

Hospitalized Stroke in Blacks and Hispanics in Northern Manhattan

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Background and Purpose: The growing black and Hispanic populations in the United States call for studies of the rates and prognosis for cerebral infarction to help plan more focused prevention programs.

Methods: Using the Statewide Planning and Research Cooperative System, we obtained discharge data for 1,034 patients over age 39, who were hospitalized for stroke from 1983 to 1986, using four zip code areas of the ethnically mixed community of Northern Manhattan.

Results: Stroke incidence increased with age in both men and women in all three race/ethnic groups. The age-adjusted stroke incidence per 100,000 per year for men ≥ 40 years of age was 567 for blacks, 306 for Hispanics, and 351 for whites. Incidence in women ≥ 40 years was 716 in blacks, 361 in Hispanics, and 326 in whites. Hypertension and diabetes were more prevalent in blacks and Hispanics with stroke, whereas whites had more ischemic cardiac disease. Crude in-hospital mortality was greater in younger blacks and Hispanics compared with whites, whereas 2-year readmission rates, overall and for stroke, were similar in the three groups.

Conclusions: These estimates of hospitalized stroke incidence and mortality substantiate the greater incidence of stroke in blacks and provide new data concerning Hispanics for public health planning. (*Stroke* 1991;22:1491-1496)

The growth of the US black population from 1980 to 1990 was projected to be 16%, with the US Hispanic population at 34% and growing five times faster than the white population.¹ Because of this population growth, a greater number of blacks and Hispanics are at risk for stroke. When stroke racial groups have been studied, the populations have largely been restricted to white versus nonwhite. Nonwhite often consists primarily of black patients, while Hispanics have rarely been identified independently. Few studies have compared stroke incidence in these three race/ethnic groups in the same region. The ethnic mixture of the community of Northern Manhattan permits the study of differences in stroke risk for blacks, Hispanics, and whites.

Subjects and Methods

The Statewide Planning and Research Cooperative System (SPARCS), a New York State data base of all hospital discharge information, was used to

estimate the incidence of hospitalized stroke for different race/ethnic groups in Northern Manhattan. Demographic, financial, and categorical information concerning the reasons, duration, and outcome of a hospital stay are collected by hospitals and assembled by SPARCS. Specified data items were obtained from the New York State Department of Health for the years 1983 to 1986 after formal approval was granted from the Data Protection Review Board.

The geographic area of interest was Northern Manhattan or Washington-Heights-Inwood specified by four zip codes: 10032, 10033, 10040, and 10034. This community district of the borough of Manhattan in New York City is north of 155th Street and south of 218th Street, and is bounded on the west by the Hudson River and separated from the Bronx on the east by the Harlem River. It is distinct from the communities of Central and East Harlem, which are to the southeast. Columbia-Presbyterian Medical Center, the only hospital in the area, accounted for 57% of the patients in this study.

The 1980 census data was used to estimate the population at risk. In 1980, nearly 182,000 people lived in Northern Manhattan, with 39% over the age of 39 and 44% white non-Hispanic, 15% black non-Hispanic, and 38% Hispanic. Hispanics are primarily from the Dominican Republic (66%), Cuba, and Puerto Rico. There are more Hispanics and whites, fewer blacks, and the median household income is

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TABLE 1. Hospitalized Stroke in Blacks, Hispanics, and Whites From Northern Manhattan: Demographics and Stroke Subtypes

Factor	Black	Hispanic	White	<i>p</i> *
Number	235	209	590	
Women	61.7%	56.0%	60.2%	NS
Mean age at stroke†	69.5±1.4	65.4±1.7	77.5±0.8	
Age 40–69	50.2%	61.2%	19.3%	
Age ≥70	49.8%	38.8%	80.7%	0.001
Stroke subtypes				
Subarachnoid hemorrhage	3.0%	6.2%	1.0%	
Intracerebral hemorrhage	10.6%	11.0%	7.0%	
Cerebral infarction	86.4%	82.8%	92.0%	0.001‡

* χ^2 with 2 df for nonstratified proportions.

†95% confidence interval for mean age at stroke.

‡White vs. others (combined blacks and Hispanics) for infarcts vs. hemorrhages (combined subarachnoid and intracerebral). NS, nonsignificant ($p>0.05$).

greater in Northern Manhattan compared with the Harlem communities. For the Northern Manhattan population, frequencies were tabulated stratified by race/ethnicity, sex, and deciles of age.

Inclusion criteria for this analysis were the following: hospitalized from 1983 through 1986, resided in the four zip codes of Northern Manhattan, discharged with diagnosis codes for stroke based on the International Classification of Diseases, 9th Revision, Coding Manual (ICD-9CM: 430, 431, 433, 434, 436), aged over 39 at stroke, and defined race/ethnicity of white, black, or Hispanic. Before 1986, Hispanic was a separate designation under race. Starting in 1986, following the US Census methodology, Hispanic was dropped as a separate race and ethnicity was added. For this analysis, race/ethnicity was redefined as white non-Hispanic, black non-Hispanic, and Hispanic.

Using the 4 years of data, the average annual incidence of stroke was calculated. A longitudinal SPARCS file was used that included an encrypted patient identifier so readmissions could be enumerated. The number of patients from Northern Manhattan with their first hospitalized stroke was estimated from the SPARCS data by counting only the *first* occurrence of stroke and excluding readmissions or those with a secondary diagnosis of the late effects of stroke (ICD code 438). The persons at risk were estimated from the US census data stratified by age, sex, and race/ethnicity. Stroke incidence was calculated by sex and age. Using ICD-9CM diagnostic categories, stroke subtype incidence was estimated for subarachnoid hemorrhage (430), intracerebral hemorrhage (431), and cerebral infarction (433, 434, 436). Because of patient confidentiality, SPARCS did not disclose patient identifiers; therefore, it was not possible to identify medical records to validate the stroke diagnoses. All hospitals had computed tomography available, which should have allowed adequate discrimination of these three stroke subtypes. Age distribution among the three race/ethnic groups was different, both within the underlying population and at the time of stroke; therefore, direct age adjustments

were calculated based on the total Northern Manhattan population as the standard.

The prevalence of hypertension, diabetes, cardiac disease, and atrial fibrillation was estimated for each race/ethnic stroke group. These frequencies were derived by combining various secondary discharge diagnoses into larger general categories and stratified by age. In-hospital mortality, disposition, and 1-year readmission rates were also compared.

Statistical significance was defined by $p<0.05$ using a two-sided χ^2 test for proportions. Standard errors were calculated for the direct age adjusted rates in each of the three groups assuming binomial variation within each age interval. Cochran-Mantel-Haenszel χ^2 was used to judge the significance of variables in a stratified analysis. Life tables were used to calculate cumulative readmission rates in the three race/ethnic groups.

Results

From 1983 to 1986, 1,034 patients (235 black, 209 Hispanic, and 590 white) were admitted for the first occurrence of stroke in Northern Manhattan (Table 1). There were more women than men in each race/ethnic group. Whites were significantly older, blacks intermediate, and Hispanics younger at the time of stroke. Cerebral infarction accounted for the majority of strokes. Blacks and Hispanics had a greater proportion of intracerebral and subarachnoid hemorrhages.

The age-adjusted incidence (\pm SEM) of hospitalized stroke in women was greatest for blacks (716 ± 125 per 100,000 per year) and similar for Hispanics (361 ± 75) and whites (326 ± 36) (Figure 1). A similar trend was observed for men. The incidence of cerebral infarction was from five to 10 times greater than hemorrhagic stroke subtypes in each race/ethnic-gender group (Table 2). Blacks had nearly twice the incidence of cerebral infarction than Hispanics or whites. Among those with cerebral infarction, there was slightly more large artery atherosclerotic infarction among whites (11%) compared with blacks (5%) and Hispanics (7%), but the

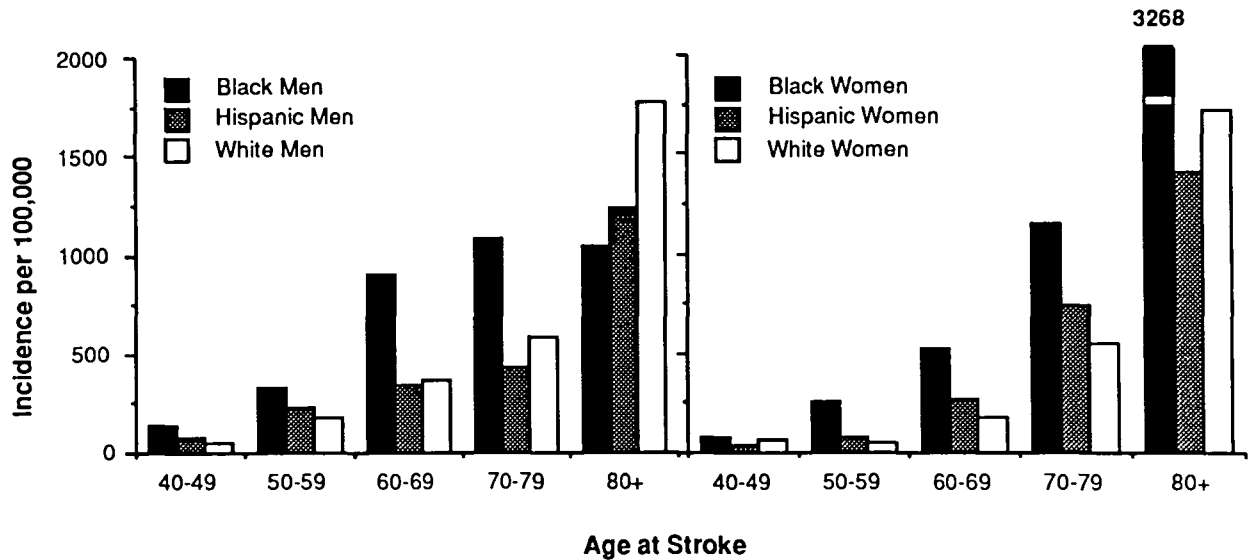


FIGURE 1. Age-specific 1-year incidence (per 100,000) of hospitalized stroke patients aged 40 or older among black, Hispanic, and white men and women in Northern Manhattan.

large number of unspecified cerebrovascular accidents (black, 81%; Hispanic, 73%; white, 72%) make these subtype-specific frequencies less reliable. The small sample sizes limited the statistical power of the study; however, the incidence of intracerebral and subarachnoid hemorrhage was increased in blacks compared with whites.

The incidence of hospitalized stroke rose with age. For white men, the age-specific incidence was 53 per 100,000 per year in the youngest age group (40–49) and increased in each subsequent 10-year age group, peaking at 1,771 per 100,000 in those over 80 (Figure 1). Incidence increased with advancing age in black and Hispanic men, but reached a plateau at an earlier age for black men. For women, the age-specific incidence clearly rose with age in all three race/ethnic groups (Figure 1).

Differences were found in the distribution of various stroke risk factors among the three race/ethnic groups (Table 3). Hypertension and diabetes were

more prevalent in blacks and Hispanics than whites, while ischemic cardiac disease and atrial fibrillation were more frequent in whites than other racial/ethnic groups. Although these differences were more marked in the older age group (age at stroke ≥ 70), they remained significant after controlling for age in the stratified analysis. Transient ischemic attacks were infrequently reported among secondary discharge diagnoses, but appeared more prevalent in whites.

Early in-hospital mortality after initial stroke was significantly greater in blacks and Hispanics than in whites among the younger age group, but not the older patients (Table 4). Mortality was similar in both age strata among blacks and Hispanics, while mortality was lower in younger whites. Among survivors of the initial stroke, Hispanics more frequently returned home than blacks and whites.

Among survivors in each race/ethnic group, the life table overall readmission rate was similar with 25%

TABLE 2. Age-Adjusted Hospitalized Stroke Incidence per 100,000 per Year (\pm SEM) in Blacks, Hispanics, and Whites Aged 40 or More From Northern Manhattan by Gender and Stroke Subtype

Stroke subgroup	Black		Hispanic		White	
	n	Incidence	n	Incidence	n	Incidence
Women						
All stroke	145	716 \pm 125	117	361 \pm 75	355	326 \pm 36
Subarachnoid hemorrhage	5	18 \pm 17	8	18 \pm 15	3	4 \pm 5
Intracerebral hemorrhage	15	60 \pm 32	12	40 \pm 26	24	24 \pm 11
Cerebral infarction	125	632 \pm 119	97	300 \pm 68	328	296 \pm 34
Men						
All stroke	90	567 \pm 123	92	306 \pm 78	235	351 \pm 48
Subarachnoid hemorrhage	2	11 \pm 15	5	14 \pm 14	3	6 \pm 7
Intracerebral hemorrhage	10	64 \pm 42	11	24 \pm 16	17	26 \pm 14
Cerebral infarction	78	488 \pm 114	76	267 \pm 75	215	318 \pm 45

n, Total number of patients over entire time interval.

TABLE 3. Hospitalized Stroke in Blacks, Hispanics, and Whites From Northern Manhattan: Differences in the Frequency of Stroke Risk Factors

Factor	Black	Hispanic	White	<i>p</i> *
Number	235	209	590	
Hypertension				
Age 40–69	56.8%	51.6%	41.2%	0.001
Age ≥70	35.9%	44.4%	27.1%	
Diabetes				
Age 40–69	22.0%	25.8%	21.9%	0.045
Age ≥70	22.2%	23.5%	13.9%	
Cardiac disease				
Age 40–69	11.0%	10.9%	9.6%	0.003
Age ≥70	5.1%	8.6%	19.5%	
Atrial fibrillation	5.5%	8.6%	11.7%	0.022

*Cochran-Mantel-Haenszel χ^2 for general association between race/ethnic group and stroke risk factor controlling for age and χ^2 with 2 df for nonstratified proportions.

to 27% readmitted within 1 year (Table 4). Stroke recurrence was the most frequent single reason for readmission in each race/ethnic group accounting for 54 of the 250 readmissions (blacks, 22.4%; Hispanics, 20.7%; whites, 21.6%) followed by readmissions for cardiac disease. The 2-year readmission rate for stroke was similar in the three groups.

Discussion

The community of Northern Manhattan provides an excellent study population to determine whether there are disparities in stroke risk among different race/ethnic groups. Our estimations indicate that there are differences in the incidence of hospitalized stroke. Blacks had nearly twice the age-adjusted incidence of whites; however, Hispanics had a similar rate as whites. Stroke incidence generally increased with age in all three groups and were similar for men and women,

except for blacks, where women had a greater stroke incidence and men had an earlier plateau.

Hispanics have rarely been identified separately in epidemiologic stroke studies. In the Lehigh Valley, where Hispanics were reported to account for 3.3% of the population, the standardized morbidity ratio for Hispanics was 0.73, suggesting that stroke occurrence rates were less than for whites.²

Prior studies have demonstrated that blacks have a greater incidence of stroke than whites of comparable age, sex, and residence.^{3–6} Many of these observations are based on mortality data. In Alabama and in the National Survey of Stroke, the age adjusted incidence rates for hospitalized stroke were twice as high for blacks.^{4,7,8} Recent evidence from the Lehigh Valley, where 1.7% of the population was black, reported a standardized morbidity rate of 2.43 for blacks compared with whites.² Our twofold increased

TABLE 4. Hospitalized Stroke in Blacks, Hispanics, and Whites in Northern Manhattan: Differences in Outcome After Stroke

Outcome	Black	Hispanic	White
Number	235	209	590
Death during hospitalization*	53	37	109
Age 40–69	29 (24.6%)	24 (18.8%)	9 (7.9%)
Age ≥70	24 (20.5%)	13 (16.1%)	100 (21.0%)
Disposition among survivors†	182	172	481
Discharged home	149 (81.9%)	154 (89.5%)	359 (74.6%)
Skilled nursing facility	18 (9.9%)	9 (5.2%)	86 (17.9%)
Other facility	15 (8.2%)	9 (5.2%)	36 (7.5%)
Readmissions among survivors‡	58	53	139
Total			
1 year	27.2±3.4%	26.0±2.1%	25.2±2.1%
2 years	35.6±4.0%	33.4±4.1%	31.7±2.3%
Stroke			
2 years	8.1±2.3%	6.1±2.1%	5.6±1.2%

* χ^2 with 2 df: $p=0.003$ for ages 40–69; $p>0.05$ for ages ≥70. Overall Cochran-Mantel-Haenszel χ^2 for stratified analysis: $p>0.05$.

†Mantel-Haenszel χ^2 : $p<0.001$ for disposition by race/ethnic group.

‡Cumulative life-table risks ±SEM: No significant differences.

incidence for blacks thus corroborates the findings in other US black populations.

It is difficult to find separate information on stroke subtypes, since most larger demographic studies combine cerebral infarction with hemorrhage. Our estimates indicate that the incidence of cerebral infarction is greatest in blacks and similar in whites and Hispanics. Hemorrhagic stroke, however, may be more frequent among both blacks and Hispanics compared with whites.

In this cohort of stroke patients, blacks and Hispanics had a higher prevalence of hypertension and diabetes than whites, whereas cardiac disease was more frequent in whites. The severity of the stroke risk factor and the underlying population base frequency are not reflected in these prevalence figures. Other possible stroke risk factors, including cigarettes, alcohol, cholesterol, and obesity, may differ in these groups and help account for the varied incidence.

Others have reported that hypertension and diabetes are more frequent in nonwhites with stroke, while transient ischemic attacks are less frequently diagnosed in nonwhites.⁹⁻¹¹ Little is published on the prevalence of stroke risk factors in Hispanics, but studies of Mexican Americans have noted a greater prevalence of non-insulin-dependent diabetes and higher concentrations of serum cholesterol and triglyceride.^{12,13} More is known about blacks, who have been reported to have an increased prevalence of hypertension and intracranial atherosclerosis.^{10,14-16}

Overall, stroke mortality did not differ in the three race/ethnic groups; however, blacks and Hispanics had a higher mortality among the younger patients. Among survivors, the most likely disposition was to be discharged home. The slightly increased likelihood of discharge home in Hispanics may be an age effect, since Hispanics were younger at stroke onset. Readmission rates were similar in the three race/ethnic groups and stroke recurrence accounted for approximately one fifth of the readmissions. Stroke recurrence is an important problem among survivors of stroke and needs to be investigated further among different race/ethnic groups.

We have emphasized that our results apply to "hospitalized" stroke incidence and, therefore, may be underestimates. The true incidence of stroke is likely to be the sum of hospitalized stroke; sudden, fatal nonhospitalized stroke; clinically silent stroke; and symptomatic, nonhospitalized stroke. Some persons with stroke may never be hospitalized, either because of mild deficits, silent strokes, outpatient evaluations, or physicians' beliefs that no medical therapy other than aspirin is necessary. In Rochester, Minnesota, the case ascertainment for transient ischemic attack was underestimated by 20-30% when medical record systems were compared with cohort methods; however, for stroke there was closer agreement in the rates.¹⁷ The incidence of nonhospitalized stroke is unknown, but may vary by geographic region. The challenges of urban living may make it too difficult for even the slightest deficits to be

tolerable without hospital attention, so it is our belief that nonhospitalized stroke accounts for a small proportion in Northern Manhattan. Even if the frequency of nonhospitalized stroke was sizeable, it would have to differ by race/ethnic group to confound the results of hospital-based studies aimed at contrasting stroke incidence.

We also recognize that data from hospital discharge information is limited. Items such as diagnosis subtype, ascertainment of risk factors, and determination of race/ethnicity may be unreliable and should be validated. The use of census data also has limitations with under-counting of persons, particularly from lower socioeconomic groups. Results from this Northern Manhattan cohort may not be generalizable to other populations with different racial/ethnic distributions and socioeconomic conditions, but can provide information about an urban environment.

Community-wide hospital data bases¹⁸ can provide important estimations of prevalence or incidence of stroke for public health planning. We hope the estimates provided by this study will be corroborated by future population-based studies. The growing number of blacks and Hispanics in the US population has alerted the National Institute of Neurological Disorders and Stroke to call for more focused epidemiological investigations on the risk of stroke in these groups. Further study of the population of Northern Manhattan may provide other clues to the determinants of stroke in different race/ethnic groups and help plan risk-modification trials and encourage more focused prevention strategies.

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