribution of infant deaths by cause in 1980 and 2000. Specifically, we expect there will be different relationships among predictors and different causes of death. Multinomial logistic regression will allow tests of this hypothesis, that each independent variable has a different relationship with each cause of death. Interaction terms as well as multilevel models will be used to specify risk estimates that include the potential mediating effects of maternal county of residence on racial differences in cause-specific infant death.

DATA

There were 310,204 births in Florida in 1980 and 2000 (see Table 1 below). The majority of these occurred in 200 (61.79%). There were just over 118,000 births in 1980 (see Table 2 below). About 25% of

these occurred to African American women (n=29,424). White births made up three times more births in 1980, where they accounted for 75.19% of the cohort (n=89,109). There were close to 200,000 births in 2000, of which about 25% were to African-American women (see Table 2, below).

Table 1: Distribution of Births and Cohort Year

Births	Frequency	Percent	Cumulative Percent
1980	118,533	38.21	38.21
2000	191,671	61.79	100.00
Total	310,204	100.00	

Table 2: Distribution of Maternal Race and Cohort Year

Maternal Race 1980	Frequency	Percent	Cumulative Percent
Black	29,424	24.81	24.81
White	89,109	75.19	100.00
Total	118,533	100.00	
Maternal Race 2000	Frequency	Percent	Cumulative Percent
Black	145,895	76.12	76.12
White	45,776	23.88	100.00
Total	191,671	100.00	

In 1980 and 2000, most infant deaths were due to one of three causes: Prematurity Related Conditions, Congenital Anomalies or Sudden Infant Death Syndrome (see Table 3 below). Infants dying of prematurity related conditions decreased from 36.15% in 1980 to 32.35% in 2000. Infants dying of Congenital Anomalies increased during the 20 year period in Florida, from 21.08% in 1980 to 23.49% in 2000. The proportion of infants dying of Sudden Infant Death Syndrome (SIDS) decreased dramatically, from 12.10% to 7.83% in 2000.

Interestingly, infants dying of Obstetric Conditions increased during this period, from 3.26% in 1980 to 7.35% in 2000. Additionally, infants dying of perinatal infections increased over the period, from 3.86% in 1980 to 6.50% in 2000, while infants dying of “external causes” such as homicides and accidents remained somewhat comparable over the period.

Table 3: Cause of Death Distributions and Cohort Year

Underlying Causes of Death	1980 Frequency	1980 %	2000 Frequency	2000 %
Prematurity Related Conditions	487	36.15	343	32.35
Congenital	284	21.08	249	23.49

Anomalies				
SIDS	163	12.10	83	7.83
Obstetric Conditions	44	3.26	78	7.35
Birth Asphyxia	57	4.23	40	3.77
Perinatal Infections	52	3.86	69	6.50
Other Infections	90	6.68	38	3.58
External Causes	54	4.00	45	4.24
Undetermined	116	8.61	115	10.84
Total	1,347	100.00	1,060	100.00

UPDATE

We have the data in hand and have begun multivariate analyses.

REFERENCES

- Binkin, N.J., K.R. Rust, and R.L. Williams. 1988. "Racial differences in neonatal mortality. What causes of death explain the gap?" *American Journal of Diseases in Childhood* 142 (4):434-440.
- Dollfus, C., M. Patetta, E. Siegel, and A.W. Cross. 1990. "Infant Mortality: A Practical Approach to the Analysis of the Leading Causes of Death and Risk Factors." *Pediatrics* 86(2):176-183.
- Eberstein, I.W. 1989. "Demographic research on infant mortality." *Sociological Forum* 4(3):409-422.
- Eberstein, I.W. and J.R.Parker. 1984. "Racial Differences in Infant Mortality by Cause of Death: The Impact of Birth Weight and Maternal Age." *Demography* 21(3):409-422.
- Song, S. and W.P. Frisbie. 2007. "Race/Ethnic Disparities in Cause-Specific Infant Mortality Change Over Two Decades." Presented at Annual Meeting of the Population Association of America, 2007.
- Sowards, K.A. 1997. "Premature Birth and the Changing Composition of Newborn Infectious Disease Mortality: Reconsidering "Exogenous" Mortality." *Demography* 34(3):399-409.