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Recognition of Stroke Symptoms by the General Public Associated with Delayed Hospital Presentation: A Health Awareness Challenge

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Abstract

This review of literature examines knowledge of stroke risk factors and recognition of symptoms by the general public and their link to emergency department delays. This review is written with the intent of illustrating the need for educational campaigns and effective programming to improve the public's recognition of the symptoms of stroke and the urgency in seeking prompt medical attention for increased survival and decreased disability.

RECOGNITION OF STROKE SYMPTOMS BY THE GENERAL PUBLIC ASSOCIATED WITH DELAYED HOSPITAL PRESENTATION: A HEALTH AWARENESS CHALLENGE

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CHAPTER 1

INTRODUCTION

Every 45 seconds someone in the United States will have a stroke this year and every three minutes someone will die of one. Stroke is the third leading cause of death in the U.S. and the leading cause of serious long-term disability. Every year, an estimated 700,000 Americans suffer a new or recurrent stroke and 150,000 die as a result of one. This equals one out of every 16 deaths in the U.S. today, resulting from stroke ("Impact of Stroke," n.d.). "Due to an aging US population and other changing socio-demographics, the number of new and recurrent strokes is projected to increase to nearly 1 million annually by the year 2050" ("New Guidelines," 2006, para. 5).

When the American Stroke Association asked 1,000 Americans to name the greatest threat to their health, only 10 named stroke. There are currently 4.6 million stroke survivors living in the United States, and 35 percent of those surveyed said that they or someone close to them has had a stroke. Ironically, only 1 percent of those surveyed was worried about personally having a stroke. Cancer was mentioned as the most worrisome health condition by 33 percent of respondents ("American Stroke Association," 2002).

The threat of stroke rates low among the American public, even for those whose life has been affected by stroke. As a result, many Americans are unaware of their increased risk and often associate the warning signs of stroke with other conditions, delaying the urgency of treatment. Time to treatment is critical in acute stroke. Tissue plasminogen activator (tPA) is an FDA approved clot dissolving agent used to treat

ischemic stroke within three hours of stroke symptom onset ("Tissue Plasminogen Activator (tPA)," n.d.). "Effective treatment with tPA has been available since 1996 and can improve the odds of good outcome by 30%, unfortunately, stroke reversing treatment is underutilized with less than 3% of stroke patients being eligible" (C. Casper, presentation, April 14, 2006). "The key to a full recovery starts the moment a person exhibits stroke symptoms" (Elkind, 2005, para. 10).

Etiology

"A stroke or 'brain attack' occurs when a blood clot blocks an artery (a blood vessel that carries blood from the heart to the body) or a blood vessel (a tube through which the blood moves through the body) breaks, interrupting blood flow to an area of the brain. When either of these things happen, brain cells begin to die and brain damage occurs" ("What is Stroke?" n.d., para. 1). Kochan and Kanamalla (2005) define stroke simply as "damage to the brain and resultant neurologic deficits, which occur when the blood supply to a given area of the brain is lost" (para. 1).

Studies, such as Saver's (2005), have determined that time lost is brain lost. "For every minute's delay, the brain loses 1.9 million neurons, 14 billion synapses and 7.5 miles of myelinated fibers. If a stroke runs its full course, an estimated 10 hours on average, the brain loses 1.2 billion neurons, 8.3 trillion synapses, and 4,470 miles of myelinated fibers" (p. 265). "A pea-sized piece of brain dies for every 12 minutes that treatment is delayed, and brain tissue the size of 1.5 ping-pong balls is irretrievably lost if a typical stroke runs its course without treatment" (Saver, 2005, p.265).

Saver (2005) explained the following:

> During normal aging, a predictable number of brain cells die. The estimated loss of brain cells during stroke can be translated into accelerated brain aging – 8.7 hours for every second's delay, 3.1 weeks for every minute, 3.6 years for every hour, and 36 years for a stroke that goes untreated. Quantitative estimates of the pace of neural circuitry loss in human ischemic stroke emphasize the time urgency of stroke care. The typical patient loses 1.9 million neurons each minute in which stroke is untreated. (p. 265)

"Stroke, however, is not a single process. Instead, it may be the result of 1 or more of the following processes: thrombotic stroke, embolic stroke, hemorrhagic stroke, and reversible ischemic stroke (Kochan & Kanamalla, 2005, para. 1).

Ischemic Stroke (Thrombotic & Embolic Stroke)

"Thrombotic stroke occurs when plaque and clot form locally on the wall of a cerebral artery, leading to a progressive narrowing of the arterial lumen until it becomes completely occluded" (Kochan & Kanamalla, 2005, para. 2). "Embolic stroke occurs when a clot and/or plaque become dislodged from the heart or walls of the extracranial arteries that supply the brain (eg, cartotid artery bifurcation) and are carried by the arterial blood flow into the brain. There, the embolus lodges in a small-diameter vessel" (Kochan & Kanamalla, 2005, para. 3).

Hemorrhagic stroke

"Hemorrhagic stroke occurs when a blood vessel in the head ruptures, reducing blood flow to all or part of the brain" (Kochan & Kanamalla, 2005, para. 4).

"Hemorrhages can result from a number of conditions that affect your blood vessels, including high blood pressure (hypertension) and weak spots in your blood vessel walls aneurysms). A less common causes of hemorrhage is the rupture of an arteriovenous malformation (AVM)- a malformed tangle of thin-walled blood vessels, present at birth" ("Stroke: Causes," n.d., para. 5).

Transient Ischemic Attack

A transient ischemic attack (TIA), otherwise known as a "mini stroke," occurs when a smaller blood clot blocks a distal small artery. "The cessation of flow to the affected area of the brain is temporary, either because the small clot spontaneously breaks down and blood flow is established or because collateral vessels bypasses the occluded segment before irreversible damage occurs. Although the deficits may resolve completely, the event should be considered an early warning sign of stroke. Early treatment of the underlying cause may prevent a more devastating and permanent loss of function" (Kochan & Kanamalla, 2005, para. 6).

"In a TIA, conditions indicative of an ischemic stroke are present and the typical stroke warning signs develop. However, the obstruction (blood clot) occurs for a short time and tends to resolve itself through normal mechanisms. Even though the symptoms disappear after a short time, TIAs are strong indicators of a possible or impending major stroke" ("What Are the Types of Stroke?" n.d., para. 9).

Giles, Flossman, and Rothwell (2006) studied 241 people (average age 71) with documented TIA. Each participant was interviewed about his or her initial perception of the cause of the symptoms, immediate response, and the timeline from symptom onset to

presentation for evaluation and treatment. Overall, only 10% of patients sought treatment in an emergency department, while most (86.7%) initially sought care from a family physician. The study indicates: 44.4 percent of patients responded to the symptoms as an "emergency," defined in this study as presentation for evaluation and treatment as soon as they were able (usually within minutes or hours); 11.2 percent sought treatment on the same day that symptoms occurred, but not as soon as they could have (non-emergency); and 44.4 percent delayed seeking medical care- 17.8 percent delayed until the next day- and 26.6 percent delayed two days or more (2006).

Kochan and Kanamalla state "approximately 83% of strokes are ischemic, whereas 17% of strokes are hemorrhagic" (2005, para. 11). Regardless of stroke type, "more than 700,000 people suffer a stroke in the US each year, and approximately two-thirds of these individuals survive and require rehabilitation ("Post Stroke Rehabilitation," n.d., para. 1).

Risk Factors

"Risk factors are conditions or habits that make a person more likely to develop a disease. They can also increase the chances that an existing disease will get worse" ("What are the Risk Factors," n.d., para.1). A person's traits (family history/heredity) and lifestyle habits are known risk factors and may increase or decrease a person's chance of having a stroke. Many risk factors can be modified, treated, or controlled, but others can not. Modifiable risk factors include: high blood pressure, diabetes, elevated cholesterol, smoking, obesity, physical inactivity, atrial fibrillation, carotid artery disease, transient ischemic attack (TIA), excessive alcohol and chronic stress. Other risk factors that a

person cannot change known as unmodifiable risk factors include: increased age, gender, family history, race, and prior history ("Understanding a Stroke," n.d.).

Modifiable Risk Factors

High blood pressure (hypertension) is the most important modifiable risk factor for stroke. "High blood pressure is a common condition, affecting 65 million Americans- 1 in 3 adults" ("Controllable Risk Factors," n.d., para. 4). The Stroke Center at the University of Medicine & Dentistry of New Jersey states that "compared with people with controlled high blood pressure, people with uncontrolled high blood pressure are seven times more likely to have a stroke" ("Risk Factors for Stroke," n.d., para. 41). High blood pressure presents without symptoms, therefore it is often referred to as the 'silent killer' ("Common Misperceptions," n.d.).

Seshadri and colleagues (2006) state "epidemiological studies have identified blood pressure (BP) as the single most important, modifiable stroke risk factor, and BP in middle age predicts the risk of stroke in older persons" (p. 345). Authors studied the lifetime risk (LTR) for stroke based on results from the Framingham Study and "observed that the LTR of stroke for middle-aged and 'young-old' adults (55 to 75 years of age) was substantial at 1 in 6 or higher. This risk was higher in women (1 in 5) compared with men, largely because of the greater life expectancy in women, which increased their period at risk" (p. 348).

"Given the 'epidemic' of diabetes, with substantially increasing diabetes prevalence each year across all age- and race/ethnicity groups, the importance of diabetes as a risk factor for stroke is increasing" (Kissela et al., 2005, p. 356). Kissela et al. (2005)

state "diabetes is clearly one of the most important risk factors for ischemic stroke, especially for those occurring before age 65 (p. 358). The Stroke Center at the University of Medicine & Dentistry of New Jersey reports "the risk of stroke is two-and-a-half times higher in people with diabetes" ("Stroke Statistics," n.d., para. 3). Ho, Paultre, and Mosca (2003) found that diabetic patients have a risk comparable to that of patients with a history of stroke. "We estimate that 37-42% of all ischemic strokes in both African Americans and whites are attributable to the effects of diabetes alone or in combination with hypertension" (Kissela, 2005, p. 355). Jorgensen, Nakayama, Raaschou, and Olsen (1994) found diabetes to influence stroke by age, subtype, rate of recovery, and mortality.

High cholesterol (hyperlipidemia) may also contribute to strokes in the same way it contributes to heart disease, through hardening of the arteries. "Nearly 107 million Americans adults have a total blood cholesterol of 200 or higher" ("Controllable Risk Factors," n.d., para. 5). Horenstein, Smith, and Mosca (2002) found cholesterol as a risk factor for nonhemorrhagic stroke death in women, especially among African American women older than 55 years of age. Men with high blood pressure, but who have elevated HDL, or good cholesterol were found by Goya Wannamethee, Shaper, and Ebrahim (2000) to be associated with a 50 percent reduction of nonfatal stroke risk.

Cigarette smoking is one of the leading preventable risk factors for stroke. "Among other things, smoking damages blood vessel walls, speeds up the clogging of arteries, raises blood pressure and makes the heart work harder. Smoking doubles the risk of stroke. Smoking women have special concerns. If a woman smokes, has a history

of migraines, and takes oral contraceptives, her stroke risk is increased as much as 34 times" ("Controllable Risk Factors," n.d., para. 7).

The First National Health and Nutrition Examination Survey Epidemiologic Follow-Up Study examined evidence that exposure to secondhand smoke can increase an individual's risk of stroke. Women smokers whose spouses smoked had six times the increased relative risk of stroke, than cigarette smoking women with nonsmoking spouses. The authors emphasize that risk of stroke is not only denoted by the smoking behavior of one individual, but also by the secondhand smoking of the spouse (Qureshi, Fareed, Suri, Kirmani, & Divani, 2005).

Numerous health authorities stress the risks of obesity and physical inactivity. The National Stroke Association explains that "excess weight puts a strain on the entire circulatory system. It also makes people more likely to have high cholesterol, high blood pressure, and diabetes- all of which increase your risk for stroke" ("Obesity," n.d., para. 9). Hu et al. (2005) found that as little as 29 minutes per day of physical activity per day can reduce the risk of all subtypes of stroke. Daily active commuting, such as walking or biking, reduces the risk of ischemic stroke.

Mid-life body mass index (BMI) has been identified as an indicator of stroke later in life (Song, Sung, Smith, & Ebrahim, 2004). Jood, Jern, Wilhelmsen, and Rosengren's (2004) findings supported previous studies investigating the role of BMI among middle-aged men who were obese and found it doubled their risk of suffering a stroke. A study of men age 47 to 55, who had a BMI considered to be obese had a 1.93 relative risk for

suffering a stroke (all types of stroke combined) over 28 years of follow-up, compared to men with a lower BMI during middle age.

Atrial fibrillation (AF) refers to a certain kind of irregular heart rhythm, which leads to blood clots forming in the heart. These blood clots can then be released from the heart and travel to the brain, causing what is referred to by doctors as an embolic stroke. AF affects 2.2 million Americans and raises the risk of stroke as much as six times. "AF is most often found in people over the age of 65 and in people who have heart disease or thyroid disorders. About 15% of all people who have a stroke have AF", according to the National Stroke Association ("Controllable Risk Factors," n.d., para. 4). In addition to AF, the Stroke Center at the University of Medicine & Dentistry of New Jersey, adds that "cardiac heart failure (CHF) causes 75,000 strokes per year in the United States" ("Stroke Statistics," n.d., para. 3).

"The carotid arteries in your neck supply blood to your brain. A carotid artery narrowed by fatty deposits from atherosclerosis (plaque buildups in artery walls) may become blocked by a blood clot. Carotid artery disease is also called carotid artery stenosis" ("Stroke Risk Factors," n.d., para. 9).

According to the American Stroke Association, "alcohol abuse can lead to multiple medical complications, including stroke. For those who consume alcohol, a recommendation of no more than two drinks per day for men and no more than one drink per day for nonpregnant women best reflects the state of the science for alcohol and stroke risk" ("Stroke Risk Factors," n.d., para. 18). "Drinking lots of alcohol has been linked to stroke in some studies. Drinking more than two drinks per day may increase

stroke risk by 50%" reports the National Stroke Association ("Controllable Risk Factors," n.d., para. 8).

People with high levels of stress have double the risk of stroke. Truelsen, Nielsen, Boysen, and Gronbeck (2003) found individuals with high levels of self-reported stress had an 89 percent higher risk of fatal stroke than those individuals who reported that they were stress free. Researchers theorize that chronically stressed people have multiple cardiovascular risk factors such as smoking, physical inactivity, high blood pressure, and increased alcohol intake. There was no significant effect of stress on nonfatal types of stroke such as ischemic or TIA and the findings do not represent acute stress. Incidence of ischemic stroke has also higher in persons with low socioeconomic status, a factor often leading to chronic stress (Jakovljevie, 2004). Depression, often interrelated with low socioeconomic status, was found to be an independent risk factor for stroke and TIA in those younger than 65 years old (Salaycik et al., 2007).

Transient ischemic attacks, or TIAs, are often called 'mini-strokes.' "Transient ischemic attacks (TIAs) are "warning strokes" that produce stroke-like symptoms but no lasting damage. TIAs are strong predictors of stroke. A person who's had one or more TIAs is almost 10 times more likely to have a stroke than someone of the same age and sex who hasn't" ("Stroke Risk Factors," n.d., para. 5). According to the American Stroke Association, "TIAs are important in predicting if a stroke will occur rather than when one will happen. They can occur days, weeks or even months before a major stroke. In about half the cases, the stroke occurs within one year of the TIA" ("Transient Ischemic Attacks (TIA)," n.d., para. 3).

Unmodifiable Risk Factors

Stroke risk increases with age. People of all ages, including children and unborn babies, can have a stroke. Almost three-quarters of all strokes occur in people 65 years or older, with the remaining quarter occurring in those under age 65 ("Stroke Facts and Statistics," n.d.). "After age 55, your stroke risk doubles for every decade" ("Uncontrollable Risk Factors," n.d., para. 2).

The National Stroke Association states that "women are more worried about their risk of getting breast cancer than their stroke risk. What's more, women think stroke is a man's disease. But the truth is more women than men will die from stroke" ("Women and Stroke," n.d., para. 1). Roquer, Rodríguez Campello, and Gomis (2003) found that gender is associated to some clear differences in patients suffering first-ever strokes. The study, examining sex differences in first-ever strokes, found women to have more severe first strokes at an older age and remain more disabled than men. Their findings indicated that women who have a first stroke are, on average, six years older than men who have a first stroke. Strokes in women tend to involve high blood pressure and blood clots that form in a chamber of the heart, due to higher rates of atrial fibrillation, while strokes in men tend to involve drinking too much alcohol, smoking, and blood clots that form in the legs.

Family history and race play a significant role in stroke risk. According to Mayo Clinic, "your risk of stroke is slightly greater if one of your parents or a brother or sister has had a stroke or TIA" ("Stroke: Risk Factors," 2007, para. 1). African Americans have almost twice the risk of stroke, as well as higher death rates, compared to Caucasians in

America. ("Know the Facts," 2007). This risk is the result of a higher incidence and prevalence of high blood pressure and diabetes compared to Caucasians (Schneider et al., 2003). Specifically, "black women have higher prevalence rates of high blood pressure, obesity, physical inactivity, and diabetes than white women" ("Know the Facts," 2007, para. 1).

Prior stroke or heart attack increases an individual's risk of suffering a recurrent stroke. According to the National Stroke Association, "if you have already had a stroke or a transient ischemic attack (ministroke), you have a 25-40% chance of having another stroke in the next 5 years" ("Uncontrollable Risk Factors," 2004, para. 6).

Prevalence

Each year 700,000 Americans experience a stroke and 150,000 die of stroke each year. These figures account for one stroke every 45 seconds and one death every three minutes. Stroke also accounts for the leading cause of long-term disability in the U.S. today. The American Stroke Association reports that in 2007, the estimated costs of stroke-related medical bills and disability in the U.S. will reach nearly $63 billion per year ("Impact of Stroke," 2006). These data suggest that while more people are surviving stroke, they are doing so with the high cost of disability.

Although the U.S. experienced a decline in stroke mortality during the 1970s and early 1980s, stroke hospitalizations actually increased 18.6 percent from 1988 through 1997 (Casper et al., 2003). Explanations for this trend remain uncertain, however may include improved rehabilitative care and a change in the etiology of the disease process (Shahar et al., 1995) During this time, the number of stroke survivors in the U.S.

increased from 1.5 million to 2.4 million, illustrating an improved survival rate (Muntner, Garrett, Klag, & Coresh, 2002). However, the Centers for Disease Control and Prevention emphasize "substantial disparities in the health and economic burden of stroke among racial and ethnic populations have been documented, with African Americans far more likely to die of stroke than members of other racial and ethnic groups in the United States" (Casper et al., 2003, p. 2). Currently, stroke accounts for one out of every 16 deaths and remains the third leading cause of death in the U.S. today ("Impact of Stroke," n.d.).

Demographics

Age and gender have long been known as stroke risk factors. Recent studies are also showing a strong link between ethnicity and stroke. Specifically, African Americans and Hispanic Americans have a higher risk of stroke than non-Hispanic whites.

The Framingham Study revealed that 28% of strokes occur in patients younger than 65 years. The study also showed that, for patients older than 55 years, the incidence of stroke doubles with each successive decade. (Kochan & Kanamalla, 2005, para. 12). "The incidence rate of stroke in Caucasian males is 62.8 per 100,000, with a 26.3 percent death rate. In Caucasian females, the incidence is 59 per 100,000, with a death rate of 39.2 percent. The estimated age adjusted prevalence of stroke for Americans aged 20 years and older is 2.2 percent for non-Hispanic white men and 1.5 percent for women; for non-Hispanic blacks, 2.5 percent for men and 3.2 percent for women; and for Mexican Americans, 2.3 percent for men and 1.3 percent for women" ("Stroke Statistics," n.d., para. 3).

Stroke is no longer just your "grandfather's disease" as statistics show twice as many women dying from stroke than from breast cancer. The American Stroke Association reports that each year approximately 46,000 more women than men suffer a stroke and because of the longer life expectancy of women, more women than men will die of stroke each year ("Women, Heart Disease and Stroke," 2007). "Women account for approximately 43 percent of strokes that occur each year, but they account for 61 percent of stroke deaths" ("Stroke Statistics," n.d., para. 3). Additionally, "women who are pregnant have a higher stroke risk. So do women taking birth control pills who also smoke or have high blood pressure or other risk factors" ("Risk Factors You Can't Control," n.d., para. 2).

Along with women, African Americans are disproportionately affected by stroke. According to the Stroke Center at the University of Medicine & Dentistry of New Jersey, "The incidence of stroke in African-American males is approximately 93 per 100,000, with a death rate of approximately 51 percent. In African-American females, the incidence is 79 per 100,000, with a death rate of 39.2 percent. Young African-Americans have a two to three times greater risk of ischemic stroke than the Caucasian population of the same age" ("Stroke Statistics," n.d., para. 3). According to the American Stroke Association, "blacks have almost twice the risk of first-ever strokes compared to whites" ("Know the Facts," n.d., para. 1). The prevalence of high blood pressure (leading preventable risk factor to stroke) in African Americans in the U.S. is the highest in the world. In addition to higher prevalence of high blood pressure, "black women have

higher prevalence rates of high blood pressure, obesity, physical inactivity, and diabetes than white women" ("Know the Facts," n.d., para. 1).

A 2007 search of the Medical Literature Analysis and Retrieval System Online (Medline) involving the keywords *Stroke in African Americans* detected 481 citations, up from 251 citations in 2000, indicating that African American ethnicity has been the subject of escalating research. Fustinoni and Biller (2000) suggest that "patterns of disease that distinguish different ethnic groups may well exist and should be adequately established if better health standards for the populations concerned can be achieved as a consequence" (p.1014).

"Stroke is the fourth-leading cause of death among Hispanics. Studies indicate that they have a higher rate of hemorrhagic strokes at a younger age than non-Hispanic whites. One study found that hemorrhagic strokes occurred more commonly in Hispanics than in any other sub-group" ("Stroke among Hispanics," n.d., para. 2). The risk of stroke is higher at younger ages among Hispanics, leading to a potentially longer period of disability (Jacobs, Boden-Albala, Lin, and Sacco, 2002).

Jacobs, Boden-Albala, Lin, and Sacco (2002) found young African Americans and Hispanics to have a greater stroke incidence than young whites living in the same community. "The Northern Manhattan Stroke Study, a large, urban stroke investigation in 2002, found that the average age for stroke in Hispanics was 67 compared to 80 for non-Hispanic whites" ("Stroke among Hispanics," n.d., para. 3).. Stroke was 2.4 times more likely to occur in African Americans compared to whites 2.5 times more likely to occur in Hispanics versus whites (Jacobs et al., 2002).

Regardless of age, Mexican/Hispanic Americans have a higher incidence of stroke than non-Hispanic whites. Much of the research gathered on Mexican Americans and stroke comes from the Brain Attack Surveillance in Corpus Christi Project. After adjusting for age, Mexican Americans have a higher incidence of hemorrhage than non-Hispanic whites. Mexican Americans also have "an increased incidence of ischemic stroke and transient ischemic attack at younger ages compared with non-Hispanic Whites" (Morgenstern, 2004, p. 379).

Significance of the Study

This review of literature examines knowledge of stroke risk factors and recognition of symptoms by the general public and their link to emergency department delays. This review is written with the intent of illustrating the need for educational campaigns and effective programming to improve the public's recognition of the symptoms of stroke and the urgency in seeking prompt medical attention for increased survival and decreased disability.

Statement of the Problem

Tissue plasminogen activator (tPA) has been shown to achieve beneficial neurological outcomes if administered within three hours of stroke symptom onset in patients presenting with acute ischemic stroke. Yet most patients do not recognize warning signs and symptoms soon enough to be eligible for treatment with tPA. Recent data shows that the national use of tPA is less than 4 percent of eligible stroke patients (Davalos, 2005).

Limitations

1. The scope of this research on public awareness of stroke symptoms is general information, not information regarding specific states or regions.
2. This research is intended to educate present and future health care professionals as to the need for ongoing and well-designed stroke awareness and education programs.
3. Programs should serve to increase the public's knowledge of risk factors for stroke, recognition of the five most common warning symptoms of stroke, and the urgent need to call 911 to activate emergency medical services (EMS) upon symptom onset.

Delimitations

1. The review of literature focused on awareness and recognition of stroke risk factors and symptoms by the general public, the first step in taking action towards the treatment of acute stroke.
2. The review of literature focused on studies within the last 14 years utilizing the Medline/PubMed database.
3. This paper did not examine hospital or pre-hospital diagnosis nor did this paper study the hospital protocols or care pathways for the diagnosis and treatment of acute stroke.
4. The review of literature neither examined nor compared specific state-to- state data.

Methodology

The review of literature was done utilizing library-based electronic research tools such as Medline and PubMed. Medical databases were incorporated in the search. Key phrases such as "stroke awareness," "stroke education," and "public knowledge of stroke" initiated the search. Databases included the National Library of Medicine, British Medical Journal, Stroke: Journal of the American Stroke Association, Neurology, Annals of Emergency Medicine, and the Atlas of Stroke Mortality, Department of Health and Human Services, Centers for Disease Control. Internet sites such as the American Stroke Association; National Stroke Association; and the National Institutes of Health, Heart, Lung and Blood Institute were also referenced. The amount of information available related to stroke was impressive and had to be thoroughly examined as to its contribution and relevance in this research paper.

Definitions

Acute stroke- the sudden onset of stroke symptoms or warning signs

Body Mass Index (BMI) "is a number calculated from a person's weight and height. BMI provides a reliable indicator of body fatness for most people and is used to screen for weight categories that may lead to health problems" ("Body Mass Index," n.d., para.1)

Cerebrovascular disease- "cerebrovascular disease, or stroke, is the death of brain tissue that occurs when the brain does not receive enough blood flow and oxygen" ("Cerebrovascular Disease (Stroke)," n.d., para. 1)

Healthy People 2010- "a statement of national health objectives designed to identify the most significant preventable threats to health and to establish national goals to reduce these threats" ("About Healthy People 2010," n.d., para. 1)

Hemorrhagic stroke- "strokes caused by the breakage or 'blowout' of a blood vessel in the brain" ("Types of Stroke," n.d., para. 7)

Ischemic stroke- "strokes occur as a result of an obstruction within a blood vessel supplying blood to the brain" ("What Are the Types of Stroke?" n.d., para. 2)

Risk factor- "a variable associated with an increased risk of disease or infection" ("Risk Factors," n.d., para. 1)

Stroke- "a stroke occurs either when the blood supply to part of the brain is blocked or when a blood vessel in the brain bursts, causing damage to a part of the brain. A stroke is also sometimes called a brain attack" ("Stroke," n.d., para. 1)

Tissue Plasminogen Activator (tPA)- "Tissue plasminogen activator (tPA) is a thrombolytic agent (clot-busting drug). It's approved for use in certain patients having a heart attack or stroke. The drug can dissolve blood clots, which cause most heart attacks and strokes" ("Tissue Plasminogen Activator (tPA)," n.d., para. 2)

Transient ischemic attack (TIA) – "an event, sometimes called a mini-stroke, or stroke symptoms that always last less than 24 hours before disappearing. While TIAs generally do not cause permanent brain damage, they are a serious warning sign of stroke and should not be ignored!" ("What is TIA?" n.d., para.1)

CHAPTER 2

REVIEW OF LITERATURE

Stroke is the third leading cause of death and the leading cause of long-term, serious disability in the U.S. today. Every year about 700,000 Americans suffer a new or recurrent stroke and 150,000 lose their lives to stroke ("Impact of Stroke," n.d.). Stroke represents one out of every 16 deaths in the U.S. and of every five of those deaths, two are men and three are women ("Impact of Stroke," n.d.).

Even though stroke is the third leading killer behind cardiovascular diseases and cancer, Americans still do not consider stroke to be a public health threat. The National Stroke Association cites common public stroke myths to be the following: "stroke is unpreventable," "stroke cannot be treated," "stroke only strikes the elderly," and "stroke happens to the heart" ("Stroke Myths," n.d., para. 1). Stroke symptoms are not well recognized by the public, and often times attributed to other health conditions, "too many stroke sufferers make the mistake of thinking that symptoms will go away" (Squires, 1998, para. 18).

"In 1996 the U.S. Food and Drug Administration (FDA) approved the use of tPA to treat ischemic stroke in the first three hours after the start of symptoms. This makes it very important for people who think they're having a stroke to seek help immediately. If given promptly, tPA can significantly reduce the effects of stroke and reduce permanent disability" ("Tissue Plasminogen Activator," n.d., para.5).

According to Squires (1998), "patients who received tPA were discharged from the hospital sooner, recovered more of their faculties earlier and were less likely to suffer

lingering effects. TPA patients had shorter hospital stays -- an average of 10.9 days compared with 12.4 days for those who did not receive the drug. More importantly, those treated with the drug were more likely to be well enough at discharge to go home, rather than to be sent to a rehabilitation center or to a nursing home for additional care" (para. 8).

Additionally, Squires found a $600,000 saving for every 1,000 patients treated with the tPA. Unfortunately in most cases, people experiencing stroke do not recognize the symptoms soon enough to present to the hospital within 3 hours to be eligible for tPA treatment.

Most Common Stroke Symptoms

"The National Institute of Neurological Disorders and Stroke notes these major signs of stroke: sudden numbness or weakness of the face, arms, or legs; sudden confusion or trouble speaking or understanding others; sudden trouble seeing in one or both eyes; sudden trouble walking, dizziness, or loss of balance or coordination; sudden severe headache with no known cause. All of the major symptoms of stroke appear suddenly, and often there is more than one symptom at the same time" ("Signs and Symptoms of Stroke," n.d., para. 2).

Risk Factors for Stroke

Risk factors are characteristics and behaviors that increase or influence an individual's risk of disease. Therefore, the only way to prevent a stroke is to reduce the number of personal risk factors. Modifiable stroke risk factors are those that can be prevented, treated, or controlled and include: high blood pressure, tobacco use, diabetes

mellitus, atrial fibrillation, high blood cholesterol, history of transient ischemic attacks (TIAs), physical inactivity and obesity, excessive alcohol or illegal drug use, carotid or other artery disease, peripheral artery disease, blood disorders, sickle cell disease, or other forms of heart disease ("Stroke Risk Factors," n.d.). Non-modifiable stroke risk factors are those that cannot be controlled or prevented, including: increasing age, gender, family history and race, and previous stroke, heart attack, or TIA ("Uncontrollable Risk Factors," n.d.).

Disability & Mortality Rates of Stroke

The effects of a stroke depend primarily on the location of the blood vessel affected, and disability depends on the extent of brain tissue affected. The American Stroke Association explained the following:

> The effects of a stroke depend on several factors including the location of the obstruction and how much brain tissue is affected. However, because one side of the brain controls the opposite side of the body, a stroke affecting one side will result in neurological complications on the side of the body it affects. For example, if the stroke occurs in the brain's right side, the left side of the body (and the right side of the face) will be affected, which could produce any or all of the following: paralysis on the left side of the body; vision problems; quick, inquisitive behavioral style; and memory loss. If the stroke occurs in the left side of the brain, the right side of the body (and the left side of the face) will be affected, producing some or all of the following: paralysis on the right side of the body; speech/language problems; slow, cautious behavioral style; and memory loss. ("What Are the Effects of Stroke?" n.d., para. 3)

"Four out of five families will be somehow affected by stroke over the course of a lifetime" ("Stroke Statistics," n.d., para. 1) Of the estimated 5.5 million stroke survivors in the US, more than 1.1 million American adults reported difficulty with functional limitations, activities of daily living, etc., resulting from stroke ("Quality of Life Worse Among Stroke Survivors," 2006). The American Heart Association's Heart Disease & Stroke Statistics- 2007 Update reports, "among ischemic stroke survivors who were at least 65 years of age, these disabilities were observed at 6 months after stroke: 50% had some hemiparesis, 30% were unable to walk without some assistance, 26% were dependent in activities of daily living, 19% had aphasia, 35% had depressive symptoms, 26% were institutionalized in a nursing home" (Rosamond et. al. 2007, p. e104).

Stroke survivors — especially minorities — tend to feel worse physically and mentally compared to people who have not had a stroke, according to a study published in Stroke: Journal of the American Heart Association. "After adjusting for age, gender, race, ethnicity, geography, education and other risk factors and medical conditions, stroke survivors had on average a 4.1 percent lower mental health score, 7.9 percent lower physical health, score, 6.9 percent lower health utility, 7.2 percent lower self-rating of health" ("Quality of Life Worse Among Stroke Survivors," 2006, para. 8).

Stroke survival rates provided by the Stroke Center at the University of Medicine & Dentistry of New Jersey indicate that "10 percent of stroke victims recover almost completely, 25 percent of stroke victims recover with minor impairments, 40 percent of stroke victims experience moderate to severe impairments requiring special care, 10 percent of stroke victims require care in a nursing home or other long-term care facility,

15 percent of stroke victims die shortly after the stroke, 7.6 percent of ischemic strokes and 37.5 percent of hemorrhagic strokes result in death within 30 days. Subarachnoid hemorrhage (SAH) represents only about 7 percent of all strokes, and it is the most deadly— with more than a 50 percent fatality rate. Of the survivors, approximately half will suffer permanent disability, 22 percent of men and 25 percent of women die within a year of their first stroke, 14 percent of people who have a stroke or TIA will have another within a year, about 25 percent of stroke victims will have another within five years" ("Stroke Statistics," n.d., para. 2).

Economic Burden of Stroke

"Americans will pay about $62.7 billion in 2007 for stroke-related medical costs and disability" ("Impact of Stroke," n.d., para. 4). Given the amount of medical resources dedicated to stroke and the disability resulting from stroke, a tremendous financial burden exists for individuals, families, and society. "Smoking, high blood pressure and high cholesterol have taken a substantial toll on the American wallet. When these cardiovascular risk factors led to a fatal heart attack or stroke in people who had not had a previous heart attack or stroke, it cost more than $13 billion in hospitalization and lost wages annually. When these uncontrolled risk factors lead to a recurrent heart attack or stroke that was fatal, it cost another $13 billion per year, according to research published in *Stroke: Journal of the American Heart Association.* Overall, the American Heart Association estimates that direct and indirect costs of stroke are $53.6 billion a year" ("Ignored Cardiovascular Risk Factors Costs Billions," n.d., para. 2).

The lifetime costs of a stroke vary by type of stroke, with the hemorrhagic variety accounting for the greater cost, followed by ischemic stroke (Taylor et al., 1996). According to the STEM Study, the cost for a patient with a major impairment ($124,564) was estimated to be more than twice that for those with a minor impairment ($45,893). "For the short-term, this difference was due to the substantially longer stay in hospital; only 30% of survivors with a major stroke compared with 81% of those with minor strokes were discharged to home at the end of 12 weeks" (Caro & Huybrechts, 1999, p. 2579).

The Stroke Center at the University of Medicine & Dentistry of New Jersey (2005) states that the direct costs (i.e., hospital charges, physicians, other healthcare professionals reimbursement, drugs, medical durables and home health care) of medical care and therapy are estimated at $28 billion per year, while indirect costs (lost future earnings) from lost productivity and earnings due to disability are estimated at $15 million per year. The average cost of care for a patient up to 90 days after stroke is $15,000 and for 10 percent of patients, the cost of care for the first 90 days after a stroke is $35,000. "The percentage breakdown of the direct costs of care for the first 90 days after a stroke is: initial hospitalization 43%, rehabilitation 16%, physician costs 14%, and hospital readmission 14%" ("Stroke Statistics," n.d., para. 4).

Demaerschalk and Yip (2005) state "in 2003, there were an estimated 616,000 ischemic stroke cases in the United States. Over $7 million would be saved in the United States for every 2% increase in tPA-treated stroke patients. Almost $37 million and $74

million would be saved by treating 10 and 20% of ischemic stroke patients, respectively" (p. 2502).

Misperceptions of Stroke

With the largest health awareness campaigns aimed at cancer and heart attack prevention, it should not be surprising when 1,000 Americans were asked what health threat they feared the most, only 10 Americans answered stroke. Yet 35 percent of those respondents knew someone of close relation who had suffered a stroke (Hachinski, 2002).

Stroke has a definite stereotype associated with its pathology. In a telephone survey, 73 percent of participants identified the brain as an organ of the body where a stroke occurs, yet almost 16 percent still perceived a stroke as a heart problem (Yoon, Heller, Levi, Wiggers, & Fitzgerald, 2001). Although risk does increase with age, it must be stressed that stroke can occur to anyone, at any time, of any age.

Incidence of stroke is increasing in the younger populations and therefore it can no longer be labeled "your grandfather's disease." Knowledge of stroke risk factors and warning signs are considered moderate at best among the general public. Reeves, Hogan, and Rafferty (2002) indicated that the largest gaps in stroke knowledge exist among those with the greatest risk.

Risk Factor Perceptions

Pancioli et al. (1998) conducted telephone interview surveys to assess current public knowledge of stroke warning signs and risk factors. The results of this study indicated 57 percent correctly listed at least one of the five stroke warning signs and 68 percent were able to name one correct risk factor. In regard to risk factors, 469 (57%) of

818 respondents with a history of high blood pressure reported high blood pressure, 402 (35%) of respondents who were current smokers reported smoking, and 32 (13%) of 255 respondents with diabetes, reported diabetes as a risk factor for stroke. Authors reported that self-reported risk factors did not demonstrate knowledge of stroke risk factors. The population at increased risk for stroke, men and African Americans, were least knowledgeable about stroke risk factors (Pancioli et al., 1998).

In a similarly designed study by Reeves et al. (2002), the stroke risk factors most commonly mentioned were hypertension (32%), smoking (29%), and physical inactivity (26%). Researchers found that age, race, sex, education, high blood pressure and smoking were predictors of poor risk factor knowledge. Pandian et al. (2005) found that "one hundred and ninety-five (20.7%) participants did not know a single risk factor. Only 482 (51.2%) individuals could name 1 risk factor correctly, 174 (18.5%) subjects knew 2 risk factors and only 91 (9.7%) of them could name 3 or more risk factors" (p. 644).

Research studies in the area of risk factor perception among the public consistently illustrate that persons who are most aware of and recognize their own increased risk for stroke are those persons most likely to participate in stroke prevention behaviors. Samsa et al. (1997) found less than half of patients at increased risk of stroke were aware of their risk and a smaller proportion (27%) remembered being informed of an increased risk by their physician. Characteristics of patients most aware of their own increased risk were younger, higher income and education; depressed, previous TIA, poor physical function, existence of limited daily activities, and claimed to be in poor health

status. It was also noted that less than half (42%) of those patients with a previous stroke were cognizant of their elevated risk for a recurrent stroke (Samsa et al., 1997).

In Yoon et al. (2001) 822 participants selected at random from an electronic telephone directory completed a telephone survey. The goal of this survey was to assess baseline knowledge regarding stroke risk factors, symptoms, treatment, and educational resources. "Of the respondents, 258 (31.4%) respondents had been told that they had high blood pressure (hypertension); 48 (5.8%), diabetes; 24 (2.9%), previous history of stroke; 35 (4.3%), angina; 206 (25.1%), high cholesterol; and 356 (43.3%), family history of stroke" (Yoon, 2001, p. 1927).

Similarly, when the American Heart Association surveyed the public as to what proactive steps individuals could take to prevent a stroke, "23% answered controlling high blood pressure, 18% said exercising regularly, and 17% mentioned eating healthy" (as cited in Hachinski, 2002, p. 1173). Therefore, if individuals do not perceive that they are at risk for stroke, significantly less are going to learn recognize the signs/symptoms of stroke and take the proactive steps to prevent it.

The perception of risk for stroke does not appear to differ across socio-demographic groups as illustrated by a randomized trial by Krueter and Strecher (1995). The public's perceived risk of heart attack; cancer, stroke, and motor vehicle crash were assessed and compared within health risk assessments. Of those with the greatest risk of stroke, 41 percent believed their risk to be less than normal. Women, younger patients, and those with the least formal education responded that their risk was low.

Individualized risk assessments were found to be effective in increasing perceived stroke risk.

A study highlighted by the Journal of Neurology, Neurosurgery and Psychiatry, found that not only did the public need more education about risk factors for stroke and the need for early treatment, but health professionals needed the education as well. This 160-person study found, that while nurses could list more stroke risk factors than the public, only 25 percent of nurses could name three or more risk factors. However the nurses' ability to list atrial fibrillation, diabetes, or previous history of stroke was no more than the other groups. The study also found that most of the public's knowledge of stroke did not come from their health services, but from personal or family experience (Carroll, Hobart, Fox, Teare, & Gibson, 2004).

Stroke Warning Sign Perceptions

Rapid recognition of stroke warning signs can mean the difference between life, death, and serious long-term disability due to stroke. "Patients' failure to recognize stroke symptoms and subsequent delay in presentation to the emergency department plays a critical role in the exclusion of potential r-TPA candidates" (Wein et al. 2000, p. 1925).

Yoon and Byles (2002) focus groups made up of half stroke survivors/family caregivers and half community individuals agreed that stroke warning signs are not easy to recognize and their lack of knowledge is one of the main reasons for the delay in early hospital presentation. Those experiencing a stroke confused their stroke symptoms with symptoms of migraine, food poisoning, and Meniere's disease. "Some did not identify their experience as stroke because the symptoms did not present as expected. Both groups

thought that they would not receive any medical attention for minor symptoms such as headache and dizziness" (p. 1065). In fact, a majority of participants revealed that they "waited until the next morning or after the weekend because they believed that the symptoms would go away soon" (p. 1065).

Reeves et al. (2002) found that while 69 percent of 2,500 respondents reported at least one correct warning sign of stroke, only 14 percent could name three warning signs. Sudden numbness or weakness was the most commonly reported warning sign, reported by 42% of respondents; while 30% reported sudden, slurred speech, disorientation, or difficulty understanding. Additionally, Reeves et al. (2002) found that "stroke knowledge was poorest among groups that have the highest risk of stroke" (p. 1547). Feldmann et al. (1993) emphasized that "despite their education level, regular health care, and risk factors, especially prior stroke and transient ischemic attack, these patients were not knowledgeable about stroke and delayed many hours before contacting physicians" (p. 1802).

"More than 75 percent of Americans cannot name the most common warning sign of stroke — sudden numbness or weakness of the face, arm or leg, especially on one side of the body — according to the American Stroke Association. Fewer than half of all individuals over 50 are actually aware of what stroke is, its signs and symptoms, and the importance of seeking immediate medical attention" ("Stroke Statistics," n.d., para. 3). In a Gallup poll, "only 58% of adults over age 50 could correctly name weakness, numbness or paralysis as major stroke symptoms. These data are consistent with a random

telephone survey by Dornan et al., who found that 43% of their adult sample were unable to name 1 warning sign stroke" (Stern, Berman, Thomas, & Klassen, 1999, p. 720).

"Similarly, studies by Kothari et al and Pancioli et al found that 39% of patients with acute stroke and 43% of the general population were unable to identify any stroke warning signs, and that most stroke patients and the general population had a very limited knowledge of stroke risk factors" (as cited in Stern, 1999, p. 720). The study by Kothari et al. (1997) showed 39 percent of patients unfamiliar with stroke signs and symptoms, and those patients over 65, who face the greatest risk, knew even less about brain attacks than other groups. Pandian and colleagues (2005) found that of their 942 subjects, less than 8% were able to identify other stroke symptoms besides paralysis of one side of the body.

Ironically, even people who have had a stroke do not always know the signs, symptoms, and risk factors related to their brain attack, according to researchers at the University of Cincinnati who found that nearly four of ten stroke patients surveyed in hospital emergency departments lacked basic knowledge of the signs, symptoms, or risk factors of a stroke. Participants enrolled in the clinical trial investigating control of risk factors among African Americans, reported inadequate awareness of control and treatment of stroke risk factors. While 73 percent of participants had been prescribed blood pressure medication, only 30 percent had blood pressure under 140/80 (Ruland, Raman, Chaturvadi, Leurgans, & Gorelick, 2003).

In a study of stroke knowledge among stroke support group members, Weltermann et al. (2000) reported 80 percent of stroke support group members familiar

with at least 2 stroke symptoms. In addition, 80 percent of support group members knew to seek immediate medical assistance, compared to only 78 percent of the general population and 41 percent of the senior population. Thus, in the first study of its kind, members of stroke support groups were found to be more knowledgeable about stroke.

There is not a single stroke symptom that stands out in the research as the most recognizable warning sign. Blurred and double vision or loss of vision in one eye was the most common stroke warning sign listed by Yoon et al. respondents, in comparison to Pancioli et al. who reported that the most common stroke warning signs listed by respondents were dizziness and numbness. Research by Kothari et al. indicated the most common stroke warning signs, as noted by the patient at the time of onset, were weakness and numbness (as cited in Yoon et al., 2001). In contrast to Kothari, Yoon's study (2001) found that few respondents would seek emergency care for dizziness and/or numbness.

Studies show that often respondents have difficulty differentiating between heart attacks and strokes; however knowledge of the organ involved in acute stroke was higher among men (Pandian, 2005). It is also common to find warning symptoms of heart attack such as "chest pain or chest tightness," associated with stroke warning signs (Yoon et al., 2001; Reeves et al., 2002; Pancioli, 1998). Yoon and Byles (2002) suggest that "this kind of confusion may be one cause for delay in presentation to hospital" (p. 1065).

Factors Leading to Activation of Emergency Medical Services

Activating Emergency Medical Services (EMS) through 911 has been shown to promote the best outcomes in hospital presentation. Presentation to the Emergency Department by EMS is associated with strikingly decreased pre-hospital and in-hospital

delays (Schroeder, Rosamond, Morris, Evenson, and Hinn, 2000; Morris, Rosamond, Madden, Schultz, and Hamilton, 2000). Wein et al. (2000) suggested the "activation of Emergency Medical Services (EMS) is the single most important factor in the rapid triage and treatment of acute stroke patients" (p. 1925). Therefore, persons who activate EMS via 911 present to the emergency department (ED) sooner than those who present to the ED via other forms of transportation (Kothari et al. 1999; Rosamond, Gorton, Hinn, Hohehaus, & Morris 1998; Schroeder et al., 2000; Williams, Bruno, Rouch, & Marriott, 1997).

Billings-Gagliardi and Mazor (2005) developed the Stroke Action Test (STAT) containing 21 items that describe stroke symptoms from the five groups of warning signs and 7 items that describe non-stroke symptoms. For each item, participants had to select 1 of 4 options including: "call 911," "call doctor," "wait 1 hour," and "wait 1 day." The results of the study indicated that the participants would "call 911" for only 34% of the stroke symptoms and "call doctor," more often than "call 911."

Derex, Adeleine, Nighoghossian, Honnorat, and Trouillas (2002) found that only 35 percent of stroke patients activated EMS and were transported via ambulance. Numerous studies have sought to identify what factors most influence individuals to call 911; activating an emergency response. The strongest characteristic noted by researchers is a sense of urgency. "People who perceive their symptoms (or the symptoms of someone around them) as serious and urgent are likely both to take quick action and to call 911" (Schroeder et al., 2000, p. 2591). In addition to a sense of urgency, results indicate other characteristics such as: severity and/or suddenness of symptoms, type of

stroke, and identification of problem by friends and family as the leading factors in activating EMS (Furlan, 2001; Rosamond et al., 1998; Schroeder et al., 2000; Mandelzweig, Goldbourt, Boyko, & Tanne, 2006). Mandelzweig et al. (2006) suggest that even more influential than reaction time is the extent of perceived control over symptoms and the possible role of personality traits, such as "high anxiety" in the decision to seek help.

Severity of Symptoms

Severity of symptoms has been shown to favor early hospital arrival, whereas milder, less visible symptoms result in delay (Smith et al., 2001). Milder, less visible symptoms may be attributed to other disease conditions. Interestingly, Kissela et al. (2001) found a majority of strokes among African Americans are often smaller with milder symptoms, which if applicable to the general population, may contribute to the low percentage of African Americans patients who present to the ED in time to be eligible for tPA.

In one of the first studies to investigate 911 calls in cases of acute stroke, researchers found that speech problems such as incoherent answers, limb weakness and disturbances in consciousness were the symptoms most often reported by callers. In 20 percent of the Handshu, Poppe, Raufs, Neundorfer, & Erbguth (2003) cases, a fall was often presented as the main reason for the 911 call and in the same percentage of calls the word "stroke" was mentioned by the callers; however dispatchers suspected stroke in only half of the calls. The authors note that "these symptoms which interfere with daily

activities may imply that something more serious is occurring to the person leading to the activation of EMS" (p. 1008).

Type of stroke is also strongly associated with EMS use. Schroeder and colleagues (2000) showed that "patients with hemorrhagic stroke were more likely to use EMS than were patients with ischemic stroke, and patients with either hemorrhagic or ischemic stroke were more likely to use EMS than those with TIA. This supports the theory that patients who use EMS have more severe symptoms than individuals not using EMS" (p. 2595).

Lacy, Suh, Bueno, and Kostis (1998) suggest that "a history of illness probably contributes to heightened awareness and recognition of stroke symptoms, prompting earlier pursuit of medical attention. Our data suggest that if patients realize that they are having a stroke or have symptoms comparable to previous experience, they seek medical treatment sooner" (p. 68). However, Schroeder et al. (2000) found "patients with greater knowledge and awareness of stroke and its symptoms were not more likely to use EMS. In fact, those with knowledge of stroke symptoms and who reported having previously received information about stroke symptoms were less likely to use EMS" (p. 2595).

Furlan explains that this failure to activate EMS could result from patients' awareness that they were not eligible for thrombolytic therapy such as tPA or if they were being transported to the ED via other transportation (2001). Schroeder et al. (2000) emphasized that "patients who arrived by ambulance had more severe strokes, 10 were older, more likely to be black, and more likely to have blood discernible on the initial CT" (p. 2591).

Identification of Problem by Friends and Family

Sense of urgency and severity of symptoms are not the only factors leading to activation of EMS. Schroeder et al. (2000) found "another strong predictor of EMS use was having someone other than the patient first identify that there was a problem" (p. 2593). Morris and colleagues (2000) indicated "patients alone at symptom onset had a median prehospital delay of 3.6 hours compared with 2.1 hours for those who were not alone" (p. 2587). Wein et al. (2000) supported the role of witnesses, in that it showed family members and spouses as the largest initiators of 911 calls for acute stroke, followed by paid caregivers and neighbors, colleagues and friends, with the latter group most often transporting acute stroke patients in their private cars. Kothari et al. (1999) found as many as 40 percent of stroke sufferers indicated that they did not choose to seek medical attention, rather a friend or family member made the decision; while Rosamond and colleagues (1998) indicated that delay from symptom onset to hospital presentation was less where a witness recognized that there was a problem.

Wein et al. (2000) found that individuals who were employed were less likely to have EMS activated, perhaps because those who are employed spend more time away from their family, the largest initiators of 911 calls. Half of men and Caucasians were specifically more likely to have a family member activate EMS. Pandian et al. (2005) indicated that "seventy-one percent of subjects reported that they would visit a hospital emergency department if they or one of their relatives experienced symptoms suggesting a stroke. Less than 1% of subjects thought that they would buy medicines from a shop instead of taking the person to the doctor" (p. 646).

Age Correlation

Studies have found a direct association between age and EMS use. Age has been found to be predictive of EMS use as older adults have been found to be more likely to use EMS than younger adults. (Yoon, 2001; Schroeder, 2000). Lacy et al. (2001) suggest "this may be related to the presence of organized retirement communities in the geographic areas studied. Another explanation is that older patients are more likely to perceive stroke symptoms as a serious occurrence based on personal experience or exposure to stroke patients in their communities" (p. 67).

Characteristics of Patient Delay

Many factors contribute to delays in seeking medical treatment; however, researchers attest that the principal factor is the lack of public knowledge regarding the warning signs of acute stroke. Williams et al. (1997) found that "71% did not profess to know the cause of their symptoms, and 29% thought their symptoms represented something else. In the late arrival group, the most common reason for delay in presentation was a lack of recognition of the seriousness of symptoms" (p. 913). Wester, Radberg, Lundgren, and Peltonen (1999) found that 44 percent of stroke and 48 percent of TIA patients among 329 participants did not recognize their first symptoms as stroke-related. Additionally, 24 percent of stroke and 20 percent of TIA patients in the study did not seek treatment within the first hour despite recognizing the first symptoms.

In a study by Handshu, Poppe, Raufs, Neundorfer, and Erbguth (2003) examining individuals admitted to the stroke unit via EMS Dispatch, the average time between onset of symptoms to EMS call was 38 minutes; however, less than 20 percent of 911 callers

mentioned stroke as the possible cause of the health problem. Dispatchers suspected a stroke in almost 52 percent of all calls and a high priority ambulance was sent in nearly 80 percent of all cases. It took an average of 12 minutes for the ambulance to arrive at the patient's home and 51 minutes on average to arrive at the hospital. The study suggests that " the infrequent use of the word 'stroke' is a hint for insufficient knowledge about stroke symptoms in the population of our study area, and the people calling for help in the previous work were probably younger and better educated" (p. 1009).

The effectiveness of stroke treatment is highly dependent on the amount of time lapsed between onset of symptoms and treatment. Lacy et al. (2001) state "early treatment is crucial in maximizing the benefit of stroke intervention. Effective thrombolytic therapy is dependent on timely intervention, and guidelines for use of recombinant tissue plasminogen activator recommend therapy within 3 hours after onset of stroke symptoms" (p. 63). Lacey and colleagues (2001) collected prospective data from ten hospitals of the Robert Wood Johnson Health System in New Jersey over a period of six months. A total of 553 patients presenting with signs and symptoms of acute stroke were studied. "Forty- six percent of patients arrived within 3 hours after onset of symptoms, and 61% arrived within 6 hours" (p. 65). The study found that "delays in arrival time were significantly associated with sex, race, transportation mode and history of cardiovascular disease" (p. 63).

Delays in acute stroke presentation are not improving according to national and international studies. "Those studies show that 25% to 59% of stroke patients arrived at the ED within three hours and 35% to 66% of patients arrived within 6 hours" (as cited in

Lacy et al., 2001, p. 67). Harraff et al. (2002) found that delay between symptoms and ED arrival was 6 hours. Delay for patients using EMS was 2 hours 3 minutes compared with 7 hours 12 minutes for those who presented to their primary care physician first.

Initial contact with a general practitioner was found to be a major determinant of delay among patients with acute stroke (Salisbury, Banks, Footit, Winner, & Reynolds, 1998). Studies have found that individuals living alone and being at home during onset of symptoms are more likely to call a family member or primary physician before contacting EMS (Smith et al., 1998). "Among patients who first contacted a physician, a greater proportion of men were referred immediately to the emergency department" (Mandelzweig et al., 2006, p.1252). During the Temple Foundation Stroke Project, researchers observed that roughly 25 percent of the total 429 initial calls were made to family members, friends, a personal physician, or an insurance provider before calling EMS (Wein et al., 2000). Handschu et al. (2003) added that " 41.1% of all callers were the patient's spouse; in 23.4% of the calls, other relatives placed the call; in 19.8%, neighbors, colleagues, or friends called; in 8.5%, a person not related to the patient placed the call; and in 7.1% of all calls, the patients themselves made the call. Mean age of callers was 53.4 years; 58.2% of them were female" (p. 1006).

Lacy and colleagues (2001) was among the first studies to examine determinants of delays in stroke presentation and evaluation. Of the few existing studies, many had been conducted in smaller geographical or rural areas, limiting applicability of results to urban areas. Tan, Chang, and Liou (2002) found delays greater than two hours to include "interhospital transfer, location of stroke onset, first aid at outpatient clinic and delayed

medical management due to unawareness of emergent medical help hinder the timely seeking medical attention" (p.460).

Rucker, Brennan, and Burstin (2001) found 71 percent of patients who delayed care thought their problem would go away or was not serious. Previous research demonstrates that acute stroke patients experiencing milder physical limitations such as paralysis, difficulty speaking, or difficulty recognizing or identifying objects are less likely to activate EMS. Ironically, persons with prior stroke were the least likely to activate 911, even after having history of a previous stroke (Wein et al., 2000).

Age, Race, and Gender Factors

Age, race, and gender issues are also important determinants of delays in arrival to the ED. Rucker et al. (2001) found that African Americans patients reported more delay, while older patients less delay in presenting to the ED. However, age remains a dividing issue in the results of existing studies. Individuals age 70 and older have been identified as more likely to delay in hospital presentation, while other studies identify individuals ages 65-74 as more likely to arrive sooner than those younger (Lacy et al., 2001).

Ethnicity has shown to be a strong predicting factor in delayed ED arrival. Studies have shown African Americans and Hispanic Americans are less likely to utilize EMS than whites. Hispanic Americans have the longest delay time to arrive at the emergency department, followed by African Americans who took longer than whites (Menon, Pandey, & Morgenstern, 1998; Lacy et al., 2001). Zweifler, Lyden, Taft, Kelly, and Rothrock's small study reported "only 53% of blacks (compared with 73% of both

Mexican Americans and whites) reached medical attention within 24 hours of stroke onset" (1995, p. 247). In the Smith et al. Minnesota Stroke Survey (1998), an Asian American sample, although small, had a significantly longer delay than whites. Smith and colleagues suggest longer delays among racial groups may be attributable to cultural factors or the lack of established care provider.

In their study of race/ethnicity and stroke mortality, Wein, Smith, and Morgenstern (1999) found that language barriers, beliefs regarding the impact of illness, and individuals not feeling entitled to use the healthcare system are all issues of acculturation found more frequently among African Americans (AAs) and Hispanic Americans (HAs) than non Hispanic whites (NHWs). Issues such as education level, socioeconomic status, health insurance, and availability of regional health care could also influence whether individuals will present to the hospital, their primary care physician, or not present to the hospital for stroke care. Wein et al. (1999) noted that Hispanic Americans "are likely to identify themselves as being from another country and do not embrace the culture and language of the United States, which results in an under utilization or even lack of awareness of healthcare resources, namely, social and preventative health services" (p. 1503).

In Texas, Wein (1999) found 30% of HAs, 25% of AAs, and 10% of NHWs did not have health insurance. "Language barriers may also result in an underutilization or even a lack of awareness of healthcare resources. Monolingual HAs have been documented to be less likely to have a usual source of health care or seek preventative healthcare treatment when compared with bilingual HA who tend to be more

acculturated. Differing beliefs regarding the impact of an illness will also influence the need to present to the health care system" (p. 1503).

Prior investigation suggests that gender does not play an important role in arrival time to the ED. However, there is significant debate associated with females having a longer delay time. Menon (1998) stated that besides Hispanic Americans, "women have a relatively longer delay to hospital presentation" (p. 428). Mandelzweig et al. (2006) reported "being a woman was associated with a 3-fold risk of delay in reaching the hospital" and "although fatigue was associated with delay in both sexes, perceived control of symptoms was associated with a >5-fold risk of delay in women" (p. 1252).

CHAPTER 3

SUMMARY AND RECOMMENDATIONS

The tremendous need for educational efforts to increase the knowledge of stroke risk factors and the recognition of stroke symptoms has been sufficiently illustrated in the research gathered in this paper. The public's lack of knowledge in recognizing warning symptoms, the underutilization of 911 and EMS, and the delays in seeking treatment for stroke are all well-documented factors in the effective treatment of acute stroke. Improving the spectrum of stroke prevention, knowledge and treatment requires a multi-faceted approach.

Recommendations for Community Educators

Community education is greatly needed to increase recognition and promote prevention of stroke, especially among those at increased risk. The largest individual barriers to effective acute stroke therapy are the inability of the public to recognize stroke symptoms, especially in the non-elderly population, and to quickly activate the emergency medical system (Schneider et al., 2003). Many stroke awareness programs currently exist through organizations such as the American Stroke Association (a division of the American Heart Association), National Stroke Association, Centers for Disease Control (CDC), and the National Institute of Health's Heart, Lung and Blood Institute. The long lasting impact of public education and screenings remain debatable, therefore illustrating the complexities of health promotion for risk factor modification (McPherson & Kersten, 2004).

Suggested Strategies for Community Education

Many people think of community education as the dissemination of free brochures and health screenings, however newer and more proven methods are being developed integrating media, culturally sensitive messaging, and educational interventions. While community stroke screenings are a commonly used strategy to improve recognition or warning signs and risk factors, there is no evidence that such screenings modify health behaviors and often instead attract a highly motivated older population (DeLemos, Atkinson, Croopnick, Wentworth, & Akins, 2003).

Media awareness and educational intervention campaigns have been shown to increase knowledge of risk factors, warning signs, and actions similarly across all ages, sexes, and levels of education, in racially diverse populations.

Television advertising has been found to be effective in reaching mass audiences. Television advertising has also been associated with increasing knowledge of stroke warning signs and lead to a significant increase in ED visits for stroke (Hodgson, Lindsay, & Rubini, 2007). Hachinski (2002) cites "continuous television advertising over 46 weeks in Canada raised the awareness of 2 or more warning symptoms of stroke, from 36% to 62%" (p. 1173). Dornan and Johns (1998) found hospital arrival time decreased significantly following an extensive community stroke awareness campaign including media appearances by local stroke experts, newspaper articles, and public service announcements.

Alberts, Perry, Dawson, and Bartels (1992) noted that 139 of 159 (86%) patients with stroke presented to hospital within 24 hours of symptom onset after media

interviews on television and radio, newspaper articles and lectures, compared to 70 of 187 (37%) prior to educational campaign. A similar intervention program revealed that more than 90 percent of residents were influenced through flyers and bulletins on stroke lectures aimed at patients with high blood pressure. In addition, programming encouraged all residents to limit salt intake, exercise more, quit smoking, and refrain from alcohol. Risk of death from stroke was shown to be 26 percent lower among the intervention community ("Community Intervention," 2004).

Media awareness does not have to require TV, radio, or print channels, but includes use of technology products such as video, Internet, DVD, or CD Rom. Stern (1999) suggests short programs may be equally successful when used as stand alone tools or accompanied by discussion through a trained facilitator. "Slide/audio programs are inexpensive, easily disseminated, and not dependent on the availability of trained volunteers" (p. 723). Similar interactive computer programs and internet-based patient education program have also shown promise ("Keen ER Identification," 2002).

Current interactive products, such as *Stroke: When Minutes Matter* and *Know Stroke* are readily available through American Heart Association and the National Institute of Neurological Disorders and Stroke, and should be utilized in face-to-face programming among assisted living and retirement communities, senior centers, and cardiac rehabilitation centers, targeting those who are African American, hypertensive, diabetic, and/or senior citizens. Both products are led by a facilitator and include posters, bookmarks and a video or DVD.

In 1997, the American Heart Association developed the "Search Your Heart" program aimed to overcome cultural barriers by providing direct cardiovascular disease and stroke prevention education targeting the African American and Latino/Hispanic communities. "We're reaching out to communities of color through faith-based organizations because, historically, churches have served two key roles -- they've been the voice of the community, and they've been the cultural center. People trust their churches for information, and they look to their spiritual leaders who can help to impact both their spiritual and physical well-being" ("Communities of Color," 2004, para. 3). The Search Your Heart program also requires a peer facilitator who plans and promotes awareness activities within the faith-based site.

"Search Your Heart is valuable to communities of color because it facilitates targeting high-risk groups, and it does so in a non-threatening environment and from a trusted community resource" (para. 8). Each facilitator is provided with a Search Your Heart kit, which includes fact sheets on cardiovascular disease, stroke, nutrition, exercise, etc.; step-by-step directions for planning a blood pressure and/or stroke screening; pre and post test surveys; and promotional materials

The review of literature also led to the recommendation for program goals to target high risk populations whose behaviors could have the largest impact on the incidence of stroke. Community intervention programs should be developed and/or utilized for the following:

1. Correlating risk factors (smoking, heart disease, hypertension, TIAs, diabetes, and atrial fibrillation) with stroke.

2. Increasing the knowledge and urgency of stroke warning signs
3. Reinforcing the activation of local 911 and EMS systems

Community intervention programs should target the following individuals:

- African Americans
- Diabetics
- Those with family and/or personal history of stroke
- Hypertensives
- Those age 75 years or older

Family members of patients at increased risk for stroke have the ability to create the supportive environment for preventive behavior change as well as being the key initiators of symptom recognition and emergency medical systems activation. Welterman et al. (2000) found in many regions, stroke support groups are key promoters of stroke awareness and education.

Community and public educators should be encouraged to initiate partnerships with organizations having related goals and objectives. Dornan et al. (1998) suggest positive outcomes from public messages that are short, straight forward, and fluid. Welterman et al. (2000) emphasize that such initiatives and resources should be done in collaboration with partners, not in replication (2000).

Recommendations for Healthcare Providers

"Stroke is unique among neurological diseases, since it has a high prevalence and burden of illness, high economic cost, and it is preventable" (Gorelick, 1994, p. 220). Healthcare providers must understand and develop their role as stroke educators within

their patient settings to promote prevention. Experts agree; prevention education should begin with hypertension and tobacco use, the two leading contributors to stroke risk and therefore the two that could most substantially reduce the rate of stroke (Gorelick et al., 1994).

Members of the National Stroke Association's Stroke Advisory Board and Cedars-Sinai Health System Department of Health Services Research identified six key stroke risk factors (high blood pressure, heart attack, atrial fibrillation, diabetes, high cholesterol, and coronary artery disease), and four lifestyle factors (smoking, alcohol use, physical activity, and diet), with an emphasis on high blood pressure, as the largest indicators of stroke. Observational studies support the role of modifying lifestyle-risk factors in stroke prevention. Measures that assist patients to improve adherence rates (i.e. blood pressure control, diabetes management) are critical to a successful stroke prevention plan (Gorelick et al., 1999).

Healthcare providers constructing stroke prevention communication need to be aware that patients often misunderstand risk, underestimate their own personal risk and assume invincibility. Hachinski (2002) notes that "73% of respondents with stroke experience said that their doctors had not discussed risk factors with them" (p. 1173). Samsa et al. (1997) offers two possible explanations for why so few patients are aware of their increased risk: "(1) this information is being transmitted inadequately by the providers and (2) this information is being received by the patient but is not being retained or believed. While health professionals can control only how stroke prevention messages are transmitted, in doing do it is important to be aware of the cognitive and

psychological aspects of the patients who are the intended audience. For example, when designing stroke prevention messages it should be recognized that patients tend to misunderstand risk, tend to underestimate their risk for stroke, and assume that adverse events will not happen to them" (p. 919).

Suggested Strategies for Clinical Educators and Healthcare Providers

Clinical educators and healthcare providers (i.e., physicians, physician assistants, nurse practitioners, nurses, etc.) should be the key initiators of stroke prevention education in the clinical setting. Effective communication between health care provider and patient is the first step in achieving successful outcomes and avoiding adverse events. If patients do not recall being told they are at increased risk, they are certainly not going to recall ways to prevent a stroke.

Samsa and colleagues (1997) suggest that healthcare providers play the main communicator role in the education of all patients regarding risk prevention, encouraging patient feedback and targeting those at-risk patients least aware of their increased risk. Providers might develop various educational strategies contingent on the symptom status. Strategies for stroke patients might concentrate on the preceding stroke as a warning of impending stroke and strategies for patients with no known history of stroke symptoms, might concentrate on the patient's vulnerability for stroke. In addition, authors suggest that "it is important to solicit feedback regarding what the patient actually understands and believes" (p. 920).

According to a study in Stroke: Journal of the American Heart Association, "teachable moments" should be explored for implementation in emergency departments.

Scott et al. (2002) found that patients with atrial fibrillation (a risk factor for stroke) are often treated in the ER. Because irregular heart rhythms such as atrial fibrillation (AF) make people more vulnerable for a stroke, treatments initiated in the ER with blood thinning agents can reduce the risk of stroke in those with atrial fibrillation by almost 70 percent. "Current estimates suggest 40,000 strokes could be prevented each year by fully implementing American Heart Association recommended guidelines on AF" ("Keen ER Identification," 2002, para. 6).

The National Stroke Association states 80 percent of strokes are preventable, which equates to 600,000 strokes that could be prevented ("What is Stroke?" 2007). Almost one-third of the 700,000 strokes that occur each year are recurrent strokes. Due to an aging population the number of new and recurrent strokes is projected to increase to almost one million annually by 2050 ("New Guidelines," 2006). Because stroke is largely preventable, especially secondary strokes, the American Stroke Association developed a web-based quality improvement program called Get with the Guidelines-Stroke (GWTG-Stroke). The focus is on protocols for ensuring patients are treated and discharged with timely and appropriate medications, risk modification counseling, offered free continuing medical education (CME) credit, and ensure effective communication between hospital care and the primary care setting. In 2006, 118 national hospitals received performance awards for their use of Get with the Guidelines-Stroke. ("Get With the Guidelines-Stroke," 2007).

Stroke Education among Primary Care Physicians

Primary care physicians should be considered the front lines of stroke care in the United States. Shi, Macinko, Starfield, Xu, and Politzer (2003) indicate that more primary care physicians may result in fewer stroke deaths. Authors found that the average "the presence of primary care is associated with improvements in health and reductions in stroke death over time, despite worsening economics or lower levels of education" (para. 7). Therefore, the study suggests that primary care prevention may serve as an effective strategy for combating stroke mortality and reducing the adverse impact of income inequality on health, especially in rural areas.

While the quantity of Primary Care practices may be beneficial to reducing stroke incidence, the quality of Primary Care of stroke has been deemed "mediocre." According to Brass (2004), "there appears to be a 'knowledge gap' between established treatment guidelines and clinical practice in the areas of primary and secondary stoke prevention, but it is hoped that continued education will help physicians and health care organizations build systems of care that incorporate evidence-based guidelines into their clinical routines" (para. 2).

According to a Duke University Medical Study, one-third of patients were not hospitalized or prescribed any specialized tests by their primary care physician (PCP) within 30 days of their first visit after complaining of symptoms characteristic of stroke or a mini-stroke. In only 45 percent of these cases did the PCP call for a specialist. In addition, specialized imaging studies to determine blockages in vessels or heart rhythm abnormalities were under-utilized by PCPs. Only 21 percent of TIA and 35 percent of

stroke patients received appropriate imaging scans on their first visit. To best test for atrial fibrillation, known to cause clots that can then travel to the brain and cause TIAs or stroke, PCPs ordered electrocardiograms in 19 percent of cases and echocardiograms in 16 percent of cases. The results of this study indicate that Primary Care Physicians often do not take additional actions that could prevent future strokes ("Primary Care Physicians," 2004).

Since primary care physicians provide the majority of secondary stroke prevention, there is an inherent need to encourage compliance with published guidelines for secondary stroke prevention. "The National Committee for Quality Assurance (NCQA) and the American Heart Association/ American Stroke Association joined forces to create a new program that recognizes primary care physicians and others who care for patients with cardiovascular disease and stroke. The Heart/Stroke Recognition Program assesses physicians based on five performance standards for managing patients' health" ("Heart/Stroke Recognized Physicians," 2007, para. 1). The five performance standards include: blood pressure control, complete lipid profile, LDL cholesterol control, use of aspirin or another antithrombotic, and smoking status and smoking cessation advice or treatment. "Physicians who meet the specific performance criteria in these areas will be recognized in national health plan directories. In the future, these types of programs may be associated with "pay-for-performance," with increased reimbursement for recognized physicians" ("American Academy of Family Physicians," n.d., para 18).

Many healthcare providers agree, if we are going to reduce the public health burden of stroke, it is going to have to be a team approach. Although neurologists are specialists

in the area of stroke care, neurologists only see about 10 percent of all acute stroke patients in the U.S. and only a third of stroke patients see a neurologist at any point during their course. "Neurologists may be thought leaders and local champions in many communities, but we have to get the primary care physicians to think of stroke as their disease" (Brass, 2004, para. 15). Brass suggests neurologists "may be able to set up in partnerships with primary care provider systems to ensure that limitations and gaps in stroke care don't occur. If change is going to occur, it will be primarily through primary care" (para. 15).

Stroke Education among Medical Students

Ensuring a future of healthcare providers skilled in stroke prevention and risk factor management begins in medical school. "Medical school provides a unique opportunity to reach all future physicians and to ensure that all have at least a minimal knowledge about stroke, regardless of their future specialty. This is important because general internists, family practitioners, emergency physicians, cardiologists (and other medical specialists), surgeons, obstetricians and gynecologists, as well as neurologists, all have opportunities to provide effective stroke prevention, patient education, and treatment interventions" (Billings-Gagliardi et al., 2001, p. 2854).

Alberts (1995) showed that the content and depth of content of stroke curricula for medical students differs from one medical institution to another among the 31 medical schools in the US and Canada who participated in the survey. Almost 40 percent of medical schools did not have a required neurology rotation for medical students and during a typical clinical rotation medical students receive an average of 3.3 hours of

didactic teaching and 9.8 hours of clinical teaching on stroke. Additionally, most internal medicine programs surveyed were especially lacking specific stroke education curriculum and practicums. Billings-Gagliardi and colleagues (2001) who introduced stroke curricula to first year medical students, found that students more than doubled their overall stroke knowledge scores and sustained knowledge eight months later. Some students were even found to immediately incorporate stroke prevention into patient encounters.

Suggested Strategies for Dispatchers and Emergency Medical Technicians (EMTs)

Significant emphasis is being placed on public education regarding stroke recognition and the need for rapid response to stroke symptoms. Much emphasis is also being placed on additional stroke education for primary care physicians and medical students, who are most likely to encounter patients with acute stroke or TIAs. However, 911 dispatchers, Emergency Medical Dispatchers (EMD), and Emergency Medical Technicians (EMTs) are among the most critical links in the chain of stroke survival.

Emergency dispatchers are the providers who serve as an interface between the medical establishment and the general public, while more than 800,000 EMTs deliver care to persons who call for assistance. These providers have various education levels, employment circumstances, and practice situations.

Porteous, Corry, and Smith (1999) found medical dispatchers to have a poor recognition of stroke. A review of 911 calls of patients treated for stroke or TIA at two urban San Francisco hospitals showed that of the 61 calls evaluated, dispatchers recognized stroke only 31 percent of the time. In 51 percent of calls, the caller used the

word "stroke" without prompting, yet the dispatcher coded the call as stroke in fewer than half of those calls. In 59% of these calls, EMS was sent as low priority response.

Crocco's Dispatcher Survey (2004) suggests four criteria correctly predicted as many as 80 percent of stroke calls: *weakness, facial droop, impaired communication*, and *use of word 'stroke.'* When dispatchers recognize possible stroke criteria, they are able to indicate the need for a priority response (lights and/or sirens), appropriate personnel (paramedic vs. EMT-Basic), level of care sent, and shorter prehospital times. In addition, Dr. Crocco advocates the "improvement of dispatcher education of stroke, development of dispatch algorithms for stroke and evaluation of impact on prehospital times" (T. Crocco, presentation, April 14, 2006).

The National Stroke Association *Stroke Rapid Response Project: An Interim Report* (2006) suggests that "it is possible to impact and improve this knowledge deficit among 911 dispatchers/communicators and EMS personnel through a staged educational initiative. By identifying local stroke advocates to deliver didactic sessions and by providing future trainers with educational materials, large numbers of field personnel can be better educated and sustain that knowledge over time" (p. 5).

Proceedings of a National Symposium on Rapid Identification and Treatment of Acute Stroke (1996) made the following four recommendations to improve prehospital emergency care of stroke:

1. Stroke management should be re-prioritized in EMS systems as a time-dependent, urgent medical emergency, just as is currently stressed for major trauma and acute myocardial infarction; 2. A *Chain of Recovery* should be ensured in each community

and emphasized with educational initiatives in order to optimize the chances of recovery for stroke patients; 3. New educational initiatives should be developed and widely promulgated, as applicable, for each of the various persons constituting the respective links in the *Chain of Recovery*: (a) the public at large; (b) EMS dispatchers; (c) first-responder crews; (d) basic and advanced life-support ambulance/response crews; and (e) receiving facility personnel, including emergency department (ED) staff members and neurological disease specialists; 4. Task forces should be created to: (a) help develop model educational initiatives for each of the respective links; and (b) develop standardized data sets to help ensure more effective research and outcomes analyses. (para. 2)

National and State Level Recommendations

There are many proactive avenues that health professionals, the general public, and survivors may take in the promotion, prevention, and treatment of stroke. On the national and state level, individuals can become grassroots advocates or partners in the writing of national action plans, such as *Healthy People 2010* and the state plan, known as *Healthy Iowans 2010.*

"*Healthy People 2010* is a set of health objectives for the Nation to achieve over the first decade of the new century. It can be used by many different people, States, communities, professional organizations, and others to help them develop programs to improve health" ("What is Healthy People 2010," n.d., para. 1). The United States Department of Health and Human Services explains that "*Healthy People 2010* builds on initiatives pursued over the past two decades. The 1979 Surgeon General's Report,

Healthy People, and *Healthy People 2000: National Health Promotion and Disease Prevention Objectives* both established national health objectives and served as the basis for the development of State and community plans. Like its predecessors, *Healthy People 2010* was developed through a broad consultation process, built on the best scientific knowledge, and designed to measure programs over time" ("What is Healthy People 2010," n.d., para. 2).

Originally in *Healthy People 2010*, objectives were written to improve patient knowledge of early warning signs for stroke (objective 12-2), and acute heart attack (MI). However, additional objectives, establishing the importance of calling 911 and increasing the proportion of eligible patients who receive thrombolytic therapy within one hour of symptom onset, were written for MI without corresponding objectives for stroke (Evenson et al., 2001).

Proof that even at the national level, lack of support exists for stroke. Therefore, recommendations are that organized groups advocate for the inclusion of stroke objectives, both at a national level and at a state level, such as *Healthy Iowans 2010*

On the state level, "*Healthy Iowans 2010* serves as a road map for improving the health of Iowans. The *Healthy Iowans 2010* database spreadsheet, containing core data for measuring goals in the state health plan, can serve as a convenient source of information on chapter goals. The chapter goals are broken down by health indicators, age, race, and gender groups, baseline, numerator, denominator, measure of frequency, crude/adjusted rates, periodicity of collection/calculation, county level data, and cross references to goals in other chapters. *Healthy Iowans 2010* was developed by more than

500 Iowans from 238 organizations, in coordination by the Iowa Department of Public Health. The 300-page document consists of 23 chapters covering topics from access to quality health services to violent and abusive behavior. Each chapter has measurable goals with specific action steps to be accomplished within specific time frames ("Healthy Iowans 2010 Database," n.d., para. 1).

Stroke was included in the *Healthy Iowans 2010* chapter formerly dedicated solely to cardiovascular disease for the first time in 2005. Stroke goals and action steps written into the state's action plan will lend critical support to state cardiovascular and stroke applications submitted by the Iowa Department of Public Health to the Centers for Disease Control (CDC) for federal grants.

This addition, could lead to $500,000 dollars the first year and a million dollars the following year for community stroke intervention programs and professional education. The U.S. Congress approved funding for CDC to initiate heart disease and stroke prevention programs for approved states in 1998. In 2006, the CDC supported programs in 32 states and the District of Columbia: 19 as capacity building programs and 14 as basic implementation programs. Additionally, four state-based stroke registries were added. ("National Stroke Awareness Month," 2007). In 2007, 49 states applied, including Iowa for the first time.

SUMMARY

Stroke remains the third leading cause of death in the United States and the leading cause of disability. An estimated 700,000 Americans will suffer a stroke in 2007, and that number is expected to increase to one million strokes annually by 2050.

The United States has experienced a decline in stroke mortality, however hospitalizations are increasing. For every minute's delay in receiving stroke treatment, 1.9 million neurons die, leaving survivors with brain damage and increased disability. The estimated cost of health care and lost productivity due to stroke is projected to reach $63 billion in 2007.

Although tPA has shown to be an effective treatment of ischemic stroke and remains the only stroke treatment approved by the FDA to date, most stroke patients lack or deny stroke symptom recognition, leading to a delay in seeking medical attention. The window of treatment for use of tPA remains three hours, therefore patients who do not seek prompt medical attention are often deemed ineligible for the treatment. Only 3-4 percent of ischemic stroke patients currently receive tPA, however over $7 million could be saved in the U.S. for every 2 percent increase in tPA-treated stroke patients.

Certain demographics have been found to have an increased risk of stroke. For those individuals age 55 and older, the incidence of stroke doubles each decade of age. More women than men are suffering and dying from stroke. Along with women, African Americans are twice as likely to die from stroke, especially African American women. Mexican/Hispanic Americans also have a higher incidence of stroke and the longest delay time to arrive at the emergency room.

Only 1 percent of the American population worries about stroke and even fewer know how to prevent it. Modifiable risk factors include high blood pressure, diabetes, high cholesterol, smoking, second hand smoke exposure, obesity, physical inactivity, atrial fibrillation, carotid artery stenosis, alcohol abuse, chronic stress and transient ischemic strokes (TIAs). Unmodifiable risk factors include age, gender, family history, ethnicity, and previous history of stroke or heart attack. Unfortunately, studies indicate 32 percent of the general public and 43 percent of stroke survivors do not know any of the risk factors for stroke. Eighty percent of strokes are preventable, which means up to 600,000 strokes that could have been prevented each year if people just took simple measures such as controlling their high blood pressure.

Stroke symptoms occur suddenly and without known cause. The five most common symptoms of stroke are: sudden numbness or weakness of the face, arms, or legs; sudden confusion or trouble speaking or understanding others; sudden trouble seeing in one or both eyes; sudden trouble walking, dizziness, or loss of balance or coordination; and sudden severe headache with no known cause. Forty-three percent of the general public and 39 percent of stroke survivors do not know any of the signs and symptoms of stroke. Therefore, knowledge of stroke symptoms is predictive of early hospital arrival.

The activation of EMS through 911 has shown the best outcomes in hospital presentation, such as decreased pre-hospital and in-hospital delay. While a sense of urgency appeared to be the strongest contributor to EMS activation, severity and/or

suddenness of symptoms, type of stroke, and identification of symptoms by friends/family or co workers also significantly contributed to activation of EMS.

While educational resources do exist for medical professionals, many medical professionals do not utilize those resources most effectively to benefit the stroke patient and their family. Both medical school students and 911 dispatchers have been shown to have great potential to improve the scope of stroke care. However, both types of professionals often receive inadequate training in stroke.

Primary care physicians, on the front lines of stroke care, have been shown to dramatically affect the mortality of stroke, and need improved communication processes between their primary care settings and neurology to ensure a streamlined process of care. However, through the use of such programs as "Get with the Guidelines-Stroke," progress is being made toward improving the stroke systems of care in the areas of primary and secondary prevention, as well as in acute care.

Community intervention programs should be developed to: 1) correlate risk factors (smoking, heart disease, hypertension, TIAs, diabetes, and atrial fibrillation) with stroke, 2) increase the knowledge and urgency of stroke warning signs, and 3) reinforce the activation of local 911 and EMS systems. Community intervention programs should target the following groups who are at a higher risk for stroke: African Americans, diabetics, those with a family and/or personal stroke history, family members of patients at increased risk for stroke, hypertensives, and those age 55 years or older.

Community and medical educators should focus their efforts on delivering a simplified message, which is culturally sensitive, repetitive, and illustrates cost and

rewards. In particular, a growing body of evidence shows that use of mass media, such as TV advertising can change awareness, knowledge and even behavior, if messages have a single and clear message with prolonged exposure. In the case of stroke, directing public awareness to the critical link between recognizing stroke symptoms and calling 911.

In short, positive outcomes in stroke are attributable to knowledge of stroke risk factors, quick recognition of stroke symptoms, 911 and emergency medical system activation. Thus, the need for educational campaigns and effective programming to improve the public's recognition of the symptoms of stroke and the urgency in seeking prompt medical attention is critical to increased treatment by tPA and decreased disability.

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APPENDIX A

Professional Stroke Resources for Health Professionals

Ask Your Doctor (AYD) Program- provides primary care physicians with the knowledge and materials necessary to facilitate dialogue with patients about stroke prevention, treatment and rehabilitation (National Stroke Association)

Get with the Guidelines: Stroke- quality improvement program for acute stroke treatment and ischemic stroke prevention (American Stroke Association)

Improving the Management of TIA to Prevent Stroke - Archived Audio Webcast (National Stroke Association)

JCAHO Primary Stroke Center Certification Program- first nationwide stroke center certification program for hospitals (American Stroke Association and Joint Commission on Accreditation of Healthcare Organization).

Journal of Stroke and Cerebrovascular Diseases- multidisciplinary, bi-monthly clinical journal devoted to all aspects of stroke (National Stroke Association)

NIH Stroke Scale Training Online- National Institutes of Health free online stroke scale for continuing education credit (American Stroke Association)

Stroke: Clinical Updates- bi-monthly newsletter for stroke clinicians and is a benefit of National Stroke Association's professional membership program (National Stroke Association)

Stroke Connection Magazine- bi-monthly publication for in-depth information on conditions such as aphasia, central pain, high blood pressure and depression, to tips for daily living from healthcare professionals and other stroke survivors (American Stroke Association)

Stroke Council- The mission of the Stroke Council is to foster excellence in stroke research and education and to achieve the objectives of the American Stroke Association in stroke research, treatment and prevention (American Stroke Association)

Stroke Rapid Response- train-the-trainer program to be used by EMS educators to train EMS professionals to accurately identify and expedite delivery of stroke patients (National Stroke Association)

Stroke Smart Magazine- bi-monthly publication for stroke survivors and their families, caregivers and stroke care professionals (National Stroke Association)

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Books

A Stroke In Time, Frances Nemtin

After a Stroke: A Support Book for Patients, Caregivers, Families and Friends, Carol Burton, Geoffery A. Donnan

After a Stroke: Enhancing the Quality of Life, Wallace Pife

After the Stroke: Coping with America's Third Leading Cause of Death, Evelyn P.

Body Awareness As Healing Therapy: The Case of Nora, Moshe Feldenkrais

Cracking Up: Nice Day for Brain Hemorrhage, Peter Swet, Florence Weiner, Matthew H.M. Lee & Harriet Bell

Brain Attack: Danger, Chaos, Opportunity Empowerment, Perez, P. Johnson,

How to Conquer the World with One Hand...and an Attitude, Stephanie Minsch, Paul E. Berger

Living With Stroke: A Guide for Families Help and New Hope for All Those Touched by Stroke, Richard C. Senelick, MD; Peter W. Rossi, MD & Karla Doughtery

Living With Stroke: A Guide for Families, Richard C. Senelick, Peter W. Rossi & Karla Doughtery

Look Up for Yes, Julia Tavalaro, Richard Tayson,

My Stroke Insight: A Brain Scientist's Personal Journey, Jill Bolte Taylor

My Year Off: Recovering Life After a Stroke, Robert McCrum

Oh My Gosh! I Had a Stroke! Booklet for Stroke Survivors, JackQue McKinney Day

Oh My Gosh! I Had a Stroke! Booklet for the Families, Friends and Caregivers of Stroke Survivors, JackQue McKinney Day

One-Handed in a Two-Handed World, Tommye K. Mayer

Recovering At Home After a Stroke, a Practical Guide for You & Your Family, Florence Weiner, Matthew H.M. Lee & Harriet Bell

Return to Ithaca, Barbara Newborn

Slow Dance: Story of Stroke, Love, and Disability, Bonnie Sherr Klein, Persimmon Blackbridge

Speechless: My Recovery from Stroke, Jennifer Gordon

The Best of Stroke Connection Magazine: A collection of personal stories by stroke survivors and care givers, complied by American Stroke Association

The Diving Bell and the Butterfly, Jean Dominique Bauby

The Enabling Garden: A Guide to Lifelong Gardening, Gener Rothert, Laurie Noffs (Illustrator)

The Family Guide to Surviving Stroke and Communication Disorders, Dennis Tanner

The Shattered Mind: The Prism After Brain Damage, Howard Gardner

The Stroke Recovery Book, Kip Burkman

When Someone You Loves Has a Stroke, Marilynn Larkin, Lynn Sonberg Gonzalez, R.G., Hirsch, J.A. Koroshetz, W.J. & Schaefer, L.P.

Stein, J. *Stroke and New Family: A New Guide.* Cambridge, Massachucetts; London, England.

Wall, B. *The Long Gray Tunnel: A True Story of Crisis, Spirit and Recovery.* Austin, Texas

World Wide Web

http://www.americanheart.org	American Heart Association
http://www.americanheart.org/statistics	Heart Disease and Stroke Statistics – 2005 Update
http://www.strokeassociation.org	American Stroke Association
http://www.stroke-site.org	Brain Attack Coalition
http://www.cdc.gov/cvh/maps	Centers for Disease Control
http://www.stroke-tia.com	Educational Resource on Stroke and TIA
http://www.healthypeople.gov	Healthy People
http://www.thegoddessfund.org	H.K. Goddess Fund- Stroke Research in Women
http://www.strokecenter.org	Internet Stroke Center-Washington University
http://www.mayoclinic.com/health/stroke	Mayo Clinic Cerebrovascular Dis: Stroke Education
http://www.nlm.nih.gov/medlineplus/stroke	Medline- Stroke
http://www.nhlbi.nih.gov	National Heart, Lung & Blood Institute

http://www.ninds.nih.gov	Nat. Inst. of Neurological Dis. & Stroke
http://www.stroke.org	National Stroke Association
http://www.stanfordhospital.com	Stanford Hospital & Clinics- Stanford Univ. Medical Center
http://www.theuniversityhospital.com/stroke	Stroke Center at The University Hospital
http://www.healthsystem.virginia.edu	University of Virginia Health System

Healthcare Professional Organizations

http://aan.com/professionals	American Academy of Neurology
http://www.aapmr.org	Am. Academy of Phy. Med. and Rehabilitation
http://www.aapa.org	American Academy of Physician Assistants
http://www.aann.org	American Association of Neuroscience Nurses
http://www.aans.org	American Association of Neurological Surgeons
http://www.asitn.org	Am Soc of Intervent. & Thera. Neuroradiology
http://www.asnweb.org	American Society of Neuroimaging
http://www.vascularweb.org	Joint Societies of Vascular Surgery