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RESEARCH NOTE

ECONOMIC EVALUATION OF A NURSING-LED INTERMEDIATE CARE UNIT

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Abstract

Objectives: The aim of this paper is to examine the costs of introducing a nursing-led ward program together with examining the impact this may have on patients' outcomes.
Methods: The study had a sample size of 177 patients with a mean age of 77, and randomized to either a treatment group (care on a nursing-led ward, n = 97) or a control group (standard care usually on a consultant-led acute ward, n = 80). Resource use data including length of stay, tests and investigations performed, and multidisciplinary involvement in care were collected.
Results: There were no significant differences in outcome between the two groups. The inpatient costs for the treatment group were significantly higher, due to the longer length of stay in this group. However, the postdischarge costs were significantly lower for the treatment group.
Conclusions: The provision of nursing-led intermediate care units has been proposed as a solution to inappropriate use of acute medical wards by patients who require additional nursing rather than medical care. Whether the treatment group is ultimately cost-additive is dependent on how long reductions in postdischarge resource use are maintained.

Keywords: Economic evaluation, Intermediate care, Nursing-led care

This study examined the costs and consequences of caring for patients in a nursing-led intermediate care unit (NLIU) in an inner London teaching hospital. Care on the unit was nurse-managed and modeled on the clinical nursing unit developed in Oxford, UK (12). Patient populations in such units tend to be either elderly or chronically ill (or both). These units are described as nurse-led because patient care is directed by nurses. In this unit, there was no routine involvement from consultant-led hospital medicine. A doctor employed on a sessional basis (8 hours per week) fulfilled the role of the patient's general practitioner

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(GP) and provided routine medical care. The model implemented here did differ in some important ways from that described by Pearson et al. (12). In particular, the establishment of the ward was such that care was not exclusively delivered by registered nurses but included a number of unqualified auxiliary nurses. The establishment was comparable to that of the elderly care wards that shared the same hospital site, a satellite of a large acute trust. The organization and establishment of this NLIU is described in more detail elsewhere (7).

The overall purpose of the evaluation was to identify the potential viability of the NLIU as a model of intrmediate care, which would facilitate the transition from acute hospital care to the community. Intermediate care is defined as:

> That range of services designed to facilitate the transition from hospital to home, and from medical dependence to functional independence, where the objective of care is not primarily medical, the patient's discharge destination is anticipated and a clinical outcome of recovery (or restoration of health) is desired (13).

The NLIU is operationally defined in this study as:

> An in-patient environment offering active treatment to a group of patients where case mix is based on nursing need. The multi-disciplinary clinical team is led by nursing staff and nursing is conceptualised as the predominant active therapy. Nurses have authority to admit and discharge patients (8).

The NLIU was designed to substitute a stay in the NLIU for a period of acute hospital stay prior to discharge. The aims of the NLIU are to maximize recovery prior to discharge, provide a more appropriate care environment, and reduce the routine involvement of doctors in the care of medically stable patients.

Research has shown that in the inner London areas, 14.6% of all hospital patients are inappropriately placed in acute beds (14), while it has also been suggested that this figure may be as high as 48% in medicine (2). Of these patients, 43% have been identified as requiring additional nursing care. The provision of an NLIU provides a method of preparing patients for discharge from hospital while reducing the inappropriate use of acute beds.

Though there is no age limit, the nature of the NLIU means that the patient population is largely elderly with at least one chronic illness. No single diagnostic category predominates. Patients recovering from injury or surgery to the hip form the largest single group (21%) and neurological disorders are common (16%). However, a variety of diagnostic groups account for the remainder of the population, representing a wide range of medical/surgical problems. In approximately 10% of patients there was no identifiable medical reason for admission. In 76% of the sample, the main reason given by those referring patients to the NLIU was the need for rehabilitation ($n = 134$), although multiple reasons for referral were common, with social problems given as a reason for referral in 33% of all cases.

A pilot study based on the first year of the NLIU suggested that length of stay and mortality were not significantly different from that experienced by patients receiving usual care, while patients experienced improved outcomes in terms of physical independence and psychological well-being. However, the results of this pilot study were tentative since improvements in outcomes were generally nonsignificant (7). The aims of this study were to replicate and extend the pilot study by measuring the costs and consequences of introducing an NLIU.

METHODOLOGY

Patients were recruited from acute units of the hospital. Suitable patients were randomized to receive care in either the NLIU or to "usual" care, where they remained on an acute

ward that was traditionally managed (i.e., by a consultant). Randomization was computer-generated and was closed to clinicians. Clinical outcome data on these patients were collected prospectively using the Barthel Index of disability (10) and the 12-item Goldberg General Health Questionnaire (GHQ) (6). The Barthel Index has been widely used and validated in secondary care environments. The GHQ, which measures psychological well-being, was also included since changes in patient health outcomes may not be restricted to those encompassed by a functional scale such as the Barthel Index. Data on resources used by the patients during their hospital stay and after discharge, such as home help and Meals on Wheels, were also recorded. As the costs to all relevant government agencies have been estimated, the study takes the perspective of these statutory service providers.

Patient Sample

All inpatients who were referred to the NLIU by doctors with authority to make discharge decisions were included in the study. During the recruitment period from May 1995 through February 1997, 318 patients were referred to the NLIU for inclusion in the trial. Of these, 276 (87%) were actually suitable, the remainder were either medically unstable, referred for terminal care, or were excluded for administrative reasons. A total of 130 patients were randomly allocated to the treatment group, with 146 randomly allocated to the control group. However, due to inability to give informed consent ($n = 45$) and refusal to participate ($n = 54$), 97 were finally recruited to the treatment group and 80 to the control group.

The study employed a randomized controlled trial (RCT) design on these 177 patients. The patient population was elderly, with a mean age of 77, and were often physically or functionally dependent (mean Barthel Index score, 53; possible range, 0 to 100). Research assistants who, although not blinded to the allocation (due to the obvious geographical locations), were not involved in the delivery of care assessed clinical outcomes.

This sample size gave approximately 80% power to detect medium effect sizes (10-point shift in the Barthel Index) on the outcome measure at the 5% level of significance.

Data Collection

Resource Use. Resource use data were collected as part of the clinical trial. Length of stay was recorded for each patient, as were readmissions (and length of stay on readmission). The level of multidisciplinary involvement in care was a crucial part of the study, and therefore minutes of contact with hospital-based professionals such as occupational therapists and physiotherapists were recorded by the clinical researchers. Similarly, medical involvement in care, the number (and type) of medical review as well as tests/investigations and medication were routinely collected. Postdischarge resource use data were estimated using data from the 1-month follow-up and the hospital discharge plan.

Unit Cost Data. Unit cost data referring to the 1996–97 year were used where possible and are available from the authors on request. Where data from earlier years were employed, the Health Service Cost Index was used to inflate the estimates.

Since the aim of the study was to compare the costs of patients randomized to different types of wards, cost per inpatient day was calculated on a ward rather than a specialty basis using the financial accounts estimates of the cost of each ward and adding an estimate of the cost of medical input. The ward costs included all ward-based costs, including nursing staff, supplies, estates, and maintenance. Due to uncertainty surrounding the extent of, and therefore the cost of, medical coverage for the NLIU, two figures were estimated for the NLIU: one including comprehensive medical coverage (identical to that received by other medical wards), the other only including the cost of the GP cover on the ward. The primary analysis assumed that the NLIU received an identical amount of medical input to the other wards as well as the GP's input. Cost per inpatient day calculated on a ward basis

as described above did not include the costs of medication, therapy inputs, or consultations with other health professionals. The unit costs of tests conducted during inpatient stay was estimated using cost data from the local trust, where available, and other provider sources where these data were lacking.

For health professionals, Netten and Dennet (11) provide estimates of the cost per hour of client contact. Estimates of the cost per consultation were then derived using an average length of consultation and included an allowance for salary overheads, holiday entitlements, and capital overheads. For instance, speech therapists' and physiotherapists' input is measured using therapeutic units (TUT), with each TUT representing a 10-minute consultation. For the other professionals, costs were based on a half-hour consultation.

The cost of drugs for each group was estimated using a retrospective analysis of patient records.

Data Analysis

The costs of tests, therapy, inpatient stay, and drugs were summed for each patient to give a ward-based inpatient cost per patient. For the treatment and the control groups, the mean total cost was estimated. Comparisons between the two groups in terms of average (mean) costs were made. Total cost data were positively skewed and therefore to check the validity of using the *t* test (i.e., to test its robustness to non-normality), bootstrapping was performed and 95% confidence intervals calculated around the observed and bootstrapped means. Bootstrapping is a technique used to estimate standard errors and other methods of statistical precision (5).

Postdischarge cost data were also examined. These data were also positively skewed, and again bootstrapping was performed. Cost data for 1 month were estimated. Several individuals had their cost estimate based on expected resource use (i.e., via a hospital discharge plan) while others were based on actual resource use in the 1-month follow-up. These data were not merged with inpatient cost data because it is not certain whether expected resource use is a reasonable proxy for actual resource use. In addition, inpatient costs were measured over the length of stay of the patient, whereas community costs only considered the 1-month postdischarge period, which may or may not be representative of later periods.

Primary data analysis in this section was performed using SPSS version 8.0 for windows. Bootstrapping was performed using Stata version 5 and reports the bias-corrected estimator.

RESULTS

Clinical Outcomes

There were no significant differences in age between groups at pretest (treatment group mean age, 76; control group mean age, 77), gender (treatment group, 39% male; control group, 35% male), or in the number or type of diagnoses on admission.

Patients were assessed for all outcomes within 48 hours of their hospital discharge. Data were missing for 24 patients in the study; all of these were due to patients who died as inpatients. Mortality in the treatment group ($n = 17$) was higher than in the control group ($n = 7$). This difference was not statistically significant, and none of the increased mortality could be attributed to the intervention. In addition, postdischarge mortality in the control group was greater than in the treatment group (despite the likely under-recording of postdischarge deaths), suggesting that earlier discharge in the control group may have displaced deaths into a community setting. However, given that the study was not powered to detect differences in mortality, these results should be interpreted with caution.

Table 1. Adjusted Mean Patient Outcomes (with 95% CIs) and Mean Resource Use by Group (in Hospital)

	Treatment	Control
Barthel	79.82 (72.48–87.16)	73.91(66.23–81.59)
GHQ	1.86 (1.56–2.19)	2.04 (1.74–2.39)
Study length of stay (n = 177)	59.9	42.0
Total number of tests	6.9	5.7
OT TUTS	28.3	31.6
Physiotherapy TUTS	72.2	52.9
Speech therapy TUTS	6.6	6.6
% visited dietician	37.0	38.0
% visited social worker	57.7	63.8
% visited pain team	10.3	7.5
% visited clinical nurse specialist	5.2	7.5

From the time of referral into the study to discharge from hospital, the Barthel Index improved by a mean of 13.4 points for the treatment group and 10.6 points for the control group. Again, this difference was not significant.

Analysis of residuals on the raw data revealed that the variance was not homogeneous across all values of the covariate (Barthel Index at recruitment into the study). The data were therefore transformed by ranking, with the results and the confidence intervals presented in Table 1. Similarly, for the GHQ, measuring psychological well-being, there were no significant differences between the groups at recruitment into the study. At the postdischarge follow-up, 101 of 153 surviving patients completed the questionnaire (50 treatment, 51 control). There was no significant difference in completion of the questionnaire between groups or between those who completed and those who did not.

The GHQ data were transformed using square roots, and GHQ score at recruitment was used as a covariate in the analysis. The adjusted GHQ scores at follow-up were 1.86 for the treatment group and 2.04 for the control group; this difference was not significant. These results are summarized in Table 1.

Resource Use

Mean resource use by group is presented in Table 1. For the physiotherapists, occupational therapists, and speech therapists, the mean number of TUTS is reported. For social workers, dieticians, clinical nurse specialists, and visits to the pain management team, the clinical trial only reported whether the patient had been visited; thus the proportion of patients in each group who were visited by these individuals is presented. Of these differences, only the study length of stay proved to be statistically significant, and no clear trend is obvious as, for instance, the treatment group uses more physiotherapy while the control group uses more occupational therapy.

The most commonly performed tests on the patients were a full blood count (on 58.2% of patients), urine microscopy (41.8%), wound microscopy (11.3%), and chest x-ray (10.7%). Use of medical staff time could not be directly observed. However, medical activity was monitored by counting entries in the medical notes. By this index, the level of medical activity differed little between treatment and control, with a mean of 18.1 entries in the notes for treatment group patients compared with 23.9 for the control group, which was not statistically significant.

Postdischarge costs are presented in Table 2. Though the treatment group used, on average, less resources except visits to the GP surgery, none of these differences was significant

Table 2. Postdischarge Costs per Month

	Postdischarge total cost (£1996–97) (n = 97 nurse-led, n = 80 control)	Postdischarge community and Social Service cost (n = 80 nurse-led, n = 73 control)
Treatment		
Mean	990	162
Median (range)	974 (1,742)	8 (830)
Control		
Mean	1,259	253
Median (range)	1,209 (2,841)	57 (1,929)

Table 3. Mean Total Hospital Costs (£, 1996–97)

	Treatment (n = 97)	Control (n = 80)
Mean total inpatient cost	10,278	7,757
Inpatient ward cost	9,483	7,076
Cost of drugs	168	137
Cost of tests	48	41
Cost of therapy	578	503
Mean total inpatient cost with medical cover cost for treatment group excluded	8,544	7,757

at the 5% level. Nonetheless, lower resource use in most categories ultimately resulted in a significantly lower postdischarge cost per month in the treatment group.

Inpatient Costs

For the primary analysis of inpatient costs, it was assumed that the NLIU received the same amount of medical care as other medical wards, in addition to the cost of the GP. This assumption inflates the cost of the treatment group and biases the results in favor of the control but recognizes that a substantial proportion of the medical care given was provided from on-call physicians rather than the unit's own medical officer. The results using this analysis showed that mean total costs in the treatment group were £10,278, while the mean for the control group was £7,757. Thus, the mean difference between the groups was £2,521. The 95% confidence intervals around the difference in mean total costs was £84 to £4,957, while the confidence intervals around the bootstrapped mean were £71 to £4,818. Examination of the p plot of the bootstrapped data indicated that these data were normal and that the t test was therefore appropriate. Table 3 shows the results that are broken down into the mean ward cost per inpatient stay, the mean costs of medication, and the mean cost of inpatient therapy.

The difference between the groups in mean inpatient cost was statistically significant ($p = .043$, $t = 2.042$). Inpatient ward costs dominate the total costs of the patient while in hospital. Excluding the cost of hospital medical coverage entirely from the cost of the treatment group substantially reduced the cost of the inpatient ward costs and therefore the costs of the hospital stay for the treatment group, and suggests what may happen if the unit were located outside the hospital environment. Although this group was still found to be more expensive than the control group, this difference was no longer significant ($p = 0.494$, $t = 0.685$). The mean difference between the groups was £787 with a 95% confidence

interval of £−1,482 to £3,055; the bootstrapped estimate also shows nonsignificance in the difference with a range of £−1,578 to £2,852. The costs of therapy, drugs, and tests did not change under this scenario.

The cost of drugs was found to be higher in the treatment group than in the control group despite the latter being more expensive per week; this was clearly the result of longer inpatient stays in the treatment group. Potential reasons for the extended length of stay in the treatment group has been discussed briefly below, and in more detail elsewhere (9).

Sensitivity Analysis

Sensitivity analysis was performed on the main driver of costs, i.e., the inpatient ward cost. Varying this estimate and holding all others constant, the average ward cost on acute wards would have to increase by over 60% for the intervention to be cost-neutral (using the assumption of full medical cover for the NLIU). This assumes that the length of stay remained the same in both groups; clearly, reducing inpatient length of stay in the treatment group or increasing it in the control group would also affect the total costs.

Though several other unit costs were varied, including the costs of health professionals, the result that inpatient stay was more expensive in the treatment group than in the control group was robust to such alterations.

Postdischarge Costs

The costs of inpatient stay were considerably higher in the treatment group, primarily due to the longer length of stay in this group. However, the costs of service provision in the community by Social Services and Community Health Services were also considered. Patients in the treatment group were significantly less expensive for 1-month postdischarge care ($t = -3.080$, $p = .002$) than those in the control group, with a mean difference of £270, respectively. The 95% confidence interval around the observed mean difference was £97 to £442; the 95% confidence interval for the bootstrapped data was £100 to £457. For the treatment group, mean costs were £990, while for the control group mean costs were £1,259. These costs include the cost of nursing and residential homes where applicable and also allow a cost for patients discharged to their own home. In many instances, patients pay for their own accommodation whether it is a nursing home or their own home. Comparing only the social and community health service provision received by each group, the mean cost for the treatment group was £162 for 1 month, while for the control group this cost was £253. Therefore, based on these data, postdischarge costs were between £91 and £270 less in the treatment group than the control group.

Using the potential savings described above, reductions in costs of postdischarge care would negate the increased costs of longer hospitalization if these levels of service provision were maintained for 5 to 10 months. Whether such a scenario is realistic would require a further study with a longer follow-up period.

DISCUSSION

Four other controlled studies have been carried out in the nursing-led care field. One U.S. study found that nursing-led care increased length of stay (1), while a U.K. study in elderly care suggested it reduced length of stay (3). Pearson et al. (12) showed no significant difference in costs between nursing-led and traditionally managed care, while another study (4) estimated that nursing-led care resulted in reduced costs. The results of this study conflict with the majority of earlier studies, nor are the results in agreement with results previously reported from the pilot study, which showed improved outcomes and no increase in the length of inpatient stay. Given the finding of essentially neutral outcomes in this

clinical trial, the issue of the relative costs associated with the intervention becomes crucial. The NLIU is often presented as a potentially cost-saving alternative to medically led care. Whatever assumptions are employed regarding the level of medical cover, the patients in the NLIU are associated with higher hospital costs than those in the control wards; this is due primarily to the increased length of stay on the NLIU rather than the cost per inpatient day. Closer inspection of hospital stays suggests that the longer lengths of stay associated with transfer to the NLIU may in fact be a site effect that is common to all wards on the satellite site where the NLIU is located. Other factors associated with increased length of stay (and hence cost) include a reduced level of qualified nursing staff in the NLIU in both the pilot and main studies (8). A limitation of this study was that the follow-up period postdischarge was not long enough. Long-term costs may be larger in the control group if the substitution effect of secondary care for community care is maintained over a longer time frame. Given that this study was based in a single NLIU, the generalizability to other settings could also be questioned. Nevertheless, extensive sensitivity analysis has indicated that the results in terms of significantly increased costs are robust and likely to be generalizable.

CONCLUSION

Whatever the reason for the increased length of stay in the treatment group, this was offset, at least in part, by savings in the level of community and social services used by this group. These costs were significantly lower in the treatment group, suggesting some substitution effect between inpatient care and community and/or social service provision. Whether this postdischarge resource use in the control group would remain higher than that of the treatment group for a long enough period to make the intervention cost-saving requires more research. What is clear from these findings is that there is no evidence for short-term cost savings associated with an NLIU of the type evaluated here. In this case, the factors associated with reduced daily costs on the NLIU (such as lower levels of registered nurses) are also associated with increased care costs.

POLICY IMPLICATIONS

The NLIU considered here showed no significant detrimental effects on patient outcomes but did not deliver the anticipated benefits. Considering only the narrow range of inpatient costs, this study would not support the increased use of other NLIUs, at least on cost-effectiveness grounds. However, the potential for postdischarge savings needs to be investigated further before this model of care can be recommended or rejected.

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