

Trends in stroke incidence in the United States

Will women overtake men?

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Stroke poses a heavy burden on health systems, with serious implications for societies and economies. At the global level, stroke is the second leading cause of death and the third most common cause of disability.¹ In the United States, about 795,000 strokes occur every year: on average, someone has a stroke every 40 seconds and someone dies as a result of a stroke every 4 minutes.² Stroke incidence and mortality rates have decreased in the last decades³; however, the aging of populations and improvements in stroke management have resulted in higher numbers of people experiencing a stroke, and more stroke survivors requiring long-term treatment.¹ Assessing changes in morbidity and mortality associated with stroke and potential differences among populations and subpopulations is essential as a basis for health policy planning, proper allocation of resources, and development of strategies aimed at primary and secondary prevention of stroke.

In this issue of *Neurology*®, Madsen et al.⁴ report changes in stroke incidence rates between 4 periods: July 1993–June 1994 and calendar years 1999, 2005, and 2010, using data from the Greater Cincinnati/Northern Kentucky Stroke Study (GCNKSS). The GCNKSS is a population-based epidemiologic study of stroke including data from 5 counties (2 southern Ohio counties and 3 contiguous Northern Kentucky counties that border the Ohio River), with a largely biracial population of 1.3 million people. This surveillance study tracks all hospitalized strokes (ICD-9 codes 430–436) among residents ages ≥ 20 years old, and a sampling scheme was used to ascertain out-of-hospital strokes. Sex-specific age- and race-adjusted incidence rates of stroke per 100,000 among black and white participants were standardized to the 2000 US census population and trends over time in rates of overall stroke and by stroke types ischemic stroke, intracerebral hemorrhage, and subarachnoid hemorrhage were examined. In addition, the authors evaluated stroke case-fatality and self-reported prevalence of stroke risk factors and medication use. Data on risk factors were collected in a random-digit dial survey conducted during each study period in a sample

representative of the GCNKSS ischemic stroke study population.

During the 4 study periods, there were 7,710 incident strokes. In total, 57.2% (n = 4,412) of strokes were among women, and women had a higher mean age than men at time of stroke. Overall, incidence rates decreased over time in men but not in women. Similar sex disparities in the decline of ischemic stroke were reported, whereas intracerebral hemorrhage and subarachnoid hemorrhage incidence rates were stable over time in both men and women. Moreover, no significant changes in case-fatality were observed over time in men and women. Interestingly, incidence rates of all stroke and ischemic stroke for 2010 were similar for both sexes, and the prevalence of hypertension, diabetes mellitus, and hyperlipidemia increased over time, despite the decline in age at stroke. These findings of increased risk factor prevalence have important implications for primary prevention of stroke and warrant further research.

In recent decades, age-adjusted stroke risk has consistently been reported to be higher for men than women.^{1,5,6} Since there is evidence for decreasing stroke incidence in both sexes during the last decades, the similar rates for 2010 suggest sharper declines in rates for men than women. Notably, stroke incidence rates in women decreased from 1999 to 2005, but afterwards no changes were evident, while the decreasing trend observed for men from 1999 to 2005 continued through 2010. Sex differences in the distribution or treatment of stroke risk factors as well as lower rates of successful control of risk factors in women might have contributed to the findings. The study by Madsen et al.⁴ has many strengths; however, some aspects related to stroke incidence require future evaluation. Previous reports from GCNKSS have highlighted the smaller decline as well as absolute disparity in stroke rates between black and white participants,⁷ but the intersection of race and sex was not noted in this study. The potential contribution of some risk factors including physical inactivity, nutrition, and chronic kidney disease could not be assessed in the study.⁴ Moreover, data on the

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prevalence of women-specific risk factors for stroke,⁸ such as use of hormonal medications, pregnancy complications including preeclampsia, age at menopause, as well as prevalence of migraine, were not available. In addition, the prevalence of atrial fibrillation, an important risk factor for stroke, associated with higher risk of stroke in women with atrial fibrillation compared to men, was unknown,⁸ and data on the potential effects of biomarkers on sex-specific risk of stroke were not available.

In the next decades, life expectancy for both sexes will continue to increase in the United States. In 2060, life expectancy is projected to reach 87.1 years for women and 84.0 for men, compared to 81.7 and 77.1 years, respectively, in 2015.⁹ Over 52,000,000 women and 45,000,000 men will be ≥ 65 years old in the United States in 2060, twice the number as in 2015. Furthermore, the estimated number of ≥ 85 -year-old Americans for 2060 is approximately 20 million.¹⁰ Since stroke occurs mostly in older people, the burden of stroke will most likely increase with the continuing aging of populations. It is still speculative whether women will overtake men in having higher incidence rates of stroke, but if the trends reported by Madsen et al.⁴ continue, they might.

Evaluating sex-specific stroke incidence rates by age group and analyzing changes in the distribution of ischemic stroke subtypes will contribute to a better understanding of changes over time and help to identify factors contributing to the decline in stroke incidence rates. Additional studies in different populations and communities are required to confirm the observed trends and to further identify factors contributing to sex differences in the decline in stroke rates.

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