Sex Differences in Stroke Recovery and Stroke-Specific Quality of Life

Results From a Statewide Stroke Registry

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Background and Purpose—Little is known about sex differences in stroke recovery. The few available studies have found that female stroke survivors are less likely to achieve independence in activities of daily living and have poorer quality of life than male survivors.

Methods—A total of 373 acute stroke survivors discharged from 9 hospitals participating in a statewide stroke registry were prospectively enrolled in an outcomes study. Follow-up data, including the Barthel Index and Stroke-Specific Quality of Life, were obtained from the survivor or a proxy by telephone interview 90 days postdischarge. The independent effects of sex on activities of daily living independence (Barthel Index ≥95) and Stroke-Specific Quality of Life scores, controlling for age, race, subtype, prestroke ambulatory status, and other patient characteristics, were determined using adjusted odds ratios and least-squares means, respectively.

Results—Twenty-five percent of the patients required a proxy respondent. In adjusted models, females were less likely to achieve activities of daily living independence (adjusted OR: 0.37, 95% CI: 0.19 to 0.87). Females had lower least-squares means Stroke-Specific Quality of Life scores in Physical Function (3.9 versus 4.2, \( P < 0.001 \)), Thinking (2.8 versus 3.4, \( P < 0.001 \)), Language (4.3 versus 4.5, \( P = 0.03 \)), and Energy (2.6 versus 3.0, \( P < 0.01 \)). Interactions between sex and prior stroke were found for Mood, Role Function, and Summary Score, resulting in lower least-squares means for females only among subjects without prior stroke.

Conclusions—Compared with males, female stroke survivors had lower functional recovery and poorer quality of life 3 months postdischarge. These differences were not explained by females’ greater age at stroke onset or other demographic or clinical characteristics. (Stroke. 2007;38:2541-2548.)

Key Words: acute stroke ■ disability ■ quality of life ■ registries ■ survival

Many studies have investigated sex differences in symptoms, management, and outcomes of heart disease, but less is known about sex differences in cerebrovascular disease. Stroke is a leading cause of death in the United States, ranking third for females and fourth for males. Although age-adjusted stroke mortality rates are slightly higher for men than women, women have a much higher stroke death rate overall (68 versus 44 per 100,000 in 2002) owing to women’s higher average age at stroke presentation. Several studies have found that women who survive stroke have less favorable outcomes than their male counterparts. Women are less likely to be discharged home than men and are more likely to have physical impairments and limitations in activities of daily living (ADL), or basic components of self-care, on follow up. Women experience more mental impairment, depression, and fatigue and lower overall quality of life (QOL) than men after stroke. In cohort-based studies, various investigators have found sex differences in stroke presentation and medical history. However, the studies that have accounted for age and other differences in medical history and presentation have not eliminated these sex disparities; thus, their origins remain unknown.

Awareness of sex differences in functional status and QOL after a stroke may eventually enable better targeting of prevention, intervention, and rehabilitation services to relevant populations. Few stroke registries or data banks have reported on QOL using disease-specific instruments that account for the full range of stroke’s effects on health. Registries have the advantages of greater inclusiveness and generalizability than single-hospital studies or clinical trial data sets. The objectives of this study were to use data from a hospital-based statewide acute stroke registry to determine the magnitude of sex differences in stroke outcomes 3 months postdischarge, including dependence in ADL and stroke-specific QOL.
Methods
The Paul Coverdell National Acute Stroke Registry (PCNASR) was developed to monitor the quality of stroke care in the United States.\textsuperscript{13,14} Details of the design of the Michigan prototype, called the Michigan Acute Stroke Care, Outcomes and Treatment Surveillance System (MASCOTS), have also been published.\textsuperscript{15,16} Briefly, the MASCOTS registry collected detailed chart-level information, including demographics, stroke subtype, medical history, prestroke and poststroke ambulatory status, and modified Rankin Scale (mRS) at discharge, on 2566 consecutive acute stroke admissions from 15 Michigan hospitals. The MASCOTS Outcomes Study (MOS) was designed to measure relevant outcomes in a prospective sample of stroke survivors discharged from the registry. Hospitals were instructed to consent 50 consecutive acute stroke admissions. Six of the 15 original registry hospitals did not participate in the MOS because they had insufficient caseloads or lacked additional resources.

All hospitalized acute stroke cases were eligible for the MOS, except those that had very poor prognosis (defined as a life expectancy <6 months and/or discharge to a hospice). Subjects who developed a stroke while hospitalized for another reason were not included. Informed consent was obtained directly from the patient during their hospital stay. For patients who were unable to complete the consent process on their own as a result of language difficulties, cognitive impairments, or medical complications, a next of kin or legal guardian was sought as a proxy. Patients or proxies who could not complete a follow-up telephone interview in English were excluded. The MOS was approved by the Institutional Review Board of Charles University in Prague, Czech Republic. The Michigan Academic Stroke Consortium (MASCOTS) registry was approved by the Institutional Review Board of Michigan. The MOS was approved by the Institutional Review Board of Michigan State University and all participating hospitals.

A follow-up telephone survey conducted approximately 90 days after discharge collected information on a range of variables, including the Barthel Index (BI)\textsuperscript{17} and Stroke-Specific Quality of Life (SS-QOL).\textsuperscript{18,19}

Definition of Exposure Variables
Three categories of stroke subtype were created based on those defined by the Coverdell stroke registries:\textsuperscript{4-6} Ischemic stroke, hemorrhagic stroke, and transient ischemic attack (TIA). Medical history of stroke, diabetes, heart disease, and hypertension were categorized as present versus absent/no information. Ambulatory status was dichotomized as independent versus dependent (defined as needing assistance or unable to ambulate). Race/ethnicity was categorized as white versus nonwhite with nonwhite including black, Hispanic, Asian/Pacific Islander, and other. Age was categorized by 10-year intervals, i.e., <50, 50 to 59, 60 to 69, 70 to 79, and ≥80 years. The mRS was analyzed both as a 6-point ordinal measure and as a continuous variable (0 to 2, 3 to 5).

Definition of Outcome Measures
We used the 35-item, 7-domain scale SS-QOL instrument.\textsuperscript{18,19} Individual domains consist of 3 to 10 questions (each scored 1 to 5) that are averaged to generate an overall continuous score with a minimum value of 1 (worst) and a maximum value of 5 (best). The 7 domains include Physical Function, Language, Vision, Thinking, Energy, Mood, and Role Function. The Physical Function questions relate to difficulty with mobility, work, self-care, and arm or hand function. The Language domain relates to difficulty in speaking and being understood, whereas the Thinking domain assesses difficulty with memory or concentration. The Energy questions ascertain how much effort is required to complete tasks, whereas the Thinking domain assesses difficulty with memory or concentration. The Energy questions ascertain how much effort is required to complete tasks, whereas the Thinking domain assesses difficulty with memory or concentration. The Thinking domain assesses difficulty with memory or concentration. The Energy questions ascertain how much effort is required to complete tasks, whereas the Thinking domain assesses difficulty with memory or concentration. The Energy questions ascertain how much effort is required to complete tasks, whereas the Thinking domain assesses difficulty with memory or concentration. The Energy questions ascertain how much effort is required to complete tasks, whereas the Thinking domain assesses difficulty with memory or concentration. The Energy questions ascertain how much effort is required to complete tasks, whereas the Thinking domain assesses difficulty with memory or concentration. The Energy questions ascertain how much effort is required to complete tasks, whereas the Thinking domain assesses difficulty with memory or concentration. The Energy questions ascertain how much effort is required to complete tasks, whereas the Thinking domain assesses difficulty with memory or concentration.

Statistical Analyses
All statistical analysis was conducted using SAS version 9.1.3 (SAS Institute Inc., Cary, NC). Subjects in the MASCOTS registry were compared with MOS subjects with respect to categorical baseline characteristics using χ² tests. Male and female MOS subjects were compared with respect to follow-up status (ie, participation, refusal, loss to follow up, or death) and baseline characteristics using χ² tests. Sex differences in mRS data were also analyzed using the Cochran-Mantel-Haenszel test with modified Ridit scores for ordered categories.\textsuperscript{20} The independent effect of sex on ADL recovery was assessed through a multivariable logistic regression model. The model was developed through backward elimination with a significance level of 0.3 to enter and 0.05 to stay; however, age, race, and prestroke ambulatory status were included regardless of statistical significance. Medical history, ambulatory status at discharge, stroke subtype, mRS, and interview source were also considered for inclusion. After statistically significant main effects were identified, all 2-way interactions between sex and each main effect were entered into the model; nonsignificant interaction terms were removed one by one. Models were first developed with age as a continuous variable; however, to rule out the possibility of residual confounding by age, we examined several different specifications, including higher-order terms (ie, age² and age³), age as a categorical variable (10-year intervals), and log(age). None of these adjustments led to meaningful changes in the magnitude of the sex differences, so we report our final logistic regression model using age categories (10-year intervals) for ease of clinical interpretation.

The independent effects of sex on the 7 SS-QOL domain scores and the Summary Score were tested through separate multivariable linear regression models. Modeling procedures were similar to those described for logistic regression, with age, race, and stroke subtype included in all models. Like with the logistic model, different specifications of age were considered but did not meaningfully alter the coefficients for sex. Least-squares means for males and females were calculated from the final adjusted models to illustrate the magnitude of the independent effects of sex on SS-QOL scores. When a final model included interactions involving sex, least-squares means were calculated within strata of the effect modifying variable. The influence of proxy responses was assessed by generating least-squares means from the model after excluding scores from proxy respondents.

Results
Baseline characteristics of the 373 eligible subjects consented and enrolled in the MOS are shown in Table 1. Proxy respondents were the source for 25% (N=68) of the interviews. Some sex differences were evident at baseline. Females were older than males (mean 66 versus 62, t=2.59, P<0.01), less likely to have a history of heart disease, and less likely to smoke. There was a trend toward greater prevalence of diabetes in females. A difference in stroke subtype was also evident with females having a larger proportion with TIA. Males and females did not differ significantly in requiring a proxy respondent. mRS scores did not differ by sex either as an ordinal measure (Cochran-Mantel-Haenszel P=0.91) or when dichotomized; for modeling purposes, we chose to use the dichotomized version for ease of interpretation. We found that characteristics (including proportion of females) of the 373 subjects enrolled in the MOS were similar to the other MASCOTS registry subjects (n=1318), except that they were slightly younger, more likely to have ischemic stroke, less likely to have TIA, and more likely to be ambulatory at discharge (data not shown).

The 90-day follow-up interview was completed by 72% (N=270) of the subjects, 12% (n=46) refused or were unable to participate, 11% (n=42) were lost to follow up, and 4%
No significant sex differences in participation, refusal, loss to follow up, or death were observed (2.56, df 3, P = 0.13).

Overall, 155 subjects (57%) scored ≥95 on the BI indicating independence in ADL at 3 months (Table 2). In unadjusted analysis, females had significantly lower odds (OR: 0.44) than males of achieving ADL independence. After further adjustment for age, race, ambulatory status prestroke, proxy interview, mRS, and medical history of stroke, the OR decreased to 0.37. No 2-way interactions with sex were statistically significant. The Hosmer and Lemeshow test indicated that the model fit the data adequately (P = 0.64).

Unadjusted mean SS-QOL scores were significantly higher for males in the Physical Function, Thinking, Energy, and Role Function domains and in the Summary Score (data not shown). There were no significant differences in the unad-
justed scores for Language, Vision, or Mood. A ceiling effect was evident for the Language and Vision domains in our sample with 31% and 63%, respectively, attaining the highest possible scores.

Multivariable linear regression models found that sex was an important predictor of all SS-QOL domains (with the exception of Vision) and the Summary Score with either significant main effects or interactions. Parameter estimates for these models are detailed in supplemental Table I (available online at http://stroke.ahajournals.org). Least-squares means for males and females derived from the adjusted models, which summarize the independent effects of sex on SS-QOL scores and illustrate the interactions, are shown in Table 3. Significant main effects of sex, indicating poorer outcomes for females, were present for Physical Function, Language, Thinking, and Energy. Mood, Role Function, and Summary Score had interactions between sex and stroke history. The Mood domain had an additional interaction between sex and interview source.

The largest mean differences (approximately half a point) were observed for Thinking and Energy. Differences of similar magnitudes were evident for Mood, Role Function, and Summary Score, but only among those subjects without a prior stroke (the majority of subjects). In the Mood domain, the interaction of sex with interview source resulted in higher scores for males among patients who completed the interviews themselves but nonsignificantly higher scores for females using proxy respondents.

### Table 2. Unadjusted and Adjusted Odds Ratios for ADL Independence (BI ≥95) at 90 Days Postdischarge in 270 Stroke Survivors

<table>
<thead>
<tr>
<th>Mean (SD)</th>
<th>No.</th>
<th>BI (% ≥95)</th>
<th>Unadjusted OR* (95% CI)</th>
<th>Adjusted OR† (95% CI)</th>
<th>Wald P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>All subjects</td>
<td>270</td>
<td>57.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>112</td>
<td>68.8</td>
<td>0.44 (0.26–0.74)</td>
<td>0.37 (0.19–0.74)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Female</td>
<td>158</td>
<td>49.4</td>
<td>1.00</td>
<td>1.00</td>
<td></td>
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<tr>
<td>Age</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>&lt;50</td>
<td>42</td>
<td>73.8</td>
<td>1.00</td>
<td>1.00</td>
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<tr>
<td>50–59</td>
<td>46</td>
<td>58.7</td>
<td>0.52 (0.21–1.29)</td>
<td>0.58 (0.21–1.64)</td>
<td>0.3</td>
</tr>
<tr>
<td>60–69</td>
<td>62</td>
<td>67.7</td>
<td>0.84 (0.34–2.03)</td>
<td>1.12 (0.40–3.14)</td>
<td>0.83</td>
</tr>
<tr>
<td>70–79</td>
<td>69</td>
<td>60.9</td>
<td>0.56 (0.24–1.32)</td>
<td>0.92 (0.34–2.51)</td>
<td>0.87</td>
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<tr>
<td>≥80</td>
<td>51</td>
<td>25.5</td>
<td>0.14 (0.05–0.35)</td>
<td>0.23 (0.08–0.68)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Race</td>
<td></td>
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<tr>
<td>White</td>
<td>202</td>
<td>60.6</td>
<td>1.62 (0.90–2.91)</td>
<td>1.58 (0.78–3.22)</td>
<td>0.2</td>
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<tr>
<td>Nonwhite</td>
<td>53</td>
<td>47.2</td>
<td>1.00</td>
<td>1.00</td>
<td></td>
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<tr>
<td>mRS</td>
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<tr>
<td>3–5</td>
<td>42</td>
<td>73.8</td>
<td>1.00</td>
<td>1.00</td>
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<tr>
<td>0–2</td>
<td>46</td>
<td>58.7</td>
<td>0.52 (0.21–1.29)</td>
<td>0.58 (0.21–1.64)</td>
<td>0.3</td>
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<tr>
<td>Ambulatory status prestroke</td>
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<tr>
<td>Dependent</td>
<td>251</td>
<td>60.2</td>
<td>0.15 (0.03–0.71)</td>
<td>0.35 (0.07–1.82)</td>
<td>0.21</td>
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<tr>
<td>Independent</td>
<td>11</td>
<td>18.2</td>
<td>1.00</td>
<td>1.00</td>
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<tr>
<td>Ambulatory status at discharge</td>
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<tr>
<td>Dependent</td>
<td>80</td>
<td>37.5</td>
<td>0.29 (0.17–0.51)</td>
<td>‡</td>
<td></td>
</tr>
<tr>
<td>Independent</td>
<td>185</td>
<td>66.0</td>
<td>1.00</td>
<td>1.00</td>
<td></td>
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<tr>
<td>Stroke subtype</td>
<td></td>
<td></td>
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<tr>
<td>Ischemic stroke</td>
<td>202</td>
<td>51.5</td>
<td>0.33 (0.15–0.73)</td>
<td>‡</td>
<td></td>
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<tr>
<td>Hemorrhagic stroke</td>
<td>27</td>
<td>74.1</td>
<td>0.81 (0.26–2.55)</td>
<td>‡</td>
<td></td>
</tr>
<tr>
<td>TIA</td>
<td>41</td>
<td>75.6</td>
<td>1.00</td>
<td>1.00</td>
<td></td>
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<tr>
<td>Interview type</td>
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<tr>
<td>Proxy</td>
<td>68</td>
<td>29.4</td>
<td>0.20 (0.11–0.36)</td>
<td>0.28 (0.12–0.61)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Subject</td>
<td>202</td>
<td>66.8</td>
<td>1.00</td>
<td>1.00</td>
<td></td>
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<tr>
<td>Prior stroke</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Present</td>
<td>104</td>
<td>38.5</td>
<td>0.43 (0.26–0.72)</td>
<td>0.41 (0.22–0.77)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Absent</td>
<td>166</td>
<td>61.5</td>
<td>1.00</td>
<td>1.00</td>
<td></td>
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</table>

*Unadjusted odds ratios from logistic regression model.
†Adjusted ORs from multivariable logistic regression adjusted for all other variables in model. Hosmer and Lemeshow goodness-of-fit test for fully adjusted model: χ²=6.06, df=8, P=0.64.
‡Not included in final adjusted model.
respondents, mean scores in all domains increased as expected; however, the magnitude of the sex differences and their statistical significance remained the same (data not shown). The only exception was the Language domain in which there was a loss of statistical significance, although the mean difference remained the same.

**Discussion**

In this broadly inclusive cohort of stroke survivors from a hospital-based statewide stroke registry, we found marked sex differences in ADL independence and QOL as measured by the SS-QOL instrument. These differences were not explained by age, stroke subtype, or comorbidities. Our findings substantially agree with other recent reports of sex differences in stroke outcomes from other countries.2–5,21 However, this is the first report of stroke outcomes from a prototype of the Paul Coverdell National Acute Stroke Registry and, to our knowledge, the first registry-based study to report data from the SS-QOL.

After adjustment for potential confounders, we found that in women, the odds of achieving ADL independence (defined as BI ≥95) at follow up were less than half that of males (OR: 0.37). ADL independence is an important basic component of autonomy, and our study corroborates evidence that women are less likely to achieve this autonomy after a stroke. The reasons for this inequality are unknown, but factors such as sex-related differences in stroke characteristics,11 severity,9 quality of care,22 or depression23 have all been suggested. The European BIOMED study found that women were more likely to be disabled at 3 months as defined by a BI score of 70 or less after adjusting for age and country.5 In data from a Swedish registry, women were less likely to be independent in primary ADL (mobility, toilet visits, and dressing) at 3-month follow up.2 Finally, based on 459 subjects from the Kansas City Stroke Study, Lai and colleagues found that females had 30% lower odds of achieving a BI score of ≥95 at 6 months.6 However, this difference was eliminated after adjusting for age, prestroke physical function, stroke severity, and depression. Our results differ with the sex difference actually increasing after adjustment. We were not able to adjust for depression, although it is unlikely that depression confounded the association between sex and ADL recovery in the Kansas City study, because the authors found no sex difference in the prevalence of depression. It is possible that residual confounding by severity or prestroke functional status remained despite that fact that we adjusted for prestroke ambulatory status and poststroke mRS.

Only a few reports of QOL in stroke survivor cohorts based on disease-specific instruments are available in the literature.4,12 No reports of SS-QOL scores by sex from any stroke registry have been published to date. Our finding that females have lower SS-QOL Physical Function domain scores than males is not surprising in light of the large sex difference we found in the odds of ADL recovery. Other stroke studies have found poorer physical function among females using different measures. For example, in the Kansas City Stroke Study,
females were less likely to score at least 90 points on the SF-36 Physical Functioning scale. Researchers from the Registry of the Canadian Stroke Network reported significantly lower median Stroke Impact Scale composite physical function scores for women than men, which roughly corresponded to a half-point difference in mRS scores.

In this study, prior stroke and interview type interacted with sex in the Mood domain. Females had lower Mood scores (ie, more depressive feelings) than men among the subgroup with no prior stroke history and among patient interviews. The interaction with interview type raises concern about the validity of proxy Mood scores, because female patients who needed a proxy had a trend toward higher scores than male patients who needed a proxy, whereas female patients responding for themselves had lower scores than male patients responding for themselves. The interaction of interview type with sex could be a function of systematically different characteristics of the proxies responding for males and females. Unfortunately, we did not collect data on the relationship or sex of the proxy respondent. Proxy responses for the more qualitative domains such as Mood should probably be interpreted with greater caution. Although the SS-QOL Mood domain is not a clinically validated depression scale, the lower Mood scores for female patients echo findings from many other studies. Females experience more depressive symptoms after stroke than males, are more likely to self-report depression after a stroke than males, and have more clinically diagnosed major depression than males among subjects with no stroke history. Depression has far-reaching consequences for health. Studies have found that poststroke depression hinders functional recovery and depressive symptoms in stroke-free adults are associated with an increased risk of stroke mortality. A tendency toward depressive affect would likely influence patients’ perceptions about their QOL in other areas and could be one of the causes of the lower QOL scores for females in other domains and in the overall score.

Compared with other domains, the sex difference in the Thinking domain was large (3.4 versus 2.8 in males and females, respectively), indicating that women feel less satisfied with their level of memory and concentration than men. However, a study assessing objective cognitive differences in stroke survivors found that women actually performed better than men on memory tasks. Self-assessment of memory and concentration could be negatively influenced by depression. Moreover, depression could cause real deficits in memory and mental processing.

The Role Function domain attempts to measure whether the subject participates in social and family activities to the degree desired. Our results suggest that Role Function is, not surprisingly, a complex construct that is influenced by many aspects of health. We found that Role Function scores differed by sex only among subjects who had not had a prior stroke (2.9 versus 3.5 for females and males, respectively). To our knowledge, the interaction between sex and stroke history evident in both the Role Function and Mood domains of the SS-QOL has not been previously described, possibly because most previous studies excluded subjects with prior strokes. Future longitudinal analyses of the time course of stroke recovery based on interviews with this cohort conducted 1 and 2 years poststroke may shed additional light on the sex difference in the effects of a first stroke.

One consideration when interpreting sex differences in QOL is whether some of the findings could be explained by gender role differences, particularly for items that refer to activities traditionally performed by women (eg, housework or cooking). Of the 35 individual items in the SS-QOL, 14 had mean score differences of at least 0.3 points between males and females. Of these, a possible sex bias was apparent in only 2 (ie, “Did you have trouble doing daily work around the house?” and “Did you have trouble opening a jar?”). Nevertheless, because QOL data represent patients’ preferences and values, the observed sex differences in SS-QOL scores could be attributable to sex differences in the relative importance of certain domains. For example, if females value cognitive functioning more highly than males, a difference in SS-QOL Thinking domain scores could be observed even if objective measures of cognitive function were equal. This ability to identify value-based differences, which would be undetectable using objective or physiological measures, is a hallmark of QOL instruments.

Our finding that 25% of stroke survivors required proxy assistance to complete the telephone interview is similar to rates of proxy use from other stroke studies. Because our goal was to assess the burden of stroke across its entire spectrum, we were committed to collecting outcomes data from all stroke survivors, ranging from patients experiencing TIA with no residual effects to subjects who were sufficiently impaired to preclude participation in a telephone interview. The use of proxy respondents may introduce bias, whereby proxy respondents rate the subject’s health lower than the subject would rate his or her own health. Proxy information for the BI, which requires observations of what the subject actually does, has been shown to be valid. We believe that accepting some proxy-related bias regarding QOL is preferable to the certain bias of a survival cohort that excludes the most seriously affected subjects. To test the impact of the proxy responses on our conclusions, we performed a sensitivity analysis by recalculating least-squares means from our adjusted models after excluding proxy scores. As expected, mean scores were higher overall; however, the mean differences between adjusted male and female scores were largely unchanged.

Because women experience stroke, on average, at a later age than men, we suspected that the observed differences in QOL were attributable to age. To address the possibility of confounding, we explored several strategies for age adjustment, including higher-order age terms, log(age), and categorical grouping, and explored age-related interactions involving other variables. However, none of these alternative model specifications meaningfully altered the parameter estimates for sex.

Some published reports have found sex differences in stroke severity based on Canadian Neurological Scale scores or based on more severe symptoms at presentation, whereas other studies have found that severity did not differ by sex. Unfortunately, data on stroke severity using the National Institutes of Health Stroke Scale were only
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Disclosures
None.

References

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recorded for a minority of subjects in this registry, and information necessary to calculate severity retrospectively was not available. As a crude proxy for stroke severity, we considered length of hospital stay and mRS at discharge; neither measure differed by sex. However, we cannot rule out the possibility that the poorer outcomes observed among females are attributable in part to their having more severe strokes.

We acknowledge other limitations as well. Because the MASCOTS Registry’s primary focus was on quality improvement, we did not collect baseline data on several factors such as marital status, income, education, or social support that could influence recovery and adjustment to life after stroke.33–35 These factors may differ by sex and could explain some differences in recovery and quality of life. Furthermore, the registry did not collect detailed retrospective information on prestroke functional status or QOL. If these data were available, they would likely increase the overall predictive power of the linear regression models, which is currently limited to explaining no more than 35% of the variance in any domain. Our finding of low predictive power is similar to that found in other analyses of QOL data.9

A strength of this study is the recruitment of a broad range of patients from a statewide hospital-based stroke registry. Our results indicate that cases included in the MOS were largely representative of stroke survivors from the larger MASCOTS registry. Because the MOS excluded cases with very poor prognosis, the MOS participants were slightly younger and more likely to be ambulatory on discharge compared with the MASCOTS registry cases. The lower proportion of patients experiencing TIA in the MOS was probably a reflection of their shorter hospital stay, which would have given less opportunity for the study nurses to obtain consent.

In summary, we found substantial sex-based differences in functional recovery and QOL poststroke in this broadly representative stroke cohort. Data on stroke outcomes from unselected populations in the United States are scarce. More studies that assess stroke survivors in both subjective (ie, health-related QOL) and objective measures (ie, cognitive functioning, clinical diagnosis of depression) are needed to determine the causes of the sex differences in outcomes, which persist despite accounting for the differences in age, comorbidities, and other clinical features between male and female patients with stroke. If modifiable determinants of poorer stroke outcomes in women can be found, interventions such as those involving increased rehabilitation efforts, social support, and/or counseling could be tested.


Sex Differences in Stroke Recovery and Stroke-Specific Quality of Life: Results From a Statewide Stroke Registry
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