Designing a Message for Public Education Regarding Stroke
Does FAST Capture Enough Stroke?

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Background and Purpose—Previous studies have shown poor public knowledge of stroke warning signs. The current public education message adopted by the American Heart Association lists 5 stroke warning signs (“suddens”). Another message called FAST (face, arm, speech, time) could be easier to remember, but it does not contain as many stroke symptoms. We sought to assess the percentage of stroke/transient ischemic attack (TIA) patients identified by both public awareness messages by examining presenting symptoms of all stroke/TIA patients from a large, biracial population in 1999.

Methods—Cases of stroke who presented to an emergency department or were directly admitted were ascertained at all local hospitals by screening of ICD-9 codes 430 to 436, and prospective screening of emergency department admission logs, in 1999. Study nurses abstracted initial presenting symptoms from the medical record. All-cause 30-day case-fatality was calculated.

Results—During 1999, 3498 stroke/TIA patients (17% black, 56% female) presented to an emergency department. Of these events, 11.1% had presenting symptoms not included in FAST, whereas 0.1% had presenting symptoms not included in the suddens. The FAST message performed much better for ischemic stroke and TIA than for hemorrhage, missing 8.9% of the ischemic strokes and 8.2% of the TIAs, versus 30.6% of intracerebral hemorrhage/subarachnoid hemorrhage cases. Case-fatality in patients missed by FAST was similar to patients with FAST symptoms (9.0% versus 11.6%, \( P=0.15 \)).

Conclusions—Within our population, we found that the FAST message identified 88.9% of stroke/TIA patients. The FAST message performed better for ischemic stroke and TIA than for hemorrhagic stroke. Whether the FAST message is easier to recall for the public than the “suddens” message has yet to be determined. (Stroke. 2007;38:2864-2868.)

Key Words: acute stroke ■ epidemiology ■ symptoms

Stroke is the third leading cause of death in the United States and a leading cause of major disability; yet, public knowledge regarding stroke in general is quite poor.1–9 Previous studies have documented that the general public has limited knowledge regarding stroke risk factors and warning signs, as well as how quickly medical attention should be sought should acute symptoms occur.1–9

Rapid recognition of stroke warning signs is a crucial factor in the acute treatment of stroke.10–12 In order to treat ischemic stroke patients with thrombolytics13 or treat intracerebral hemorrhage (ICH) patients with recombinant factor VIIa (should this treatment become standard of care),14 patients must arrive at an emergency room as soon as possible to allow time for evaluation and treatment. Yet, it has been shown that only 21% to 25% of acute ischemic stroke patients and ≈60% of ICH patients arrive to the emergency department in <3 hours from symptom onset.15 A recent study from California found that increasing the proportion of ischemic stroke patients who arrive early to the emergency department would hypothetically increase the use of thrombolytics much more than any other intervention, such as the use of stroke teams or faster emergency medical services triage.16

The public stroke education message currently adopted by the American Heart Association17 is a list of 5 stroke warning signs (Figure 1, the “suddens” message) created by the Brain Attack Coalition. Because this list of symptoms is quite long, it may be difficult for the lay public to remember. In an attempt to simplify the message, the mnemonic FAST (“Face”, “Arm”, “Speech”, “Time”) was created by study investigators in 1999, based on the Cincinnati Pre-Hospital Stroke Scale18 (Figure 2). Other abbreviated versions of the FAST message are also being used (eg, Figure 3). FAST combines 3 common stroke warning signs and a plan of action, should symptoms occur, into a single message. One
potential concern regarding the FAST message is that not all stroke symptoms are included.

In the present study, we examined the percent of stroke patients identified by the suddens and FAST public education messages within our biracial population of 1.3 million in 1999 by retrospectively evaluating stroke symptoms on presentation and comparing them to the symptom content of the 2 messages.

Methods
The detailed methods of our Greater Cincinnati/Northern Kentucky Stroke Study (GCNKSS) have been previously published.19 The GCNK population is similar to the overall US population in terms of socioeconomic indicators and percentage of blacks.20 The GCNKSS was approved by the Institutional Review Board at all participating hospitals.

GCNKSS involved ascertainment of all stroke events (ischemic, transient ischemic attack [TIA], and hemorrhagic) that occurred in the population during 1999. Study nurses screened the medical records of all inpatients with primary or secondary stroke-related ICD-9 discharge diagnoses of 430 to 436 from the acute-care hospitals in the study region. Once potential cases were identified, a study nurse abstracted information regarding demographics, initial stroke symptoms, and other relevant clinical information. A study physician reviewed every abstract and all available neuroimaging studies to verify whether or not a stroke or TIA had occurred.

Symptoms on presentation were abstracted by study research nurses from the medical record, as documented by emergency department nurses and physicians at the initial presentation. In addition to categorizing symptoms on abstract forms, the research nurses recorded detailed descriptions of the patients’ symptoms, which in retrospect were reviewed and categorized by physician investigators. Categories were designed to conform to the 2 public awareness messages in question: the “suddens” as listed in Figure 1, and FAST as listed in Figure 2.

Case-fatality was defined as death from any cause within 30 days of stroke onset. To verify vital status for case-fatality calculations, death certificate data from the Ohio and Kentucky Departments of Vital Statistics were reviewed. The national Social Security Death Index was queried for any patient who did not have an Ohio or Kentucky death record. Patients for whom a death record could not be found were presumed to be alive.

Data were managed using a combination of SAS (SAS Institute), version 9.1, and EXCEL. Analysis was done using SAS. Descriptive statistics are reported as mean±SD and range or as number and percentage. Mean differences were compared between the FAST and “suddens” message responses using a t test, as were age comparisons. Categorical variable differences were analyzed using χ2 for unpaired comparisons and McNemar test or Cohen k for paired comparisons. Percent of stroke patients identified is defined as number of stroke cases identified by the symptoms described in the

SIGNS and SYMPTOMS of Stroke
For a Brain Attack think F-A-S-T

F=face numbness or weakness especially one side
A=arm numbness or weakness especially one side of body
S=speech slurred or difficulty speaking or understanding
T=time to call 911 if these occur suddenly or are accompanied by: the loss of vision, the loss of balance with dizziness or the worst headache of your life, with no known cause, both sudden and severe.

Time is of the essence – treatment with tPA needs to begin within three hours of onset.

Figure 1. Currently accepted warning signs and symptoms of stroke.17

Figure 2. Original FAST message, including numbness.
message divided by the total number of cases. $P<0.05$ was considered statistically significant; exact probability values are reported.

**Results**

Among adult GCNK residents during 1999, 3824 strokes (ischemic or hemorrhagic) and TIAs, including first-ever and recurrent stroke, were evaluated in a hospital setting. For the purposes of this analysis, 285 cases that occurred while the patients were already hospitalized for another reason were excluded because their symptoms would not have been witnessed by the lay public, 25 cases were excluded because of missing presentation symptom data. The mean (±SD, range) age of the 3498 remaining stroke/TIA patients (which includes 59 direct admits) was 71.2 (±13.7, 18 to 99); 56.0% were female; 82.6% were white, 16.8% were black, and 0.6% fell into other racial classifications.

The initial symptoms that prompted the patient to seek medical attention, as classified by the FAST and “suddens” messages, are shown in the Table. The most common presenting symptoms were “sudden numbness or weakness of the face, arm, or leg” (73.4% of all stroke and TIA events) and “sudden confusion, trouble speaking or understanding” (64.1%). The “face” and “arm” component of the FAST message together capture 70.6%, and the “speech/understanding” component of FAST captures 56.5%. Only 3 cases (0.09%) did not have any symptom included among the suddens, whereas 11.1% of the cases did not have symptoms captured by FAST ($P<0.0001$). This translates into a percent identified of 99.9% for suddens and 88.9% for FAST. There were no significant differences in the percentages of patients without face, arm, or speech symptoms by race or gender (data not shown). Cases missed by FAST tended to be slightly younger (mean±SD=68.9±14.8) than cases with FAST symptoms (mean±SD=71.5±13.5, $P<0.001$). Symptoms missed by the FAST message were not uncommon, but they rarely occurred without accompanying FAST symptoms. In the absence of FAST symptoms, dizziness occurred in 5.3% of patients, visual symptoms in 4.1%, headache in 4.0%,
confusion in 3.0%, and leg weakness or numbness in 1.7% (categories are not mutually exclusive).

The Table reveals notable differences in the distribution of presentation symptoms by stroke subtype. Whereas sudden weakness or numbness occurred in three quarters of ischemic events, it was found in less than half of the hemorrhagic strokes. Dizziness or trouble with balance or coordination was reported in about half of the ischemic and hemorrhagic strokes, but it occurred less frequently in TIAs (29.5%). Not surprisingly, hemorrhagic stroke had a 2-fold higher rate of headache on presentation (39.8%) than did ischemic stroke but was much more prevalent in ICH/subarachnoid hemorrhage cases (19.8%). As a result, the FAST message performed much better for ischemic stroke and TIA than for hemorrhagic stroke and TIA, versus 30.6% of ICH/subarachnoid hemorrhage cases (19.8%). As a result, the FAST message performed much better for ischemic stroke and TIA than for hemorrhagic stroke, missing 8.9% of the ischemic strokes and 8.2% of the TIAs, versus 30.6% of ICH/subarachnoid hemorrhage cases, P<0.0001.

The abbreviated version of the FAST message in Figure 3 does not mention numbness, instead focusing only on weakness. If numbness is not included in the FAST message, the percent identified decreases; in our data, the percentage of all stroke missed rises from 11.1% to 16.8% (P<0.0001). The impact of excluding numbness varies by stroke subtype: ICH/subarachnoid hemorrhage is minimally affected (30.6% when numbness and weakness is included versus 32.6% when considering only weakness, P=0.005), whereas the effect is great for TIA (8.2% versus 20.6%, P<0.0001) and moderate for ischemic stroke (8.9% versus 12.3%, P<0.0001).

The all-cause case-fatality for those patients missed by the FAST message (n=388) was 9.0% at 30 days, versus 11.6% for those captured by the FAST message (n=3110; P=0.15).

Discussion

Within our population, we found that the FAST message identified 88.9% of stroke/TIA patients. Although visual complaints, severe headache, and dizziness were not uncommon, they occurred infrequently in isolation from other, more common stroke symptoms, including face, arm, and speech/language symptoms.

A conclusion regarding which message, FAST or the suddens, is more effective cannot be based solely on the ability of the message to identify patients, but must also consider how easy the messages are to remember. If a higher percentage of the general public can recall the components of the FAST message, as opposed to the suddens list, the simplicity of the FAST message might result in a greater number of identified acute stroke events even though it is not designed to capture all stroke symptoms. Whether the FAST message is easier for the public to recall than the suddens, however, remains to be proven. Such information would be crucial in determining whether it is acceptable to promote a public awareness message that potentially misses 11% of stroke and TIA cases. It should be noted that the currently accepted list of symptoms, the 5 suddens, to our knowledge, was not studied with regard to retention and readability in the public forum, before publication and acceptance, but instead was developed as a consensus statement by a panel of experts. Based on the health education literature that recommends “chunking” of information,21–24 we hypothesize that FAST will indeed be easier to remember than the suddens, but this still needs to be tested in a blinded, prospective manner.

In the abbreviated version of FAST in Figure 3, the word choice is simpler and at a lower reading level, such as “face uneven” instead of “weakness or numbness,” or “speech sound strange” instead of “difficulty speaking or understanding.” The impact of these changes in word choice would need to be studied, but we hypothesize that the simpler the word choice and concepts, the better it will be understood and remembered by the lay public. Because excluding “numbness” (as shown in Figure 3) would reduce the percentage of stroke and TIA patients identified by the FAST message, especially for identifying TIA, we recommend that “numbness” remain in future versions of the message.

Another key component when evaluating the effectiveness of public awareness messages is the outcomes of those patients missed by the message. The case-fatality of patients missed by the FAST message was similar to those identified by the suddens message. Nevertheless, these missed patients had an all-cause mortality at 30 days of 9.0%, which suggests that patients missed by the FAST message do not necessarily have a benign poststroke outcome.

Table. Stroke Symptoms Upon Presentation to the Emergency Department, by Stroke Subtype, as Classified by the FAST and Five Suddens Public Awareness Messages, Greater Cincinnati/Northern Kentucky Stroke Study, 1999

<table>
<thead>
<tr>
<th>Stroke Subtype</th>
<th>n</th>
<th>FAST Message</th>
<th>Sudder Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ischemic</td>
<td>2141</td>
<td>962 (44.9%)</td>
<td>1485 (69.4%)</td>
</tr>
<tr>
<td>TIA</td>
<td>965</td>
<td>312 (32.3%)</td>
<td>618 (64.0%)</td>
</tr>
<tr>
<td>ICH/SAH</td>
<td>389</td>
<td>92 (23.7%)</td>
<td>146 (22.2%)</td>
</tr>
<tr>
<td>All Stroke</td>
<td>3498*</td>
<td>1366 (39.1%)</td>
<td>2268 (64.8%)</td>
</tr>
</tbody>
</table>

*Includes 3 strokes of unknown type.}

SAH indicates subarachnoid hemorrhage.
Limitations of this analysis include a potential bias related to the method of symptom ascertainment using retrospective chart review. There may be a bias for medical personnel to record symptoms of stroke that are more “typical,” or there may be incomplete symptom ascertainment related to incomplete documentation. Prospective symptom ascertainment would be ideal, but this is not feasible in a population-based epidemiology study of this size.

In summary, the FAST message is able to identify a high percentage of stroke and TIA patients, although it performs much better for ischemic stroke and TIA than hemorrhagic stroke. Further study is needed to determine whether this method of education is superior to currently accepted methods, and at this time we cannot recommend one public awareness message over another.

Disclosures
None.

References
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Stroke. 2007;38:2864-2868; originally published online August 30, 2007;
doi: 10.1161/STROKEAHA.107.484329

Stroke is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
Copyright © 2007 American Heart Association, Inc. All rights reserved.
Print ISSN: 0039-2499. Online ISSN: 1524-4628

The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://stroke.ahajournals.org/content/38/10/2864

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