Region of Birth and Mortality from Circulatory Diseases among Black Americans

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ABSTRACT

Objectives. This study examines the relationship between birthplace and mortality from circulatory diseases among American Blacks.

Methods. All Black deaths from circulatory diseases (*International Classification of Diseases,* 9th Revision, codes 390 through 459) were extracted from the National Center for Health Statistics mortality detail files for 1979 through 1991. Age-specific and age-adjusted mortality rates with 95% confidence intervals were calculated for males and females for combinations of five regions of residence at birth and four regions of residence at death.

Results. Males had higher mortality rates from circulatory diseases than females in every regional combination of birthplace and residence at death. For both genders, the highest rates were for those who were born in the South but died in the Midwest; the lowest rates were for those who were born in the West but died in the South. Excess mortality for both Southern-born males and females begins at ages 25 through 44.

Conclusions. There is a region-of-birth component that affects mortality risk from circulatory diseases regardless of gender or residence at time of death. We must examine how early life experiences affect the development of circulatory disorders. (*Am J Public Health.* 1997;87:800–804)

Introduction

Geographic variations in the incidence and mortality of circulatory diseases (i.e., cardiovascular diseases and stroke) have been reported worldwide.[1–5] In the United States, mortality differentials from circulatory diseases have been reported for both geographic regions and population subgroups.[6–14,15(pp.118–120),16] The highest US regional death rates from circulatory diseases are for residents of the South, with the highest rates for diseases of the heart, in particular, exhibited for both male and female residents of Mississippi. The highest US mortality rates from circulatory diseases based on population group in the United States are for Blacks, whose rates for mortality from specific circulatory diseases are among the highest in the world.[17,18]

Explanations offered for the observed patterns include differences in genetic or national stocks[16,19,20]; differences in behavioral risk factors (alcohol, diet, exercise, tobacco)[3,20–24]; differences in access to medical care, in utilization of medical services, and in treatment regimens[25–29]; and differences in degree of urbanization.[9,12] Another, primarily British school of thought focuses on experiences in the perinatal period (maternal nutrition, birthweight, and infant feeding practices) and early childhood (nutritional deprivation and poverty) as explanations.[30–41]

The relationship between place of birth and place of residence at death from circulatory diseases has only been examined for US populations for the period 1979 through 1981.[10] This paper reports the results of an internal migration study designed to describe that relationship in an ecological fashion, by relating place of birth for Black Americans to the risk of eventually dying from a noncongenital disease of the circulatory system. Given that (1) mortality rates from circulatory diseases are highest in the South, (2) mortality rates from circulatory diseases are highest among blacks, (3) American Blacks have historically had a large presence in the South, and (4) this population underwent a massive internal migration from the South to the Northeast and Midwest regions of the United States over the first half of this century[42] (a trend that reversed after 1970, with significant numbers of African Americans migrating to the South from the North and West[43]), we hypothesized that Blacks born in the South would demonstrate an increased burden of mortality from circulatory diseases regardless of their region of death. This expectation is based on the fact that Southern Blacks historically suffered from abject poverty with nutritional deprivation, which would place them at higher risk for the development of heart diseases and stroke, the major contributors to deaths from circulatory diseases, regardless of whether they migrated and/or escaped from these conditions.[42,44,45] If so, Southern-born blacks should manifest elevated mortality rates, even if they migrated to other regions.

Methods

All deaths from circulatory diseases (*International Classification of Diseases,*

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TABLE 1—Age-Adjusted Circulatory Diseases Mortality Rates, by Regions of Birth and Death for Black Americans, 1979 through 1991

Region of Death and Gender	Mortality Rate, by Region of Birth				
	Northeast (95% CI)	Midwest (95% CI)	South (95% CI)	West (95% CI)	Foreign (95% CI)
Northeast					
Male	382.0 (±4.9)	459.5 (±24.9)	512.6 (±4.1)	308.6 (±44.2)	294.5 (±6.0)
Female	241.1 (±3.2)	272.9 (±15.6)	350.9 (±2.7)	189.6 (±32.3)	203.6 (±3.7)
Midwest					
Male	371.6 (±21.1)	399.2 (±5.0)	518.8 (±3.4)	350.9 (±41.1)	227.0 (±17.9)
Female	269.8 (±15.7)	260.9 (±3.3)	356.4 (±2.4)	195.6 (±26.0)	177.0 (±13.9)
South					
Male	352.1 (±13.8)	363.5 (±16.6)	518.6 (±1.7)	133.4 (±16.7)	204.2 (±8.3)
Female	221.3 (±9.6)	232.2 (±11.9)	345.0 (±1.1)	79.0 (±10.5)	144.7 (±5.9)
West					
Male	343.5 (±22.8)	436.4 (±14.6)	479.4 (±4.9)	236.5 (±10.1)	302.2 (±20.3)
Female	238.1 (±16.8)	302.4 (±10.4)	341.1 (±3.5)	173.3 (±7.6)	221.0 (±13.9)

Note. CI = confidence interval.

9th Revision [ICD-9] codes 390 through 459) among Blacks in the United States for the years 1979 through 1991 were extracted from the National Center for Health Statistics mortality detail files. The fourth-digit ICD-9 subclassifications were not used for this study as we were interested in the overall patterns of mortality from diseases of the circulatory system, not one specific disease type. The variables place of birth and death are indicated in the records, and race is assigned by physician or medical examiner in these numerator data.

The authors contracted with the US Bureau of the Census to create a unique population-at-risk (denominator) data set that included population counts for the years 1980 and 1990 by age, race, gender, state of birth, and state of residence at the time of the census. This was necessary because not all the variables needed for this study were available from the public use census tapes for both time periods. Race is self-declared by respondents to the US decennial censuses, a difference between numerator and denominator data in ascertainment of the variable that might cause difficulties in interpretation of results. Linear interpolation was used to estimate the population at risk for 1981 through 1989. The 1980 population was used to estimate the population at risk for 1979, and the 1990 population was used to estimate 1991.

Age-specific mortality rates were calculated for males and females for combinations of four regions of birth (Northeast, Midwest, South, West) as well as for a single category for the foreign-born, with four regions of residence at death (Northeast, Midwest, South, and West) based on the US Census aggregates of states. (Northeast consists of Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, and Pennsylvania; Midwest consists of Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, and Kansas; South consists of Delaware, Maryland, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida, Kentucky, Tennessee, Alabama, Mississippi, Arkansas, Louisiana, Oklahoma, Texas, and the District of Columbia; West consists of Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada, Washington, Oregon, California, Alaska, and Hawaii.) Age-adjusted death rates from circulatory diseases and 95% confidence intervals were also calculated for both genders and for each regional combination. The direct method of age adjustment was selected, with the 1960 population of the United States used as the standard in order to be consistent with the authors' previous research on migration among American Blacks for all-cause mortality and selected external causes.[10]

Results

National Center for Health Statistics data yielded 1 292 527 deaths from diseases of the circulatory system among Blacks during the 13-year study period (636 588 male deaths; 655 939 female deaths). At the time of death 515 of these cases resided outside of the United States, and these were excluded from the analysis. An additional 14 343 cases (1.1%) did not list state of birth in the case record, and these were excluded as well. Overall, 16.4% (210 032) of the 1 277 669 remaining cases died in the Northeast; 19% (242 503) died in the Midwest; 57.4% (733 479) died in the South; and the remaining 7.2% (91 655) died in the West.

The age-adjusted death rates from circulatory diseases and 95% confidence intervals based on place of birth and place of residence at time of death are found in Table 1. For each region of residence at time of death, there are four comparisons to be made between those born in the South and those born in other regions (16 comparisons for each gender).

The table shows that males had higher mortality rates from circulatory diseases than females in every regional combination of place of birth and place of residence at time of death. In other words, the effect of gender on mortality from circulatory diseases holds regardless of region of birth or death, with male rates consistently higher than female rates.

Of particular interest is the fact that for both males and females, the highest rates for mortality from circulatory diseases occurred for those who were born in the South but died in the Midwest (519 per 100 000 for males; 356 for females). Additionally, the lowest rates for both males and females occurred among those who were born in the West but died in the South (133 per 100 000 for males; 79 for females). The second-lowest rates for

TABLE 2—Age-Specific Mortality Rates from Circulatory Diseases per 100 000 for Black Americans, by Region of Birth and Death, 1979 through 1991

Age Group	Region of Birth	Region of Death			
		Northeast	Midwest	South	West
		Males			
25–44	Northeast	79	63	41	43
	Midwest	60	76	42	62
	South	128	121	92	89
	West	35	45	24	49
	Foreign country	28	18	25	20
45–64	Northeast	645	636	540	484
	Midwest	678	668	539	642
	South	842	835	842	709
	West	434	368	176	402
	Foreign country	277	225	204	331
65+	Northeast	2281	2255	2280	2088
	Midwest	2902	2436	2414	2863
	South	3354	3516	3548	3281
	West	2217	2693	914	1385
	Foreign country	2503	1891	1631	2489
		Females			
25–44	Northeast	42	29	24	29
	Midwest	37	41	26	35
	South	60	57	48	47
	West	16	30	19	34
	Foreign country	16	17	15	16
45–64	Northeast	332	351	265	247
	Midwest	355	355	313	352
	South	456	462	465	413
	West	330	205	108	215
	Foreign country	165	172	128	198
65+	Northeast	1737	1997	1725	1849
	Midwest	2098	1942	1744	2459
	South	2807	2920	2796	2798
	West	1271	1658	559	1260
	Foreign country	1969	1703	1285	1738

both genders occurred among the foreign-born who died in the South (204 per 100 000 for males; 145 for females). In other words, there is a regional component operating that both predisposes an individual to mortal outcomes from circulatory diseases (for those born in the South) and seems to confer some protective effect (for the foreign-born or those born in the West) regardless of gender.

An examination of the male rates in Table 1 shows that for all 16 comparisons, those born in the South had statistically significantly higher mortality rates from circulatory diseases than their counterparts who died in the same regions ($P < .05$). This finding also holds for females, with all 16 comparisons again statistically significantly higher for those who were Southern-born ($P < .05$). Again, this shows that there is a region-of-birth component operating.

Table 2 presents age-specific mortality rates for diseases of the circulatory system for three select age groups. (A complete set of tables based on decennial age groups are available from the authors, but to save space, they are not reproduced here.)

A pattern in the age-specific death rates is that being Southern-born is related to excess mortality from circulatory diseases at an early age, and this pattern holds regardless of region of death. For example, rates for males who were born in the South and died in the Northeast exceed rates for those who were born in and also died in the Northeast beginning at age 25 through 44 years (128 and 79 per 100 000, respectively). This excess mortality among the Southern-born holds across age groups (842 per 100 000 for those 45 through 64; 3354 per 100 000 for those 65 and older among those dying in the Northeast). It also holds across age groups for males dying in the Midwest, South, and West. In other words, among the Southern-born, there is a clear pattern of excess mortality that holds regardless of region of death. Furthermore, that excess appears as early as 25 through 44 years of age.

In contrast, 25- through 45-year-old and 45- through 64-year-old males who were foreign-born but died in the Northeast had far lower rates than those who were born in any of the regions of the United States and who died in the Northeast. This same pattern of lower mortality from circulatory diseases among the foreign-born holds for males who died in the Midwest, South, and West, as well. The second lowest rates for males are found among the Western-born in the 25- through 44-year-old and 45- through 64-year-old age groups, again regardless of region of death. In our original calculations of decennial age-specific mortality rates, there were relatively few Western-born Blacks who died in other regions in some of the cells. The 20-year age cohorts reported as age-specific mortality rates in Table 2, however, reflect sufficiently large numbers for rate stability. In other words, there seems to be a protective effect for circulatory disease mortality for Blacks who were foreign- and Western-born compared with those who were born in the Northeast, Midwest, or South regardless of their region of death.

For females, the excess mortality among the Southern-born shows a similar pattern to that for males, except that the rates are generally lower. Those who were born in the South but died in the Northeast, Midwest, South, or West had higher rates as early as ages 24 through 44 years (60, 57, 48, and 47 per 100 000, respectively). The suggestion of a protective effect for being foreign- or Western-born again shows up for females in the 24- through 44-year-old and 45- through 64-year-old age groups. The lowest rate in the 65 and older age group is for those who were born in the West and died in the South.

Discussion

There are limitations to this migrant study, not the least of which is the use of mortality data to study a broad category of disorders we called "circulatory diseases." Not everyone who suffers from one of these disorders dies of it, nor do all

who die from a disease of the circulatory system necessarily have the cause correctly diagnosed or reported on their death certificate. The accuracy of death-certificate diagnoses have been reported elsewhere.[46,47] In the absence of confirmatory autopsy data for all cases in this population-based data set, we chose to minimize misclassification error by utilizing the broad category called circulatory diseases rather than using the specific ICD-9 codes for different types of heart disease or stroke. This decision gave us the advantage of a larger population and smaller standard errors in the death rates.

Local or regional biases in reporting may affect studies investigating geographic patterns of disease. We cannot claim that such differentials have had no impact on these results. There is no evidence to suggest, however, that Southern-born Blacks in all regions would be more likely to have a circulatory disease assigned as the cause of death than would Blacks who died in the same region but who were not born in the South. Otherwise stated, while there may be interregional biases in the reporting of cause of death, misclassification of cause of death among those who died in any given region should have been nondifferential, and any effect would have biased our results toward the null.

Conversely, it is possible that migrants might have different circulatory death rates than nonmigrants because they may be self-selected for survival[5] or have more or less access to care or different rates of utilization of services than nonmigrants. If access to care or utilization of services biased the reporting of cause of death, then all migrants, not only those from the South, would be affected. Given that one migrant group (Southern-born) had the highest rates, and another (foreign-born) had the lowest rates, we must conclude that migration, itself, was not the driving factor for our results.

Another limitation to using mortality data is that there are no validity studies of state-of-birth coding on death certificates. Lanska and Peterson note, however, that this information is common knowledge among family members, and any errors are unlikely to produce significant systemic bias in ecological studies.[6]

Similarly, death certificates yield no information about when persons migrated from their place of birth to their place of residence at time of death. Census data do yield information on place of birth and place of residence at the time of the census, but not on place of residence throughout the life span. In the absence of a population-based data set that can provide such information and be individually matched to mortal outcomes, an ecological study design to examine the relationship between place of birth and mortality from circulatory diseases is both obligate and apt.[48]

Finally, a limitation of using census data for population-at-risk estimates is the widely acknowledged problem of undercounting minorities, especially in urban areas. There is the possibility that one or more of our regions may have been disproportionately affected by undercounting. Yet we have no reason to suspect that undercounts would have been directionally biased toward or against American-born migrants, or toward or against Southern-born Blacks, in particular. Rather, any undercounting would have been nondifferential, and any intraregional effects should have biased our results toward the null.

There was also the possibility that disease competition could have skewed the death rates in this study. That is, Southern-born Blacks could have had high circulatory diseases mortality rates because those born in other regions died from other causes. We tested this possibility in prior research, by calculating age-adjusted death rates for all causes of death and for selected specific potential competitive causes, such as cancer, diabetes, homicide, and suicide, for Black males for 1979 through 1981 and for cancer for 1979 through 1991.[49] These computations show that competition from alternative diseases does not explain high mortality rates from circulatory diseases among Southern-born Black Americans.[10]

Despite the limitations of this study, we found an association between place of birth and mortality from circulatory diseases among Black Americans. In this arguably heterogeneous population, which has historically shown little progress towards assimilation,[45] those who were Southern-born consistently had higher mortality rates from diseases of the circulatory system regardless of region of death. Conversely, those who were foreign- or Western-born exhibited lower rates of dying of circulatory diseases even when they migrated to other regions. One plausible hypothesis for these patterns is that a factor or factors operating in the prenatal environment or in early childhood influences the development of circulatory diseases, an explanation that is supported by the literature.[30–41] Additional evidence that factors may be operating in early life is our finding that significant differences in mortality based upon region of birth are apparent beginning in the 25- through 44-year-old age group. This means that it is not only the lifelong behavioral and dietary patterns among the elderly cohort that account for the excess of circulatory diseases mortality among American Blacks.[50] Nor is it simply social class.[51] We need to further investigate how early exposures, including poverty and diet, aid in the development of, and eventual mortality from, these diseases. Indeed, if we understand these pathways, we may make more headway in prevention than through focusing on the dietary patterns and personal behaviors of older cohorts.

A follow-up study is currently underway to examine the specific ICD-9 classifications for heart diseases and stroke for this population. Congenital malformations of the heart and circulatory system will be separately examined for a region-of-birth component. Additional internal migration studies should also be done to determine whether the geographic pattern for diseases of the circulatory system reported here for Blacks holds for other population groups. If being Southern-born is a strong risk factor for mortality from circulatory diseases among groups other than African Americans, even if those groups migrate to other regions, then we need to consider what is in the environment of the American South that increases the risk of developing these diseases. If, however, the pattern does not hold, then we need to examine what is in the experience of Southern-born Blacks that puts that group, specifically, at higher risk. Conversely, it would be of enormous public health value to know what factors are functioning to protect foreign- and Western-born Blacks from mortality from circulatory diseases, even after migration to other regions. The possibility exists, for example, that foreign- and Western-born migrants are less poor than their counterparts born in other US regions and might have suffered less poverty in childhood. There is also the possibility that the foreign-born and Western-born had early diets that included more fruits, vegetables, and fiber and/or less fat. Knowing dietary patterns before and after migration would help us determine whether it is the early or later dietary factors that are the driving forces behind the development and prevention of circulatory diseases.

To determine these factors, retrospective case–control studies should be designed to tease out the role of nutritional

deprivation, dietary patterns, and other behavioral and environmental exposures operating at different periods of life (including the trimesters of the prenatal period, the neonatal period, infancy, early childhood, childhood, and early adolescence). After all, we now know that diet, exercise, genetics, and smoking affect heart-disease and stroke mortality among adults, yet we do not understand how early life experiences and exposures predispose people toward, or protect them from, developing circulatory diseases. Once we understand the role of these early factors, factors that appear to continue to operate even after migration, then public health interventions to reduce morbidity and mortality from circulatory diseases should theoretically be possible. □

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