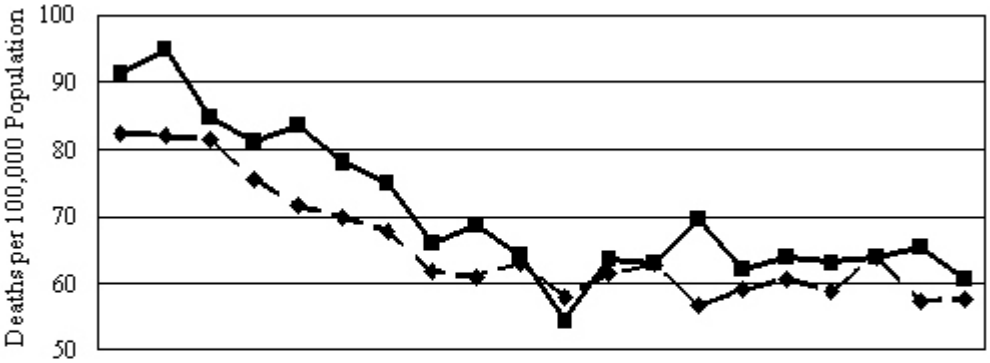
STROKE: AN OVERVIEW

It is estimated that more than 700,000 Americans suffer a cerebrovascular event, or stroke, each year. Approximately 500,000 of these are first strokes, and 200,000 are recurrent attacks. On average, someone suffers a stroke every 45 seconds, and a stroke death occurs every 3.1 minutes (1). According to American Heart Association data, approximately 4,700,000 stroke survivors are alive in the United States today (2). Stroke is the leading cause of adult disability in the United States and the third leading cause of death nationwide. In West Virginia, stroke ranks as the fourth leading cause of death, after heart disease, cancer, and chronic lower respiratory disease; between 1,200 and 1,300 people die from stroke each year in the state.

> In West Virginia, between 1,200 and 1,300 people die from stroke each year; of these, about 62% are women.

Death rates from stroke declined markedly in the 1970s and 1980s in both the state and the country as a whole; however, this decline leveled off in the 1990s (3). Figure 1 illustrates the latter part of this trend, showing 20 years of stroke mortality rates in West Virginia among men and women. Rates among both men and women decreased in the state rather consistently until 1992, after which slight increases occurred.

Figure 1. Age-adjusted Mortality Rates* for Cerebrovascular Disease by Sex
West Virginia, 1982-2001



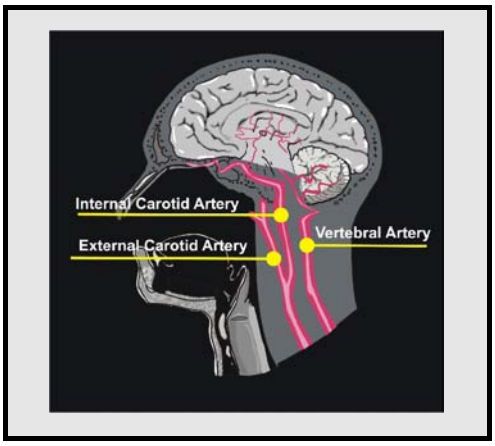
	198	198	198	198.	198	198	198	198	199	199	199	199	199	199	199	199	199	199	200	200
Male	91.4	94.8	84.5	81.2	83.2	78.2	74.5	66	68.8	64.4	54.6	63.8	63.2	69.2	62.3	63.5	63.2	63.9	65.4	60.6
Female	82.5	82	81.5	75.6	71.6	69.9	67.5	61.8	61.2	63.	58.	61.2	62.9	56.8	59.2	60.8	58.8	64	57.4	57.6

Even though the mortality rate for stroke declined 12.3% from 1990 to 2000 in the United States, the actual number of stroke deaths rose nearly 10% (2) and stroke-related hospitalizations increased 19% (4). National projections for stroke mortality are bleak. A study funded by the National Institutes of Health (NIH) and published in *Stroke: Journal of the American Heart Association* (*Stroke*) in 2003 projected stroke deaths through 2032 (5). The analysis predicted that total stroke mortality in the United States would nearly double (an increase of 98%) over the next 30 years if reductions in stroke risk factors, especially among high-risk populations, are not achieved. The increase in stroke mortality is predicted to be highest among African-Americans (134%) and nonwhite, nonblack races (221%).

BRAIN ATTACK

Also known as a cerebrovascular accident (CVA) or a "brain attack," a stroke occurs when there is an interruption to or disruption in the blood flow to the brain. The brain accounts for about 2% of a person's total body weight; however, it continuously receives about 20% of the blood flowing through the body. Since the brain controls all of the body's actions, this blood flow is vital to provide a constant supply of oxygen and other nutrients to the brain cells. The reduced blood flow from a stroke causes a lack of oxygen and nutrients to the cells, and they begin to die. Once dead, brain cells cannot be revitalized or regrown.

There are four main blood supplies to the brain, the **carotid arteries** and the **vertebral arteries**. The carotid artery splits into external and internal arteries near the top of the neck, with the external carotid supplying blood to the face and neck and the internal carotid going into the skull. Within the skull, the internal carotid branches into two large arteries (the anterior cerebral and middle cerebral arteries) and several smaller arteries. Together these arteries supply blood to the front two-thirds of the brain.



The vertebral arteries travel up to the brain on either side of the spinal column and join to form the basilar artery near the brain stem at the base of the skull. The vertebral-basilar system supplies blood to the cerebellum and the brain stem before branching into two posterior cerebral arteries; these supply blood to the back third of the brain.

The fact that there are only four main blood supplies to the brain makes it crucial that these arteries are healthy. Any blockages or weaknesses in an artery can result in a stroke, leading to major brain damage or even death.

TYPES OF STROKE

There are two major types of stroke: **ischemic stroke** and **hemorrhagic stroke**. Ischemic strokes account for approximately 88% of total strokes (1) and occur when blood flow is stopped or reduced due to an obstruction in an artery. Hemorrhagic stroke, less frequent but the deadlier of the two types, occurs when a blood vessel ruptures or leaks and there is bleeding into or around the brain. Ischemic strokes are usually caused by either a **cerebral thrombosis**, which happens when a blood clot or plaque build-up forms in an artery bringing blood to the brain, blocking the blood flow, or the more deadly **cerebral embolism**, which occurs when a blood clot that has formed in another part of the body (usually the heart) has broken free and become lodged in an artery leading to the brain.

The two most common types of hemorrhages in the brain are (1) **intracerebral hemorrhage (ICH)**, when a blood vessel ruptures and bleeds within the brain itself, and (2) **subarachnoid hemorrhage (SAH)**, which occurs when a blood vessel ruptures on the surface of the brain, between the inner and middle layers of the tissue covering the brain. Intracerebral hemorrhage accounts for about 9% of all strokes (1) and is more common than subarachnoid hemorrhage among people over the age of 60. SAH accounts for the remaining 3% of all strokes (1).

A **transient ischemic attack** (TIA), also known as a "little stroke" or mini-stroke, occurs when there is a short-lived interruption of blood flow to the brain. Approximately 80% of TIAs are caused by a blockage in an artery, either a blood clot or plaque (6). The remaining 20% of TIAs are the result of minor bleeding in the brain due to a leaking aneurysm or vascular malformation. TIAs generally last less than an hour and do not result in permanent brain damage; they can be followed by a major stroke, however, if the cause is not treated, so should be considered a warning of potential serious illness.

TEMPORAL AND SEASONAL VARIATION IN STROKE

Researchers used data from the Framingham Heart Study, a 40-year period of surveillance, to ascertain seasonal and temporal patterns of initial strokes among that cohort of 5,070 people (7). Their results indicated a significant association between winter and cerebral embolic strokes among women but not among men. No such association was found for hemorrhagic stroke. The most frequent day for stroke occurrence was Monday for intracerebral hemorrhage among both men and women. For subarachnoid hemorrhage, Sunday and Monday were significantly more frequent for men and Friday and Saturday for women. The morning hours (8:00 AM to noon) were more likely to be associated with all stroke subtypes.

Data from the Finnish Stroke Register from 1982-92 (15,449 stroke events) were analyzed for seasonal influence; the findings showed a 12% greater incidence of ischemic stroke among men and 11% greater incidence among women in winter than in summer (8). For intracerebral hemorrhage, there was a 28% greater likelihood and 33% greater likelihood of occurrence during winter than during summer. No significant differences by season were found for subarachnoid hemorrhage.

Oberg et al. examined data involving 72,779 veterans hospitalized for stroke at any Veterans Affairs hospital from 1986-95 (9). They found that the peak occurrence of ischemic stroke among this male population was in mid-May, even after controlling for region (i.e., climate) and race. No seasonal effect was found for hemorrhagic stroke.