Use of Hospital Resources by Acute Stroke Patients

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Stroke is not only a devastating but also an expensive disease. However, there have been few studies investigating the actual use of hospital resources by stroke patients, and no prospective ones. In 1976 it was estimated[1] that in Scotland, while stroke patients only accounted for 2.1 per cent of all discharges (including deaths) they occupied 6.2 per cent of all hospital beds at a cost of 6 per cent of the local NHS budget. The effect was largely felt in general medical and geriatric wards, where stroke patients accounted for 12 per cent and 25 per cent of all bed-days respectively. Another study[2] on 1,094 patients with acute stroke admitted to a London hospital over six years found that, for those discharged alive, the average length of stay was 37 days for men and 50 days for women. In Edinburgh[3], minimally disabled patients stayed in hospital for an average of 27 days, while those who were more disabled stayed in for an average of 47 days. Lastly, in a Midlands hospital stroke patients accounted for 8 per cent of all male and 11 per cent of all female admissions to general medical wards[4].

The high use of resources by patients with stroke has prompted suggestions that more economic ways of managing these patients need to be investigated[5]. For example, it is possible that patients managed in stroke units may not only spend less time in hospital but may also recover function faster[6]; a second study[7] failed to confirm this. In order to develop new policies, it is important to have some estimate as to the current load on hospitals and present patterns of management. We have conducted such an investigation in our own hospital, trying to look for ways of improving efficiency. In particular we wished to discover:

1. How many stroke patients are admitted with acute stroke?
2. How are they referred to hospital?
3. How long do they stay, and how many are in at any one time?
4. Where do they go at discharge?
5. What use is made of specialised investigations, or of follow-up facilities?

Method and Patients

Patients were included in this study provided that (a) their clinical diagnosis was of acute stroke (based on the WHO definition[8]), (b) they were admitted within three months of the stroke, or had the stroke while in hospital, and (c) they were in hospital between 22nd June 1981 and 27th September 1982. Those admitted with long-standing strokes were not included, even if the admission related to their old stroke. A three-month cut-off was used because most recovery has occurred by then[9], making it unlikely that admission was related to the acute stroke.

Patients were identified by two means. First, one investigator (V.W.) visited the medical wards weekly and compiled a register of all stroke patients. Second, using Regional Health Authority discharge information based upon Hospital Activities Analysis (HAA) coding, all patients discharged with stroke (codes 430-438) were identified. The diagnosis of stroke was based, where possible, upon history and examination (by D.W.). When patients had died or left the hospital before being seen, their notes were scrutinised (by D.W.) to ensure that the clinical diagnosis was stroke.

Results

Over the 15 months (July 1981—September 1982), 443 patients were admitted with a diagnosis of acute stroke. Because Frenchay Hospital has specialist departments (i.e. neurology, neuroradiology, neurosurgery, and a Stroke Unit), some patients were admitted specifically to use facilities within these units (e.g. CAT scan). We have, therefore, divided these 443 episodes into two major groups. The first, ‘Group 1’, includes 351 single admissions related to an acute stroke. Four of these 351 admissions were patients admitted with a second acute stroke within the study period. Three patients from Group 1 were re-admitted shortly after their first discharge, for reasons relating to their stroke, e.g. failure of a trial home visit. These have been included in the analysis of bed occupancy, but excluded from all other analyses. ‘Group 2’ included the 88 patients referred for reasons relating to the specialist facilities within this hospital. One patient admitted with an acute stroke 21
months before the study commenced has been excluded from all analyses.

**Group 1: General Characteristics**

The mean age of the 351 stroke patients was 68.2 years, but the 179 men (mean age 65.9 years) were significantly younger than the 172 women (mean age 70.7 years; P<0.001). In total, 59 (33 per cent) men and 90 (52 per cent) women died: the average age of those who died was 71.6 years, with no statistically significant difference between the sexes. Weakness was left-sided in 136 and right-sided in 137 patients; it was difficult to categorise 43 patients because they either died before the side of their weakness could be identified, or they had bilateral symptoms, e.g. from a brain-stem stroke; 35 (10 per cent) patients had no significant weakness, being admitted, for example, with aphasia.

**Admission**

In this study 186 (53 per cent) patients were admitted on the day of their stroke, 42 (12 per cent) the next day and a further 48 (14 per cent) during the rest of the first week; 22 (6 per cent) were admitted in the second week, with the remaining 20 being admitted randomly over the next nine weeks. Overall, 156 (44 per cent) patients were referred directly by their GP, with a further 26 (7 per cent) being referred by the Deputising Service; 91 (26 per cent) were admitted through Casualty, 33 (10 per cent) were already in hospital, 33 (10 per cent) were admitted from outpatients or from a domiciliary visit, and 12 (3 per cent) were transferred from other hospitals to be nearer home. Only 248 (71 per cent) of these Group 1 patients came from within the geographically defined Frenchay Health District (population approximately 210,000): 78 (22 per cent) came from neighbouring health districts and 25 came from farther afield.

**Bed Occupancy**

This was calculated for the 351 acute episodes, together with the three recurrent admissions as described earlier. The calculation of bed occupancy was based on the dates of admission, or stroke for those already in hospital, and discharge or death. During the study period, the number of stroke patients in hospital ranged from 14 to 33, the average being 22.9 per day. The average number of men was 10.7 (range 6-17), and women 12.2 (range 6-21); this difference is statistically significant (P<0.001). The average number of patients in hospital under the general physicians was 13.8 per day; under the neurologists it was 4.3 per day. There was no significant monthly variation in the admission rate, death rate, or bed occupancy throughout the year.

During the period of this study, Frenchay Hospital had 542 beds and there was an average of 407 patients in hospital at any time; 67 of these were under the care of general physicians, 36 under the geriatrician, 22 under the neurologists and the rest under other consultants. Thus, stroke patients occupied 5.6 per cent of all occupied beds. Those under the care of general physicians occupied 20.6 per cent of all their beds, while those under neurologists occupied 19.5 per cent of their beds.

**Outcome: Discharge and Follow-up**

The outcome of the 351 admissions is shown in Table 1; 149 (42 per cent) patients died, 161 (46 per cent) returned home or to live with relatives, and 41 (12 per cent) were transferred to some form of institutional care; none remained in this hospital after October 1983. Women were not only more likely to die (P<0.001) but were also more likely to need long-term care (P<0.01) if they survived. Of the 167 patients leaving hospital (i.e. including the six going to Part III accommodation), 88 (53 per cent) returned for at least one medical out-patient appointment and 66 (40 per cent) attended for out-patient rehabilitation.

**Length of Stay**

This was calculated from the day of admission (day of stroke for those in hospital) to the day of discharge or death (i.e. those leaving on the day of admission stayed 0 days, those leaving the next day stayed 1 day, etc.). The proportion still in hospital is plotted against time in Fig. 1 for three groups of patients: (a) those dying in hospital (n=149); (b) those leaving to enter institutional care.
(n = 41); (c) those returning home or to relatives (n = 161). Overall, of the 351 patients, those dying occupied 3,129 bed-days, those going home 4,717 bed-days and those passing on to institutional care 5,391 bed-days.

The length of stay of the 149 patients dying in hospital ranged from 0 to 488 days (median 5; mean 21). Those returning home (mean age 63.7 years) stayed between 0 and 250 days (median 16; mean 29.3). Those discharged to institutional care (mean age 74 years) stayed between 2 and 770 days (median 83; mean 131.5): this group was significantly older ($P<0.001$) than those going home, which may account for the preponderance of women. For the 161 discharged home, there was no significant correlation between age, sex or side of weakness and length of stay.

Another way of considering the fate of these patients is to calculate, as a function of the time elapsed since stroke, the likelihood of a patient still in hospital going home, dying or needing long-term care. This is illustrated in Fig. 2 which shows, for example, that of the 129 patients still alive and in hospital at three weeks post-stroke, 55 per cent went home, 26 per cent to long-term care and 19 per cent died. Only 37 patients remained in hospital at 12 weeks after the stroke: 54 per cent went to long-term care, 22 per cent died and 24 per cent returned home or to relatives.

**Investigations**

Most of the 351 patients had some routine investigations (e.g. full blood count) while in hospital, but our analysis only considers those likely to be related specifically to stroke. A CAT scan was performed on 189 patients (54 per cent), an arteriogram on 24 (7 per cent) and 25 patients had a lumbar puncture (7 per cent). Other investigations were rare; two patients had an EEG, three had carotid ultrasound scans, one an isotope brain scan, and two had brain biopsies. A post-mortem was carried out on 30 (20 per cent) of those dying.

**Variations between Consultants**

The patients were under the care of a variety of consultants: 252 (72 per cent) were cared for by the three general physicians, 61 (17 per cent) by the two neurologists, 16 by the one geriatrician, 5 by two neurosurgeons, and 17 by various other surgeons. The patients cared for by the three general physicians were almost all admitted randomly as emergencies under the physician on duty. We have compared the outcomes of patients admitted under each physician (Table 2). Considering those patients who returned home or to relatives, Consultant 3 discharged his patients significantly quicker than Consultant 2, and significantly quicker than Consultants 1 and 2 combined. Although fewer of his patients died, this was not statistically significant.

**Table 2. Comparison of three general physicians.**

| General physician | 1     | 2     | 3     |
|-------------------|-------|-------|-------|
| No. patients      | 81    | 94    | 77    |
| Average age (yr)  | 67.4  | 70.1  | 70.5  |
| No. who died       | 42 (52%) | 48 (51%) | 32 (42%) |
| No. to institutional care | 7 (9%) | 9 (10%) | 9 (12%) |
| No. to home/relatives | 32 (39%) | 37 (39%) | 36 (47%) |
| Average length of stay (days) of those going home or to relatives | 27.0 | 37.8 | 19.5* |

*3 v 2; t = 2.96, $P<0.01$

3 v 1: $t = 1.53$, NS

3 v 1&2 combined: $t = 2.89$, $P<0.01$

Group 2: The Excluded Patients

The 88 excluded patients were obviously very different. Most (86) were transferred from other hospitals, most were referred to the neurosurgeons (50) or neurologists (35), most (83) had a CAT scan, 35 (39 per cent) had arteriography and 15 (17 per cent) had a lumbar puncture. Only 19 (21 per cent) died in this hospital and the average length of stay for the remaining 69 was 15 days. This group occupied an average of 2.8 beds per day, totalling 1,022 bed-days each year, usually in the neurosurgical wards.

**Discussion**

This study confirms that stroke is still an expensive disease in our hospital. (This refers only to patients in Group 1, as does all further discussion.) During one year 252 patients were admitted with an acute stroke and a further 28 suffered a stroke while in hospital. These 280 stroke patients occupied 8,358 bed-days. The Frenchay District finance department costed a general medical bed

![Graph](image-url)
at £67 per day in 1982, which means that these patients cost £560,000 for one year or 4 per cent of the Unit's £14.1 million annual budget for 1981/1982. Of this total, 41 per cent was accounted for by patients who were discharged to institutional care, 36 per cent by patients discharged home alive and 23 per cent by those dying in hospital. Before discussing these findings any further, a few comments are needed regarding any bias in the selection of patients.

First, our hospital contains specialist departments which might bias the referral of patients. We have attempted to counteract this by excluding those patients who were clearly referred to one of these specialist services, although it was occasionally difficult to be certain of the reasons for referral. Otherwise we feel that our hospital serves a fairly typical Health District, having a catchment area which includes urban, suburban and rural populations.

Second, and counteracting the first bias, acute stroke patients from the Health District are admitted to several other hospitals, both within and outside the District. Figures from a community study, conducted throughout the period of this study[10], show that 74 per cent of stroke patients within the Frenchay Health District were admitted to hospital. Of these, 56 per cent were admitted to this hospital, with a further 30 per cent going to one of the other two 'District' hospitals, leaving 14 per cent going to hospitals outside the District. We have not investigated admissions to these other hospitals, but in our study 22 per cent of 'normal' admissions were of patients from outside the District.

Interpretation of these findings is also affected by many factors which will vary from hospital to hospital and area to area. For example, in this hospital stroke patients are accepted as part of the emergency medical 'take', but in some areas more patients may be admitted to geriatric hospitals. In this District, hospital admission is usually easily achieved, but in some areas it can be quite difficult to admit a patient who has suffered a stroke[11]. Although the majority of patients were admitted under general physicians to general medical beds, some were admitted to other wards or under the care of other consultants. Factors unrelated to the stroke may have prolonged some patients' stay in hospital.

One particular item that might have affected our findings was a controlled trial of a domiciliary service for acute stroke being conducted in the Health District[10]. This might have slightly reduced the number of patients admitted from the trial area, and shortened their length of stay. Any effect was probably small, and only 240 (68 per cent) of the 351 patients came from that study population. It will have reduced the number attending for therapy after discharge.

The factors just discussed may affect the absolute findings to a small extent, but the general outlines are probably similar for most hospitals and indeed our findings are consistent with other work. For example, patients admitted with an acute stroke can be neatly divided into three outcome categories — those who die, those returning home, and those needing long-term care — and our study supports others[12,13] which have found that the stay in the acute hospital is shortest for those who die and longest for those needing institutional care. We are unable to demonstrate any influence of either age or sex on the length of stay of those going home. It is likely that the difference in age between those going home and those needing care may account for the correlation between age and length of stay previously reported[2,13]. Similarly, the fact that women seem more likely to need long-term care may account for the earlier observation that they are in hospital longer[2]. The observation that in the USA it is younger patients who stay in longer[14] perhaps confirms that extrinsic (social) factors influence length of stay more than intrinsic (patient) factors.

How can the cost be reduced? There is evidence that the need for nursing support, rather than a need for medical expertise, is the usual reason for hospital admission[5]. Therefore, one possible way would be to reduce the number admitted by providing more home support services which might particularly reduce the need for admission of the 35 per cent admitted after the first 24-48 hours. However, as only 44 per cent of patients were referred by their GPs, knowledge of and access to any such service would need to be widely based if the admission rate is to be reduced.

A second, complementary, approach would be to reduce the length of stay of those admitted. In this study about 12 per cent of all patients were referred on to institutional care, a similar proportion to that in North London[2]. These patients were responsible for a disproportionate amount of the resources used (41 per cent) and it must be asked whether their stay in the acute hospital needed to be so long. It will be obvious very quickly that many of these patients will never recover sufficiently to return home. For example (see Fig. 2), of those in hospital 10 weeks after their stroke, 51 per cent will need long-term care, 21 per cent will die and 28 per cent will go home. It is likely that those going on to long-term care or going to die will only need the facilities of the acute hospital for a few weeks. Recent studies[15,16] have shown that reasonable prediction of functional recovery is possible within the first 3-4 weeks using simple clinical measures. Assuming that alternative accommodation (long-stay ward or Part III accommodation) is cheaper, one should consider identifying those patients who no longer need the expensive resources of an acute hospital, and transferring them earlier to less expensive places of care.

Apart from identifying and moving those destined for long-term care, it may also be possible to reduce the length of stay by concentrating stroke patients into specialised wards[6]. In this hospital there were, on average, enough patients to fill a ward (23 patients). However, there was a considerable fluctuation in the number of patients in hospital at any one time (14-33), which means that any ward dedicated exclusively to stroke patients will either have to turn patients away on occasions or, if it is large enough to cope with every potential patient, it will often have many unused beds. A more practical alternative would be to designate two wards (1 male, 1 female) as being priority wards for stroke patients, taking other general medical patients as
well. Our figures suggest that such wards would usually be about half full of stroke patients. Such an arrangement would allow staff to gain expertise in managing stroke patients while maintaining a variety of patients, thus lightening the physical and emotional nursing load.

This study suggests that it may also be possible to reduce the length of stay of stroke patients going home even without creating 'stroke wards'. Consultant 3 discharged patients sooner than his general medical colleagues. This observed difference may have several explanations: the patients admitted by Consultant 3 may have been less severely affected (particularly if he selectively admitted patients to other hospitals in the District), the findings may just be due to chance, Consultant 3's patients may all have done badly at home because they were not fit to be discharged, or his patients may have had better home circumstances. This study has not collected the information necessary to explain the differences which only became apparent after analysis. Further, even if he does actually discharge patients sooner, any saving of hospital resources he achieves will need to be balanced against extra community costs, any increased stress on the patient and his family, and any reduction in the patient's recovery. Nevertheless, this variation between consultants should be utilised to investigate different policies. There may also be equally large variations between different districts: in Oxford only 40 per cent of patients suffering a first stroke are admitted to hospital (Sandercock; personal communication), as against 74 per cent in Frenchay.

In conclusion, this study highlights the considerable variation in many aspects of the patterns of care of stroke patients; for example, only 46 per cent were admitted by their GP, 35 per cent were admitted more than two days after their stroke, 54 per cent had a CAT scan and 53 per cent came back for medical appointments. This variability may simply reflect the wide variability in the manifestations of stroke. However, it may also reflect uncertainty about the best management of stroke patients, this uncertainty leading to different policies being applied to similar patients. If this is the case, there may be scope for reducing the use of hospital resources. For example, in this study one consultant physician discharged his patients considerably sooner than the other two physicians; to investigate this further a more complete audit of stroke care would be needed. In addition, it is possible that the development of a 'District policy' would improve the management of stroke patients by, for example, pointing out that a lumbar puncture cannot reliably detect cerebral haemorrhage. This policy would take the form of general guidelines and would need to be widely disseminated both within the hospital and outside it. Such guidelines might profitably be combined with an audit so that variations in policy, whether accidental or deliberate, could be evaluated more fully.

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References

1. Carstairs, V. (1976) In Stroke, pp.516-28. (ed F. J. Gillingham, C. Mawdsley and A. E. Williams.) Edinburgh: Churchill Livingstone.
2. Sheikh, K., Meade, T. W., Brennan, P. J., Goldenberg, E. and Smith, D. S. (1981) Community Medicine, 3, 210.
3. Garraway, W. M., Akhtar, A. J., Smith, D. L. and Smith, M. E. (1981) Journal of Epidemiology and Community Health, 35, 39.
4. Acheson, J., Acheson, H. W. K. and Tellwright, J. M. (1968) Journal of the Royal College of General Practitioners, 16, 428.
5. Wade, D. T. and Langton Hewer, R. (1983) Lancet, 1, 807.
6. Garraway, W. M., Akhtar, A. J., Prescott, R. J. and Hickey, L. (1980) British Medical Journal, 281, 827.
7. Stevens, R. S., Ambler, N. R. and Warren, M. D. (1984) Age and Ageing, 13, 65.
8. Aho, K., Harmsen, P., Harano, S., Marquardsen, J., Smirnov, V. E. and Strasser, T. (1980) Bulletin of the World Health Organisation, 58, 113.
9. Skillbeck, C. E., Wade, D. T., Langton Hewer, R. and Wood, V. A. (1983) Journal of Neurology, Neurosurgery and Psychiatry, 46, 5.
10. Wade, D. T., Langton Hewer, R., Skillbeck, C., Bainton, D., Burns Cox, C. and West, P. (1983) International Journal of Rehabilitation Research, 6, 510.
11. Warren, M. D., Cooper, J. and Warren, J. L. (1967) British Journal of Preventive and Social Medicine, 21, 141.
12. Gibson, C. J. (1974) Archives of Physical Medicine and Rehabilitation, 55, 898.
13. Granger, C. V., Kaplan, M. T., Jones, B. and Fell, N. (1982) Archives of Physical Medicine and Rehabilitation, 63, 352.
14. Walker, A. E., Robins, M. and Weinfield, F. D. (1981) Stroke, 12, suppl. 1, 13.
15. Prescott, R. J., Garraway, W. M. and Akhtar, A. J. (1982) Stroke, 13, 641.
16. Wade, D. T., Skillbeck, C. E. and Langton Hewer, R. (1983) Archives of Physical Medicine and Rehabilitation, 64, 24.