Economic evaluation of a nursing-led inpatient unit: the impact of findings on management decisions of service utility and sustainability

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Aims The nursing-led inpatient unit is designed to substitute for a period of care in acute hospital wards and to improve patient outcome prior to discharge to the community. This paper aims to evaluate the cost, from the UK National Health Service perspective, of transfer to a nursing-led inpatient unit for intermediate care and to discuss the impact of these findings to the future development and sustainability of the nursing-led inpatient unit.

Background Recent economic analyses have showed that nursing-led inpatient units are associated with increased costs of care with length of stay as the main driver of inpatient costs.

Method The cost-effectiveness analysis was part of a randomized-controlled trial with a sample size of 175, of which 89 were in the nursing-led inpatient unit arm and 86 in the control arm. Resource use data included length of stay, investigations performed, multiprofessional input and nursing input. Clinical outcome was measured using Barthel Index, a functional status measure.

Results Cost per day was lower on the nursing-led inpatient unit although cost per hospital stay was higher due to significantly increased length of stay. Postdischarge community care costs were lower. The incremental cost-effectiveness ratio of the treatment was £1044 per point improvement of the Barthel Index.

Conclusions The nursing-led inpatient unit was associated with higher costs however, the question of whether the nursing-led inpatient unit is cost-effective has not been clearly answered because of the limited follow-up period of the study. The increased cost of care on the nursing-led inpatient unit was not a major factor in local management decisions about the future of the unit. The changes in the context of service provision within which the nursing-led inpatient unit operated as a result of substantial investment in intermediate care did have a major impact.

Keywords: cost-effectiveness analysis, economic evaluation, intermediate care, hospital utilization, nurse clinicians, randomized-controlled trial

Accepted for publication: 22 June 2005
Introduction

Cost-effective management of the health and social care needs of older adults in the postacute stages of illness is an important health care policy issue (Department of Health (DoH) 2001, 2002). Several factors, notably the increasing numbers of older adults with multiple chronic conditions requiring complex health and social care, and pressures to manage demand for acute hospital beds have prompted the need for alternative models of postacute care. Intermediate care comprises a range of transitional services between secondary care and primary care that propose to promote faster recovery from illness, prevent unnecessary acute hospital admission, support timely discharge and maximize independent living (DoH 2002). These services are either home-based as in ‘hospital at home’ schemes (Shepperd & Iliffe 2001) or institution-based as in community hospitals (Young & Donaldson 2001) and nursing-led inpatient units (NLIU) (Griffiths & Wilson-Barnett 1998). As yet there is no consensus on which models are the most effective or cost-effective.

Nursing-led in-patient units, typically situated in acute hospitals, provide active treatment for postacute patients who have recovered from the acute medical or surgical crisis that led to hospital admission, still require multi-professional inpatient care and their predominant need is for rehabilitative nursing care. Key features of the operational definition of the NLIU (Griffiths & Wilson-Barnett 1998) are the substitution of nurses for doctors to provide overall patient management and leadership of the multidisciplinary team, case mix is based on nursing need and nurses have authority to admit and discharge patients. As a new model of health care, there is a need to demonstrate that NLIU care is not only effective but also cost-effective to ensure that patients receive safe, effective care and that resources are deployed appropriately.

This paper reports an evaluation of the costs and outcomes of a NLIU in a busy inner city district general hospital (Griffiths et al. 2001, Harris 2003). This paper discusses the methods used to estimate the costs of this complex intervention in detail particularly the innovative methods to estimate nursing input costs, a key resource in this study. The paper also describes the development of the NLIU after the evaluation study was completed and the impact of the findings of the cost-effectiveness analysis on the decisions made about the continued operation of the unit.

Literature review

Several studies evaluate the effectiveness of the NLIU model of care (Hall et al. 1975, Pearson et al. 1988, 1992, Griffiths & Evans 1995, Griffiths et al. 2000, 2001, Steiner et al. 2001), yielding inconsistent results. A review of early studies (Hall et al. 1975, Pearson et al. 1988, 1992) reported some patient benefits but that methodological weaknesses render the findings inconclusive (Griffiths & Wilson-Barnett 1998). Results of later, more robust studies (Griffiths et al. 2000, 2001, Steiner et al. 2001) show a consistent although statistically non-significant trend towards improved patient outcome on the NLIU and significantly longer hospital stay. However, a recently completed systematic review of the effectiveness of postacute intermediate care in NLIUs (Griffiths et al. 2004, Griffiths et al. 2005) which includes the studies cited in this paper, showed that NLIU care is significantly associated with better functional status at discharge and increased length of stay, raising questions about the cost-effectiveness of this model of care. Currently, as intermediate care investment and development is escalating, these questions are particularly important.

Early studies evaluating the cost-effectiveness of NLIUs were confined to simple analysis at an organizational level using hospital insurance reimbursement payments (Hall et al. 1975) or average cost per patient per ward (Pearson et al. 1992). The latter estimated that the cost of care per inpatient day was 12% lower for a NLIU compared with the acute hospital setting although this is inconclusive due to limited cost data. Richardson et al. (2001) conducted a more comprehensive economic analysis of a NLIU using primarily a top-down approach to the measurement of costs, calculating cost per inpatient day for each ward and cost of 1 month of postdischarge community health and social care provision. Whichever estimate of medical input was employed, the patients on the NLIU were associated with higher inpatient costs than those on the acute wards. This is primarily due to increased length of stay on the NLIU rather than cost per inpatient day. Patients on the NLIU were also associated with lower cost of postdischarge community health and social care however, due to the limited follow-up time it is not known whether this cost reduction is sustainable long enough to offset the increased costs of inpatient hospital care.

Similarly, Walsh et al. (2005), using a primarily top-down approach to their cost-minimization analysis of NLIU care, found that inpatient costs incurred on the NLIU were higher than for patients on acute wards although they also found higher total costs (i.e. costs of all care during the 6 months after randomization) for NLIU patients. However, in their review of this study, Cullum et al. (2005) concluded that a cost-minimization analysis was inappropriate given the reported...
improvement in functional status on the NLIU (Steiner et al. 2001). Even though this difference was not statistically significant, the outcome of care on the NLIU and on standard hospital wards cannot be considered equivalent.

Although the costs of care data in these two recent studies are considerably more comprehensive than in earlier studies, there are several weaknesses. Cost estimates of medical and other professional input need to be more accurate. In particular the different patterns of case mix acuity and nursing activity within NLIUs in comparison with acute units suggest that average ward costs may be a poor proxy for actual costs of care for this non-acute patient group. Consequently there is a need to collect data at a bottom-up, individual patient level that will allow nursing care inputs to be costed more accurately. As the nursing staff budget typically accounts for the major part of ward budgets, actual nursing staff input is likely to be one of the major economic variables in the comparison of care on NLIUs with care on acute wards.

**Background to the development of this NLIU**

The proposed rationale for the NLIU model of care is based on the changing needs of hospital patients (Hall 1969). Some patients, as discussed earlier, need inpatient postacute care, principally nursing, to restore health and functional and psychosocial independence prior to discharge. It is argued that such care would be most effective if delivered in a designated nursing environment.

Although all NLIUs cite Hall’s (1969) rationale as important, all were set up to address organizational and management challenges within existing services or the hospital of which they were part (Hall et al. 1975, Pearson 1992, Evans & Griffiths 1994, NLIU Evaluation Project Team 1999, Walsh 2000). These issues typically included the need to increase availability of acute hospital beds in such a way that did not require junior medical input and had the potential to be cost-effective. There was also the opportunity to develop nursing practice in a more advanced and autonomous way.

The NLIU reported in this paper is no exception. The district general hospital was considering how to respond to increasing numbers of emergency admissions and a shortage of acute beds. Having secured funding from the health authority to open an additional ward, an action research project was carried out to identify the service development options open to the trust and to plan the most appropriate service for the trust’s local population (Davis 1996). As part of this project, in line with the Audit Commission’s (1992) ‘Lying in Wait’ report, 14–25 inpatients at any one time were assessed to have recovered from their acute medical problems but still had rehabilitation and education needs requiring inpatient hospital care. From the proposed options identified by Davis (1996), development of a NLIU was selected as the most suited to the hospital’s needs and strategic plan. One major consideration was increased costs of recruiting a full medical team in addition to a full nursing complement if a traditional acute medical ward was opened.

**Method**

**Study design**

The cost-effectiveness analysis was part of a randomized-controlled trial that also evaluated clinical effectiveness of the NLIU (Griffiths et al. 2001, Harris 2003). The local research ethics committee approved the study and the recruitment strategies used are reported in detail (Harris & Dyson 2001).

**Intervention**

Patients were referred to the NLIU, a 19-bed unit by their hospital consultant. Their suitability for NLIU care was assessed by unit nurses and referring doctors. They were medically stable with no significant change in medical management anticipated and had ‘active’ nursing needs with potential for improvement. Consenting patients were randomized to the treatment group (plan to transfer to the NLIU) or the control group (care delivered in acute wards) using sequentially numbered sealed envelopes containing computer-generated random allocations.

Patient care on the NLIU was managed by one of three nurse practitioners (F grade) responsible for the planning and delivery of nursing care, discharge planning and coordination and leadership of the multidisciplinary team including referral for medical input when required. The nursing staff to patient ratios on the NLIU and the control group wards were comparable (NLIU – 0.84, control ward mean – 0.81) as were proportions of qualified staff (NLIU – 63%, control ward mean – 61%). Routine medical input was provided on nurses’ request by a primary care doctor employed for 8 hours a week in two to three sessions. Emergency or specialist medical review was provided by the usual hospital service, the patient being transferred...
back to an acute ward if necessary. Input from other health care disciplines was available on referral by the nursing team.

The control group received usual care in the acute hospital setting in traditional acute wards where the patient’s doctor or medical consultant had responsibility for the coordination of care and leadership of the multidisciplinary team.

Economic evaluation technique

A cost-effectiveness approach was taken to determine whether the provision of a nursing-led intermediate care service had an impact on resource use and outcomes when compared with the use of acute beds. Ideally cost-effectiveness analyses should employ a societal perspective so that the impact on every individual and/or agency is included. In this analysis, the largest effects were likely to be the direct costs to the UK National Health Service (NHS) and to agencies providing community health and social services.

Data collection

Clinical outcome

Clinical outcome data were collected prospectively using the Barthel Index (BI) (Mahoney & Barthel 1965), a widely used functional status measure with scores ranging from 0 (maximum dependence) to 20 (independent). Researchers completed the scale with nurses involved in the patients’ direct care, occasionally using nursing and medical notes and direct observation. Baseline data were collected after referral to the NLIU (within 24 hours) and outcome data within 48 hours prior to discharge.

Resource use

Resource use data were collected by the research team as part of the main clinical trial. Length of stay, readmission and length of stay on readmission were recorded prospectively for each patient. Levels of multidisciplinary input were recorded retrospectively in minutes for physiotherapists, occupational therapists and dieticians from therapy time sheets and in number of contacts for speech and language therapists, social workers and clinical nurse specialists. Medical input, i.e. the number and type of medical reviews and tests/investigations was recorded retrospectively from the patients’ medical case notes.

Nursing input was estimated by the analysis of nursing activity using approaches developed by Ball et al. (1984) and Williams (1996). The nursing activity analysis was conducted in two phases. Phase 1 was a systematic assessment of all nursing activity to estimate the proportion of direct nursing care, indirect nursing care (nursing activity for an individual patient conducted without the patient present, e.g. telephone calls to arrange discharge), unit-related work and personal activity or unproductive time carried out on the wards assessed. The NLIU and two acute wards that had the highest rate of referral to the NLIU were assessed. Each acute ward was continuously observed from 06.00 to 24.00 hours for a period of 3 days and the NLIU for 6 days using non-participant observation. During the observation period the activities of all the nursing staff on duty were recorded every 5 minutes and categorized by type of activity. The second phase comprised observation of direct patient care using a method developed by Williams (1996). All patients recruited into the study during a 6-month period were involved in the second phase of the nursing activity assessment. The observation sessions took place from 08.00–14.00 to 14.00–20.00 hours. Each patient was observed, where possible, for one morning and one evening session shortly after referral. During each session care received by the patient was directly observed by a researcher, timed in seconds using a stopwatch and the grade of the nurse involved in the interaction recorded.

Costs of nursing input were calculated using data from both phases of the nursing activity analysis. The total nursing input received by patients was estimated by multiplying the average direct nursing time on the NLIU and the acute wards from phase 2 by the respective proportions of direct and indirect care estimated in phase 1. This ensured that indirect nursing input was accounted for in the cost data.

Unit cost data

Unit cost data were collected from service providers and from the literature. Unit cost data for 1997/98 were used in the analysis. Where data from earlier years were employed, the Health Service Pay and Prices Index was used to inflate the estimates. Mean total cost of the intervention and control groups was estimated as the product of the unit costs and the resources used. Unit cost data for cost per inpatient day, investigations and professional staff inputs were collected from the finance department of the acute trust and national pay scales. Collection of individual patient resource use has already been described. As the study attempts to compare the costs of patients randomized to different types of ward, the cost per inpatient day was calculated by ward rather than by
speciality. Three separate estimates of cost per inpatient day were employed.

- The first estimate used a bottom–up method; cost of nursing input for each study arm was estimated using data from the nursing activity analysis. Cost of medical cover was apportioned to each group (with the estimate for the NLIU based on the percentage of medical contacts on NLIU when compared with the control wards). The costs of therapy and tests/investigations were measured at patient level as part of the clinical trial and added to the cost per day together with the cost of overheads such as estates, laundry, energy, administration, domestic, catering and capital costs.

- The second estimate used the same method as described above, but reduced the cost of nursing by discounting the effect of unproductive time. In economic terms opportunity cost is defined as the value of the alternative that has to be given up. If personal time is of no value, then the opportunity cost of doing another activity in that time is zero.

- The third estimate, a top–down method, used the cost per bed day from the year-end accounts for each ward (excluding costs of resources measured elsewhere, for instance, tests and investigations). This method, limited in this study as patients in the control group would have been assigned a cost that was partly dependent on the speciality within which they were based, is included for completeness.

For each of the above estimates, the control group were attributed an additional cost for routine medical ward rounds estimated on the basis of the number and duration of ward rounds in each medical firm each week and which medical staff attended. This weekly cost was divided by the average number of consultant bed days using figures obtained by the hospital information department. Although an assumption has been made about control group patients receiving equal time as acutely ill patients during ward rounds, this additional cost was included as medical staff confirmed that they saw all their patients on ward rounds including those who were medically stable.

The calculations of the cost of each inpatient episode accounted for whether the patient was transferred to another ward. For example, where a treatment group patient became unwell and was transferred to an acute ward for a week, the calculation of the cost of their hospital stay included the cost of care on the NLIU and the cost of a week’s care on the particular acute ward. Furthermore, if a patient was re-admitted within 28 days, the cost of this stay, calculated according to which wards the patient was cared on, was added to the cost per patient stay. Postdischarge cost data were also examined. Expected resource use, estimated from the hospital discharge plan, was used as a proxy for actual resource use. These data were not merged with inpatient cost data, as it is uncertain whether expected resource use is a good proxy for actual resource use.

Data analysis

All analyses were conducted on an intention-to-treat basis. The costs of tests, professional inputs and inpatient stay were summed for each patient to give a ward-based inpatient cost per patient. For treatment and control groups the mean costs were estimated and compared. BI data, ranked due to non-normality, were analysed using ANCOVA with the pretest score as a covariate. The total mean cost and total mean effectiveness for the treatment and control group are presented. Cost-effectiveness ratios were calculated where appropriate. Sensitivity analyses were employed on cost data to produce a range of estimates to allow for uncertainty in the assumptions used and the precision of the original estimates.

Results

Subjects

Patients were excluded from the study if they had previously been a patient on the NLIU or had already participated in the study, were not assessed as medically stable, had no identified nursing needs or had an anticipated stay of <4 days. During the 20-month study period 350 of the 585 patients referred to the NLIU were suitable for nursing-led care. Of these, 176 were able and willing to consent to participate. Eighty-nine were randomly allocated to the treatment group and 87 to the control group. One control group patient withdrew (see Figure 1).

For this sample of 175 patients there were no significant difference in age between the groups at pretest (treatment group mean age: 78 years, control group mean age: 79 years), gender (treatment groups: 36% male, control group: 29% male), number and type of diagnoses on admission or mean pretest BI (treatment group: 12.0, control group: 12.6).

Seventy-five, 6-hour direct nursing care observation sessions were undertaken, 36 with treatment group patients (n = 21, six patients observed only once) of which 19 were 08.00–14.00 hours sessions and 39 with control group patients (n = 23, seven patients observed once) of which 21 were 08.00–14.00 hours sessions.
Clinical outcome

There was no statistically significant difference in mortality, discharge destination or re-admission between treatment and control groups. Patients cared for on the NLIU showed a greater improvement in functional independence than those in the control group (treatment group mean change in BI: 3.6, control group mean change in BI: 2.6) although this difference was not statistically significant at conventional levels.

Resource use

Mean resource use per group is presented in Table 1. The nurses on the NLIU were observed in a greater proportion of direct nursing care activities (51%) than those on the control wards (43%) although a lower proportion of indirect care activities (13% vs. 15%). They also engaged in a lower proportion of unit-related activities (19% vs. 26%) although a greater proportion of personal time, e.g. meal breaks and unproductive time (17% vs. 15%) of which 4.1% was unproductive time on the NLIU compared with 6.1% on the control wards.

Unit cost data

The range of unit costs identified is presented in Table 2.

Cost of care per day

For each of the three estimates used cost of care per day is cheaper on the NLIU. Using estimate 1 the cost per day on the NLIU is £116.50 in comparison with £131.00 on the acute wards; using estimate 2 the NLIU cost per day is £111.37 vs. the acute ward cost per day of £124.39; using estimate 3 costs per day are £139.56 and £142.20 for NLIU and acute wards respectively. Estimates 1 and 2 used estimates of actual nursing input from the observation data and the differences in cost per day between the NLIU and acute wards are greater.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Inpatient resource use by group</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Resource</strong></td>
<td><strong>Mean resource use from referral to NLIU to discharge from hospital</strong></td>
</tr>
<tr>
<td>Dietician (minutes)</td>
<td>Treatment group</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
</tr>
<tr>
<td>OT (minutes)</td>
<td>19.5</td>
</tr>
<tr>
<td>Physiotherapy (minutes)</td>
<td>168.9</td>
</tr>
<tr>
<td>Speech therapy (number of consultations)</td>
<td>179.6</td>
</tr>
<tr>
<td>Social work (direct contacts)</td>
<td>0.01</td>
</tr>
<tr>
<td>Social work (indirect contacts)</td>
<td>2.6</td>
</tr>
<tr>
<td>Clinical nurse specialists (number of consultations)</td>
<td>9.3</td>
</tr>
<tr>
<td>Chiroprist (number of consultations)</td>
<td>0.9</td>
</tr>
<tr>
<td>Number of investigations</td>
<td>0.2</td>
</tr>
<tr>
<td>Length of stay (days)</td>
<td>16.9</td>
</tr>
<tr>
<td>Number of medical reviews in case notes</td>
<td>36.9</td>
</tr>
<tr>
<td>Direct nursing time in a 6 hour observation session (minutes)</td>
<td>11.3</td>
</tr>
<tr>
<td>D/E grade nurses (minutes)</td>
<td>26.9</td>
</tr>
<tr>
<td>F/G/H grade nurses (minutes)</td>
<td>(36 observation sessions)</td>
</tr>
<tr>
<td>A grade nurses (minutes)</td>
<td>10.9</td>
</tr>
<tr>
<td>F/G/H grade nurses (minutes)</td>
<td>7.9</td>
</tr>
<tr>
<td>A grade nurses (minutes)</td>
<td>8.1</td>
</tr>
</tbody>
</table>

OT, occupational therapist; NLIU, nursing-led inpatient units.
although the costs of care per day were lower on the NLIU, the overall mean hospital stay costs in the treatment group were higher. Mean cost per hospital stay was £5144 for the treatment group and £4100 for the control group when using estimate 1 for cost per inpatient day although this difference (£1044) is not significant ($t = 1.445$, $df = 174$, $P = 0.150$). For estimate 2, mean cost of hospital stay was £4938 for the treatment group and £3919 for the control group and the difference of £1018 is not significant ($t = 1.474$, $df = 174$, $P = 0.142$). Using speciality-based costs as in estimate 3, the mean hospital costs were £6017 for the treatment group and £4410 for the control group, a difference of £1607 ($t = 1.973$, $df = 174$, $P = 0.050$). The driver of total inpatient costs is primarily length of stay. Sensitivity analyses showed that the mean treatment group length of stay would have to reduce by 20.3% to 29.4 days for costs to be equal to the control group. The mean hospital cost results were also found to be robust to changes in the costs of therapy and tests.

### Postdischarge costs

Mean costs of postdischarge care per week including discharge destination were lower in the treatment group than the control group (£374.91 vs. £401.60 respectively) although this difference is not statistically significant (Mann–Whitney U-test $W = 2772.5$, $z = -0.955$, $P = 0.25$).

### Incremental cost-effectiveness ratio

The mean BI improvement scores were 3.6 and 2.6 for the treatment and control groups respectively. Thus, the

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**Table 2**

<table>
<thead>
<tr>
<th>Cost component</th>
<th>Unit</th>
<th>Estimated cost (£) 1997/98</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inpatient costs</td>
<td>Average cost per inpatient day</td>
<td>NLIU (1)£116.56</td>
<td>NHS Trust</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Acute wards (2)£111.37</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(3)£139.56</td>
<td></td>
</tr>
<tr>
<td>Costs of investigations</td>
<td>Cost per test</td>
<td>From 4 (full blood count)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>to 1955 (prostate biopsy)</td>
<td></td>
</tr>
<tr>
<td>Inpatient OT</td>
<td>Cost per minute</td>
<td>0.533</td>
<td>Netten and Dennet (1997)</td>
</tr>
<tr>
<td>Inpatient physiotherapist</td>
<td>Cost per minute</td>
<td>0.500</td>
<td>Netten and Dennet (1997)</td>
</tr>
<tr>
<td>Inpatient social worker (direct)</td>
<td>Cost per 40 minutes face-to-face contact</td>
<td>52.00</td>
<td>Netten and Dennet (1997)</td>
</tr>
<tr>
<td>Inpatient social worker (indirect)</td>
<td>Cost per 15 minutes client-related work</td>
<td>5.25</td>
<td>Netten and Dennet (1997)</td>
</tr>
<tr>
<td>Inpatient clinical nurse specialist</td>
<td>Cost of 40 minutes social worker</td>
<td>52.00</td>
<td>Netten and Dennet (1997)</td>
</tr>
<tr>
<td>Inpatient dietician</td>
<td>Cost per minute of OT</td>
<td>0.533</td>
<td>Netten and Dennet (1997)</td>
</tr>
<tr>
<td>Community nurse</td>
<td>Cost per half hour consultation</td>
<td>17.00</td>
<td>Netten and Dennet (1997)</td>
</tr>
<tr>
<td>Day centre</td>
<td>Cost per day</td>
<td>39.00</td>
<td>Netten and Dennet (1997)</td>
</tr>
<tr>
<td>Day hospital</td>
<td>Cost per day</td>
<td>39.26</td>
<td>Netten and Dennet (1997)</td>
</tr>
<tr>
<td>Home help</td>
<td>Cost per hour</td>
<td>8.17</td>
<td>Netten and Dennet (1997)</td>
</tr>
<tr>
<td>Postdischarge OT</td>
<td>Cost per minute</td>
<td>0.567</td>
<td>Netten and Dennet (1997)</td>
</tr>
<tr>
<td>Meals on wheels/lunch club</td>
<td>Cost per meal</td>
<td>3.00</td>
<td>Netten and Dennet (1997)</td>
</tr>
<tr>
<td>Postdischarge physiotherapy</td>
<td>Cost per half hour</td>
<td>15.00</td>
<td>Netten and Dennet (1997)</td>
</tr>
<tr>
<td>Postdischarge speech therapy</td>
<td>Cost per half hour</td>
<td>20.00</td>
<td>Netten and Dennet (1997)</td>
</tr>
<tr>
<td>Postdischarge dietician</td>
<td>Cost per half hour of OT</td>
<td>17.00</td>
<td>Netten and Dennet (1997)</td>
</tr>
<tr>
<td>Postdischarge social worker (direct contact)</td>
<td>Cost per half hour</td>
<td>39.00</td>
<td>Netten and Dennet (1997)</td>
</tr>
<tr>
<td>Home care hospital team</td>
<td>Cost per half hour of community mental health team</td>
<td>24.00</td>
<td>Netten and Dennet (1997)</td>
</tr>
<tr>
<td>Bathing assistant</td>
<td>Cost per hour of home help</td>
<td>8.17</td>
<td>Netten and Dennet (1997)</td>
</tr>
<tr>
<td>Nursing home</td>
<td>Cost per week</td>
<td>391.65</td>
<td>Kavanagh et al. (1995)</td>
</tr>
<tr>
<td>Residential home</td>
<td>Cost per week</td>
<td>302.36</td>
<td>Kavanagh et al. (1995)</td>
</tr>
<tr>
<td>Own home</td>
<td>Cost per week</td>
<td>253.89</td>
<td>Kavanagh et al. (1995)</td>
</tr>
<tr>
<td>Other hospital</td>
<td>Cost per week</td>
<td>864.65</td>
<td>Netten and Dennet (1997)</td>
</tr>
<tr>
<td>Hostel</td>
<td>Cost per week</td>
<td>330.00</td>
<td>Netten and Dennet (1997)</td>
</tr>
<tr>
<td>Sheltered accommodation</td>
<td>Cost per week</td>
<td>141.75</td>
<td>Netten and Dennet (1997)</td>
</tr>
</tbody>
</table>

OT, occupational therapist; NLIU, nursing-led inpatient units; NHS, National Health Service.
incremental effectiveness of the treatment was 1.0 on the BI. Given that the first estimate of inpatient costs yielded an additional cost of £1044 in the treatment group, the incremented cost-effectiveness ratio (ICER) is £1044 per point improvement in the BI.

Discussion

Overall, this study has established that the NLIU can provide safe, effective care for patients who are medically stable yet still require inpatient hospital treatment without routine medical intervention (Griffiths et al. 2001). In terms of meeting the local requirements of the NHS trust, i.e. to provide a clinically effective service to medically stable patients using 19 newly commissioned beds without the costs of an additional medical team, the NLIU has demonstrated its potential.

This study has not demonstrated the NLIU to be a cost saving alternative to medically led care. Despite a lower cost ‘per day’ in the NLIU, patients in the NLIU were associated with higher costs of hospital stay than those in the control wards because of the significantly longer length of stay on the NLIU. Although overall hospital costs were higher in the NLIU group, there is some potential for savings in the costs of social and community services the patients receive postdischarge. The NLIU patients were associated with lower postdischarge costs than patients on the control wards. This difference was not significant although provides limited evidence of a substitution effect between inpatient care and community and/or social service provision.

Impacting on patient-level costs is of course, not the only possible consequence of introducing NLIUs. Patient outcomes also need to be considered. In this study the NLIU group performed better in terms of BI scores than the control group. The question then becomes, are these improvements worth paying for? Unfortunately, this study did not use a utility measure that would enable formal comparison of ICERs [e.g. by calculating a cost per quality-adjusted life-year (QALY)] with other interventions. Thus, while it seems highly probable that this NLIU was not cost saving, it is not possible to make any firm conclusions regarding the cost-effectiveness of nursing-led inpatient care from this study.

Development of the NLIU after the completion of the evaluation study

With the emphasis on the importance of evidence-based practice in health care, a crucial question to ask is what impact has the evaluation of the clinical and cost-effectiveness had on the NLIU and its subsequent operation. The findings of no statistically significant benefit in patient outcomes and increased cost have led some authors (Walsh et al. 2005) to suggest that the NLIU model of care should not be pursued and that intermediate care investment should be made in other services. To address this question, the NLIU in this study was revisited recently by focussed discussion with senior hospital management staff. This discussion included consideration of what had happened to the NLIU and whether these developments had been influenced by the research study and in particular the economic evaluation.

With the overwhelming imperative for NHS trusts to provide value for money, it may not be surprising that the NLIU is no longer a designated nursing-led unit. The unit now comprises 13 medically led specialist rehabilitation beds and six nursing-led intermediate care beds funded by the local primary care trust. However, this decision to reconfigure the majority of the nursing-led beds to medically led beds was made in mid-2002 while the findings of the NLIU evaluation were available to the Trust in mid-1998. Therefore, it would appear that despite the increased cost of care on the NLIU, the unit was still considered to be a valuable service. This may be due to a number of reasons, for example, the opportunity costs of the acute beds freed up by transferring patients to the NLIU and the reduced waiting times in the accident and emergency department (A&E). The climate of health care provision changed dramatically after the NLIU evaluation was completed. Therefore, the circumstances of this decision are more complex than the increased costs alone. The increased length of stay on the NLIU was of great concern and efforts were made by the NLIU, in line with recommendations of the evaluation study, to reduce this. These recommendations included supporting NLIU nurses in discharge planning, increasing their skills in making discharge decisions and increasing their awareness of day-to-day bed pressures and A&E pressures (NLIU Evaluation Project Team 1999, Harris 2003). However, the overriding reason for the reduced viability of the NLIU was the consequences of changes in the service provision context within which the NLIU operated. As a result of political influence in health care reform and the huge national investment in intermediate care (DoH 2001, 2002), numerous new substitution services were developing and these, with the initiatives to support early discharge substantially reduced the number of postacute patients in acute beds who would be suitable for care on the NLIU. Thus, the NLIU had difficulty filling beds with the result that unsuitable patients were accepted and beds were filled with...
medical outliers, both consequences leading to suboptimal use of beds. As there was no resident medical team on the NLIU, concerns were raised about clinical risk and patient safety. In this situation service managers had little choice but to reconfigure the nursing-led beds.

In addition to the changes in the context of service provision, there was an unanticipated difficulty in recruiting and retaining nurses to work on the NLIU. Although working on an innovative unit where nursing leads multiprofessional care might be seen as ‘cutting edge’, both in terms of professional practice and service development, building a stable team was difficult. Other opportunities for nurses, e.g. matron and nurse consultant posts may have contributed to this. Recruiting and retaining a nurse leader for the NLIU was particularly problematic with long periods where the post was unfilled. This reinforces the existing literature that stable clinical leadership is crucial to sustaining innovative development (Kitson 1991, Redfern et al. 1997).

In view of these circumstances, an interesting hypothetical question is whether the reconfiguration of the majority of nursing-led beds would have occurred if the economic analysis demonstrated that the NLIU was cost neutral or indeed extremely cost-effective. However, the senior managers thought that the outcome would have been the same. The need and demand for services at the primary/secondary care interface had changed with many other intermediate care services available to substitute for, what was considered until recently, part of the secondary care episode. Furthermore, the cost of intermediate care services within the acute hospital setting are always going to be more expensive than community intermediate care structures because of higher institutional overheads. Therefore, the continuing congruence of the NLIU care model within an acute hospital setting is open to question. Would this model of care be more useful and appropriate in a community-based setting where it may also help relieve some of the work pressures experienced by general practitioners (BMA 2004)?

The diminution of the NLIU due to reform of health care services may appear a retrograde step for nursing particularly at a time of considerable development of nursing initiatives. However, the experience of developing the NLIU and the findings of the evaluation that nurses can safely lead inpatient care on a 24 hour, 7 days a week basis had embedded a confidence in nursing in the Trust that has enabled the continuance of nursing-led beds albeit a smaller number and has resulted in the adoption and integration of other well-accepted nursing-led initiatives. The reconfiguration of nursing-led beds resulted from a detailed review of the NLIU undertaken in 2002, involving NLIU staff and other stakeholders. In this review, the confidence in the therapeutic value of nursing and the expertise in rehabilitation and complex discharge planning that the nurses developed on the NLIU were seen as an important contribution to patient care within a multiprofessional specialist rehabilitation unit. Further developments in the use of the six nursing-led intermediate care beds are also in progress, for example, patient referral by community nurse consultants and as step up beds as a mechanism for admission avoidance (to acute beds).

Clearly the introduction of intermediate care has been highly political and the impact of this influence on how this range of services has developed is less clear and merits further exploration. Davies (2004) discusses the political influence on nursing developments and the continuing ambiguity in how nursing and the scope of nursing practice are viewed in government strategy.

**Conclusions**

The NLIU is often presented as a potentially cost-saving alternative to medically led care for postacute patients. However the NLIU in this study, as with other recent NLIUs, was associated with higher costs. Whether length of stay on the NLIU could be reduced or the modest savings in the cost of postdischarge community care were maintained in the longer term to reduce the cost of NLIU care was not followed up in this study. Thus, the question of the cost-effectiveness of the NLIU has not been clearly answered. It would appear from this paper that the NLIU might be difficult to sustain in an acute trust.

This study was undertaken before intermediate care became an important focus of government policy and at that time the predominant perspective was that of a single agency, the NHS Trust. However, since then the range of intermediate care services available has considerably increased with the result that a wider perspective of cost-effectiveness is required. With alternative models of intermediate care there are questions about which services are best suited to which patients’ needs (Carpenter et al. 2003). The range of intermediate care services, from admission avoidance schemes to hospital-based medically led rehabilitation units, address a wide range of patient need. For intermediate care to have maximum benefit the accurate assessment of patients’ need and matching patient needs with the appropriate intermediate service is important for both patient outcome and resource use effectiveness. Moreover, consideration of the carers’ needs as well as patients’ needs in assessment criteria is important. An inpatient model of intermediate care...
care such as the NLIU may be preferred by some carers who may be overwhelmed by the additional needs of patients who are discharged with home-based intermediate care (Shepperd & Iliffe 2001, While 2001). Thus, a comprehensive approach to evaluation is required to address these issues with detailed costing from a multi-agency perspective paying particular attention to costs for patients and carers and to the longer term costs and sustainability of health benefits.

Implications for nursing managers

The use of bottom-up, individual patient data is a useful, although labour intensive, approach that increases the accuracy of resource use data and can identify local resource management issues. The external policy environment and context of service provision may influence the adoption of research findings beyond the control of the institution within which the research has taken place. Economic analyses of services spanning more than one recognized boundary of care provision need to have a wider ‘whole systems’ perspective to the measurement of costs and effectiveness. Where different models of care are evaluated, consideration of the costs to patients and carers and an adequate period of follow up are important to identify longer term costs and health benefits.

Acknowledgements

This study was funded by the Organisation and Management Group, NHS Executive, North Thames Research and Development Programme (grant no. OM438). The views expressed are the authors and not necessarily the funding body.

The authors also thank Jennie Negus and Mary Flatley for their contribution to the paper.

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