Development and Validation of the Stroke Action Test

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**Background and Purpose**—Accurately assessing the public’s readiness to respond to stroke is important. Most published measures are based on recall or recognition of stroke symptoms, or knowledge of the best action for stroke when the diagnosis is provided. The purpose of this study was to develop and evaluate a new written instrument whose items require the respondent to associate individual symptoms with the most appropriate action.

**Methods**—The Stroke Action Test (STAT) contains 21 items that name or describe stroke symptoms from all 5 groups of warning signs and 7 items that are nonstroke symptoms. For each item, the respondent selects 1 of 4 options: call 911, call doctor, wait 1 hour, or wait 1 day. The instrument validation sample included 249 subjects from community-based organizations. Score reliability and validity were analyzed using multiple data and information sources.

**Results**—The mean overall STAT score (all 28 items) for the lay people was 36.8%. On average, they chose call 911 for 34.1% of the stroke symptoms. They chose call doctor for 39.4% of the stroke symptoms, wait 1 hour for 20.1%, and wait 1 day for 6.0%. Score reliability is good (α=0.83). Evidence confirming score validity is presented based on analysis of item content and response patterns, and examination of the relationships between test scores and key variables related to stroke knowledge.

**Conclusions**—STAT directly assesses a critical aspect of practical stroke knowledge that has been largely overlooked and provides scores with good reliability and validity. (Stroke. 2005;36:000-000.)

**Key Words:** reproducibility of results ■ stroke ■ stroke assessment ■ survey instrument
TABLE 1. Sample Test Items

| If this happened to you or an adult friend/relative, what would you do?* | Sudden weakness of the face, especially on one side. (medical language, stroke symptom) He was trying to eat lunch, but pieces of his sandwich kept falling out of the right side of this mouth. That hadn’t ever happened before. (lay language, stroke symptom) His finger joints were sore, and then a finger locked-up so he couldn’t open his hand. (lay language, non-urgent medical condition) |

*Response options: call 911 immediately, call doctor’s office immediately, wait 1 hour then decide, wait 1 day then decide

Additional Study Features Providing Data on Score Validity

To allow examination of the effect of item language on STAT scores, symptoms were presented in terse medical language (for the stroke symptoms, quotations from the consensus statement on stroke warning signs), or in lay language, based on descriptions given by lay people who had personally experienced or observed that symptom. For direct comparisons, 8 stroke symptoms were presented in terse medical language (for the stroke symptom) involve sudden unilateral numbness or weakness of the face, arm or leg, or trouble speaking or understanding. Two items contain a common stroke syndrome (eg, sudden right-side weakness of the face and arm, together with trouble speaking). The 7 nonstroke symptoms represent both urgent and nonurgent medical conditions. The overall SMOG Readability Index of the items is grade 7.22 The complete STAT instrument can be accessed online at http://www.umassmed.edu/entities/cellbio/stat.cfm.

TABLE 2. Characteristics of Lay People (n=249)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Lay People Mean (SD) or %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, y</td>
<td>43.9 (12.0) (range 25–75)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>50.8</td>
</tr>
<tr>
<td>Female</td>
<td>49.2</td>
</tr>
<tr>
<td>Race</td>
<td></td>
</tr>
<tr>
<td>White (non-Hispanic)</td>
<td>45.2</td>
</tr>
<tr>
<td>Hispanic or Latino</td>
<td>27.4</td>
</tr>
<tr>
<td>Black or African American</td>
<td>19.4</td>
</tr>
<tr>
<td>Asian</td>
<td>2.0</td>
</tr>
<tr>
<td>American Indian or Alaska Native</td>
<td>1.6</td>
</tr>
<tr>
<td>Other or unreported</td>
<td>4.4</td>
</tr>
<tr>
<td>Education (highest level achieved)</td>
<td></td>
</tr>
<tr>
<td>Less than high school graduation</td>
<td>18.5</td>
</tr>
<tr>
<td>High school or GED</td>
<td>27.8</td>
</tr>
<tr>
<td>Some college or 2-y degree</td>
<td>27.8</td>
</tr>
<tr>
<td>College graduate</td>
<td>25.8</td>
</tr>
<tr>
<td>Overall health (self-assessed)</td>
<td></td>
</tr>
<tr>
<td>Excellent to very good</td>
<td>49.6</td>
</tr>
<tr>
<td>Good</td>
<td>35.0</td>
</tr>
<tr>
<td>Fair to poor</td>
<td>15.4</td>
</tr>
<tr>
<td>Personal experiences with stroke</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>49.6</td>
</tr>
<tr>
<td>No</td>
<td>50.4</td>
</tr>
</tbody>
</table>

Instrument Validation Sample

Two hundred forty-nine examinees were recruited from community-based organizations in Central Massachusetts. Criteria for inclusion were ages 25 to 75, self-assessed ability to read English, and lack of personal medical training. Examinees took the STAT in a witnessed small-group setting. Time to complete the test was observed, but no time limit was set. Examinees also provided demographic information, rated their own overall health, and reported their level of experience with stroke. For this study, experience with stroke was coded as “yes” or “no,” in which “yes” was defined as any personal interactions with individuals who had strokes. Participants received a $7 stipend. To allow investigation of the effects of stroke training on scores, a group of first-year medical student (MS1) volunteers took STAT before (n =93) and after (n =72) 10 hours of instruction in stroke prevention and recognition.23 The study received exempt status from the Institutional Review Board at the University of Massachusetts Medical School.

Analyses

Descriptive statistics were used to summarize the characteristics of subjects, mean item and test scores, and frequencies with which they chose each response option. Reliability of test scores was evaluated using Cronbach α. To gather additional validity evidence, scores of subgroups of examinees and of MS1 before and after stroke instruction were compared (t tests and paired t tests). The possible effect of item language on scores was evaluated by calculating the proportion of lay people correctly answering equivalent items that named a symptom in medical language or described the symptom in lay language (see highlighted Sample Test Items). Results were compared using McNemar χ² tests.

Results

Demographic characteristics, self-reported health, and personal stroke experiences of the 249 lay people in the instrument validation sample are summarized in Table 2. The majority of examinees completed the 28-item STAT in ≈5 minutes; almost no one took >10 minutes. The mean overall STAT score (based on all 28 items) for these lay people was 36.8%. The mean score on the 21 items containing stroke symptoms was 34.1%. This means that on average, participants in this study chose call 911 for 34.1% of the stroke symptoms. The version of STAT evaluated in this study contains 28 items that name or describe a symptom. For each item, the task of the respondent is to answer the question, “If this happened to you or an adult friend/relative, what would you do?” by selecting 1 of 4 response options: (1) call 911 immediately; (2) call doctor’s office immediately; (3) wait 1 hour and then decide; or (4) wait 1 day and then decide (Table 1). For scoring purposes, each correct response receives 1 point; incorrect responses receive 0 points. The total score is reported as percent of correct responses. Tests are either hand-scored or computer-scored after the answer sheet is scanned.

STAT items include 21 stroke symptoms representing all 5 groups of warning signs, as well as 7 nonstroke symptoms. Eleven items involve sudden unilateral numbness or weakness of the face, arm or leg, or trouble speaking or understanding. Two items contain a common stroke syndrome (eg, sudden right-side weakness of the face and arm, together with trouble speaking). The 7 nonstroke symptoms represent both urgent and nonurgent medical conditions. For direct comparisons, 8 stroke symptoms were presented in terse medical language (for the stroke symptom) involve sudden unilateral numbness or weakness of the face, arm or leg, or trouble speaking or understanding. Two items contain a common stroke syndrome (eg, sudden right-side weakness of the face and arm, together with trouble speaking). The 7 nonstroke symptoms represent both urgent and nonurgent medical conditions. The overall SMOG Readability Index of the items is grade 7.22 The complete STAT instrument can be accessed online at http://www.umassmed.edu/entities/cellbio/stat.cfm.
The STAT is a new written instrument designed to assess lay people’s knowledge of the correct response to individual stroke symptoms. Most lay people complete the test in ~5 to 7 minutes, and it can be easily scored. The reliability of STAT scores, as estimated by the Cronbach α coefficient, is good. Data and information presented in Results also provide evidence that STAT scores are likely to reflect knowledge of the correct action to take if stroke occurs. This validity evidence is as follows.

First, STAT contains 28 items. The symptoms most often reported in stroke databases are most heavily represented, and all 5 major groups of stroke warning signs are sampled. Seven nonstroke symptoms are included to broaden the range of correct responses, because if only stroke items were included then there would be only a single correct answer: call 911.

Second, there is a logical relationship between the task the test-taker must perform and the underlying behavior that the test seeks to predict: specifically, calling 911 in the event of a stroke. Most previous measures are based on recall or recognition of stroke symptoms, or knowledge of the best action for stroke (diagnosis provided). By contrast, STAT assesses whether the respondent can connect symptoms and appropriate action. The importance of this distinction is underscored by our findings that 94% of examinees agreed that calling 911 is the best response to stroke; yet, on average, only 34% selected call 911 in response to specific symptoms. A similar discrepancy was reported in an epidemiological investigation of score validity included comparing mean scores for 8 of 11 were higher in the recognition format (P<0.01). Most examinees demonstrated knowledge of the correct response to stroke when the diagnosis was provided, because 93.8% agreed with the statement, “If you think you are having a stroke, the first thing to do is call 911 or an ambulance.”

### Discussion

The reliability of the 28-item test was good (α=0.83). Investigations of score validity included comparing mean STAT scores across subgroups of examinees. As Table 3 shows, STAT differentiated individuals with different levels of education and stroke training or experience, as would be expected. MS1s without training scored higher than lay people; lay people who reported personal stroke experiences scored higher than lay people without them; and lay people who were college graduates scored higher than lay people who were not. In addition, scores of the same individuals (MS1s) were significantly increased by intense instruction (MS1s after stroke instruction: 42.1 (17.0) vs. 36.8 (19.2) P<0.001). Most examinees demonstrated knowledge of the correct response to stroke when the diagnosis was provided, because 93.8% agreed with the statement, “If you think you are having a stroke, the first thing to do is call 911 or an ambulance.”
study of 882 Australian lay people conducted by telephone interviews.\textsuperscript{11} 

Third, STAT items are presented in lay and medical language, a decision made early in the process of designing the test in an effort to assure that the majority of test-takers would understand what was being asked. That decision is now supported by data showing that scores were higher on items that described stroke symptoms in lay language than on items that presented the same symptoms in the medical language of the consensus statement on stroke warning signs. We had expected that medical terms and terse style might increase scores because it would make a symptom appear more ominous or urgent.\textsuperscript{26} Because just the opposite occurred, we now hypothesize that some of the examinees did not recognize the symptom in medical language, or did not understand what was meant.

Fourth, scores show positive relationships with other variables reported in the stroke literature. For example, examinees reporting personal experiences with stroke scored higher than those with none.\textsuperscript{27} In addition, examinees scored highest on an item about sudden face and arm paralysis together with problems talking; these symptoms are among the most frequently reported by callers activating the emergency medical system in acute stroke.\textsuperscript{28} Finally, as the MSI data show, STAT scores are significantly improved by stroke training.

The purpose of this study was to develop and evaluate the STAT instrument, not to conduct an epidemiological investigation. Our study sample contains individuals with characteristics that are typical of the population to whom such a test would likely be administered in the future, including a range of ethnicities, ages, education, and experience. However, they are not intended to be a random sample of the US population at large. That fact acknowledged, it is disturbing that overall this sample of lay people would call 911 for only 34.1\% of stroke symptoms. They chose an inappropriate response, call your doctor’s office, more often than they chose call 911.

An important limitation of STAT, or any similar instrument, is that it can replicate only a fraction of what would actually be experienced by a patient or witness in an actual stroke situation. We need to continue working on ways to portray symptoms more realistically, perhaps with the use of multimedia technology, because this should further increase the predictive value of test scores. In the future, it would also be important to evaluate the instrument for use with groups of older or less healthy individuals, and to develop and validate a culturally sensitive Spanish language version.

In summary, STAT directly assesses a critical aspect of practical stroke knowledge that has been largely overlooked and provides scores with good reliability and validity. Our findings also focus attention on the importance of directing public education to the critical link between individual stroke symptoms and calling 911, and of using lay and medical language in describing stroke symptoms to the public. If STAT were given to a larger, population-based sample, responses to individual items could help identify which stroke symptoms lay people are least likely to respond to and permit more targeted public education efforts. Additionally, use of a standardized instrument, such as STAT, would greatly facilitate cross-study comparisons.

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References


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