Evidence for Age and Sex Differences in the Secondary Prevention of Stroke in Scottish Primary Care

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Background and Purpose—Secondary preventive measures play an important role in the reduction of stroke, the third largest cause of death in Scotland. We investigated whether sex, age, or deprivation differences existed in the secondary prevention of stroke in primary care.

Methods—A retrospective cross-sectional study using a computerized database with 61 practices (377,439 patients) to identify group differences in secondary preventive therapy between March 2003 and April 2004 for 10,076 patients with a diagnosis of any stroke.

Results—Women with any stroke were more likely than men to be prescribed a thiazide (odds ratios [OR], 1.60; 95% confidence interval [CI], 1.46 to 1.75) but less likely to be prescribed an angiotensin-converting enzyme inhibitor (OR, 0.73; 95% CI, 0.67 to 0.81). Women with ischemic stroke were less likely to receive either an antiplatelet or warfarin (OR, 0.84; 95% CI, 0.75 to 0.94) or statin therapy (OR, 0.82; 95% CI, 0.74 to 0.90) than men. Women with atrial fibrillation received less warfarin (OR, 0.62; 95% CI, 0.48 to 0.81) but more antiplatelet therapy than men (OR, 1.30; 95% CI, 1.00 to 1.68). The oldest patients (older than 75 years) with ischemic stroke received more antiplatelet therapy than the youngest patients (younger than 65 years) (OR, 1.83; 95% CI, 1.64 to 2.06). No significant differences in secondary preventative treatment across deprivation groups were found.

Conclusion—Important sex and age differences exist in the care of patients with stroke and suggest that women and the elderly need to be targeted for secondary prevention therapy. (Stroke. 2005;36:1771-1775.)

Key Words: age ■ anticoagulation ■ antihypertensive agents ■ antiplatelet drugs ■ database ■ epidemiology ■ prevention ■ sex ■ stroke management

stroke is the third largest cause of death in Scotland, which has the highest mortality rates for stroke in Western Europe.1 A recent Scottish Executive report “Coronary Heart Disease and Stroke: A Strategy for Scotland” aims to reduce rates of ischemic heart and stroke disease through the adoption of a “high-risk” approach whereby key groups within the population are targeted for primary and secondary prevention.2 Blood pressure reduction is important in the secondary prevention of stroke.3 Furthermore, the PROGRESS study identified a blood pressure-lowering regimen (angiotensin-converting enzyme [ACE] inhibitor and thiazide combined) that reduced the risk of further stroke in both hypertensive and nonhypertensive patients,4 a regimen that has subsequently been recommended by The United Kingdom Royal College of Physicians national clinical guidelines.5 For patients with ischemic stroke, aspirin6 and statins7 and anticoagulation therapy for patients with atrial fibrillation8 also have a proven role in secondary prevention.

There have been a number of reports of sex and age differences in the treatment of cardiovascular disease in primary care.9,10 Previous studies have also found sex differences in the treatment of stroke patients in the acute care setting, with elderly men older than 85 years found to be more likely to receive antiplatelet therapy.11 Conflicting results have been found for sex differences in the prescribing of warfarin.11,12 Among patients hospitalized for acute stroke, investigations such as brain imaging and angiography were used less often in women than men, even after allowing for age differences.13 Furthermore, women with carotid artery disease were less likely to be referred for carotid endarterectomy.13

No differences were found in the secondary preventive treatment of deprived patients after discharge from acute care,14 whereas suboptimal preventive care was found among deprived neighborhoods in another study.15 We used a population-based analysis to investigate whether sex, age, or deprivation differences exist in the secondary prevention of stroke using a Scottish family practice database.

Materials and Methods
All individuals resident in Scotland (including children) are registered with primary care, which is free at the point of contact and
manages the treatment of patients once they are discharged from hospital. Access to secondary care is usually obtained through a general practitioner based within a primary care practice. Anonymized retrospective data on 377,439 patients registered with 61 practices participating in a continuous morbidity recording system in Scotland were obtained in April 2004. These practices and the patients registered with them were recruited to be broadly representative of the age/sex, urban/rural, and deprivation distribution of the Scottish population and have recorded the reason for every face-to-face doctor–patient encounter using trained entry clerks since March 1996. The practices record encounters as clinical diagnoses based on a mixture of general practitioner diagnosis supplemented (especially for serious conditions) by investigation and diagnostic input from specialist colleagues. The long-term nature of the database and its clinical focus ensures that initially uncertain events are confirmed or refuted over time and the diagnostic codes amended appropriately. Participating practices also routinely record repeat prescribing treatment for all patients. The Information and Statistics Division of the Scottish Executive operates a continuous quality assurance system for completeness and accuracy of diagnostic data.

From the data set, we identified all patients registered with the practices on March 31, 2004 who had ever had a computer record of transient cerebral ischemia or any stroke, including cerebral infarction and other stroke (all indicated by a Read code of G6 and below). While realizing that the Read coding for stroke includes both pathological and pathogenetic classifications, we attempted to divide such codes into hemorrhagic and nonhemorrhagic diagnoses of stroke, which would benefit from differing secondary preventive measures. To identify ischemic stroke or transient cerebral ischemia, those who had a hemorrhagic stroke (Read codes G60 and G680 [subarachnoid hemorrhage], G61 and G681 [intracerebral hemorrhage], G62 and G682 [other intracranial bleed]) were excluded. The key characteristics of all stroke patients, as of March 2004, were determined. These were sex, age (<64, 65 to 75, or ≥75), ever had hypercholesterolemia recorded (Read code C320 and below; yes or no), number of stroke-related comorbidities diabetes (C10 and below), hypertension (G2 and below), atrial fibrillation (G573 and below), coronary heart disease (G3 and below), heart failure (G58 and below), and peripheral vascular disease (G73 and below); 0, 1, 2 or 3+1 and deprivation status based on postal code using Carstairs’s DEPCAT categorization system based on indicators of poverty, such as overcrowding in households, unemployment, and the proportion of all persons in private households with no car. Deprivation quintile 1 comprises the most affluent patients and 5 comprises the most deprived. Use of secondary prevention treatments was assessed by determining whether between April 1, 2003 and March 31, 2004 a prescription had been issued (at least once) for a thiazide or an ACE inhibitor in patients with any stroke, antplatelet (including aspirin, clopidogrel or dipyridimole), warfarin, and statin therapy for patients with ischemic stroke; and for ischemic stroke patients with atrial fibrillation antplatelet or warfarin therapy.

Statistical Analysis
Binary logistic regression was used to determine odds ratios and 95% confidence intervals for sex, age and deprivation groups receiving each type of treatment, adjusted for potential confounding by sex, age, hypercholesterolemia, number of stroke related comorbidities (excluding atrial fibrillation when examining treatment in patients with this condition), deprivation, and practice. Standardization (direct to the total practices population) was used and when appropriate, \( \chi^2 \) tests were used for trend and were used to compare differences in the prevalence of disease. All analyses were performed using SPSS for Windows 11.0 (SPSS Inc.).

The study protocol was approved by the Scientific Advisory Group of the Primary Care Clinical Informatics Unit–Research.

Results
10,076 (2.7% of all patients; 95% confidence intervals [95% CI] 2.6% to 2.7%) registered in the study practices had a computer record of any stroke and 9201 (2.4%; 95% CI, 2.3% to 2.5%) had a record of ischemic stroke. The overall age standardized prevalence of any stroke was higher in women (2.8%; 95% CI, 2.7% to 2.9%) than men (2.6%; 95% CI 2.5% to 2.7%), with male patients tending to be younger than female (mean age, 69.72 versus 72.71 years, respectively; \( P<0.001 \)). Transient cerebral ischemia occurred more commonly in women than men, with cerebral infarction being more common among men (Table 1).

No significant differences were found between men and women in the recorded history of hypertension, heart failure, or in those with ischemic stroke or atrial fibrillation. However, men with stroke were more likely than women to have concurrent diabetes, peripheral vascular disease, and coronary heart disease. Male and older patients were more likely to have >3 comorbidities recorded than female and younger patients. More deprived patients were less likely than their more affluent counterparts to have multiple comorbidity (Table 2).

The age- and sex-standardized prevalence of any stroke significantly increased from 2.3% (95% CI, 2.2% to 2.4%) (n=1700) among the least deprived group (deprivation category 1) to 3.0% (95% CI, 2.8% to 3.1%) (n=1532) in the most deprived category 5) (\( P<0.001 \)).

Prescription of Secondary Preventative Therapies
Overall, 44.5% (95% CI, 43.5% to 45.4%) of all stroke patients were prescribed a thiazide, 29.2% (95% CI, 28.3% to 30.1%) an ACE inhibitor and 19.1% (95% CI, 18.3% to 19.8%) an ACE inhibitor and a thiazide in the same year. 76.8% (95% CI, 77.5% to 79.2%) of ischemic stroke patients received either antplatelet or warfarin therapy and 42.8% (95% CI, 41.7% to 43.8%) statin therapy. 93.0% (95% CI, 91.3% to 94.3%) of ischemic stroke patients with an additional diagnosis of atrial fibrillation were prescribed antplatelet therapy or warfarin.
Women with any stroke were more likely than men to be prescribed a thiazide but less likely to be prescribed an ACE inhibitor even after adjustment for age, hypercholesterolemia, number of stroke-related comorbidities, deprivation, and practice (Table 3). Women with ischemic stroke were significantly less likely than men to receive antiplatelet, warfarin, or statin therapy. Women with ischemic stroke and atrial fibrillation were significantly less likely than men to be prescribed warfarin but more likely to be prescribed antiplatelet therapy.

Compared with the youngest age group, older patients with stroke were more likely to receive a thiazide and the oldest group less likely to receive an ACE inhibitor (Table 4). The oldest patients with ischemic stroke and atrial fibrillation were significantly more likely to receive antiplatelet therapy, or antiplatelet or warfarin, and less likely to receive statin therapy. The oldest patients with ischemic stroke and atrial fibrillation were more likely to receive antiplatelet therapy but much less likely to be prescribed warfarin.

When comparing the care of patients from the higher deprivation categories with those in the least deprived group (quintile 1), no significant differences were observed in the provision of secondary prevention treatments (Table 5).

**Discussion**

This analysis of prescribing data derived from primary care practices in Scotland has revealed important sex- and age-related differences in the care of patients with stroke, but no important differences among deprivation groups.

Men with ischemic stroke were prescribed more antiplatelet therapy than women. These findings were in agreement with previous observations from a European hospital-based study. 13 Whereas men may be more likely to be on antiplatelet therapy before they have a stroke because of the higher prevalence of concomitant ischemic heart disease, inequities in the prescribing of this therapy should disappear after an ischemic stroke. 1

Women with a diagnosis of atrial fibrillation received less warfarin even when age and other factors were allowed for. This finding is at variance with European and Canadian hospital stroke care studies 11,13 but in accordance with findings from a Swedish hospital-based study. 12 It has been suggested that primary care physicians perceive women to have a greater potential for contraindication, no indication, or a greater chance of bleeding with warfarin therapy. 20 Furthermore, with the longer life expectancy of women and the direct relationship between stroke and advanced age, in terms of severity and residual disability, older female patients will be those bearing the major burden of disease. 13 No information was available in this data set on levels of compliance, which would require further study. The undertreatment of women

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**TABLE 2. Number of Comorbidities Among Patients With any Stroke by Sex, Age, and Deprivation**

<table>
<thead>
<tr>
<th>Comorbidities†</th>
<th>0, No. (%)</th>
<th>1, No. (%)</th>
<th>2, No. (%)</th>
<th>3+, No. (%)</th>
<th>P value, χ² test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Women</td>
<td>1879 (35.6)</td>
<td>1908 (36.1)</td>
<td>979 (18.5)</td>
<td>515 (9.8)</td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>1548 (32.3)</td>
<td>1628 (34.0)</td>
<td>1011 (21.1)</td>
<td>608 (12.7)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Age (years)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;65</td>
<td>1469 (49.5)</td>
<td>970 (32.7)</td>
<td>385 (13.0)</td>
<td>144 (4.9)</td>
<td></td>
</tr>
<tr>
<td>65 to 75</td>
<td>777 (28.3)</td>
<td>977 (35.6)</td>
<td>649 (23.6)</td>
<td>343 (12.5)</td>
<td></td>
</tr>
<tr>
<td>&gt;75</td>
<td>1181 (27.1)</td>
<td>1589 (36.4)</td>
<td>956 (21.9)</td>
<td>636 (14.6)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Deprivation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1*</td>
<td>569 (33.5)</td>
<td>613 (36.1)</td>
<td>320 (18.8)</td>
<td>198 (11.7)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>536 (29.9)</td>
<td>670 (37.4)</td>
<td>344 (19.2)</td>
<td>242 (13.5)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>898 (30.8)</td>
<td>1037 (35.6)</td>
<td>643 (22.0)</td>
<td>339 (11.6)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>787 (36.9)</td>
<td>717 (33.6)</td>
<td>428 (20.1)</td>
<td>203 (9.5)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>637 (41.6)</td>
<td>499 (32.6)</td>
<td>255 (16.4)</td>
<td>141 (9.2)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

*Most affluent deprivation quintile.
†Comorbidities include atrial fibrillation, coronary heart disease, hypertension, diabetes, heart failure, and peripheral vascular disease.

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**TABLE 3. Adjusted Odds Ratios of Stroke Patients Receiving a Secondary Preventative Drug, Males Versus Females, for Year Ending 31st March 2004**

<table>
<thead>
<tr>
<th></th>
<th>Male* No. (%)</th>
<th>Female No. (%)</th>
<th>OR (95%CI)†</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Stroke</td>
<td>1908 (39.8)</td>
<td>2572 (48.7)</td>
<td>1.60 (1.46 to 1.75)</td>
</tr>
<tr>
<td>ACE inhibitors</td>
<td>1604 (33.5)</td>
<td>1338 (25.3)</td>
<td>0.73 (0.67 to 0.81)</td>
</tr>
<tr>
<td>Thiazide and ACE Inhibitor</td>
<td>976 (20.4)</td>
<td>944 (17.9)</td>
<td>0.95 (0.85 to 1.06)</td>
</tr>
<tr>
<td>Ischemic stroke</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antiplatelets</td>
<td>3048 (69.8)</td>
<td>3262 (67.5)</td>
<td>0.90 (0.82 to 0.99)</td>
</tr>
<tr>
<td>Statins</td>
<td>2041 (46.7)</td>
<td>1892 (39.2)</td>
<td>0.82 (0.74 to 0.90)</td>
</tr>
<tr>
<td>Warfarin</td>
<td>446 (10.2)</td>
<td>394 (8.2)</td>
<td>0.85 (0.73 to 0.99)</td>
</tr>
<tr>
<td>Antiplatelets or Warfarin</td>
<td>3438 (78.7)</td>
<td>3627 (75.1)</td>
<td>0.84 (0.75 to 0.94)</td>
</tr>
<tr>
<td>Ischemic stroke and atrial fibrillation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antiplatelets</td>
<td>286 (51.7)</td>
<td>329 (58.0)</td>
<td>1.30 (1.00 to 1.68)</td>
</tr>
<tr>
<td>Warfarin</td>
<td>321 (58.1)</td>
<td>265 (46.7)</td>
<td>0.62 (0.48 to 0.81)</td>
</tr>
<tr>
<td>Antiplatelets or Warfarin</td>
<td>518 (91.4)</td>
<td>513 (92.8)</td>
<td>0.82 (0.50 to 1.33)</td>
</tr>
</tbody>
</table>

*Reference group.
†Adjusted for age, hypercholesterolemia, practice, deprivation, and number of comorbidities.
with cardiovascular disease has been previously described as the “Yentl syndrome.” Our results suggest that this phenomenon may also operate in patients with cerebrovascular disease.

The lower use of statins in older patients with ischemic stroke may have been caused by prescriber perceptions about these treatments being less effective or less cost-effective in this group. Despite such concerns, recent guidelines have stated that patients on lipid-lowering therapy should not have their drugs stopped because of age. Furthermore, because older patients are more likely to have more severe disease, they would be expected to benefit more from these important secondary preventive therapies. The greater use of antiplatelet treatments among older patients compared with the youngest group may be explained by some younger patients having to pay a prescription charge and so they are purchasing this medication from pharmacies without prescription. Information about such “over-the-counter” purchases is not recorded routinely by practices.

A notable feature of the study practices is the dedicated support provided to enter information about each patient–physician contact. Thus, once a diagnosis is made, its recording should be the same irrespective of the characteristics of the user. Although there might be systematic bias in the diagnostic labeling used, or in the ascertainment of stroke in different groups, once a diagnosis has been made, subsequent treatment should be the same irrespective of age, sex, or socioeconomic status (provided that other factors such as severity were the same). The computer systems used by the general practitioners were initially designed for repeat prescribing.

| TABLE 4. Adjusted Odds Ratios of Stroke Patients Receiving a Secondary Preventative Drug by Age for Year Ending 31st March 2004 |
|---------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|                                 | <65 years* No. (%) | 65 to 75 years No. (%) | OR (95%CI)† | >75 years No. (%) | OR (95%CI)† |
| **All stroke**                  |                 |                 |                 |                 |                 |
| Thiazides                       | 866 (29.2)      | 1279 (46.6)     | 1.58 (1.40 to 1.78) | 2335 (53.5)      | 2.02 (1.81 to 2.26) |
| ACE inhibitors                  | 761 (25.6)      | 960 (35.0)      | 1.05 (0.92 to 1.19) | 1221 (28.0)      | 0.74 (0.65 to 0.83) |
| Thiazide and ACE inhibitor      | 440 (14.8)      | 607 (22.1)      | 1.01 (0.93 to 1.25) | 873 (20.0)       | 0.91 (0.79 to 1.05) |
| **Ischemic stroke**             |                 |                 |                 |                 |                 |
| Antiplatelets                   | 1416 (57.7)     | 1890 (73.7)     | 1.86 (1.64 to 2.10) | 3004 (71.9)      | 1.83 (1.64 to 2.06) |
| Statins                         | 1171 (47.7)     | 1382 (53.9)     | 1.02 (0.90 to 1.15) | 1380 (33.0)      | 0.43 (0.38 to 0.49) |
| Warfarin                        | 164 (6.7)       | 241 (9.4)       | 0.96 (0.77 to 1.19) | 435 (10.4)       | 1.05 (0.85 to 1.28) |
| Antiplatelets or Warfarin       | 1520 (61.9)     | 2059 (80.3)     | 2.06 (1.80 to 2.37) | 3304 (79.0)      | 2.04 (1.80 to 2.31) |
| **Ischemic stroke and atrial fibrillation** |                 |                 |                 |                 |                 |
| Antiplatelets                   | 40 (43.0)       | 135 (49.2)      | 1.33 (0.80 to 2.22) | 440 (58.4)       | 1.97 (1.23 to 3.17) |
| Warfarin                        | 67 (72.0)       | 172 (62.7)      | 0.58 (0.34 to 1.01) | 347 (46.8)       | 0.30 (0.18 to 0.50) |
| Antiplatelet or Warfarin        | 84 (90.3)       | 260 (94.9)      | 1.86 (0.73 to 4.74) | 687 (91.2)       | 1.21 (0.54 to 2.72) |

*Reference group.  †Adjusted for sex, hypercholesterolemia, practice, deprivation, and number of comorbidities.

| TABLE 5. Adjusted Odds Ratios of Stroke Patients Receiving a Secondary Preventative Drug by Carstairs Deprivation Quintile |
|---------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|                                 | 1st* No. (%) | 2nd No. (%) | OR (95%CI)† | 3rd No. (%) | OR (95%CI)† | 4th No. (%) | OR (95%CI)† | 5th No. (%) | OR (95%CI)† |
| **All stroke**                  |                 |                 |                 |                 |                 |                 |                 |                 |                 |
| Thiazides                       | 752 (44.2)      | 824 (46.0)      | 1.02 (0.83 to 1.24) | 1332 (45.7)      | 0.92 (0.76 to 1.12) | 908 (42.5)      | 1.02 (0.82 to 1.25) | 664 (43.3)      | 0.95 (0.74 to 1.23) |
| ACE inhibitors                  | 448 (36.4)      | 542 (30.2)      | 1.02 (0.82 to 1.27) | 842 (28.9)       | 1.10 (0.93 to 1.30) | 630 (29.5)      | 1.14 (0.90 to 1.43) | 480 (31.3)      | 1.17 (0.89 to 1.54) |
| Thiazide and ACE inhibitor      | 305 (17.9)      | 361 (20.2)      | 0.95 (0.75 to 1.22) | 565 (19.4)       | 0.98 (0.78 to 1.25) | 386 (18.1)      | 1.07 (0.83 to 1.39) | 303 (19.8)      | 1.11 (0.81 to 1.52) |
| **Ischemic stroke**             |                 |                 |                 |                 |                 |                 |                 |                 |                 |
| Antiplatelets                   | 997 (65.0)      | 1106 (67.2)     | 0.95 (0.77 to 1.18) | 1848 (69.3)      | 1.10 (0.89 to 1.35) | 1371 (69.7)     | 1.16 (0.93 to 1.44) | 988 (71.1)      | 1.19 (0.91 to 1.56) |
| Statins                         | 593 (38.7)      | 656 (39.9)      | 1.06 (0.85 to 1.32) | 1134 (42.5)      | 1.19 (0.97 to 1.47) | 659 (43.7)      | 1.20 (0.95 to 1.50) | 691 (49.8)      | 1.26 (0.96 to 1.64) |
| Warfarin                        | 133 (8.7)       | 152 (9.2)       | 0.88 (0.62 to 1.26) | 266 (10.0)       | 1.10 (0.79 to 1.53) | 162 (8.2)       | 0.86 (0.61 to 1.27) | 127 (9.1)       | 0.97 (0.63 to 1.50) |
| Antiplatelets or Warfarin       | 1129 (73.6)     | 1262 (73.7)     | 0.91 (0.71 to 1.17) | 2070 (77.8)      | 1.06 (0.84 to 1.35) | 1511 (76.8)     | 1.06 (0.83 to 1.37) | 1003 (73.7)     | 1.20 (0.88 to 1.64) |
| **Ischemic stroke and atrial fibrillation** |                 |                 |                 |                 |                 |                 |                 |                 |                 |
| Antiplatelets                   | 93 (50.0)       | 120 (52.4)      | 1.33 (0.74 to 2.36) | 207 (57.5)       | 1.45 (0.82 to 2.56) | 109 (55.3)      | 1.47 (0.82 to 2.56) | 86 (58.1)       | 1.53 (0.77 to 2.83) |
| Warfarin                        | 99 (53.2)       | 120 (52.4)      | 0.83 (0.46 to 1.48) | 182 (50.6)       | 1.09 (0.62 to 1.93) | 105 (53.3)      | 1.02 (0.53 to 1.98) | 80 (54.1)       | 1.23 (0.54 to 2.78) |
| Antiplatelet or Warfarin        | 168 (90.3)      | 210 (91.7)      | 1.14 (0.36 to 3.60) | 332 (92.2)       | 1.57 (0.55 to 4.52) | 183 (92.9)      | 1.65 (0.55 to 6.23) | 138 (93.2)      | 2.81 (0.58 to 9.98) |

*Reference group.  †Adjusted for age, sex, hypercholesterolemia, practice, and number of comorbidities.
scribing. Given the chronic nature of stroke, most prescrip-
tions (98.2%) were issued as repeat prescriptions. We were
unable to control directly for disease severity but could allow
for a number of other confounders such as age, sex, depriva-
tion, practice, hypercholesterolemia and number of comor-
bidities. Alternative explanations for the findings include
differences between groups in frequency of side effects or
response to therapy in the different groups. Prevalence cases
of any stroke were examined, because it could be argued that
every patient experiencing this condition should be offered
secondary prevention treatment regardless of when the event
occurred. Furthermore, events occurring in the more distant
past are more likely to be followed-up by primary care. In
addition, use of prevalent cases has enabled us to have many
more events in the analysis, increasing the power of the study
to detect differences that might exist.

Although epidemiological and clinical research has inves-
tigated sex differences in stroke occurrence, associated mor-
tality, and drug effectiveness, little is known about patterns
of secondary prevention treatment between groups. Our results
suggest that women and the elderly need to be targeted for
secondary prevention therapy so that they benefit fully from
such measures. Further epidemiological and sociological
studies investigating the reasons for the differing manage-
ment of stroke are required.

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References
1. Sans S, Kesteloot H, Kromhout D. The burden of cardiovascular diseases
mortality in Europe. Task Force of the European Society of Cardiology on
Cardiovascular Mortality and Morbidity Statistics in Europe. 
2. The Scottish Executive Department of Health. Coronary Heart Disease
Blood pressure and risk of stroke in patients with cerebrovascular
disease. The United Kingdom Transient Ischaemic Attack Collaborative
4. PROGRESS Collaborative Group. Randomised trial of a
perindopril-based blood-pressure-lowering regimen among 61,105 indi-
viduals with previous stroke or transient ischaemic attack. Lancet. 2001;
358:1033–1041.
5. Intercollegiate Stroke Working Party National Clinical Guidelines for
6. Antiplaetlet Trialists’ Collaboration. Collaborative overview of ran-
donised trials of antiplaetlet therapy–I: prevention of death, myocardial
infarction, and stroke by prolonged antiplaetlet therapy in various cate-
gories of patients. Antiplaetlet Trialists’ Collaboration. BMJ. 1994;308:
81–106.
7. Heart Protection Study Collaborative Group. MRC/BHF Heart Protection
Study of cholesterol lowering with simvastatin in 20,536 high-risk indi-
8. Atrial Fibrillation Investigators. Risk factors for stroke and efficacy of
antithrombotic therapy in atrial fibrillation. Analysis of pooled data from
five randomized controlled trials. Arch Intern Med. 1994;154:
1449–1457.
9. Hippius-Cox J, Pringle M, Crown N, Meal A, Wynn A. Sex inequalities in
ischaemic heart disease in general practice: cross sectional survey.
BMJ. 2001;322:832.
10. Simpson CR, Hannaford P, Williams D. Evidence for inequalities in the
management of coronary heart disease in Scotland. Heart. 2005;91:
630–634.
11. Holroyd-Leduc JM, Kapral MK, Austin PC, Tu JV. Sex differences and
similarities in the management and outcome of stroke patients. Stroke.
agement and outcome after stroke: a Swedish national perspective.
Study of Stroke Care Group. 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. Stroke. 2003;34:
1114–1119.
15. de Koning JS, Klazinga N, Koudstaal PJ, Prins A, Borsboom GJ, Peeters A, Mackenbach JP. Deprivation and systematic stroke prevention in
general practice: an audit among general practitioners in the Rotterdam
16. Milne RM, Taylor MW, Taylor RJ. Audit of populations in general
practice: the creation of a national resource for the study of morbidity in
Scottish general practice. J Epidemiol Community Health. 1998;52(Suppl
1):205–24S.
17. Whitehall FG, Nevin SL, Milne RM, Taylor RJ, Taylor MW, Watt AH. 
Completeness and accuracy of morbidity and repeat prescribing records
held on general practice computers in Scotland. Br J Gen Pract. 1996;
18. Information and Statistics Division. CMR Data Quality Assurance
19. Carstairs V, Morris R. Deprivation and Health in Scotland. Aberdeen:
20. Deplanque D, Leys D, Parnetti L, Schmidt R, Ferro J, De Reuck J, Mas
JL, Gallai V, SAFE II Investigators. Stroke prevention and atrial fibril-
lation: reasons leading to an inappropriate management. Main results of
21. Wenger NK, Speroff L, Packard B. Cardiovascular health and disease in
22. Shepherd J, Blauw GJ, Murphy MB, Bollen EL, Buckley BM, Cobbe SM,
Ford I, Gav A, Hyland M, Jukema JW, Kamper AM, Macfarlane PW,
Meinders AE, Norrie J, Packard CJ, Perry JJ, Stott DJ, Sweeney BJ, Twomey C, Westendorp RG, PROSPER study group. PROspective Study of
Pravastatin in the Elderly at Risk, Pravastatin in elderly individuals at
risk of vascular disease (PROSPER): a randomised controlled trial.
23. Lipids and the Primary Prevention of Coronary Heart Disease. Edin-
24. Hopper S, Pierce M Aspirin after myocardial infarction: the importance of
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