Stroke Units in Their Natural Habitat
Can Results of Randomized Trials Be Reproduced in Routine Clinical Practice?
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Background and Purpose—Meta-analyses of randomized controlled trials of acute stroke care have shown care in stroke units (SUs) to be superior to that in conventional general medical, neurological, or geriatric wards, with reductions in early case fatality, functional outcome, and the need for long-term institutionalization. This study examined whether these results can be reproduced in clinical practice.

Methods—A multicenter observational study of procedures and outcomes in acute stroke patients admitted to designated SUs or general medical or neurological wards (GWs), the study included patients of all ages with acute stroke excluding those with subarachnoid hemorrhage, who were entered into the Riks-Stroke (Swedish national quality assessment) database during 1996 (14 308 patients in 80 hospitals).

Results—Patients admitted to SUs who had lived independently and who were fully conscious on admission to the hospital had a lower case fatality than those cared for in GWs (relative risk [RR] for death, 0.87; 95% confidence interval [CI], 0.79 to 0.96) and at 3 months (RR, 0.91; 95% CI, 0.85 to 0.98). A greater proportion of patients cared for in an SU could be discharged home (RR, 1.06; 95% CI, 1.03 to 1.10), and fewer were in long-term institutional care 3 months after the stroke (RR, 0.94; 95% CI, 0.89 to 0.99). No difference was seen in outcome in patients cared for in SUs or GWs if they had impaired consciousness on admission.

Conclusions—The improvement in outcomes after stroke care in SUs compared with care in GWs can be reproduced in the routine clinical setting, but the magnitude of the benefit appears smaller than that reported from meta-analyses. (Stroke. 1999;30:709-714.)

Key Words: randomized controlled trials n stroke outcome n stroke units n stroke, acute

The Stroke Unit Trialists’ Collaboration has, in a number of published and unpublished meta-analyses, shown convincing evidence for improved early survival and functional outcome in patients with acute stroke treated in stroke units (SUs) compared with those cared for in general wards.1–4 These benefits are seen irrespective of whether the stroke unit was established in medical, neurological, or geriatric departments. A meta-analysis of 19 randomized (or pseudorandomized) controlled trials showed an odds reduction of 19% in case fatality and a 25% odds reduction in combined outcomes of death or need for institutionalized care after the stroke. Furthermore, a 29% odds reduction in deaths or dependency on others for activities of daily living (ADL) has been reported.4 Stroke is a leading cause of death and disability worldwide, and reductions of the order of magnitude seen from the results of the meta-analysis would bring important decreases in suffering to patients and their relatives and result in significant savings for the community if they could be achieved in the routine care of stroke patients.

In this study the impact of routine care of stroke patients in SUs has been examined. The study was made possible by the implementation of Riks-Stroke, a nation-wide quality assessment register for patients with acute stroke.

Subjects and Methods
A national quality assessment register for acute stroke was set up in Sweden in 1994 to monitor the quality of stroke care and to improve it by providing comparative feedback data on process and outcome. All units in Sweden that admit patients with acute stroke were invited to take part, and since 1998 all such units in the country have participated. A computerized data registration sheet is used, and local data are submitted to Riks-Stroke’s national data management center for coordination and analysis. Each participating unit receives feedback annually in which the unit’s results are compared with those of the national data (see the Figure).
Data collection in Riks-Stroke is kept simple to ensure maximum coverage; it includes information on the patient’s sex, age, history of previous stroke, life situation before the current stroke, and need of assistance in 3 primary ADL functions (namely, mobility, personal hygiene, and dressing/undressing). Items related to acute care include the time from the onset of symptoms to admission to hospital, type of department to which the patient is admitted (eg, medical, neurological, or geriatric), whether or not the unit has organized stroke care (stroke unit), the patient’s level of consciousness on admission, whether or not a CT scan was performed, and, in patients who died, whether or not a postmortem was performed. In addition, drug treatment during the acute phase was added from 1998. Details registered at discharge included the duration of the acute admission to hospital, diagnosis of the stroke type according to the Riks-Stroke criteria (included in the computer program available at each participating unit), the patient’s status at discharge (alive or dead), and details of further management (at home or in an institution), and whether or not they required further care in an institution. Each patient registered in Riks-Stroke was followed up 3 months after the stroke, and a 9-item form was filled in by the patient, a family member, or, in the case of institutionalized patients, who were unable to respond themselves, by a staff member. In many hospitals these data were obtained by telephone interviews by the staff of the acute unit. In this study 30.5% of the follow-up forms were completed by the patient, 12.5% by a family member, 52.6% by staff at a hospital or other institution, and 4.3% by someone else. Data on living (whether alone, with relatives, or in an institution) and degree of function (as recorded before the stroke) and, from 1998, patient satisfaction with the in- and outpatient care received at the hospital were also recorded.

In the Riks-Stroke collaboration, an acute stroke is defined by the WHO criteria, and a stroke unit as a service provided by a designated stroke ward or stroke team working exclusively in the care of stroke patients. This report presents data collected during 1996 during which 14 300 patients were admitted to 87 units in 80 hospitals (in some hospitals, patients with acute stroke were admitted to different departments; medical, geriatric, or neurological) and registered in the Riks-Stroke database. Patients with subarachnoid hemorrhage were excluded from the study because the majority of them were managed in neurosurgical units, not included in Riks-Stroke.

Descriptive data are shown as means, medians, and proportions with their 95% confidence intervals (95% CI). Comparisons of outcome between patients cared for in SUs and GWs are presented as relative risks with 95% CI. Continuous variables were compared using a 1-way ANOVA by ranks (the Kruskal-Wallis test). Logistic regression was used for adjustments for covariates. All calculations were made using the SPSS statistical package.

Results

During 1996, a total of 7300 men (51.0%) and 7008 women (49.0%) were included in the Riks-Stroke database. Before admission to the hospital for acute stroke, 7438 (52.0%) were cohabitant and living at home; 6212 (43.4%) were living alone, and 551 (3.9%) were living in an institution (information on previous living was missing in 107 patients; 0.7%).

The majority of patients (8642; 60.4%) were treated in a SU in the acute phase, and 4752 (33.2%) were treated in a medical or neurological ward (GW). A total of 913 patients (6.4%) were treated in settings that did not fulfill the criteria for SUs or GWs (eg, admitted for observation and treatment in emergency departments or directly to rehabilitation units). They were excluded from further comparisons between SU and GW patients (information on type of acute stroke service was missing in 1 patient).

Initial analyses showed an imbalance in functional dependency before the stroke event between patients admitted to SUs and GWs. To make direct comparisons of outcome between the 2 settings possible, the ensuing analyses were restricted to patients who were living at home without community support. Among these patients, those who had been treated in SUs and GWs did not differ in marital status or ADL functions before the stroke, or in the prevalence of previous stroke (Table 1). GW patients were, on average, 1.2 years older than SU patients. The major difference in prognostic variables was a significantly higher proportion of GW patients presenting with impaired consciousness on admission to hospital. In the SUs, a significantly larger proportion of patients underwent CT scanning (93.8% versus 87.4% in the GWs; P<0.0001 by χ² test). This resulted in a lower proportion of patients left with an unspecified stroke subtype at discharge from the SUs compared with the GWs (Table 1).

Because of the uneven distribution of patients with lowered consciousness between the 2 clinical settings, the following analyses of outcome, presented in Table 2, were stratified by level of consciousness.

Early Outcome in Patients With Unimpaired Consciousness

Among patients who were living at home without community support before the stroke event and those who did not have lowered consciousness on admission to the hospital, the mean length of hospital stay was 0.8 days longer in the SUs than in the GWs (Table 2), a difference that was
statistically significant \((P<0.0002)\) by the Kruskal-Wallis test). A significantly higher proportion of those treated in SUs was discharged to home and a significantly lower proportion to nursing homes. Furthermore, when patients discharged to any type of institutional care were considered as a single group, there was a significant reduction in SU patients. The absolute risk reductions in favor of the SUs were all modest. In comparison with GW care, for 1000 patients admitted to SUs, 35 more were able to return to home, 16 fewer were transferred to nursing homes, and 23 fewer to institutional care of any type.

Case fatality during the stay in the acute ward was low in SU and GW patients, but it was significantly lower in those treated in SUs (Table 2), with 13 fewer deaths per 1000 patients admitted. The differences in proportion discharged to further institutional care and in case fatality remained statistically significant after adjustment for the small difference in age between SU and GW patients in a logistic regression model \((P<0.0001)\) for both outcomes.

### Early Outcome in Patients With Impaired Consciousness on Admission

In patients with independent living before the stroke event but arriving at the hospital with impaired consciousness, the length of hospital stay was, on average, 2.1 days longer in the SUs (Table 2). Case fatality during the hospital stay was about 6 times higher than in patients presenting with an unaffected level of consciousness. There was no significant difference in case fatality between the SU and GW patients. In fact, in patients with impaired consciousness, the only significant difference at discharge from the SU was that a larger proportion was transferred to geriatric or other rehabilitation units.

### TABLE 1. Basic Characteristics of Patients Living at Home Without Community Support Before the Stroke, Admitted to SUs and GWs

<table>
<thead>
<tr>
<th></th>
<th>Stroke Units (n=6687)</th>
<th>General Wards (n=3396)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, y</td>
<td>73.0 (72.7–73.2)</td>
<td>74.2 (73.9–74.5)</td>
</tr>
<tr>
<td>Sex, proportion of men</td>
<td>57% (56–58%)</td>
<td>56% (54–57%)</td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married/co-habitant</td>
<td>62.7%</td>
<td>62.2%</td>
</tr>
<tr>
<td>Single or widowed</td>
<td>37.2%</td>
<td>37.8%</td>
</tr>
<tr>
<td>Information missing</td>
<td>0.1%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Independent in activities before stroke</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outdoor mobility</td>
<td>95.1%</td>
<td>94.8%</td>
</tr>
<tr>
<td>Toilet visits</td>
<td>94.0%</td>
<td>93.7%</td>
</tr>
<tr>
<td>Dressing</td>
<td>94.2%</td>
<td>94.4%</td>
</tr>
<tr>
<td>History of previous stroke</td>
<td>23.3%</td>
<td>22.5%</td>
</tr>
<tr>
<td>Impaired consciousness on admission</td>
<td>14.9%</td>
<td>19.0%</td>
</tr>
<tr>
<td>Stroke subtype</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ischemic</td>
<td>83.2%</td>
<td>74.5%</td>
</tr>
<tr>
<td>Hemorrhagic</td>
<td>10.4%</td>
<td>11.3%</td>
</tr>
<tr>
<td>Unspecified</td>
<td>6.4%</td>
<td>14.2%</td>
</tr>
</tbody>
</table>

95% confidence intervals are shown in brackets.

### TABLE 2. Outcome in Patients Admitted From Independent Living at Home to SUs and GWs

<table>
<thead>
<tr>
<th>Outcome Variable</th>
<th>Without Impaired Consciousness</th>
<th></th>
<th>With Impaired Consciousness</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SUs (n=5584)</td>
<td>GWs (n=2654)</td>
<td>RR (95% CI)</td>
<td>SUs (n=979)</td>
</tr>
<tr>
<td>Length of acute hospital stay, mean days (95% CI)</td>
<td></td>
<td></td>
<td>13.5 (13.1–13.9)</td>
<td>12.7 (12.2–13.3)</td>
</tr>
<tr>
<td>Discharge from acute unit(^a)</td>
<td></td>
<td></td>
<td>74.4% 70.9%</td>
<td>1.06 (1.03–1.10)</td>
</tr>
<tr>
<td>Home</td>
<td></td>
<td></td>
<td>12.3% 11.3%</td>
<td>1.02 (0.98–1.07)</td>
</tr>
<tr>
<td>Sheltered living</td>
<td></td>
<td></td>
<td>4.8% 6.4%</td>
<td>0.90 (0.83–0.97)</td>
</tr>
<tr>
<td>Nursing home</td>
<td></td>
<td></td>
<td>12.0% 11.3%</td>
<td>1.02 (0.98–1.07)</td>
</tr>
<tr>
<td>Geriatric or other rehabilitation</td>
<td></td>
<td></td>
<td>12.0% 11.3%</td>
<td>1.02 (0.98–1.07)</td>
</tr>
<tr>
<td>Other institutional care</td>
<td></td>
<td></td>
<td>2.7% 3.6%</td>
<td>0.90 (0.82–1.00)</td>
</tr>
<tr>
<td>Any institutional care</td>
<td></td>
<td></td>
<td>3.1% 4.4%</td>
<td>0.87 (0.79–0.96)</td>
</tr>
<tr>
<td>Dead</td>
<td></td>
<td></td>
<td>6.3% 7.6%</td>
<td>0.91 (0.85–0.98)</td>
</tr>
</tbody>
</table>

3 months’ follow-up of survivors\(^a\)

<table>
<thead>
<tr>
<th>Outcome Variable</th>
<th>Without Impaired Consciousness</th>
<th></th>
<th>With Impaired Consciousness</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SUs (n=979)</td>
<td>GWs (n=624)</td>
<td>RR (95% CI)</td>
<td>SUs (n=979)</td>
</tr>
<tr>
<td>At home w/o community support</td>
<td></td>
<td></td>
<td>71.5% 69.5%</td>
<td>1.03 (1.00–1.07)</td>
</tr>
<tr>
<td>At home with community support</td>
<td></td>
<td></td>
<td>10.7% 12.7%</td>
<td>0.94 (0.89–0.99)</td>
</tr>
</tbody>
</table>

Independence in ADL functions at 3 months

| Outdoor mobility                 | 72.8% 70.5% | 1.04 (1.00–1.08) | 43.6% 40.2% | 1.05 (0.95–1.17) | 72.8% 70.5% | 1.04 (1.00–1.08) | 43.6% 40.2% | 1.05 (0.95–1.17) |
| Toilet visits                    | 81.7% 81.0% | 1.01 (0.97–1.05) | 54.2% 51.2% | 1.05 (0.94–1.16) | 81.7% 81.0% | 1.01 (0.97–1.05) | 54.2% 51.2% | 1.05 (0.94–1.16) |
| Dressing                         | 78.6% 77.4% | 1.02 (0.98–1.06) | 48.7% 48.8% | 1.00 (0.90–1.10) | 78.6% 77.4% | 1.02 (0.98–1.06) | 48.7% 48.8% | 1.00 (0.90–1.10) |

95% confidence intervals are shown in brackets.

\(^a\)Analyses restricted to subjects living independently at home before the stroke event.
### TABLE 3. Outcome in Patients Admitted From Independent Living at Home by Type of Stroke Services Provided in the Hospital

<table>
<thead>
<tr>
<th>Outcome Variable</th>
<th>Without Impaired Consciousness</th>
<th>With Impaired Consciousness</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hospitals w/≥85% of pts. in SUs (321 pts.) &amp; Hospitals w/≥85% of pts. in GWs (226 pts.)</td>
<td>Hospitals w/≥85% of pts. in SUs (321 pts.) &amp; Hospitals w/≥85% of pts. in GWs (226 pts.)</td>
</tr>
<tr>
<td>Age, y</td>
<td>73.6% (72.9–73.3)</td>
<td>79.4% (75.7–83.1)</td>
</tr>
<tr>
<td></td>
<td>72.3% (72.3–72.9)</td>
<td>74.6% (73.4–75.7)</td>
</tr>
<tr>
<td>Length of acute hospital stay, mean days (95% CI)</td>
<td>12.5 (11.9–13.1)</td>
<td>14.2 (13.2–15.2)</td>
</tr>
<tr>
<td></td>
<td>12.5 (11.9–13.1)</td>
<td>14.2 (13.2–15.2)</td>
</tr>
</tbody>
</table>

Discharge from acute unit

- **Home**: 73.6% (72.3%) & 79.4% (75.7–83.1%
- **Sheltered living**: 2.1% (3.3%) & 2.1% (3.3%)
- **Nursing home**: 3.0% (4.8%) & 3.0% (4.8%)
- **Geriatric or other rehabilitation**: 14.1% (10.2%) & 14.1% (10.2%)
- **Other institutional care**: 3.7% (3.1%) & 3.7% (3.1%)
- **Any institutional care**: 22.0% (21.4%) & 22.0% (21.4%)
- **Dead**: 2.8% (6.2%) & 2.8% (6.2%)
- **Case fatality at 3 months**: 5.6% (8.6%) & 5.6% (8.6%)

3 months’ follow-up of survivors

- **At home w/o community support**: 74.5% (71.0%) & 74.5% (71.0%)
- **At home with community support**: 13.2% (14.7%) & 13.2% (14.7%)
- **In long-term institution**: 9.9% (12.0%) & 9.9% (12.0%)
- **Other**: 2.5% (2.3%) & 2.5% (2.3%)

Independence in ADL functions at 3 months

- **Outdoor mobility**: 73.8% (72.8%) & 73.8% (72.8%)
- **Toilet visits**: 79.6% (84.3%) & 79.6% (84.3%)
- **Dressing**: 76.6% (80.0%) & 76.6% (80.0%)

95% confidence intervals are shown in parentheses.

*Analyses restricted to subjects living independently at home before the stroke event.*

### 3-Month Follow-up

At 3 months’ follow-up, the only difference between SU and GW patients that persisted as statistically significant was a lower proportion in long-term institutions if the patients had been treated in an SU in the acute phase (Table 2). This difference was only observed in patients who arrived at the hospital without impaired consciousness. For 1000 patients admitted, there were 20 fewer in a long-term institution at 3 months after the stroke. This difference remained statistically significant ($P<0.0001$) after adjustment for age in a logistic regression model. There were only weak tendencies toward better outcome in primary ADL proficiency at 3 months’ follow-up in SU patients (Table 2).

### Outcome in Hospitals With and Without Good Access to SU Services

In the majority of hospitals covered by the Riks-Stroke register, the number of beds in SUs was not sufficient to accommodate all patients with acute stroke. As presented above, imbalance in prognostic factors between patients selected to SUs and GWs, respectively, was corrected by restricting the analyses to patients who were living independently before the stroke and by stratification for level of consciousness on admission. To further reduce the influence of any possible imbalance between patients admitted to SUs and GWs, the clinical outcome in patients treated in hospitals in which the great majority of patients (85% or more) were treated in an SU was compared with that in hospitals in which the great majority (≥85%) of stroke patients were admitted to a GW. The denominator being all stroke events reported to Riks-Stroke from the individual hospitals. This comparison was possible because all Swedish hospitals admitting acute stroke patients are part of the national health system, and each has a defined local catchment area. Thirteen hospitals were in the group with ≥85% of patients in SUs and 11 hospitals in the group with ≥85% in GWs.

Prognostic variables did not differ significantly between patients treated in hospitals with and without good access to SU care (data not shown), except that a significantly higher proportion in hospitals with low access to SU care was recorded as having impaired consciousness on admission. Therefore, stratification by level of consciousness was done in the comparisons of outcome. The proportion of patients with unspecified stroke subtype was 3 times higher in hospitals with ≥85% of patients in GWs as compared with hospitals with ≥85% in SUs (14.9% versus 4.4%; $P<0.0001$ by $χ^2$ test).

The clinical outcome in the 2 types of hospitals, stratified by level of consciousness on admission, is compared in Table 3. A picture emerges similar to the one in comparisons between patients in SUs and GWs (Table 2). The length of hospital stay in patients without impaired consciousness was...
significantly shorter in patients with \( \geq 85\% \) of stroke patients in SUs. The other major difference was found in case fatality. In hospitals with a high proportion of patients in SUs, the case fatality was lower, not only in subjects without but even in subjects with impaired consciousness on admission. This difference in case fatality between hospitals persisted in both groups at 3 months’ follow-up (Table 3). Adjustments for the small differences in patient age between the 2 types of hospitals in a logistic regression model produced identical results (data not shown).

**Discussion**

Riks-Stroke is the first register with a national coverage that assesses the quality of management of acute stroke. It also allows regional and interhospital comparisons and permits comparisons of the impact of structural differences in stroke services. In the present report we have used this feature of the Riks-Stroke registry to compare the outcomes of patients treated in designated SUs with those of patients treated in GWs.

Membership in the Riks-Stroke collaboration is voluntary, but by 1998 all hospitals in Sweden admitting patients with acute stroke had joined. The registry is still being built up because a number of hospitals do not as of yet have full coverage of all stroke patients. In 1996, the year for which data are reported in this study, the database included 14 308 cases (excluding those with subarachnoid hemorrhage). Routine hospital statistics for 1996 showed that a total of 25 222 patients had been admitted to the hospital with a diagnosis at discharge of acute stroke. Previous validations have shown a considerable overdiagnosis of acute stroke in routine practice. Thus, as a crude estimate, approximately 70% to 75% of all patients suffering an acute stroke in Sweden in 1996 were included in the present study.

Patients admitted to SUs and GWs were initially found to differ in key prognostic factors. Although a history of previous stroke was equally common in the 2 patient groups, a somewhat higher proportion of patients admitted to GWs had already been dependent on others for care before the current stroke, and more patients admitted to GWs also had impairment of consciousness on admission to hospital. To minimize the effects of a selection bias, only patients who had been living at home without support from the community were included, and they were stratified by level of consciousness on admission. This selection produced groups of patients admitted to SUs and GWs that were closely similar in prognostic factors. However, because this is an observational study, there still may be an imbalance in prognostic factors not recorded in the Riks-Stroke registry. The great advantage of the present study is that it measures outcome in routine clinical practice and that the patient groups are large enough to allow subgroup analyses with adequate statistical power.

To further reduce any possible bias in the selection of patients admitted to SUs and GWs, the clinical outcome in hospitals in which the great majority of patients were treated in SUs was compared with that in hospitals in which few or no stroke patients had access to SU care. Several population-based epidemiological studies have shown that 95% or more of all patients suffering an acute stroke in Sweden are admitted to hospital. Because all hospitals in Sweden that admit patients with acute stroke serve a defined geographical area, it seems probable that group comparisons between hospitals with different types of stroke services will be based on similar case mixes. Nevertheless, hospitals in which few or no patients were admitted to an SU reported a greater proportion of patients with impaired consciousness on admission. Whether this reflects differences in examination practices and skills or is due to a true difference in case mix has yet to be ascertained. We have therefore also stratified patients by level of consciousness in our comparisons between hospitals with different stroke services.

Computerized tomography is available in all Swedish hospitals that admitted patients with stroke. Nevertheless, brain CT scanning was performed more often in patients admitted to SUs than in those admitted to GWs, and this resulted in a smaller proportion of patients who had an unspecified stroke diagnosis at discharge in the SU group. This item has been selected as one of the quality indicators of acute stroke management in Riks-Stroke.

There were several differences in outcome between patients admitted to SUs and GWs supporting the findings of the randomized trials of SU care with effects on survival and on the need for institutional care after the acute phase. Although the results of the present study were qualitatively similar to those of the randomized trials, the effects of SU care were quantitatively smaller. On the other hand, the results in the randomized trials are presented as an odds reduction, which is not the same as relative reduction. In an article from the Stroke Unit Trialists’ Collaboration, they reported that SU care was associated with 50 of 1000 patients returning home independently, and 10 of 1000 fewer patients going to institutional care. Our results are rather comparable, with 35 of 1000 extra returning home, and 16 fewer were transferred to nursing homes. Although, there are also several possible explanations for the relatively smaller effect in the present study compared with that found in the randomized trials.

First, there may have been a selection bias in hospitals in which patients with stroke were managed in GWs. Hospitals that entered the Riks-Stroke collaboration early on probably had a particular interest in stroke care, even if a formal SU had not been established. This possible selection bias may have reduced the differences in outcome between patients admitted to SUs and those admitted to GWs. Second, the majority of the trials included in the meta-analyses were performed during the 1970s and 1980s, before improvement in general knowledge and interest in stroke care occurred in doctors, nurses, and rehabilitation staff. The concept of the SU has probably provided a general stimulus for stroke management and has perhaps also influenced the quality of stroke care in hospitals with no formal SU. This would tend to reduce differences in care in patients admitted to SUs and GWs today compared with when SUs were first introduced. Third, there may be a dilution effect of any intervention when it is transferred from randomized trials to routine clinical practice. The organization and staffing of an SU (or a stroke team) may vary considerably between units. Features common to all SUs are that they are hospital-based, have a
systematic organization of stroke services, and use an inter-disciplinary approach to stroke management. However, these basic features allow for a considerable variation in practice. Thus, it may be assumed that adherence to the basic principles of SU organization and the quality of stroke management vary between the SUs taking part in the present study. This would also dilute the overall effects of SU care on the national level and also provide an impetus for improvement in stroke management in many hospitals that have SUs. The Riks-Stroke registry, by providing feedback information on the quality of care and the outcomes of stroke, serves to stimulate this development.

Appendix

Participating Centers and Investigators


The Riks-Stroke organization is supported by a grant from the Swedish National Board of Health and Welfare. This study was also supported by grants from the Swedish Medical Research Council (Grants 27P-12314 to BS and 27X-07192 to KA), the Social Sciences Research Council (Grant 97–0225-2B to KA), the Stroke Fund, Vårdalstiftelsen, the Heart and Chest Fund, and the Swedish Public Health Institute.

References


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Ann Staal

Computer Records and Data Analyses

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