Are There Inequalities in the Provision of Stroke Care?
Analysis of an Inner-City Stroke Register

Christopher McKevitt, PhD; Catherine Coshall, MSc; Kate Tilling, PhD; Charles Wolfe, MD

Background and Purpose—There is evidence of unequal access to health care interventions even where universal health systems operate. We investigated associations between patients’ sociodemographic characteristics and the provision of acute and longer-term stroke care in a multiethnic urban population.

Methods—We used data from 1635 patients with first-ever stroke, collected by a population-based stroke register from 1995 to 2000. Using multivariable analyses, controlled for sociodemographic and clinical factors, we investigated access to 22 evidence-based components of care.

Results—1392 patients (85.1%) were admitted to hospital; of these, 354 (25.4%) were admitted or transferred to a stroke unit. Of those with clinical need, 607 (70.7%) received physical therapies; 477 (59.8%) received speech and language therapy. Older age was associated with lower odds of hospitalization (odds ratio [OR], 0.50; 95% CI, 0.32 to 0.77, \(P=0.02\)) and diagnostic brain imaging (OR, 0.15; 95% CI, 0.08 to 0.30, \(P<0.01\)) but higher odds of receiving physical therapy (OR, 4.24; 95% CI, 1.22 to 14.73, \(P<0.01\)). Black ethnicity was associated with higher odds of stroke unit admission (OR, 1.59; 95% CI, 1.01 to 2.49, \(P<0.04\)). There was a weak association between socioeconomic status and admission to hospital and stroke unit. Gender was associated only with treatment of hypertension before stroke.

Conclusions—Provision of individual components of care over 1 year varied for specific sociodemographic categories, but there was no consistent pattern of inequality. Clinical decision-making processes are likely to influence these patterns. Further information about clinician and patient roles in decision making is required. (Stroke. 2005;36:315-320.)

Key Words: access to health care ■ socioeconomic factors ■ stroke

There is evidence of unequal provision of health care interventions even where universal health systems operate. Older age is associated with reduced rates of invasive procedures for coronary heart disease.1 Women are less likely to be referred to cardiac rehabilitation.2 Members of some ethnic minorities are less likely to have invasive cardiac procedures.3,4 Lower socioeconomic status (SES) has been associated with reduced access to angioplasty and coronary artery bypass graft3 and poorer hypertension control.5

Stroke, as a leading cause of death and disability worldwide, presents a major public health challenge.6 In the United Kingdom (UK), the “haphazard” nature of stroke service provision has long been recognized,7 with persistent geographic variations in access to diagnostic procedures, stroke units, and rehabilitation therapies.8–11 Patients in UK centers receive fewer diagnostic procedures and rehabilitation therapies than those in other European centers.12 Studies have also reported associations between specific components of stroke care and patient characteristics, including older age, female gender, and ethnicity.13–16

Studies investigating sociodemographic differences in health care provision have tended to focus on a single intervention. However, the management of chronic disorders entails multiple interventions over long periods of time, delivered across different sectors. Ensuring the best possible outcomes for all patients requires access to all appropriate interventions. We report findings from a study examining patterns of clinical service provision to determine whether these differ by age, sex, SES, and ethnicity.

Methods

Data Collection

Data are from a population-based register that since 1995 prospectively records first-ever stroke in a geographically defined area: 22 wards in south London, with a population of 234 533 (1991 census). Cases are identified through “hot pursuit” using multiple sources of notification.17 They are registered at onset, assessed within the first week, and followed up by trained interviewers at 3 months, 12 months, and annually. Data have been estimated to be 88% complete.17 The study has local Ethics Committee approval and informed consent/assent is obtained. Register methods are detailed elsewhere.17,18 Data collected include the following: age (<65, 65 to 74, 75 to 84, and 84+ years); gender; ethnicity (White, Black [Black African, Black Caribbean, Black mixed], and other [includes 6 other ethnic categories]); SES (Registrar General’s occupational codes, grouped in manual/nonmanual); pre- and poststroke morbidity;
disability (Barthel Index [BI], Frenchay Activities Index [FAI]); and health-related quality of life (SF-36, Hospital Anxiety and Depression scales [HADS]).

To account for case mix, we used markers of stroke severity measured at the time of maximum impairment, controlling for them in statistical analyses: consciousness, Glasgow Coma Score (GCS; <13, not alert; 13+, alert; disability, BI within 5 to 7 days of stroke onset (Bl 20=indipendent; BI 19 to 15= mild/moderate disability; BI 14 to 0=severe disability); and continence (incontinent/continent).

Where appropriate, we also adjusted for other possible confounders: case fatality (survival to <3, 3 to 7, and 8+ days poststroke); location of short-term care, because where the patient is treated (general medical ward, admitted/transfered to a stroke unit, or not admitted to hospital) may relate to service availability; residence at 3 months and 1 year (living alone at home or in sheltered accommodation, with another at home, in a residential or nursing home, or still in hospital); disability at 3 months and 1 year; cognitive deficit, using Mini-Mental State Examination (MMSE) score <24 (to April 1999) or the Abbreviated Mental Test (AMT) score <8 (from April 1999); and treatment/service at a previous time point, because this may influence decision to use treatments/services subsequently.

Using clinical guidelines,19 we defined 2 binary indicators of evidence-based care. These were 3 indicators of short-term care (admission to hospital; admission/transfer to a stroke unit; and brain imaging by computed tomography [CT]/magnetic resonance imaging [MRI]); 11 indicators of appropriate management of clinical risk factors (atrial fibrillation, hypertension, diabetes before stroke, 3 months and 1 year after stroke; and antiplatelet treatment for ischemic stroke, 3 months and 1 year after stroke); 4 indicators of rehabilitation therapy provision for those with recorded deficits (physiotherapy or occupational therapy [PT/OT] and speech and language therapy [SALT], between 0 to 90 days and 90 to 365 days poststroke), with deficits for PT/OT defined as visual field defects, motor deficits, and sensory deficits and for SALT, dysarthria, dysphagia, and failed swallow test; follow-up by a specialist or general practitioner (GP) at 3 months and 1 year after stroke.

Statistical Methods

Univariate associations between sociodemographic characteristics (age, gender, ethnicity, and SES) and each indicator of care were analyzed using χ2 tests or Fisher exact test (as appropriate). Multivariable logistic regression models were used to examine associations between sociodemographic characteristics and indicators of care, controlling for appropriate confounding factors. Where there were insufficient cases, analyses were not undertaken. Because SES data were missing for a high proportion of subjects, analyses were made with and without adjustment for SES.

All models included sociodemographic variables, as these were the exposures of interest. Modeling short-term care provision, we adjusted for case fatality as a proxy for severity. Models of the provision of CT/MRI brain scans also controlled for location of short-term care.

All models of 3 month and 1 year indicators controlled for all stroke severity markers, location of short-term care, living arrangements, and disability (BI). Models of risk factor management at 3 months and 1 year additionally controlled for whether treatment had been provided at the previous time point. Models of provision for rehabilitation therapies also adjusted for cognitive status at maximum impairment (for therapy during the period 0 to 90 days) and at 3 months (for therapy during the period 90 to 365 days), and 90- to 365-day models controlled for provision of therapy at 90 days. Models of the 3 month and 1 year outcome “follow-up by a specialist/GP” excluded patients still in hospital. Models for this outcome at 1 year controlled for follow-up at 3 months.

Results

From 1 January 1995 to 31 December 2000, 1729 people with first-ever stroke were registered; we excluded 87 people categorized as “other” ethnicities and 7 for whom no ethnicity was recorded, giving a sample of 1635 (Table 1). The mean age at onset was 71.6 years (SD 14.2, 0 to 106 years). There were approximately equal numbers of males and females: 18% were from Black ethnic groups; 21% were from nonmanual occupational groups. Fifty percent were incontinent at the time of maximum impairment; 44% percent were moderately/severely disabled (BI≤14) 7 days poststroke.

Of the total sample, 900 (55.1%) had a 3-month assessment, 533 (32.6%) died before 3 months, and 202(12.4%) were lost to follow-up (declined, not traced in time, or moved away). Of 1102 (67.4%) survivors, 794 (72.1%) had a 1-year assessment, 118 (10.7%) died before the 1-year assessment, and 191 (17.5%) patients had not yet had an annual follow-up or were lost to follow-up. Analyses were conducted with and without adjustment for SES; not including SES left the conclusions materially unchanged, except for results reported below.
Table 2 reports the number and percentage of patients eligible for interventions and those actually treated at 3 time points. Eighty-five percent were admitted to hospital, but only 25% were admitted/transferred to a stroke unit. At 3 months, >30% of people with hypertension had not received appropriate medication, whereas 60% of those with atrial fibrillation and 25% with diabetes were not treated. Proportions treated at 1 year improved modestly, except in the case of diabetes where they declined slightly. Of those with deficits, nearly 30% did not receive PT/OT, and just over 40% did not receive SALT within 3 months of stroke onset.

 Associations between sociodemographic characteristics and type of short-term care provided, controlling for stroke severity and early death, are shown in Table 3. Compared with people aged <65 years, those aged 75 to 84 years were less likely to be admitted to hospital. Age was also associated with having a CT/MRI brain scan, with those aged >74 years less likely to have a scan. No differences by gender were found in admission to hospital or stroke unit or the likelihood of having a brain scan. Black patients were more likely to be admitted to hospital and stroke unit. There was weak evidence that people from nonmanual
Occupational groups were more likely to be admitted to hospital and stroke unit. We investigated the relationship between sociodemographic characteristics and risk factor management. Compared with younger people, those aged 65 to 74 and 75 to 84 were more likely to have managed hypertension before stroke (OR, 1.54; 95% CI, 1.10 to 2.17 and OR, 1.64; 95% CI, 1.17 to 2.29, \(P<0.01\)). Women were more likely than men to have managed hypertension before stroke (OR, 1.39; 95% CI, 1.08 to 1.78, \(P<0.01\)). We did not find age, gender, ethnicity, or SES differences in risk factor management at 3 months or one year poststroke.

Table 4 reports relationships between sociodemographic characteristics and the provision of rehabilitation therapies at 0 to 90 days after stroke and medical follow-up at 3 months and 1 year after stroke. There were insufficient cases to investigate rehabilitation provision at 1 year poststroke. Older people were more likely to have PT/OT; people in nonmanual occupational groups were less likely to have PT/OT and SALT. Other factors were associated with provision of

### Table 3. Associations Between Sociodemographic Characteristics and Type of Short-Term Care Provided

<table>
<thead>
<tr>
<th>Age group (y)</th>
<th>Admission to Hospital</th>
<th>Admission/Transfer to Stroke Unit*</th>
<th>CT/MRI Brain Scan</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR 95% CI P</td>
<td>OR 95% CI P</td>
<td>OR 95% CI P</td>
</tr>
<tr>
<td>&lt;65</td>
<td>1.00 0.02 1</td>
<td>1.00 0.14 1</td>
<td>1.00 &lt;0.01 1</td>
</tr>
<tr>
<td>65–74</td>
<td>0.72 0.47–1.11 1.52</td>
<td>1.07–2.17 0.75 1.30</td>
<td>0.90–1.88 0.36 1.30</td>
</tr>
<tr>
<td>75–84</td>
<td>0.50 0.32–0.77 1.30</td>
<td>0.83–2.02 0.15</td>
<td>1.05–1.46 0.08–0.30</td>
</tr>
<tr>
<td>&gt;84</td>
<td>0.58 0.32–1.04 1.30</td>
<td>0.83–2.02 0.15</td>
<td>1.05–1.46 0.08–0.30</td>
</tr>
</tbody>
</table>

Sex

| Male          | 1.00 0.95 1 | 0.95 0.80 1 | 0.95 0.80 1 |
| Female        | 1.01 0.73–1.40 | 1.03 0.79–1.36 | 0.78 0.52–1.16 |

Ethnic group

| White         | 1.00 0.04 1 | 0.04 <0.01 1 | 0.04 <0.01 1 |
| Black         | 1.59 1.01–2.49 | 2.01 1.45–2.77 | 0.79 0.42–1.47 |

Socioeconomic status

| Manual        | 1.00 0.06 1 | 0.06 0.09 1 | 0.06 0.09 1 |
| Nonmanual     | 1.52 0.98–2.35 | 1.40 0.95–2.07 | 1.23 0.68–2.24 |

**For patients admitted to hospital only.**

### Table 4. Associations Between Sociodemographic Characteristics and Access to Rehabilitation Therapies and Medical Follow-Up

<table>
<thead>
<tr>
<th>Age group (y)</th>
<th>Physiotherapy/Occupational Therapy*</th>
<th>Speech and Language Therapy*</th>
<th>Follow-Up With Hospital Specialist/GP*</th>
<th>Follow-Up With Hospital Specialist/GP*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0–90 Days Post-Stroke</td>
<td>0–90 Days Post-Stroke</td>
<td>By 3 Months†</td>
<td>By 1 Year†</td>
</tr>
<tr>
<td></td>
<td>OR 95% CI P</td>
<td>OR 95% CI P</td>
<td>OR 95% CI P</td>
<td>OR 95% CI P</td>
</tr>
<tr>
<td>&lt;65</td>
<td>1.00 &lt;0.01 1</td>
<td>1.00 0.72 1</td>
<td>0.01 0.01 1</td>
<td>0.72 0.72 1</td>
</tr>
<tr>
<td>65–74</td>
<td>3.78 1.76–8.12 1.21</td>
<td>0.58–2.50 0.37 0.37</td>
<td>0.18–0.75 0.82 0.82</td>
<td>0.32–2.12 0.32–2.12</td>
</tr>
<tr>
<td>75–84</td>
<td>2.15 0.98–4.69 1.08</td>
<td>0.51–2.30 0.33 0.33</td>
<td>0.16–0.69 0.60 0.60</td>
<td>0.22–1.60 0.22–1.60</td>
</tr>
<tr>
<td>&gt;84</td>
<td>4.24 1.22–14.73 1.87</td>
<td>0.60–5.87 0.26 0.26</td>
<td>0.11–0.65 0.54 0.54</td>
<td>0.15–2.01 0.15–2.01</td>
</tr>
</tbody>
</table>

Sex

| Male          | 1.00 0.53 1 | 0.53 0.56 1 | 0.53 0.56 1 | 0.53 0.56 1 |
| Female        | 0.82 0.45–1.51 | 0.85 0.49–1.48 | 0.71 0.45–1.13 | 0.99 0.50–1.96 |

Ethnic Group

| White         | 1.00 0.18 1 | 0.18 0.94 1 | 0.18 0.94 1 | 0.18 0.94 1 |
| Black         | 0.61 0.30–1.25 | 0.97 0.47–2.00 | 1.04 0.56–1.96 | 1.39 0.49–3.91 |

Socioeconomic status

| Manual        | 1.00 0.10 1 | 0.10 0.02 1 | 0.10 0.02 1 | 0.10 0.02 1 |
| Nonmanual     | 0.53 0.25–1.13 | 0.43 0.21–0.88 | 1.13 0.67–1.90 | 2.34 0.98–5.59 |

*Adjusted for stroke severity, disability at 3 months.
†Excludes patients in hospital.
therapies. Compared with those treated on general medical wards, stroke unit patients were more likely to receive SALT. Those not admitted to hospital were less likely to have any type of therapy. At 3 months, patients aged >65 years were less likely to have seen a specialist or GP; people from nonmanual occupational groups were more likely to have seen a specialist or GP at 1 year. Follow-up with a specialist or GP was less likely for those with mild to moderate disabilities and severe disabilities. Those seen at 3 months were also more likely to be seen 1 year after stroke.

Discussion

Using an existing population-based data set and evidence-based guidelines, we investigated the provision of stroke care over 1 year. The quality of care overall was suboptimal, compared with evidence-based guidelines. Before stroke, there were deficiencies in the management of hypertension and atrial fibrillation. The proportion of patients admitted to a stroke unit was low overall, but there was an annual trend toward increased admission, rising to almost 50% by 2000. Strategies to prevent recurrence were inadequately implemented. For example, although antiplatelet medication for people who have had an ischemic stroke is a simple cheap intervention, this was not prescribed to >20% of patients in this sample. Rehabilitation rates were low, with between 30% and 40% of people with neurological deficits not receiving PT/OT and SALT, respectively, by 3 months. Evidence for the efficacy of late rehabilitation is weak; nevertheless, in this sample, provision of therapies beyond three months was remarkably low. By 1 year after stroke a substantial minority of the sample had not had any contact with specialist or primary care medical services.

Some sociodemographically defined groups have different chances of receiving some components of care. Even after controlling for stroke severity, age was associated with lower rates of admission to hospital and having a brain scan but not admission/transfer to a stroke unit. Risk factor control appeared to decline with age; although this did not reach statistical significance, it supports other UK findings. However, we found a positive association between increased age and provision of PT/OT in the first 3 months after stroke, even after controlling for disability.

Unlike other studies, we found little evidence of gender influencing access to care. Reasons for this are unclear but may include artifact, methodological differences, or differences in local practice.

In the United States, people from ethnic minorities have poorer access to health care and may be less likely to receive appropriate care, independent of SES. In this sample, black patients were more likely to be admitted to hospital and a stroke unit. This may be related to their younger age (although this was controlled for in the analysis), or it may suggest that local clinicians are sensitized to the stroke risk profile of Black Caribbean and African patients.

We found weak evidence that people of higher SES were more likely to be admitted to hospital and to a stroke unit, suggesting class differences in service provision. This requires further investigation given the high proportion of missing data for this variable in our sample. Nevertheless associations between SES and health care utilization are well documented elsewhere.

Some caution is needed in interpreting these data. Statistical modeling required amalgamating some sociodemographic groups that may be heterogeneous into single categories. Missing SES data, reflecting difficulties collecting this information in an older population, may have also masked differences in provision. Nevertheless, since sociodemographic characteristics were not associated with missing SES data, nor with missing BI scores, we do not believe that this introduced bias. Likewise, although there was a fairly high proportion of missing data for rehabilitation therapies, sociodemographic characteristics were not associated with these missing data. Some data (eg, use of rehabilitation therapies) rely on patient self-report, leading to possible bias in measurement and masking actual differences. Investigating inequalities for specific subgroups of the population, such as black men or older women, requires investigation of interactions. We did not carry this out, as we considered it inappropriate to include interaction terms in the models, given the large numbers of variables already included. Therefore, we have not investigated the existence of inequalities for subgroups of the sample. The strengths of this study are its unbiased 88% complete population sample and the scope of the enquiry. That is, because we investigated the range of components of stroke care, rather than a single intervention, our results present a picture of how the package of care is provided over time.

The picture is complex, with sociodemographic characteristics differently associated with different components of care. In a parallel qualitative study, we have identified processes that may constitute the mechanisms leading to differences. These include clinical decision-making, strategies to manage resources leading to prioritizing some patients over others, and patient decisions. If policies to redress real inequity are to be developed, research is needed to understand how these processes may translate into different patterns of care for different types of patient.

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