Sex Differences in Management and Outcome After Stroke
A Swedish National Perspective

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Background and Purpose—It is disputed whether there are sex differences in management and outcome after stroke; early studies have shown inconsistent results. The objective of this study was to verify and explain differences between men and women in management and outcome after stroke in a national perspective.

Methods—In 2001, 20,761 stroke patients were registered in Riks-Stroke, the national quality register for stroke care in Sweden in which all 84 hospitals participate. Data from 9 hospitals that had reported <70% of the estimated stroke events were excluded from analyses, leaving 19,547 patients (9,666 women, 9,881 men) at 75 hospitals for the present analyses.

Results—Women were older than men (77.8 versus 73.2 years). After age adjustment, female patients were more often disabled, living at home with community support, or in institutions before the stroke. They also had a different cardiovascular risk factor profile. Case fatality ratios during the first 3 months were similar in men and women. After 3 months, more women were physically and mentally impaired and dependent on other persons. Female patients with atrial fibrillation received oral anticoagulants less often than men. Even after multiple adjustments for differences between sexes, female sex was independently associated with institutional living 3 months after the stroke (odds ratio, 1.2; 95% confidence interval, 1.0 to 1.4).

Conclusions—Women have a worse prestroke condition. Except for case fatality ratios, they also have a worse outcome after stroke after adjustment for other prognostic factors. There are also sex differences in the medical management of stroke that need to be rectified. (Stroke. 2003;34:1970-1975.)

Key Words: delivery of health care ■ gender ■ stroke management ■ stroke outcome

A recent review of the subject of stroke and sex concluded that there are differences between sexes in short-term case fatality.1 Among survivors of stroke, there is also some evidence that men have a more favorable outcome. In a study performed by Wyller et al,2 women had a worse outcome not only in motor function but also in cognitive function and activities of daily living (ADL). A recently published study showed that female sex was a prognostic factor for functional dependency after stroke.3 A small Swedish study (n = 99) of patients with severe stroke undergoing in-hospital rehabilitation showed that male sex was an important factor for improvement.4 Contrary to the previously mentioned studies, one recently published study found better survival for elderly women 1 year after stroke.5 Several other studies have shown no statistically significant differences between men and women in either case fatality or functional outcome after stroke.6–8 Instead, these studies claim that other factors besides sex independently predict the outcome.

Sex differences in medical management of stroke have rarely been studied. Although current evidence and recommendations support equal treatment strategies for stroke prevention for men and women, previously published studies have shown that women receive treatment with antiplatelet agents less often than men.5,8 The controversies about the influence of sex on stroke management and outcome seem to reflect the fact that many studies have poor statistical power and other studies have included only selected patients. There are also variations in follow-up time. In Riks-Stroke, the Swedish national register for stroke care, all hospitals that care for stroke patients during the acute phase are included. The register enables a national perspective on sex differences and stroke. The aim of this study was to evaluate differences between men and...
women in management and outcome after stroke in routine clinical practice and to find possible explanatory models.

**Patients and Methods**

Patients participating in this study were those included in Riks-Stroke during 2001. The register was established in 1994 to monitor the quality of stroke management with an aim of improving stroke care by providing comparative feedback data on process and outcome. Riks-Stroke is a hospital-based register that since 1998 has covered all hospitals in Sweden that admit patients with acute stroke. A computerized data registration sheet is used, and local data are submitted by an Internet-based system to the national data management center of Riks-Stroke for coordination and common presentation. Once a year, each participating hospital receives feedback information. Results from each individual hospital are compared with the national summary.

In the Riks-Stroke register, all new acute stroke events (International Classification of Diseases, 10th revision [ICD-10], codes I61, I63, and I64), except transient ischemic attacks and subarachnoidal hemorrhages (ICD-10 G45 and I60), are included. The strategy of Riks-Stroke is to prioritize coverage over details. Thus, data collection is kept very simple. The register provides information on sex; age; history of previous stroke; risk factors, including atrial fibrillation, diabetes, hypertension, and smoking; use of selected, predefined antithrombotic medications before stroke; living condition; and need of assistance in 3 primary ADL functions (mobility, toilet visits, and dressing/undressing). Items related to acute care include delay from onset of symptoms to admission, type of department (medical, neurological, geriatric, etc), care in organized stroke care (stroke unit), level of consciousness on admission to hospital, CT scan, antithrombotic drug treatment during the acute phase, and autopsy in fatal cases. At discharge, length of acute care hospital stay, diagnosis of stroke subtype according to the specified Riks-Stroke criteria (included in the computer program), status at discharge (dead or alive), further management (at home, in institutions at various levels), and antithrombotic medications (both already begun and planned) are recorded.

Three months after stroke, the patient is contacted by mail or telephone and asked to fill in a questionnaire. The 3-month questionnaire describes living condition, level of dependency in ADL, satisfaction with hospital care, help and support after hospital care, and dependency on family members. Information on self-perceived health and depression is included as single questions. Feeling of depression is dichotomized as often/always feeling depressed and sometimes/never feeling depressed. General health is dichotomized as fairly bad/very bad and fairly good/very good.

The present report is based on data from 2001. During that year, a total of 20 761 patients from 84 hospitals and hospital clusters in Sweden were entered into the database. From estimates from epidemiological data and official discharge registries, the coverage rate of each hospital was assessed. Nine hospitals that reported <70% of the expected number of stroke patients were excluded, leaving 19 547 patients in 75 hospitals. Analyses of background variables and hospital treatment were performed on these patients. At the 3-month follow-up, 3333 patients had died, and 13 397 patients had completed a 3-month follow-up questionnaire. Information about the 3-month follow-up was missing for 2817 patients (17.4% of survivors), and they were excluded from analyses of follow-up data.

**Statistical Analyses**

Statistical analyses were performed with the SPSS statistical package (version 10.0). Comparisons in mean age between men and women were performed with Student's t test. Because women were on average 4 years older when they had their strokes, each of the other variables was tested separately after adjustment for age using binary logistic regression with age as a linear covariable (Tables 1 through 3).

Multiple logistic regression analyses were performed to adjust for differences in background variables at the time of the stroke event or at the 3-month follow-up and to identify independent predictors for living condition at follow-up. Conditions and variables that were considered potential prognostic factors for living condition at follow-up were included in the analyses. The variables included in the regression models regarding prestroke status and acute stroke care were age (<=65, 65 to 74, 75 to 85, >85 years), sex, cohabitant status, first-ever or recurrent stroke, presence of diabetes, conscious or unconscious on admission, stroke unit care, and stroke subtype (cerebral infarction, intracerebral hemorrhage, unspecified stroke). Variables included from the follow-up were dependency in ADL functions, self-perceived general health, and depression. Because of a high frequency of missing values for the self-perceived health variables, the missing values were categorized into a third category and were included in the analyses. The frequency of missing values for other variables was <10%, and patients with missing values were automatically excluded in the multiple regression models. Each background variable was first tested separately, adjusted for age, and then analyzed with a multiple stepwise backward design. The models were also tested with manual removal of variables (by their known clinical importance) and with a stepwise forward design. These selection procedures resulted in the same final models as the backward procedures, so the odds ratios (ORs) and confidence intervals (CIs) were not changed (data not shown). The stepwise method systematically removed variables that were not statistically significant, leaving a final model. Estimates of statistically significant differences were based on ORs with 95% CIs.

**Results**

**Before the Stroke and During In-Hospital Care**

Of the 19 547 patients included in the study, 9881 (50.5%) were men, and 9666 (49.5%) were women. The mean age was 75.5 years; women were 4 years older than men (77.8 versus 73.2 years; P<0.001). As shown in Table 1, even after adjustment for age, women were more frequently living at home with community support or living in an institution before the stroke, whereas men more often lived at home without help from community. Among those living at home, women were more often living alone. Women in total were more dependent on help with ADL. Previous stroke, diabetes, and smoking were more common among men; hypertension was more common among women.

There were no statistically significant differences in the proportion of men or women with atrial fibrillation. However, women with atrial fibrillation who had an ischemic stroke more often had an impairment of consciousness on admission to hospital (24.4% versus 19.0%; OR, 1.36; 95% CI, 1.18 to 1.58). Among all patients, impaired consciousness was slightly more frequent among women than men. As many women as men underwent CT scan and treatment in a stroke unit (Table 1). On admission to hospital, female patients with first-ever stroke were, after age adjustment, less often treated with antithrombotic agents (Table 1). Among patients with atrial fibrillation, women were less frequently treated with oral anticoagulants (OR, 0.75; 95% CI, 0.59 to 0.95). At discharge from hospital, women received antithrombotic agents as secondary stroke prevention less often than men (Table 1). Women with atrial fibrillation were also less often treated with anticoagulants (OR, 0.79; 95% CI, 0.68 to 0.93) but more often treated with antiplatelet agents (OR, 1.19; 95% CI, 1.03 to 1.38) as secondary prevention compared with men.
Three-Month Follow-Up

The 7-, 28-, and 90-day case fatality ratios did not differ between men and women (Table 2). Table 3 shows age-adjusted comparisons between men and women at the 3-month follow-up. Among patients who had been living at home before stroke, more women than men changed their residency to an institution. Fewer women were living with a close relative, and fewer women were still living at home. More women needed help with primary ADL. A depressive mood was more common among women, and more women perceived that their health was fairly bad or very bad. Women received more help from both social and medical services. Among those who had not received help, more women than men expressed a desire to receive help. Women were also more dependent on help and support from relatives. In total, women both wished to have more help and received more help than men did.

As shown in Table 4, female sex predicted, after adjustment for other factors, institutional living 3 months after stroke among patients who lived at home before stroke. Other independent predictors were old age, living alone at stroke onset, presence of diabetes, impaired consciousness on admission, not receiving care in stroke unit, being dependent in primary ADL at follow-up, estimating health as fairly bad or very bad, and often or always feeling depressed.

Included Versus Excluded Patients

Patients treated in included hospitals were on average 1 year younger than patients treated in excluded hospitals (75.5 versus 76.6 years; \( P < 0.001 \)). As shown in Table 5, patients in

### TABLE 1. Comparison Between Men and Women of Background Variables From Before the Stroke and During Stroke Care

<table>
<thead>
<tr>
<th>Variable</th>
<th>Women N</th>
<th>n</th>
<th>%*</th>
<th>Men N</th>
<th>n</th>
<th>%*</th>
<th>OR†</th>
<th>95% CI†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Living situation and ADL function</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Living at home without community support</td>
<td>9521</td>
<td>6444</td>
<td>67.7 (77.1)</td>
<td>9763</td>
<td>8220</td>
<td>84.2 (86.2)</td>
<td>0.54</td>
<td>0.50–0.58</td>
</tr>
<tr>
<td>Living at home with community support</td>
<td>9521</td>
<td>1885</td>
<td>19.8 (14.1)</td>
<td>9763</td>
<td>930</td>
<td>9.5 (8.6)</td>
<td>1.74</td>
<td>1.08–1.90</td>
</tr>
<tr>
<td>Institutional living</td>
<td>9521</td>
<td>1192</td>
<td>12.5 (7.8)</td>
<td>9763</td>
<td>613</td>
<td>6.3 (5.4)</td>
<td>1.51</td>
<td>1.36–1.68</td>
</tr>
<tr>
<td>Living alone</td>
<td>8319</td>
<td>4994</td>
<td>60.0 (60.2)</td>
<td>9116</td>
<td>2849</td>
<td>31.3 (33.3)</td>
<td>3.02</td>
<td>2.78–3.29</td>
</tr>
<tr>
<td>Independent ADL</td>
<td>9464</td>
<td>8268</td>
<td>87.4 (86.5)</td>
<td>9748</td>
<td>8941</td>
<td>91.7 (90.0)</td>
<td>0.93</td>
<td>0.92–0.93</td>
</tr>
<tr>
<td>Risk factors</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Previous stroke</td>
<td>9298</td>
<td>2598</td>
<td>27.9 (26.7)</td>
<td>9582</td>
<td>2670</td>
<td>30.0 (30.1)</td>
<td>0.82</td>
<td>0.77–0.71</td>
</tr>
<tr>
<td>Diabetes</td>
<td>9320</td>
<td>1867</td>
<td>20.0 (20.2)</td>
<td>9587</td>
<td>2123</td>
<td>22.1 (22.0)</td>
<td>0.90</td>
<td>0.83–0.96</td>
</tr>
<tr>
<td>Treatment for hypertension</td>
<td>9116</td>
<td>4369</td>
<td>47.9 (47.6)</td>
<td>9392</td>
<td>4248</td>
<td>45.2 (45.5)</td>
<td>1.09</td>
<td>1.02–1.15</td>
</tr>
<tr>
<td>Atrial fibrillation</td>
<td>9212</td>
<td>2565</td>
<td>27.8 (20.7)</td>
<td>9461</td>
<td>2255</td>
<td>23.8 (16.5)</td>
<td>1.05</td>
<td>0.98–1.12</td>
</tr>
<tr>
<td>Smoking</td>
<td>7981</td>
<td>965</td>
<td>12.1 (11.5)</td>
<td>7989</td>
<td>1590</td>
<td>19.9 (15.3)</td>
<td>0.72</td>
<td>0.66–0.79</td>
</tr>
<tr>
<td>Stroke characteristics and management</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intracerebral hemorrhage</td>
<td>9666</td>
<td>1055</td>
<td>10.9 (11.2)</td>
<td>9881</td>
<td>1256</td>
<td>12.7 (11.9)</td>
<td>0.93</td>
<td>0.85–1.02</td>
</tr>
<tr>
<td>Fully conscious on admission</td>
<td>9477</td>
<td>7381</td>
<td>77.9 (75.7)</td>
<td>9719</td>
<td>8151</td>
<td>83.9 (76.6)</td>
<td>0.76</td>
<td>0.71–0.82</td>
</tr>
<tr>
<td>Computed tomography</td>
<td>9543</td>
<td>9274</td>
<td>97.2 (98.1)</td>
<td>9763</td>
<td>9563</td>
<td>98.0 (98.2)</td>
<td>0.98</td>
<td>0.81–1.18</td>
</tr>
<tr>
<td>Stroke unit care</td>
<td>9666</td>
<td>6908</td>
<td>71.5 (72.5)</td>
<td>9881</td>
<td>7303</td>
<td>73.3 (73.3)</td>
<td>0.96</td>
<td>0.90–1.02</td>
</tr>
<tr>
<td>Primary prevention with antithrombotic agents among patients with first stroke</td>
<td>6475</td>
<td>2234</td>
<td>34.5 (32.6)</td>
<td>6486</td>
<td>2421</td>
<td>37.3 (39.4)</td>
<td>0.75</td>
<td>0.69–0.80</td>
</tr>
<tr>
<td>Secondary prevention with antithrombotic agents among patients with cerebral infarction</td>
<td>7023</td>
<td>6449</td>
<td>91.8 (92.3)</td>
<td>7212</td>
<td>6744</td>
<td>93.5 (93.3)</td>
<td>0.86</td>
<td>0.76–0.98</td>
</tr>
</tbody>
</table>

*Age-adjusted percentages are given in parentheses.
†OR and 95% CI are age-adjusted.

### TABLE 2. Comparison of Case Fatality Between Men and Women

<table>
<thead>
<tr>
<th>Variable</th>
<th>Women N</th>
<th>n</th>
<th>%*</th>
<th>Men N</th>
<th>n</th>
<th>%*</th>
<th>OR†</th>
<th>95% CI†</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–90 days</td>
<td>8242</td>
<td>1748</td>
<td>21.2 (16.3)</td>
<td>8481</td>
<td>1435</td>
<td>16.9 (16.4)</td>
<td>0.995</td>
<td>0.92–1.08</td>
</tr>
<tr>
<td>0–7 days</td>
<td>8978</td>
<td>700</td>
<td>7.8 (6.7)</td>
<td>9160</td>
<td>612</td>
<td>6.7 (6.7)</td>
<td>1.00</td>
<td>0.89–1.12</td>
</tr>
<tr>
<td>8–27 days</td>
<td>7679</td>
<td>561</td>
<td>7.3 (4.8)</td>
<td>7983</td>
<td>463</td>
<td>5.8 (5.2)</td>
<td>0.91</td>
<td>0.80–1.04</td>
</tr>
<tr>
<td>28–90 days</td>
<td>6981</td>
<td>488</td>
<td>7.0 (4.5)</td>
<td>7406</td>
<td>360</td>
<td>4.9 (4.3)</td>
<td>1.04</td>
<td>0.90–1.21</td>
</tr>
</tbody>
</table>

*Age-adjusted percentages are given in parentheses.
†OR and 95% CI are age-adjusted.
excluded hospitals were more often dependent in primary ADL and less often treated in stroke units. However, patients included in the Riks-Stroke register in these hospitals had a lower 90-day case fatality.

Table 5 also shows comparisons between patients followed up at 3 months and those for whom the 3-month follow-up was missing. The latter category had a worse prestroke condition, more often had impaired consciousness on admission to hospital, and less often had received stroke unit care.

**Discussion**

At 3 months after stroke onset, women were more dependent on help for ADL, and among those living at home before stroke, more women had moved into an institutional living. This is partly explained by a worse prestroke condition among women. Nevertheless, these results were valid even after adjustment for other predictive variables and after analyses of the subgroup of patients being independent in ADL and living at home with a close relative before stroke onset (data not shown).

In the present study, differences in risk factor profiles between men and women confirmed results from previous studies. A diagnosis of diabetes and the habit of smoking are more common among male stroke patients, although these risk factors may have a stronger impact in women. The relative risk for stroke is the same for hypertensive women as for hypertensive men, but hypertension is more frequent among women, implying a higher absolute risk for stroke. Depression after stroke is very common and affects survival, functional outcome, and life satisfaction. In one study, it was shown that women are diagnosed twice as often with major depression 2 weeks after stroke as men. The increased frequency of depression in female stroke patients has been shown to persist at 6 months and 1 year after stroke. However, another study showed no relationship between sex and poststroke depression. Different mechanisms have been suggested to cause poststroke depression in men and women, which may have implications for treatment.

Our findings indicate that women are more dependent on and in need of help and support after stroke. This need has not been sufficiently met. Impaired physical and mental capaci-
ties are not the only factors that predict transition to institutional living. Good social support counteracts this process and is associated with faster and more extensive recovery of functional status after stroke.19,20 At discharge from hospital, women received antithrombotic stroke prevention less often than men. This results mainly because of differences in the proportion treated with oral anticoagulants. This finding is in agreement with previous observations that women with atrial fibrillation are less often treated with oral anticoagulants as primary stroke prevention.21,22 This may seem paradoxical because compared with men, women with atrial fibrillation have as high a risk for embolism, more severe strokes, and a higher long-term mortality. The beneficial effect of oral anticoagulants has been shown to be even larger among women.23,24 Women with atrial fibrillation are older, more often have comorbidity, may have an increased risk of complications and thus are in need of more careful monitoring of anticoagulant intensity.21 However, the differences

### TABLE 4. Logistic Regression Analyses of Institutional Living at 3-month Follow-Up, Among Patients Who Lived at Home Before Stroke: Separate Analyses of Each Variable and Multiple Analysis

<table>
<thead>
<tr>
<th></th>
<th>Separate Analyses (age-adjusted)</th>
<th></th>
<th>Multiple Analysis</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N=11 661</td>
<td>OR</td>
<td>95% CI</td>
<td>OR</td>
</tr>
<tr>
<td>Age*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;84</td>
<td>Reference category</td>
<td></td>
<td></td>
<td>Reference category</td>
</tr>
<tr>
<td>75–84</td>
<td>0.43</td>
<td>0.38–0.48</td>
<td></td>
<td>0.62</td>
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<tr>
<td>65–74</td>
<td>0.17</td>
<td>0.15–0.20</td>
<td></td>
<td>0.36</td>
</tr>
<tr>
<td>&lt;65</td>
<td>0.06</td>
<td>0.04–0.08</td>
<td></td>
<td>0.15</td>
</tr>
<tr>
<td>Women</td>
<td>1.37</td>
<td>1.23–1.53</td>
<td></td>
<td>1.18</td>
</tr>
<tr>
<td>Recurrent stroke</td>
<td>1.37</td>
<td>1.23–1.54</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td>1.57</td>
<td>1.39–1.79</td>
<td></td>
<td>1.34</td>
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<tr>
<td>Intracerebral hemorrhage</td>
<td>1.84</td>
<td>1.55–2.18</td>
<td></td>
<td>1.27</td>
</tr>
<tr>
<td>Fully conscious on admission</td>
<td>0.19</td>
<td>0.16–0.22</td>
<td></td>
<td>0.32</td>
</tr>
<tr>
<td>Stroke unit care</td>
<td>0.96</td>
<td>0.85–1.06</td>
<td></td>
<td>0.83</td>
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<tr>
<td>Living alone before stroke</td>
<td>1.80</td>
<td>1.61–2.01</td>
<td></td>
<td>2.28</td>
</tr>
<tr>
<td>Independent ADL at follow-up</td>
<td>0.05</td>
<td>0.04–0.06</td>
<td></td>
<td>0.06</td>
</tr>
<tr>
<td>Estimated health at follow-up</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Good/fairly good health</td>
<td>Reference category</td>
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<td></td>
<td>Reference category</td>
</tr>
<tr>
<td>Fairly bad/very bad health</td>
<td>3.51</td>
<td>3.07–4.00</td>
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<td>1.45</td>
</tr>
<tr>
<td>Information missing</td>
<td>5.44</td>
<td>4.72–6.27</td>
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<td>2.42</td>
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<tr>
<td>Depression at follow-up</td>
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<tr>
<td>Never/sometimes depressed</td>
<td>Reference category</td>
<td></td>
<td></td>
<td>Reference category</td>
</tr>
<tr>
<td>Often/always depressed</td>
<td>2.54</td>
<td>2.18–2.95</td>
<td></td>
<td>1.19</td>
</tr>
<tr>
<td>Information missing</td>
<td>4.07</td>
<td>3.53–4.70</td>
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<td>1.88</td>
</tr>
</tbody>
</table>

*This variable is not age-adjusted.

### TABLE 5. Comparison Between Patients Included and Patients Excluded in Analyses According to the 2 Major Reasons for Exclusion

<table>
<thead>
<tr>
<th>Hospital Coverage</th>
<th>&gt;=70% Coverage (N=19 547) n (%)</th>
<th>&lt;70% Coverage (N=1216) n (%)</th>
<th>P value</th>
<th>3-Month Follow-Up</th>
<th>&gt;=70% Coverage (N=14 488) n (%)</th>
<th>&lt;70% Coverage (N=2840) n (%)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women</td>
<td>9881 (50.5)</td>
<td>588 (48.4)</td>
<td>0.14</td>
<td>7039 (48.6)</td>
<td>1434 (50.5)</td>
<td>0.06</td>
<td></td>
</tr>
<tr>
<td>Independent ADL before stroke</td>
<td>16 457 (85.8)</td>
<td>948 (81.2)</td>
<td>&lt;0.001</td>
<td>12 554 (87.4)</td>
<td>2359 (85.6)</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td>Institutional living before stroke</td>
<td>1805 (9.4)</td>
<td>115 (9.8)</td>
<td>0.62</td>
<td>1131 (7.9)</td>
<td>260 (9.4)</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td>Intracerebral hemorrhage</td>
<td>2311 (11.8)</td>
<td>145 (11.9)</td>
<td>0.80</td>
<td>1432 (9.9)</td>
<td>338 (11.9)</td>
<td>0.001</td>
<td></td>
</tr>
<tr>
<td>Previous stroke</td>
<td>5468 (29.0)</td>
<td>322 (27.3)</td>
<td>0.21</td>
<td>3986 (28.3)</td>
<td>788 (29.1)</td>
<td>0.37</td>
<td></td>
</tr>
<tr>
<td>Fully conscious on admission</td>
<td>15 532 (80.9)</td>
<td>959 (79.8)</td>
<td>0.34</td>
<td>12 477 (87.4)</td>
<td>2340 (84.5)</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>Stroke unit care</td>
<td>14 211 (72.7)</td>
<td>840 (69.2)</td>
<td>0.01</td>
<td>10 790 (74.5)</td>
<td>2025 (71.3)</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>90-day case fatality</td>
<td>3184 (19.0)</td>
<td>3184 (16.3)</td>
<td>0.03</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Institutional living at follow-up</td>
<td>2436 (19.5)</td>
<td>147 (19.9)</td>
<td>0.77</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Patients treated in hospitals with coverage <70% and patients not followed up 3 months after stroke.
between men and women remained after adjustment for age in
how men and women with stroke are treated are not the result
of rational medical considerations.

Riks-Stroke is the first register with a national coverage that
assesses the quality of management of acute stroke care in
hospital. Earlier studies have shown that 92% to 97% of patients
with stroke are treated as inpatients.25,26 After consideration
of selection bias, it seems reasonable that hospital-based stroke
registries can be used in studies of acute stroke care in Sweden.

Riks-Stroke permits comparisons of processes and outcome
of stroke care between all hospitals and regions in Sweden.
The participation in the Riks-Stroke register is voluntary, but since
1998, all Swedish hospitals admitting stroke patients have
joined. In some hospitals, the register is still in a buildup phase,
and coverage is incomplete. To ensure that the patient population
in the present study was reasonably representative, we excluded
hospitals in which the registration was obviously incomplete.
Unpublished data from Riks-Stroke show that patients who die
during stroke care are less frequently included in the register. It
is also well known that hospitals with an organized stroke care
unit include more patients in Riks-Stroke.25 These results agree
well with the findings in the present study, and it is reasonable
to assume that the patients reported here are more representative
of a national sample of stroke patients than those who had been
excluded. The other reason for exclusion in this study was a
missing 3-month follow-up. Predictors of outcome were the
same for all patients and for the subgroup with a favorable
condition before stroke. Those patients for whom a 3-month
follow-up was not performed had a worse prestroke condition.
Therefore, the results from this study should be interpreted
carefully for this group of patients. Because most information
in the 3-month follow-up questionnaire was to be assessed on
the actual day of responding to the questionnaire, recall bias is
unlikely.

Level of consciousness is an indicator of stroke severity, and
decreased consciousness is one of the strongest predictive factors
for poor outcome after stroke.27,28 In our study, an impairment
of consciousness was slightly more common among women. In
contrast to this finding, there were no differences in case fatality
between men and women. Among stroke survivors, more
women were institutionalized at the 3-month follow-up.
Differences in prestroke condition, comorbidities, medical manage-
ment, and need and distribution of help and support also explain
sex differences in stroke outcome. Strategies to reduce the
apparent sex difference in the management of stroke need to be
developed. As a first item of such an agenda, the mere fact that
sex differences exist should be more widely recognized among
those who care for stroke patients.

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