

## PREVENTION OF STROKE

**Primary prevention** refers to those activities designed to prevent the onset of a disease or condition. The most effective way to prevent stroke is, of course, to avoid the risk factors that are associated with the disease. While age, sex, race, and family history are nonmodifiable risk factors, a person has control over many lifestyle choices that are linked with stroke and discussed above. These include never starting, or quitting, cigarette smoking, maintaining a healthy weight, eating more fruits and vegetables, consuming alcohol moderately, if at all, and being physically active. All these behaviors can contribute to avoiding hypertension, the most common cause of stroke, as well as the development of diabetes, another serious stroke risk factor, and atherosclerosis.

**Secondary prevention** measures are aimed at identifying and treating those persons who have stroke risk factors, but may be currently asymptomatic, to prevent the occurrence of a cerebrovascular event. Lifestyle changes that lower risk and the identification and treatment of underlying disease such as atrial fibrillation are the main focus of secondary prevention interventions. Keeping hypertension under control involves quitting smoking and reducing exposure to environmental tobacco smoke, losing weight through a healthy diet, reducing one's dietary sodium intake and increasing one's potassium, calcium, and magnesium intake through supplements, becoming more physically active, and complying with a prescribed medication regimen that usually includes a beta-blocker or ACE inhibitor and a diuretic.

Controlling both blood pressure and glycemic levels is of utmost importance in persons with diabetes. Results from the U.K. Prospective Diabetes Study showed "substantial benefits" from even moderate reductions in arterial pressure among diabetic subjects and found "tight" blood pressure control, i.e., <150/85 mmHg, more beneficial than even strict glycemic control in preventing macrovascular complications (108).

Lowering total and low-density cholesterol and triglyceride levels and increasing high-density cholesterol lowers one's risk of stroke. Compliance with hyperlipidemia therapy in the form of lipid-lowering agents (statins) among persons with high cholesterol levels is a form of secondary prevention, as is anticoagulant (e.g., warfarin) or antiplatelet (e.g., aspirin, ticlopidine) therapy among patients with atrial fibrillation. Aspirin may also be prescribed to asymptomatic patients for its anti-inflammatory effects.

Patients who have experienced a TIA are at greater risk for a major stroke and are treated with anticoagulants or aspirin unless such use is contraindicated. Further evaluation and testing are performed to assess the presence and severity of carotid disease, or atherosclerosis. In the absence of a TIA occurrence, the first indication of asymptomatic cerebrovascular disease is often a carotid bruit, or swishing sound, detected by the physician in the carotid arteries that can also indicate carotid disease. Testing, e.g., carotid duplex or Doppler ultrasound, both of which use high-frequency sound waves to image blockage(s), is used to determine the severity of the obstruction. If the stenosis, or

blockage, is greater than 60%, carotid endarterectomy is an option. Carotid endarterectomy is a surgical procedure during which the plaque causing the obstruction is removed from the artery. While there is consensus in the medical community on the value of endarterectomy in patients with high-grade stenosis and TIA, it is lacking on the usefulness of the procedure in asymptomatic patients. The current American Heart Association guidelines for performing endarterectomy recommend the surgery in younger, healthier patients with associated risk factors who have 60% or greater stenosis if the estimated surgical risk is <3% and life expectancy is at least five years (109). For patients for whom the surgical risk is 3% to 5%, the guidelines indicate surgery if the stenosis is 75% or greater.

Women and African-Americans are less likely than white males to receive carotid endarterectomy (110, 111). Possible explanations for these differences include the fact that women are more likely than men to have intracranial atherosclerosis, requiring alternate methods of prevention. African-Americans are also less likely to have severe atherosclerosis in the carotid arteries; in addition, racial bias, affordability, and racial variation in patient decision to have the procedure may influence the statistics. Further investigation is warranted to explain gender and racial differences.

**Tertiary prevention** goes beyond secondary prevention measures to address the care of persons who have already suffered a first stroke. Tertiary measures are aimed at the prevention of a second or third stroke and the minimalization of disability through patient rehabilitation, in order to reestablish partial or complete independence and improve quality of life.

Research shows that patients who suffer a recurrent stroke have poorer outcomes than those who suffer a first stroke (112). A study by the Stroke Prevention Patient Outcomes Research Team (PORT) found that 57% of patients with a first stroke survived 24 months after their stroke, compared with 48% of those who had a recurrent stroke. While costs were similar for hospital stays and in the first one to three months following a stroke, total costs were higher for patients with a recurrent stroke for months four to twenty-four.

## THE ECONOMIC COSTS OF STROKE

Data from the American Heart Association estimate the 2004 economic costs of stroke at \$53.6 billion (1). Nearly two-thirds (62%) of this, or \$33.0 billion, was comprised of direct health care expenditures:

- 26.5 billion – hospital/nursing home
- 2.7 billion – physicians/other health professionals
- 1.1 billion – drugs
- 2.7 billion – home health/other medical durables

Thirty-eight percent (38%) of the total, or \$20.6 billion, represented indirect costs:

- 6.1 billion – lost productivity due to morbidity
- 14.5 billion – lost productivity due to mortality

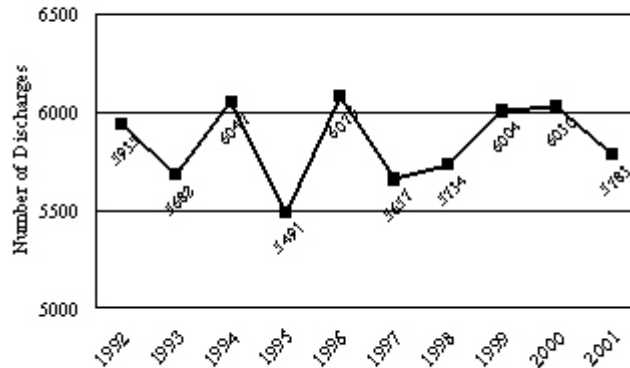
Stroke was the 8<sup>th</sup> most expensive medical condition in the United States in 1997, according to a study by the Division of Social and Economic Research of the Agency for Healthcare Research and Quality (113). Medicare was by far the primary source of payment for direct costs associated with stroke, covering an estimated 66%, the highest percentage among the top 15 most expensive conditions. Stroke had the highest mean per person expenditure (\$14,172), as well as the highest percentage of total expenditures used for home health care (13%).

Taylor et al. estimated the lifetime costs of incident stroke by stroke subtype in a study published in *Stroke* in 1996 (114). The aggregate lifetime cost of all estimated 392,344 strokes occurring in 1990 was estimated to be \$40.6 billion; \$29.0 billion (71%) for ischemic stroke, \$6.0 billion (15%) for intracerebral hemorrhage, and \$5.6 billion (14%) for subarachnoid hemorrhage. The study's authors attributed 45% of costs to acute-care costs incurred in the first two years following a first stroke; long-term ambulatory care accounted for 35% and nursing home costs for approximately 18%.

A retrospective study by Hass et al. of nursing home residents in Rochester, Minnesota, compared residents with a confirmed stroke, either major or minor, with those who had not had a stroke. Nursing home residents who had suffered a major stroke were younger and more disabled, requiring more services. While the mean number of nursing home days did not differ between residents with a stroke and those without, the per diem Medicaid reimbursement was 11% higher for those residents with major stroke (115). Residents who suffered a minor stroke showed similar characteristics and costs as residents who had not had a stroke.

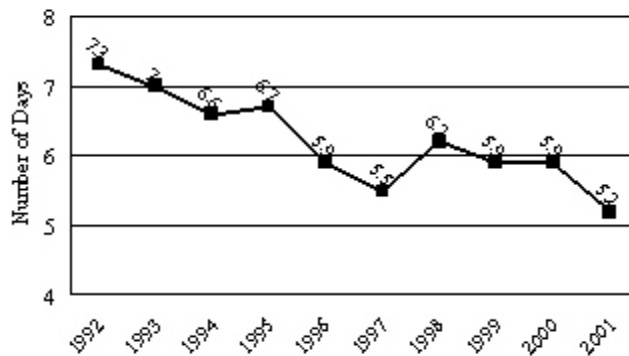
## STROKE HOSPITALIZATIONS IN WEST VIRGINIA

Figure 16. Total Hospital Discharges for Stroke\*  
WV Residents Discharged from WV Hospitals, 1992-2001



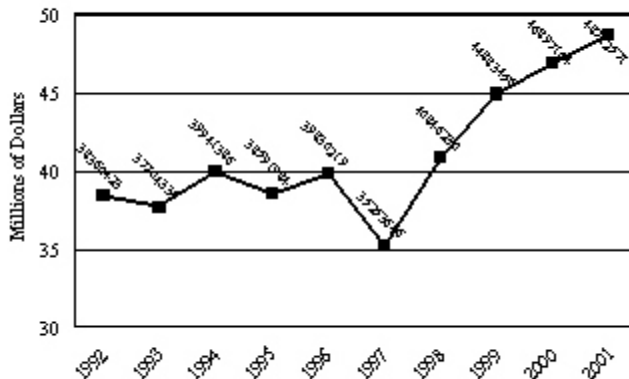
\*Diagnosis Related Groups (DRGs) 14 and 15. See Appendix A for definitions.  
Source: WV Health Care Authority

Figure 17. ALOS\* of In-Patient Hospitalizations for Stroke\*\*  
WV Residents Discharged from WV Hospitals, 1992-2001



\*Average Length of Stay  
\*\* DRGs 14 and 15  
Source: WV Health Care Authority

Figure 18. Total Charges for In-Patient Hospitalizations for Stroke  
WV Residents Discharged from WV Hospitals, 1992-2001



\*DRGs 14 and 15  
Source: WV Health Care Authority

Data obtained from the West Virginia Health Care Authority show that in 2001 there were 5,783 hospitalizations of West Virginia residents in West Virginia hospitals due to stroke. Women accounted for 62% of these; 57% were among persons aged 45-64 and 19% among those aged 85+.

There was little variation in the numbers of stroke hospitalizations in the state from 1992-2001 (Figure 16). Over this same time period, however, the average length of stay (ALOS) for a patient with a stroke diagnosis decreased by 29%, from 7.3 days in 1992 to 5.2 days in 2001 (Figure 17). Charges, on the other hand, have risen steadily since 1997, from \$35 million in 1997 to \$49 million in 2001 (Figure 18).

A breakdown by payer of 2001 hospital charges (\$48,712,571) for stroke is shown in Figure 19. The bulk of the charges (76%) were billed to Medicare, 6% were billed to Medicaid, and 4% to the Public Employees Insurance Agency (PEIA). The remaining charges were billed to other private and government insurance plans or covered by the patient or charity.

A comparison of 2001 rates of stroke hospitalization in the state and the nation is shown in Table 1. The state's overall rate of 32.1 hospitalizations per 10,000 population was higher than the national rate of 27.1. Both men and women were hospitalized for stroke at higher rates in West Virginia than in the nation as a whole. State rates were higher among elderly residents aged 85+.