Clinical Medicine 2011, Vol 11, No 1: 40–3

What reductions in dependency costs result from treatment in an inpatient neurological rehabilitation unit for people with stroke?

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ABSTRACT – This paper examines the reductions in care costs that result from inpatient multidisciplinary rehabilitation for younger people with acquired brain injury. Thirty-five consecutive patients admitted following a stroke over one year were recruited to this observational study. Physical ability, dependency and potential community care costs were measured on admission and discharge. Fifty-one community-dwelling patients were transferred to rehabilitation from acute medical wards in a large teaching hospital; 35 met the inclusion criteria. After a median of 59 days of rehabilitation, 29 patients were discharged home and six to nursing homes. Patients made highly significant gains in physical ability (median Barthel index 50 to 64; $p<0.001$). Dependency decreased; median calculated costs for care were reduced from £1,900 to £1,100 per week, a saving of £868 per week. Total annualised care costs reduced from £3,358,056 to £1,807,208, a potential saving of £1,550,848. The median time to repay rehabilitation costs was 21 weeks. Savings occurred in those with moderate and severe disability and they have the potential to continue to accrue for over 12 years. Similar results will probably be found for rehabilitation in other forms of acquired brain injury.

KEY WORDS: acquired brain injury, cost, dependency, rehabilitation, stroke

Introduction

Stroke has devastating consequences for people and their families – individuals are unable to return to work, and spouses and children take on roles as carers. Nationally, stroke has been estimated to consume 4% of NHS resources.[1] The cost to society of homecare, loss of family income from patients' and relatives' reduced ability to work, housing alterations and provision of residential care is substantial and will increase.

Quality of life in patients with stroke is inversely related to stroke severity. Quality of life is even lower in patients who are so severely disabled that they are unable to return to living in their own homes. Interventions that reduce the care needs of patients following stroke are acknowledged to bring important benefits to individuals, their families and the wider community.

Randomised controlled trials have demonstrated the effectiveness of rehabilitation in reducing the physical and psychological impact of stroke.[2,3] Good acute stroke care followed by comprehensive multidisciplinary rehabilitation improves outcome and shortens overall length of stay in hospital.[4]

The aim of this study is to examine the reduction in care costs that can be achieved by a goal-orientated multidisciplinary inpatient rehabilitation programme following acute stroke management. The specific questions to be answered include:

- what were the care costs in the community for the patients at the beginning and end of inpatient rehabilitation?
- what were the overall savings per year in the patients in rehabilitation?
- what were the projected lifetime savings?
- what length of time did it take for the potential savings to offset the costs of inpatient rehabilitation?

Methods

Sample

The study sample consists of consecutive patients following a stroke, aged 16 to 65 years, admitted for multidisciplinary rehabilitation to the inpatient rehabilitation unit at the National Demonstration Centre for Rehabilitation at Leeds Teaching Hospitals NHS Trust over one year. Inclusion criteria for this study were: ischaemic or haemorrhagic stroke identified on computerised tomography or magnetic resonance imaging, motor impairment with or without a sensory impairment, and with no pre-existing disabling neurological condition. Patients were excluded from analysis if they failed to complete at least two weeks of rehabilitation, became acutely unwell and were transferred off the rehabilitation unit, or had incomplete data sets. This study was deemed not to require ethical approval by the local research ethics committee.

Intervention

The Leeds National Demonstration Centre for Rehabilitation Medicine is a 19-bed neurological rehabilitation unit. It provides five-day multidisciplinary rehabilitation for those of working age with neurological impairments who are likely to benefit

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from its services. It serves a local population of 750,000 and also accepts patients with more complex neurological disabilities from the Yorkshire region of three million.

All patients receive input from consultant physicians and specialty registrars in rehabilitation medicine, specialist rehabilitation nursing, physiotherapy and occupational therapy.[5] Speech and language therapists, social workers, neuropsychologists and dietitians also contribute to the rehabilitation programme as required. Rehabilitation goals are agreed on admission for each patient and reviewed every two weeks in multidisciplinary team meetings. Case conferences are held with the patient and their family as soon as possible after admission and again prior to discharge. Patients are expected to return home at weekends as soon as this is feasible, to facilitate their reintegration into the community. Discharge meetings are attended by the community stroke rehabilitation team who will be responsible for the patient's ongoing rehabilitation at home.

Measures

The Barthel index is a clinician-rated assessment of independence in personal activities of daily living, initially developed in 1955.[6] The modified Barthel index,[7] is scored from zero to 100; scores of 75 or more indicate mild disability with little dependency.[8] Very low scores, less that 30, suggest that major problems are likely to be encountered in returning home. The index has been shown to be reliable and valid in stroke rehabilitation[9] and responsive to change but has significant floor and ceiling effects.[10–12] It is an ordinal scale, with the measurement weakness associated with this. Nevertheless, it is clinically useful and usually quick and easy to score.

The Northwick Park Dependency Scale is a newer scale, which is also ordinal. It is used to assess the impact of patients' physical needs on nursing time.[13] The Northwick Park Dependency Scale (NPDS) and Care Needs Assessment (NPCNA) were developed to facilitate the conversion of care needs into care plans which can be costed. The community costs used in the calculations were those obtained from health and social services of the north London area where Northwick Park Hospital is situated. These scales have been accepted in many places in the UK as helpful in assessing care needs in the community to facilitate discharge planning. The NPDS and NPCNA are reliable, valid and sensitive to changes in patients' needs.[11]

Procedure

Eligible patients were identified by one of the authors (RB) from the inpatient casenotes on the rehabilitation unit. The Barthel index, NPDS and NPCNA were recorded every two weeks by consensus of the multidisciplinary team from admission to discharge.

Data were also extracted from the multidisciplinary notes to a standardised pro forma. The type of stroke and associated impairments, including cognitive and visual impairment and mood disturbance were recorded.[14] Patients were deemed to have cognitive impairment if they scored less than 26 on the Mini-Mental State Examination.[15] Visual neglect was ascertained by confrontational testing. Mood disturbance was determined by a battery of scales depending on the patients' cognitive communication disorders.[16]

The cost of inpatient treatment on the rehabilitation unit for each patient was calculated based on the acute trust's reference costs for medical, nursing and therapy input and overheads.

The potential costs of care in the community for each patient were calculated using NPDS and NPCNA data at the beginning, mid-point and end of the admission. The difference in weekly care costs is the cost on admission minus the cost on discharge as calculated using the NPDS and NPCNA. Positive values indicate a decrease in care costs representing potential savings in the local health and social care economies.

Statistical analyses

Analyses included descriptive statistics: median, interquartile range (IQR) and frequencies.[17] The sign test was used to compare paired ordinal variables from admission to discharge (Barthel index and NPDS). The Wilcoxon signed ranks test was used to compare costs. The Statistical Package for the Social Sciences, version 14 was used throughout. Statistical significance was set at a p-value of less than 0.05.

Results

Sample

Patients were admitted between 1 April 2006 and 31 March 2007. During this period, 51 patients with stroke were admitted. Thirty-five met the inclusion criteria and had complete sets of data available for analysis. All patients were living in the community prior to their stroke and were transferred directly from the acute stroke unit or other acute medical wards. The demographics of these patients are described in Table 1 and the admission and discharge scores for the Barthel index and NPDS in Table 2.

What were the care costs in the community for the patients at the beginning and end of inpatient rehabilitation?

The median calculated weekly cost of care for these patients reduced significantly from £1,900 to £1,100 (Table 3). For one patient, care costs increased from £168 to £234. Care costs for all other patients remained the same or were reduced.

What were the overall savings per year in the patients in rehabilitation?

For the 35 patients, the total calculated annualised care costs were reduced from £3,358,056 to £1,807,208. This represents a potential saving in care costs of £1,550,848 over one year.

What were the projected lifetime savings?

Given that the expected remaining lifetime of patients who survive a week after first stroke is 12.5 years for men and 13.5 years for women,[18] this gives a potential total saving of £20,288,632.

What length of time did it take for the potential savings to offset the costs of inpatient rehabilitation?

The median cost of inpatient rehabilitation was £17,759 per patient (interquartile range £13,244–27,993) with a total cost of £801,262 for the 35 patients. For each patient the saving in weekly care costs attributed to the rehabilitation intervention was recorded and used to generate a theoretical payback time in weeks for the cost of participation in the rehabilitation programme. The median payback time was 21 weeks (IQR 12–38 weeks).

There is increasing scrutiny of care costs in the community with further restrictions being contemplated. We have therefore arbitrarily divided our patients whose weekly care costs were greater than £1,000 per week into three groups. Of the 20 patients whose estimated cost of care was over £1,000 per week on admission, costs were reduced from £1,364 to £968 per week. Seventeen patients returned home (one to a warden-controlled flat) and three to nursing homes. Care cost reductions occurred in both groups.

Twelve patients had an estimated cost of care over £2,000 per week on admission. Their costs were reduced from £2,669 to £1,169 per week. Nine went home and three went to nursing homes, all with reduced costs.

One patient's initial cost of care was £3,452. He was discharged home at a reduced cost of £2,008 per week.

Discussion

This small, prospective, observational study suggests that inpatient multidisciplinary rehabilitation can regularly and significantly reduce dependency and care costs in adults of working age. These results are similar to many other studies of inpatient multidisciplinary rehabilitation but details of the reduction in costs related to what is often perceived as a costly and time consuming intervention have also been included.

All patients except one gained increased physical ability over the course of rehabilitation, which is consistent with the known effectiveness of rehabilitation. This was associated with an equally significant improvement in independence and a decrease in care costs.

It is recognised that the savings in care costs are theoretical and based on costs in north London in 1999. Calculation of the cost of rehabilitation is based on national costs for inpatient acquired brain injury rehabilitation in the 2005/6 financial year. It is likely that costs at the time of the study were not less than these, leading to a possible underestimate of weekly care costs. Some of the weekly care costs in the community will be borne by the NHS (eg Continuing Healthcare) and some by social services. It was not possible to apportion these, but given that we are being encouraged to increase the amount of inter-agency working, this may be irrelevant.

Some of the costs of care will be borne by family members and this was not part of the calculations. Some carers may be more able or willing than others to do this as it may involve giving up their paid employment. In addition, it is not known how many of the study participants did not go back to work after their stroke.

Table 1. Demographics of patients included in the analyses.

Variable	Result
Sex	
Male	23
Female	12
Median age in years (IQR); range	57 (45–60); 28–65
Stroke type	
Cerebral infarct	26
Intracerebral haemorrhage	4
Subarachnoid haemorrhage	5
Stroke impairments	
Cognitive impairment	6
Visual neglect	13
Mood disturbance	10
Median length of time in days (IQR); range	
Acute stroke care	36 (25–48); 0–83
Rehabilitation	59 (44–93); 13–175
Total	102 (79–145); 34–230
Discharge destination	
Home	28
Warden-controlled flat	1
Nursing home	6

IQR = interquartile range.

Table 2. Admission and discharge physical scores.

Measure	Admission Median (IQR)	Discharge Median (IQR)	Z-score p-value
Barthel index	30 (14–38)	64 (42–84)	−4.526 <0.001
NPDS	37 (30–43)	19 (13–28)	−5.409 <0.001

IQR = interquartile range; NPDS = Northwick Park Dependency Score.

Table 3. Admission and discharge costs of care.

	Admission	Discharge	Change	Z-score p-value
Median	1,900	1,100	868	−4.844 >0.001
IQR	1,364–2,661	366–1,364	356–1,442	
Range	168–3,452	105–2,008	−92–1,774	

IQR = interquartile range.

This study has a number of limitations. The sample was only of those referred for rehabilitation that were under the age of 65 years and therefore not representative of all patients who sustain a stroke. Many patients with less severe strokes, or those who make a quick recovery, tend not to be referred for further rehabilitation as they can be discharged home directly from the acute stroke unit with community-based rehabilitation. The sample size is also small, and a cohort of 35 patients represents a small proportion of all of those who sustain a stroke in this catchment area each year. Patients with other forms of acquired brain injury (eg traumatic, hypoxic) also participated in rehabilitation at the inpatient unit. Their care costs were not examined, but it is clear from previous work that their independence improves with rehabilitation input.[19]

Given these caveats, it is still likely that the reported savings are of importance; they suggest that a relatively modest investment in inpatient rehabilitation (median 59 days) is usually recovered within less than half a year. These benefits will continue to accrue for approximately 13 years. The benefits are not only to the individual and their family, but to society and to the government. The saving each year to the primary care trust and social services was £1,550,848 for 35 younger stroke patients, for a city of 750,000 people. In a population of 100,000 people the saving each year would be of the order of £200,000. For the total population of the UK (this is somewhat hypothetical) the potential annual saving could be £136,000,000. Survival after stroke has been increasing over time,[18] and with greater implementation of the rehabilitation elements of the National Stroke Strategy it is likely that it will continue to do so, leading to increasing savings in future years.[1]

It has generally been assumed that the greatest benefits of rehabilitation have been gained by those with less severe impairments. However, the median Barthel index score for our group of patients was 30 on admission, indicating that these patients may have struggled to return to independent living.[8] This was not the case and confirms the work of other groups in the UK.[20] Even those whose initial care costs would have been high (over £1,000, £2,000 or £3,000) gained independence with reduced care costs.

In conclusion, this prospective, observational study describes improvements in a small cohort of adults of working age with stroke resulting in substantial impairments who participated in an inpatient multidisciplinary rehabilitation programme. Significant savings in care costs in the community were realised as a result of rehabilitation. These findings suggest that many with acquired brain injury will similarly benefit from rehabilitation with reduced community care costs. Therefore it is important that the patients gain access to rehabilitation and that due emphasis is placed on it in strategy documents at all levels within the NHS.

Acknowledgements

The authors wish to thank all the members of the multidisciplinary team in the rehabilitation unit who facilitated the collection of these data.

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