Cost of Acute Stroke Care in Toronto, Canada

L.T. Smurawska, MD; A.V. Alexandrov, MD; C.F. Bladin, MBBS, FRACP; J.W. Norris, MD

Background and Purpose Stroke cost consumes a large proportion of the gross domestic product in all developed countries, and while health care costs are rising, the ability to contain them is diminishing.

Methods We calculated the cost of acute stroke care for all first admissions to a teaching hospital in Toronto, Canada, in 1991 through 1992 for 285 consecutive patients.

Results The average cost per patient was $27,500 Canadian, and strokes in men cost less than in women ($23,000 versus $32,000 Canadian), for a total cost of $8 million Canadian over 2 years. More women died than men (34% versus 17%, \( P < 0.02 \)), mainly from systemic complications of stroke, but because women stayed hospitalized longer, they cost more in the long term. The major factor determining cost was social support, and more men than women went home or to rehabilitation units \( (P < 0.02) \). Family support was greater for men (82%) than women (39%, \( P < 0.0002 \)).

Conclusions Significant cost reductions are more likely to be achieved by altering discharge policies and improving social conditions for early return to the home than by reducing laboratory or medical personnel costs. (Stroke. 1994;25:1628–1631.)

Key Words • cerebrovascular diseases • costs and cost analysis • social support

With rapidly shrinking financial resources for medical care, cost containment becomes crucial. In Canada, 9% of the gross domestic product is spent on health care; in the United States this figure rose to its present 14% from 4% over the last 30 years.1 In the United Kingdom, 6.2% of the gross domestic product is expended on health care costs, while in the Scottish National Health Service cost of stroke represented 4.3% of total costs and 5.5% of hospital costs in 1988.3 These enormous escalating costs reflect such factors as increasing technology and specialization. Proposed reforms including reduced access to health care resources and rationing of laboratory facilities are based more on political expediency than scientific deduction. In Canada, despite more hospital care, health care is less expensive than in the United States because of lower administrative costs and less centralization of resources.3 Although there are numerous studies of the cost of stroke from the epidemiological perspective, there are very few studies performed by clinicians and even fewer by neurologists with expertise in stroke. The diagnosis of stroke is notoriously inaccurate,4 particularly when many patients do not undergo even basic tests such as computerized tomography (CT).5 In the study reported here, all patients had standardized clinical and laboratory assessments in a special stroke unit, and all cost accounting was prospectively recorded by the hospital administration.

Subjects and Methods

We retrospectively evaluated the hospital files from January 1991 through December 1992 of all first-ever stroke admissions...
living, life skills, community and home reintegration, education, rounds with patient/case conference, supportive intervention, reaction activity, patient-related reporting and recording, therapeutic adaptation, and treatment and preparation; (5) physicians (fees for service for each patient generated according to the Ontario Health Insurance Plan); and (6) pharmacy (cumulative cost for each patient).

Results

A total of 285 consecutive stroke patients were evaluated. The numbers of men (133) and women (152) were not significantly different, but the women were significantly older (77±12 years versus 73±11 years, P<.003). Mean length of hospital stay was shorter for men than women (34±47 days versus 47±68 days), but this difference was not significant.

Mortality

Significantly more women died than men (34% versus 17%, P<.02), with most patients dying within 10 days of admission (Fig 1). In men the major cause of death was cerebral (mass effect from cerebral edema or hemorrhage), whereas in women the systemic complications of stroke (cardiac and pulmonary) were the major cause (Table 1). Men died sooner than women (16±28 days versus 31±49 days, NS).

Length of Stay for Survivors

For those surviving, the mean length of hospital stay for women was longer than that for men (55±74 days versus 39±49 days, P<.06). On discharge from the hospital, more men went home or to rehabilitation facilities (P<.02) than women, whereas more women went to long-term care (P<.01) (Fig 2).

Severity of stroke (measured by the CNS) was the same in both sexes on admission (78±27 points in men compared with 71±30 points for women) and at 2 weeks (84±24 versus 82±28 points, respectively).

Using a CNS score of more than 60 points to determine suitability for transfer out of the acute care unit, we determined that 65% (134/207) of patients were inappropriately detained in the unit because of lack of access to alternative discharge facilities. Of the remainder, 57% died within 10 days; therefore, only 16% of patients needed to stay in the unit because of the severity of their disability.

The type of stroke also had no effect on the number of days spent in the hospital. The hospital stay for patients with devastating hemiplegia was not significantly different from those with transient lacunar strokes (cerebral hemorrhage, 38±84 days; lacunar infarcts, 36±58 days; cardioembolic infarcts, 47±54 days; and cryptogenic infarcts, 45±57 days).

Impact of Social Support

Family support for all patients after stroke was significantly greater for men (82%) than for women (39%, P<.0002) (Table 2). Most survivors (65%), irrespective of their sex, had family support, whereas this applied to only a minority (45%) of fatal stroke victims. Most of the survivors with family support (69%) were men (P<.002), whereas most of those with no social support (77%) were women (P<.001). Most victims of fatal strokes without family support (85%) were women (P<.0008).

Cost of Stroke

The average cost per stroke admission was $27 500 Canadian ($21 150 US); strokes in men cost less than strokes in women ($23 000 versus $32 000 Canadian; $17 700 versus $24 600 US), although this difference was not statistically significant. Mean cost per day was $680.00 Canadian ($520.00 US). In the distribution of costs (Fig 3) the major portion was nursing (42%), whereas physician costs were only 6%. The average cost

<table>
<thead>
<tr>
<th>TABLE 1. Cause of Death on First Stroke Admission</th>
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<tr>
<td>Men</td>
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<td>Women</td>
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**Fig 1.** Graph showing death rate during hospital stay.

**Fig 2.** Bar graph showing outcome of stroke patients comparing men to women.

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**TABLE 2. Presence of Family Support in Fatal and Nonfatal Strokes According to Sex**

<table>
<thead>
<tr>
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<th>Support</th>
<th>No Support</th>
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<tbody>
<tr>
<td></td>
<td>Men</td>
<td>Women</td>
</tr>
<tr>
<td>Survivors (n=211)</td>
<td>92</td>
<td>42</td>
</tr>
<tr>
<td>Fatal strokes (n=74)</td>
<td>17</td>
<td>17</td>
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Discussion

Our most relevant finding was that the major determinant of stroke costs during the first admission was social and not medical. The total costs of laboratory tests and physician visits were 8% and 6%, respectively, so even if major expenses such as physician visits and laboratory testing could be curtailed or substantially reduced, the preferable avenue to reduce costs would be to reduce the hospital stay. The severity of the neurological disability was not a major risk factor, since patients with minor cerebral lesions and negligible disability spent almost as long in the hospital as those with serious neurological deficits.

Twenty-six percent of our patients died after admission, which is similar to previous data from our unit and others.\textsuperscript{11,12} Significantly more women than men died in the first admission, but because they died later in the course of their illness, they cost more overall. Women also died mainly from systemic complications, reflecting their higher age and poorer general medical status, whereas men died predominantly from the immediate complications of cerebral infarction and hemorrhage (such as coning from cerebral edema).\textsuperscript{11} Men tended to go home or to rehabilitation facilities, whereas women went more commonly to nursing homes and hospitals for long-term care. This reflects the relative social isolation of the women as well as the better general medical condition of the men. From rehabilitation units, most patients returned home, again reducing the costs of men's strokes. Men consistently had more family support because they were younger; women were older and frequently had no surviving spouse. Similarly, more men had family support before their stroke, while most of those who died had no family support.

The impact of social support on stroke outcome has been studied previously. High levels of social support were associated with faster and more extensive recovery after stroke.\textsuperscript{13} In the study by Kelly-Hayes,\textsuperscript{14} older age, extent of impairment, and mental status were major factors in stroke recovery. In men, being unmarried was the sole contributor to institutional placement.

Nearly all of our patients were initially admitted to the acute stroke assessment unit.\textsuperscript{6} The value of such units has been debated for two decades.\textsuperscript{15} Randomized studies indicate that these units have little impact on mortality in the first week, when death is mainly due to acute cerebral damage that is as yet untreatable. In the subacute stage, however, when systemic complications are the major problem, clinical outcome is improved compared with treatment in general medical wards.\textsuperscript{16} Whether this is economical, however, is unknown, because such units may expensively prolong life and suffering in patients who would otherwise have died, in addition to speeding recovery in patients with less disability.

Persson et al\textsuperscript{17} estimated the direct costs of stroke in Sweden, including posthospital care (unlike our study), and found that nursing-home costs for women were higher than men. They suggested that more women were living in isolation before their stroke. They also found that women cost 52% more than men (compared with 39% in our population). In a comparison of US to Canadian (Montreal) hospitals, Gibson\textsuperscript{18} noted that the mean length of hospital stay in Montreal was twice that in the United States (32 days). Duration of hospital stay also reflects the sources of funding. In Canada, health care is a provincial concern and is largely government financed.

We have only studied direct costs in acute stroke patients for their first admission. Indirect costs including loss of income, workday loss, and other associated costs were not calculated. Asplund et al\textsuperscript{19} calculated the average cost in Sweden from first stroke to death as $79 000 US (using 1991 prices), with 80% direct and 20% indirect costs. In our hospital, total direct costs of acute stroke patients were $4.0 million US per year. If patients were discharged from acute care institutions after investigations were completed (by 10 days in 85%), this would save $1.7 million US per year.

The unexpected long duration of hospital stay for stroke patients in Canada compared with other countries has a multifactorial explanation. In the United States, length of hospital stay is dictated by diagnostic-related groups, by which payment is limited by predetermined time of hospitalization. There is no such constraint in Canada, and this is compounded by the difficulty in placing acute stroke survivors in facilities for long-term care.

Mortality for stroke is declining and the population is aging in developed countries, further escalating future health costs.\textsuperscript{20} The major factor in stroke cost is the unconscionable delay in discharging patients from acute-care hospitals, and the major determinant of this prolonged hospital stay is social rather than medical. Changing these social factors would have much more impact than reducing laboratory costs or physician salaries.

Acknowledgments

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References


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