# Black-White Differences in Stroke Risk Among Young Adults

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Background and Purpose: Little information is available regarding black-white differences in stroke incidence in young adults.

*Methods:* Cerebral infarction and intracerebral hemorrhage rates among adults 15 to 44 years of age were studied in Baltimore City and Baltimore County for 1988. Diagnoses were based on neurologist review of data obtained from medical records at 41 hospitals by neurological nurses.

*Results*: The cerebral infarction rates per 100 000 were 22.8 for black males, 10.3 for white males, 20.7 for black females, and 10.8 for white females. The intracerebral hemorrhage rates per 100 000 were 14.2 for black males, 4.6 for white males, 4.8 for black females, and 1.5 for white females.

Conclusions: Blacks had significantly (P<.05) higher rates than whites for both cerebral infarction and intracerebral hemorrhage. Cerebral infarction rates are high in Baltimore compared with Florence, Italy, or Stockholm, Sweden. (*Stroke*. 1993;24[suppl I]:I-13-I-15.)

We want are available regarding stroke incidence among young adults because of the necessity for studying very large populations to achieve stable rates. The best currently available incidence data are from Florence, Italy,<sup>1</sup> and Stockholm, Sweden.<sup>2</sup> To our knowledge, the present study is the first to study stroke rates in a large American population 15 to 44 years of age and, in addition, to compare incidence rates between blacks and whites.

## Subjects and Methods

As a part of the Baltimore-Washington Cooperative Young Stroke Study, stroke incidence rates were studied in Baltimore City and Baltimore County for 1988. The total population of this region was 1 436 166, and the population 15 to 44 years of age was 660 789. The source of the demographic data was the Maryland Office of Planning, which updates its estimates every 3 years. The estimates for 1988 used for the present study were prepared in 1990.

All 19 acute-care hospitals in Baltimore City and Baltimore County as well as 22 other regional hospitals participated in this discharge registry study. Because of referral patterns, it was believed unlikely that stroke cases residing in the study region would be hospitalized outside the area of surveillance.

At each hospital a trained neurological nurse reviewed the chart of every patient 15 to 44 years of age who was discharged with a primary or secondary diagnosis reflecting a possible ischemic stroke or intracerebral hemorrhage. Charts with International Classification of Diseases–Ninth Revision (ICD-9) codes 431.00 to 438.00, 671.50 to 671.54, and 674.00 to 674.04 were reviewed. The abstracting process yielded (1) a narrative summary that described past strokes and transient ischemic attacks, the presenting neurological symptoms and signs, and their evolution and (2) demographic information, risk factors, neuroimaging and other laboratory data, therapy, and autopsy data, if available.

On the basis of this information, two neurologists independently classified the event as a cerebral infarction, intracerebral hemorrhage, or other diagnosis. Stroke was defined according to the criteria of the World Health Organization.<sup>3</sup> The definitions of cerebral infarction and intracerebral hemorrhage were based on the criteria of the National Institute of Neurological and Communicative Disorders and Stroke data bank.<sup>4</sup> Disagreement was resolved by a consensus conference. Stroke occurring as an immediate consequence of trauma was excluded. Cerebral infarction associated with subarachnoid hemorrhage was also excluded. Only first strokes were included in the present analyses.

Adjusted relative odds and 95% confidence intervals (CIs) were calculated by the method of Woolf.<sup>5</sup> Relative odds are a very close approximation to relative risk in the current setting, in which disease rates are low.<sup>6</sup>

## Results

The results for ischemic stroke are shown in Table 1 (males) and Table 2 (females). The results for intracerebral hemorrhage are shown in Table 3 (males) and Table 4 (females).

The sex-adjusted relative odds of ischemic stroke for blacks compared with whites was 2.1 (95% CI, 1.2 to 3.6). The sex-adjusted relative odds of intracerebral hemorrhage for blacks compared with whites was 3.1 (95% CI, 1.3 to 7.4).

The race-adjusted relative odds of ischemic stroke for males compared with females was 1.1 (95% CI, 0.6 to 1.7). The race-adjusted relative odds of intracerebral hemorrhage for males compared with females was 2.4 (95% CI, 1.1 to 5.4).

#### Discussion

To put these results into perspective, Table 5 compares our registry data with the results of studies in Stockholm, Sweden,<sup>2</sup> and Florence, Italy.<sup>1</sup> For cerebral infarction, it can be seen that the rate among Baltimore whites is two to four times the international rates, whereas the rate among Baltimore blacks is four to seven times the international rates. For intracerebral

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Age group	Blacks			Whites				
	No. of strokes	No. at risk	Rate per 100 000	No. of strokes	No. at risk	Rate per 100 000	Relative odds (black/white)	95% CI for relative odds
15-39 y	14	111 876	12.5	10	167 615	6.0	2.1	0.9-4.3
40-44 y	15	15 104	99.3	10	27 362	36.5	2.7	1.2-6.1
Total	9	126 980	22.8	20	194 977	10.3	2.2	1.3-3.9
Age adjusted							2.4	1.1-5.4

TABLE 1. Cerebral Infarction Incidence for Males Aged 15 to 44 Years in Baltimore City and County, 1988, From the Baltimore-Washington Cooperative Young Stroke Study

CI, confidence interval.

 TABLE 2.
 Cerebral Infarction Incidence for Females Aged 15 to 44 Years in Baltimore City and County, 1988, From

 the Baltimore-Washington Cooperative Young Stroke Study

Age group	Blacks			Whites				
	No. of strokes	No. at risk	Rate per 100 000	No. of strokes	No. at risk	Rate per 100 000	Relative odds (black/white)	95% CI for relative odds
15-39 y	21	126 773	16.6	10	164 956	6.1	2.7	1.3-5.8
40-44 y	9	18 504	48.6	11	28 599	38.5	1.3	0.5-3.1
Total	30	145 277	20.7	21	193 555	10.8	1.9	1.1-3.3
Age adjusted							2.0	0.9-4.4

CI, confidence interval.

 TABLE 3.
 Intracerebral Hemorrhage Incidence for Males Aged 15 to 44 Years in Baltimore City and County, 1988,

 From the Baltimore-Washington Cooperative Young Stroke Study

Age group	Blacks			Whites				
	No. of strokes	No. at risk	Rate per 100 000	No. of strokes	No. at risk	Rate per 100 000	Relative odds (black/white)	95% CI for relative odds
15-39 y	11	111 876	9.8	6	167 615	3.6	2.7	1.0-7.4
40-44 y	7	15 104	46.3	3	27 362	11.0	4.2	1.1-16.4
Total	18	126 980	14.2	9	194 977	4.6	3.1	1.4-6.8
Age adjusted							3.2	1.1-9.5

CI, confidence interval.

TABLE 4.Intracerebral Hemorrhage Incidence for Females Aged 15 to 44 Years in Baltimore City and County, 1988,From the Baltimore-Washington Cooperative Young Stroke Study

Age group	Blacks			Whites				
	No. of strokes	No. at risk	Rate per 100 000	No. of strokes	No. at risk	Rate per 100 000	Relative odds (black/white)	95% CI for relative odds
15-39 y	5	126 773	3.9	2	164 956	1.2	3.3	0.6-16.8
40-44 y	2	18 504	10.8	1	28 599	3.5	3.1	0.3-34.1
Total	7	145 277	4.8	3	193 555	1.5	3.1	0.8-12.0
Age adjusted							3.2	0.5-19.4

CI, confidence interval.

hemorrhage, the rate among Baltimore whites is intermediately between that of Florence and Stockholm, whereas the rate among Baltimore blacks is nearly twice the rate in Stockholm.

The incidence of cerebral infarction in this young age range is similar for males and females. In contrast, for intracerebral hemorrhage, rates are two to three times higher in males. Similar results were found in Stockholm County.<sup>2</sup>

By international standards, our results show high rates for cerebral infarction among Baltimore whites and even higher rates among Baltimore blacks. These results are a new finding and would not be suggested by available international data, which pertains primarily to incidence at older ages or to mortality. It seems unlikely that differences of such magnitude could be explained by differences in hospitalization rates of affected persons, by differences in study classification procedures, or by differences in the age structure of the populations. The international similarities for intracerebral hemorrhage rates support this point of view. In fact, we may have slightly underestimated stroke rates in Baltimore by not counting out-of-hospital deaths, as was done in the Stockholm and Florence studies.

Available data for the Evans County study,<sup>7</sup> the South Alabama study,<sup>8</sup> and the National Health and Nutrition Ex-

	Cerebr	al infarction	Intracerebral hemorrhage		
Study	No. of cases	Rate per 100 000	No. of cases	Rate per 100 000	
Stockholm, Sweden (1973-1977)	139*	5	144	5	
Florence, Italy (1983-1988)	18	3	10	2	
Baltimore, Md (1988)					
Blacks	59	22	25	9	
Whites	41	11	12	3	

TABLE 5. International Comparisons for the Incidence of Cerebral Infarction and Intracerebral Hemorrhage in Subjects Aged 15 to 44 Years

\*Estimated from data in Mettinger et al.<sup>2</sup>

amination follow-up study9 have suggested that the excess stroke risk experienced by blacks is more prominent at younger ages. However, the present study extends this finding into young adulthood.

It will be important for future studies in other American urban areas to confirm our findings with respect to cerebral infarction and to try to explain the reasons for the excess stroke risk experienced by American blacks, particularly at younger ages.

## Appendix

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