Sex Differences in the Clinical Presentation, Resource Use, and 3-Month Outcome of Acute Stroke in Europe
Data From a Multicenter Multinational Hospital-Based Registry

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Background and Purpose—The information on the existence of sex differences in management of stroke patients is scarce. We evaluated whether sex differences may influence clinical presentation, resource use, and outcome of stroke in a European multicenter study.

Methods—In a European Concerted Action involving 7 countries, 4499 patients hospitalized for first-in-a-lifetime stroke were evaluated for demographics, risk factors, clinical presentation, resource use, and 3-month survival, disability (Barthel Index), and handicap (Rankin Scale).

Results—Overall, 2239 patients were males and 2260 females. Compared with males, female patients were significantly older (mean age 74.5±12.5 versus 69.2±12.1 years), more frequently institutionalized before stroke, and with a worse prestroke Rankin score (all values P<0.001). History of hypertension (P=0.007) and atrial fibrillation (P<0.001) were significantly more frequent in female stroke patients, as were coma (P<0.001), paralysis (P<0.001), aphasia (P=0.001), swallowing problems (P=0.005), and urinary incontinence (P<0.001) in the acute phase. Brain imaging, Doppler examination, echocardiogram, and angiography were significantly less frequently performed in female than male patients (all values P<0.001). The frequency of carotid surgery was also significantly lower in female patients (P<0.001). At the 3-month follow-up, after controlling for all baseline and clinical variables, female sex was a significant predictor of disability (odds ratio [OR], 1.41; 95% CI 1.10 to 1.81) and handicap (OR, 1.46; 95% CI 1.14 to 1.86). No significant gender effect was observed on 3-month survival.

Conclusions—Sex-specific differences existed in a large European study of hospital admissions for acute stroke. Both medical and sociodemographic factors may significantly influence stroke outcome. Knowledge of these determinants may positively impact quality of care. (Stroke. 2003;34:1114-1119.)

Key Words: gender ■ prognosis ■ stroke management ■ stroke outcome

Studies have reported sex differences in the management of patients with ischemic heart disease.1-3 When compared with men, women were more likely to receive, in the acute phase, a less aggressive therapy and, in general, a reduced amount of diagnostic and therapeutic procedures. The information on the existence of sex differences in management of stroke patients is still scarce. Although epidemiological and clinical research evaluated the role of sex in relation to mortality and drugs effectiveness,4-6 an analysis of differences, between male and female stroke patients, in clinical presentation, resource use, and outcome in a large multinational data set has never been performed.

The information on sex-related differences may provide useful insight for risk factors control as well as for acute and long-term care interventions, such as the establishment of more appropriate in-hospital diagnostic and therapeutic pathways, and the setting-up of prevention and rehabilitation programs. The longer life-expectancy of women, and the direct relationship between stroke and advanced age, suggest that older female patients will be those bearing the major burden of the disease, both in terms of severity and residual disability.

The objective of the present study was to determine whether there were differences between sexes in risk factors,
clinical presentation, resource use, and 3-month outcome in patients hospitalized for acute stroke in a large European setting.

Subjects and Methods
A European Union Concerted Action was initiated to establish the relationships between resource use, costs, and outcome of packages of care for stroke in Europe. The specific objectives have been outlined previously. The study was prospective and involved 12 centers (22 hospitals) in 7 countries: England, France, Germany, Hungary, Italy, Portugal, and Spain. The hospitals were chosen because they contained staff interested in stroke research. They provide general acute care to the local population, most are community hospitals, serving up to 150,000 inhabitants. Some centers have acute stroke-monitoring facilities. Patient-based data collection began in September 1993, and related to all first-ever stroke admissions for the subsequent year. Stroke was defined according to the World Health Organization. The study variables were chosen after an initial workshop and were similar to those used by the Monitoring and Determinants in Cardiovascular Disease (MONICA) Stroke Study.

Patients were evaluated in the acute phase and 3 months after the stroke. The study was approved by the Ethics Committees of participating institutions. Written informed consent was given according to institutional guidelines. Variables germane to this article include the following: (1) baseline characteristics: age, sex, living conditions (living at home alone, not alone, or in institution), drug usage before stroke, and prestroke level of handicap, as defined by the modified Rankin Scale; (2) vascular risk factors and comorbid conditions: hypertension (previous diagnosis, current treatment, or values $\geq 160/95$ mm Hg in at least 2 subsequent measurements), atrial fibrillation (history of chronic atrial fibrillation, supported by past ECG and positive ECG for the arrhythmia during hospitalization, or past medical history with positive ECG), previous myocardial infarction, transient ischemic attack (acute neurological deficit of vascular origin, lasting <24 hours), diabetes mellitus (previous diagnosis or concurrent treatment with insulin or oral hypoglycemic medications, or fasting plasma glucose level of $\geq 7.8$ mmol/L [\(\geq 140\) mg/dL]), smoking (current or former practice), and alcohol consumption; (3) clinical state at time of maximum impairment within the first 7 days: level of consciousness, evaluated by the Glasgow Coma Scale, subsequently dichotomized into 2 categories of coma (score of 8 or less) or noncoma (score > 8), confusion, weakness or paralysis, speech or swallowing problems, and urinary incontinence; (4) use of major diagnostic tests (brain imaging, angiography, Doppler examination, echocardiogram) and therapeutic interventions (neurosurgery, carotid surgery, other vascular surgery), and amount of inpatient rehabilitation (formal therapy sessions) (brain imaging was CT scan for almost all the patients); and (5) destination from acute hospital: home, rehabilitation hospital, or institution.

Pathological types of stroke were defined as cerebral infarction, cerebral hemorrhage, subarachnoid hemorrhage, or unclassifiable stroke according to the presence and results of brain imaging. Using the clinical criteria from the Oxfordshire Community Stroke Project (OCSP),13 subtypes of ischemic stroke were rated into total anterior circulation infarct, partial anterior circulation infarct, posterior circulation infarct, and lacunar infarct.

Outcome data were collected 3 months after stroke onset. These included information on vital status, activities of daily living as evaluated by using the Barthel Index and the Rankin Scale. These assessments were usually made through a direct or a proxy face-to-face interview. In case of death, the date and cause were registered.

Statistical Analysis
Analysis of differences in the frequency of categorical variables was performed by using the $\chi^2$ test. Student’s t test for independent samples evaluated the continuous variables. Disability and handicap were rated according to the Barthel Index and the Rankin Scale. Previous observations emphasized that intervals among points are not necessarily equal in these scales, and, therefore, that it would be more appropriate not to analyze them as continuous variables. Consequently, the Barthel Index and the Rankin Scale were evaluated at univariate analysis using the Mann-Whitney nonparametric test and, subsequently, dichotomizing the scales, by logistic regression analysis. The selected categories were 0 to 14 and 15 to 20 for the Barthel Index, and 0 to 1 and 2 to 5 for the Rankin Scale. Results were expressed as odds ratios (ORs).

The role of sex as an independent predictor of 3-month death, disability, and handicap was evaluated in a series of forward stepwise logistic regression analyses, taking into account all baseline and clinical variables, and controlling for age and country. All statistical levels quoted are 2-tailed. The 95% CIs were calculated. Data were analyzed using SPSS (version 10.1) software.

Results
During the 12-month study period, 4534 consecutive patients with first-in-a-lifetime stroke were registered in the participating hospitals, and 4499 (mean age 71.8 $\pm$ 12.6 years; range 13.7 to 102.1 years) completed the data set. Overall, 2239 patients were males (49.8%; mean age 69.2 $\pm$ 12.1 years; range 13.7 to 100.1 years), and 2260 females (50.2%; mean age 74.5 $\pm$ 12.5 years; range 18.3 to 102.1 years). Compared with males, female patients were significantly older and more often lived at home alone or were institutionalized before stroke. They showed higher level of handicap, as defined by prestroke Rankin Scale, and a higher frequency of hypertension, atrial fibrillation, and antihypertensive treatment. History of myocardial infarction, current or previous smoking, alcohol consumption, and antiplatelet therapy were significantly more frequent in male patients (Table 1).

The clinical conditions at time of maximum impairment were more severely compromised in female patients, who, at the neurological evaluation, were more often in a coma and presented more frequently with paralysis, aphasia, swallowing problems, and urinary incontinence (Table 2).

Table 3 shows that a definition of pathological subtype was obtained significantly more often in male patients. This was mostly explained by the significantly lower proportion of brain imaging performed in female patients, with a subsequent higher number of pathologically unclassified stroke in women (31.2% versus 22.7%; $P<0.001$). A definition of clinical subtype following the OCSP classification was achieved in 2472 (90.2%) of the 2740 events defined as ischemic strokes. Apart from partial anterior circulation infarcts, slightly more frequent in women, no major differences were observed between sexes.

The use of investigation was far less frequent among female patients for all the resources considered: brain imaging, Doppler examination, echocardiogram, and angiography. Among surgical interventions, carotid surgery was performed significantly more frequently in male patients. Correction for age confirmed the effect of sex on the chance of receiving examinations or carotid surgery. No major sex differences were observed in the percent of patients receiving physiotherapy, speech therapy, and occupational therapy (Table 4). Likewise, no differences were observed considering the mean number of physiotherapy (13.8 $\pm$ 14.1 in women versus 13.5 $\pm$ 13.8; $P=0.553$), speech therapy (9.8 $\pm$ 11.0 in women versus 8.9 $\pm$ 8.7; $P=0.237$), and occupational therapy (11.4 $\pm$ 12.2 in women versus 10.7 $\pm$ 10.3; $P=0.429$) sessions.
Table 1: Distribution of Baseline Variables by Sex

<table>
<thead>
<tr>
<th>Variable</th>
<th>Males (n=2239)</th>
<th>Females (n=2260)</th>
<th>P</th>
<th>Total Sample (n=4499)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean±SD age, y</td>
<td>69.2±12.1</td>
<td>74.5±12.5</td>
<td>&lt;0.001</td>
<td>71.8±12.6</td>
</tr>
<tr>
<td>Living at home alone</td>
<td>20.6%</td>
<td>36.1%</td>
<td>&lt;0.001</td>
<td>28.4%</td>
</tr>
<tr>
<td>Institutionalized</td>
<td>3.7%</td>
<td>7.9%</td>
<td>&lt;0.001</td>
<td>5.8%</td>
</tr>
<tr>
<td>Atrial fibrillation</td>
<td>15.2%</td>
<td>20.8%</td>
<td>&lt;0.001</td>
<td>18.0%</td>
</tr>
<tr>
<td>Hypertension</td>
<td>46.7%</td>
<td>50.7%</td>
<td>0.007</td>
<td>48.7%</td>
</tr>
<tr>
<td>Diabetes</td>
<td>20.5%</td>
<td>21.3%</td>
<td>0.536</td>
<td>20.9%</td>
</tr>
<tr>
<td>Current or previous smoking</td>
<td>57.3%</td>
<td>18.4%</td>
<td>&lt;0.001</td>
<td>37.8%</td>
</tr>
<tr>
<td>Alcohol intake</td>
<td>47.9%</td>
<td>21.1%</td>
<td>&lt;0.001</td>
<td>34.5%</td>
</tr>
<tr>
<td>Previous myocardial infarction</td>
<td>14.0%</td>
<td>8.0%</td>
<td>&lt;0.001</td>
<td>11.0%</td>
</tr>
<tr>
<td>Previous transient ischemic attack</td>
<td>13.4%</td>
<td>11.7%</td>
<td>0.084</td>
<td>12.5%</td>
</tr>
<tr>
<td>Antihypertensive therapy</td>
<td>37.4%</td>
<td>45.1%</td>
<td>&lt;0.001</td>
<td>41.2%</td>
</tr>
<tr>
<td>Anticoagulant therapy</td>
<td>4.0%</td>
<td>3.8%</td>
<td>0.747</td>
<td>3.9%</td>
</tr>
<tr>
<td>Antiplatelet therapy</td>
<td>20.4%</td>
<td>16.8%</td>
<td>0.003</td>
<td>18.6%</td>
</tr>
<tr>
<td>Prestroke Rankin Score (2-5)</td>
<td>22.9%</td>
<td>31.7%</td>
<td>&lt;0.001*</td>
<td>27.3%</td>
</tr>
</tbody>
</table>

*Mann-Whitney test.

The 28-day case-fatality was 14.5% in women and 12.1% in men (P=0.017). The in-hospital mortality was 15.3% in women and 12.5% in men (P=0.009). Hospital stay was significantly longer in female patients (21.9±23.8 days; P=0.010). Women were less often discharged home (65.8% versus 73.0%; P<0.001) and significantly more often referred to an institution (7.8% versus 7.8%; P=0.013) after the discharge. Fifteen percent of patients were discharged to other or unspecified destinations.

Follow-up information was completed for 3534 patients (78.6% of the total study sample; 50.1% females). Followed patients represented 78.3% of women and 78.8% of men (P=0.703). At 3 months, 30.9% of the female patients were dead versus 26.1% of the male patients (P=0.001). Among survivors at 3 months, mean scores for the Barthel Index were 14.7±6.2 in women versus 16.6±5.2 in men (P<0.001; Mann-Whitney test), and the respective values for the Rankin Scale were 2.6±1.5 versus 2.2±1.5 (P<0.001; Mann-Whitney test). The delta between prestroke and 3-month Rankin Score was 1.8±1.6 for women and 1.6±1.5 for men (P=0.002; Mann-Whitney test).

Table 2: Clinical State at Time of Maximum Impairment by Sex

<table>
<thead>
<tr>
<th>Variable</th>
<th>Males (n=2239)</th>
<th>Females (n=2260)</th>
<th>P</th>
<th>Total Sample (n=4499)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confusion</td>
<td>29.1%</td>
<td>30.2%</td>
<td>0.420</td>
<td>29.6%</td>
</tr>
<tr>
<td>Coma</td>
<td>7.0%</td>
<td>10.1%</td>
<td>&lt;0.001</td>
<td>8.6%</td>
</tr>
<tr>
<td>Weakness</td>
<td>46.3%</td>
<td>43.4%</td>
<td>0.050</td>
<td>44.8%</td>
</tr>
<tr>
<td>Paralysis</td>
<td>36.3%</td>
<td>42.4%</td>
<td>&lt;0.001</td>
<td>39.3%</td>
</tr>
<tr>
<td>Aphasia</td>
<td>30.3%</td>
<td>34.8%</td>
<td>0.001</td>
<td>32.6%</td>
</tr>
<tr>
<td>Dysarthria</td>
<td>36.2%</td>
<td>31.2%</td>
<td>0.001</td>
<td>33.7%</td>
</tr>
<tr>
<td>Swallowing problems</td>
<td>25.0%</td>
<td>28.7%</td>
<td>0.005</td>
<td>26.9%</td>
</tr>
<tr>
<td>Urinary incontinence</td>
<td>37.3%</td>
<td>46.0%</td>
<td>&lt;0.001</td>
<td>41.7%</td>
</tr>
</tbody>
</table>

Table 5 reports the results of 3 (age- and country-adjusted) models of logistic regression analysis evaluating predictors of 3-month death, disability (Barthel Index <15), and handicap (Rankin Score >1). Among baseline variables, prestroke Rankin was a significant predictor of 3-month death, and history of hypertension showed a protective effect. Sex did not reveal a significant effect on survival. Among acute-phase variables, coma, paralysis, swallowing problems, and urinary incontinence significantly increased the risk of death at 3 months. Female sex and prestroke Rankin were positive predictors of 3-month disability and handicap, whereas prestroke institutionalization and diabetes were significant predictors only of 3-month handicap. Paralysis, swallowing problems, and urinary incontinence in the acute phase were significantly related to disability and handicap at the follow-up examination.

Discussion

This study evaluated the existence of sex differences in clinical presentation, management, and outcome in a large sample of European stroke patients. There were differences in baseline living conditions, risk factor profile, and stroke severity. No major sex differences were found in the use of in-hospital rehabilitation services, but diagnostic tools and interventions such as carotid surgery were used rather sparingly in women. Female sex was associated with a higher 28-day case-fatality rate, higher in-hospital and 3-month mortality, and with a longer in-hospital stay. Women were more likely to be discharged to an institution than home and were more disabled and more severely handicapped as assessed 3 months after stroke. At multivariate analyses, death, disability, or handicap were predicted by selective baseline and acute phase variables. Female sex showed a significant effect on 3-month disability and handicap, whereas the effect was statistically nonsignificant on 3-month survival.
Our results come from a multicenter study, and this might have reduced the homogeneity of our data set. However, when we analyzed the single variables separately for each country, the major findings were essentially confirmed. In all the countries, female patients showed higher rates of pre-stroke institutionalization (difference with men was significant in the United Kingdom, France, Germany, and Italy). The proportion of patients receiving brain imaging ranged from 64.2% in Hungary to 96.7% in France, but brain imaging was less frequently performed in women in all the countries. Female patients were less often discharged home in every country except Hungary and Portugal, where figures for both sexes were similar. Women were more disabled and more severely handicapped 3 months after stroke in all countries, and difference with men was significant in the United Kingdom, Germany, Spain, Portugal, and Italy. The variable “country” was also considered in the regression models evaluating the predictors of 3-month outcome.

Our rate of lost to follow-up (21.4%) is similar to those previously reported in studies on stroke outcome.17,18 Although gender did not appear to influence follow-up rates, the chance of being lost to follow-up was higher among younger patients (mean age 72.6±12.1 years in followed versus 69.2±13.8 in lost patients; P<0.001). This may have affected the precision of our estimates, but probably not enough to determine a distortion in the observed trends.

The frequency of baseline variables confirms epidemiological data on the sex distribution of stroke-related risk factors, as well as of social and comorbid conditions.19,20 Pre-stroke institutionalization and hypertension were more frequent among female patients, whereas smoking, alcohol intake, and previous myocardial infarction were more common among male patients. Men were more likely to receive antiplatelet therapy before stroke, and this could be explained by their higher frequency of ischemic heart disease. However, it is of interest to observe that despite the significantly higher frequency of atrial fibrillation in women, there were no sex differences in the use of anticoagulant therapy, which was very low in both sexes. These results were in accordance with a retrospective Canadian study evaluating sex differences in the management and outcome of stroke patients.5 Our Concerted Action has already shown that for stroke patients with atrial fibrillation, increasing age was the only independent determinant of not being on anticoagulants.21

Several studies indicate that recommended treatments are administered less often to women suffering myocardial in-

### TABLE 3. Stroke Pathological Types and Clinical Syndromes of Ischemic Stroke by Sex

<table>
<thead>
<tr>
<th>Variable</th>
<th>Males</th>
<th>Females</th>
<th>P</th>
<th>Total Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of patients</td>
<td>2239</td>
<td>2260</td>
<td></td>
<td>4499</td>
</tr>
<tr>
<td>Cerebral infarction</td>
<td>65.3%</td>
<td>56.5%</td>
<td>&lt;0.001</td>
<td>60.9%</td>
</tr>
<tr>
<td>Cerebral hemorrhage</td>
<td>10.3%</td>
<td>10.4%</td>
<td>0.852</td>
<td>10.3%</td>
</tr>
<tr>
<td>Subarachnoid hemorrhage</td>
<td>1.7%</td>
<td>1.9%</td>
<td>0.682</td>
<td>1.8%</td>
</tr>
<tr>
<td>Unclassifiable</td>
<td>22.7%</td>
<td>31.2%</td>
<td>&lt;0.001</td>
<td>27.0%</td>
</tr>
</tbody>
</table>

### TABLE 4. Resource Use During Hospitalization by Sex

<table>
<thead>
<tr>
<th>Variable</th>
<th>Males</th>
<th>Females</th>
<th>P</th>
<th>P*</th>
<th>Total Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brain imaging</td>
<td>85.7%</td>
<td>77.1%</td>
<td>&lt;0.001</td>
<td>0.006</td>
<td>81.4%</td>
</tr>
<tr>
<td>Doppler</td>
<td>44.0%</td>
<td>32.8%</td>
<td>&lt;0.001</td>
<td>0.001</td>
<td>38.4%</td>
</tr>
<tr>
<td>Echocardiogram</td>
<td>30.5%</td>
<td>22.8%</td>
<td>&lt;0.001</td>
<td>0.029</td>
<td>26.6%</td>
</tr>
<tr>
<td>Angiography</td>
<td>9.5%</td>
<td>5.5%</td>
<td>&lt;0.001</td>
<td>0.015</td>
<td>7.5%</td>
</tr>
<tr>
<td>Neurosurgery</td>
<td>3.0%</td>
<td>3.1%</td>
<td>0.816</td>
<td>0.168</td>
<td>3.0%</td>
</tr>
<tr>
<td>Carotid surgery</td>
<td>1.5%</td>
<td>0.3%</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>0.9%</td>
</tr>
<tr>
<td>Other vascular surgery</td>
<td>0.6%</td>
<td>0.4%</td>
<td>0.370</td>
<td>0.698</td>
<td>0.5%</td>
</tr>
<tr>
<td>Physiotherapy</td>
<td>65.0%</td>
<td>64.6%</td>
<td>0.823</td>
<td>0.935</td>
<td>64.8%</td>
</tr>
<tr>
<td>Speech therapy</td>
<td>23.1%</td>
<td>23.7%</td>
<td>0.692</td>
<td>0.453</td>
<td>23.4%</td>
</tr>
<tr>
<td>Occupational therapy</td>
<td>24.1%</td>
<td>23.2%</td>
<td>0.556</td>
<td>0.688</td>
<td>23.6%</td>
</tr>
</tbody>
</table>

*Adjusted for age.
fraction, helping to explain differences in outcome.\textsuperscript{1,2,22} In our survey, gender, and not stroke severity, seemed to be a major discriminating factor for the use of diagnostic resources or therapeutic interventions such as carotid surgery. In spite of more severely compromised clinical conditions, in women examinations such as brain imaging, Doppler sonography, echocardiogram, and angiography were performed significantly less often. Although no significant sex differences are reported in the incidence of major complications after carotid endarterectomy,\textsuperscript{23} in our study carotid surgery was performed in 1.5% of male and only in 0.3% of female patients ($P<0.001$).

These attitudes might, in part, be blamed on age. Mean age was significantly higher in female patients, although differences remained significant after adjustment for age. On the other hand, in the North American Symptomatic Carotid Endarterectomy Trial, elderly patients with 50% to 99% symptomatic carotid stenosis were found to benefit more from carotid endarterectomy than younger patients.\textsuperscript{24} Other studies conducted in the Unites States report that women hospitalized for stroke undergo fewer angiograms and carotid endarterectomies than men.\textsuperscript{25,26} A reason for not referring female patients for cerebral angiography and carotid endarterectomy could be the erroneous perception of physicians that women might have a higher rate of operative morbidity or mortality. We had no information on onset of symptoms and time of arrival at hospital, a crucial point for therapies such as thrombolysis, still not widely available for European stroke patients. Further studies should address whether age, gender, or other socioeconomic factors may determine delays in stroke evaluation and treatment.

A higher mortality in the acute phase in women, due to an age effect, could be regarded as an alternative explanation. A portion of deaths might be due to do-not-resuscitate orders, in which advanced age may take a part. During the first 48 hours from the stroke onset, there were 77 deaths among female and 50 among male patients. These numbers can have only a minor influence on main findings. However, when the analyses were limited to this group of patients, we found that 66.0% of men and only 37.7% of women had received brain imaging before death ($P=0.002$). The limited investigation, and hence intervention, received by female patients might contribute to their worse prognosis.

The predictive effect of motor symptoms, swallowing problems, and urinary incontinence on disability and handicap is consistent with previous data on clinical features of the acute phase predicting disability in stroke survivors.\textsuperscript{27} Female sex increased by almost one half the risk of disability and handicap 3 months after stroke. During hospitalization, rehabilitation referral and treatment were not significantly different between sexes. Other putative factors are likely to have a role on the effect of sex on 3-month outcome. Women lived at home alone more frequently than men, especially in Northern countries, although living alone was not selected as an independent determinant of outcome. On the contrary, prestroke institutionalization proved a significant determinant of handicap at follow-up. Women were more frequently institutionalized before stroke, and were more frequently referred to an institution after hospital discharge. Prestroke institutionalization heavily influenced destination after discharge. Of women institutionalized at baseline, only 14.6% returned home, as compared with 70.2% of women living at home at baseline ($P<0.001$). Both medical and social factors are recognized as increasing the risk of being institutionalized.\textsuperscript{28,29} In particular, it has been shown that frailty, defined as a vulnerable state resulting from the balance and interplay of medical and social factors, is strongly associated with institutionalization.\textsuperscript{30,31} Comorbidity, cognitive impairment, marital status, absence of caregivers, and lack of motivation are all potential contributors to frailty.\textsuperscript{31,32} These factors are also well known for reducing effectiveness of rehabilitation, and for negatively influencing the recovery after stroke.\textsuperscript{33,34} Because some degree of functional dependence may be induced by institutional care per se, we are cautious in generalizing these results. However, even after accounting for more advanced age, and for comorbidity and frailty, medical attitudes during the acute phase could

\begin{table}[h]
\centering
\caption{Predictors of 3-Month Death, Disability (Barthel Index 0–14), and Handicap (Rankin Scale 2–5)}
\begin{tabular}{llll}
\hline
Variable & Death & Disability & Handicap \\
\hline
Female sex & NS & 1.41 (1.10–1.81) & 1.46 (1.14–1.86) \\
Prestroke institutionalization & NS & NS & 2.57 (1.18–5.60) \\
Prestroke Rankin Score (2–5) & 1.47 (1.15–1.88) & 3.05 (2.25–4.13) & 2.38 (1.67–3.40) \\
Hypertension & 0.77 (0.62–0.96) & NS & NS \\
Diabetes & NS & NS & 1.49 (1.13–1.96) \\
Coma & 6.52 (4.46–9.53) & NS & NS \\
Paralysis & 2.00 (1.58–2.52) & 3.23 (2.46–4.23) & 2.68 (2.01–3.56) \\
Aphasia & NS & NS & 1.47 (1.12–1.93) \\
Swallowing problems & 2.61 (2.05–3.32) & 2.22 (1.56–3.17) & 1.97 (1.31–2.95) \\
Urinary incontinence & 2.45 (1.91–3.15) & 4.21 (3.18–5.58) & 2.87 (2.04–4.04) \\
\hline
\end{tabular}
\textsuperscript{NS indicates nonselected in the final model. Logistic regression analysis with stepwise selection of variables adjusted for age and country.}
\end{table}
play a role in determining a different outcome between male and female stroke patients.

Socioeconomic status was reported to affect mortality and treatment after stroke even in a country with a universal health insurance program such as Canada. In our data set, only employment status at stroke onset was available as socioeconomic indicator. This was considered a poor indicator, as it was referred only to the current status. For instance, retired people represented 71.9% of the study sample. In any case, the variable employment was tested in the multivariate models, but it did not change our results on gender differences. Although no major disparities in access to healthcare by sex are currently reported in Europe, sex differences in indicators of social status such as education, occupation, and income may lead different levels of patient compliance, or cause miscommunication between patients and physicians, causing poorer control of risk factors, or the incorrect use of preventive treatments such as the anticoagulant therapy in fibrillating patients. A more strict adherence to international guidelines for stroke prevention seems advisable to remove sex differences in management of individuals at risk, differences that may be acting before stroke onset and hospitalization.

In conclusion, our findings suggest a complex interplay of sociodemographic factors, preexisting frailty, and disease severity in determining outcome of stroke. Although other interventions may require a long-term perspective, the achievement of a diagnostic accuracy similar to that reached in male patients and aimed at a better definition of pathogenic features, together with a particular attention to the acute-phase predictors of functional outcome, seem affordable objectives, with possible positive consequences on general management and prognosis.

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