

# Alternative strategies for stroke care: a prospective randomised controlled trial

Lalit Kalra, Andrew Evans, Inigo Perez, Martin Knapp, Nora Donaldson, Cameron G Swift

## Summary

**Background** Organised specialist care for stroke improves outcome, but the merits of different methods of organisation are in doubt. This study compares the efficacy of stroke unit with stroke team or domiciliary care.

**Methods** A single-blind, randomised, controlled trial was undertaken in 457 acute-stroke patients (average age 76 years, 48% women) randomly assigned to stroke unit, general wards with stroke team support, or domiciliary stroke care, within 72 h of stroke onset. Outcome was assessed at 3, 6, and 12 months. The primary outcome measure was death or institutionalisation at 12 months. Analyses were by intention to treat.

**Findings** 152 patients were allocated to the stroke unit, 152 to stroke team, and 153 to domiciliary stroke care. 51 (34%) patients in the domiciliary group were admitted to hospital after randomisation. Mortality or institutionalisation at 1 year were lower in patients on a stroke unit than for those receiving care from a stroke team (21/152 [14%] vs 45/149 [30%];  $p < 0.001$ ) or domiciliary care (21/152 [14%] vs 34/144 [24%];  $p = 0.03$ ), mainly as a result of reduction in mortality. The proportion of patients alive without severe disability at 1 year was also significantly higher on the stroke unit compared with stroke team (129/152 [85%] vs 99/149 [66%];  $p < 0.001$ ) or domiciliary care (129/152 [85%] vs 102/144 [71%];  $p = 0.002$ ). These differences were present at 3 and 6 months after stroke.

**Interpretation** Stroke units are more effective than a specialist stroke team or specialist domiciliary care in reducing mortality, institutionalisation, and dependence after stroke.

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**Departments of Medicine** (L Kalra PhD, A Evans MRCP, I Perez MD), **and Health Care of the Elderly** (C G Swift PhD), **Guy's, King's and St Thomas's School of Medicine, Denmark Hill Campus, Bessemer Road, London SE5 9PJ, UK; Centre for Economics of Mental Health, Institute of Psychiatry, Denmark Hill, London** (M Knapp PhD); **and Biostatistics Unit, Research and Development Department, King's College Hospital, Denmark Hill, London** (N Donaldson PhD)

**Correspondence to:** Lalit Kalra  
(e-mail: lalit.kalra@kcl.ac.uk)

## Introduction

The effectiveness of organised stroke care in reducing mortality, institutionalisation, and dependence has been clearly shown in a systematic review of major randomised trials in stroke management.<sup>1</sup> The importance of early, organised, hospital-based management has also been emphasised in various professional recommendations for stroke care and is essential for wider use of thrombolysis and other acute interventions.<sup>2–4</sup>

Despite professional consensus 20–50% of acute-stroke patients in some countries (notably the UK) are not managed in hospitals.<sup>5</sup> Specialised care at home has had a variable success as an alternative way to provide organised multidisciplinary care for defined conditions.<sup>6,7</sup> The only controlled study comparing the management of acute stroke patients at home or in hospital showed no difference in either functional recovery or stress among carers.<sup>8</sup> However, patients were not randomised at the point of entry and only 31% of the trial patients were managed exclusively at home. In addition, comparisons with stroke-unit care were not undertaken.

It may not be possible to provide stroke-unit care in hospital for all patients because of bed constraints. A specialist stroke team, which consults throughout the hospital and provides continuity of care in the hospital and community, can overcome this limitation and has the added advantage of disseminating specialist practice to other settings where stroke patients may be managed. A randomised controlled study in 130 patients recruited within 7 days of stroke showed a non-significant decrease in mortality (25% vs 34%) but significant improvement in functional recovery in men after stroke-team intervention.<sup>9</sup> The study was limited because of a small sample size and short duration of follow-up.

The benefits of organised stroke care have been attributed to increased multidisciplinary coordination, staff specialisation, and better communication with patients and their carers.<sup>10</sup> Evidence on the superiority of any one method of organisation of care over others was inconclusive and direct comparisons of different methods of organised stroke care were recommended to identify the best strategy for managing stroke patients.<sup>1</sup> The objective of this study was to compare the efficacy of stroke unit, stroke team, and domiciliary stroke care in reducing mortality, dependence, and institutionalisation in patients with moderately severe strokes.

## Methods

### Setting

The study was done in a suburban district in the UK with 291 000 residents between April, 1995, and October, 1999. The health and social-care needs of the district were provided for by one hospital trust, one community-health provider, one family-health-services authority, and one social-services agency. The delivery of care was negotiated with all interested parties before the study began. The study

was approved by the local ethics committee in February, 1995.

### Patients

Patients were recruited from a population-based stroke register set up with standard criteria.<sup>11</sup> The WHO definition of stroke was used and the diagnosis of stroke made on clinical criteria.<sup>12</sup> Patients were included in the study at the time of presentation but no later than 72 h after stroke onset. The research team was notified by telephone or fax by general practitioners for patients at home and by accident and emergency services for patients on the observation unit. A physician did the initial assessment to confirm the diagnosis and eligibility for inclusion.

Patients with moderately severe stroke (persistent neurological deficit affecting continence, mobility, and ability to look after themselves, requiring multidisciplinary treatment) who could be supported at home with nursing, therapy, and social services were included in the study. We excluded patients with mild stroke, severe strokes (unconsciousness, swallowing problems not amenable to dietary modification, heavy nursing needs), those admitted to other hospitals, and those with atypical neurological features who needed specialised assessments or investigation to establish a diagnosis of stroke. Patients who were institutionalised or had severe disability before stroke were also excluded.

### Study design

Baseline assessments were undertaken by a doctor specialising in stroke before randomisation. These included patient demography, comorbidity, premorbid function, stroke subtype,<sup>13</sup> Orgogozo score for neurological deficits,<sup>14</sup> Orpington prognostic scale for the level of motor, proprioceptive, and cognitive impairments<sup>15</sup> and a 20-point scale for activities of daily living (Barthel index) consisting of feeding, dressing, going to the toilet, and mobility assessments.<sup>16</sup> Other baseline investigations included full blood counts, blood glucose, renal, liver, and thyroid tests, coagulation profile, and chest radiography (for patients in accident and emergency departments) to exclude competing diagnoses.

Randomisation was done by block randomisation. This method was favoured for practical reasons of ensuring bed availability, sharing workload between professionals, and to guard against imbalance due to time-trends over the duration of the study (such as an advance in stroke management). The allocation schedule was computer generated with random numbers and prepared before the study began. Allocation codes were held in a central office away from the study area. After baseline assessment, the assessor telephoned the randomisation office, and consecutive patients were allocated to stroke unit, stroke team, or domiciliary care as advised by the randomisation schedule.

Care on the stroke unit (acute and rehabilitation) was provided by a stroke physician supported by a multidisciplinary team with specialist experience in stroke management. There were clear guidelines for acute care, prevention of complications, rehabilitation, and secondary prevention. Routine management involved joint assessments and goal setting, coordinated treatment, and planned discharges.

Patients allocated to stroke-team care were managed on general wards and remained under the care of admitting physicians. All patients were seen by a specialist team

(doctor, nurse, physiotherapist, occupational therapist) with expertise in stroke management. The team undertook stroke assessments and collaborated with ward-based nursing and therapy staff in goal setting, planning of treatment, discharge, arrangement, and liaison with patients and relatives. Day-to-day treatment was provided by staff on the ward.

Patients allocated to domiciliary care were managed in their own home by a specialist team consisting of a doctor, nurse, physiotherapist, occupational therapist, and speech and language therapists, with support from a district nursing and social services for nursing and personal-care needs. Patients were under the joint care of the stroke physician and general practitioner. Investigations, including computed tomography scans, were done on an outpatient basis. Therapy was provided by the specialist stroke team. Each patient had an individualised care plan outlining activities and the objectives of treatment, which was reviewed at weekly multidisciplinary meetings. This support was provided for a maximum of 3 months.

Patients were withdrawn from domiciliary care and admitted specifically to the stroke unit (and not general medical wards) if there was deterioration in clinical status or neurological examination, development of new problems, need for specialist investigations, excessive care needs that could not be met at home, patient or general practitioner choice, or domiciliary stroke-team decision. The reasons for withdrawal were recorded. These patients were monitored for outcome and included in the intention-to-treat analysis.

The stroke unit and stroke-care team were based in the same hospital but provided by different teams. Treatment after discharge from the stroke unit or general medical wards with specialist team support, or after the first 3 months of domiciliary care, was provided by community services for all groups.

### Outcome assessments

Outcome was assessed at 3, 6, and 12 months after stroke onset. The primary outcome measure was death or institutionalisation at 1 year. Dependence was measured by the modified Rankin scale (a categorical seven-point scale that assesses overall function; death is rated as 6),<sup>17</sup> and the Barthel index.<sup>16</sup> The modified Rankin scale score at 1 year was divided to classify patients who were independent and those who require minor assistance for day-to-day activities (scores 0, 1, 2, or 3) as having a good outcome. The Barthel index was similarly divided for dependency, and score of 15–20 were classified as favourable.<sup>18</sup>

An independent observer, who was unaware of treatment allocation, assessed patients in their own environment. The only exceptions to this were 16 patients (six in stroke unit, seven in stroke team, three in domiciliary group) still in hospital at 3 months, in which case location may have identified allocation. Assessments in these patients were undertaken by other members of the project. The independent assessor was asked to guess the allocation of the 435 patients completing 1 year of follow-up at the end of the study and was correct for 178 (41%) patients ( $\kappa=0.12$ ). The amount of therapy received by patients in the first 3 months after stroke and duration of hospital stay (acute and rehabilitation) were recorded by the therapists as they provided the treatment.

### Statistical analysis

The sample size was calculated from pooled data from the systematic review of stroke-unit care.<sup>1</sup> The odds ratio for death or institutionalisation was 0.7 (95% CI 0.6–0.8) for

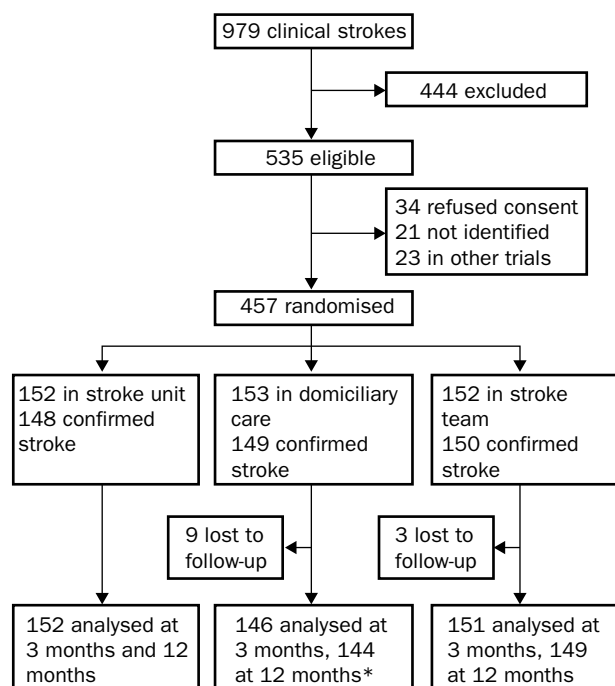


Figure 1: Trial profile

\*51 patients in this group were admitted to hospital within 2 weeks of randomisation but are included in the intention-to-treat analysis.

stroke-unit care relative to conventional care. The total rates were 397/1019 and 494/1041, respectively. A sample size of 138 in each group was needed to give the study 90% power at the 5% significance level to detect this magnitude of change.

Data were analysed on an intention-to-treat basis. Means, SD, median interquartile ranges, and statistical tests for significance were calculated. The Kruskal-Wallis test was used to compare medians for continuous variables (eg, age, length of stay, and therapy input) with skewed distributions and ordinal scales. The  $\chi^2$  test was used for discrete variables (eg, stroke subtype, mortality, institutionalisation, and the divided modified Rankin score and Barthel index). The main outcome measures analysed were mortality and mortality or institutionalisation. Logistic-regression models were fitted to the data to adjust for the independent effects

	Stroke unit (n=148)	Stroke team (n=150)	Home care (n=149)	p
<b>Demography</b>				
Median age, years (IQR)	75 (72–84)	77.3 (71–83)	77.7 (67–83)	0.09
Females	69 (47%)	76 (51%)	68 (46%)	0.63
Living alone	50 (34%)	55 (37%)	50 (34%)	0.82
<b>Premorbid independence</b>				
Continence	146	147	148	0.61
Dressing	146	143	142	0.20
Mobility	145	146	146	0.91
<b>Stroke characteristics</b>				
Left/right	76/69	67/76	76/70	0.57
Cerebral haemorrhage	19 (13%)	14 (9%)	10 (7%)	0.20
Stroke subtypes <sup>13</sup>				0.42
TACS	18	11	14	
PACS	77	81	82	
LACS	42	43	47	
POCS	11	15	6	
Median Orgogozo score <sup>14</sup> (IQR)	75 (46–90)	80 (60–90)	85 (58–90)	0.18
OPS <sup>15</sup> (1.6–6.8)*	3.2 (2.4–4.4)	3.2 (2.4–4.4)	2.8 (2.0–4.0)	0.27
Barthel index <sup>16</sup> (0–20)*	8 (5–12)	9 (5–12)	10 (4–14)	0.46

TACS=total anterior circulation syndrome; PACS=partial anterior circulation syndrome; LACS=lacunar syndrome; POCS=posterior circulation syndrome; OPS=Orpington prognostic scale.<sup>15</sup> \*Median (IQR).

Table 1: Baseline characteristics of patients

of demographic, clinical, and stroke characteristics at 3, 6, and 12 months. In addition, Cox's regression models were fitted at 12 months to account for the precise event times and the patients lost to follow-up.

## Results

### Patients

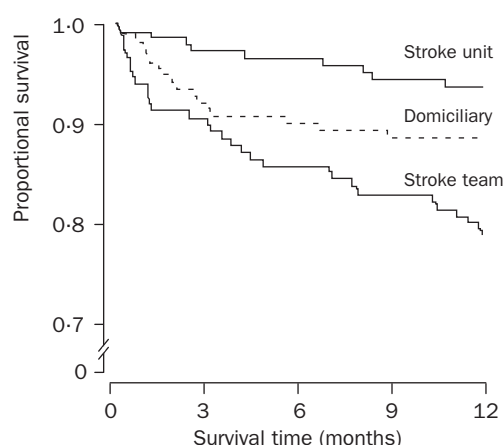
A total of 1206 suspected strokes were notified to the stroke register during the study period. Of these, 102 (8%) patients had transient ischaemic attacks,<sup>19</sup> 69 (6%) other neurological disease, and 56 (5%) had metabolic, metastatic, drug-induced, or infective disorders. The study sample was recruited from the remaining 979 (81%) patients with a clinical diagnosis of stroke (figure 1). 457 (85%) of the 535 patients meeting inclusion criteria were randomised, 152 were assigned to stroke-unit care, 152 to stroke-team care, and 153 to domiciliary care. 344 (75%) patients were recruited to the study within 24 h, 72 (16%) between 24 h and 48 h, and 41 (9%) between 48 h and 72 h of stroke onset.

Investigations after randomisation showed non-stroke diagnoses in ten patients (four in stroke unit, two in stroke team, four in domiciliary care), who were included in the intention-to-treat analysis. The analysis also included 51 patients in the domiciliary care group who were admitted to the stroke unit within 2 weeks of randomisation. Reasons for admission were clinical deterioration (n=12), need for further investigations (n=2), excessive care needs (n=15), and decision by the patient or general practitioner (n=22).

The baseline characteristics of patients, stroke type and severity, level of impairment, and initial disability were well matched between the three groups (table 1). The median Barthel index placed all groups at the moderately to severely disabled level.<sup>18</sup> Nine patients in the domiciliary care group and three patients in the stroke-team group were lost to follow-up at 12 months. All completed assessments in these patients were included in the analysis.

### Outcome

Patients managed on the stroke unit were less likely to die or be institutionalised compared with those managed at home or managed by the stroke team at 1 year (table 2). These differences in the primary endpoint were also present at 3 and 6 months after stroke. Mortality was significantly higher



### Number at risk

Stroke unit	152	146	142	140	139
Domiciliary	153	132	125	124	123
Stroke team	152	133	124	122	115

Figure 2: Kaplan-Meier survival curves for different strategies of care after acute stroke

Endpoint	Stroke unit	Stroke team	Home care	Unit vs team		Unit vs home		Team vs home	
				OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p
<b>Mortality or institutionalisation</b>									
3 months	15/152 (10%)	30/151 (20%)	29/146 (20%)	0.50 (0.29–0.87)	0.01	0.50 (0.29–0.87)	0.01	1.00 (0.96–1.04)	0.99
6 months	19/152 (13%)	37/149 (25%)	34/144 (24%)	0.40 (0.24–0.67)	0.001	0.42 (0.24–0.75)	0.003	1.05 (0.71–1.56)	0.81
12 months	21/152 (14%)	45/149 (30%)	34/144 (24%)	0.46 (0.30–0.72)	0.001	0.59 (0.37–0.95)	0.03	1.28 (0.87–1.87)	0.20
<b>Mortality</b>									
3 months	6/152 (4%)	18/151 (12%)	14/146 (10%)	0.33 (0.14–0.77)	0.01	0.41 (0.17–0.98)	0.05	1.24 (0.64–2.38)	0.52
6 months	10/152 (7%)	25/149 (17%)	19/144 (13%)	0.39 (0.20–0.76)	0.006	0.50 (0.25–1.02)	0.06	1.27 (0.74–2.19)	0.39
12 months	13/152 (9%)	34/149 (23%)	21/144 (15%)	0.37 (0.21–0.66)	0.001	0.59 (0.31–1.11)	0.10	1.56 (0.96–2.53)	0.07
<b>Institutionalisation</b>									
3 months	9/152 (6%)	12/151 (8%)	15/146 (10%)	0.75 (0.33–1.69)	0.49	0.58 (0.27–1.26)	0.17	0.77 (0.37–1.61)	0.49
6 months	9/152 (6%)	12/149 (8%)	15/144 (10%)	0.74 (0.33–1.67)	0.47	0.57 (0.26–1.24)	0.16	0.78 (0.39–1.57)	0.48
12 months	8/152 (5%)	11/149 (7%)	13/144 (9%)	0.71 (0.29–1.72)	0.45	0.58 (0.25–1.35)	0.21	0.82 (0.38–1.75)	0.61
<b>Modified Rankin 0–3</b>									
3 months	125/152 (83%)	111/151 (74%)	107/145 (74%)	1.13 (1.01–1.28)	0.04	1.12 (0.99–1.26)	0.06	1.00 (0.86–1.15)	0.96
12 months	129/152 (85%)	99/149 (66%)	102/144 (71%)	1.29 (1.13–1.47)	0.001	1.21 (1.07–1.37)	0.002	0.94 (0.81–1.09)	0.42
<b>Median modified Rankin (IQR)</b>									
3 months	2 (2–3)	3 (2–4)	2 (1–3)	..	0.09	..	0.92	..	0.10
12 months	2 (1–3)	2 (1–5)	2 (1–4)	..	0.005	..	0.14	..	0.34
<b>Barthel 15–20</b>									
3 months	123/152 (82%)	106/151 (70%)	106/145 (73%)	1.16 (1.02–1.32)	0.02	1.11 (0.99–1.25)	0.09	0.96 (0.83–1.11)	0.58
12 months	131/152 (87%)	102/149 (69%)	102/144 (71%)	1.27 (1.12–1.44)	0.001	1.22 (1.09–1.37)	0.001	0.97 (0.85–1.11)	0.65

Table 2: Primary and secondary outcomes at 3, 6, and 12 months

in patients managed by the stroke team compared with the stroke unit at all time points. Mortality in patients managed at home was higher than that on the stroke unit at 3 months but not at 6 and 12 months. Although mortality, institutionalisation, and dependence were lower in the domiciliary-care group than in the specialist stroke team, these differences were not significant (table 2). The plot of cumulative survival in the three groups is shown in figure 2.

All baseline prognostic variables (table 1) were entered into a multiple-logistic-regression model for mortality or institutionalisation that showed an independent effect of age, baseline Barthel index, and dysphasia at all time points. After adjustment for these variables, the odds of dying or being institutionalised at 1 year were 3.2 (95% CI 1.6–6.4) times greater for stroke-team patients and 1.8 (95% CI 1.1–3.8) for patients receiving specialist home care than for stroke-unit care. Cox's regression analysis, adjusted for age (hazard ratio 1.1 [95% CI 1.0–1.1]), initial Barthel score (0.8 [0.8–0.9]), and dysphasia (1.9 [1.1–3.2]), showed better outcome in stroke-unit patients compared with stroke team (2.4 [1.4–4.2]) or domiciliary care (1.7 [1.05–3.8]) for mortality or institutionalisation. Common causes of death were chest infection, dehydration/renal failure, and pulmonary embolus in the first 3 months, and stroke recurrence or unrelated illness thereafter. There were no significant differences in the proportion of patients being institutionalised in each group.

A favourable outcome (Barthel score 15–20) in activities of daily living at 3 months was seen in 82% of patients in the stroke-unit group compared with 70% of patients in the stroke team and 74% of patients in the domiciliary-care group (table 2). There was no significant change in this measure in any of the groups between 3 and 12 months. Dependency measured by the modified Rankin score was closely similar to Barthel scores (table 2). The absolute difference between the stroke unit and stroke team for patients who were independent or had minor levels of disability (good outcome) was 18%, and that between stroke unit and home care was 14% (figure 3). However, when we used a different division where only total independence (modified Rankin score 0, 1, 2) was a good outcome,<sup>17</sup> there were no significant differences between the three groups included in the study (figure 3).

#### Resource use

The total duration of hospital stay was similar between patients managed on the stroke unit and those managed by the stroke team (table 3). The mean length of stay of the 51 patients admitted to hospital from domiciliary care was 48.6 (SD 26.7) days (median 50 [IQR 27–65] days). The proportion of patients receiving different types of therapy was similar for the three groups except for speech and language therapy, which was available to a higher

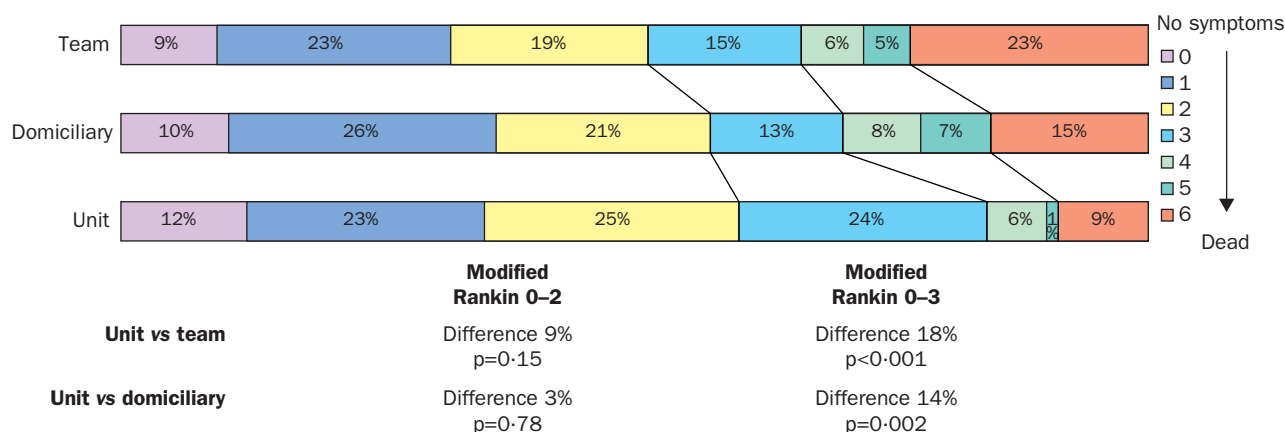


Figure 3: Distribution of modified Rankin scores at 1 year

	Stroke unit	Stroke team	Home care
<b>Length of hospital stay (days)</b>			
Mean (SD)	32.0 (29.6)	29.5 (40.1)†	
Median (IQR)	22.5 (8–48)	16 (10–33)†	
<b>Physiotherapy</b>			
Patients treated	151 (99%)	149 (98%)	148 (99%)
Duration per patient (h)*	21.5 (12.0–39.3)	5.3 (2.7–10.7)	7.3 (3.0–13.8)
<b>Occupational therapy</b>			
Patients treated	151 (99%)	132 (87%)	151 (99%)
Duration per patient (h)*	6.0 (3.0–11.5)	2.0 (1.0–4.0)	3.0 (2.0–6.0)
<b>Speech therapy</b>			
Patients treated	106 (70%)	71 (47%)	75 (49%)
Duration per patient (h)*	4.2 (2.2–8.4)	2.3 (1.2–4.4)	2.0 (1.2–4.3)

Duration for therapy computed for patients actually receiving treatment. \*Median (IQR). † $p=0.12$ .

Table 3: Length of hospital stay and therapy input

proportion of patients on the stroke unit (table 3). Patients on the stroke unit received significantly more therapy from all disciplines than those managed by the stroke team or at home. There were no significant differences in the duration of therapy between the stroke team and home care. A detailed health economic assessment will be presented in a later report.

#### Further analysis of data

The main analyses were repeated after excluding ten patients (four stroke unit; two in stroke team; four home care) who had a non-stroke diagnosis. These did not show any imbalances between the baseline characteristics of the three groups and did not change the significance of the findings of the intention-to-treat analysis. 12 patients (nine in home care, three in stroke team) were lost to follow-up by the end of the study. None of these patients were notified as having died during the 12 months after stroke (registrar's office), nor were any of them institutionalised in local or neighbouring nursing homes. Reanalysis of data for the best outcome (alive and not institutionalised) or the worst outcome (alive but institutionalised) did not change the significance of the overall findings of this study.

## Discussion

Our study provides evidence that stroke-unit care protects against premature death and dependence from the outset compared with other methods of organised care. Patients managed on general wards with specialist-team support had continuing higher death rate and higher levels of dependence at all time points up to 1 year. Patients in the domiciliary arm of the study had a high death rate initially that stabilised on follow-up probably because one third of these patients were transferred to the stroke unit within the first few days for management. The higher mortality seen on general wards might well have been replicated in the domiciliary setting if this were not the case. The absolute difference between patients who were independent or had minor disability was 18% between stroke unit and stroke team and 14% between the stroke unit and domiciliary care (figure 3). The numbers needed to treat for stroke-unit care to have an effect are six and seven, respectively, which are lower than for most other therapies and provide strong support for early specialist management of all stroke patients, irrespective of stroke severity.<sup>2–4</sup>

Differences in enthusiasm, specialisation, or attitudes between the staff on the stroke unit and those involved in other forms of care may have influenced outcome. Although there is no method of controlling for enthusiasm or attitudes, the level of seniority and experience of the specialist staff (doctors, nurses, and therapists) were similar

in the different settings. The important difference between settings was that only patients in the stroke unit received dedicated specialist care throughout 24 h and had a more structured and consistent approach to stroke-related problems, early rehabilitation, and secondary prevention. The number of patients receiving different types of therapy was generally similar between the three groups, but patients managed on the stroke unit received significantly greater amounts of therapy than did other groups. Theoretically, patients managed by the stroke team or those managed at home might have achieved equally good functional outcomes had they received the same amount of therapy. However, decreased amounts of rehabilitation therapy cannot explain the higher death rates in these settings. The quality of care seems important, and data on the processes of care, appropriateness of interventions, and frequency of stroke-related complications will be presented later. What is clear is that 24 h, consistent, structured, and dedicated care based on core principles of stroke management cannot be reproduced at the same level of intensity at home or on general wards.

The study has certain limitations inherent to pragmatic trials of service interventions. The study was undertaken with patients who had moderately severe strokes, which may limit generalisation to other levels of stroke severity. It would be unethical to randomise patients with very severe strokes to management at home, as these patients are best cared for on stroke units.<sup>20</sup> Patients with mild stroke were excluded because there was insufficient evidence to warrant admitting these patients, who are usually assessed in neurovascular clinics, and their rehabilitation needs were met in the community.<sup>21,22</sup>

Assessment of outcome cannot be double blinded in such trials because location identifies allocation, but all possible measures need to be taken to maintain masked conditions for assessment. This masking was achieved by the use of an independent observer for outcome assessments who was not involved in the initial assessment, allocation, or management of patients. Other observers were used for assessments that may have led to inadvertent unmasking of allocation (16 out of 1259 assessments). The independent observer was able to guess patient allocation correctly in 41% patients, which suggests poor agreement and shows the adequacy of masking procedures. 12 patients were lost to follow-up; although information on mortality was sought from different sources, a sensitivity analysis was done to reduce non-report bias.

Mortality and institutionalisation were chosen as primary outcome measures because these are least susceptible to observer bias. Assessment of good outcome in terms of dependence was more difficult. Many studies in acute intervention have used total independence as a good outcome and all other levels of dependence as a bad outcome.<sup>17,23</sup> This methodology may not be useful for stroke management as a whole, in which the major objective is to reduce disability. Many professionals and patients regard the ability to live at home with intermittent support as a good outcome compared with high dependence or institutional care.<sup>24</sup> Although the combined acute and rehabilitation stroke unit did not increase the proportion of patients who were fully independent it greatly reduced the proportion with severe disability compared with other strategies of stroke management. This benefit may not be seen on purely acute stroke units, which undertake acute evaluation and monitoring functions but do not provide rehabilitation.

Should any acute stroke patient be managed in settings other than a stroke unit? The need for specialist management in patients with the possibility of a diagnosis other than stroke, severe strokes, high dependence, or special needs (eg, swallowing problems) is accepted.<sup>25</sup> These reasons resulted in nearly half the stroke patients being excluded from randomisation in this study. The question of alternative strategies for stroke care arises in the other half of stroke patients with clear diagnosis and less severe strokes. The benefits of hospital admission have not always been clear in this group<sup>26,27</sup> and there was an opinion that organised care at home could achieve similar outcomes to stroke-unit care.<sup>28</sup> This study, which was started before the WHO Pan-European Consensus on Stroke Care,<sup>3</sup> does not support this assumption. Nearly a third of the patients had to be admitted to hospital despite well defined criteria for patient selection, high levels of support from the specialist stroke team, and community services operating in the most favourable configuration of health and social services.

Decisions to support acute stroke patients at home or in other settings have been superseded by research supporting intensive investigation and monitoring in all patients<sup>29,30</sup> and thrombolytic interventions in some patients.<sup>31</sup> This study provides further support for early specialist care on dedicated units for all stroke patients irrespective of stroke severity. The most pragmatic strategy for effective stroke care appears to be early management on stroke units before specialised rehabilitation or early supported discharge and rehabilitation at home depending upon the needs and circumstances of individual patients.<sup>32,33</sup>

#### Contributors

Lalit Kalra was responsible for the conception, design, initiation and overall coordination of the study, analysis and interpretation of data, drafting of the paper and its intellectual content. Andrew Evans was responsible for assessments, collation, analysis and interpretation of data, and writing of the paper. Inigo Perez was involved with the design of the study, day-to-day administration of the project, data collection, collation, and interpretation. Martin Knapp was involved in the conception and design of the study, interpretation of data, and critical review of the paper. Cameron Swift was involved in the conception of the study, interpretation of the data, and critical review of the paper. Nora Donaldson provided statistical input to the design, data analysis, interpretation, and writing of the paper.

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