PAPER

Stroke in Devon: knowledge was good, but action was poor

C Carroll, J Hobart, C Fox, L Teare, J Gibson

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See end of article for authors' affiliations
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Correspondence to:
Dr C Carroll, Department of Neurology, Derriford Hospital, Plymouth PL6 8DH, UK; camille.carroll@ pms.ac.uk

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Background and aim: Effective implementation of early treatment strategies for stroke requires prompt admission to hospital. There are several reasons for delayed admission. Good awareness should facilitate early admission. We identified local targets for education.

Methods: Four groups, each of 40 people, completed questionnaires to determine their knowledge of stroke symptoms and risk factors, and the action they took or would take in the event of a stroke. The groups were: patients with a diagnosis of stroke or TIA (within 48 hrs of admission); patients at risk of stroke; the general population; and nurses.

Results: Forty per cent of stroke patients identified their stroke. Median time from onset of symptoms to seeking medical help was 30 minutes. Medical help was sought by the patient themselves in only 15% of cases. In 80% of cases the GP was called rather than an ambulance. Of the at risk group, 93% were able to list at least one symptom of acute stroke, as were 88% of the general population. An ambulance would be called by 73% of the at risk group in the event of a stroke. Patients with self reported risk factors for stroke were largely unaware of their increased risk. Only 7.5% of at risk patients acquired their stroke information from the medical profession.

Conclusions: Public knowledge about stroke is good. However, stroke patients access acute services poorly. At risk patients have limited awareness of their increased risk. A campaign should target people at risk, reinforcing the diagnosis of stroke and access to medical services.

E arly admission to hospital is critical for the effective implementation of early treatment strategies for stroke,[1][2] which have been shown to reduce morbidity and cost associated with the condition.[3][4] Nevertheless, there is often a significant delay in patients with stroke reaching hospital.[5–8] This delay has three components:[9] appraisal delay, the time from noticing a symptom to deciding one is ill; illness delay, the time from onset of symptoms to seeking professional help; and utilisation delay, the time from seeking professional care to arrival at the hospital.

Several public education campaigns have successfully increased the level of stroke knowledge.[9][10] While it is assumed that good stroke knowledge results in faster access to medical services, this link has not been proven.[9][11–14]

This study had two aims. Firstly, we identified factors governing delay in admission to hospital that could be the focus for education. Secondly, we determined education opportunities that are currently being missed. This study focused on less disabled patients, as patients with severe strokes are admitted sooner than those who are less disabled.[15]

METHODS

The study was undertaken at Derriford Hospital in Plymouth, England. Four groups were studied:

- Patients with a diagnosis of stroke or transient ischaemic attack (TIA), admitted during the previous 48 hours. Exclusion criteria were inability to communicate, impaired consciousness, or a diagnosis of subarachnoid haemorrhage.
- Patients at risk of stroke identified in hypertension, diabetic, and chronic renal failure clinics.
- Members of the general public recruited from Derriford Hospital.
- Medically trained nurses from non-neurological medical wards.

Following statistical advice, the group size was set at 40, this figure being achievable in a busy neurology unit and sufficient to identify trends and differences between groups that might merit further study. Study days were identified on the basis of practical considerations. Fifteen such days were identified over a 7 month period between December 2001 and July 2002. On study days, all patients admitted during the previous 48 hours with a diagnosis of stroke or TIA were interviewed. Our unit admits all acute neurology patients and routinely admits patients with TIA if they present acutely. There is no difference in the early management of stroke patients compared with patients who have had a TIA. In addition, consecutive at risk patients attending outpatient clinic appointments who were willing to take part in the study were interviewed. All nurses present on a medical ward at the time of the study were also interviewed. Members of the public were recruited from patients and relatives on non-medical wards and visitors to the hospital restaurant or cafeteria.

Subjects from each group were interviewed using a standardised, structured interview with open ended questions administered by members of the neurology department on identified study days. The Plymouth local ethics committee approved the study.

In stroke patients, appraisal delay was determined by assessing the ability of patients to correctly identify their diagnosis. Illness delay was estimated as time to seeking medical help from the onset of symptoms. The method of seeking medical help was recorded as this influences utilisation delay.[8] Non-stroke samples were asked to list stroke symptoms. The symptoms of stroke that were accepted as correct were those matching the NINDS criteria.[13] Perception of stroke as a medical emergency was assessed in the non-stroke samples, as well as the action that would be taken if either they or a family member had suffered a stroke.

All respondents were asked to list three risk factors for stroke. Their own risk factors were determined and whether a member of the medical profession had ever discussed with

them their increased risk of stroke, as well as other sources of stroke knowledge. Established risk factors were those listed on the *Journal of the American Medical Association* patient education page,[16] hypercholesterolaemia, previous stroke/TIA, and history of ischaemic heart disease.

Medically trained nurses were chosen as they were predicted to have an increased knowledge of stroke symptoms and risk factors, and could be used in an education programme.

Data analysis
The questionnaires were interview administered, therefore the dataset was complete and there were no missing data. Data were analysed in Microsoft Excel and SPSS. Time delays were compared using the two tailed Student's *t* test. All other comparisons were performed using appropriate non-parametric analyses.

RESULTS
Demographic data
A total of 40 people in each group were interviewed. The group of stroke patients was 42% male, the group of at risk patients 52% male, the general population group 52% male, and the nurses group 8% male. The mean age (SD) was 70.9 (12.8) years for the stroke patients, 68.2 (12.1) for the at risk patients, 54.4 (19.2) years for the general population, and 38.9 (8.7) years for the nurses.

Knowledge of stroke in the non-stroke groups
Most people in the three non-stroke groups were able to list at least one stroke symptom (at risk: 92.5% (CI 8.2); general population: 87.5% (CI 10.2); nurses: 100% (CI 0)). Medically trained nurses listed significantly more stroke symptoms than the general population (p<0.01, table 1); there was no difference to the at risk group. Commonly cited symptoms were weakness and speech disturbance. Age, less than or greater than 75 years, made no difference to the level of stroke symptom knowledge in both the at risk ($\chi^2 = 0.05$, df = 1, p = 0.6) and general population ($\chi^2 = 0.29$, df = 1, p = 0.6) groups. Most stated that stroke is always an emergency (at risk: 85% (11.1); general population: 92.3% (8.3)). In contrast, 23% (13) of medically trained nurses said that stroke was an emergency only occasionally. Most people said they would call an ambulance rather than the GP in the event of a stroke (p<0.01, table 2).

Table 1 Identification of stroke symptoms and risk factors by the different groups

	Number of stroke symptoms identified		Number of stroke risk factors identified	
	Median	IQR	Median	IQR
Stroke patients	N/A	N/A	0†	1
At risk	2	1	1	0.75
General population	2	1	1	1.75
Medically trained nurses	2*	1.5	2‡	1.75

*Medically trained nurses identified significantly more stroke symptoms than the general population group (Kruskal–Wallis and Mann-Whitney U, p=0.006).
†Stroke patients identified significantly fewer risk factors for stroke than the other groups (Kruskal-Wallis and Mann-Whitney U, p<0.05).
‡Medically trained nurses identified significantly more stroke risk factors than the other groups (Kruskal-Wallis and Mann-Whitney U, p<0.01).

Table 2 Help that would be sought in the event of a stroke

	GP	Ambulance	A&E
At risk	27.5 (13.8)	72.5 (13.8)	0 (0)
General population	20 (12.4)	80 (12.4)	2.5 (4.8)
Medically trained nurses	17.5 (11.8)	90 (9.3)	0 (0)

A&E, Accident and Emergency department.
Data are percentage (CI).

Recognition of stroke by patients and action taken following their stroke
Forty per cent (15.2) of stroke patients correctly identified the diagnosis. Only 32% (14.8) of those with risk factors remembered being told they were at risk. However, these patients were no more likely to recognise that they were having a stroke than those who did not know that they were at risk for stroke (57% (36.7) *v* 35.5% (16.8); $\chi^2 = 1.13$, df = 1, p = 0.29). Illness delay ranged from 5 minutes to nearly 6 days, with a median of 30 minutes (table 3). Medical help was sought by the patient in 15% (11.8) of cases, a family member in 67.5% (14.5), and a member of the public in 17.5% (11.8). When patients recognised they were having a stroke, illness delay was shorter and patients were more likely to call for help themselves. Neither of these differences was significant (p = 0.79 and $\chi^2 = 0.03$, df = 1, p = 0.87 respectively). The general practitioner was the point of access to medical services in 80% (12.4) of cases (table 3). This is significantly different from the planned course of action in the non-stroke groups ($\chi^2 = 49$, df = 3, p<0.001). Where the stroke was recognised by the patient or a family member, there was a trend towards it being more likely that an ambulance would be called ($\chi^2 = 0.74$, df = 1, p = 0.39) (table 3).

Knowledge of stroke risk factors
Forty per cent (15.2) of stroke patients were able to name at least one major risk factor. Overall, stroke patients' knowledge of stroke risk factors was worse than in the other groups (table 1, p<0.05). There was a significant age effect among stroke patients with regard to knowledge of stroke risk factors. Fifty-seven per cent of stroke patients aged <75 years were able to list at least one stroke risk factor compared with 19% aged ≥75 years ($\chi^2 = 4.94$, df = 1, p = 0.026). Knowledge of stroke risk factors by stroke patients was better in patients who recognised they were having a stroke, although not reaching significance (56.25% *v* 29.2%, $\chi^2 = 2.93$, df = 1, p = 0.8). Among stroke patients, the most commonly mentioned risk factors were smoking and

Table 3 Time from onset of symptoms to when help was sought and the nature of medical help sought (per cent) by patients with a cerebral ischaemic event

	Time (mins) taken from onset of symptoms to seeking help, median (IQR)	Nature of medical help sought		
		GP	Ambulance	A&E
Overall	30 (10 to 161)	80 (12.4)	17.5 (11.8)	5 (6.7)
Stroke recognised	25 (10 to 83)	75 (13.4)	25 (13.4)	0 (0)
Stroke not recognised	30 (13 to 183)	83 (11.6)	12.5 (10.2)	8.3 (8.5)

GP, general practitioner; A&E, Accident and Emergency department.
Data are % (CI) unless otherwise stated.

Table 4 The percentage (CI) of each group that identified stroke risk factors.

Risk factors	Stroke patients	At risk	General population	Nurses	χ^2	p
Smoking	**22.5 (12.9)**	**40 (15.2)**	**50 (15.5)**	**47.5 (15.5)**	7.7	0.052
Hypertension	**20 (12.4)**	**32.5 (14.5)**	**27.5 (13.8)**	**75 (13.4)**	30.9	<0.01
Cholesterol	**10 (9.3)**	**12.5 (10.2)**	**7.5 (8.2)**	**40 (15.2)**	19.0	<0.01
AF	**7.5 (8.2)**	**0 (0)**	**0 (0)**	**2.5 (4.8)**	6.1	0.1
Diabetes	**5 (6.7)**	**2.5 (4.8)**	**0 (0)**	**7.5 (8.2)**	3.5	0.32
Old age	**0 (0)**	**2.5 (4.8)**	**0 (0)**	**7.5 (8.2)**	6.1	0.1
Ischaemic heart disease/CVD	**0 (0)**	**10 (9.3)**	**15 (11.1)**	**7.5 (8.2)**	6.3	0.1
Stress	17.5 (11.8)	20 (12.4)	35 (14.8)	5 (6.7)		
Poor diet	17.5 (11.8)	30 (14.2)	27.5 (13.8)	15 (11.1)		
Overexertion	10 (9.3)	0 (0)	12.5 (10.2)	0 (0)		
Thick blood	7.5 (8.2)	7.5 (8.2)	2.5 (4.8)	0 (0)		
Family history	5 (6.7)	10 (9.3)	7.5 (8.2)	17.5 (11.8)		
Overweight	5 (6.7)	22.5 (12.9)	32.5 (14.5)	20 (12.4)		
Alcohol excess	5 (6.7)	20 (12.4)	10 (9.3)	0 (0)		
Fast heart rate	5 (6.7)	0 (0)	0 (0)	0 (0)		
Inactivity	2.5 (4.8)	5 (6.7)	12.5 (10.2)	5 (6.7)		
Heart valve disease	2.5 (4.8)	0 (0)	0 (0)	0 (0)		

AF, atrial fibrillation; CVD, cerebrovascular disease.
Factors that were counted as correct are shown in **bold**.

hypertension (20%) (table 4). No patient recognised that ischaemic heart disease is a risk factor for stroke, despite this being present in 22.5% of cases. Only 20% of stroke patients with atrial fibrillation correctly identified this as a risk factor for stroke (table 5). Stroke patients with a background of diabetes, hypertension, or smoking were more likely to identify their risk factors for stroke compared with patients with high cholesterol or atrial fibrillation (table 5).

In the at risk group, the percentage of people with a risk factor who were unaware of its significance for stroke was: atrial fibrillation 100%; diabetes 90%; ischaemic heart disease or previous cerebrovascular event 86%; and hypertension 57% (table 5). However, patients with hypertension and smoking were significantly more likely to identify these as risk factors. None of the stroke patients, and only a third of the at risk group who had suffered a previous stroke or TIA recognised this as being a risk factor for further stroke.

Overall, medically trained nurses listed significantly more risk factors for stroke than any of the other groups (p<0.01, table 1). However, only 25% (13.4) were able to list three or more risk factors. These were most likely to be smoking, hypertension, and high cholesterol, of which they were significantly more aware than the other non-stroke groups (table 4). However, nurses' ability to list atrial fibrillation, diabetes, or previous history of cerebral ischaemia as risk factors was no better than that of the general population or at risk groups (table 4).

Twenty two per cent of stroke patients and 33% of at risk patients remembered having their risk of stroke discussed with them. These patients were no more likely to list correctly one or more risk factors ($\chi^2 = 0.03$, df = 1, p = 0.86; and $\chi^2 = 1.6$, df = 1, p = 0.95 respectively). This is in keeping with the finding that only 12.5% of stroke patients and 7.5% of at risk patients cited a member of the medical profession as a source of information about stroke risk factors (table 6).

In each group, the main source of knowledge for both risk factors was personal or family experience (table 6). A similar pattern was found for source of knowledge about stroke symptoms (data not presented). Most nurses cited their training as their other main source of knowledge.

DISCUSSION

Public education campaigns should prompt early diagnosis of stroke, and by implication, earlier hospital admission.[9] [11–14] This study investigated stroke and stroke knowledge in part of Devon to identify local factors contributing to delay that could be targeted by an education programme to facilitate early hospital admission.

Knowledge of stroke in three non-stroke populations was good; about 90% listed at least one recognised stroke symptom, with no significant age effect, the at risk group matching the level of symptom knowledge of medically trained nurses. This exceeds previously published data of 40–56%,[13] [14] [17] [21] and may reflect recruitment of participants from

Table 5 The percentage (CI) of each group having a particular risk factor and the percentage of those who recognised it as such

Risk factor	Stroke patients		(Compared with those without RF)		At risk patients		(Compared with those without RF)	
	% with RF	% of those with RF who listed it	χ^2	p	% with RF	% of those with RF who listed it	χ^2	p
HT	45 (15.4)	33.3 (21.7)	3.64	0.056	75 (13.4)	43.3 (17.7)	6.42	0.01
DM	15 (11.1)	33.3 (37.7)	11.9	<0.01	27.5 (13.8)	9.1 (17.0)	2.7	0.44
Smoker	25 (13.4)	60 (30.4)	10.75	0.01	10 (9.3)	100 (0)	6.67	<0.01
Ex-Smoker	30 (14.2)	8.3 (15.6)	0.06	0.8	30 (14.2)	41.7 (27.9)	0.06	0.8
EC	17.5 (11.8)	14.3 (25.9)	0.17	0.67	62.5 (15.0)	16 (14.4)	0.75	0.39
AF	25 (13.4)	20 (24.8)	3	0.08	15 (11.1)	0 (0)	0	1
IHD or CVD	45 (15.4)	0 (0)	12.1	<0.01	50 (15.5)	15 (15.6)	0.11	0.99

RF, risk factor; HT, hypertension; DM, diabetes; EC, elevated cholesterol; AF, atrial fibrillation; CVD, cerebrovascular disease; IHD, ischaemic heart disease

Table 6 The percentage of people in each group who cited a particular source of knowledge for stroke risk factors

Group	Source of knowledge						
	Personal experience	Family experience	Medical services	Literature	Television	Advertising	Other
Stroke	20	2.5	12.5	15	7.5	0	15
At risk	37.5	17.5	7.5	27.5	5	0	10
General	32.5	20	7.5	2.5	12.5	2.5	7.5
Nurses	57.5	5	0	15	12.5	0	45

hospital rather than the community. The majority (about 80%) of the non-stroke population consider stroke an emergency and say they would call an ambulance in the event of a stroke. This figure is greater than the 52.7% found in another population based study,[18] which may reflect a difference in knowledge base between the two populations.

Stroke patients' awareness that they were experiencing a stroke was poor. Only 40% identified that they were having a stroke. Other studies report lower percentages (35%[19] and 25%[7]). Stroke patients' use of acute medical services was also poor. A minority of patients called for medical help themselves (15%), although there was a trend towards patients who knew they were having a stroke to seek medical help earlier. Even when they lived alone, patients tended to call a family member rather than medical services. A family member was the point of access to the medical services in 67.5% of cases.

The median time to calling for help was 30 minutes, which compares with 50 minutes to 4 hours found by others.[6] The low figure suggests that family members, although possibly not recognising the signs of stroke, nevertheless quickly regard the event as requiring medical assistance. The GP was the initial point of contact with the medical services in 80% of cases; an ambulance was called in 17.5%. This contrasts with the findings of 45% and 43% respectively in another UK based study,[8] highlighting regional variations in accessing medical services, and demonstrating the importance of assessing local trends.

Access to medical services via the GP is associated with a significant increase in delay to reaching hospital.[8] Calling an ambulance results in less delay.[7 19] The present study demonstrates a trend towards an ambulance being called if the patient or family member recognised the event as being a stroke. Therefore, while self-recognition of stroke is not sufficient to result in rapid medical access, it remains an important first step. Alternatively, significant reductions in delay might be achieved if GPs sent patients directly into hospital via ambulance.

There was a significant discrepancy between awareness of stroke and behaviour of stroke patients: following their stroke most patients accessed medical services via a family member and GP, rather than calling an ambulance, which is what the majority of the non-stroke groups state they would do. The explanation for this may lie in the additional finding that good knowledge of stroke symptoms in the general and at risk populations is not sufficient to enable self diagnosis of stroke by patients. The response to specific symptoms is therefore different from that planned in event of a stroke.[20] This suggests a need for targeted education to consolidate the link between symptoms and the diagnosis of stroke. Patients with stroke are disinclined to access medical services themselves. This may reflect denial of illness[21] or a defence mechanism,[22] and merits further investigation.

Education campaigns should target patients at risk of stroke. Self awareness of increased risk is therefore essential for success of an education programme. This study demonstrates that at risk patients have limited awareness of their

increased risk, which has also been demonstrated by other studies.[17 18 23]

Previous studies have investigated the source of knowledge about stroke and found that it is derived mainly from friends, relatives, or the media rather than from the medical services, the latter being quoted by only 8% of people in a community study,[24] similar to the present finding of about 7.5%. However, most risk factors require regular medical review, thereby providing an educational opportunity that is currently being missed. The finding that nurses did not cite important modifiable risk factors such as atrial fibrillation suggests that such patients may not be identified as being at risk by nurses during episodes of patient contact, resulting in further educational opportunities being missed.

An education programme could use GPs, nurses, or nurse specialists. With average consultation times of around 5 minutes, GPs may not be in a position to give good risk factor information and advice regarding stroke. Practice nurses could take on this role in vascular risk clinics. Interestingly, the stroke symptoms cited by nurses were more likely to include management difficulties on the ward, such as dysphagia and hypertension. This altered perception would need to be addressed if non-neurologically trained nurses were to be used in an education programme. Additionally it would have to be ensured that nurses used in such a programme were able to identify patients at risk by having a good knowledge of stroke risk factors. This would ensure that the opportunities for both therapeutic intervention and education are maximised.

The finding in this study that a smaller percentage of nurses regard stroke as always representing an emergency, and the observation that most GPs do not send stroke patients into hospital via ambulance,[8] suggest a negative perception of treatment imperative within the medical profession. Any campaign will need to educate all professionals to address this issue.

Education programmes should:

- Reinforce the need for early admission to an acute stroke unit/hospital.
- Reinforce the link between occurrence of symptoms and the diagnosis of stroke.
- Emphasise the need to seek medical attention early.
- Emphasise the need to call an ambulance rather than the GP.
- Educate GPs to call an ambulance for patients with stroke.

This study is limited by its size and by the non-random selection of the groups. However, certain trends are suggested that could form the basis for a larger study to more clearly define local needs and provide a basis for planning further work to develop an education programme within the context of a local stroke service. An important group of patients that will have been excluded by the design of this study are those who have had a brief TIA at home and not sought medical

advice. Nevertheless the data presented show that the general and at risk populations in Devon know about stroke but do not recognise it when it happens to them, thereby limiting their ability to take the action they know they should take in the event of a stroke. Additionally, the study highlights the need for further studies to assess psychological influences operating on patients and their families in the setting of acute stroke and the degree to which negative perception of treatment imperative impacts on this. Any preconceptions regarding stroke in potential educators would need to be explored prior to their used in an education programme.

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Authors' affiliations
C Carroll, J Hobart, C Fox, L Teare, J Gibson, Department of Neurology, Derriford Hospital, Plymouth, UK

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