

Variation in the magnitude of black-white differences in stroke mortality by community occupational structure

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Abstract

Study objective—The aim was to examine the patterns of black-white differences in stroke mortality across communities with varying levels of occupational structure in the southern region of the United States

Design—Annual age adjusted race-sex specific rates for stroke mortality were calculated for the years 1979–1981 and related to socioeconomic conditions.

Setting—The study involved 211 state economic areas comprising the southern region of the USA.

Study population—Data on stroke mortality for black and white men and women between the ages of 35 and 74 years living in the study area were acquired from the National Center for Health Statistics.

Measurements and main results—Occupational structure was measured as the proportion of white collar workers in each state economic area, and is an indicator of the employment opportunities and related social and economic resources of a community. Stratified analyses and linear regression modelling indicate that communities of lower occupational structure have (a) higher levels of stroke mortality for all four race-sex groups ($p < 0.05$) and (b) larger racial inequalities in stroke mortality ($p < 0.01$). For men and women, the excess stroke mortality among blacks compared to whites is larger in communities of lower occupational structure.

Conclusions—Consideration of occupational structure and related patterns of economic development is crucial for understanding the distribution of stroke mortality within and between racial groups, as well as for planning effective public health interventions. The larger racial inequalities in communities of lower occupational structure in the south suggest that aspects of the black experience which are conducive to high rates of stroke mortality are exacerbated in those communities. Public health interventions to reduce the racial and social inequalities in stroke mortality should recognise the social context within which nutritional, occupational, medical care, and environmental determinants of stroke are distributed.

among blacks than among whites in the United States has led researchers to investigate the racial differentials. One line of inquiry has examined the relationship between indices of community socioeconomic structure and hypertension related morbidity and mortality for blacks and whites.¹⁻⁴ This perspective addresses the concept that macro level social and economic conditions influence the distribution of risk factors for hypertension related morbidity and mortality, and furthermore that blacks and whites may be differentially affected. However, the previous studies were not able to make direct comparisons between races because they employed race specific indices of socioeconomic structure, or compared blacks and whites from different communities. In order to understand better how social and economic forces (such as development and underdevelopment) may exacerbate or reduce racial inequalities in health, it is important to assess qualities of the socioeconomic structure which apply to both blacks and whites. In this study we examine the patterns of black-white differentials in stroke mortality among communities in the southern region of the United States which are categorised according to the overall structure instead of the race specific occupational structure.

The occupational structure of a community refers to the employment opportunities which reflect a community's placement in the national and world economy as well as its social and economic resources. The quantity and quality of such resources may affect blood pressure levels and risk of stroke through mechanisms such as diet,⁵⁻⁸ cigarette smoking,⁹ job related stress,¹⁰⁻¹² social cohesion,¹³⁻¹⁵ economic pressures,¹⁶⁻¹⁸ and medical care.¹⁹⁻²¹ Hence, occupational structure is viewed here as reflecting the context within which the prevalence of risk factors for stroke are determined.

Communities may differ not only by level of social and economic resources, but also in the extent to which these resources are shared by all groups within the community. Varying racial differences in stroke mortality across levels of occupational structure may reflect the uneven dissemination of resources within poor versus more affluent communities. As an initial step in investigating this hypothesis, this study examines the pattern of racial differentials in stroke mortality across categories of occupational structure.

Methods

State economic areas are the units of analysis for this study. State economic areas were defined by

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The well documented pattern of higher hypertension related morbidity and mortality

the Bureau of the Census based upon size and composition of the population, along with the amount and type of economic activity.²² A state economic area can be either a single metropolitan county or an aggregation of non-metropolitan counties which follow county and state boundaries.

We restricted this study to the 211 state economic areas in the southern region of the United States (as defined by the Bureau of the Census). This region has consistently experienced the highest rates of stroke mortality in the United States, and a recent study showed evidence of substantial geographical variation in stroke mortality within the south.²³ The recent pattern of economic development within the south, characterised by the continued underdevelopment of some areas, which remain dependent upon labour intensive low wage industries, while other areas have experienced economic growth,²⁴⁻²⁶ also provided the rationale for restricting this study to the south.

Annual age adjusted race-sex specific rates for stroke mortality among people aged 35-74 years were calculated for each state economic area during 1979-1981. The stroke mortality data (9th revision ICD codes 430-438) were acquired from the National Center for Health Statistics, and the population counts were obtained from the Bureau of Census. The rates were directly age adjusted to the 1970 US population. In order to increase the stability of the rates, three year population weighted average rates were calculated for each race-sex specific group. The weights were the annual proportion of the total race-sex specific population, ages 35-74 years, in each state economic area for the years 1979-1981.

The occupational structure of each state economic area was represented by the proportion of the civilian labour force employed in white collar occupations in 1980. In order to reflect the occupational structure of the shared environment, we did not calculate race specific percentages of white collar workers. White collar workers include "(a) professional, technical and kindred workers, managers and administrators except farms, and (b) sales and clerical workers". These

data were obtained from the 1983 County and City Data Book.²⁷

We ranked state economic areas according to the proportion of the civilian labour force employed in white collar occupations, and created five categories of occupational structure by dividing the distribution into five groups—each with an approximately equal range of the distribution. Category 1 is the lowest category of occupational structure (comprised of state economic areas with the lowest percentages of white collar workers) and category 5 is the highest. Equal division of the range of the independent variable allows for rough extrapolation of patterns observed as a categorical variable to patterns expected as a continuous variable.

We computed population weighted average race and sex specific stroke mortality rates for each category of community occupational structure. Patterns of race-sex specific stroke mortality rates and black-white rate differences across the levels of the community occupational structure were assessed. Weighted linear regression was employed to provide summary estimates of the effects of race and community occupational structure on stroke mortality rates, along with the combined effect of race and occupational structure. In the regression model, occupational structure was used as a continuous variable (ie, the percent of white collar workers for each state economic area).

Results

Descriptive statistics of occupational structure and stroke mortality rates across the state economic areas are presented in table I. Both the mortality rates and the community occupational structure have fairly normal distributions, with black men and black women having distributions of stroke mortality rates skewed slightly to the right. The interdecile ratio shows the largest relative variation in stroke mortality rates among blacks, and indicates a substantial amount of variation in the level of community occupational structure among state economic areas in the south.

The categorisation of state economic areas into levels of occupational structure and the race-sex specific person-years used to calculate the population weighted stroke mortality rates are presented in table II. Although the distribution of state economic areas by occupational structure is skewed toward the left (ie, towards lower levels of occupational structure), the areas in the higher levels of occupational structure have large populations which enhance the stability of the rates.

In the southern region of the US, the 1979-1981 stroke mortality rates among black men and black women are 2.5 times higher than those of white men and women (rates per 100 000: black men 181, white men 71; black women 128, white women 52). Within the south, the rates of stroke mortality for both blacks and whites vary by occupational structure, and the magnitude of excess stroke mortality among blacks compared to whites also varies by occupational structure.

Examination of the stroke mortality rates by level of occupational structure (figs 1 and 2)

Table I Descriptive statistics of occupational structure and stroke mortality rates across the state economic areas in the southern region of the United States

Variable	10 ^o %	Mean	Median	90 ^o %	90 ^o % - 10 ^o % Range	90 ^o % / 10 ^o % Inter decile ratio
Occupational structure (percent white collar workers)	37.0	46.9	45.1	59.6	22.6	1.6
Stroke mortality (rate per 100 000)						
Black men	89.1	181.1	177.4	264.6	175.5	3.0
Black women	72.9	128.2	125.9	188.8	115.9	2.6
White men	53.8	71.2	71.2	88.4	34.6	1.6
White women	39.9	51.5	50.9	63.0	23.1	1.6

Table II Distribution of state economic areas (SEAs) and race-sex specific person-years by category of occupational structure

	Occupational structure				
	1 (low)	2	3	4	5 (high)
Range of % white collar workers	< 40	41-48	49-56	57-64	> 64
No of SEAs (%)	53(25)	76(36)	42(20)	35(17)	5(2)
Person-years					
Black men	237 833	549 563	287 955	667 077	140 941
Black women	301 765	694 011	366 065	837 916	168 703
White men	1 962 058	3 453 562	1 905 333	3 557 046	459 977
White women	2 166 346	3 797 769	2 136 717	3 971 706	497 700

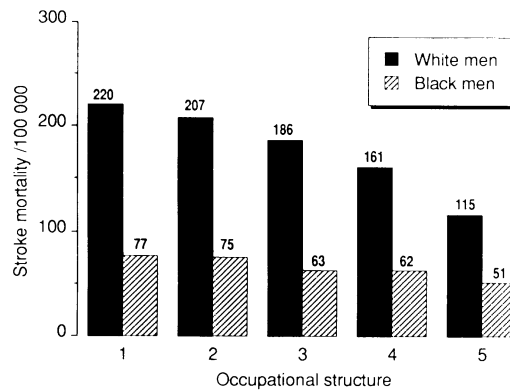


Figure 1 Stroke mortality rates per 100 000 for men by category of occupational structure, the south, USA, 1979-1981.

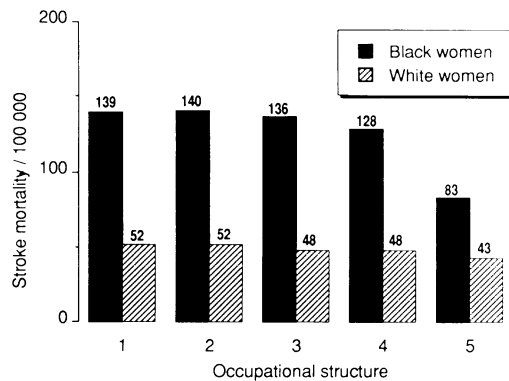


Figure 2 Stroke mortality rates per 100 000 for women by category of occupational structure, the south, USA, 1979-1981.

reveals inverse patterns for all four race-sex groups. Stroke mortality rates in low occupational structure communities are higher than rates in the high occupational structure communities. The difference between rates in the lowest and the highest category of occupational structure is larger among blacks than whites, and greater among men than women.

For men, the magnitude of the black-white difference in stroke mortality shows an inverse pattern by level of occupational structure. The

largest black-white difference in stroke mortality (143 per 100 000) occurs in the category of lowest occupational structure. As the level of occupational structure increases from category 2 to category 5, the black-white differences are 132, 123, 99, and 64 per 100 000 respectively. Among women, the racial difference of stroke mortality appears to be fairly similar among the four lowest categories of occupational structure (87, 88, 88, and 80 per 100 000) with a sharp decrease in the highest category (40 per 100 000).

The results from the weighted linear regression analysis, using occupational structure as a continuous variable, are presented in table III. The excess stroke mortality among blacks compared to whites is statistically significant ($p < 0.01$) for both women (124.03 per 100 000) and men (225.40 per 100 000).

The effect of occupational structure on stroke mortality is larger among blacks than among whites. For every 10% increase in white collar employment the stroke mortality rates among black men and women decrease by 29.6 and 10.6 deaths per 100 000 respectively, while the rates among whites decrease by 8.1 and 2.3 deaths per 100 000. These differences in the occupational structure effect on blacks compared to whites are statistically significant ($p < 0.01$) for both men and women.

The summary estimates of the association between occupational structure, race, and stroke mortality, provided by the weighted linear regression analysis, support the observations from the bar graphs (figs 1 and 2) in which occupational structure was examined as a categorical variable.

Discussion

In the southern region of the United States, during the years 1979-1981 there was an inverse association between occupational structure and stroke mortality rates for blacks and whites, as well as an inverse association between occupational structure and black-white differentials in stroke mortality. The highest rates and the largest excess mortality for blacks were experienced by communities of lowest occupational structure.

The interpretation of ecological measures as population rather than individual attributes is often ignored despite the logic which links public health concerns to an understanding of properties of the community. Viewed from a public health perspective, the occupational structure of a community reflects the division of labour which is related to economic and political relations with other communities. Communities with lower levels of occupational structure have labour markets which are predominantly blue collar and are based upon manufacturing and/or agriculture activities. As documented in table IV, there is a monotonic association between occupational structure and industry profile. The lower the level of occupational structure, the larger the proportion of the work force which is employed in agriculture and manufacturing. In addition, as the data in table IV indicate, these communities of lower occupational structure are more likely to be non-metropolitan communities. Such

Table III Estimated race and occupational structure effects^a on stroke mortality per 100 000 in the south, 1979-1981

Variable	Rate differences	
	Women	Men
Race	124.03	225.40
Occupational structure (blacks) ^b	-10.6	-29.6
Occupational structure (whites) ^b	-0.23	-0.81

^a Results are derived from the following model: $\text{Stroke}_i = \alpha + \beta_1(R) + \beta_2(OS) + \beta_3(R \cdot OS)$ Where $i = \text{gender}$; $R = \text{race}$; $OS = \text{occupational structure}$. Race is coded: 0 = whites and 1 = blacks

^b Rate differences are presented for every 10% increase in white collar employment

Table IV Distributions of metropolitan status and 1980 industry profiles^a in the south by category of occupational structure

	Occupational structure				
	1 (low)	2	3	4	5 (high)
Metropolitan status ^b					
Metro	4%	10%	74%	94%	100%
Non-metro	96%	90%	26%	6%	0%
Industry profile ^c					
Agriculture	8.0%	7.6%	3.4%	2.3%	0.8%
Manufacturing	29.8%	21.8%	16.2%	15.3%	6.9%
Total Services ^d	26.9%	32.2%	39.3%	41.1%	61.1%
Health	5.1%	6.0%	7.1%	7.1%	6.2%
Education	7.5%	8.3%	8.1%	7.4%	9.1%
Other	35.3%	38.4%	41.1%	41.3%	31.2%

^a Data source: Census of Population and Housing 1980, STF3C, Washington DC. US Department of Commerce, Bureau of the Census, 1980

^b Metropolitan status = percent of state economic areas in each category of occupational structure according to metropolitan status

^c Industry profile = percent of the labour force in each category of occupational structure employed in a particular industry.

^d Total services = health services, educational services, business and repair services, finance, insurance and real estate, public administration, other professional and related services, personal, entertainment and recreational services.

communities often suffer from economic uncertainty and loss of resources because they are dependent upon the success or failure of a few major employers.²⁸ On the other hand, communities of higher occupational structure have labour markets which are primarily service orientated, and are more diversified than the lower occupational structure communities. For instance, in the communities of highest occupational structure 61.1% of the labour force are employed in services as compared to only 26.9% of the labour force in communities of lowest occupational structure. The communities which are primarily service orientated are in a better position to acquire economic stability, and are often the recipients of resources which are derived from the communities of lower occupational structure.^{28 29}

These social and economic patterns have been documented in the southern region of the USA. Communities of lower occupational structure, which are predominantly rural, have remained underdeveloped, while economic development has occurred in the higher occupational structure urban areas of the south.²⁴ Profits from raw materials and cheap labour in the rural south which were previously accrued primarily in the northeast are now being received, to some degree, by areas of higher occupational structure within the south.³⁰ Such development has been associated with more stable labour markets and higher levels of well being in the developed areas. However, this sort of development has occurred at the expense of the underdevelopment of the areas that have supplied the basic resources for economic stability, improved working conditions, and improved infrastructure in the developed areas.³⁰⁻³³

Our data indicate that the communities with the lowest occupational structure have the highest rates of stroke mortality. These communities are on average less able to provide quality employment, transportation, medical care, education, and housing. Such attributes may influence the distribution of blood pressure levels—the strongest biomedical risk factor for stroke—through nutritional, environmental, occupational, and medical care determinants.

Within the south, underdeveloped low occupational structure areas show not only higher rates of stroke mortality, but also larger racial inequalities in stroke mortality. While excess stroke mortality in blacks compared to whites has been consistently observed in the USA, analyses presented here show that in the south the excess is greater in low than in high occupational structure areas. This suggests that those aspects of the black experience which are conducive to high rates of stroke mortality, including a high prevalence of poor living and working conditions and lack of medical care, are exacerbated in low occupational structure areas of the south. The psychophysiological dimensions of poverty and racism, including suppressed hostility, thwarted aspirations, and raised blood pressure,^{3 34} may be important mechanisms in this process.

At the other end of the spectrum of occupational structure, the black-white differential in stroke mortality is reduced but is still substantial. This would indicate that blacks

realise some relative gains in health from living in more affluent communities, but that the distribution and utilisation of wealth serves to maintain social inequalities in health in areas with the most resources. Thus the character of development in areas of high occupational structure remains problematic for the health of black residents as well as for those people living in low occupational structure communities.

The results of this study are subject to biases of outcome misclassification related primarily to the accuracy of medical diagnosis of stroke³⁵ and choice of underlying cause of death on the death certificate.^{36 37} Accurate diagnosis of stroke is difficult given the diversity of clinical features and the expense of diagnostic tests. The validity of death certificate information is often challenged due to the difficulties and subjective nature of assigning underlying cause of death, and the bias which is introduced by having different people fill out the certificate for each death. It is of interest to note, however, that the results of a national death certificate study suggested that geographical differences in stroke mortality were not due to differences in death certificate coding.³⁸ Furthermore, these problems of diagnosis and choice of underlying cause of death are minimised in this study because we excluded the older age groups among whom the difficulties are more serious.

The effects of occupational structure on mortality in the south are not restricted to stroke mortality. A previous study of trends in the association between occupational structure and ischaemic heart disease mortality among whites during the years 1968–1982 reported the emergence of an inverse association in the later years.³⁹ After 1972 communities with lower levels of occupational structure experienced higher rates of ischaemic heart disease mortality than communities with higher levels of occupational structure. Furthermore, these findings were strongest for the southern region of the United States.

The results of these studies, and the interpretations we have presented, emphasise the perspective that health experiences of populations are interdependent. Recognising the importance of development patterns and the distribution of resources among social groups such as blacks and whites is crucial to explaining the distribution of disease in populations and planning effective health interventions. More research is needed to gain a better understanding of the mechanisms through which structural characteristics of a community influence the patterns of health and disease within and between communities.

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