Efficiency of specialist rehabilitation in reducing dependency and costs of continuing care for adults with complex acquired brain injuries

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Record Status
This is a critical abstract of an economic evaluation that meets the criteria for inclusion on NHS EED. Each abstract contains a brief summary of the methods, the results and conclusions followed by a detailed critical assessment on the reliability of the study and the conclusions drawn.

Health technology
The study assessed the effect of a tertiary specialist inpatient rehabilitation service for younger adults with severe complex neurological disabilities.

Type of intervention
Rehabilitation.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised patients with acquired brain injury (of any cause) admitted to a tertiary specialist inpatient rehabilitation unit.

Setting
The setting was tertiary care. The economic study was carried in the UK.

Dates to which data relate
The effectiveness and resource use data were derived from patients admitted to the rehabilitation service between 1999 and 2005. The authors do not appear to have converted costs to a common price year.

Source of effectiveness data
The effectiveness data were derived from a single study.

Link between effectiveness and cost data
The costing was undertaken retrospectively on the same patient sample as that used in the effectiveness study.

Study sample
A total of 387 patients were admitted to the rehabilitation unit between 1999 and 2005, of whom 320 (83%) had acquired brain injury. Of these 320 patients, outcome measures (i.e. NPDS/NPCNA, FIM and Barthel Index (BI)) were available for 297. The mean age of these patients was 43.8 (standard deviation, SD=14.1) years, and the male-to-female ratio was 2:1. These 297 patients were grouped into three dependency groups, as assessed at admission using the NPDS:

83 patients were in a low dependency group (NPDS < 10), i.e. they were largely self-caring and only requiring incidental help with activities of daily living (ADL);
112 patients were in a medium dependency group (NPDS between 10 and 24), i.e. they required help from one person for most ADL tasks; and

102 patients were in a high dependency group (NPDS >= 25), i.e. they required help from two or more people for most ADL tasks, and required special nursing needs.

**Study design**
This was a retrospective before-and-after study performed in one group of patients. It compared the effects of inpatient rehabilitation on patient outcomes. The study was based on a single tertiary specialist inpatient rehabilitation unit at Northwick Park Hospital. The patients were followed up until discharge from the unit, on average 112 (SD=66) days.

**Analysis of effectiveness**
All patients included in the study were accounted for in the analysis. Three primary health outcomes were used, the FIM, the NPDS and the NPCNA.

The FIM comprised 13 motor and 5 cognitive items.

The NPDS is an ordinal scale of dependency on nursing time that includes two sections, basic self-care needs and special nursing needs. The NPDS was recorded at fortnightly intervals by a named nurse.

The NPCNA was derived from the NPDS by a computerised programme to provide a daily timetable of care needs. This measure was estimated by calculating the care hours per week and the approximate weekly cost of care based on UK care agency rates.

**Effectiveness results**
The mean changes in outcomes from admission to discharge for the low dependency group (i.e. patients with NPDS < 10 at admission) were:

- a 1.9 reduction (95% confidence interval, CI: -2.6 to -1.1) in the NPDS scores;
- a 7.5 reduction (95% CI: -9.6 to -5.2) in care hours per week;
- a 12.0 increase (95% CI: 9.7 to 14.2) in the FIM scores; and
- a 2.8 increase (95% CI: 2.3 to 3.4) in the BI scores.

The mean changes in outcomes from admission to discharge for the medium dependency group (i.e. patients with NPDS between 10 and 24 at admission) were:

- an 8.2 reduction (95% CI: -9.5 to -7.0) in the NPDS scores;
- a 13.6 reduction (95% CI: -16.2 to -11.0) in care hours per week;
- a 26.1 increase (95% CI: 23.6 to 28.7) in the FIM scores; and
- a 6.2 increase (95% CI: 5.6 to 6.8) in the BI scores.

The mean changes in outcomes from admission to discharge for the high dependency group (i.e. patients with NPDS >= 25 at admission) were:

- a 16.3 reduction (95% CI: -18.5 to -14.0) in the NPDS scores;
- a 16.0 reduction (95% CI: -18.9 to -13.0) in care hours per week;
Clinical conclusions
The authors concluded that the NPDS/NPCNA detected changes in dependency potentially associated with substantial savings in the cost of ongoing care, especially in high dependency patients.

Measure of benefits used in the economic analysis
The measures of benefits used were the NPCNA and FIM scores.

Direct costs
The authors did not report whose direct costs were included in the analysis, but it would appear that the costs of the third-party payer were included. The costs included were the costs of inpatient stay at the rehabilitation unit (i.e. cost per bed day multiplied by the length of stay). The authors reported that the rehabilitation service was funded through a block contract, with no differential costs being applied between severity groups. From the block contract, the authors retrospectively estimated that the cost per day was 221 in 2000/01, 256 in 2001/02, 281 in 2002/03, and 325 in 2003/04 and in 2004/05. Discounting was not relevant, as the costs were incurred during less than one year, and was therefore not reported. The study reported the average costs. The authors do not appear to have inflated the costs to a single price year.

Statistical analysis of costs
The authors provided mean values and SDs around the average costs.

Indirect Costs
The indirect costs were not included in the analysis.

Currency
UK pounds sterling (£).
FIM efficiency, which was calculated by dividing the change in total FIM score from admission to discharge over length of stay.

The time taken to offset the cost of rehabilitation was 38.8 months in the low dependency group, 21.5 months in the medium dependency group and 16.3 months in the high dependency group.

The FIM efficiency was 0.17 in the low dependency group, 0.25 in the medium dependency group and 0.16 in the high dependency group.

Authors' conclusions
The Northwick Park Dependency Score and Care Needs Assessment (NPDS/NCNA) detected changes in dependency potentially associated with substantial savings in the cost of ongoing care, especially in high dependency patients. Floor effects in responsiveness of the Functional Independence Measure (FIM) can lead to an underestimation of the efficiency of rehabilitation in higher dependency patients.

CRD COMMENTARY - Selection of comparators
The authors implicitly compared the inpatient rehabilitation programme with no inpatient rehabilitation, as the outcomes of patients before rehabilitation admission were compared with outcomes after discharge. You should decide if the comparator used represents current practice in your own setting.

Validity of estimate of measure of effectiveness
The analysis was based on a retrospective before-and-after study. This study design has important limitations. For example, outcomes might have been affected by factors external to the intervention which, in this case, may include natural improvement of the condition over time. Also, the retrospective nature of the study increases the potential for selection bias. The study sample appears to have been representative of the study population. The authors conducted appropriate statistical analyses to identify if differences before and after rehabilitation discharge were statistically significant. Despite the authors' efforts, the design used means that the internal validity of the study is likely to be low.

Validity of estimate of measure of benefit
The estimation of benefits was obtained directly from the effectiveness analysis. The authors justified their choice of the benefits (i.e. NPDS, NPCNA and FIM) on the grounds that these were the battery of outcome measures used at the Regional Rehabilitation Unit at Northwick Park.

Validity of estimate of costs
The authors did not report the perspective adopted in the economic analysis. They provided a very simple costing analysis by multiplying the cost per bed day (calculated retrospectively from the funding received by the rehabilitation unit) and the hospital length of stay. The costs and the quantities were reported separately, which will enhance the generalisability of the authors' results. Average costs of the rehabilitation programme were appropriately provided together with SDs. Since all costs were incurred during less than one year, discounting was unnecessary. The price year was not reported.

Other issues
The authors compared their results with those from another UK study that had found a similar FIM efficiency after rehabilitation. The issue of generalisability to other settings was not addressed. The authors do not appear to have presented their results selectively and their conclusions reflected the scope of the analysis. The authors reported a number of further limitations. First, the data were collected by treating clinicians and may, therefore, be less reliable than data collected in formal research settings. Second, the FIM version 4.0 used in this study was not the latest FIM.
version. Finally, the NPCNA estimates of continuing care costs were not a true assessment as applied in health economic studies.

**Implications of the study**
The authors reported that theirs was one of the first studies showing that rehabilitation could prove to be cost efficient for the most severely disabled patients with acquired brain injury.

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**Bibliographic details**

**Other publications of related interest**
Because readers are likely to encounter and assess individual publications, NHS EED abstracts reflect the original publication as it is written, as a stand-alone paper. Where NHS EED abstractors are able to identify positively that a publication is significantly linked to or informed by other publications, these will be referenced in the text of the abstract and their bibliographic details recorded here for information


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Subject indexing assigned by NLM

**MeSH**
Activities of Daily Living /classification; Adult; Brain Damage, Chronic /economics /etiology /rehabilitation; Cost-Benefit Analysis; Dependency (Psychology); Disability Evaluation; Efficiency; England; Female; Follow-Up Studies; Humans; Length of Stay /economics; Male; Middle Aged; Needs Assessment; Rehabilitation Centers /economics; Research Support, Non-U.S. Gov't; Retrospective Studies; Specialism

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