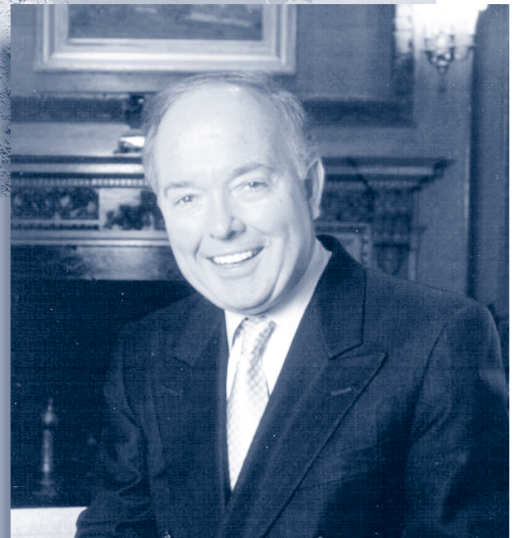


SURVIVORS OF THE FIGHT

STROKE IN COLORADO



Colorado Department
of Public Health
and Environment

*A Report to the Colorado Legislature from the
Colorado Stroke Advisory Board*

November 2003

Individuals pictured on the cover are (clockwise from top left):

- Guffie Menogan
- Dottie Wham
- Bill Hibyl
- Rabbi Sandra Cohen

Many thanks to these and other stroke survivors who offered their stories for this report to illustrate the very personal impact of stroke. Thanks also to the National Stroke Association for use of the photos.

For further information contact:

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www.cdphe.state.co.us

website for information on stroke: www.cdphe.state.co.us/pp/cvd/stroke.html

November 2003—Second Edition

STATE OF COLORADO

Bill Owens, Governor
Douglas H. Benevento, Executive Director

Dedicated to protecting and improving the health and environment of the people of Colorado

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Colorado Department
of Public Health
and Environment

October, 2003

Honorable Members of the Colorado Legislature:

On behalf of the Colorado Stroke Advisory Board, we respectfully submit this report on the status of stroke and stroke care in Colorado. This has been a unique opportunity to bring to the table the many disciplines impacting the spectrum of stroke: public health agencies, urban and rural hospitals, rehabilitation specialists, emergency medical systems, specialized medical practices, the voluntary agencies, and most importantly, stroke victims. The board has gained an understanding of each other's roles as well as the critical interdependence of these roles in providing a more effective system of stroke prevention, treatment, and rehabilitation in Colorado.

The board members wish to express their appreciation to the legislature for enacting this important first step toward improving the cerebrovascular health of all Coloradans. Serving on this board has been a privilege and an honor for each of us. We hope our work will justify the confidence placed upon us.

Sincerely,

Don B. Smith MD
Co-Chair

Pamela A. Netro, RN, BSN, CNRN
Co-Chair

EXECUTIVE SUMMARY

A Report to the Colorado Legislature from the Colorado Stroke Advisory Board

Stroke is an old problem, but recent advances show it is not an insolvable one. In fact, there may be few major public health problems in which the opportunity for progress is so great. The cause of stroke is understood. An effective treatment is available when it can be delivered quickly. The major risk factors are known, and altering the risks can prevent most strokes from ever happening. Yet in Colorado, as elsewhere, the gap between knowledge about stroke and what is actually done in practice to combat stroke remains large.

In an effort to close this gap, the Colorado Stroke Advisory Board offers this report of findings and recommendations regarding the problem of stroke in Colorado, as mandated by House Bill 02-1125. The following is a summary:

The Syndrome of Stroke

- Stroke is the primary cause of long-term disability and the third leading cause of death.
- Because the brain is more dependent than any other organ on constant blood circulation, the window of opportunity for treatment of stroke is narrow. Once circulation is interrupted, irreversible damage develops in short order.
- About 85 percent of strokes are ischemic strokes that occur when the vessels supplying blood, oxygen, and nutrients to the brain are blocked. The other type of stroke, hemorrhagic stroke, involves the rupture of a blood vessel supplying blood, oxygen, and nutrients to the brain.

Percent of adults (age 18+) reporting various stroke risk factors by race/ethnicity, Colorado BRFSS 2000–2001

Risk Factor	White	African American	Hispanic
High blood pressure	22%	47%	20%
Tobacco smoking	24%	32%	26%
High cholesterol	31%	49%	34%
Diabetes	5%	20%	7%
Obesity	15%	37%	22%
Sedentary lifestyle	18%	34%	36%

Risk Factors for Stroke

- Stroke and stroke risk factors vary considerably in Colorado according to:
 - age
 - ethnicity
 - gender
 - health behaviors and lifestyle
- Stroke is often preventable. Up to 80 percent of strokes could be prevented if available risk factor modifiers were fully implemented.

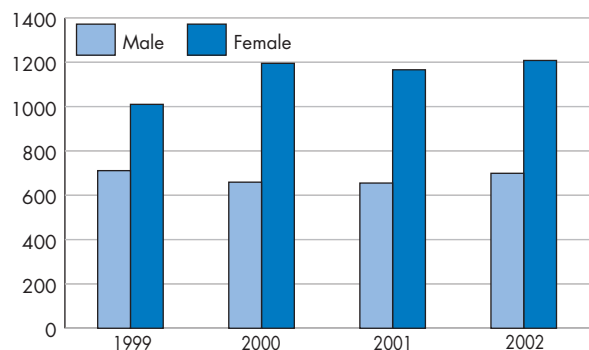
Stroke's Lingering Effects

- Complications that follow an acute stroke are numerous, and the suffering caused by stroke cannot be quantified or overemphasized.
- Stroke rehabilitation is helpful, but most stroke survivors live with functional impairment.

Patterns of Stroke and Stroke Deaths in Colorado

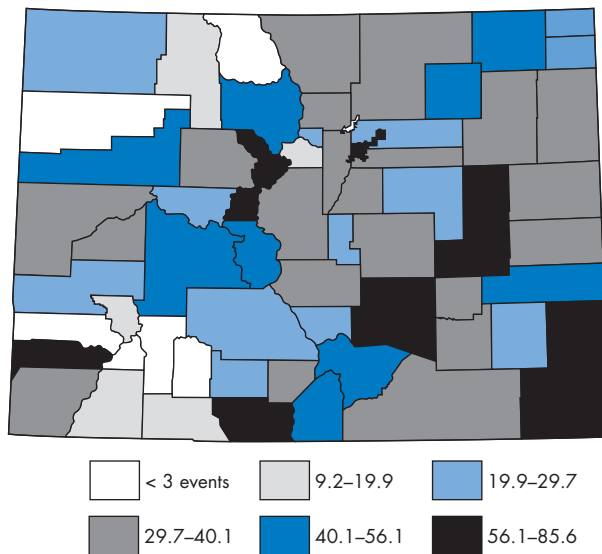
- Tens of thousands of Coloradans are affected by stroke each year. The number of stroke deaths among women exceeds stroke deaths in men, particularly among women over the age of 85.

Annual number of stroke deaths by gender, Colorado residents, 1999–2002



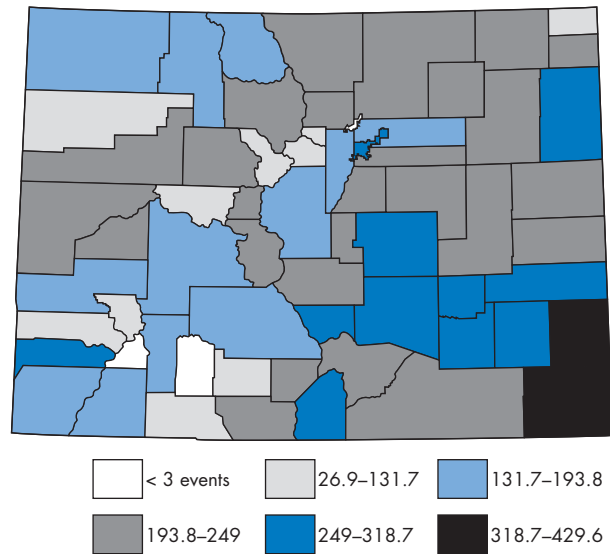
- Average rates of deaths and hospitalizations for stroke are illustrated in the following maps. This information provides an opportunity for public health agencies and other groups to intervene.

Age-adjusted hospital discharge rates by county for hemorrhagic stroke as primary diagnosis, Colorado residents, 1999–2001*



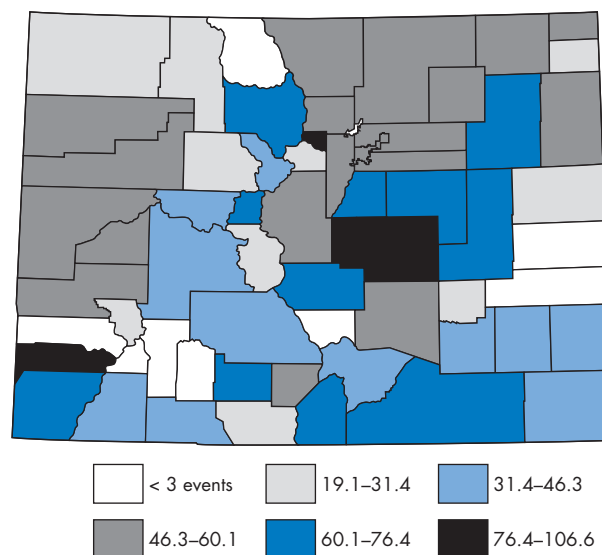
*Rate per 100,000 population. Age-adjusted to the 2000 U.S. standard population. Data from the Colorado Health and Hospital Association.

Age-adjusted hospital discharge rates by county for ischemic stroke as primary diagnosis, Colorado residents, 1999–2001*



*Rate per 100,000 population. Age-adjusted to the 2000 U.S. standard population. Data from the Colorado Health and Hospital Association.

Age-adjusted stroke death rates by county, Colorado residents, 1999–2001*

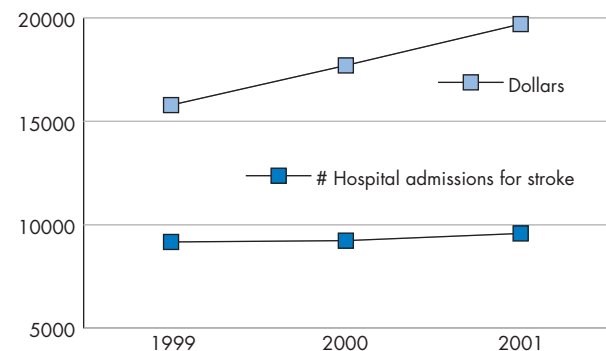


*Rate per 100,000 population. Age-adjusted to the 2000 U.S. standard population.

Costs of Stroke in Colorado

- Colorado's annual financial burden for stroke runs in the tens of millions of dollars. Medicaid payments for stroke care in Colorado averaged \$47.4 million per year from 1999–2001. This does not include the costs of emergency transport or medications.
- Payments to hospitals in Colorado for stroke treatment increased an average of 12 percent per year between 1999–2001.

Number of hospital admissions with stroke as a primary diagnosis and payment per hospital admission

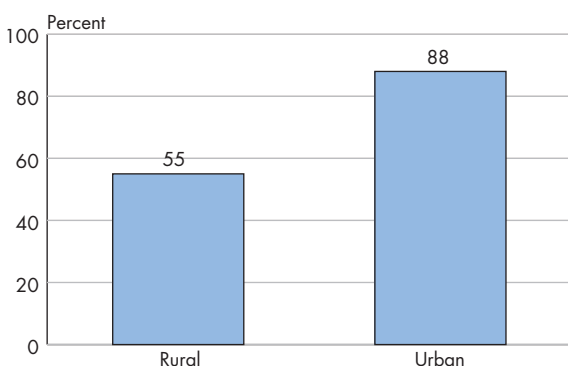


Data from the Colorado Health and Hospital Association. Payments not adjusted for inflation.

Treatment of Stroke

- Effective, but potentially risky treatments for stroke are available.
- The clot-busting thrombolytic drug r-tPA was used in only 1.1 percent of strokes in Colorado between 1999–2001. The national average for r-tPA use is three percent.
- Effective treatment must be rapid treatment. Rapid treatment is challenging in urban areas. In rural areas it is especially challenging.
- Coordination and responsiveness in stroke care must occur across a range of prehospital and internal hospital systems. Presently there is not a system providing the requisite coordination in Colorado.
- Stroke patients show an improved overall outcome when managed by specially trained staff. Clinical pathways/standing orders for stroke treatment facilitate efficient, standardized care.
- Stroke centers promise to improve care within hospitals. A higher volume of patients leads to more confident decision-making by physicians about use of clot-busting thrombolytic therapy. There are currently no designated stroke centers in Colorado.

Percent of hospitals utilizing clinical pathways/standing orders



Colorado Stroke Advisory Board Survey

Recommendations for Improving Awareness and Treatment of Stroke in Colorado

- Information on stroke prevention, signs and symptoms of stroke, and responding to stroke as a medical emergency should be made more readily available in Colorado. Only 30 percent of Coloradans know the signs and symptoms of stroke.
- Nonprofit organizations in Colorado are important elements in the fight against stroke. Designation of stroke centers in Colorado will likely proceed by non-governmental agencies.
- The state could play an important role in linking these centers in a collaborative network.
- The state should promote system change and policy development for stroke prevention, acute stroke treatment, and stroke rehabilitation.
- A state-level stroke registry for reporting treatments and outcomes would be an important resource for strategically improving the evaluation and treatment of stroke.

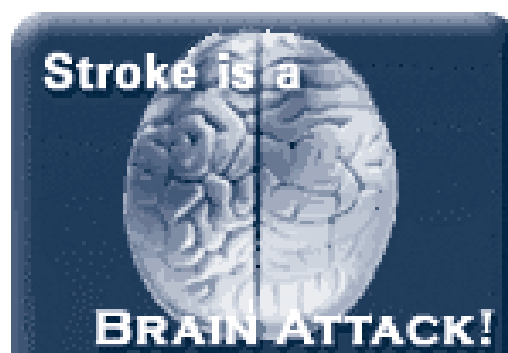


Image courtesy of the National Stroke Association

STROKE ADVISORY BOARD REPORT

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SECTION 1: INTRODUCTION AND BACKGROUND

Origin of the Stroke Advisory Board and Goals of this Report:

Stroke is the primary cause of long-term adult disability and the third leading cause of death in Colorado and the United States. Few illnesses can match stroke for sudden, life-altering impact. Robust independence may suddenly turn to permanent invalidism. Many people fear stroke more than they fear heart attack or cancer. Like stroke, these illnesses may kill, but unlike stroke, they are usually not disabling. They do not usually rob their victims of communication, of mobility, of continence, of dignity, or of the essence of one's personality. Stroke often does.

Stroke is common, tragic, and complex. It is an age-old problem but not necessarily one that can't be solved. Although stroke is both treatable and preventable, moving from recent advances in the understanding of stroke to taking action in medical practice has been slow and difficult.

The personal vignettes in this report help demonstrate the struggles of individuals in their fight to overcome this disabling disease. The outcomes represented in some of these individuals' stories portray the potential quality of life that many stroke victims could have if given the medical opportunity.

In recognition of the importance of stroke and of the gap between potential and practice, the 2002 Colorado Legislature created the Stroke Advisory Board. Colorado, among other states, has begun to ask how the state might better address the challenge of stroke. The Stroke Advisory Board was mandated by the 2002 legislation to examine the problem of stroke in Colorado and to report back to the Joint Budget Committee and the House and Senate Health, Education, Welfare and Institutions Committees. As stated in House Bill 1125 (Appendix A), the duties of the advisory board included, but were not limited to, those listed in Figure 1.

— A SURVIVOR'S STORY —

Retired State Senator **Dottie Wham** is a survivor. The 78-year-old dynamo has lived through a critical blood disorder and breast cancer. In 1999 she suffered a stroke. She was talking on the phone with her daughter just after Christmas when she had the first symptom. Her daughter heard Wham's speech start to slur, but Wham didn't realize she was slurring her words. Like so many stroke sufferers, Wham didn't recognize that she was experiencing stroke symptoms. Later that night, she woke up and when she tried to get out of bed felt the telltale numbness. "I felt a general weakness throughout my body, rather than on one side, and my husband detected a slurring of my speech," recalled Wham. Still, like so many women, Wham was hesitant about seeking medical treatment. It was her husband, Bob, who convinced her to go to the hospital. Because just a day before she had passed a physical with flying colors, Wham couldn't believe that she'd had a stroke. "I walked into the ER, they got me on a bed, took me in for a brain scan and then told me I had a stroke. I said, 'You are out of your mind!'"

Wham has fully recovered but remembers the difficult times. "It (stroke) is a physical struggle, but the bigger struggle is from an emotional standpoint. All stroke victims cry. I just told people I was going to cry." She also remembers the discussion about whether she would be allowed to drive. "When I speak to stroke groups the driving question always comes up. It is such a loss of independence." After her stroke, Wham went to the Division of Motor Vehicles and passed a driving test.

She continues a high-paced life, including her work as an advocate for stroke education and prevention.

Figure 1. Duties of the Stroke Advisory Board

- (a) Evaluation of current available stroke treatments and the development of recommendations for Colorado, based on medical evidence, to improve stroke prevention and treatment.
- (b) Evaluation of potential implementation strategies for stroke therapies, including a stroke center system.
- (c) Completion of a statewide comprehensive stroke prevention and treatment needs assessment.
- (d) Determination of the impact that delayed or inappropriate treatment has on the quality of patients' lives and the associated financial costs to such patients and the state.
- (e) Studying the health and economic benefits of early stroke treatment.

Membership of the Stroke Advisory Board:

Prospective board members were recruited by public announcement. Applications were submitted to the Cardiovascular Health Program within the Colorado Department of Public Health and Environment. Douglas Benevento, the department's executive director, selected the board according to the membership criteria specified in the legislation. The board membership is as follows:

- Patrick Barnett, public health representative, Colorado Department of Public Health and Environment;
- John Boyd, MD, at-large hospital administrator, Mercy Hospital, Durango;
- Ned Calonge, MD, MPH, chief medical officer, Colorado Department of Public Health and Environment;
- Melissa Francis, stroke rehabilitation facility representative, Spalding Rehabilitation Hospital;
- Don Frei, MD, neuroradiologist, Radiology Imaging Associates;
- Erin Leary, organization representing stroke victims, American Stroke Association;
- Judith Lindauer-Gosik, MD, primary care physician, Kaiser Permanente;
- Diane Mulligan-Fairfield, organization representing stroke victims, National Stroke Association;
- Dave Munch, MD, urban hospital administrator, Lutheran Medical Center;
- Bruce Myers, occupational therapist, Northern Colorado Medical Center, Greeley;
- Pamela Netro, RN, co-chair, stroke care nurse, Boulder Community Hospital;
- John Nichols, MD, Emergency Medical Services Advisory Board;
- Norman Paradis, MD, emergency medicine physician, University of Colorado Health Sciences Center;
- Deb Pellini, rural hospital administrator, Kremmling Memorial Hospital District, Granby;
- Don Smith, MD, co-chair, neurologist, Colorado Neurological Institute;
- Dottie Wham, stroke survivor;
- Wayne L. Wittenberg, MD, neurosurgeon, Boulder County;
- Cathy Schuster, coordinator, Colorado Department of Public Health and Environment.

The Board wishes to acknowledge and thank the following individuals who also offered their expertise:

- Michael Armacost, Prehospital Care Program, Colorado Department of Public Health and Environment;
- Issam Awad, MD, former board member, University of Colorado Health Sciences Center;
- Laurie Borgers, Prehospital Care Program, Colorado Department of Public Health and Environment;
- David Brand, Prevention Services Division, Colorado Department of Public Health and Environment;
- Danielle Branum, Health Facilities Division, Colorado Department of Public Health and Environment;
- Jane Brock, MD, MSPH, Colorado Foundation for Medical Care;
- Deedy Buric, former board member, National Stroke Association;
- Jana Cahoon, Cardiovascular Health Program, Colorado Department of Public Health and Environment;
- Mary Chase, Health Statistics Section, Colorado Department of Public Health and Environment;
- Rick Ciminelli, Integrated Document Factory, Colorado Department of Personnel & Administration;
- Cindy Duffy, Office of External Affairs and Planning, Colorado Department of Public Health and Environment;
- Gail Finley-Rarey, Trauma Program, Colorado Department of Public Health and Environment;
- Daniel Huddle, DO, Radiology Imaging Associates;
- Richard Hughes, MD, Denver Health Medical Center;
- Steven Hughes, MD, former board member, Memorial Hospital, Colorado Springs;
- Jill Hunsaker, Colorado Turning Point Initiative;
- Jillian Jacobellis, PhD, MS, Prevention Services Division, Colorado Department of Public Health and Environment;
- Ann Lockhart, consultant, Colorado Department of Public Health and Environment;
- Michael McManus, Information Technology Services, Colorado Department of Public Health and Environment;

- Lori Maldonado, Office of Communications, Colorado Department of Public Health and Environment;
- Normie Morin-Voillequé, PhD, MPH, Prevention Services Division, Colorado Department of Public Health and Environment;
- Ann McNulty, HIPAA coordinator, Colorado Department of Public Health and Environment;
- Ken Mesch, retired, Colorado Department of Public Health and Environment;
- Heather Pace, intern, Colorado Department of Public Health and Environment;
- Cindy Parmenter, Office of Communications, Colorado Department of Public Health and Environment;
- Kathleen Peng, University of Colorado, Boulder;
- Jack Pommer, State Representative, Boulder;
- Grace Sandeno, Cardiovascular Health Program, Colorado Department of Public Health and Environment;
- John Schlue, Health Facilities Division, Colorado Department of Public Health and Environment;
- Kirida Sin, Information Technology Services, Colorado Department of Public Health and Environment.

Sources of the Information in this Report: The sources for the information and opinions presented in this report are many, including:

- Knowledge and expertise of board members
- Evidence-based medical literature*
- Findings of a statewide stroke prevention and treatment needs assessment
- Resources of the National Stroke Association and the American Stroke Association
- Colorado Department of Public Health and Environment
- Colorado Health and Hospital Association
- Colorado Department of Health Care Policy and Financing
- Centers for Disease Control and Prevention
- Colorado Foundation for Medical Care

*In recent years, an important method for improving medical care has been to base medical decisions for an individual patient on the results of well-designed clinical trials, rather than on more traditional resources such as expert opinion or physiological reasoning. This method has been called “evidence-based medicine.”

Summary:

- Stroke is the third leading cause of death in Colorado and the primary cause of long-term disability.
- House Bill 02-1125 was written to study stroke in Colorado and develop recommendations to improve stroke prevention and treatment. A copy is included as Appendix A.
- The Colorado Stroke Advisory Board was created, and expert members were recruited and appointed from a variety of stroke-related disciplines.

SECTION 2: BASIC INFORMATION ABOUT STROKE

Overview: This section provides background information about stroke for those who are not familiar with the medical nature of the problem.

Signs and Symptoms: Stroke is the damage that results when circulation to the brain is interrupted. The signs and symptoms of stroke are usually sudden in onset. They vary from person to person. Common signs and symptoms are listed in Figure 2. The signs and symptoms that occur in a given person depend on which part of the brain is affected by the stroke.

Figure 2. Signs and symptoms of a stroke

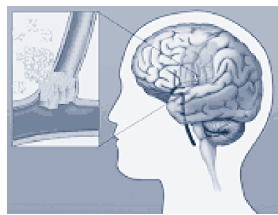
- Sudden numbness or weakness of one side of the body
- Sudden blurred vision, double vision, or loss of vision
- Sudden difficulty understanding or speaking
- Sudden difficulty with walking, balance, and/or coordination
- Sudden, severe headache

Two Types of Stroke: There are two general categories of stroke: ischemic and hemorrhagic. Ischemic stroke is caused by a **blockage** of the vessels that supply blood, oxygen, and nutrients to the brain (Figure 3). Most strokes, about 80–85 percent of the total, are ischemic. A hemorrhagic stroke is caused by a **rupture** of a blood vessel that supplies blood, oxygen, and nutrients to the brain (Figure 4). This type of stroke often is associated with sudden onset of a headache.

Figure 3. Ischemic stroke (blockage of a blood vessel)

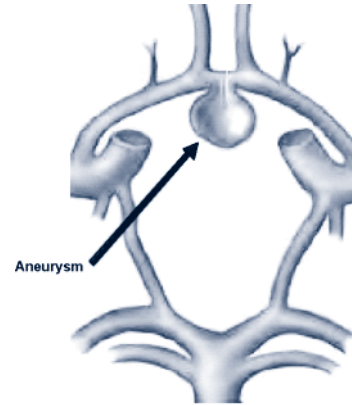


Figure 4. Hemorrhagic stroke (rupture of a blood vessel)



Causes of Stroke: For each of these two categories of stroke, there are multiple ways in which blood vessel blockage or rupture may occur. Among the more common causes of blockage are blood clots that arise from the heart or from cholesterol deposits in the neck. These clots may migrate to block an artery in the brain. Blood vessel rupture can be caused by high blood pressure or by

Figure 5. Cerebral artery aneurysm



structural abnormalities in the blood vessels such as aneurysms (Figure 5) or vascular malformations. Hemorrhagic strokes include those due to bleeding within the brain (intracerebral hemorrhage) and those due to bleeding in the space under the membranes that cover the brain (subarachnoid hemorrhage). The likely cause of the bleeding differs depending on the location of the hemorrhage. Intracerebral hemorrhage is most often due to high blood pressure, vascular malformations, or amyloid angiopathy (a degenerative change in the wall of blood vessels). Subarachnoid hemorrhage is typically due to rupture of an aneurysm, an abnormal ballooned-out segment of an artery wall.

The preferred treatment for a stroke varies, depending on the type of stroke and the underlying cause. The window of opportunity for treatment of stroke is narrow. The brain is more dependent than any other organ in the body on a constant blood circulation. Once circulation is interrupted, irreversible damage develops in short order. If treatment is to be effective, it must be started quickly. The term “brain attack” has been used widely in an attempt to reinforce the need for urgent medical evaluation and treatment of stroke.

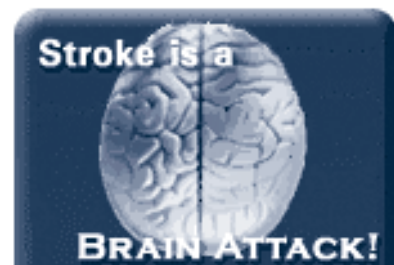


Image courtesy of the
National Stroke Association

Transient Ischemic Attacks (TIA): A transient ischemic attack (TIA) is a warning sign of a stroke. A TIA has the same signs and symptoms as a full-blown stroke, although TIA symptoms usually disappear within an hour or less. Some symptoms may last up to 24 hours. About five percent of patients return to the emergency room with a stroke within two days of TIA diagnosis. Overall, about 10.5 percent of TIA patients return to the emergency room with a stroke within 90 days.¹ Like stroke, a TIA should be viewed as a medical emergency. Identifying the cause and applying preventive treatments can minimize the risks of stroke in a person experiencing TIAs.

Silent Strokes and Vascular Cognitive Impairment: Circulatory disturbance may damage the brain in sudden and obvious ways in stroke, but it also causes damage that is gradual and insidious. Multiple tiny strokes or circulation-related injuries to the brain can lead to “vascular cognitive impairment” or outright dementia. It has been estimated that “silent” or unrecognized strokes are far more common than the ones identified clinically.

Risk Factors for Stroke: As implied above, stroke is a syndrome, not a disease per se. It has no single set of symptoms and no single cause. Similarly, the factors that predispose to stroke are many. Some of these factors are beyond our control, such as age, gender, family history, and ethnicity. Even so, the impact of many risk factors can be decreased. The most well recognized, modifiable stroke risk factors are shown in Figure 6.

Figure 6. Modifiable stroke risk factors

- High blood pressure
- Heart disease
- Atrial fibrillation or irregular heartbeat
- Tobacco smoking
- High cholesterol or fats in the blood
- Diabetes
- Obesity
- Sedentary lifestyle
- Unhealthy diet

It has been estimated that the majority of strokes could be prevented, if the risk-reducing strategies currently available were effectively applied. These strategies, as well as acute treatment strategies, are discussed in more detail in Sections 3 and 4.

The Stroke Population: Although most strokes affect persons over the age of 55, stroke is not exclusive to older people. Younger adults and even children can suffer from this devastating disease.² Among stroke victims, younger people are more likely to have a hemorrhagic stroke. In Colorado,

approximately one-third of strokes suffered by those under age 45 were hemorrhagic versus 15 percent for stroke victims of all ages.

Summary:

- Stroke is the damage that results when circulation to the brain is interrupted. The same things happen in the heart, and we call it a heart attack. Stroke is a brain attack.
- Common signs and symptoms include:
 - Sudden numbness or weakness on one side of the body
 - Sudden blurred vision, double vision, or loss of vision
 - Sudden difficulty in understanding or speaking
 - Sudden difficulty in walking, balance, or coordination
 - Sudden, severe headache
- About 85 percent of strokes in Colorado are ischemic strokes. An ischemic stroke occurs when there is a blockage of the vessels that supply blood, oxygen, and nutrients to the brain.
- The other type of stroke, hemorrhagic stroke, is caused by the rupture of a blood vessel that supplies blood, oxygen, and nutrients to the brain. Hemorrhagic strokes are more likely to occur in young people under age 45.
- Because the brain is more dependent than any other organ on constant blood circulation, the window of opportunity for treatment of stroke is narrow. Once circulation is interrupted, irreversible damage develops in short order.
- Some factors of stroke are beyond our control, such as age, gender, family history, and ethnicity. There are, however, many risk factors which can be modified:
 - High blood pressure
 - Heart disease
 - Atrial fibrillation or irregular heartbeat
 - Tobacco smoking
 - High cholesterol or fats in the blood
 - Diabetes
 - Obesity
 - Sedentary lifestyle
 - Unhealthy diet
- Stroke is strongly related to age. Risk increases with each decade of life beyond the age of 55.

SECTION 3: STROKE TREATMENT AND REHABILITATION

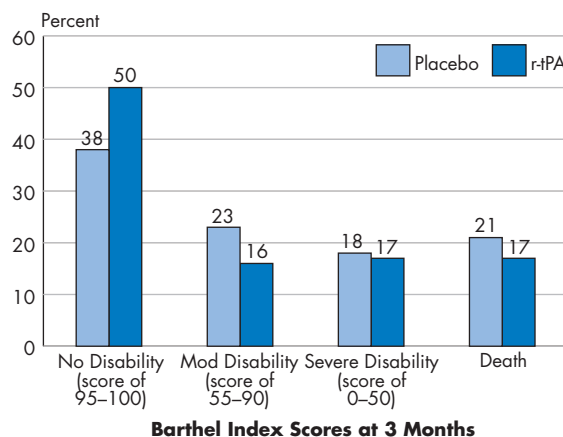
Overview: This section provides general information and evaluation of currently available stroke treatments (HB 1125 requirement a) and rehabilitation, and a review of the health and economic benefits of early stroke treatment (HB 1125 requirement e).

Acute Ischemic Stroke: Until 1996, there was no approved treatment for acute ischemic stroke. In that year, the United States Food and Drug Administration approved a drug, recombinant tissue plasminogen activator (r-tPA), for use within the first three hours after the onset of symptoms. This clot-dissolving agent is administered intravenously. It has been shown to be an effective, but not a miraculous treatment. Earlier treatment within the three-hour window gives better results than later treatment.

Results from a study funded by the National Institute of Neurological Disorders and Stroke showed that among ischemic stroke patients who received r-tPA, approximately half had no disability at three months post-stroke (Figure 7). Even with r-tPA use, 17 percent died within those three months. In ischemic stroke patients who were eligible for r-tPA but received a placebo, 38 percent were disability free at three months post-stroke, and 21 percent died in that time frame. In 1998, a national study group examined the overall cost-savings with use of r-tPA. At that time it was estimated to be \$4,255 for each patient treated.³ This estimate is based on 1996 health care costs, so greater cost-savings with r-tPA use is likely in 2003.

Despite its benefits, r-tPA is infrequently used. A majority of stroke patients do not reach medical attention in time for it to be administered. Risk/benefit calculations regarding r-tPA in an individual patient are complex and must be accomplished very quickly. Although r-tPA can change what might have been a disabling stroke into a benign TIA, it can also cause a life-threatening brain hemorrhage. This fact has made many physicians reluctant to use it. Currently three percent of patients with ischemic stroke receive r-tPA in the United States.⁴ In Colorado, the percentage appears to be significantly lower at 1.1 percent (see Section 5).

Figure 7. Patient outcomes at three months in r-tPA study sponsored by the National Institute of Neurological Disorders and Stroke



Source: NEJM: 1995, 333:1581-1588

Some hospitals offer alternative treatment to intravenous r-tPA. This is known as intra-arterial, or IA treatment. In IA treatment the clot causing the stroke is dissolved or removed to open the passage for blood to flow to the brain cells. The treatment is performed by placing a catheter in the vascular system. The catheter is then passed into the blocked artery where the administration of r-tPA can be performed directly into the clot or a device can be applied to the catheter to remove the clot completely. Intra-arterial clot dissolution appears to be a useful therapy for some patients with acute ischemic stroke. Currently there are no reliable criteria for deciding which patients will benefit the most from this form of treatment. While IA treatment may be more effective than intravenous treatment in reopening blocked arteries, it usually requires more time to accomplish. Since time is of the essence in a stroke, the benefit of IA treatment can be canceled-out by the delay involved in administering IA treatment. Intra-arterial treatment has not yet been approved by the Food and Drug Administration, but seems a likely important treatment for acute ischemic stroke in the future. When stroke patients arrive at the hospital more than three hours after onset of symptoms, intravenous r-tPA is probably not an option. Intra-arterial therapy is sometimes helpful up to six hours after symptom onset.

— A SURVIVOR'S STORY —

Melvina “Mel” Taylor is a 70-year-old woman who takes pleasure in meeting her friends and working on craft items and projects for her church. She was enjoying an extended family gathering on July 4, 2000, when she experienced the “worst headache” of her life. For the next week, she was normal except for an intermittent dull headache. Six days later, however, on July 10, Mel suddenly had the “worst eye pain” she had ever experienced. She collapsed immediately after asking her husband to call 911. She was taken to the emergency room of a local hospital where it was determined that she had suffered from a hemorrhagic stroke that was caused by a large ruptured aneurysm. She was taken into emergency surgery to “clip” the aneurysm and prevent ongoing bleeding. According to her neurosurgeon, Mel had suffered two bleeds, (increasing her risk for a poor outcome) one on July 4 that clotted quickly and the other on July 10 which incapacitated her. Mel developed a common complication known as cerebral vasospasm that led to three weeks in the Intensive Care Unit. During that time, she remained semicomatose but she eventually awoke. Mel continued to improve slowly and was later transferred to a rehabilitation center. It was there that Mel first became aware of her surroundings. Though Mel did not remember any details of the hospital stay, her husband and family had remained at her bedside throughout her course of treatment hoping that she would make it through.

Mel currently has some difficulty with her short-term memory but has resumed a full life enjoying her family and making crafts.

Acute Hemorrhagic Stroke: Hemorrhagic strokes are more deadly than ischemic strokes. There are two main types of hemorrhagic strokes: subarachnoid hemorrhage and intracerebral hemorrhage.

A subarachnoid hemorrhage bleeds into the lining of the brain. This is due to rupture of an aneurysm and is a life-threatening event. The bleeding in this situation can be massive. It is not uncommon for the blood that has come from the aneurysm and into the tissue to apply pressure back on the rupture and seal itself off. As the body breaks down

the blood in the brain through natural processes, the pressure on the rupture is lifted, and it can re-bleed. Each brain bleed increases the risk of poor outcome and even death. Direct surgical action to repair the aneurysm is usually required to prevent future bleeding. The repair can be done by applying a clip to the aneurysm to seal it off completely, or by inserting a catheter into the vascular system to fill the aneurysm with a substance to clog it.

Intracerebral hemorrhage is another type of hemorrhagic stroke. This is often caused by high blood pressure. In circumstances when the hemorrhage is very large, surgery is required to remove the blood. For patients with a less severe hemorrhage, surgery may not be required, and the body will break down the blood and reabsorb it.

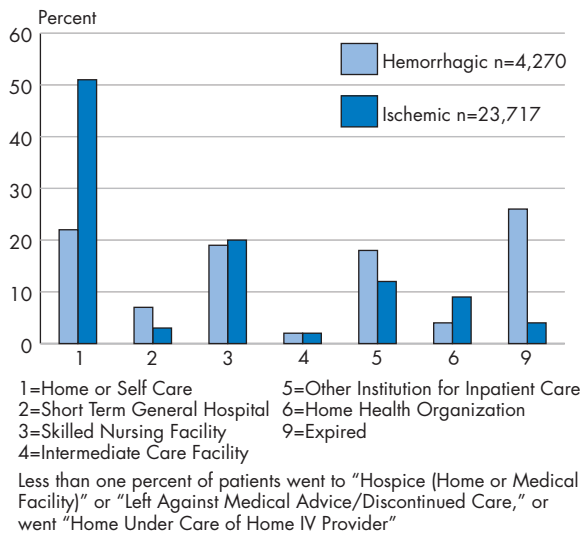
Preventing Complications of Acute Stroke: Numerous complications may follow an acute stroke. Some of the more common complications are shown in Figure 8.

Figure 8. Complications of stroke

- Stroke progression
- Brain swelling
- Arterial spasm
- Hydrocephalus (water on the brain)
- Seizures
- Pneumonia
- Urinary tract infections
- Blood clots in the legs or lungs
- Irregularities of the heartbeat
- Heart failure
- Bedsore
- Falling
- Dehydration
- Depression
- Altered thought processes
- Nutritional or chemical changes of the body

Avoiding complications (and treating them if they occur) is a major focus of acute stroke management. Studies have shown that outcomes for stroke patients treated in organized stroke units are superior to those of stroke patients cared for in general medical wards, but very few hospitals have stroke units in Colorado, or the country at large.^{5, 6, 7}

Figure 9. Destination of stroke patients leaving the hospital, hemorrhagic vs. ischemic stroke, Colorado residents, 1999–2001



Data from the Colorado Health and Hospital Association

Stroke Rehabilitation: The mechanisms of recovery from stroke are not well understood, but evidence points toward remodeling of nerve pathways as an important factor. Rehabilitation is one way of expediting this remodeling.

Stroke rehabilitation is the systematic effort to reduce disability and help stroke survivors reintegrate into community life. It is an interdisciplinary process requiring a coordinated effort by the patients, caregivers, and a number of medical professionals.

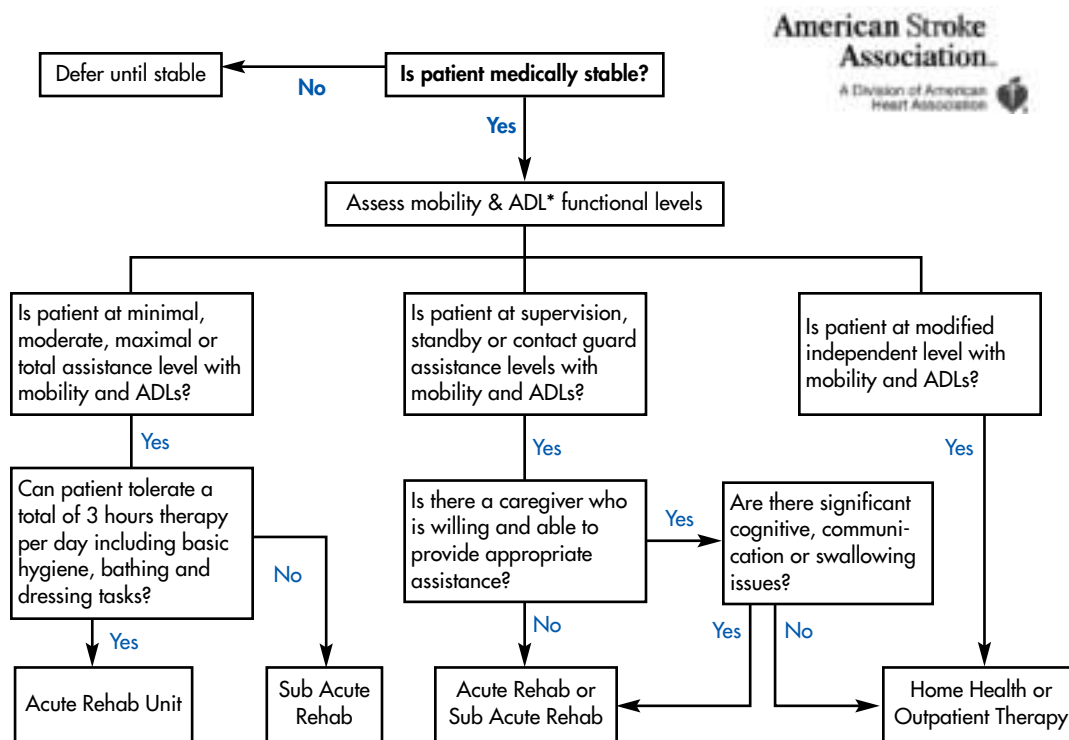
A person needing rehabilitation following a stroke has several options for receiving help: in an acute rehabilitation unit, in a skilled nursing unit, or in a transitional care unit. Home health and outpatient services are alternative options. Figure 10 outlines the decision-making process and provides a brief description of these levels of care. Many other factors are considered when deciding the most appropriate level of rehabilitation for an individual such as medical status, functional status, and social and family supports. Some of the factors are shown in Figure 11. Research has demonstrated older persons with stroke receive greater benefit from inpatient rehabilitation than from nursing home rehabilitation.⁸

— A SURVIVOR'S STORY —

Audrey Kreibich is a 77-year-old socially and physically active Boulder County woman who enjoys visiting friends and exercising. Three years ago, Audrey was home washing the dishes when she experienced a sudden onset of weakness on the right side of her face, her right arm, and right leg. The weakness was so severe that she could not hold her own weight. Her husband witnessed this attack and immediately dialed 911. The paramedics recognized Audrey's symptoms as stroke-related and transported her to a hospital in the region with a protocol for treating stroke emergencies. Within 65 minutes, Audrey found herself in the chaos of a busy emergency room. The physician met her at the door and quickly whisked her off for tests and scans. Her symptoms continued to worsen in this short time frame to the point that she was no longer able to speak or move her right side. She was only able to wiggle the toes on her right foot. Though she could move her left side, she was trapped inside a body that was no longer functioning as it did only moments earlier. She was diagnosed with an ischemic stroke. It was determined she was a candidate for r-tPA, a clot-busting drug, to reverse the effects of a stroke. Within 20 minutes of administration of r-tPA, Audrey was delighted that she could move her right arm and could talk again. The drug dramatically changed her outcome. Instead of having permanent paralysis and difficulty speaking, Audrey had a three-day hospital stay and was able to return home without any need for intense rehabilitation.

Today, three years later, Audrey continues to enjoy her social activities and exercise program and is living a healthy active life.

Figure 10. Stroke Rehabilitation Guideline



*Activities of Daily Living

LEVELS OF STROKE REHABILITATION CARE

What is acute rehabilitation?

An inpatient level of care that provides:

- Three hours of therapy per day from at least two therapy disciplines (Physical Therapy, Occupational Therapy, or Speech Therapy)
- Rehab team approach with social worker and psychologist as active team members
- Physiatrist as either attending physician or a consultant while on the rehab unit
- Twenty-four hour rehabilitation nursing
- Ability to admit directly from emergency department, physician's office, or home with no need for three-day qualifying stay

What is sub-acute rehabilitation?

An inpatient level of care in a skilled nursing facility or transitional care facility that provides:

- One to two hours of therapy from at least one discipline, but may receive therapy from several disciplines

- Rehab services for patients who cannot tolerate a higher intensity level of care. May be valuable for building a stroke patient's endurance for acute rehab or providing important continuing therapy to patients who no longer require acute rehab services.

- Twenty-four hour nursing

What is home health rehabilitation?

A level of rehabilitative care provided in the home which:

- Bridges the gap between hospital or sub-acute settings and the home environment
- Provides a setting to evaluate how the patient can function at home
- Is used when the patient is homebound

What is outpatient rehabilitation?

A level of care provided in the community which:

- Provides rehab services in a clinic or outpatient department of a hospital or doctor's office
- May be provided in a more intense and integrated program, such as day hospital

Figure 11. Factors that affect the success of rehabilitation:

- Deficits at the time of admission to the rehabilitation unit
 - Timing of rehabilitation
 - Type of inpatient rehabilitation
 - Type of post hospital rehabilitation such as home health care versus outpatient therapy
-

Summary:

- In 1996, the United States Food and Drug Administration approved recombinant tissue plasminogen activator (r-tPA) for use within the first three hours after the onset of ischemic stroke symptoms. This is a clot-dissolving drug that is administered intravenously and has been shown to be an effective treatment reducing the disabling impact of stroke.
- The decision whether a patient is a good candidate for r-tPA is complex and must be made quickly. There are some cases where the use of r-tPA can cause a life-threatening brain hemorrhage. Consequently, many physicians are reluctant to use it.
- Currently, three percent of patients with ischemic stroke receive r-tPA in the United States. In Colorado, the percentage is significantly lower, around one percent.
- Intra-arterial clot dissolution is sometimes helpful for patients with acute ischemic stroke, as it can be administered between three to six hours after symptom onset. This treatment has not yet been sanctioned by the Food and Drug Administration.
- Complications that follow an acute stroke are numerous and may include:
 - Recurrent stroke(s)
 - Brain swelling
 - Arterial spasm
 - Water on the brain
 - Seizures
 - Pneumonia
 - Urinary infections
 - Blood clots in the legs or lungs
 - Irregular heartbeat
 - Heart failure
 - Bed sores
 - Falling
 - Dehydration
 - Depression
 - Altered thought processes
 - Nutritional or chemical changes of the body
- Stroke rehabilitation is the systematic interdisciplinary process of reducing disability and helping stroke survivors reintegrate into community life. Research has demonstrated older persons with stroke receive greater benefit from inpatient rehabilitation than from nursing home rehabilitation.

SECTION 4: STROKE PREVENTION BY MODIFYING RISK FACTORS

Overview: This section reviews the risk factors an individual can change to reduce the chances of having a stroke.

The Gap Between Potential and Practice: No matter how effective stroke treatment or stroke rehabilitation may become, they will never match stroke prevention. Many options for stroke prevention exist, but like r-tPA for acute treatment, they are underused. An example of underused stroke prevention is proper treatment of atrial fibrillation. Atrial fibrillation is an abnormal heartbeat that causes the top chamber of the heart to contract irregularly leaving blood to pool within its chamber. The pooling of blood allows blood clots to form. These clots can become dislodged and travel to the brain causing an ischemic stroke. The risk of stroke increases about five-fold in patients with atrial fibrillation. One-third of strokes in people older than 75 years have been attributed to atrial fibrillation.⁹ Warfarin, a “blood thinner,” can reduce the annual rate of stroke by two-thirds in persons with atrial fibrillation without a substantial increase in the incidence of hemorrhage.¹⁰ In a study by the Western States Peer Review Organization Collaborative, out of 189 Colorado hospitalizations for Medicare beneficiaries, only 61 percent of patients with atrial fibrillation who could take warfarin were discharged on warfarin.¹¹

Other examples of underutilized effective stroke risk reduction practices include:

- Identification and control of high blood pressure
- Tobacco use cessation
- Weight control
- Regular physical exercise

Although some stroke risk factors cannot be changed, and some stroke risk factors are probably still unknown, it is estimated that up to 80 percent of strokes could be prevented if the risk factor modifications now available were fully implemented.¹²

Stroke risk factor modification may involve lifestyle change, medication, and even surgery. The best strategy for a given patient depends on that individual's combination of risk factors.

The Behavioral Risk Factor Surveillance System:

The Survey Research Unit of the Colorado Department of Public Health and Environment conducts a yearly phone survey of Coloradans' health behaviors and health conditions known as the Behavioral Risk Factor Surveillance System (BRFSS). The survey tool includes questions about known risk factors for stroke. The following figures from the BRFSS illustrate how Coloradans fare in their risk for stroke.

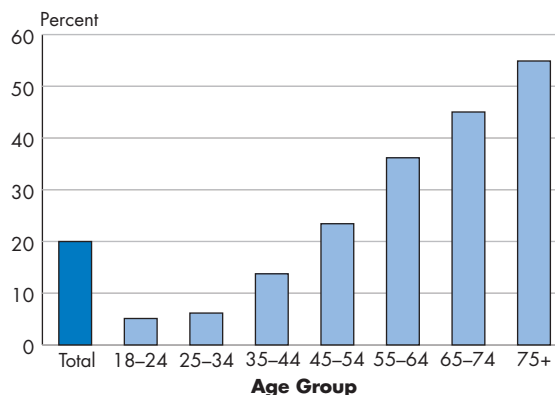
Heart Disease:^{13, 14, 15} The heart and the aorta, the large artery leading from the heart, are common sources of blood clots that cause stroke. Treating, or better yet, avoiding heart disease can be effective in preventing stroke. Medical treatments may include:

- Anticoagulants such as warfarin
- Milder anti-clotting agents such as aspirin
- Cholesterol-lowering drugs
- Medications to regularize the heart rhythm
- Procedures to alter clot-forming areas within the heart

The impact of heart disease can be minimized by a healthy lifestyle and by addressing the following risk factors for both heart disease and stroke.

High Blood Pressure: This is the most important, treatable risk factor for stroke. High blood pressure dramatically increases the risk for both ischemic and hemorrhagic stroke. Treatment of high blood pressure greatly reduces the risk of

Figure 12. Percent of adults (age 18+) ever told that they have high blood pressure, Colorado BRFSS, 2002



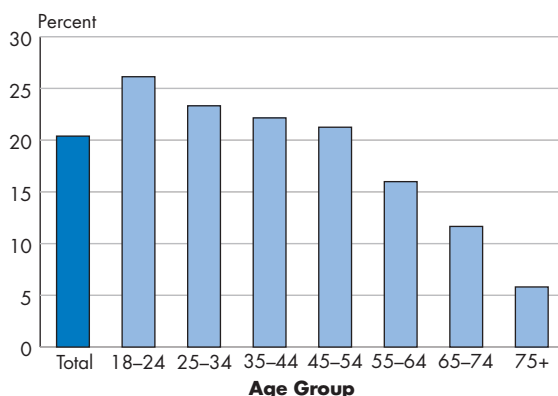
stroke. Blood pressure can be lowered through diet and exercise and use of medications. Figure 13 illustrates the four levels of blood pressure classification. A decrease in the diastolic or lower number for blood pressure by five to six points reduces the risk of stroke by 42 percent. The treatment of isolated systolic, or upper number, hypertension in the elderly decreased the risk for stroke by 36 percent.¹⁶ The American Heart Association estimates that roughly 75 percent of people with high blood pressure do not have their blood pressure under adequate control.

Figure 13. Blood pressure classifications according to the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure

Blood Pressure Classification	Systolic Blood Pressure	Diastolic Blood Pressure
Normal	less than 120	and less than 80
Prehypertension	120–139	or 80–90
Stage 1 Hypertension	140–159	or 90–99
Stage 2 Hypertension	greater than or equal to 160	greater than or equal to 100

Smoking/Tobacco Use: Cigarettes are a primary cause of preventable death in this country. Cigarette use increases the risk, not only of stroke, but also of heart attack, cancer, and chronic lung disease. Even light smokers, smoking one to four cigarettes a day, have more than twice the risk of developing heart disease than nonsmokers.¹⁷ Smoking raises blood pressure, damages blood vessels, and alters coagulation and cholesterol levels. Stopping smoking reverses these harmful effects and reduces the risk of stroke.

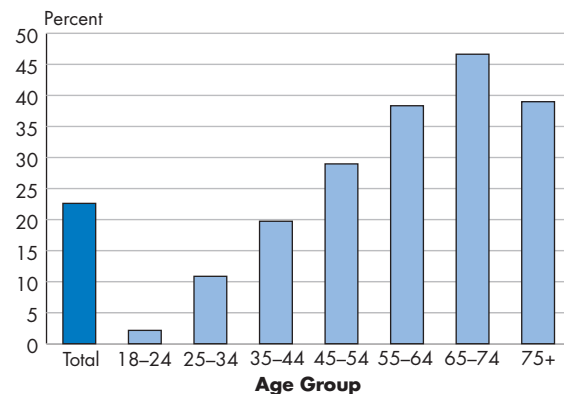
Figure 14. Percent of adults (age 18+) who currently smoke, Colorado BRFSS, 2002



Elevated Cholesterol: Excess cholesterol in the bloodstream forms deposits or plaque on artery walls leading to restricted blood flow that can cause a stroke. Furthermore, cholesterol plaques trigger the formation of blood clots that may block arteries. High blood cholesterol is defined as more than 240 milligrams with desirable cholesterol levels below 200 milligrams.¹⁷ Cholesterol is comprised of low density lipids (LDL), sometimes called “bad cholesterol,” and high density lipids (HDL), the “good cholesterol.” The LDL cholesterol can be decreased through diet, physical activity, weight reduction, smoking cessation, and medications. These same interventions have been shown to increase the level of HDL cholesterol. Raising HDL levels above 50 milligrams reduces the risk of ischemic stroke.¹⁸

Figure 15 shows the proportion of Coloradans who report they have been told their cholesterol is high. This is likely a low estimate, since it does not include people who are unaware they have elevated cholesterol.

Figure 15. Percent of adults (age 18+) who have ever been told that their blood cholesterol is high, Colorado BRFSS, 2002



Large Vessel Atherosclerosis: Cholesterol deposits, or atherosclerotic plaques, tend to form in the large arteries that supply blood to the brain. These deposits promote blood clots that adhere to the plaque. The blood clots or parts of the plaque can break loose and travel to the brain causing a stroke. Carotid endarterectomy, a surgical treatment to remove the plaque, may be useful in preventing future strokes in some patients (see Figure 16). An alternative treatment for patients who are not good surgical candidates is angioplasty and stenting. This involves compressing the plaque via a balloon-tipped catheter and inserting a metal mesh to expand the artery and flatten the plaque.

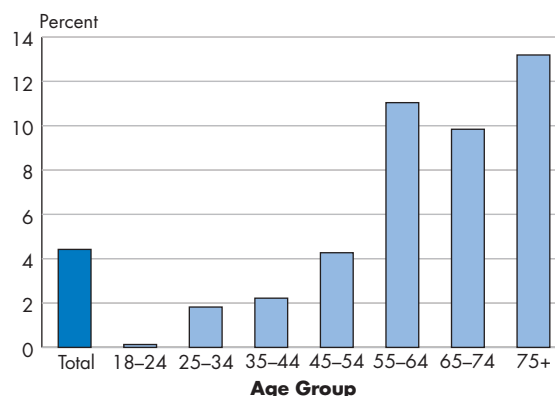
Figure 16. Atherosclerotic plaque removal



Diabetes: People with diabetes have about two-to-four times greater risk of stroke than people without diabetes.¹⁷ Diabetes lies at the heart of a recently recognized syndrome that includes obesity, high blood pressure, resistance to insulin, blood clotting disturbances, and elevated serum fat and cholesterol levels. Good control of diabetes is known to decrease damage to small blood vessels. Control, or better yet, prevention of diabetes is an important strategy for stroke prevention.

Obesity: The U.S. Surgeon General has called obesity in the United States a “national epidemic.”

Figure 17. Percent of adults (age 18+) that have been diagnosed with diabetes, Colorado BRFSS, 2002

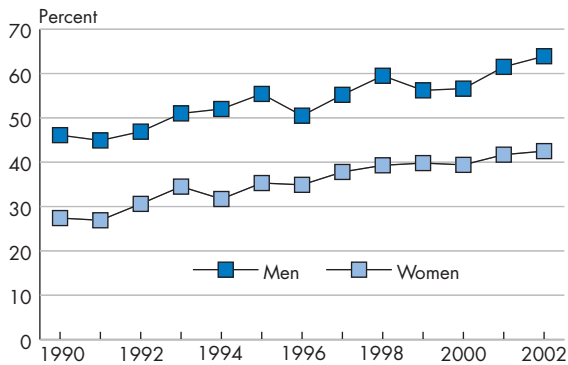


Being overweight increases the risks of high blood pressure, diabetes, and elevated cholesterol. Avoiding obesity will lower one's risk of stroke. Overweight and obesity are calculated by body mass index, or BMI, a measure of weight compared to height. Obesity is defined as a BMI of 30 or more. A BMI between 25 and 30 is considered “overweight.” An ideal BMI is between 18.5 and 25.¹⁷ The percentage of overweight and obese adults in Colorado is increasing, as shown in Figure 19.

Figure 18. Body Mass Index (BMI) Table

	BMI	19	20	21	22	23	24	25	26	27	28	29	30	35	40
Height	4'10"	91	96	100	105	110	115	119	124	129	134	138	143	167	191
	4'11"	94	99	104	109	114	119	124	128	133	138	143	148	173	198
	5'0"	97	102	107	112	118	123	128	133	138	143	148	153	179	204
	5'1"	100	106	111	116	122	127	132	137	143	148	153	158	185	211
	5'2"	104	109	115	120	126	131	136	142	147	153	158	164	191	218
	5'3"	107	113	118	124	130	135	141	146	152	158	163	169	197	225
	5'4"	110	116	122	128	134	140	145	151	157	163	169	174	204	232
	5'5"	114	120	126	132	138	144	150	156	162	168	174	180	210	240
	5'6"	118	124	130	136	142	148	155	161	167	173	179	186	216	247
	5'7"	121	127	134	140	146	153	159	166	172	178	185	191	223	255
	5'8"	125	131	138	144	151	158	164	171	177	184	190	197	230	262
	5'9"	128	135	142	149	155	162	169	176	182	189	196	203	236	270
	5'10"	132	139	146	153	160	167	174	181	188	195	202	207	243	278
	5'11"	136	143	150	157	165	172	179	186	193	200	208	215	250	286
	6'0"	140	147	154	162	169	177	184	191	199	206	213	221	258	294
	6'1"	144	151	159	166	174	182	189	197	204	212	219	227	265	302
	6'2"	148	155	163	171	179	186	194	202	210	218	225	233	272	311
	6'3"	152	160	168	176	184	192	200	208	216	224	232	240	279	319
	6'4"	156	164	172	180	189	197	205	213	221	230	238	246	287	328
	Weight (lbs.)														

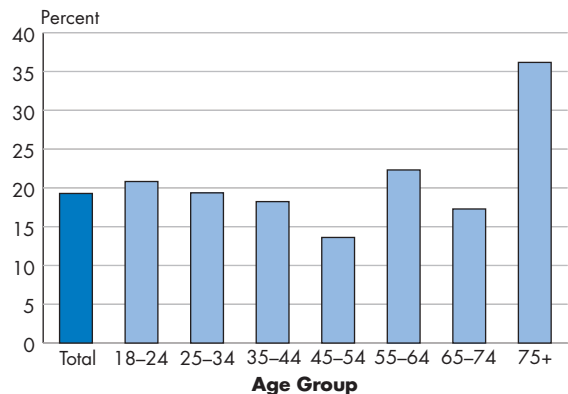
Figure 19. Percent of adults (age 18+) who are overweight or obese by gender, Colorado BRFSS, 2002



Diet: ^{19, 20, 21} Healthy food habits can help reduce three of the major risk factors: high blood cholesterol, high blood pressure, and obesity. A diet low in saturated fat and high in fruits, vegetables, and whole grains has been shown to decrease the risk of stroke. Fish consumption also has been reported to be protective. Lower salt diets can reduce blood pressure. Dietary guidelines recommend at least five daily servings of fruits and vegetables. In Colorado in 2000, only 23 percent of adults were in compliance with this recommendation. Females, at 27 percent, were more likely to comply than males, at 20 percent.¹⁷

Sedentary Lifestyle: Regular physical exercise has many health-promoting effects. It likely benefits the blood circulatory, or cardiovascular, system as a whole. Exercise lowers blood pressure, helps to avoid obesity, and increases the level of “good,” protective cholesterol.

Figure 20. Percent of adults (age 18+) reporting no leisure time physical activity in the past 30 days, Colorado BRFSS, 2002



Coloradans in general are active, however, inactivity among the oldest Coloradans (age 75+), who are at greatest risk for stroke, is high. Behavioral studies show inactivity levels nearly double in the over age 74 group (Figure 20).

Variation in Stroke Risk Factors by Race/Ethnicity: Information about the incidence of major risk factors in the primary ethnic groups in Colorado is shown in Figure 21. Other than diabetes, the risk factors known to contribute to stroke are high in all groups. All six stroke risk factors listed are notably high among African Americans and likely contribute to the higher rate of stroke deaths portrayed in Figure 32.

Figure 21. Percent of adults (age 18+) reporting various stroke risk factors by race/ethnicity, Colorado BRFSS, 2000–2001

Risk Factor	White	African American	Hispanic
High blood pressure	22%	47%	20%
Tobacco smoking	24%	32%	26%
High cholesterol	31%	49%	34%
Diabetes	5%	20%	7%
Obesity	15%	37%	22%
Sedentary lifestyle	18%	34%	36%

When reviewing risk factors for poor health and their role in racial and ethnic health disparities, the root causes need to be considered. These causes are highly associated with race and ethnicity and have a large influence on health behaviors. They can result in continuous stress for the individual, and many times the adoption of unhealthy behaviors that can lead to chronic disease. Health risk modification strategies need to take into account chronic environmental stressors, social inequalities, and cultural differences in order to be effective.²¹

Summary:

- Stroke treatment or rehabilitation will never be as good as stroke prevention. It is estimated up to 80 percent of strokes could be prevented if available risk factor modifiers were fully implemented.
- Many options for preventing stroke exist, but are underused. Options include:
 - Identifying and treating irregular heartbeat or atrial fibrillation

- Identifying and controlling high blood pressure
 - Tobacco use cessation
 - Reducing cholesterol
 - Surgical removal of plaque from the carotid artery
 - Identifying and controlling diabetes
 - Reducing overweight and obesity
 - Healthy food habits
 - Regular exercise
- Most of the risk factors known to contribute to stroke are high in all racial/ethnic groups. Effective risk modification strategies need to take into account chronic environmental stressors, social inequalities, and cultural differences.

— A SURVIVOR'S STORY —

Judy Trent's mother Francis had just celebrated her 77th birthday. Francis lived alone in Scottsbluff, Nebraska. Her granddaughter planned to check on her in a few days. Francis had high blood pressure and sometimes forgot to take her medicine. Judy didn't realize that high blood pressure is the number one risk factor for stroke. Two days later, Judy's daughter called reporting that Francis had had a stroke. She was found lying on the floor of her home and, by all accounts, had been there for a day and a half. The family was devastated. Francis was still alive but in very serious condition. She had a general weakness throughout most of her body and couldn't talk, eat, or walk. The doctors gave her less than a week to live.

Francis is a strong woman, and she pulled through. But after 90 days, her Medicare coverage ran out, and she had to be moved out of the hospital. She still wasn't able to eat or walk. The hospital suggested a nursing home, but Judy knew how depressing it would be for her mom. She wanted to bring her home to Penrose, Colorado, to recover. "I wasn't too sure of myself, if I could do it myself," said Judy. She was surprised at just how helpless her mother had become. Taking care of her mother full time meant Judy had to quit her job at a garden shop. The family lost more than 30 percent of its income. Judy got help from the Area Agency on Aging and arranged extended rehabilitative nursing care for her mother.

Now, a year later, Francis is doing well, walking with a walker, and feeding herself. Judy says, "I didn't know anything about stroke. If I had known more, I would have been more consistent with mom and told her to take her blood pressure medicine."

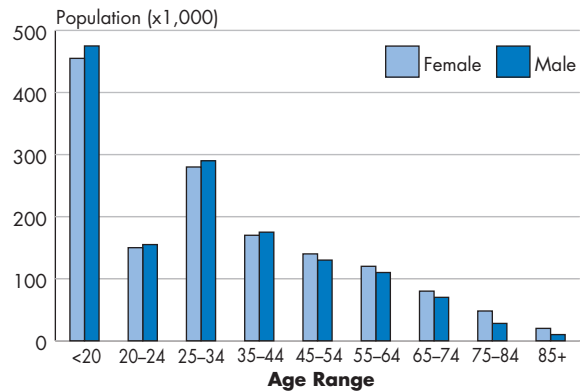
SECTION 5: STROKE IN COLORADO

Overview: This section reviews stroke in Colorado including the impact that delayed or inappropriate treatment has on quality of life and associated costs to patients and the state (HB 1125, requirement d).

Colorado Geography and Demographics:¹⁷ Geographically, Colorado is a large state with a population density of 39 persons per square mile, compared to the national population density of 77. As seen in Figure 22, Colorado is comprised of 64 counties: 12 are urban, 29 are considered rural, and 23 are considered frontier with fewer than six people per square mile.

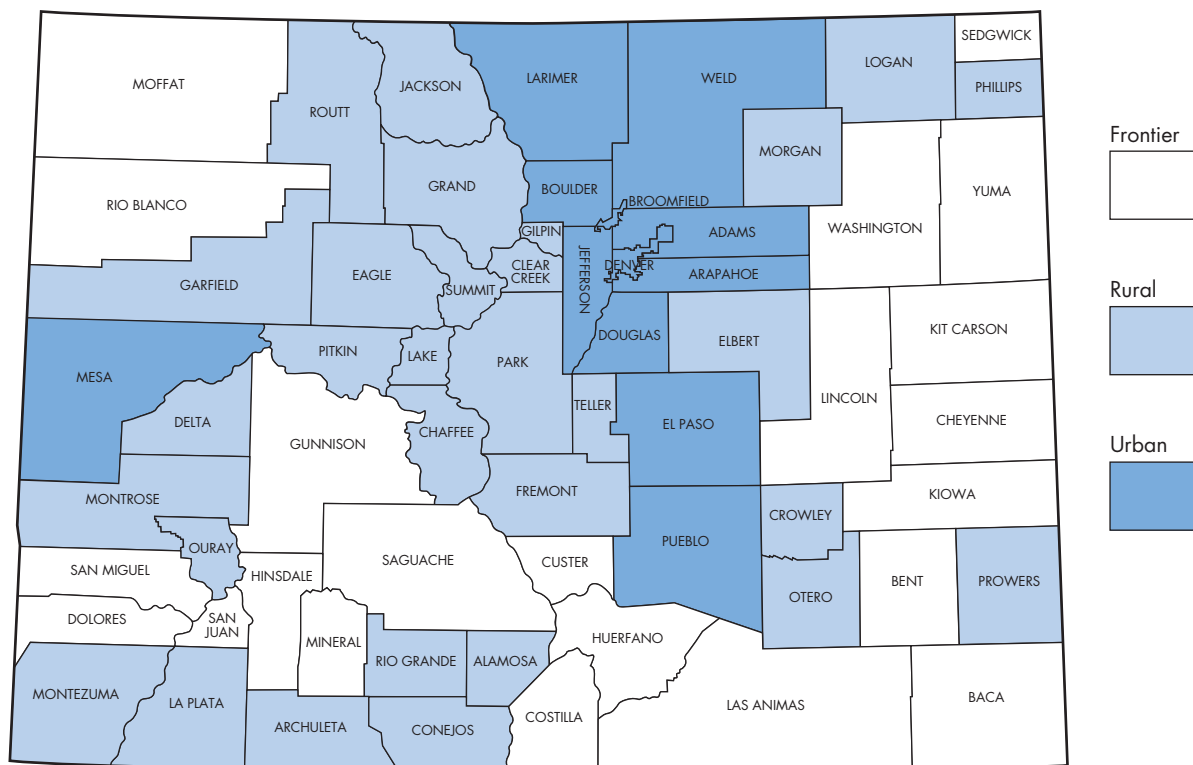
Compared to national averages, Colorado's population is young, healthy, rapidly growing, and increasingly wealthy. With a population of approximately 4.3 million residents, Colorado is home to only 1.5 percent of the United States population. The male/female distribution among adults is 48.4 percent male and 51.6 percent female. The age and gender distributions are shown in Figure 23.

Figure 23. Colorado's population by age and gender, 2000



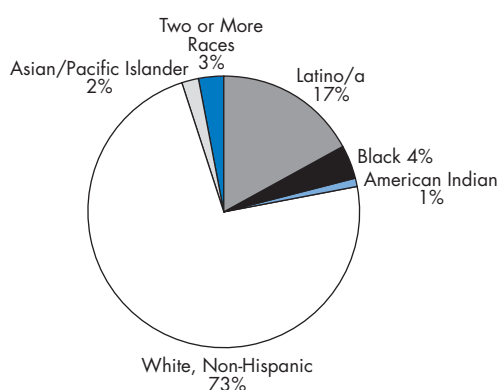
Eighty percent of Colorado residents are concentrated in 10 metropolitan counties on the east side of the Rocky Mountains in a region known as the Front Range. The remaining 20 percent are scattered throughout the eastern plains, mountains, and western plains of the state.

Figure 22. Colorado's urban, rural, and frontier counties



Minority groups account for more than 25 percent of Colorado's population, and the numbers are increasing. During the past decade, there was a nearly 33 percent increase in Hispanic migration to Colorado. Colorado's racial and ethnic composition differs from the national mix. The percentage of Hispanics is higher than the national average while the percentages of Asians and Pacific Islanders and African Americans is lower. The percentage of Native Americans is proportionally similar to the United States. Colorado also has a growing immigrant work force, consisting primarily of individuals of Hispanic origin.

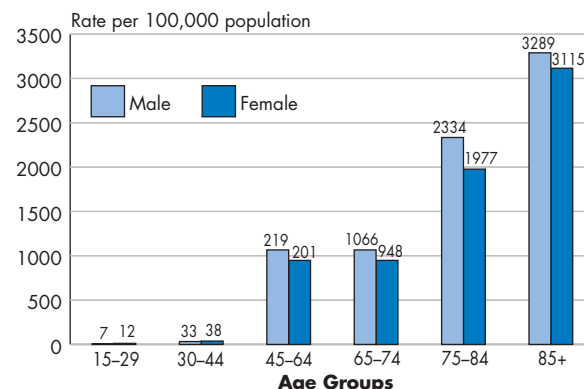
Figure 24. Colorado's racial/ethnic mix, 2000



Annual Number of Strokes and Stroke Rate: The precise number of strokes each year in Colorado is uncertain, but at a minimum, it includes the following: mild strokes not requiring hospitalization (number unknown), non-hospitalized stroke deaths (hundreds of deaths annually), hospital admissions due to a stroke, and strokes which occur during hospitalization for another primary cause. Because several of these numbers are unknown, there is no way to calculate an accurate stroke rate. However, the death rate from stroke and the hospitalization rate from stroke give insight into the scope of the problem in Colorado.

Hospitalizations and deaths from stroke are strongly related to age for both men and women, as seen in Figures 25 and 26. At all ages above 44, the rate of hospitalizations for stroke is higher in men than in women. However, because women, on average, live longer than men, the total number of stroke deaths in women exceeds that in men as seen in Figures 27 and 28.

Figure 25. Hospitalization rate with stroke as a primary diagnosis by age and gender, Colorado residents, 1999–2001



Cerebrovascular Disease=ICD-9-CM 430–434, 436–438. Data from Colorado Health and Hospital Association

Figure 26. Death rate for stroke as the underlying cause of death by age and gender, Colorado residents, 1999–2001

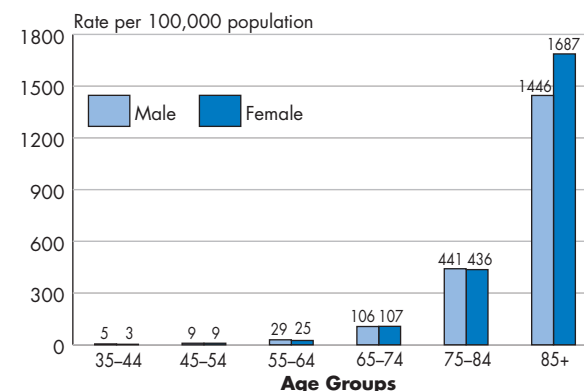


Figure 27. Population and stroke deaths in people age 85 and older by gender, Colorado residents, 2001

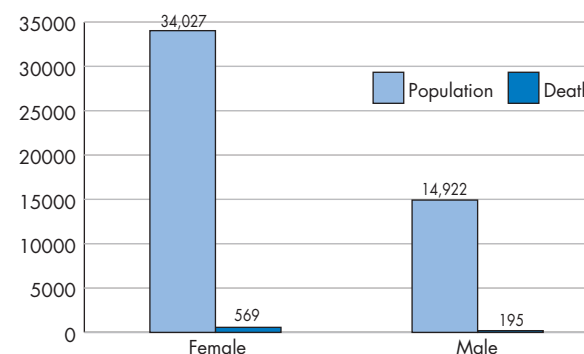
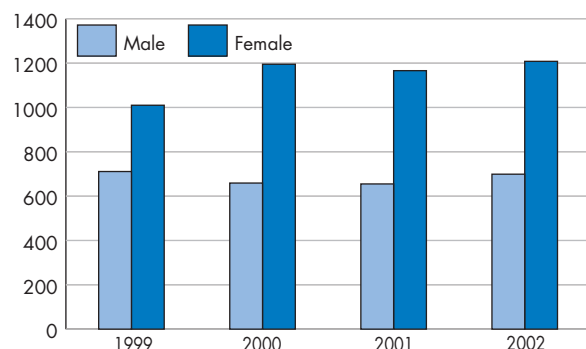
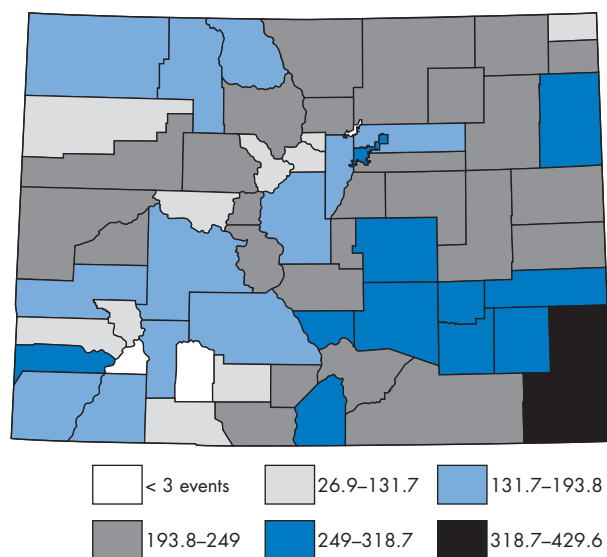


Figure 28. Annual number of stroke deaths by gender, Colorado residents, 1999–2002



Variations in data collection rules lead to large differences in the number of strokes reported from hospital discharge data. Using a stroke definition that includes hemorrhagic, ischemic, and TIAs, there were 9,582 hospitalizations in 2001 with a primary diagnosis of stroke, and 22,092 hospitalizations with any diagnostic mention of stroke. The former number is believed to be closer to the number of new strokes in Colorado in 2001, but it is an underestimate, as it does not include non-hospitalized strokes or non-hospitalized stroke deaths.

Figure 29. Age-adjusted hospital discharge rates by county for ischemic stroke as primary diagnosis, Colorado residents, 1999–2001*



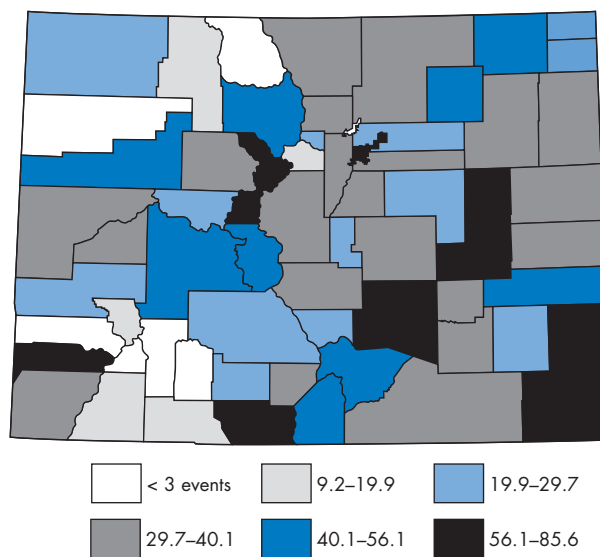
*Rate per 100,000 population. Age-adjusted to the 2000 U.S. standard population. Data from the Colorado Health and Hospital Association.

Stroke in Colorado's Population: Hospital discharge rates capture the occurrence of stroke in Colorado that resulted in hospitalization or occurred during inpatient hospitalization, by county of residence (Appendices B and C). The rates do not reflect the long-term outcome of hospitalization.

Figures 29 and 30 illustrate the hospital discharge rates for ischemic and hemorrhagic stroke for years 1999–2001. Colorado's eastern plains have higher hospital discharge rates for both types of stroke compared to the rest of the state. The southeast corner of Colorado has the highest rates overall, though the rates are considered less stable due to low population levels in the region. The northeast corner of the state also has higher rates, while the southwest corner of Colorado has some of the lowest rates. Both the City and County of Denver and Pueblo County have high hospital discharge rates for both types of stroke.

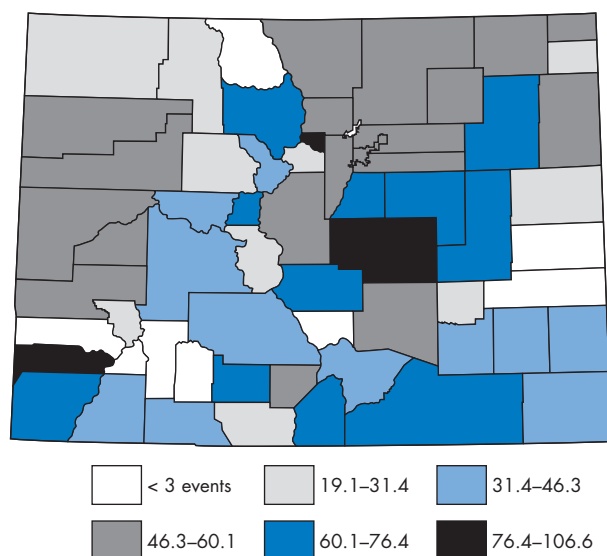
Stroke Deaths in Colorado: Mortality or death rates with stroke as the underlying cause include deaths that occurred in a non-hospital setting, in emergency rooms, and during hospitalization. Figure 31 illustrates deaths from stroke in Colorado for the years 1999–2001. (Also see Appendix C.) According to a report from the Centers for Disease Control and Prevention, 60 percent of Colorado stroke deaths

Figure 30. Age-adjusted hospital discharge rates by county for hemorrhagic stroke as primary diagnosis, Colorado residents, 1999–2001*



*Rate per 100,000 population. Age-adjusted to the 2000 U.S. standard population. Data from the Colorado Health and Hospital Association.

Figure 31. Age-adjusted stroke death rates by county, Colorado residents, 1999–2001*



*Rate per 100,000 population. Age-adjusted to the 2000 U.S. standard population.

in 1999 occurred before transport to an emergency department, 37 percent of stroke deaths occurred in the hospital, and three percent occurred in the emergency department. The report ranks Colorado eighth highest among the 50 states for percent of deaths occurring pretransport. The national average for pretransport stroke deaths is 47.6 percent. Pretransport deaths occurred at a residence, a nursing home, or an extended care facility.²²

Variation in Stroke Deaths Among Counties: As reported by the Colorado Health and Hospital Association, age-adjusted county rates for stroke hospitalizations vary considerably, 430/100,000 to 27/100,000 (Figures 29 and 30). County-by-county rates for stroke deaths are less variable, with less than a three-fold difference from the highest to the lowest county (86.5/100,000 versus 31.2/100,000).

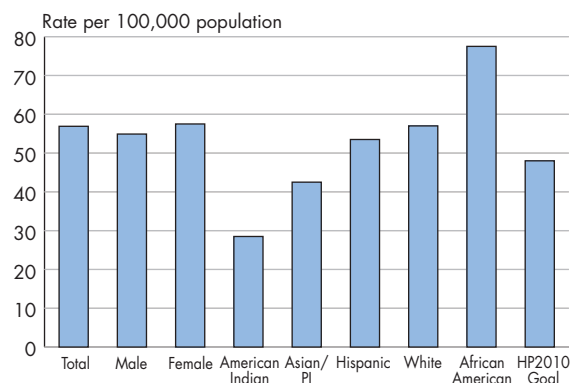
As shown with stroke hospitalizations, the eastern plains have higher stroke death rates than the rest of the state. El Paso County has high rates for both stroke hospitalizations and stroke deaths, as does Dolores County. Dolores County, however, provides an example where a low population (5,507) contributes to a high, but likely unstable, stroke death rate. These less stable rates in the non-urban counties make it difficult to assess whether regional rates are actually higher or lower than the rest of the state. In addition, some of the variation in rates

of stroke hospitalizations may be due to differences in the way stroke is diagnosed and coded by hospitals.

Variation in Stroke Death Rate by Ethnicity: Figure 32 displays the death rate over five years by gender and race/ethnicity. It also depicts the Healthy People 2010 goal to decrease the rate of stroke death in Colorado by 15 percent by the year 2010.

The stroke death rate among African Americans is the highest of any group and is over 30 percent higher than the stroke death rate among whites. This rate can be correlated to the information on risk factors in Figure 21 where a proportionally large percentage of African Americans are shown to have chronic health conditions or participate in behaviors such as smoking that are known to cause stroke. For African Americans, stroke and heart disease contribute more to the relative loss of life expectancy than any other condition.

Figure 32. Age-adjusted* stroke death rates by gender and race/ethnicity and Healthy People 2010 Goal, Colorado residents, 1996–2000



*Age-adjusted to the 2000 U.S. standard population.

While disease and lifestyle factors can be modified, non-modifiable risk factors for stroke include age, gender, and race/ethnicity. As discussed in Section 6, effective risk modification strategies for racial and ethnic groups need to consider chronic environmental stressors, social inequalities, and cultural differences.

It would be useful to review hospital discharge information by race, but it was not possible to do so for this report. Nearly 30 percent of hospital discharges from 1999–2001 were not coded for race.

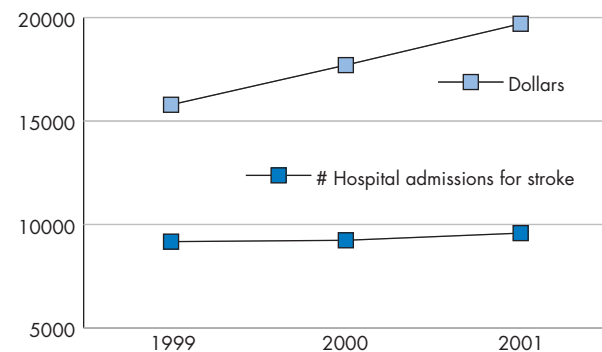
When **Guffie Menogan** retired, he was the highest ranking African-American manager for the United States Postal Service in Denver. He is a Deacon at St. Ignatius Church, and he is a stroke survivor. Stroke has ravaged Guffie Menogan's family. No one needs to tell him that African Americans have a risk up to five times greater than whites. He has lived it. His mother and his mother's sister both had strokes and died from the complications. Menogan's older brother died of a stroke in 2001. And 20 years ago, when Menogan was in seemingly perfect health, a stroke forever altered his life.

Now 72, he hopes that a more tolerant society and equitable research can finally improve the health of African Americans. Physically, he still bears some of the damage from his massive stroke. He walks with a limp and a cane. But he continues to push himself to get enough exercise. He didn't have any of the normal risk factors. "People have asked me if being black caused it," Menogan said. He suspects that the stresses of life as a black man wore him down over time. He had to fight to get into one of Colorado's best high schools in Denver. Counselors wanted to send him to the "black" school where he could learn to be a manual laborer. Once at the "white" school, he learned advanced math and science and, in 1948, graduated seventh in a class of 700. He then won a scholarship to the Colorado School of Mines. He constantly lived with racial slurs. Some whites didn't know what to make of an eloquent, well-educated, civic-minded black man, he emphasized.

Menogan can't say for certain that these stresses in his life added up to a stroke. But he has six children and 13 grandchildren depending on some solid answers about why the risk for African Americans is so much higher. Menogan believes his faith saved him. He thinks if people are all kinder to one another, regardless of race, everyone will live better, healthier lives.

The Cost of Stroke in Colorado: The number of hospitalizations for stroke as a primary diagnosis increased by 4.5 percent between 1999 and 2001 in Colorado. Over this same time period, length of hospital stays for stroke decreased by 3.5 percent from 5.93 to 5.73 days, while payments to hospitals for stroke treatment increased an average of 12 percent per year from \$15,786 to \$19,701. These figures compare to a national per-stroke hospital cost of \$19,956 in 2002, estimated by the Agency for Healthcare Research and Quality. Assuming the average yearly hospital payments for stroke care in Colorado continued to increase in 2002, it appears the average cost of hospitalization for stroke in Colorado is above the national average.

Figure 33. Number of hospital admissions with stroke as a primary diagnosis and payment per hospital admission

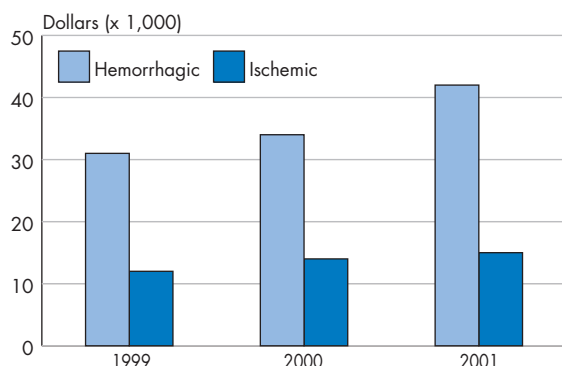


Data from the Colorado Health and Hospital Association. Payments not adjusted for inflation.

Total payments to Colorado hospitals for ischemic and hemorrhagic stroke primary diagnosis averaged \$165,673,491 a year between 1999 and 2001. More than half or 56 percent of this payment was from Medicare, Medicaid, and other government sources (Figure 35). Medicaid payments for stroke care in Colorado from 1998 to 2001 averaged \$47,511,251 per year. Colorado and the federal government share the costs of Medicaid. These figures significantly underestimate the true economic cost of stroke, however, as they do not reflect the total costs of emergency transport, doctors' fees, medications, rehabilitation, lost work, lost wages, and long-term care.

The analysis of data from skilled nursing facilities revealed another aspect of the complete cost of stroke, namely disability and dependence. Intake information from nursing care facilities provided to the Health Facilities Division of the Colorado

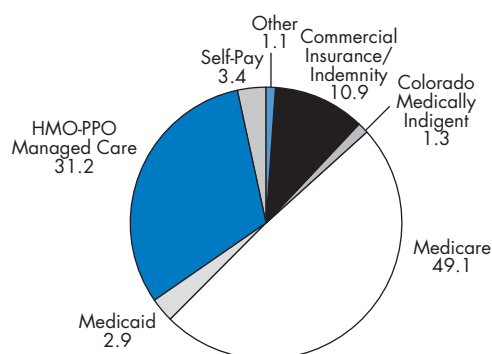
Figure 34. Average payment for hospitalizations with a primary diagnosis of stroke by type of stroke



Data from the Colorado Health and Hospital Association. Payments not adjusted for inflation.

Department of Public Health and Environment identified 5,989 stroke patients admitted over three years from February 2000 to February 2003. These records revealed approximately two-thirds of the stroke patients were not considered to have potential for discharge within 90 days. For patients over 65, Medicare coverage is limited to the first 90 days of health care including hospitalization. The patients, families, and Medicaid bear the burden for the additional cost after the 90-day Medicare reimbursement.

Figure 35. Percentage of stroke-related hospital costs paid by each type of payor based on average yearly payments of \$165.7 million, Colorado 1999–2001



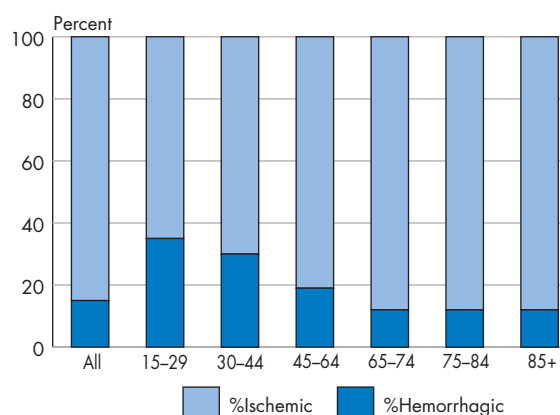
Payors < 1% included: Other liability/No fault insurance; Workmen's Comp.; CHAMPUS; and Other government funds.

Data from the Colorado Health and Hospital Association.

Differences between hemorrhagic and ischemic strokes:

As shown in Figure 36, for the years 1999–2001, ischemic strokes represented 85 percent of the total number of strokes; hemorrhagic strokes accounted for 15 percent. Younger patients had proportionately more hemorrhagic strokes than did older patients. Hospital payments were 2.4 times greater for hemorrhagic stroke than for ischemic stroke. The average length of hospital stay was 7.5 days for hemorrhagic stroke versus 4.15 days for ischemic stroke.

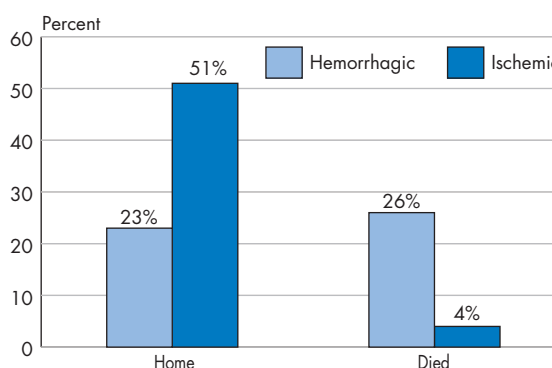
Figure 36. Proportion of stroke hospitalizations due to hemorrhagic vs. ischemic stroke by age, Colorado residents, 1999–2001



Data from the Colorado Health and Hospital Association.

The type of stroke experienced greatly affects the discharge outcome of the hospitalized patients. Patients with ischemic stroke were 2.2 times more likely to be discharged to home, 51 versus 23 percent, while patients with hemorrhagic stroke were 6.5 times more likely to die in the hospital, 26 versus 4 percent (Figure 37).

Figure 37. Percent of stroke-related hospital admissions resulting in the patient going home or dying, ischemic vs. hemorrhagic stroke, Colorado residents, 1999–2001



Data from the Colorado Health and Hospital Association.

Use of r-tPA in Colorado: After the drug r-tPA was approved for use in 1996, the Colorado Acute Stroke Network sought to determine whether physicians in Colorado could match the favorable results of treatment that were reported in the pivotal study from the National Institutes of Neurologic Disorders and Stroke. Data from the Colorado Acute Stroke Network suggested that Colorado patients with acute ischemic stroke, treated in a variety of settings, had outcomes similar to the national trial. The full report of the Colorado Acute Stroke Network may be found at: www.cdphe.state.co.us/pp/cvd/stroke.html.

Since funding for the Colorado Acute Stroke Network expired, there has not been an ongoing effort to monitor the outcomes of r-tPA use for ischemic stroke in Colorado. The Stroke Advisory Board sought to gain some insight by matching codes for r-tPA use from the Current Procedural Terminology manual with hospital discharge diagnoses for stroke. For each of the years 1999–2001, the use of r-tPA was similar. Patients with a primary diagnosis of stroke appeared to receive r-tPA only 1.1 percent of the time, an average of 88 patients treated each year. The national rate for r-tPA usage is three percent.

Complications of Stroke in Colorado: Two of the most common complications for stroke are aspiration pneumonia and urinary tract infections. Aspiration pneumonia begins with the inability of many stroke patients to swallow correctly. This leads to saliva, food, and liquids entering the lungs instead of the stomach and causing aspiration pneumonia. Many stroke patients are incontinent and may require catheterization to eliminate urine. Prolonged use of these catheters can lead to urinary tract infections.

These and other complications can be minimized through the use of clinical pathways (see Section 6, page 32) or standing orders. Clinical pathways/standing orders are preprinted guidelines for healthcare personnel to follow for every patient with a stroke diagnosis. Clinical pathways/standing orders help facilitate early evaluations by a speech pathologist to identify patients having difficulty swallowing. They also provide written criteria for early removal of catheters to avoid urinary tract infections. However, many hospitals in Colorado do not use clinical pathways (see hospital survey responses in Section 6).

Stroke complications in Colorado were not reviewed for this report, but may warrant further investigation.

— A SURVIVOR'S STORY —

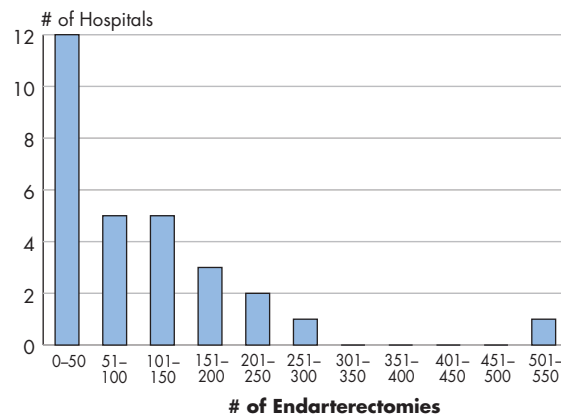
Former Colorado State Representative **Bill Hybl** is indeed a lucky man who truly understands how lucky he is. In fact, in September 1988 while Hybl was in South Korea with the U.S. Olympic team, his doctor said that he was one of the luckiest men he ever knew. That's because Hybl suffered a brain aneurysm or hemorrhagic stroke, where a blood vessel burst in his brain, just a day before opening ceremonies at the 1988 Olympic games. A hemorrhagic stroke is the most deadly form of stroke. Hybl and his wife had just come in the front door of their team headquarters hotel after returning from a shopping spree on the streets of Seoul when he was knocked to the floor with a terrible migraine headache. Hybl now jokes about thinking that the headache must have been the result of too much shopping, but this headache was no laughing matter. Fortunately, the team doctor was called immediately and recognized that Hybl was having a stroke. Hybl was rushed to the hospital.

Bill Hybl is still around to tell the story. He has fully recovered. Because of his great fortune, Hybl now works with stroke survivors on a one-on-one basis. Hybl went on to become the president of the U.S. Olympic Committee in 1991. In 2001 he was appointed by President George W. Bush as United States Representative to the United Nations. Hybl is currently the El Pomar Foundation's chairman and chief executive officer.

Variation in Carotid Endarterectomy Among Hospitals: As noted in Section 4, surgical removal of plaque from the carotid arteries, or carotid endarterectomy, can be an effective means of preventing stroke. There is considerable variation among hospitals in the number of such surgeries performed. Among 29 hospitals reporting any endarterectomies from years 1999–2001, the average annual number of procedures ranged from 2.3 to 175.6. This variation in procedures appears too large to be explained by differences in local stroke

incidence or by hospital size. It may simply reflect referral patterns, or it may indicate varying criteria among health care providers for use of this procedure. Although it would have been interesting to compare patient outcomes for endarterectomy among hospitals with such a range of experience, this information was unavailable.

Figure 38. Number of endarterectomies performed at 29 Colorado hospitals, 1999–2001



Data from the Colorado Health and Hospital Association.

Summary:

- Colorado has 64 counties: 12 are urban, 29 are rural, and 23 are considered frontier.
- Eighty percent of Colorado residents are concentrated in 10 metropolitan counties on the east side of the Rocky Mountains known as the Front Range. The remaining 20 percent of the state's residents are scattered through the eastern plains, the mountains, and the Western Slope.
- At all ages above 44, the rate of hospitalizations for stroke is higher in men than in women. However, because women, on average, live longer than men, the total number of stroke deaths in women exceeds stroke deaths in men.
- As compared with whites in Colorado, African Americans had a 30 percent higher stroke death rate, while other ethnic populations had lower death rates.
- County maps are included showing hospital discharges for stroke and stroke deaths in Colorado. High rates of hospitalizations for both hemorrhagic and ischemic stroke are shown for the southeast corner of Colorado, the City and

County of Denver and Pueblo County. El Paso County shows high rates of stroke deaths and high rates of hospitalizations for ischemic strokes.

- Stroke is expensive. The number of primary stroke hospitalizations has increased by 4.5 percent from 1999–2001. Over the same period payments to hospitals per stroke increased by 11.6 percent each year, with costs rising from \$15,786 to \$19,701.
- Medicare, Medicaid, and other government sources made 56 percent of the hospital payments for stroke between 1999–2001.
- Overall Medicaid payments for stroke care in Colorado from 1999–2001 averaged \$47,511,251 per year. These figures do not include emergency transport, medications, lost work, and lost wages.
- Hemorrhagic strokes account for 15 percent of total strokes. They are 2.4 times more costly than ischemic strokes and impact a younger group of patients. Hemorrhagic strokes are 6.5 times more likely to result in death than ischemic strokes.
- The clot-busting drug r-tPA was used in only 1.1 percent of strokes in Colorado between 1999–2001. The national average for r-tPA use is three percent.

SECTION 6: A COLORADO PREVENTION AND TREATMENT NEEDS ASSESSMENT FOR STROKE

Overview: Included in this section are the findings of a statewide stroke prevention and treatment needs assessment (HB 1125, requirement c), and the evaluation of current available stroke treatments in Colorado (HB 1125, requirement a).

Method of Assessment: Elements of the health and medical system were surveyed in order to piece together a picture of stroke care in Colorado. The different systems surveyed included:

- Emergency medical service/prehospital transport agencies
- Hospital stroke treatment
- Community resources
- Health insurance providers

Below is a summary of the survey findings.

Emergency Medical Services: The overall response rate to the prehospital transport survey (Appendix D) was 55 of 218, a 25 percent return, despite follow-up online and by telephone. Due to the low response rate, it is difficult to analyze the full status of emergency transport related to prehospital stroke care. Therefore, much of this analysis resulted from discussions with staff from the Colorado Prehospital Care Program and the board representative from the State Emergency Medical and Trauma Services Advisory Council (SEMTAC).

Prehospital care in Colorado is delivered by local emergency medical services systems, composed of first responders and air and ground transport services. Each of the more than 200 transport services in Colorado is required to have a physician medical director, who delegates medical practice to trained emergency medical technicians through the use of protocols that determine how patients are treated and where they are transported.

Emergency medical technicians are trained to recognize the signs and symptoms of stroke and transient ischemic attacks. Patients who appear to be suffering from a stroke often have altered mental status. Colorado does not have a reporting system to clarify if indeed the altered mental status was due to a stroke or other medical conditions such as chemical changes of the body. Care is focused on supportive treatments, maintaining airways, supplying oxygen, delivering intravenous fluids, and moni-

toring heart function. Patients with signs and symptoms of stroke or altered mental status are transported to the closest emergency department, since designated stroke centers do not exist in Colorado.

The survey of transport services found that 82 percent or 45 of the respondents had a protocol specific for stroke or stroke-like symptoms. Stroke represented a very small number of the total patients transported by all services. There is currently no system in Colorado to track transport times for suspected stroke patients. Transport times are important to determine the appropriate treatment.

Emergency medical services providers began to use stroke scales in the mid 1990s as a tool to identify patients with stroke symptoms. The Cincinnati Prehospital Stroke Scale is notable in that it identifies a high percentage of acute stroke patients by assessing only three physical findings, including:

- Facial droop
- Arm drift
- Speech difficulties

Emergency personnel can evaluate the patient with the Cincinnati Prehospital Stroke Scale in less than one minute. Patients with one of these three findings—as a new event—have a 72 percent probability of an acute stroke. If all three symptoms are present, the probability of an acute stroke is more than 85 percent.²³

Figure 39. Cincinnati Prehospital Stroke Scale

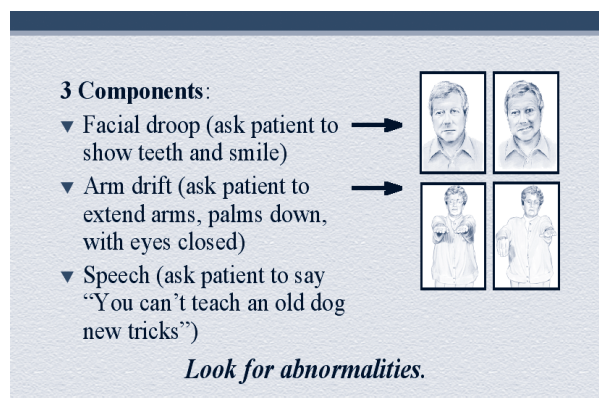


Image courtesy of the American Heart Association Advanced Cardiac Life Support Course

The prehospital use of a stroke scale or triage tool should be part of a comprehensive system of stroke care. These tools can help determine the appropriate transfer patterns for stroke centers. Outcomes for stroke patients would likely improve if facilities worked with medical directors of local emergency medical services systems and helped emergency personnel identify patients who should receive early care and transport to facilities staffed to provide stroke care. Air medical services should be considered to shorten transport time from rural and frontier communities to facilities offering emergency stroke treatment.

Patients with altered mental status have commonly been treated with glucose by emergency medical personnel while en route to the hospital. Some evidence indicates that indiscriminant use of glucose in stroke patients may be detrimental. Administering glucose to any patient with altered mental status with blood glucose within normal range is discouraged.²⁴ Prehospital providers should use a glucose monitor to determine if blood glucose levels are low before administering intravenous glucose. This low-cost glucose monitoring equipment is not widely found among transport companies.

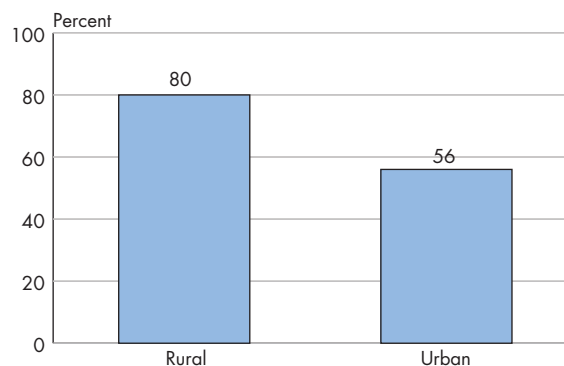
Colorado has unique challenges and opportunities in managing stroke, some of which cannot be changed such as geography, weather, and low population. The Stroke Advisory Board held lengthy discussions about Colorado's current trauma system and whether the mandate of "getting the right patient to the right facility in the shortest amount of time," should apply to the delivery of stroke treatment. (See comments on pages 36–37.) The introduction of clot-busting thrombolytic therapy has dramatically changed emergency stroke treatment, and herein lies the opportunity. The early recognition of stroke symptoms and rapid medical response, starting with transport services, is imperative.

Hospital Survey Response—Acute Treatment

Surveys were distributed to 58 hospitals throughout the state in March 2003 (Appendix E). Forty-five responses were received, a 78 percent return. Due to the large number of responses, it is believed hospital systems throughout the state are adequately represented in the analysis.

This information is separated as rural and urban, since the needs and barriers in these two locales are likely very different. Urban areas were defined as Fort Collins, Greeley, the Denver metropolitan area, Colorado Springs, Pueblo, and Grand Junction. Rural areas were defined as the remaining regions of the state.

Figure 40. Percent of hospitals responding to Colorado Stroke Advisory Board Survey, 2003

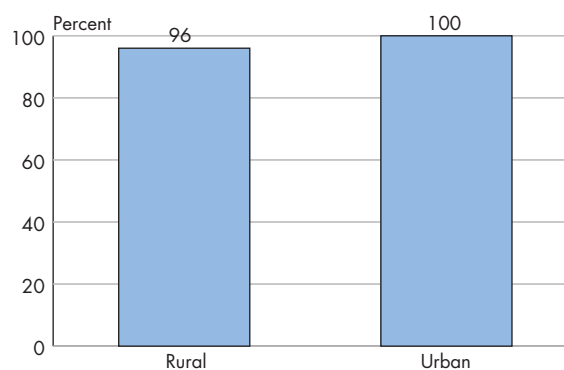


Stroke is a medical emergency requiring rapid responses in order to deliver optimal care. As mentioned in Section 4, clinical pathways/standing orders help facilitate and expedite the delivery of care. Computerized tomography (CT) scans are essential to determine if the stroke is ischemic or hemorrhagic. This is a critical factor in the decision-making process for using the drug r-tPA. Medical staff trained in stroke emergencies have proven most effective in patient management. Stroke is not only an acute event but often requires post-acute rehabilitation treatments. Established criteria for the next level of care helps facilitate the recovery process for stroke patients.

An analysis of the hospital surveys follows.

Stroke Viewed as a Medical Emergency: Ninety-six percent of rural hospitals and 100 percent of urban hospitals responding to the survey view stroke as a medical emergency. The narrow window of opportunity for administering acute treatment requires an urgent response from health care providers.

Figure 41. Percent of hospitals viewing stroke as a medical emergency

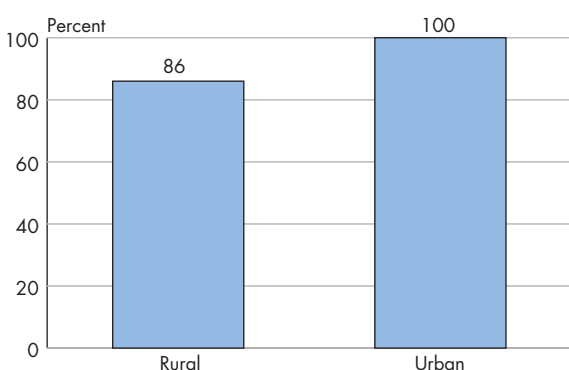


Source: Colorado Stroke Advisory Board Survey

Computed Tomography Scan Available 24 Hours/Seven Days a Week or on Call:

A computed tomography or CT scan is essential in determining the type of stroke the patient is experiencing. Based on the hospital surveys, a person entering a rural hospital has an 86 percent chance of being at a facility where a CT scan is available 24 hours/seven days a week. These survey results show that most rural hospitals have the technology available to quickly diagnose and treat acute ischemic strokes. In the urban setting, 100 percent of the responding hospitals indicated a CT scan is available 24 hours/seven days a week.

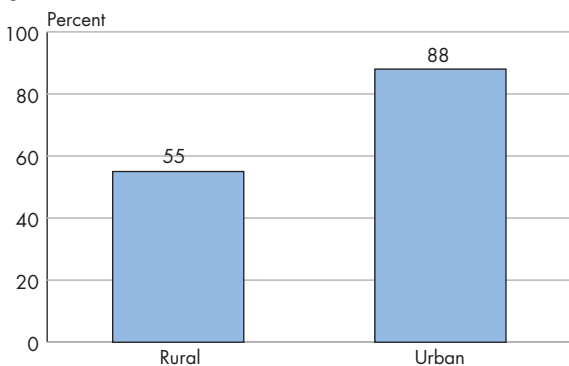
Figure 42. Percent of hospitals at which a CT scan is available 24/7 or on call



Source: Colorado Stroke Advisory Board Survey

Utilizes Clinical Pathways/Standing Orders: ^{25, 26, 37} Clinical pathways/standing orders facilitate the delivery of care. These guidelines were used in 55 percent of rural Colorado hospitals and in 88 percent of urban hospitals.

Figure 43. Percent of hospitals utilizing clinical pathways/standing orders

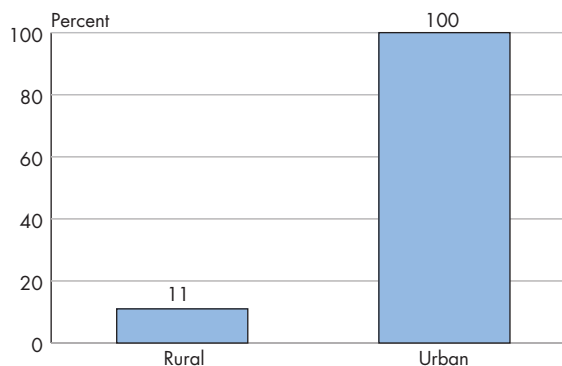


Source: Colorado Stroke Advisory Board Survey

Physicians Trained in Stroke Management: ⁴ Management decisions regarding treatment of acute stroke may require a high degree of clinical judgment. The decision of whether or not to give throm-

botolytic treatment for an acute stroke is especially challenging. Hospitals were asked whether physicians trained in stroke management were available 24 hours/7 days a week. Only 11 percent of rural hospitals reported that such on-call expertise was available. Eighty-seven percent reported such expertise was available when patients are transferred to another facility. All urban hospitals were able to provide on-call expertise. This presents an opportunity for continuing medical education in the rural settings. Health care providers in these areas often experience difficulty in obtaining this education due to staffing shortages, travel time, and distances.

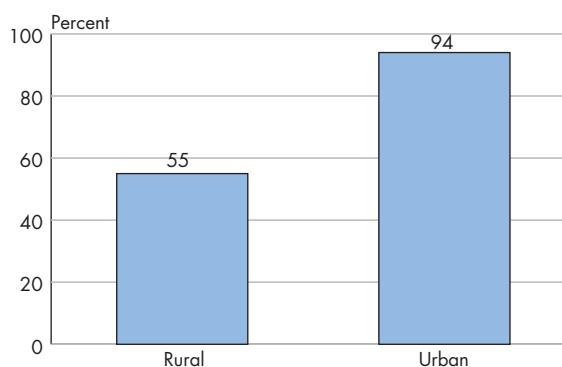
Figure 44. Percent of hospitals with a physician trained in stroke management available in-house or on call 24/7



Source: Colorado Stroke Advisory Board Survey

Clinical Pathways/Standing Orders in Emergency Departments to Include Use of r-tPA: ^{4, 28} Among hospitals with clinical pathways/standing orders, 94 percent of urban hospitals and 55 percent of rural hospitals have clinical pathways/standing orders specific to administration of r-tPA.

Figure 45. Percent of hospitals with orders in emergency room to include use of r-tPA



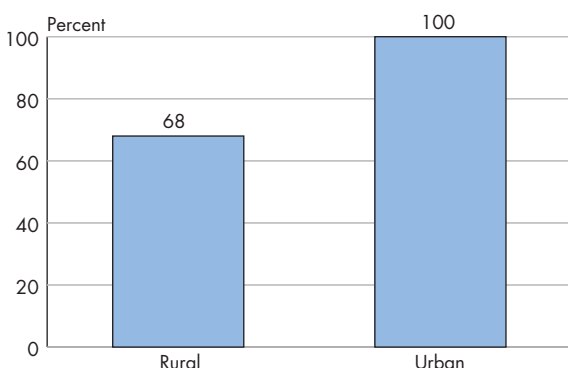
Source: Colorado Stroke Advisory Board Survey

Staff Skilled in Intensive Care Unit Care for Stroke Patients:

^{4, 5, 6} The acute management of a hemorrhagic stroke patient as well as management of a patient who has received r-tPA entails an intensive observation unit or an intensive care unit (ICU) where the staff is specially trained in their care. Studies have shown an overall improved patient outcome when specially trained staff manage their care.

Sixty-eight percent of rural hospitals responded that they have staff in the ICU with skills to care for stroke patients. Twenty-eight percent of rural hospitals responded that skilled care is available when patients are transferred to another facility. All the urban hospitals responded that they have skilled staff in the ICU to care for stroke patients.

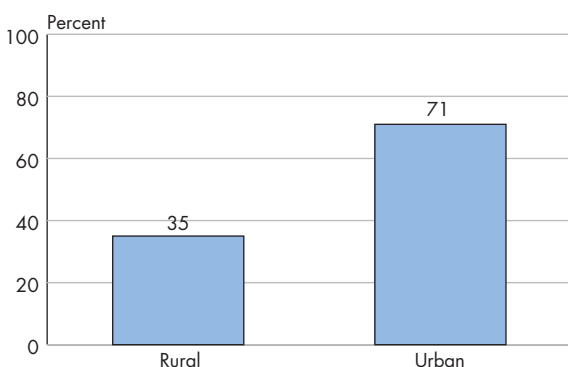
Figure 46. Percent of hospitals with staff skilled in ICU care for stroke patients



Source: Colorado Stroke Advisory Board Survey

Written Criteria for the Next Level of Care: Written criteria are helpful in determining the appropriate post-discharge referral to meet the needs of individual patients. Seventy-one percent of urban hospitals and 35 percent of rural hospitals had written criteria for the next level of care.

Figure 47. Percent of hospitals with criteria for next level of care



Source: Colorado Stroke Advisory Board Survey

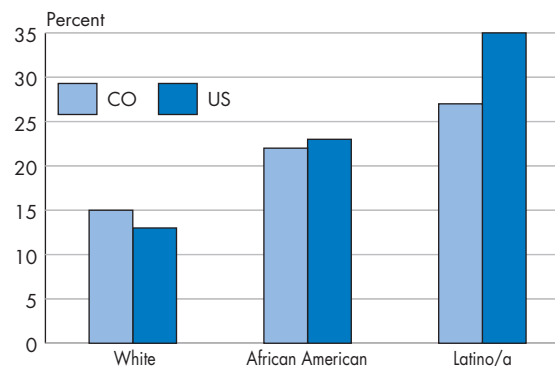
Community Resources: ^{29, 30} A phone survey was conducted with county health departments and county public health nursing services to assess the availability of educational resources on stroke. The information was separated by urban and rural counties.

Nineteen percent of the calls to rural public health agencies resulted in no response despite messages left with answering machines and services. Eighty percent stated positively that information on stroke is obtainable either through nurses available to answer questions, or through brochures or stroke screenings available upon request. Five percent of the rural respondents referred the caller to the American Heart Association for information and did not have information to mail out. The remaining 14 percent had no forms of outreach or information, nor were referrals made to other agencies.

Forty-five percent of the urban respondents provided nurses available to answer questions on stroke, distributed brochures, or provided stroke screening upon request. Twenty-two percent referred to the American Heart Association for information, and 33 percent did not have outreach programs related to stroke or any information on stroke.

Health Insurers: ^{31, 32} Many stroke survivors will suffer a recurrent stroke. Recurrent strokes often result in a higher rate of disability and death than the initial stroke. Strategies for preventing a recurrent stroke differ, depending on what is understood about the cause of the first stroke and the patient's risk factor profile. Whether or not stroke risks are identified and treated is often contingent upon components of health insurance plans.

Figure 48. Percent of non-elderly population without health insurance by race/ethnicity, Colorado vs. U.S., 1997–1999



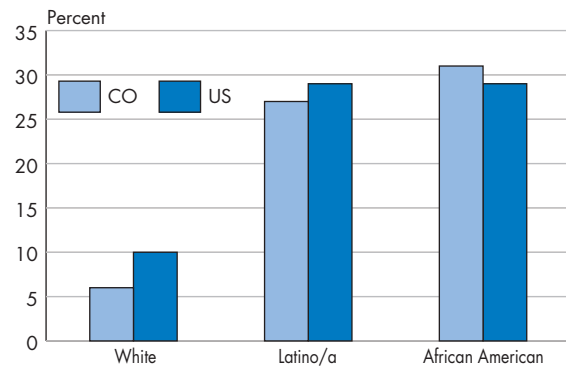
Source: Urban Institute and Kaiser Commission on Medicaid and the Uninsured estimates based on pooled March 2000 and 2001 Current Population Surveys.

The goal of the insurers' survey (Appendix F) was to assess how the high-risk stroke population is identified. Efforts were made to contact six of the major health insurance providers in Colorado. Contact was made with the quality assurance managers of four of the six major carriers. The findings revealed a great deal of variability among health care plans, and confirmed the need to develop disease management programs to recognize and treat enrollees at risk for stroke and recurring strokes.

Only one health insurance provider offered a comprehensive model for identifying high-risk cardiovascular disease patients and minimizing risk factors. The "model" provider also had systems in place for quality management of physician practices. The provider established hypertension clinics with ongoing follow-up. Member compliance with this provider's plan appears to be high due to incentives offered for ongoing follow-up.³³

Health insurance plans are largely a feature of employment and employees' benefit packages. Unemployed and underemployed persons in minimum wage settings are often without health insurance and have minimal access to disease prevention messages and interventions. Outreach efforts

Figure 49. Percent of population living below poverty level by race/ethnicity, Colorado vs. U.S., 1999–2000, family of 3 earning <\$13,853



Source: Urban Institute and Kaiser Commission on Medicaid and the Uninsured estimates based on pooled March 2000 and 2001 Current Population Surveys.

through county health agencies, rural health clinics, schools, and places of worship can help get the message about stroke prevention and warning signs to uninsured and non-English speaking households.

— A SURVIVOR'S STORY —

Ron Sager, 64, found it very hard to get up one Saturday morning in June 2001. The former Navy hospital corpsman ignored the initial warnings from his body. He was preparing for work and was unable to hold a can of shaving cream in his right hand. He then noticed he was dragging his right leg behind him. By mid-morning, his speech was slurred and his entire right leg was numb. "I was in denial," he said. Instead of seeking medical attention, he remained at home. On the following day, things became worse. He could hardly talk, and his mouth had started to droop. Still with these apparent signs, Ron waited to call his physician until the following day (two days after the initial symptoms). The physician recognized the symptoms as a stroke and advised Ron to get to the nearest hospital immediately. Ron then spent 12 days in an urban area hospital.

Ron's stroke was severe enough that the recommendation was made for him to go to a nursing home. Ron declined and arranged to stay at a friend's house while recuperating. The only information given to him at the time of discharge was a list of transportation options for the disabled.

Ron struggled with his rehabilitation in an outpatient setting, working hard to recover his strength and functions.

Ron believes hospitals should educate their staff about post-stroke treatment and follow-up. He also believes information should be given to all stroke patients and their families about services available after discharge. Ron says, in talking to other survivors, the need for information is a common frustration. "The average person and caregiver do not know what is available or how to find out. Many are scared stiff about the stroke, feel demoralized, and don't even try rehab," he said. Ron believes if it hadn't been for the personal interest of a staff physical therapist, he would not have been made aware of an excellent outpatient rehabilitation program.

Ron recovered and has returned to his job as a field representative with the U.S. Census Bureau where he conducts interviews about health issues. In that role, and especially since his stroke, he makes an effort to enlighten the public about the warning signs of stroke.

Summary

- A needs assessment was conducted with emergency medical services/prehospital transport agencies, hospitals, community resources, and health insurance providers.
- Training of emergency medical technicians includes the signs and symptoms of stroke.
- Patients with signs and symptoms of stroke are transported to the closest emergency department, since designated stroke centers do not exist in Colorado.
- Colorado currently has no system to track transport times for suspected stroke patients.
- Computerized tomography (CT) scans are essential in determining whether a stroke is ischemic or hemorrhagic. This is critical in determining the appropriate use of the drug r-tPA which can improve patient outcomes.
- A CT scan is available 24 hours a day, seven days a week in 100 percent of urban hospitals and 88 percent of rural hospitals.
- Stroke is viewed as a medical emergency in 100 percent of urban hospitals and 96 percent of rural hospitals.
- Clinical pathways/standing orders facilitate efficient, standardized acute stroke treatment. These protocols are used in 88 percent of urban hospitals and 55 percent of rural hospitals.
- Among hospitals with clinical pathways/standing orders, 94 percent of urban hospitals and 55 percent of rural hospitals have protocols specific to administration of r-tPA.
- Studies show an improved overall outcome when specially trained staff manage stroke patients. One hundred percent of urban hospitals and 68 percent of rural hospitals report having skilled staff to care for stroke patients.
- Of 48 local health departments and county public health nursing services contacted, 21 or 44 percent didn't have staff available to answer stroke questions. County nursing services offered more information than local health departments.
- A survey of four major health insurance providers revealed only one has a model for identifying patients at risk for stroke. There appears to be a significant need to develop disease management programs to recognize and treat enrollees at risk for stroke and recurring stroke.

SECTION 7: BARRIERS TO BETTER MANAGEMENT OF STROKE CARE

Overview: This section highlights barriers to better stroke care in Colorado and evaluates potential strategies for implementing stroke therapies, including a stroke center system (HB 1125, requirement b).

Societal Barriers: Public lack of knowledge about stroke is a major barrier. Figure 50 shows examples of this in data from polls conducted by the National Stroke Association between 1996 and 2002. In Colorado, the 2001 Behavioral Risk Factor Surveillance Survey included a series of questions about stroke symptom awareness. Thirty percent of respondents answered all six questions correctly.

Although more than 75 percent of Americans see their doctors regularly, only one-third of patients in a recent National Stroke Association survey responded that they had discussed stroke with their doctors.

Figure 50. Stroke Awareness Facts, National Stroke Association

- In a 1996 Gallup poll, 38 percent of people over 50 did not know that a stroke is something that occurs in the brain.
- Stroke kills twice as many women as breast cancer, yet more than 50 percent of American women don't know this fact.
- One in five adults say they have no idea how to reduce stroke risk.
- Two-thirds were unaware of the three-hour window of time when the best possible drug treatment for stroke can be administered.
- Many Americans still believe that stroke is untreatable or that the symptoms are not serious enough for emergency attention.
- Only 40 percent of the respondents said they would call 911 immediately if they were having a stroke.
- It currently takes the average American 12–24 hours to seek treatment after the onset of the first stroke symptom.

Lack of Awareness and Responsiveness: Effective stroke treatment requires a strong medical system that includes prompt responses and good clinical judgments. The American Heart Association has promoted the concept of the “chain of survival” to stress the need for interlinked components of care to function as one. The chain begins with the stroke patient and other individuals who may be nearby. Additional links in the “chain of survival” include emergency medical services personnel, hospital emergency staff, radiologists,

laboratory specialists, neurologists, and others. Each of these groups of people must have a high level of awareness and responsiveness regarding acute stroke in order to deliver thrombolytic clot-busting therapy in a timely manner. Unfortunately, delay in treatment is common, even after patients arrive in the hospital.

Lack of Reimbursement for Acute Stroke Care:

Because the risk of stroke is strongly age-related, most patients with stroke have Medicare coverage. Medicare reimbursement to physicians for acute stroke care was set long before the discovery that thrombolytic clot-busting therapy was effective. The new era of thrombolytic treatment for stroke poses a more urgent and demanding challenge for doctors, but reimbursement for acute stroke care has remained flat. This outdated reimbursement has been a disincentive to modernizing stroke care in Colorado and elsewhere, particularly when coupled with medical-legal issues.

Medical-Legal Issues: Thrombolytic therapy as a treatment for acute stroke is a two-edged sword. It can be of great benefit, but it can also cause great harm. Calculating the risk/benefit ratio in an individual patient can be difficult and requires a high degree of clinical judgment. No objective measures are available that reliably predict which patients will respond favorably and which will not. Physicians often complain that making decisions about thrombolytic therapy for stroke places them in the position to be blamed for a bad outcome whether or not they recommend the treatment. This decreases their enthusiasm for being involved with thrombolytic treatment at all. This factor may be most important in rural areas, where fewer stroke patients limit physician experience. Limited experience, in turn, leads to less confident decision-making and increased anxiety about this treatment.

Lack of an Organized System of Care: Rapid, effective stroke treatment requires a high degree of integration between prehospital and hospital services, similar to that found in the state trauma system. Such integration is lacking for stroke care. Emergency medical services personnel express frustration about getting stroke patients to hospitals quickly, only to have them sit untreated in the emergency room.

— A SURVIVOR'S STORY —

Mrs. **Betty Mead**, 71, was home in Rifle, Colorado, watching TV about 4 P.M. on the Friday before Memorial Day weekend in 1996. Her husband Loren noticed her speech was rambling and that she was behaving strangely. Loren called his son who drove them to the hospital emergency room 30 miles away from their home in rural Colorado. The emergency room physician immediately recognized the symptoms as a stroke and whisked Betty into the CT scanner for a confirming diagnosis. The emergency room physician consulted with a neurologist in Aspen who felt that this stroke was really severe. They concurred that Betty needed r-tPA to reverse the effects of this potentially devastating and life-threatening stroke. Loren was afraid and declined the treatment for his wife. The physician learned that the Mead's daughter in Denver was a physician and contacted her regarding her mother's prognosis. At this point, only ten minutes remained of the critical three-hour window of time when it was safe to give the treatment. Betty's daughter did not hesitate. She immediately responded, "Do it." The doctor administered r-tPA. Betty was comatose for five days in intensive care, but the r-tPA saved her life. After months of speech and occupational therapy, she became functional again.

She continues to recover but has some right-sided weakness and some difficulty with speech. Betty was more fortunate than her father who died of a stroke at age 40, and even more fortunate that she entered a rural hospital that acted quickly and through tele-medicine consultation was able to offer treatment for her life-threatening condition.

Ambulances and first responders in rural Colorado are often staffed by volunteers and associated with small fire districts. These organizations and their local hospital emergency rooms may not have a process for communicating about treatment protocols.

Hospital departments often function independently and may lack coordination. Acute stroke requires a rapid response from integrated systems including professional assessment and care, diagnostic imaging and laboratory testing, administration of medication, and occasionally surgical

intervention. Integrating these disciplines requires systems of care within hospitals that cross departmental lines. It seems unlikely that this will be done except in formal stroke centers. At present, however, there is no consensus in Colorado as to what constitutes a stroke center.

A strong argument can be made that stroke closely resembles trauma in the demands it makes on the medical system. An urgent, coordinated response is essential. Moreover, concentrating expertise in designated centers of excellence has considerable appeal, as greater experience will likely lead to better outcomes. However, the prospect of a state-sanctioned stroke center system, akin to the existing trauma system, may not be feasible at this time.

Stroke centers will be designated and certified by non-state agencies. The American Stroke Association and Joint Commission on Accreditation of Healthcare Organizations are working toward this end. Members of the Colorado Stroke Advisory Board believe this type of designation and certification process may improve stroke care in Colorado, but may be less effective in coordinating emergency medical services responses and monitoring overall system outcomes than a state-sanctioned system would be.

Lack of a Database to Evaluate Risk and Benefit: Currently, there is no system-wide feedback mechanism for quality improvement in decision-making for acute stroke treatment. Most doctors and most hospital authorities form impressions of the value and risk of thrombolysis based on treating small numbers of patients. Small numbers can lead to false impressions that may exaggerate either risk or benefit. Ideally, information about the successes and failures of clot-busting thrombolytic therapy in Colorado should be shared at the state level. Such information could guide physicians in strategies to better coordinate care in the evaluation and treatment of acute stroke.

The lack of information on outcomes for acute stroke treatment has been recognized at the national level. The Centers for Disease Control and Prevention is currently funding pilot projects for state level stroke registries in eight states. In addition, the proposed stroke center designation process mentioned above will entail data collection on individual cases starting from symptom onset to follow-up at 90 days post hospitalization. These data would not necessarily be reported to the state unless some form of stroke registry exists or is created.

HIPAA: Creation of an acute stroke treatment database in Colorado will require dealing with the federal Healthcare Information Portability and Accountability Act (HIPAA) which provides stronger protection of an individual's privacy with regard to medical information. A consequence of this legislation has been to make some routine activities more difficult, such as data gathering for clinical research or data-sharing for quality assessment. Data-sharing among a range of providers is now difficult. In fact, the data gathering activities of the Stroke Advisory Board were facilitated because HIPAA did not go into effect until after the board's data requests were submitted. Future attempts to improve health care by a range of providers may encounter more challenges due to the HIPAA regulations.

Rural Issues: Many Coloradans live in rural areas, remote from hospitals capable of effective acute stroke evaluation and treatment. Providing such services in remote areas of the state will require infrastructure improvements for items such as transport, including air transport, and telemedicine. Telemedicine techniques include video conferencing and transmitting CT scans by high-speed data line to off-site radiologists.

Additional "Gap" Issues: The recent emphasis on evidence-based medicine has highlighted areas where medical practices do not live up to potential. This has been referred to as a gap in medical care and was mentioned previously in the discussion of stroke prevention. Given a one percent treatment rate, Colorado does not appear to be living up to its potential regarding thrombolytic treatment.

Preventing complications of stroke in the hospital also may fall under this gap. The reasons for this gap are not fully understood. It may be due in part to the lack of a systematic, coordinated approach. Clinical pathways/standing orders for stroke patient care are often unavailable in rural areas and may not be used with regularity in urban areas.

Issues related to health care costs and access to health care are also important in understanding the gap. According to the Healthy People 2010 document, "Uninsured people are less than half as likely as people with health insurance to have a primary care provider, to have received appropriate preventive care,...or to have had any recent medical visits. Lack of insurance also affects access to care for relatively serious medical conditions.

Evidence suggests that lack of insurance over an extended period significantly increases the risk of premature death and that death rates among hospitalized patients without health insurance are significantly higher than among patients with insurance." ³⁴

Data from the 2001 Behavioral Risk Factor Surveillance Survey shows 15 percent of Colorado adults lacking health insurance and nearly 38 percent of Hispanics without health insurance. According to the United States Census Bureau, the biggest increase in the uninsured is among households earning \$25,000 to \$49,000 a year and impacted by job loss.³⁵ Costs of medications such as blood thinners to prevent stroke and the price of an ambulance ride to treat stroke appropriately may be prohibitive for the uninsured and underinsured.

Barriers to Better Stroke Recovery and Rehabilitation: Barriers to improved stroke care also exist in rehabilitation. Most stroke survivors live with some degree of functional impairment. Of the four million stroke survivors in the United States, approximately one-third need help caring for themselves.

The scientific understanding of the mechanisms of stroke recovery is only just beginning. Recovery is likely, to a significant extent, due to "remodeling" of the nerve circuits within the brain. Rehabilitation is believed to expedite this remodeling of the brain to its potential full functioning.

The rate of recovery from stroke is greatest in the first several months, but recovery may continue for years. Medicare and some other insurance policies pay for only 90 days of treatment. Once the 90-day period has ended, families must bear the financial and emotional costs. For some, that means nursing home care. For others, it means home health care and continued rehabilitation.

For patients with some resources who are not eligible for Medicaid, the costs of prescription drugs can be prohibitive. Basic Medicare does not include coverage for medication. Non-adherence to prescribed drug therapies for conditions associated with stroke, such as high blood pressure or irregular heartbeat, can cause a recurrent stroke.

The emotional burden for the patient and the caregiver is impossible to quantify but hard to overstate. Depression and emotional distress may significantly impede continuing recovery from stroke, but the present system is not attuned to this issue.

Summary:

- Lack of knowledge about stroke is a barrier to rapid treatment and better stroke care. Thirty percent of Coloradans know the signs and symptoms of stroke. Seventy-five percent of Americans see their doctors regularly, though only one-third of patients discuss stroke with their doctors.
- Medicare reimbursement to physicians for acute stroke care was set long before the discovery that thrombolytic therapy (r-tPA) was effective. The new era of treatment for stroke poses a more urgent and demanding challenge for doctors, yet reimbursement for acute stroke care has remained flat. This is a disincentive for modernizing stroke care in Colorado.
- Physicians worry that making decisions about clot-busting thrombolytic therapy for stroke places them in a position to be blamed for a bad outcome whether or not they recommend the treatment. This has resulted in decreased enthusiasm for utilizing thrombolytic treatment. This is particularly true in rural areas where lower patient volume limits experience which, in turn, leads to less confident decision-making and increased anxiety about treatment.
- Integration between prehospital and hospital services such as is found in the trauma system is lacking for stroke care. Emergency medical services personnel are frustrated when they transport stroke patients to hospitals quickly, and the patients sit untreated for long periods in the emergency room.
- Information about the successes and failures of clot-busting thrombolytic therapy should be shared at the state level through some form of stroke registry to help physicians develop strategies to coordinate care in the evaluation and treatment of acute stroke.
- Many Coloradans live in rural areas, far from hospitals capable of providing effective stroke evaluation and treatment. Providing adequate services will require infrastructure improvements in transport and telemedicine.
- Gaps in medical care for stroke include the low usage of r-tPA, preventing in-hospital complications of stroke, costs of health care, and the high percentage of people without health insurance.
- Rehabilitation shows promise for expedited recovery from stroke. Families often must bear the financial costs of rehabilitation. The emotional costs to the patient and caregiver are hard to quantify.

— A SURVIVOR'S STORY —

Denver Rabbi Sandra Cohen is a vibrant 35-year-old mother and stroke survivor. When typing the weekly synagogue newsletter last year, she was suddenly overwhelmed by numbness, dizziness, and a crushing headache. The stroke hit without warning. Confused, crying uncontrollably, and slurring her words, the Rabbi managed to call her husband and then 911. She could only say over and over, "Something is really wrong." Because she responded to her stroke as an emergency, the Rabbi was one of the few survivors in this country treated with r-tPA. Now Cohen, who previously ran 50 miles per week and ate only kosher food, is working to regain her life. Her six-year-old daughter Shira says, "While mommy's having her stroke, daddy's being mommy this year." The stroke didn't just touch the Rabbi and her family but has had a devastating impact on her congregation.

Earlier this year, the Rabbi took a leave of absence from her rabbinical duties while she battles the periodic dizziness, balance problems, and physical and mental fatigue. Her congregation misses her terribly but respects her decision. Cohen continues to work on her recovery.

SECTION 8: RECOMMENDATIONS FOR IMPROVED STROKE CARE IN COLORADO

Overview: Recommendations for improving stroke prevention and treatment for Colorado (HB 1125, requirement a) are listed in this section. The focus is lessening the burden of stroke in Colorado and improving stroke care, especially emergency stroke care.

Strengths and Opportunities in the Colorado Fight Against Stroke: The strengths of Colorado in the fight against stroke are numerous. Relative to many other states, Colorado is fortunate in having an educated and active population. Colorado is well served by national organizations such as the National Stroke Association and the American Stroke Association. These organizations, along with public health officials in Colorado, are actively engaged in campaigns to improve public knowledge about stroke risk factors and stroke warning signs.

The opportunities for progress against stroke are great. We understand the cause. We have a treatment. We know the major risk factors. We can alter the risks, and by so doing we can decrease the occurrence of stroke. There are few major public health problems where the opportunity for progress is so great.

Overcoming Barriers: Despite these strengths and opportunities, stroke remains a major problem in Colorado, affecting thousands of lives and costing millions of dollars. Section 7 points to multiple barriers to improving stroke care. These barriers can generally be grouped into one of three categories: informational, societal–fiscal, and organizational.

Excellent, on-going educational programs from the National Stroke Association, the American Stroke Association, and the Colorado Cardiovascular Disease and Stroke Prevention Program are currently addressing informational barriers. Because infrastructure exists, it is unnecessary to duplicate efforts in a new state initiative. Rather, the state should encourage and continue to partner with the organizations conducting those programs.

Societal–fiscal barriers and organizational barriers are the types of obstacles for which state-level involvement could be most useful. As seen in comments throughout this report, improving stroke

care is largely a matter of organizing and coordinating resources that already exist. An effective system of care for acute stroke for Colorado will not develop from the effort of any single hospital or hospital system. It will of necessity be a network of systems working together. It will involve the general public, hospitals, emergency medical systems, physicians, and other medical professionals. It will need to collect and analyze data in order to evaluate its performance and to understand how that performance can be improved. It will need mechanisms for coordinating its components, making decisions, and implementing change. For all of these reasons, state-level involvement is desirable.

As mentioned in Section 7, independent stroke centers will likely develop within the next several years through the efforts of the American Stroke Association and the Joint Commission on Accreditation of Healthcare Organizations. This will likely improve stroke care in pockets of the state, but it will lack the statewide impact that state involvement could provide. In addition, the ability to share data and to make strategic decisions based on that data would be limited.

Currently available data sets were not designed with the aim of improving stroke care. They are insufficient to provide answers to a number of important questions about stroke care in Colorado. These questions include, but are not limited to, those in Figure 51. These questions and others need answers, if stroke care in Colorado is to be rationally improved. Providing these answers will involve system and policy changes, as well as collaboration among medical systems. The required degree of cooperation and collaboration will likely not occur without state-level encouragement.

Specific recommendations: With the above comments in mind, the following specific recommendations for improving stroke care in Colorado are offered.

Recommendation 1: The Stroke Advisory Board should be incorporated into the Colorado Cardiovascular Disease and Stroke Prevention Program, Colorado Department of Public Health and Environment.

Recommendation 2: Funding for the Board should include, but should not be limited to gifts, grants, and donations from any source.

Recommendation 3: With above organizational structure and funding sources, the Stroke Advisory Board's ongoing activities should include:

- Promoting system and policy changes to improve acute stroke care statewide to narrow the gap between evidence-based best practices and usual practice
- Evaluating new stroke treatments
- Exploring the feasibility of a coordinated system of stroke centers
- Establishing a state stroke registry, including treatments and outcomes, for the purpose of guiding recommendations to facilitate continuous quality improvement of stroke care in Colorado
- Promoting further research and analysis regarding the variability of stroke incidence and death among counties
- Improving access to affordable health care for stroke prevention and treatment
- Overseeing and developing recommendations 4–6, below

Recommendation 4: Colorado should encourage ongoing efforts of governmental and non-governmental organizations to improve stroke education, awareness, and responsiveness among the public. Areas of particular focus should include, but should not be limited to:

- Improving public awareness of stroke signs and symptoms
- Improving public awareness of signs and symptoms of stroke as a medical emergency
- Improving public awareness of and motivation to reduce stroke risk factors
- Improving outreach to stroke survivors, caretakers, and families, limited English and low literacy populations, and populations with the greatest burden of disease

Among other means, this may be done via:

- Public service announcements
- Educational materials
- Lectures
- Toll-free numbers
- Websites and software programs

Figure 51. Unanswered Questions Regarding Stroke in Colorado

What is the **true** incidence of stroke in Colorado?

What is the **actual** cost of stroke in Colorado?

How wisely and well is intravenous r-tPA used for stroke in Colorado?

- How quickly are patients coming in for treatment?
- Of those coming in within three hours, how many receive r-tPA?
- For those who receive r-tPA, what is their outcome?
- For those denied r-tPA, what is their outcome?

What is risk/benefit ratio in Colorado for newer stroke treatments, including:

- Intra-arterial thrombolysis
- Angioplasty and stenting
- Aneurysm coiling
- Embolization or radiation treatment of vascular malformations?

What explains the outliers in the current data regarding:

- Stroke incidence by county
- Stroke deaths by county
- Distribution of carotid endarterectomies performed?

-
- Multilingual outreach initiatives
 - Broadcast public service announcements, billboards
 - Stroke risk screening
 - Urban and rural outreach

This may be conducted in partnerships with:

- American Stroke Association/Operation Stroke
- National Stroke Association
- Centers for Disease Control and Prevention
- National Institute for Neurological Disorders and Stroke
- Local hospitals
- Insurance providers and health maintenance organizations
- Pharmaceutical companies

Recommendation 5: Colorado should encourage on-going efforts of governmental and non-governmental organizations to aid health care providers in developing effective stroke risk modification strategies for patients. This may include:

- Using stroke risk assessment tools such as the National Stroke Associations Risk Disk
- Developing protocols and guidelines for preventing strokes and recurring strokes, and for disease management
- Coordinating and promoting professional conferences, regional meetings, and other continuing education opportunities

Recommendation 6: Colorado should encourage hospital and prehospital health care providers to develop systems of care to facilitate effective, rapid, evidence-based protocols for acute stroke treatment, subacute stroke management, and stroke rehabilitation. Strategies to accomplish this may include:

- Support of clinical research in stroke
- Protocols and guidelines
- Clinical pathways/standing orders
- Stroke center certification via the Joint Commission on the Accreditation of Healthcare Organizations
- Expanding the responsibilities of the trauma system to include emergency transport of stroke cases to hospitals utilizing clinical pathways/standing orders for acute stroke treatment
- Mentoring or networking programs between and among hospitals
- Standards for data collection

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APPENDIX A—HOUSE BILL 1125

HOUSE BILL 02-1125

BY REPRESENTATIVE(S) Saliman, Boyd, Fairbank, Groff, Hoppe, Mace, Marshall, Plant, Romanoff, Sanchez, Stafford, Tochtrop, and Williams S.;

also SENATOR(S) Gordon, Epps, Hanna, Hernandez, Pascoe, and Phillips.



CONCERNING THE CREATION OF A COLORADO STROKE ADVISORY BOARD, AND MAKING
AN APPROPRIATION THEREFOR.

Be it enacted by the General Assembly of the State of Colorado:

SECTION 1. 24-75-1104, Colorado Revised Statutes, is amended BY THE ADDITION OF A NEW SUBSECTION to read:

24-75-1104. Use of settlement moneys - programs. (1.5) FOR THE FISCAL YEAR 2001-2002, THE STROKE PREVENTION AND TREATMENT CASH FUND SHALL RECEIVE AN APPROPRIATION AS SPECIFIED IN SECTION 25-1-108.5 (5), C.R.S.

SECTION 2. 25-1-108.5 (5), Colorado Revised Statutes, is amended to read:

25-1-108.5. Additional powers and duties of the state board of health and the department - programs that receive tobacco settlement moneys - monitoring - annual report. (5) The costs incurred by the department in implementing the requirements of this section shall be paid proportionately from the amounts annually appropriated to each tobacco settlement program; except that the amount of said costs shall not exceed four-tenths of one percent of the total amount of moneys received pursuant to the master settlement agreement in any fiscal year. FOR THE FISCAL YEAR 2001-2002, SEVENTY-FIVE THOUSAND NINE HUNDRED SEVENTY-EIGHT DOLLARS FROM THE MONEYS PAID TO THE DEPARTMENT FROM THE TOBACCO SETTLEMENT PROGRAMS PURSUANT TO THIS SECTION SHALL BE APPROPRIATED TO THE STROKE PREVENTION AND TREATMENT CASH FUND CREATED IN SECTION 25-32-105 FOR ALLOCATION TO THE STROKE ADVISORY BOARD CREATED IN SECTION 25-32-104 TO COVER THE COSTS OF SUCH BOARD'S DUTIES PURSUANT TO SUCH SECTION.

SECTION 3. Title 25, Colorado Revised Statutes, is amended BY THE ADDITION OF A NEW ARTICLE to read:

ARTICLE 32

Colorado Stroke Advisory Board

25-32-101. Short title. THIS ARTICLE SHALL BE KNOWN AND MAY BE CITED AS THE "COLORADO STROKE ADVISORY BOARD ACT".

25-32-102. Legislative declaration. THE GENERAL ASSEMBLY HEREBY FINDS, DETERMINES, AND DECLARES THAT STROKES ARE A LEADING CAUSE OF DEATH IN COLORADO AND THAT

CURRENTLY AVAILABLE TREATMENTS MAY REDUCE THE NUMBER OF DEATHS AND DISABILITIES CAUSED BY STROKES. THE GENERAL ASSEMBLY FURTHER FINDS THAT ESTABLISHMENT OF A STROKE ADVISORY BOARD WILL ENSURE THAT STATE-OF-THE-ART INFORMATION ON STROKE EDUCATION, PREVENTION, AND POTENTIAL TREATMENT IS AVAILABLE TO HEALTH CARE PROVIDERS AND PATIENTS. THE ADVISORY BOARD IS INTENDED TO SERVE AS A CONSENSUS GROUP DESIGNED TO COORDINATE EFFORTS IN STROKE TREATMENT AND PREVENTION, INCLUDING BRINGING ADDITIONAL MONEYS TO THE STATE TO FUND IMPROVEMENTS.

25-32-103. Definitions. AS USED IN THIS ARTICLE, UNLESS THE CONTEXT OTHERWISE REQUIRES:

(1) "ADVISORY BOARD" MEANS THE STROKE ADVISORY BOARD CREATED PURSUANT TO SECTION 25-32-104.

(2) "DEPARTMENT" MEANS THE DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT CREATED IN SECTION 25-1-102.

25-32-104. Stroke advisory board. (1) THE EXECUTIVE DIRECTOR OF THE DEPARTMENT SHALL APPOINT A STROKE ADVISORY BOARD TO EVALUATE POTENTIAL STRATEGIES FOR STROKE PREVENTION AND TREATMENT AND DEVELOP A STATEWIDE NEEDS ASSESSMENT OUTLINING RELEVANT RESOURCES.

(2) MEMBERS APPOINTED TO THE ADVISORY BOARD SHALL INCLUDE:

(a) FIVE PHYSICIANS ACTIVELY INVOLVED IN STROKE CARE, WITH ONE FROM EACH OF THE FOLLOWING FIELDS:

(I) PRIMARY CARE;

(II) NEUROLOGY;

(III) NEURORADIOLOGY;

(IV) NEUROSURGERY; AND

(V) EMERGENCY CARE;

(b) ONE REGISTERED PROFESSIONAL NURSE ACTIVELY INVOLVED IN STROKE CARE;

(c) ONE HOSPITAL ADMINISTRATOR WHO REPRESENTS AN URBAN HOSPITAL;

(d) ONE HOSPITAL ADMINISTRATOR WHO REPRESENTS A SMALL RURAL HOSPITAL;

(e) ONE REPRESENTATIVE FROM THE EMERGENCY MEDICAL SERVICES ADVISORY BOARD;

(f) ONE REPRESENTATIVE FROM THE PUBLIC HEALTH FIELD WHO IS ACTIVELY INVOLVED IN PUBLIC HEALTH EDUCATION REGARDING STROKES;

(g) ONE REPRESENTATIVE FROM A STROKE REHABILITATION FACILITY;

(h) ONE STROKE SURVIVOR OR CAREGIVER;

(i) ONE REPRESENTATIVE FROM AN ORGANIZATION REPRESENTING STROKE VICTIMS; AND

(j) ONE PHYSICAL THERAPIST OR OCCUPATIONAL THERAPIST ACTIVELY INVOLVED IN STROKE CARE.

(3) DUTIES OF THE ADVISORY BOARD MAY INCLUDE, BUT SHALL NOT BE LIMITED TO:

(a) EVALUATION OF CURRENT AVAILABLE STROKE TREATMENTS AND THE DEVELOPMENT OF RECOMMENDATIONS FOR COLORADO, BASED ON MEDICAL EVIDENCE, TO IMPROVE STROKE PREVENTION AND TREATMENT;

(b) EVALUATION OF POTENTIAL IMPLEMENTATION STRATEGIES FOR STROKE THERAPIES, INCLUDING A STROKE CENTER SYSTEM;

(c) COMPLETION OF A STATEWIDE COMPREHENSIVE STROKE PREVENTION AND TREATMENT NEEDS ASSESSMENT;

(d) DETERMINATION OF THE IMPACT THAT DELAYED OR INAPPROPRIATE TREATMENT HAS ON THE QUALITY OF PATIENTS' LIVES AND THE ASSOCIATED FINANCIAL COSTS TO SUCH PATIENTS AND THE STATE; AND

(e) STUDYING THE HEALTH AND ECONOMIC BENEFITS OF EARLY STROKE TREATMENT.

(4) THE ADVISORY BOARD SHALL REPORT ITS FINDINGS TO THE JOINT BUDGET COMMITTEE, THE HEALTH, ENVIRONMENT, WELFARE, AND INSTITUTIONS COMMITTEE OF THE HOUSE OF REPRESENTATIVES, AND TO THE HEALTH, ENVIRONMENT, CHILDREN, AND FAMILIES COMMITTEE OF THE SENATE ON OR BEFORE NOVEMBER 1, 2003.

25-32-105. Stroke prevention and treatment cash fund - creation. THERE IS HEREBY CREATED IN THE STATE TREASURY THE STROKE PREVENTION AND TREATMENT CASH FUND, REFERRED TO IN THIS SECTION AS THE "FUND". THE FUND SHALL CONSIST OF ANY MONEYS CREDITED THERETO PURSUANT TO GIFTS, GRANTS, AND DONATIONS FROM ANY SOURCE; ANY MONEYS FROM FEDERAL FINANCIAL PARTICIPATION; AND ANY MONEYS APPROPRIATED THERETO BY THE GENERAL ASSEMBLY. NO MONEYS SHALL BE APPROPRIATED FROM THE GENERAL FUND FOR PAYMENT OF ANY EXPENSES INCURRED UNDER THIS ARTICLE. ALL MONEYS CREDITED TO THE FUND AND ALL INTEREST AND INCOME EARNED ON THE MONEYS IN THE FUND SHALL REMAIN IN THE FUND FOR THE PURPOSES SET FORTH IN THIS ARTICLE. NO MONEYS CREDITED TO THE FUND SHALL BE TRANSFERRED TO OR REVERT TO THE GENERAL FUND OF THE STATE AT THE END OF ANY FISCAL YEAR.

25-32-106. Additional powers and duties of the department. (1) THE DEPARTMENT SHALL HAVE THE FOLLOWING POWERS AND DUTIES:

(a) TO ADOPT RULES AS NECESSARY FOR IMPLEMENTATION OF THIS ARTICLE;

(b) TO ACCEPT GIFTS, GRANTS, AND DONATIONS FROM ANY SOURCE AND TO DEPOSIT SAME INTO THE STROKE PREVENTION AND TREATMENT CASH FUND; AND

(c) TO ACCEPT AND EXPEND MONEYS IN THE STROKE PREVENTION AND TREATMENT CASH FUND FOR THE PURPOSES OF THIS ARTICLE.

25-32-107. Repeal. THIS ARTICLE IS REPEALED, EFFECTIVE JULY 1, 2004.

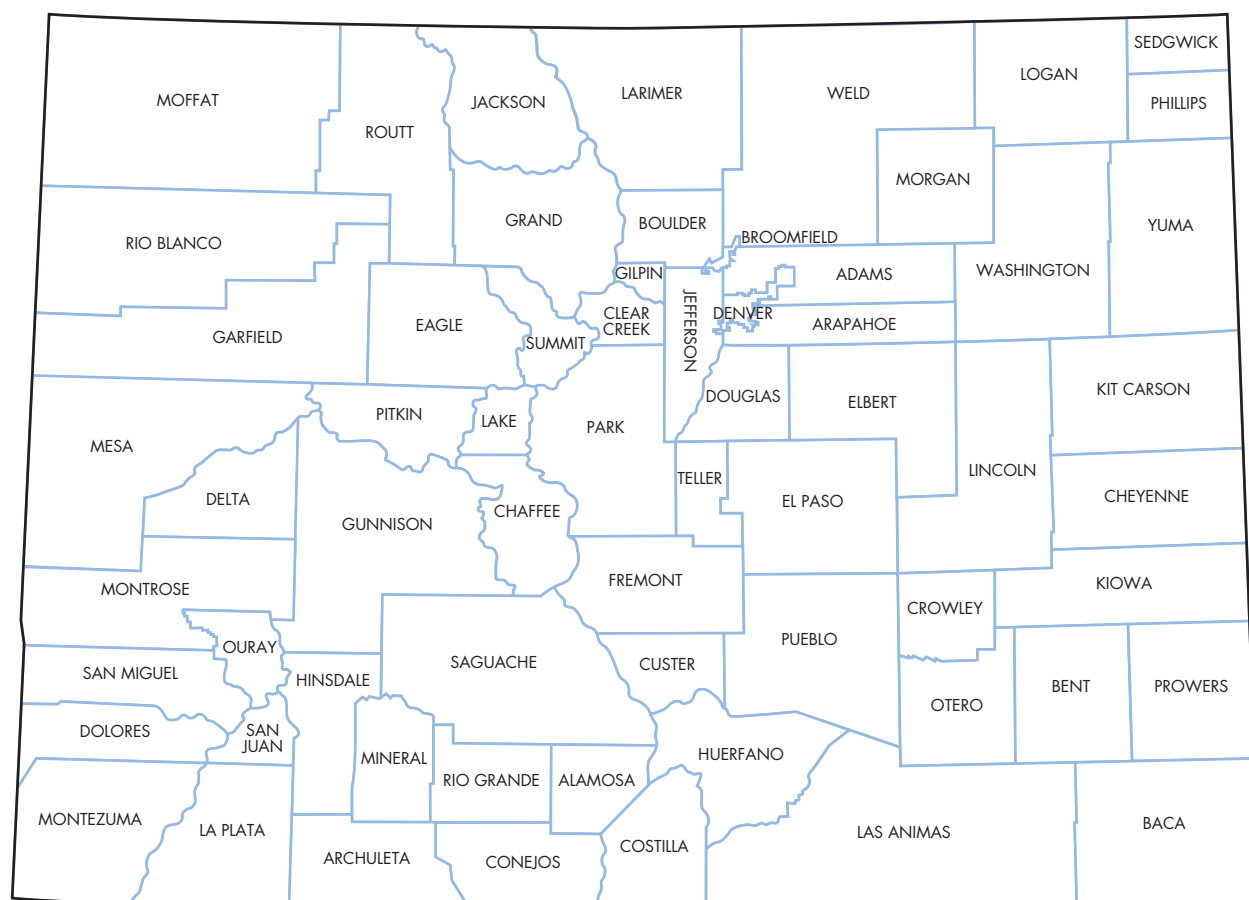
SECTION 4. Appropriation. In addition to any other appropriation, there is hereby appropriated, out of any moneys in the stroke center network cash fund created in section 25-32-105, Colorado Revised Statutes, not otherwise appropriated, to the department of public health and environment, for the fiscal year beginning July 1, 2002, the sum of thirty-nine thousand eight hundred fifty-seven dollars (\$39,857) and 0.5 FTE, or so much thereof as may be necessary, for the implementation of this act.

SECTION 5. Safety clause. The general assembly hereby finds, determines, and declares that this act is necessary for the immediate preservation of the public peace, health, and safety.

Approved: May 30, 2002

Capital letters indicate new material added to existing statutes; dashes through words indicate deletions from existing statutes and such material not part of act.

APPENDIX B—COLORADO MAP WITH 64 COUNTIES



APPENDIX C—CEREBROVASCULAR MORTALITY, 1999–2001, BY COUNTY

Cerebrovascular Mortality for 1999–2001 by County, Age Adjusted for 2000	Total Deaths	Total Population	Total Crude Death Rate	Cerebrovascular Diseases	Age-Adj. Rate	95% Lower Limit	95% Upper Limit
ADAMS	331	1,096,929	30.2	331	52.7	46.9	58.5
ALAMOSA	21	45,127	46.5	21	57.6	33	82.3
ARAPAHOE	500	1,473,892	33.9	500	50.2	45.8	54.7
ARCHULETA	10	30,146	33.2	10	41.2	14.2	68.2
BACA	12	13,550	88.6	12	46.3	19.9	72.7
BENT	8	17,827	44.9	8	35.6	11	60.1
BOULDER	316	874,363	36.1	316	57.3	50.9	63.6
CHAFFEE	18	48,748	36.9	18	†30.2	16.2	44.3
CHEYENNE	*	*	*	*	*	*	*
CLEAR CREEK	4	28,017	14.3	4	28.2	-1.9	58.3
CONEJOS	8	25,106	31.9	8	†29	9	49
COSTILLA	9	11,083	81.2	9	68.6	23.3	113.9
CROWLEY	3	15,955	18.8	3	†21.7	-2.9	46.2
CUSTER	*	*	*	*	*	*	*
DELTA	68	84,115	80.8	68	51.9	39.5	64.2
DENVER	837	1,660,758	50.4	837	54	50.4	57.7
DOLORES	6	5,507	109	6	86.4	17.7	155.1
DOUGLAS	88	543,395	16.2	88	66.6	51.8	81.4
EAGLE	10	125,433	8	10	†29.8	6.5	53.1
ELBERT	15	60,716	24.7	15	61.8	29.6	94
EL PASO	846	1,562,590	54.1	846	†86.8	81	92.7
FREMONT	105	138,717	75.7	105	65.2	52.7	77.6
GARFIELD	52	132,844	39.1	52	57.8	42	73.5
GILPIN	4	14,162	28.2	4	85.5	-10	180.9
GRAND	13	37,437	34.7	13	76.4	33.4	119.4
GUNNISON	7	41,715	16.8	7	37.9	9.9	65.9
HINSDALE	*	*	*	*	*	*	*
HUERFANO	11	23,547	46.7	11	34.7	14.2	55.3
JACKSON	*	*	*	*	*	*	*
JEFFERSON	611	1,579,843	38.7	611	52.3	48.1	56.4
KIOWA	*	*	*	*	*	*	*
KIT CARSON	9	23,919	37.6	9	†29	9.9	48

* fewer than 3 events

† significantly lower than the state average

‡ significantly higher than the state average

Source: Colorado Health Information Dataset (COHID)

Cerebrovascular Mortality for 1999–2001 by County, Age Adjusted for 2000	Total Deaths	Total Population	Total Crude Death Rate	Cerebrovascular Diseases	Age-Adj. Rate	95% Lower Limit	95% Upper Limit
LAKE	7	23,522	29.8	7	72.9	19.4	126.3
LA PLATA	38	132,480	28.7	38	†40.1	27.3	52.9
LARIMER	324	758,996	42.7	324	56.6	50.5	62.7
LAS ANIMAS	46	45,972	100.1	46	64.9	45.9	83.9
LINCOLN	15	18,300	82	15	67.8	33.3	102.4
LOGAN	43	63,001	68.3	43	60.1	42.1	78.1
MESA	227	351,544	64.6	227	54.9	47.8	62.1
MINERAL	*	*	*	*	*	*	*
MOFFAT	9	39,386	22.9	9	†31.4	10.8	52.1
MONTEZUMA	50	71,392	70	50	67.9	49.1	86.6
MONTROSE	63	101,008	62.4	63	51.1	38.5	63.7
MORGAN	51	81,830	62.3	51	56.6	41	72.2
OTERO	33	60,624	54.4	33	41.7	27.4	56
OURAY	3	11,279	26.6	3	30.3	-6.1	66.7
PARK	7	43,881	16	7	48.4	10	86.9
PHILLIPS	7	13,515	51.8	7	†23.7	5.8	41.6
PITKIN	6	44,999	13.3	6	39.2	5.5	72.8
PROWERS	20	43,051	46.5	20	44.5	25	64
PUEBLO	272	426,148	63.8	272	55	48.5	61.6
RIO BLANCO	8	18,064	44.3	8	50.5	15.5	85.6
RIO GRANDE	31	37,245	83.2	31	71.4	46.3	96.4
ROUTT	4	59,639	6.7	4	†19.1	0.5	37.8
SAGUACHE	6	17,814	33.7	6	43.6	8.6	78.7
SAN JUAN	*	*	*	*	*	*	*
SAN MIGUEL	*	*	*	*	*	*	*
SEDGWICK	7	8,186	85.5	7	51.4	10	92.7
SUMMIT	4	70,600	5.7	4	45.7	-5	96.4
TELLER	22	62,822	35	22	‡106.6	60.5	152.6
WASHINGTON	13	14,845	87.6	13	64.2	29.4	98.9
WELD	227	555,274	40.9	227	57.6	50.1	65.1
YUMA	20	29,578	67.6	20	49.8	27.8	71.9
Colorado	5,496	12,974,072	42.4	5,496	56.2	54.7	57.7

* fewer than 3 events

† significantly lower than the state average

‡ significantly higher than the state average

Source: Colorado Health Information Dataset (COHID)

APPENDIX D—PREHOSPITAL TRANSPORT SURVEY



Colorado Prehospital Stroke Survey

1. Is Enhanced 9-1-1 available in your service area?

☐ Yes ☐ No ☐ Don't know

2. Do callers to 9-1-1 in your service area receive prearrival instructions (emergency medical dispatch) when requesting emergency medical assistance?

☐ Yes ☐ No ☐ Don't know

3. Within your service area, how often can a medical helicopter respond and transport patients when requested?

- ☐ <25% of the time
☐ 25–50% of the time
☐ 50–75% of the time
☐ >75% of the time
☐ Other (please specify)

4. What percent of your staff is?

Full time: _____

Part time: _____

Volunteer: _____

5. What is your current staffing capability? (# and indicate full time, part time, and volunteer)

EMT—Basic _____

EMT—Intermediate _____

EMT—Paramedic _____

Nurse _____

6. How many patients did your service agency transport from prehospital settings to facilities in 2002?

7. In your service agency in year 2002, how many patients were transported from the field to a facility with stroke-like signs and symptoms?

8. In your service agency, estimate how many hours of continuing education deal with the recognition and management of stroke?

9. Does your agency have a medical protocol specific for cerebral vascular accident, stroke or TIA?

☐ Yes ☐ No ☐ Don't know

10. Do EMS providers in your service have the capability to notify the facility they are transporting to?

☐ Yes ☐ No ☐ Don't know

11. Do EMS personnel in your service have the ability to contact on-line medical control most of the time?

☐ Yes ☐ No ☐ Don't know

12. What is the average transport time (field to facility) for the primary facility within your service agency?

13. Contact information regarding this survey? (Survey results will be available in aggregate form only).

Agency Name: _____

Your Name _____

Phone: _____

Email: _____

APPENDIX E—COVER MEMO AND HOSPITAL SURVEY

STATE OF COLORADO

Bill Owens, Governor
Douglas H. Benevento, Executive Director

Dedicated to protecting and improving the health and environment of the people of Colorado

4300 Cherry Creek Dr. S.
Denver, Colorado 80246-1530
Phone (303) 692-2000
TDD Line (303) 691-7700
Located in Glendale, Colorado

Laboratory Services Division
8100 Lowry Blvd.
Denver, Colorado 80230-6928
(303) 692-3090

<http://www.cdphe.state.co.us>



Colorado Department
of Public Health
and Environment

March 31, 2003

MEMO

TO: Quality and Risk Management Directors
FR: Dave Munch, Vice President, Chief Operating Officer
Lutheran Medical Center
Deb Pellini, Chief Executive Officer
Kremmling Memorial Hospital District
RE: Attached survey on stroke care

We have the opportunity to improve the prevention and treatment of stroke in the State of Colorado. The Colorado Stroke Advisory Board was created by HB 1125 under the direction of Doug Benevento, Executive Director of the Colorado Department of Public Health and Environment. We need your help in answering a few questions as we assess the capabilities and services offered by hospitals throughout the State.

Please take a few minutes to fill out the enclosed brief survey. We are truly interested in your current abilities as we review the opportunities to improve the prevention and care of stroke. This is not a test. Everyone gets an 'A.' Through education, coordination and teamwork, we can make a difference.

If you have any questions contact Cathy Schuster, Coordinator, Colorado Stroke Advisory Board @ 303-692-2571. Please return the completed survey in the enclosed self-addressed envelope by April 14, 2003.

Thank you very much.

STATE OF COLORADO

Bill Owens, Governor
Douglas H. Benevento, Executive Director

Dedicated to protecting and improving the health and environment of the people of Colorado

4300 Cherry Creek Dr. S.
Denver, Colorado 80246-1530
Phone (303) 692-2000
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(303) 692-3090

<http://www.cdphe.state.co.us>



Colorado Department
of Public Health
and Environment

Please complete and return by April 21, 2003 to: (DEADLINE EXTENDED)

Cathy Schuster, Coordinator

Stroke Advisory Board

CDPHE-PSD-A5

4300 Cherry Creek Drive South

Denver CO 80246

Hospital Name: _____

Hospital City: _____

Hospital County: _____

Name and Telephone number of person(s) completing this survey:

1. Number of inpatient strokes and TIA (transient ischemic attacks) seen in the last fiscal year: _____ (include ICD-9 codes 430–437) Specify year _____
2. Does your institution treat acute stroke as a medical emergency? ☐ Yes ☐ No
3. Does your institution have standing orders / clinical pathways for strokes? ☐ Yes ☐ No
4. If yes, do your orders include the emergency department? ☐ Yes ☐ No
5. If yes, do your orders include the use of t-PA? ☐ Yes ☐ No
6. If your institution does not have standing orders / clinical pathways would you be interested in available resources in establishing an acute stroke protocol? ☐ Yes ☐ No
7. Are you interested in attending a conference on stroke care? ☐ Yes ☐ No
8. Would you participate in a statewide work group on stroke? ☐ Yes ☐ No
9. Are you aware of the cost savings data for t-PA use in acute stroke? ☐ Yes ☐ No

10. Would you like additional information on t-PA usage? ☐ Yes ☐ No

Does your institution have 24 hour, seven days a week access to (please check appropriate boxes):

	A. On-site 24 hours/day	B. Available on call 24 hours/day	C. Available by transfer 24 hours/day	D. Telemedicine capabilities
11. Neurologists Neurosurgeon, or physician experienced in managing stroke	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
12. CT scanning	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
13. Pharmacy services (someone to mix t-PA)	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
14. Staffed skilled in intensive care monitoring for t- PA patients	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
15. Cerebral angiography (physicians trained in intra- arterial clot lysis)	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	

16. Does your facility have a case management department? ☐ Yes ☐ No

17. If yes, does your case management department have written criteria for next level of care?
☐ Yes ☐ No

18. Are the following resources available in your county?

- a. Acute Rehab Facility? ☐ Yes ☐ No
- b. Long Term Acute Care? (LTAC) ☐ Yes ☐ No
- c. Skilled Nursing Facility? ☐ Yes ☐ No
- d. Long Term Care? ☐ Yes ☐ No
- e. Certified Home Care? ☐ Yes ☐ No
- f. Private Duty Home Care? ☐ Yes ☐ No

*Thank you for your participation in the process of improving stroke care for the
State of Colorado*

APPENDIX F—HEALTH INSURANCE PROVIDER SURVEY

Health Insurance Provider Survey

1. Does your organization have systems in place to “red flag” high-risk stroke patients?
2. Once a patient has suffered a stroke, are there systems or protocols to assure that secondary prevention treatment modalities are in place to minimize the risk of future strokes?
3. Does your organization offer educational opportunities for its patients and physician providers on stroke prevention for primary risk reduction? (HTN, Diabetes, Smoking, Cardiovascular disease, atrial fibrillation, Left ventricular hypertrophy)
4. Does your organization offer educational opportunities for its patients and physician providers on stroke prevention for secondary risk reductions?
5. Do you offer incentives for high risk patients who participate in risk reduction programs such as smoking cessation?
6. Do you offer incentives for patients who engage in healthy lifestyle activities (which would decrease their risk factors)?

Comments:

APPENDIX G—STROKE TERMINOLOGY

Acute: Relating to a disease or condition with rapid onset and a short, severe course.

Age-adjusted rate: A rate that has been standardized to the age distribution of a particular population so that it is, in effect, independent of the age distribution of the population it represents. Age-adjusted rates are used to compare rates over time or among different geographical areas.

Amyloid angiopathy: A change in the wall of blood vessels over time.

Aneurysm: A localized, blood-filled dilation (expansion) of a blood vessel caused by disease or weakening of the vessel wall.

CAT or CT scan (Computerized axial tomography or computed tomography): Used in diagnostic studies of internal bodily structures; computer analysis of a series of cross-sectional scans made along a single axis of a bodily structure or tissue used to construct a three-dimensional image of that structure.

Cardiovascular: Relating to the function of the heart in circulating blood.

Catheter: Hollow inflexible tube inserted into a body cavity, duct, or vessel to allow the passage of fluids or to open a passageway; its many uses include the diagnosis of heart disorders when inserted through a blood vessel into the heart.

Catheterization: The process of inserting a catheter.

Cause of death: All the diseases, conditions, or injuries that either resulted in or contributed to death, and/or the circumstances of the accident or violence that produced such injuries. Most standard mortality data are compiled by underlying cause of death (see definition).

Cerebrovascular disease: Relating to the blood supply to the brain, particularly with reference to the development of abnormal conditions.

Clinical pathways/standing orders: Preprinted guidelines for healthcare personnel to follow for every patient with a stroke diagnosis.

Clip: Fastener used in surgery to hold skin or other tissue in position or to control bleeding.

Crude death rate: The number of deaths per a specified number of population (i.e., per 1,000 or 100,000). Crude rates are not adjusted for differences in demographic distributions among populations, such as age distributions.

Epidemiology: The study of the distribution of a disease, or physiological condition, in human populations and of the factors that influence this distribution.

Healthy People 2010: A document published by the United States Department of Health and Human Services to serve as a health promotion and disease prevention agenda for the nation.

Hemorrhagic stroke: Rupture of a blood vessel resulting in a hemorrhage (profuse bleeding) into or around the brain.

Incidence: The number of new cases of disease onset in a population over a prescribed period of time.

Incontinent: Lacking normal voluntary control of excretory functions.

Intra-arterial: Within one or more arteries.

Intracranial: Within the portion of the skull enclosing the brain.

Intracerebral hemorrhage: Escape of blood in the cranium due to the loss of integrity of vascular channels and frequently leading to the formation of a hematoma (localized swelling filled with blood resulting from a break in a blood vessel).

Intravenous: Within or administered into a vein.

Ischemic stroke: Caused by blockage of an artery stopping blood flow to the brain depriving brain tissues of oxygen and blood.

Metabolic: Relating to the complex chemical processes which occur within a living cell or organism that are necessary for the maintenance of life.

Morbidity: Numbers of people with diseases.

Mortality: Numbers of people who have died.

Physiatrist: A physician specializing in rehabilitation.

Placebo: A substance containing no medication given in experimental research to compare outcomes with a medicinal drug.

Primary diagnosis: The underlying condition that resulted in hospitalization or death.

Rupture: Breaking open or bursting.

Serum: The clear yellow fluid obtained upon separating whole blood into its solid (plasma) and liquid components.

Stent: Tubular surgical device inserted into a blood vessel or other passage to prevent closure.

Subarachnoid hemorrhage: Bleeding in the space between the arachnoid membrane and pia mater that is filled with cerebrospinal fluid and contains the large blood vessels that supply the brain and spinal cord.

Syndrome: A group of symptoms that are collectively associated with or characterize a disease.

Telemedicine: Delivery of health services via remote telecommunications. This may include interactive video conferencing as well as diagnostic services by an off-site radiologist.

Thrombolysis: Dissolution (breaking up) or destruction of a blood clot.

Thrombolytic therapy/thrombolytic treatment: Use of drugs designed to break up blood clots.

TIA or Transient Ischemic Attack: Known as a mini-stroke; can have the same signs and symptoms as a stroke although with a TIA the symptoms usually disappear rapidly.

Underlying cause of death: The type of disease or injury that initiated the chain of events leading directly to the death.

Vascular: Of or pertaining to blood vessels.

Vascular System: Network of blood vessels throughout the body.

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For more information on stroke visit the following websites:

www.cdc.gov/cvh

www.cdphe.state.co.us/pp/cvd/stroke.html

www.stroke.org

www.americanheart.org

www.ninds.nih.gov/health_and_medical/disorders/stroke.htm

