Trends in US Urban Black Infant Mortality, by Degree of Residential Segregation

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ABSTRACT

Trends in Black infant mortality rates from 1982 through 1991 in large US metropolitan statistical areas were examined. In some least-segregated areas, the total Black infant mortality rate reached a low of 13 per 1000 live births in 1985; it increased sharply after 1985 in the West but not in the South. The explanation for these trends is unknown, but variation in regional trends in Black postneonatal infant mortality rates suggested that social and medical-care differences among Blacks should be examined. A high Black infant mortality rate for a group of most-segregated metropolitan statistical areas persisted and contributed to the rising Black–White ratio of rates. (*Am J Public Health.* 1996;86:723–726)

Introduction

Infant mortality rates in Blacks showed increases with rising levels of residential segregation in New York City health areas in the 1940s,[1] in 176 cities in 1981 to 1985,[2] and in 38 large metropolitan statistical areas in 1982 to 1986.[3] Black–White segregation could affect Black infant mortality rates indirectly as a result of the concentration of high poverty rates within hypersegregated metropolitan statistical areas, or, more directly, as a result of lower quality of life for both poor and nonpoor Blacks.[4,5] This report updates previous research on Black infant mortality rates in 38 metropolitan statistical areas[3] and analyzes trends in such rates in a larger number of metropolitan statistical areas grouped by segregation and region.

Methods

The index of dissimilarity was used to divide metropolitan statistical areas into quintiles defined by degree of Black–White residential segregation based on block group census data (1980 and 1990).[6] This index, with a theoretical range of 0 to 100, measures the degree of unevenness in the geographic distribution of Blacks. If the proportion of Blacks in each subarea (i.e., census block group) were the same as that in an entire metropolitan statistical area, the index would be zero. None of the US metropolitan statistical areas had an index approaching zero in 1980 or 1990; however, there was considerable variation among areas.[4,6]

Deaths occurring at the age of less than 1 year for Whites and Blacks by metropolitan statistical area have been published for 1982 through 1990.[7] For 1991, unpublished numbers of Black and White infant deaths and live births to Black and White mothers by metropolitan statistical area were provided by the National Center for Health Statistics. Denominators of infant mortality rates were numbers of live births by metropolitan statistical area, published by race of the infant until 1989, when mother's race was first used.[8–10] The latter denominators yield slightly higher infant mortality rates for Blacks[9–11]; in the United States in 1990, the Black infant mortality rate based on race of child was 17.0 per 1000 and that based on race of mother was 18.0.[9] The total race-specific infant mortality rate (total infant deaths per total live births) was calculated (all metropolitan statistical areas combined) for each quintile of segregation. Confidence intervals (CIs) for infant mortality rates were based on the normal distribution[12]; no rates involved less than 50 infant deaths. In multiple regression analysis of Black infant mortality rates by metropolitan statistical area, independent variables (by metropolitan statistical area) were Black poverty rates (from census reports), the Black–White segregation index,[6] and the rate of unmarried Black and White mothers (per 1000 live births) in 1990.[10] Data on variables (such as maternal education, prenatal care, use of tobacco and other drugs, psychosocial stresses, and medical risk factors) associated with adverse pregnancy outcomes in Black women[13–15] were not available by metropolitan statistical area.

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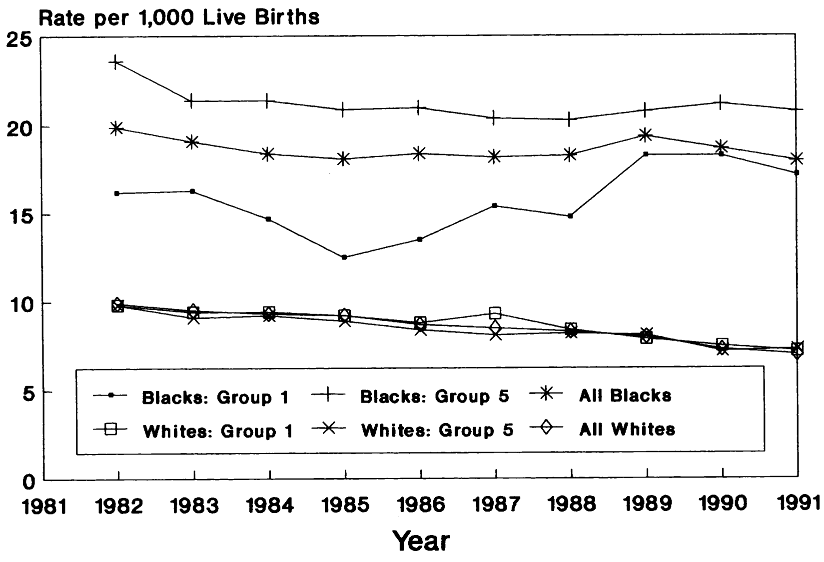

FIGURE 1—Black infant mortality rate (per 1000 live births) for 38 large US metropolitan statistical areas, 1982 through 1991: first (lowest) quintile (group 1, index <66) and fifth (highest) quintile (group 5, index >83).

Results

All 38 metropolitan statistical areas with a total population of more than 1 million in 1980 (as listed elsewhere[3]) were divided into quintiles through the segregation index for 1980[6]; rankings were similar when segregation indexes for 1990[6] were used. White infant mortality rates were unrelated to the segregation index (Figure 1)[3] and declined throughout the period 1982 through 1991. The Black infant mortality rate for the fifth (highest) quintile metropolitan statistical areas declined from 1982 to 1983 but then stabilized at more than 20 per 1000 live births. The total rate for Blacks in the first quintile areas was relatively low and declined from 1982 to 1985 but increased sharply after 1985 (Figure 1); Black rates for areas in other quintiles of segregation were intermediate (data not shown). The total Black infant mortality rate for the seven least-segregated (first quintile) metropolitan statistical areas reached a low of 12.5 (95% CI = 10.6, 14.3) per 1000 in 1985, when all seven rates were below 15; the White infant mortality rate in the 38 areas in 1985 was 9.2 (95% CI = 9.0, 9.4). The seven least-segregated areas were all located in the West, five being in California (Anaheim, Riverside, San Diego, San Jose, and Sacramento). The other two were Phoenix, Ariz, and San Antonio, Tex.

The segregation index (in 1980) was a significant predictor of the Black infant mortality rate in 1982 through 1986, when the Black poverty rate of each metropolitan statistical area was included in a regression model.[3] In a similar model for 1989 through 1991, however (as expected from Figure 1), the 1990 segregation index ($t = 1.54$, $P = .134$) was not a statistically significant predictor of the Black infant mortality rate in the 38 metropolitan statistical areas (model adjusted $R^2 = .019$). The 1990 segregation index and Black poverty rate were highly correlated (Pearson $r = .631$)[3] but not strongly enough to consider discarding a variable.[16] The rate of unwed Black mothers by metropolitan statistical area in 1990 (the midpoint of the 1989 to 1991 interval) was highly correlated with the segregation index ($r = .747$) and, when included with segregation index and Black poverty rate in a regression model, was the only variable associated with the Black infant mortality rate ($t = 3.45$; model adjusted $R^2 = .252$).

As a means of examining changes in Black infant mortality rates in a larger number of metropolitan statistical areas between 1985 and 1991 according to census-defined geographic regions and divisions,[9,10] rates for 1985 and 1991 were calculated for all 88 areas with more than 1000 Black live births in 1985 (Table 1). In 1991, these 88 areas included 491 040 live births to Black mothers, or 72% of all such births in the United States. For metropolitan statistical areas in the lowest quintile defined by the segregation index for 1980, western (but not southern) areas had a low total Black infant mortality rate in 1985. By 1991, the western advantage had disappeared as a result of an increase in western metropolitan statistical areas (as in Figure 1) and a decline in southern areas (not included in Figure 1). There was little change in the total Black infant mortality rate for the most segregated (fifth quintile) areas (Table 1), in agreement with Figure 1. The Black–White ratio of infant mortality rates in the 88 areas increased from 2.0 in 1985 to 2.5 in 1991. These results include any effect (albeit small) of the temporal change in the definition of the denominator for Black infant mortality rates (mentioned earlier).

When all 92 metropolitan statistical areas with more than 1000 live births to Black mothers in each year from 1989 to 1991 were included in a regression model, the segregation index ($t = 2.64$, $P = .01$), but not the Black poverty rate, was a significant predictor of the Black infant mortality rate; the adjusted R^2 was only .058, however. The inclusion of southern metropolitan statistical areas with relatively low Black infant mortality rates and relatively low segregation indexes (Table 1) contributed to the greater importance of the segregation index in this model than in the model (mentioned earlier) for Black rates in 38 large metropolitan statistical areas in 1989 to 1991. The rate of unmarried Black mothers by metropolitan statistical area, when added to the model (with Black poverty rate and segregation), was the only significant predictor ($t = 2.96$, $P = .004$) of Black infant mortality rates (model $R^2 = .133$) and was selected in stepwise regression (using SYSTAT).[17]

Of the 19 metropolitan statistical areas with Black infant mortality rates of more than 20 per 1000 for 1989 through 1991, 13 were located in the Middle Atlantic and East North Central divisions (which contain several large, hypersegregated metropolitan statistical areas).[6] The four areas with a lower 95% confidence limit of more than 20 were Chicago (24.5; 95% CI = 23.5, 25.5); Pittsburgh (24.1; 95% CI = 21.4, 27.1); Nassau–Suffolk, NY (23.2; 95% CI = 20.6, 26.1); and Detroit (22.4; 95% CI = 21.3, 23.6). All four were included in the fifth quintile in

TABLE 1—Black Infant Mortality Rates (IMRs) in 1985 and 1991 for the Least and Most Segregated of 88 US Metropolitan Statistical Areas (MSAs)

	1985[a]				1991[b]			
Area or Group No. (Total MSAs[c])	Total IMR (95% CI)	Mean Segregation Index (1980)	Mean Poverty Rate (1980)	Mean Rate of Unwed Mothers (1985)	Total IMR (95% CI)	Mean Segregation Index (1990)	Mean Poverty Rate (1990)	Mean Rate of Unwed Mothers (1991)
				Blacks in least-segregated MSAs[d]				
West[e] (7)	12.8 (11.0, 14.9)	58	21	490	17.6 (15.7, 19.8)	52	22	587
South[f] (11)	19.3 (17.6, 21.1)	60	31	487	16.8 (15.4, 18.3)	57	27	577
Total (18)	17.0 (15.7, 18.4)	59	27	488	17.1 (16.0, 18.3)	55	25	581
				Blacks in most-segregated MSAs[g]				
Total (16)	20.7 (19.9, 21.5)	86	30	668	20.2 (19.5, 20.9)	82	32	740
				All 88 MSAs				
Blacks (88)	18.4 (18.0, 18.8)	74	29	593	17.8 (17.4, 18.2)	70	29	672
Whites (88)	9.3 (9.1, 9.5)	74	8	131	7.1 (7.0, 7.2)	70	8	192

Note. For the 1985 analyses, segregation indexes and poverty rates were derived from the 1980 census; for the 1991 analyses, data were derived from the 1990 census. Data on unmarried mothers (per 1000 live births) were for 1985[8] and 1991 (unpublished data, National Center for Health Statistics). MSA titles have been abbreviated; for 1991, Dallas was combined with Ft. Worth, Tex, and San Francisco with Oakland for compatability with MSAs for 1985. Confidence intervals (CIs) (95%) on IMRs were based on the normal distribution[12] and refer to total IMRs; means for IMRs in each quintile (not shown) were similar to total rates.

[a]Denominators were live births in 1985 based on race of infant.[8]
[b]Denominators were live births in 1991 based on race of mother.[8–10]
[c]Total included in the analyses; all had more than 1000 "Black" live births in 1985.
[d]Segregation index of 65 or lower (range = 43–65) based on 1980 census data.[6]
[e]Pacific and Mountain divisions of the Bureau of the Census.[9,10]
[f]South Atlantic, East South Central, and West South Central divisions.[9,10]
[g]Segregation index of 82 or higher (range = 82–91) based on 1980 census data.[6]

Figure 1, and all had segregation indexes of more than 75 in 1990.

Discussion

Further studies are needed to explain both the apparent loss of advantage in the Black infant mortality rate for a group of least segregated western metropolitan statistical areas after 1985 and the persistence of a high Black infant mortality rate for a group of highly segregated metropolitan statistical areas in these ecologic analyses. While neonatal and postneonatal infant mortality rates for each area are not published by race, Black postneonatal rates in states in both the Pacific division (including California) and the Mountain division increased slightly from 1984 through 1986 to 1989 through 1991, in contrast to declines in New England and most of the South.[10] This suggests possible regional differences in trends in environmental–social circumstances or postnatal medical care for Black infants. Changes (starting around 1985) in California's health policy, with increasing emphasis on privatization and client case management that was not community oriented, were invoked to account for increases in Black (but not White) infant mortality rates in parts of California during the 1980s,[18] but detailed studies by metropolitan statistical area are needed. In contrast, a 50% decline in the Black infant mortality rate in Boston between 1990 and 1992 was attributed (albeit speculatively) to Black community empowerment programs developed prior to the 1991 Healthy Start Initiative.[19] A negative association between "relative Black political power" and Black postneonatal mortality was found among 176 US cities during 1981 to 1985.[20]

The difference in the trend in Black infant mortality rates between western and southern least segregated metropolitan statistical areas occurred despite nearly identical mean rates of unwed Black mothers (Table 1). Also, the decline in infant mortality rate after 1985 was larger for Whites than Blacks in the 88 metropolitan statistical areas, despite a larger proportional increase in the rate of unwed mothers for Whites in these areas (Table 1) (and in the United States).[9,10,21] The importance of the rate of unwed Black mothers (itself influenced by neighborhood-related economic and psychosocial factors such as unemployment of Black men, social isolation, and low self-esteem[22,23]) in regression models predicting Black infant mortality rates may be misleading as a result of collinearity with segregation and confounding with variables more directly related to infant mortality rates (e.g., psychosocial, nutritional, medical, and health care factors)[13–15,24] but not included in the models.

The two trends in Black infant mortality rates described in this paper contributed to the increase in the Black–White ratio of rates among larger metropolitan statistical areas (Table 1) and nationally,[21] underscoring the lack of recent social progress for Blacks.[25] Persistently high Black rates in hypersegrated metropolitan statistical areas, and in regions where these areas are located,[9,10] may be related to the concentration of extreme poverty (especially in central core cities of certain large metropolitan statistical areas), poorer neighborhood quality (e.g., inadequate high-density housing, crime, noise, and psychosocial stresses),[4–6] and higher prevalences of specific risk factors for adverse pregnancy outcomes (e.g., maternal medical–nutritional factors, education, reproductive patterns, smoking, and drug use).[13–15,23] While reducing segregation and Black poverty rates may be the long-term solution, expanding local interventions among high-risk Black women[26,27] could help to reduce the Black–White disparity in infant mortality rates. □

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Adjusting for Multiple Testing When Reporting Research Results: The Bonferroni vs Holm Methods

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ABSTRACT

Public health researchers are sometimes required to make adjustments for multiple testing in reporting their results, which reduces the apparent significance of effects and thus reduces statistical power. The Bonferroni procedure is the most widely recommended way of doing this, but another procedure, that of Holm, is uniformly better. Researchers may have neglected Holm's procedure because it has been framed in terms of hypothesis test rejection rather than in terms of *P* values. An adjustment to *P* values based on Holm's method is presented in order to promote the method's use in public health research. (*Am J Public Health.* 1996;86:726–728)

Introduction

It is well recognized that when one tests multiple hypotheses, all bearing on a single issue, the individual *P* values of the tests may not be an appropriate guide to actual statistical significance. Public health examples of this problem occur quite frequently. One is the attempt to characterize a new, ill-defined disease such as "sick building syndrome." If the investigator tabulates a long list of symptoms that might differentiate cases from controls, even if none of the symptoms are in fact related to the disease, some of the *P* values may fall below the customary .05 cutoff point. The argument advanced for adjusting the *P* values is that, without adjustment, the probability of declaring that some symptom is related to disease can be far higher than the nominal .05 level when none of the symptoms are actually related.

Another class of examples consists of assessing the effects of an intervention, such as a smoking cessation program, in different subpopulations determined by gender, age, social class, smoking inten-

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