

Research Article

Comparison of Provision of Stroke Care in Younger and Older Patients: Findings from the South London Stroke Register

Siobhan L. Crichton,¹ Charles D. A. Wolfe,^{1,2} Anthony G. Rudd,³ and Christopher McKeivitt¹

¹Division of Health and Social Care Research, King's College London, London SE1 3QD, UK

²NIHR Biomedical Research Centre, Guy's and St. Thomas' NHS Foundation Trust and King's College London, London, SE1 9RT, UK

³Department of Ageing and Health, St. Thomas' Hospital, Guy's and St. Thomas' NHS Foundation Trust, London, SE1 7EH, UK

Correspondence should be addressed to Siobhan L. Crichton, siobhan.crichton@kcl.ac.uk

Received 28 November 2011; Revised 30 January 2012; Accepted 11 February 2012

Academic Editor: Halvor Naess

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Background. Evidence-based stroke care should be available to all patients. However, evidence exists of inequalities according to age. This study compared access to care for younger adults to that for over 65s. **Methods.** Using population-based data from 4229 patients with first-ever stroke between 1995 and 2010, associations between age and 21 care indicators were investigated using multivariable logistic regression. **Results.** Age was not associated with stroke unit admission for ischaemic stroke ($P = 0.666$). Younger PICH patients were least likely to be admitted to stroke units ($P = 0.001$), instead treated on neurosurgical or ICU wards. Younger age was also associated with admission to neurosurgery or ICU after SAH ($P = 0.006$), increased occupational or physiotherapy at 1 year ($P = 0.043$), and contact with a GP 3 months after stroke ($P < 0.001$). **Conclusion.** Younger patients have equal or greater access to evidence-based care. However, there is a need to ensure that services meet the needs of this group.

1. Introduction

Stroke incidence increases with age but a significant proportion of strokes occur in younger people: around 30% of people recruited to the multiethnic South London Stroke Register are under 65 years of age [1]. A range of social consequences affect younger people with stroke, including an inability to return to work [2, 3]. A recent study estimated the loss of earnings attributable to stroke in the UK, for those younger than 65, to be approximately £1.5 billion or 15% of the total cost of stroke to the UK economy [4].

Evidence-based stroke care is associated with improved patient outcomes [5]. The National Clinical Guideline for Stroke (England and Wales) recommends that all patients receive access to evidence-based care appropriate to their condition and regardless of age [5]. However, there is evidence of inequalities in the provision of care and secondary prevention management according to age [1, 6–13]. Studies have found younger stroke patients more likely to

be admitted to hospital [1, 10] and receive brain imaging [1, 10–13] but less likely to have physiotherapy [1, 10], access to organised stroke care [6], and appropriate secondary prevention medication [8]. Contrastingly, other studies have found improved secondary prevention [9] and access to outpatient physiotherapy or occupational therapy [1] to be associated with younger age.

While admission to a stroke unit improves outcome across all age groups [5], the relative increase in survival rates and decrease in levels of dependency associated with stroke unit admission has been found to be the greatest among the 18–64-year age group [6, 14]. It is therefore particularly important to ensure this age group are admitted to stroke units to ensure they benefit from the associated improvements in outcome.

Existing studies vary in their definition of younger age and have not looked specifically at provision of care for those under 65 years. Therefore, this study focuses on the role of age as a predictor of access to evidence-based care, including

risk factor management, acute care, and rehabilitation therapies, in an unbiased sample of younger and older patients with stroke from a multiethnic population-based cohort in south London.

2. Methods

2.1. Study Population. The South London Stroke Register (SLSR) is an ongoing population-based register, established in January 1995, which records all first-ever strokes in patients of all ages within a defined area of south London. The source population was 271 817 with 63% white, 15% black African, 9% black Caribbean, 4% black other, and 9% of other ethnic groups (source: Census 2001 [15]).

2.2. Data Collection. Methods used in data collection have been previously described [16] and are summarised below. To maximise case ascertainment and reduce bias in studies, the SLSR uses multiple overlapping sources of notification [17, 18]. Completeness of case ascertainment has been estimated to be between 75 and 84% [17]. Stroke was defined using WHO criteria [19] and classified as ischaemic stroke, primary intracerebral haemorrhage (PICH), or subarachnoid haemorrhage (SAH) based on brain imaging (computed tomography (CT) or magnetic resonance imaging (MRI)) within 30 days of stroke onset, necropsy examination, or cerebrospinal examination (SAH only). Where there was no known pathological confirmation of stroke subtype patients were classified as undefined. Initial data were collected within 48 hours of notification to the SLSR where possible. Data were collected at onset and at 3 months, 12 months and annually after stroke by a study nurse or specially trained field worker. Sociodemographic data collected at the initial assessment included age, ethnicity (categorised as white, black, or other), socioeconomic status (classified as manual or nonmanual according to the Registrar General's occupational codes [20]), and employment status prior to stroke, categorised as full time employed (more than 30 hrs per week), part time employed (less than 30 hrs per week), unemployed and looking for work, unable to work due to disability or ill health, carer (for home, family, or dependents), retired, or unknown. Incontinence, motor deficits, and Glasgow Coma Score (categorised as 3–8, 9–12, 13–15) [21] were also collected in the acute phase following stroke onset and used as a proxy for stroke severity.

We defined patients as being of younger if aged 18–64 years at the time of stroke, based on the default retirement age in the UK. Younger patients were further categorised into two age groups, 18–54 years and 55–64 years.

2.3. Indicators of Care. A range of indicators, suggested to be useful proxies for overall quality of care [1, 5], were derived. Four indicators of short-term care were included: admission to hospital, admission to an appropriate specialist unit, more than 50% of hospital stay spent on an appropriate specialist unit, and brain imaging (using CT or MRI). The National Clinical Guideline for Stroke (England and Wales) [5] recommends that all patients with stroke be treated on

a specialist stroke unit. However, for patients with an SAH admission to an intensive care unit (ICU) or neurosurgical ward would be appropriate. Therefore, where patients had a SAH, an appropriate specialist ward was defined as a neurosurgical ward or ICU. For all other patients admission to an appropriate unit was defined as stroke unit admission. Receipt of thrombolysis was not included in this study due to low numbers of patients receiving the therapy within each age group.

There were 11 indicators relating to the appropriate management of risk factors. Information on the prior to stroke diagnosis and management of risk factors, including hypertension (>140 mm Hg systolic or >90 mm Hg diastolic), atrial fibrillation, and diabetes mellitus, was obtained using general practice records and hospital records at baseline. At 3- and 12-month follow-up information was collected using patient self-report. Appropriate medication use in patients with a diagnosis of hypertension or diabetes mellitus was recorded prior to stroke and at 3 and 12 months after stroke. In ischaemic stroke patients, the use of antiplatelets was recorded at 3 and 12 months after stroke. Anticoagulation in patients with atrial fibrillation was recorded in all patients prior to stroke and in ischaemic stroke patients at 3 and 12 months after stroke.

In eligible patients, provision of physiotherapy, occupational therapy (PT/OT), and speech and language therapy (SALT) in the month prior to the 3- and 12-month follow-ups was recorded. Eligibility for PT/OT was defined as recorded motor or sensory deficits in the arm, hand, or leg while. For SALT, patients with dysarthria, dysphasia, or a failed swallow test were considered eligible. Contact with a general practitioner (GP) was also recorded at 3 and 12 months after stroke.

2.4. Statistical Methods. Univariable analyses examined differences between sociodemographic factors, case mix factors, and indicators of care across the three age groups using χ^2 tests or Fisher's exact test as appropriate. Multivariable logistic regression models were used to analyse associations between age and the indicators of care, while adjusting for time trends in the receipt of care and controlling for possible sociodemographic (ethnicity, gender, and socioeconomic status) and case mix (Glasgow coma score, stroke subtype, motor and swallow deficits, and urinary incontinence) differences. Interaction terms between age and year of stroke were added to multivariable models to examine whether any disparities between age groups had varied across the 16 years of the study.

Models of indicators of acute care were analysed firstly across all patients and then in those with ischaemic stroke, PICH, and SAH separately. Analyses on admission to appropriate specialist units were restricted to those admitted to hospital and analyses of rates of patients spending at least 50% of stay on appropriate units were carried out firstly among all admitted patients and then only those admitted to an appropriate ward at some point during their hospital stay. Multivariate models for admission to hospital and receipt of brain imaging in patients with PICH or SAH were not

included due to the low number of younger patients not admitted or not receiving a scan ($n < 10$).

Sensitivity analyses were also conducted for the indicators of acute care. Only patients surviving at least 24 hours were included in the analyses of hospital admissions to account for differing rates of early deaths across age groups. For the other indicators only those in hospital for at least 3 days were included to remove patients who died very soon after admission and may not have had time to be admitted to an appropriate ward, or those with very mild strokes who are discharged home quickly.

Changes in access to care were controlled for in the analyses. However, the organisation of stroke services has changed considerably over the period of the study, therefore, further analyses of acute care indicators examined trends in rates of appropriate care prior to and from 2005 onwards.

Due to a change in the format of variables relating to the provision of therapies, in 2000 for the 3-month follow-up and 1999 for the one-year follow-up, data collected before and after these cut-off points were not comparable. Models for PT/OT and SALT at 3 months after stroke were therefore restricted to patients with first-ever stroke between 2001 and 2010 and at 12 months to patients with first-ever stroke between 1999 and 2010.

The use of anticoagulation therapy was not considered in multivariable analyses due to the very low number of surviving patients in the 18–54-year age group with a diagnosis of atrial fibrillation ($N = 17$ at time of stroke).

Analyses were restricted to patients without missing values. All tests were two-tailed with P values < 0.05 considered to be statistically significant. Statistical analyses were performed using Stata 11MP statistical software package.

2.5. Ethics. Informed written consent for participation in the study was obtained from all patients or their relatives. The study was approved by the St. Thomas' Hospital Research Ethics Committee (06/Q0702/147).

3. Results

Between January 1995 and December 2010 4338 patients were registered with first-ever strokes. Nine patients under 18 years of age at stroke onset were excluded leaving a total sample size of 4229. By 3 months after stroke 1102 (26.1%) patients had died and 1069 (25.3%) were lost to follow up. By 12 months after stroke 1409 (33.3%) had died, 738 (17.5%) were lost to follow up, and a further 164 (3.8%) had not yet reached the one-year follow-up point. Patient characteristics, broken down by age group, are reported in Table 1. The distribution of sociodemographic factors (gender, ethnicity, socioeconomic status, employment status) differed across age groups (all $P < 0.001$) with the largest proportion of females in the over 65-year olds and the largest proportion of blacks observed in the 18–54-year olds.

The associations between age and indicators of acute care, for all patients, and broken down by stroke subtype, are presented in Table 2. In univariable analyses, younger patients were more likely to be admitted to hospital ($P =$

0.007) and to have brain imaging ($P < 0.001$). They were also more likely to be admitted to a stroke unit, neurosurgical ward, or ICU, as appropriate, with 65.5% of 18–54-year olds compared to 57.8% of 55–64-year olds and 55.6% of over 65s who were admitted to hospital spending at least some of their stay on an appropriate unit. After controlling for sociodemographic and case mix differences, the odds of being admitted to an appropriate unit across all patients did not significantly differ with age ($P = 0.914$). However, older patients with PICH were 3 times more likely to be admitted to a stroke unit than those aged 18–54 years ($P = 0.001$). Conversely, in patients with SAH, the odds of admission to ICU or neurosurgical ward decreased with age ($P = 0.006$) with 86.6% of 18–54-year olds, 85.7% of 55–64-year olds and 58.1% of over 65s admitted to one of these wards. For patients with ischaemic stroke, although a higher proportion of young patients were admitted to a stroke unit (66.5% of 18–54-year olds, 59.3% of 55–64-year olds, and 57.5% of over 65s) after adjusting for sociodemographic and case mix factors, the difference in odds of admission was not significant ($P = 0.666$).

In sensitivity analyses, where models were restricted to those with a length of stay in hospital of at least 3 days, the significance and size of these associations remained unchanged (data not shown).

Analyses of patients admitted prior to 2005 showed similar trends and significance levels to those reported above, with overall admission rates slightly lower than average. Similarly, while the overall proportion of patients accessing appropriate care was higher than average from 2005 onwards, differences across age groups remained. During this time period, the 55–64-year age group were found to have the highest rates of admission to appropriate wards. Across all patients, 85% of 55–64-year olds were admitted to a stroke unit, ICU, or neurosurgical ward compared to 78% of 18–54 year olds and 81% of over 65s ($P = 0.0168$). In patients with ischaemic stroke the rates were 82% for 18–54 years, 90% for 55–64 years, and 83% for over-65-year olds ($P = 0.089$). The corresponding figures for PICH patients were 61%, 80%, and 73% ($P = 0.227$) and 82%, 100%, and 45% for SAH ($P = 0.016$).

The location of care for patients with PICH is summarised in Table 3. A higher proportion of younger patients with PICH were admitted to a neurosurgical ward or ICU with 55.5% of all patients of 18–54 years admitted to one of these wards at some point, compared to 27.5% of 55–64 years and 14.4% of over 65s. Among those not admitted to a stroke unit, 75% of 18–54-year olds were treated in ICU or on a neurosurgical ward.

Table 4 reports the association between age and risk factor control prior to and at 3 and 12 months after stroke. A significantly lower proportion of younger patients were on treatment for hypertension prior to stroke (53.8% of 18–54-year olds, 61.4% of 55–64-year olds, and 61.7% of over 65s) and the difference remained significant in multivariable analyses ($P = 0.029$). However, by 3 months after stroke, the lowest rate of treatment was in the over-65-year age group and no significant trend was observed in any multivariable analyses at 3 or 12 months.

TABLE 1: Patient characteristics by age group.

Patient characteristics, n()	Total (n = 4229)	18–54 years (n = 648)	55–64 years (n = 671)	65≥ years (n = 2910)	P value
Gender					
Male	2125 (50.2)	379 (58.5)	455 (67.8)	1291 (44.4)	<0.001
Female	2104 (49.8)	269 (41.5)	216 (32.2)	1619 (55.6)	
Ethnic group					
White	3021 (73.3)	320 (51.4)	434 (66.2)	2267 (79.7)	<0.001
Black	861 (20.9)	245 (39.3)	163 (24.9)	453 (15.9)	
Other	241 (5.9)	58 (9.3)	59 (9.0)	124 (4.4)	
Socioeconomic status					
Manual	1996 (47.2)	243 (37.5)	352 (52.5)	1401 (48.1)	<0.001
Nonmanual	929 (22.0)	179 (27.6)	137 (20.4)	613 (21.1)	
Unknown	1304 (30.8)	226 (34.9)	182 (27.1)	896 (30.8)	
Employment status prior to stroke					
Full time employed	541 (12.8)	293 (45.2)	187 (27.9)	61 (2.1)	<0.001
Part time employed	100 (2.4)	32 (4.9)	25 (3.7)	43 (1.5)	
Unemployed and looking for work	132 (3.1)	85 (13.1)	44 (6.6)	3 (0.1)	
Unable to work due to ill health	217 (5.1)	90 (13.9)	103 (15.4)	24 (0.8)	
Carer for family/dependents	87 (2.1)	37 (5.7)	22 (3.3)	28 (1.0)	
Retired	2905 (68.7)	22 (3.4)	215 (32.0)	2668 (91.7)	
Unknown	244 (5.8)	89 (13.3)	75 (11.2)	83 (2.9)	
Stroke subtype					
Infarction	3145 (74.4)	365 (56.3)	515 (76.8)	2265 (77.8)	<0.001
PICH	540 (12.8)	128 (19.8)	84 (12.5)	328 (11.3)	
SAH	212 (5.0)	122 (18.8)	34 (5.1)	56 (1.9)	
Undefined	332 (7.9)	33 (5.1)	38 (5.7)	261 (9.0)	
Glasgow comma score					
≤8	671 (16.5)	115 (18.5)	93 (14.6)	463 (16.5)	<0.001
9–12	480 (11.8)	60 (9.7)	50 (7.9)	370 (13.2)	
13–15	2909 (71.7)	447 (71.9)	494 (77.6)	1968 (70.3)	

There was no difference in the odds of patients in different age groups receiving physiotherapy or occupational therapy 3 months after stroke ($P = 0.461$) (Table 5). However, by 1 year after stroke those aged 18–54 were significantly more likely to still be having therapy compared to those of an older age ($P = 0.043$). Younger patients were also more likely to have had contact with their GP at 3 months after stroke ($P < 0.001$).

None of the interactions between age and stroke year were significant for any indicator of care, suggesting that differences across age groups occurred consistently throughout the study.

4. Discussion

This study compared patterns of care across stroke patients aged 18–54, 55–64, and over 65 years, by investigating management of risk factors prior to stroke, access to acute care, and provision of therapies and risk factor management over a 1-year period following stroke, using predefined

indicators of care based on clinical guidelines [1, 5, 10]. There were no significant differences in the rates of admission to stroke units among ischaemic stroke patients. However, the likelihood of admission to a stroke unit in patients with PICH increased with age, with younger patients more likely to be treated on a neurosurgical ward or in ICU. In patients with an SAH, increasing age was also associated with lower likelihood of admission to neurosurgery or ICU. The proportion of patients with hypertension on anti-hypertensive medication prior to stroke was the lowest among 18–54-year olds but there was no association between risk factor control and age found at 3 and 12 months after stroke. Younger age was also found to be associated with increased GP contact at 3 months and greater likelihood of ongoing physiotherapy or occupational therapy at 1 year after stroke.

The National Clinical Guidelines for Stroke [5] recommends that “*all patients with suspected stroke should be admitted directly to a specialist acute stroke unit following initial assessment either from the community or from the A&E*

TABLE 2: Association between age and indicators of acute care.

	Univariable, N(%)				P value	Multivariable, OR (95% CI)			P value
	18–54 years	55–64 years	≥65 years			18–54 years	55–64 years	≥65 years	
All patients									
Admission to hospital	590 (91.1)	573 (85.4)	2557 (87.9)	0.007	1	0.58 (0.37–0.93)	0.61 (0.40–0.93)	0.071	
Admission to SU/NS/ICU	368 (65.5)	321 (57.8)	1391 (55.6)	<0.001	1	1.01 (0.72–1.42)	1.01 (0.76–1.36)	0.914	
50% time on SU/NS/ICU	280 (55.5)	242 (48.4)	1017 (45.2)	<0.001	1	0.84 (0.59–0.56)	0.77 (0.56–1.04)	0.092	
50% time on SU/NS/ICU*	280 (84.0)	242 (85.2)	1017 (83.9)	0.855	1	0.54 (0.31–0.97)	0.52 (0.31–0.86)	0.017	
Brain imaging	600 (96.3)	617 (95.4)	2557 (91.5)	<0.001	1	0.92 (0.31–2.70)	0.63 (0.27–1.54)	0.189	
Ischaemic stroke									
Admission to hospital	327 (89.6)	431 (83.7)	1991 (87.9)	0.013	1	0.60 (0.37–0.99)	0.67 (0.42–1.03)	0.183	
Admission to SU	214 (66.5)	252 (59.3)	1127 (57.5)	0.010	1	0.90 (0.59–1.37)	0.91 (0.63–1.30)	0.666	
50% time on SU	171 (58.7)	197 (50.8)	844 (47.0)	0.001	1	1.07 (0.68–1.68)	0.87 (0.59–1.28)	0.266	
50% time on SU*	171 (90.4)	197 (88.3)	844 (85.4)	0.126	1	0.75 (0.33–1.68)	0.63 (0.32–1.24)	0.148	
Brain imaging	359 (99.2)	502 (98.2)	2173 (96.9)	0.019	1	0.71 (0.14–3.61)	0.44 (0.10–1.91)	0.129	
PICH									
Admission to hospital	123 (96.1)	81 (96.4)	311 (94.8)	0.744					
Admission to SU	53 (43.1)	33 (40.7)	166 (53.4)	0.043	1	2.23 (1.01–5.10)	3.07 (1.55–6.09)	0.001	
50% time on SU	35 (33.3)	21 (31.8)	101 (39.5)	0.364	1	0.96 (0.36–2.54)	0.99 (0.46–2.17)	0.999	
50% time on SU*	35 (76.1)	21 (80.7)	101 (73.2)	0.697	1	0.42 (0.08–2.23)	0.31 (0.09–1.14)	0.072	
Brain imaging	125 (98.4)	80 (96.4)	305 (95.0)	0.245					
SAH									
Admission to hospital	113 (92.6)	32 (94.1)	49 (87.5)	0.438					
Admission to NS/ICU	84 (86.6)	24 (85.7)	25 (58.1)	<0.001	1	0.84 (0.13–5.43)	0.12 (0.02–0.56)	0.006	
50% time on NS/ICU	60 (68.2)	13 (52.0)	15 (45.5)	0.049	1	0.30 (0.09–1.06)	0.12 (0.03–0.47)	<0.001	
50% time on NS/ICU*	59 (73.8)	13 (56.5)	13 (59.1)	0.182	1	0.23 (0.06–0.92)	0.12 (0.02–0.61)	0.002	
Brain imaging	109 (90.1)	31 (93.9)	44 (81.5)	0.145					

* Excluding patients admitted to hospital but not SU/NS/ICU.
 SU: stroke unit, NS: neurosurgical ward, and ICU: Intensive care unit.

TABLE 3: Location of care of patients with PICH.

	18–54 years, N(%)	55–64 years, N(%)	≥65 years, N(%)	P value
Admitted at any point during hospital stay				
Stroke unit	53 (43.1)	33 (40.7)	166 (53.4)	0.043
Neurosurgery	32 (31.7)	7 (10.1)	11 (4.1)	<0.001
ICU	38 (37.6)	14 (20.3)	33 (12.2)	<0.001
Neurosurgery or ICU	56 (55.5)	19 (27.5)	39 (14.4)	<0.001
Location of care of patients not admitted to a stroke unit				
Neurosurgery	20 (36.4)	6 (15.0)	4 (3.5)	<0.001
ICU	33 (60.0)	13 (32.5)	20 (17.2)	<0.001
Neurosurgery or ICU	42 (76.4)	17 (42.5)	21 (18.1)	<0.001

TABLE 4: Association between age and indicators relating to the management of risk factors.

	Univariable, N(%)				18–54 years	Multivariable, OR(95% CI)		
	18–54 years	55–64 years	≥65 years	P value		55–64 years	≥65 years	P value
Hypertension treatment								
Prior to stroke	143 (53.8)	261 (61.4)	1156 (61.7)	0.046	1	1.88 (1.29–2.76)	1.68 (1.21–2.36)	0.029
3 months	108 (68.8)	197 (73.8)	649 (64.1)	0.010	1	1.28 (0.75–2.19)	0.81 (0.50–1.29)	0.058
1 year	116 (71.2)	183 (71.8)	558 (66.0)	0.143	1	0.97 (0.56–1.70)	0.80 (0.49–1.31)	0.247
Diabetes								
Prior to stroke	61 (77.2)	107 (80.5)	424 (77.5)	0.752	1	0.94 (0.40–2.22)	1.21 (0.57–2.56)	0.436
3 months	31 (67.4)	61 (75.3)	190 (74.1)	0.581	1	1.90 (0.67–5.51)	1.56 (0.61–3.99)	0.607
1 year	29 (61.7)	56 (76.7)	173 (72.4)	0.194	1	1.86 (0.68–5.11)	1.70 (0.72–4.01)	0.357
Atrial Fibrillation								
Prior to stroke	6 (35.3)	16 (26.7)	85 (15.1)	0.008				
3 months	4 (40.0)	5 (31.3)	36 (37.9)	0.863				
1 year	3 (30.0)	8 (33.3)	41 (36.0)	0.912				
Antiplatelet therapy (IS)								
3 months	146 (71.6)	228 (78.1)	910 (77.8)	0.131	1	1.24 (0.78–1.99)	1.44 (0.96–2.15)	0.071
1 year	165 (79.0)	254 (81.2)	825 (77.3)	0.327	1	0.95 (0.57–1.60)	0.83 (0.53–1.30)	0.309

TABLE 5: Associations between age and continuing therapy and GP contact after stroke.

	Univariable, N(%)				18–54 years	Multivariable, OR (95% CI)		
	18–54 years	55–64 years	≥65 years	P value		55–64 years	≥65 years	P value
PT/OT								
3 months	67 (46.9)	61 (45.9)	247 (46.2)	0.985	1	1.11 (0.60–2.03)	0.88 (0.53–1.45)	0.461
1 year	43 (31.4)	32 (19.4)	100 (19.6)	0.009	1	0.61 (0.34–1.13)	0.56 (0.34–0.94)	0.043
SALT								
3 months	30 (30.3)	22 (21.6)	91 (31.2)	0.144	1	0.78 (0.34–1.82)	0.72 (0.36–1.42)	0.360
1 year	13 (12.4)	9 (8.2)	29 (7.4)	0.262	1	0.62 (0.19–1.95)	0.83 (0.33–2.07)	0.896
Seen by GP								
3 months	198 (77.0)	237 (82.9)	760 (68.8)	<0.001	1	1.54 (0.93–2.53)	0.67 (0.45–1.00)	<0.001
1 year	163 (86.2)	164 (84.1)	505 (79.0)	0.045	1	1.06 (0.52–2.16)	0.72 (0.39–1.32)	0.167

department.” However, it also states that younger adults with stroke should be managed within settings that “*recognise and manage the particular physical, psychological and social needs of younger patients with stroke*” and that this should be “*provided in an environment suited to their specific social needs.*” Results from this study suggest that the majority of younger stroke patients are receiving care on a specialist unit. While young patients with PICH are less likely to be treated on a stroke unit at any time during their stay, the majority are admitted to a neurosurgical ward or ICU instead. It has been suggested that the increased survival rates and lower levels of dependency associated with stroke unit admission are the greatest among the 18–64-year age group [14]. Although ICU may be deemed more appropriate for a younger patient, it is also important to ensure that they are not missing out on improved outcomes associated with stroke unit admission, afforded by specialist multidisciplinary stroke care.

A qualitative study of hospital and community stroke service providers looked at stroke unit admissions and selection procedures [22]. Service providers report that, even when policy states that all stroke patients be admitted, selection was occasionally required due to limited bed availability. In these cases providers commonly based selection on rehabilitation potential. Patients with mild strokes, likely to recover quickly, and those with very severe strokes, deemed unlikely to recover, may be less likely to be admitted. Younger stroke patients may be deemed more likely to recover, potentially accounting in part for the higher rates of appropriate acute care observed. The greater perceived recovery potential of younger patients may also lead to longer contact with rehabilitation services as suggested by the higher rates of physiotherapy or occupational therapy 1 year after stroke in the 18–54-year age group. A qualitative study looking at stroke professional’s attitudes to rehabilitation found elderly and unmotivated patients may be treated differently by some professionals, with greater encouragement to continue therapy potentially given to younger patients [23]. Younger patients themselves may also be more likely to push for ongoing rehabilitation therapies.

Although this study has not demonstrated any large differences in access to care according to age, with the exception of stroke unit admission for those with PICH, younger patients are more likely to report larger number of unmet needs and greater dissatisfaction with stroke services [24]. It is therefore important to ensure that existing services are meeting the needs of young people.

A study from the US found stroke survivors under 65 years of age were less likely to be seen by a general practitioner and less likely to be able to afford medications [8]. However, increasing age was associated with decreasing likelihood of being prescribed secondary prevention in the [9]. However, only stroke survivors aged 50 and over were included. In this study, there was no evidence of any differences in rates of secondary prevention and those under 65 were most likely to be seen by a GP.

A higher likelihood of having a brain scan in younger patients has previously been observed in other studies [10–13]. No significant trend between age and odds of having a

scan were found in this study although slightly higher overall rates were observed among younger patients. However, rates of brain imaging in this population were high; over 90% of all patients were scanned and this neared 100% towards the end of the study. Further, previous studies have focused on older stroke patients, categorising age differently.

A 2005 study using data from the SLSR, for the period 1995 to 2000, investigated patterns of care using similar indicators and reported that overall quality of care was suboptimal [1]. Another 2011 study looked at acute care services in the same area from 1995 to 2011 [10]. Significant improvements in care were found over the 15-year period but inequalities still exist. This study focused on the younger patients, further dividing the under-65-year age group in two, to identify any further differences between younger people, more likely to be working, and those who may already be retired or have other comorbidities, while controlling for changes in uptake of services over time.

The main strengths of this study lie in its design. Data were obtained from a large multiethnic population-based register, estimated to be 75–84% complete [17], spanning a period of 16 years. While there is a number of population-based studies that examine outcomes of stroke among working age or younger adults [25–27], to the best of our knowledge this is the first population-based study examining access to and provision of evidence-based stroke care for this age group.

The study is limited by the proportion of eligible patients completing the 3- and 12-month follow-up interview, 65.1% and 72.2%, respectively. These rates are similar to those reported in other urban population-based studies [28, 29]. This study also relied on the self-report of the receipt of rehabilitation therapies and diagnosis of new risk factors at 3 and 12 months after stroke. This could be subject to recall bias as certain subgroups of patients may be less able to accurately recall new diagnoses or having received therapy.

Current SLSR data collection allowed us to compare access to evidence-based care that should be provided regardless of age. However, clinical guidelines also suggest that working age adults may have other needs not met by these services, which need to be identified and appropriate provision made available. Data on access to other services, such as vocational rehabilitation, was not available as part of this study. Further investigation of longer-term needs and outcomes of younger stroke survivors is needed to ensure current service provision reflects their priorities.

5. Conclusions

The majority of younger stroke patients have equal, or greater, access to evidence-based care when compared to older patients. However, the UK Department of Health’s National Stroke strategy calls for the development of services to meet the particular needs of people who have a stroke in working age [29]. There is a need to ensure that evidence-based stroke services, such as stroke unit care, are meeting the needs of this group.

Acknowledgments

The authors wish to thank all health care professionals, patients, and their families involved. Particular thanks go to the field workers collecting data for the SLSR since 1995. This project received funding from the Stroke Association and NIHR Programme Grant funding (RP-PG-0407-10184). The South London Stroke Register has also received funding from the Northern & Yorkshire NHS R&D Programme in Cardiovascular Disease and Stroke, the Guy's and St Thomas' Hospitals Charitable Foundation, the Stanley Thomas Johnson Foundation, The Stroke Association, and DH HQIP funding. This paper presents independent research commissioned by the National Institute for Health Research (NIHR) under its Programme Grants for Applied Research funding scheme (RP-PG-0407-10184). The views expressed in this paper are those of the author(s) and not necessarily those of the NHS, the NIHR or the Department of Health. The authors acknowledge financial support from the Department of Health via the National Institute for Health Research (NIHR) comprehensive Biomedical Research Centre award to Guy's & St Thomas' NHS Foundation Trust in partnership with King's College London and King's College Hospital NHS Foundation Trust (to C. D. A. Wolfe).

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