

IMPROVING RECOGNITION AND RESPONSE TO THE ONSET OF STROKE

Stroke is a significant cause of morbidity, disability, and death in the United States. On an annual basis, 610 000 Americans experience a new stroke and 85 000 suffer recurrent stroke. In the United States, on average, someone has a stroke every 40 seconds and someone dies from stroke every 4 minutes.¹ Stroke accounts for 1 of every 18 deaths, claiming 130 000 American lives each year and ranking as the third leading cause of death in the United States.²

Some 87% of all strokes are ischemic in origin and the remainder are hemorrhagic.¹ Although hypertension is the most significant risk factor for stroke, atrial fibrillation and smoking contribute substantially to that risk.³ Those fortunate to survive the acute phase of stroke may then be subjected to its legacy as the single greatest contributor to long-term disability in the United States, manifested as hemiparesis, aphasia, loss of independence in ambulation and activities of daily living, depression, and institutionalization in a skilled nursing care facility.¹

The financial burden of stroke is also considerable, costing the United States an estimated \$54 billion annually in emergency department (ED) care, inpatient and outpatient care, prescription medications, lost days of work, and home health care.⁴ The cost of stroke for the years spanning 2005 and 2050 is projected to total \$1.52 trillion for non-Hispanic white Americans, \$379 billion for blacks and \$313 billion for Hispanics.¹

The Promise of Timely Therapy

Amidst the long and dark shadows cast by stroke, one glimmer of light has shone since 1995,

when a 5-year study by the National Institute of Neurological Disorders and Stroke⁵ established the clinical efficacy of intravenous recombinant tissue plasminogen activator (rtPA) when it is administered (0.9 mg/kg) within 3 hours of the onset of stroke symptoms. Under those conditions, ischemic stroke victims are at least 30% more likely to recover with little or no neurologic disability after 3 months with comparable benefits observed at 1 year. More recent results from a series of ongoing study trials⁶ suggest that rtPA may be effective for up to 4.5 hours after symptom onset in select patients, possibly widening the therapeutic window for thrombolysis to benefit even more victims of stroke. The most improvement occurs in stroke patients who receive rtPA within 90 minutes of the onset of symptoms; delays even within the 3- or 4-hour timeframe can cause morbidity and disability.⁷

Since shortly after the Food and Drug Administration's 1996 approval of rtPA for acute ischemic stroke, evidence has been accumulating that the most expeditious way to minimize the time between a stroke patient's initial experience of symptoms and administration of rtPA is by calling 911.^{8,9} The American Heart Association and The American Stroke Association direct both stroke victims as well as others who may be with them to immediately call 911 or their local emergency medical services (EMS); to anticipate that the person will protest calling 911 or EMS; and to not take "no" for an answer—insist on taking prompt action.¹⁰ EMS can provide early and knowledgeable assessment of relevant clinical findings; alert ED staff before arrival; and provide more rapid transport of the victim to a hospital, faster triage at the hospital,

Please send your ideas for how to improve the public's recognition and response to signs of an acute stroke to ccn@aacn.org.

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rapid initiation of rtPA upon arrival in the ED,^{8,9} and a greater likelihood that rtPA will be administered.^{9,11-16}

To summarize, the chain of events for realizing optimal patient outcomes from acute ischemic stroke seems quite clear:

- Recognize early symptoms of stroke
- Immediately call 911
- Administer rtPA within 90 minutes of symptom onset (ideal) or within the therapeutic window of 3 hours—possibly 4 to 4.5 hours for select patients (Not all persons with ischemic stroke should receive rtPA.¹⁷)

Given this expanding body of evidence for how to improve the immediate and long-term outcomes for patients with stroke, health care professionals might anticipate that widespread dissemination of this information in public health service announcements over the past 16 years would have assured an informed public that readily recognized the early signs of stroke and quickly acted to obtain rtPA therapy within that limited timeframe. To the contrary, however, research continues to affirm that many elements of this action plan still falter, resulting in persisting delays and limited benefits in achieving optimal care for stroke patients.

Factors Thwarting Provision of Timely Therapy

Numerous local and regional programs and media campaigns have aimed at improving identification of stroke warning signs and communicating the imperative for urgent access of EMS to secure definitive rtPA treatment.¹⁸⁻²² Despite these initiatives, national estimates of actual rtPA utilization remain disappointingly low, hovering around 2% for all ischemic strokes.^{1,12,23} One persisting and significant contributor to this low rtPA utilization rate for stroke is delay in patient presentation for medical care.^{13,14,24-26} Studies find that fewer than 25% of ischemic stroke patients arrive within 3 hours of symptom onset.^{27,28} In the United Kingdom, where it is estimated that 15% to 20% of patients with acute ischemic stroke should be eligible for rtPA, only 3.8% of patients receive this treatment.²⁹ As their neighbors across the pond have experienced, one of the primary reasons for this low rate of thrombolytic therapy is the lack of an urgent response when stroke symptoms are noted by patients or witnesses.³⁰⁻³³

Some of the factors that contribute to this delay include the following:

- Not recognizing signs and symptoms of acute stroke^{12,14,34,35}
- Not recognizing that the symptom warrants immediate medical intervention^{12,14,34}
- Not calling 911 to access the EMS for rapid transport and initiation of rtPA therapy^{14,35}
- Contacting the patient's primary care provider rather than the local EMS³⁶

A study reported by Fussman et al³⁷ confirmed that even when the public correctly recognizes stroke symptoms after a stroke education program, they most often respond by taking the affected person to the ED, rather than by immediately calling 911. Using data from a survey of 4841 adults in Michigan, respondents were asked how they would respond to 5 hypothetical health-related scenarios, 3 of which were specific to stroke (sudden trouble speaking or understanding, sudden trouble seeing in one or both eyes, sudden numbness or weakness on one side of the body) and 2 of which were not (injuring a leg, having a high fever). Fewer than 28% identified all 3 stroke symptoms and only 18% of those who recognized all 3 symptoms said they would call 911. Wide variability was found in the public's response to specific stroke symptoms: 51% of those surveyed said they would call 911 for someone suddenly having trouble speaking or understanding; only 42% would call for sudden weakness or numbness on one side of the body, but only 20% would make that call for someone experiencing sudden trouble seeing out of one or both eyes. A more narrow range of 41% to 51% in calling 911 in response to stroke symptoms was found among Montana residents¹⁸; in upstate New York, Jurkowski³⁸ found that between 33% and 72% dialed 911 if they recognized stroke symptoms.

In an attempt to determine how the presence or absence of various stroke symptoms affects the likelihood of calling 911, Kleindorfer and colleagues³⁹ completed a retrospective chart review of 2975 cases from a study in the Greater Cincinnati/Northern Kentucky area and collected data related to the symptoms reported. EMS was called for emergency transport in 1205 (40.5%) of these cases. Following univariable examination of each reported symptom, a multivariable logistic regression model was constructed to further distinguish stroke symptoms that independently influenced the public's calling 911. This analysis revealed some interesting determinants:

- Some symptoms were associated with *increased* odds of patients or witnesses calling 911: weakness,

decreased level of consciousness, speech/language changes, and dizziness. Of these, the symptom that most compelled contacting EMS was weakness (odds ratio [OR] 1.42, 95% CI 1.17, 1.73).³⁹

- Other symptoms were associated with *decreased* odds of calling 911: numbness and changes in vision. The most notable finding in the opposite direction was for numbness (OR 0.73, 95% CI 0.59, 0.90).³⁹

These findings were comparable to an Australian survey⁴⁰ in which 20% of respondents reported that they would contact EMS for weakness or paralysis, while only 15% would call 911 for numbness.

As the authors observed, this disparity suggests that some symptoms such as weakness are more readily recognized by the public as signaling an emergency, whereas other equally relevant symptoms such as numbness or vision abnormalities may fly under their recognition radar, never prompting placement of that call to 911. The numbness finding was not expected because telephone surveys in the same population had found the most commonly identified symptom of stroke was numbness/tingling, followed by dizziness, and then weakness. This apparent disconnect between knowledge and action was consistent with Fussman's³⁷ findings and frustrations.

Another point not raised by Kleindorfer et al³⁹ is that some manifestations of stroke such as extremity or facial weakness or expressive aphasia represent objective clinical signs that may be more dramatic and visible, whereas others such as numbness, headache, visual changes or receptive aphasia are more subtle, subjective symptoms known primarily or exclusively to the stroke victim. As a result, the former may prompt calls to 911 because they are visible and recognized by 2 people rather than one. This visibility aspect may also help to explain Zerwic's³⁵ finding that a nonmotor primary presenting symptom of stroke is a significant predictor of delay in securing hospital treatment.

Although these studies reached similar and overlapping conclusions regarding the substantial disconnect between knowledge of stroke symptoms and responding in the optimal manner, none were designed to determine the reasons or dynamics underlying a reluctance or delay to call 911 when those warning signs of stroke are apparent.

A recent UK study reported by Mackintosh⁴¹ attempted to examine these issues. The aim of the study was to explore the reasons why people with stroke or witnesses to the stroke either immediately contact or delay

contacting EMS at the onset of stroke symptoms. A qualitative interview design used audio-recorded, semi-structured interviews with 19 stroke patients and 26 witnesses that were completed within 14 days of an acute stroke. Findings revealed that only 26% of patients and 50% of witnesses called EMS within 1 hour of symptoms. Those who called quickly tended to be persons who had witnessed strokes in close family members and wished to avoid the negative effects they had observed as a result of stroke. The research team identified 5 major themes that appeared to be important influences in these decisions⁴¹:

1. *Prior knowledge from the Act FAST campaign* enabled recall of some stroke symptoms.

2. *How they interpreted signs and symptoms of stroke.* While some with experience of stroke in their family correctly recognized signs and sought help quickly, others failed to recognize symptoms, misinterpreted them, or did not perceive them as reflecting an emergency.

3. *How they responded to symptoms of stroke.* Some patients with prior strokes suspected it was recurring, yet did nothing in response. Others waited to see if symptoms would go away. Others vehemently opposed using EMS due to not wanting to bother them or from longstanding fear of hospitals.

4. *Deflection and delay.* Many patients contacted a friend or relative for comfort, reassurance, and/or to take responsibility for engaging EMS, thereby deflecting and delaying the decision to contact EMS. Others contacted health professionals other than EMS.

5. *Roles and responses of medical providers.* Many patients believed that the most appropriate response was to contact their physician (GP). Some GPs referred patients to the hospital without emphasizing any urgency in the situation or arranging to transport them immediately. One woman who presented to her GP with numbness in her face and arms was diagnosed as having stress and instructed to "go home and have a good cry."^{41(p5)} One response not noted in studies originating in the United States was particularly noteworthy: "Some patients in the study had previously suffered negative experiences in hospital, and their fear of hospitalization outweighed their desire to seek treatment."^{41(p6)}

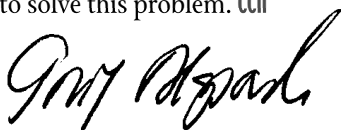
Tell Us How Critical Care Nurses Can Make a Difference in These Outcomes

When you read much of the research on this topic, the implications almost invariably relate that health care

professionals and related interest groups need to provide education about the warning signs of stroke and the need to treat these symptoms as medical emergencies by immediately calling 911. Based on some of the studies mentioned here, I suppose we could also advocate that critical care nurses could play an instrumental role by providing patient and family education that emphasizes not only signs and symptoms associated with acute stroke but also less overt, less visible symptoms such as numbness, vision changes, and difficulty understanding speech. However, the reality is that very little progress has been made in this area by following generic implications such as these for the past 16 years.

If simply disseminating information about stroke signs and symptoms and the need to call 911 was sufficient, the multitude of programs already provided would have yielded mountains of measurable evidence that affirmed our success in eradicating delays in administering rtPA to ischemic stroke patients. Because research disconfirms that notion, however, advocating more of the same seems something close to pointless. What is apparent from these studies is that we have not yet designed an approach that effectively communicates these messages in a way that both enables the public to recognize relevant signs and symptoms of stroke and that compels them to immediately call 911 when any of those warning signs is recognized. Perhaps we need to compose a different message or prepare different messages for different audiences. Perhaps the message is fine but needs to be communicated in a different medium, via multiple media, or via different media to different audiences. Perhaps the message is being sent to the wrong location, at the wrong time, or devoid of some necessary attribute such as music or video or graphics.

I don't know the answer, but rather than just ending this editorial with yet another set of generic directions on what must be done to improve this situation, I'd like to solicit your ideas of strategies that might offer promise in improving the public's recognition and response to signs of an acute stroke. Please send your recommendations, including any evidence you can cite that supports your ideas, to ccn@aacn.org. *Critical Care Nurse* looks forward to your input and welcomes your participation in helping us to solve this problem. CCH



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Editor

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