The One-Year Attributable Cost of Poststroke Aphasia

Charles Ellis, PhD, Annie N. Simpson, MSc, Heather Bonilha, PhD, Patrick D. Mauldin, PhD, Kit N. Simpson, DrPH

Background and Purpose—Little is known about the contribution of aphasia to the cost of care for patients who experience stroke.

Methods—We retrospectively examined a cohort of South Carolina Medicare beneficiaries who experienced ischemic stroke in 2004 to determine the attributable cost of aphasia. Univariate analyses were used to compare demographic, comorbidity, and severity differences between individuals with poststroke aphasia and those without aphasia. Differences in payments by Medicare because of stroke were examined using a gamma-distributed generalized linear multivariate model.

Results—Three thousand, two hundred Medicare beneficiaries experienced ischemic stroke in South Carolina in 2004, and 398 beneficiaries had poststroke aphasia. Patients with aphasia experienced longer length of stays, greater morbidity, and greater mortality than did those without aphasia. In adjusted models that controlled for relevant covariates, the attributable 1-year cost of aphasia was estimated at $1703.

Conclusions—Aphasia adds to the cost of stroke-related care, above the cost of stroke alone. (Stroke. 2012;43:00-00.)

Key Words: aphasia n costs

Stroke is a leading cause of long-term disability in the United States, and the cost of stroke-related care is substantial. Approximately 100,000 individuals who experience a stroke will subsequently have aphasia, a higher-order disturbance of language.1-2 Aphasia is associated with higher mortality, morbidity, and utilization of healthcare resources.3 Higher-order skills, such as language, are believed to be associated with higher costs for poststroke care and rehabilitation. However, few studies have examined cost issues related to aphasia despite these patients requiring extensive care in a range of medical settings.4 We sought to examine the 1-year attributable cost of aphasia among ischemic stroke survivors.

Methods

Data for this study were obtained from the South Carolina Office of Research and Statistics from a statewide cohort of Medicare participants. To identify patients with ischemic stroke, we used International Statistical Classification of Diseases and Health Related Problems (ICD-9) codes for stroke and aphasia. ICD-9 codes 434.xx and 436.xx were used for ischemic stroke,5 and 784.3 was used for aphasia. Stroke severity was defined based on a novel proxy measure as follows: mild if no major stroke-related diagnoses (eg, dysarthria), moderate if 1 stroke-related diagnosis (excluding hemiplegia), and severe if hemiplegia or 2 or more other stroke-related diagnoses. We then calculated: the number of patients with stroke, the number of patients with stroke and aphasia, selected demographic and clinical variables, length of stay (LOS) in days, and total charges submitted and payments made (US$) by Medicare for all patients.

The date of index admission was used as the start date for analysis. All billing data for patients in this inception cohort for any time up to 365 days postindex date were used. An analytic data set was created by summarizing resource use from 6 different healthcare provider sources that bill separately to Medicare for each individual patient and by linking the summaries from these multiple administrative files: hospitals, Part B providers, nursing homes, outpatient, home health, and durable medical equipment.

Attributable costs of aphasia were defined as the cost of caring for patients with aphasia poststroke over and above the cost of general stroke care. We calculated both the actual charges billed for the care of the patients and the payments made by Medicare based on 2004 US dollars. The cost analysis for this study was performed primarily from the perspective of the payer (ie, payments). The effect that each patient characteristic had on total charges and payments for our 2004 South Carolina Medicare sample of ischemic stroke patients was initially assessed by univariate analysis. To assess 1-year attributable LOS and total cost of aphasia, multivariate analyses were conducted.

Results

More than 12% of the total sample had aphasia. Patients with aphasia were older and had more comorbidity, more...
severe strokes, and longer LOSs (Supplemental Table S1, http://stroke.ahajournals.org) compared with those without. Medicare payments for the care of stroke survivors with aphasia averaged $20,734 compared with $18,683 for those without aphasia. In adjusted models, the estimated 1-year attributable cost of aphasia was $1,703 (Table). Multivariate analysis indicated that aphasia resulted in an 8.5% increase in payments and a 6.5% increase in LOS. Stroke severity, race/ethnicity, and comorbidity were associated with greater costs and longer LOS (Supplemental Table S2, http://stroke.ahajournals.org).

**Discussion**

The cost of caring for poststroke patients with aphasia was approximately $1,700 more than was the cost of caring for patients without aphasia. Those with aphasia also experienced longer LOSs compared with those without aphasia. Longer LOS in this population contributes to increased costs, thereby increasing the attributable cost of having aphasia. In addition, it is believed that patients with higher-order cognitive deficits (ie, language comprehension, memory, naming) experience longer LOS because of the greater amount of time it takes to appreciate and remediate their deficits.6

It is also notable that patients with aphasia had different personal characteristics and discharge profiles than did those without aphasia. Patients with aphasia were older and were more often discharged to a skilled nursing facility than were persons without aphasia. This finding is important because age is a primary risk factor for stroke; therefore, older patients are more likely to experience aphasia and at a greater cost.7 These findings in total are significant because clinicians, third-party payers, and medical administrators are all required to develop an accurate picture of the financial burden of poststroke disorders, as reimbursement dollars for the management of these conditions continue to decrease.2

We acknowledge several limitations to this study. First, attributable cost analysis is limited by the absence of specific measures of quality. Second, the sample of patients with aphasia reported in this study is significantly smaller than are previous reports of 21% to 38% of all stroke patients.5 This difference may represent limited use of ICD-9 coding for aphasia or undercoding relative to previous studies. Third, we used a nonstandardized and unvalidated proxy measure of stroke severity. Stroke severity is a significant predictor of LOS and cost; however, currently no standardized measure of stroke severity for administrative data exists. Fourth, we reported costs from the perspective of Medicare (payments by Medicare), and this perspective may not capture the actual costs to society (eg, out-of-pocket expenses and loss of earnings caused by stroke).

However, the findings from this study demonstrated that the 1-year attributable cost of aphasia poststroke was higher than that for patients without aphasia because of costs related to LOS, age, and discharge site. These findings are important because dramatic changes are occurring in healthcare reimbursement8–12; specifically, these are imposed caps on Medicare reimbursement for outpatient rehabilitation services.13 Previously, Medicare beneficiaries were limited to $1,500 for Part B Medicare therapy, to be shared by speech-language pathology and physical therapy, whereas occupational therapy had its own cap. Although the current therapy cap is $1,870 for speech-language pathology and physical therapy, the financial burden of the cap remains a major limiting factor to the access of long-term rehabilitative services for patients with persisting aphasia. We believe these findings are also important to understanding the complexity of variables that contribute to the cost of stroke-related care. The cost of stroke has been linked primarily to costs related to the LOS, hospital overhead, nursing salaries, physician salaries, therapists, and medications.14 The findings of this study suggest that other factors, such as poststroke disorders, also contribute to higher costs of poststroke care. Understanding these contributors is important to making informed decisions and advocating for patients with such disorders.

**Disclosures**

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**References**

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The One-Year Attributable Cost of Post-Stroke Aphasia
**Table S1.** Demographics and Characteristics of Ischemic Stroke Patients

<table>
<thead>
<tr>
<th></th>
<th>Overall (n=3200)</th>
<th>Aphasic (n=398)</th>
<th>Non-Aphasic (n=2802)</th>
<th>p-value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approx Age</td>
<td>78.1 (6.9)</td>
<td>79.2 (6.9)</td>
<td>77.9 (6.9)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Male</td>
<td>1228.0 (38.4)</td>
<td>117.0 (29.4)</td>
<td>1111.0 (39.7)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Non-Hispanic White</td>
<td>2284.0 (71.4)</td>
<td>290.0 (72.9)</td>
<td>1994.0 (71.2)</td>
<td>0.48</td>
</tr>
<tr>
<td>Died</td>
<td>1284.0 (40.1)</td>
<td>185.0 (46.5)</td>
<td>1099.0 (39.2)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Prop. Time Alive (1yr)</td>
<td>0.8 (0.38)</td>
<td>0.7 (0.39)</td>
<td>0.8 (0.4)</td>
<td>0.02</td>
</tr>
<tr>
<td>Length of Stay (days)</td>
<td>7.4 (7.0)</td>
<td>8.6 (06.3)</td>
<td>7.2 (7.1)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Charlson Morb. Score</td>
<td>3.3 (1.8)</td>
<td>3.6 (01.8)</td>
<td>3.3 (1.8)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
Table S2. Effect of patient characteristics on hospital cost\textsuperscript{a} and LOS by multivariable analysis

<table>
<thead>
<tr>
<th>Variable</th>
<th>Total hospital cost (log) (n=3200)</th>
<th>LOS (log) (n=3200)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Parameter estimate</td>
<td>P value\textsuperscript{b}</td>
</tr>
<tr>
<td></td>
<td>(95% CI)</td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>8.962 (8.657, 9.268)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Non-aphasic</td>
<td>-0.085 (-0.149, -0.023)</td>
<td>0.008</td>
</tr>
<tr>
<td>Age</td>
<td>0.0024 (-0.001, -0.006)</td>
<td>&lt;0.13</td>
</tr>
<tr>
<td>African American</td>
<td>0.085 (0.039, 0.131)</td>
<td>0.0003</td>
</tr>
<tr>
<td>Charlson Score</td>
<td>0.084 (0.072, 0.096)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Proportion Time Alive</td>
<td>0.732 (0.672, 0.791)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>(1 yr)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stroke Severity (Mild)</td>
<td>Ref.</td>
<td></td>
</tr>
<tr>
<td>Stroke Severity (Mod.)</td>
<td>0.113 (0.059, 0.168)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Stroke Severity (Sev.)</td>
<td>0.143 (0.007, 0.285)</td>
<td>0.04</td>
</tr>
</tbody>
</table>

\textsuperscript{a} All payments are expressed in 2004 constant US$.

\textsuperscript{b} Significance was determined at the 0.05 level.