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Original Paper

Cost of Care in a Randomised Trial of Early Hospital Discharge after Surgery for Breast Cancer

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The aim of this study was to determine the effect of the reduction of the length of hospital stay after surgery for breast cancer on the rate of care consumption and the cost of care. Patients with operable breast cancer were randomised to a short or long postoperative hospital stay. Data on care consumption were collected for a period of 4 months in diaries administered by patients, and socioeconomic status was evaluated by questionnaires. A cost minimisation analysis using the 'societal' perspective was performed and savings were compared with the savings of hospital charges. The use of professional home care was higher for the short stay group during the first month (7.2 versus 1.3 h, $P < 0.0001$). The number of out-patient consultations, the intensity of informal home care and patient's expenses did not increase after early discharge. The total cost of care was reduced by US$1320 by introducing the short stay programme ($P = 0.0007$), but the savings were substantially lower than the savings in hospital charges (US$2680). © **1998 Elsevier Science Ltd. All rights reserved.**

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INTRODUCTION

IN-PATIENT HOSPITAL care constitutes the major expense in the initial treatment of cancer [1]. Shifting treatment to a short stay in hospital or out-patient procedures is one of the measures expected to reduce the expenses of cancer care. Breast cancer is the most frequent newly diagnosed cancer in women. The savings realised by shortening hospitalisation after initial surgical treatment may be substantial [2].

Most breast cancer patients require surgery for treatment of the primary tumour and for staging of the disease by axillary dissection. Postoperatively, some form of care is necessary for wound and drain management and psychosocial support. Early discharge from hospital is realised by shifting hospital care to out-patient care and to professional and informal home care. In The Netherlands, professional home care is delivered by general practitioners, physiotherapists, district nurses and home helps. Informal care is defined as care provided by relatives, neighbours, friends and volunteers [3]. The extent of substitution between intramural care and home care, and the care intensity used by this category of patients in the different settings, are unknown. Studies of the economic effects of early discharge after breast cancer surgery have mainly focused on savings of hospital charges without taking into account additional costs of out-patient care and home care [4–8]. A shift in costs may counteract the savings achieved by shortening hospitalisation.

We conducted a randomised trial to assess the medical, psychosocial and economic effects of early hospital discharge after surgery for breast cancer. The results of the medical and psychosocial evaluation have been described previously [9]. There were no statistically significant differences between the two groups in the incidence of wound complications, seroma formation, or physical or psychological complaints, in the experience of psychosocial problems, or in coping strategies used.

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In this paper we present the results of the economic evaluation. The aim of the economic evaluation was to determine the effect of the reduction of the length of hospital stay after breast cancer surgery on the rate of care consumption and the costs of professional and informal care, both within and outside the hospital.

PATIENTS AND METHODS

Design of the trial

Patients. The sample comprised a consecutive series of patients with stage I or II breast cancer who had surgery for a primary tumour in the breast and axillary dissection between October 1993 and April 1995. Patients were excluded if they had received pre-operative radiotherapy or chemotherapy, were at high risk of complications (ASA classification 3 and higher), or were mentally incompetent; patients who had difficulty with the Dutch language or an inappropriate home situation were also excluded. The study was carried out in two hospitals, a cancer centre and a middle-sized general hospital, in Rotterdam. Approval from the ethics committees of both hospitals was obtained before the start of the study and written consent was obtained from all participants.

Study design. The study design was a prospective randomised trial. Patients were randomised to either a short postoperative stay with discharge in the morning of the fourth postoperative day with drain *in situ* or a long postoperative stay, i.e. discharge after drain removal. Randomisation took place in the out-patient clinic after the patient had been informed of the diagnosis of her cancer. Operative procedures performed included modified radical mastectomy and lumpectomy with axillary dissection. For both groups, drains were removed when the production of serous fluid had decreased to less than 30 ml per day or after 14 days regardless of the drainage volume. For women assigned to short stay treatment, drain removal was performed in the out-patient clinic or at home. A comprehensive early discharge protocol was developed to guarantee continuity of care and information [10]. Community nursing care was offered to all short stay patients. The community nurse scheduled a number of home visits after discharge, with a minimum of two. This schedule was flexible to the needs of the patient. The general practitioner was informed by letter about the early discharge of the patient. Telephone support from the hospital was available 24 h a day. Home help was arranged for patients of both groups according to their needs.

Data collecting procedures. The study period started on the first postoperative day and continued during the following 4 months. At admission, patients were given a daily diary, to be used for 1 month, and a weekly diary, to be used for the following 3 months. The weekly diary was introduced after initiation of the study and distributed to 90 patients. In the diaries, the length of stay in hospital, the number of out-patient visits and the amount of time the care professionals and informal carers had spent directly on the patient in hospital and at home were recorded. Demographic characteristics were collected by questionnaires. Clinical study end-points were recorded in the diaries and patient files by the doctors and nurses and included wound and drain complications, duration and amount of axillary drainage, incidence of seromas and number of aspirations.

Economic analysis

For the determination of costs, a cost minimisation analysis was performed by analysing the total costs of both postoperative regimens [11, 12]. This meant that the two alternatives were compared on the basis of minimum cost; an approach useful for comparing different treatment techniques with similar patient outcome. The choice of perspective was that of 'societal level', which meant that all costs and benefits for all parties in society were accounted for [13]. The cost analysis was carried out in three phases. The resources were tabulated in appropriate units and the use of the resources was measured. After valuation of the resources, the volumina were multiplied by the unit costs. The resources measured were: (1) the number of postoperative days in hospital; (2) the use of professional care in the hospital of the following disciplines: surgeons, residents, nurses, breast cancer nurses, and physiotherapists; (3) the number of out-patient visits and the use of professional care in the out-patient departments; (4) the use of professional home care; (5) the use of informal home care; (6) transport to hospital and costs incurred by the patient. The costs of these units were determined. The costs of a hospital day and an out-patient visit were based on the economic administration of the hospital and included direct costs (manpower and materials) and indirect costs (overheads). A hospital day amounted to US$287 and a consultation to US$106. The cost of professional care used in the hospital measured at patient level was determined in terms of hourly wages based on salary costs of the financial department of the hospital, including employer's costs.

The cost per hour of care by professional workers outside the hospital was calculated taking into account the costs not directly related to patient care, such as the cost of overheads and transport. Informal care was valued according to the market value approach. In this approach, the price of professional care is used as the shadow price for informal care, with the reasoning that if informal care is not available, it has to be substituted by professional care [3]. Because informal care takers have a lower productivity and carry out less complicated tasks, the market price of the cheapest home help, household service, was used. The costs of materials and transport were recorded by the patients. Transport by car was recorded in kilometres and multiplied by a fixed price of 31$ ct per km.

Prices from 1994 were used (US$1.00 = approximately 1.78 Dfl). Average total costs and medians with 95 interpercentile range were calculated.

A cost analysis from a financial perspective was also carried out. This perspective implies that the charges of the Dutch tariff system have been used.

Statistical analysis

A comparison of patient characteristics and complications was carried out using the SPSS package. The cost analysis was performed using STATA (Stata Statistical Software: Release 5.0 College Station, TX: Stata Corporation). Categorical data were compared by the chi-square test without correction of continuity. Continuous variables were compared by the Mann–Whitney U test. Statistical significance is defined for P values < 0.05.

The sample size of the economic part of the study was based on the main end-point in the medical and psychosocial part of the trial [9]. It was not possible to calculate the required sample size for the economic analysis before the

start of the study because the deviation of costs was unknown. Nevertheless, for the final 36 patients in the short stay group and the 39 patients in the long stay group the standard deviation of the total cost of treatment can be obtained.

Using mean total costs of US$4302 in the long stay group and US$3062 in the short stay group (a reduction of 30%) it can be shown that the power to detect this difference as significant (alpha one-sided 0.05) is 98%. The mean and standard deviations on a log scale are 8.30 and 0.42 log $ in the long stay group and 7.96 and 0.37 log $ in the short stay group.

RESULTS

Patient groups

During the study period, 173 women were operated on for breast cancer, of whom 139 were randomised. Reasons for non-randomisation were: refusal to participate ($n = 22$), an unsatisfactory home situation ($n = 10$) and not having been asked to participate ($n = 2$). A further 14 women were excluded after randomisation because they were allocated to another form of treatment ($n = 4$), or withdrew from participation ($n = 10$) for several reasons. Data from the daily diary (first month) were available for 120 (61 short stay and 59 long stay) patients and from the weekly diary (months 2–4) for 79 (37 short stay and 42 long stay) patients. There were no differences in the reasons for non-compliance of the diaries between the two groups. Total costs over the 4 month study period were calculated for the subset of patients who had returned the daily diary as well as the weekly diary ($n = 75$). Data on tumour stage, type of treatment, age, marital status, educational level and family income are detailed in Table 1.

Complications

There were no significant differences between short and long stay patients in median values of drainage volume from the axillary drain (515 ml versus 685 ml), the median duration of drainage (8 days versus 9 days), number of patients with aspirations (10 versus 8), or number of patients with wound (10 versus 9) or drain complications (38 versus 27). The mean number of aspirations required per patient was higher in the long stay group (3.5 versus 1 in the short stay group, $P = 0.04$).

Care intensity

Table 2 presents the data on the intensity of postoperative care per patient.

In accordance with the protocol, in-patient hospital care was longer for the patients randomised for discharge after drain removal: the mean length of stay was 4.1 days for the short stay group and 9 days for the long stay group. The use of professional home care following discharge, especially district nursing and home help, was higher for the short stay group than for the long stay group: respectively, 7.2 and 1.3 h ($P < 0.0001$). There was no statistically significant difference between the two groups in the number of out-patient visits, or the amount of informal care used. As shown in Table 2, the variance in use of care in the home situation was highly skewed to the left, as indicated by the value of the median which is much smaller than the mean. This pattern is a quite common phenomenon in healthcare consumption: many 'modest' consumers and relatively few 'large' consumers [3].

Cost analysis

The overall total cost of care amounted to US$3062 for the short stay treatment and US$4382 for the long stay treatment, leading to a potential saving of US$1320 (95% confidence interval 580–2056) by introducing short stay for this category of patients (Table 3). The mean total cost excluding informal care and patient expenditures was U$2253 for the short stay group (median US$1929, range US$1367–4793) and US$3603 (median US$3466, range US$1736–6817) for the long stay group. The mean difference was US$1350 (95% confidence interval 747–1876).

For the short stay group, the cost of hospitalisation amounted to 41% of the total cost and the cost of home care to 35% of the total cost. For the long stay group, these percentages were 64 and 19%, respectively. The extent of substitution between hospital care and home care was limited. Cost reduction was only slightly influenced by an increase in

Table 1. *Patient characteristics*

	Short stay* ($n = 62$)	Long stay ($n = 63$)
Operative procedures		
Axillary dissection (after previous lumpectomy)	10 (16%)	21 (33%)
Breast conserving therapy	20 (32%)	14 (22%)
Modified radical mastectomy	21 (34%)	21 (33%)
Mastectomy and direct breast reconstruction	11 (18%)	7 (11%)
Tumour size (cm)		
0–2	33 (53%)	39 (62%)
> 2–5	19 (31%)	17 (27%)
> 5	3 (5%)	4 (6%)
Unknown	7 (11%)	3 (5%)
Nodal status		
Negative nodes	40 (65%)	41 (65%)
Positive nodes	21 (34%)	21 (33%)
Unknown	1	1
Adjuvant treatment		
No treatment	45 (73%)	40 (63%)
Radiotherapy nodal regions	2 (3%)	2 (3%)
Chemotherapy	3 (5%)	7 (11%)
Hormonal therapy	7 (11%)	3 (5%)
Combinations	5 (8%)	11 (17%)
Demographics		
Median age (years)†	55 (29–80)	58 (30–75)
Marital status		
Married or living together	51 (82%)	47 (75%)
Single	4 (6%)	9 (14%)
Divorced	2 (3%)	2 (3%)
Widowed	5 (8%)	1 (2%)
Unknown	–	4 (6%)
Monthly family income (US$)		
600–1100	13 (21%)	7 (11%)
> 1100–2000	20 (32%)	25 (40%)
> 2000	20 (32%)	16 (25%)
Unknown	9 (15%)	15 (24%)
Education level		
Primary school	12 (19%)	10 (16%)
Secondary school	40 (64%)	43 (68%)
University	10 (16%)	5 (8%)
Unknown	–	5 (8%)

Values are numbers of patients. *No significant differences between study groups. †Median (95 interpercentile range).

Table 2. Intensity of care per patient

	Weeks 1–4		Weeks 5–17	
	Short stay ($n=61$)	Long stay ($n=59$)	Short stay ($n=37$)	Long stay ($n=42$)
Hospital care				
Hospital stay (days)	4.1 (4)	9.0 (9)		
Professional care in hospital (h)	2.7 (2.6)	4.8 (3.0)		
Number of out-patient visits	2.7 (2)	2.4 (2)	1.2 (1)	1.2 (1)
Home care				
Professional care				
Community nurse (h)	2.3* (1.75)	0.3 (0.0)	0.6 (0.0)	0.05 (0.0)
General practitioner (h)	0.5 (0.4)	0.3 (0.1)	0.1 (0.0)	0.3 (0.0)
Physiotherapist (h)	0.3 (0.0)	0.2 (0.0)	1.1 (0.0)	1.3 (0.0)
Home help (h)	4.1 (0.0)	0.5 (0.0)	7.7 (0.0)	9.3 (0.0)
Total (h)	7.2* (2.9)	1.3 (0.25)	9.6 (0.5)	10.9 (0.3)
Informal care (h)	29.7 (10.6)	20.1 (5.7)	24.7 (1.0)	24.5 (6.5)
Total home care (h)	37† (17.7)	21.4 (10.0)	34.4 (9.5)	35.4 (12.0)

*$P<0.0001$, †$P=0.006$.

Table 3. Cost of care (in US$)

	Cost per hour of care	Short stay ($n=36$)	Long stay ($n=39$)
Hospital care			
Hospitalisation		1256* (1224; 853–1525)	2787 (2657; 1160–4280)
Out-patient visits		504 (440; 90–1530)	437 (322; 0–1337)
Total hospital care		1760† (1683; 1199–2911)	3224 (3101; 1445–5133)
Home care			
Professional care			
District nurse	45/h	115* (76; 0–449)	18 (0; 0–143)
General practitioner	75/h	46 (35; 0–209)	54 (19; 0–260)
Physiotherapist	42/h	64 (12; 0–331)	66 (0; 0–332)
Home help	24/h	267 (0; 0–1765)	240 (0; 0–2073)
Total		493 (186; 10–2215)	379 (75; 0–2181)
Informal care	11/h	563 (259; 0–2376)	470 (223; 0–1896)
Total home care		1057 (886; 76–3716)	849 (619; 0–2983)
Patient expenditures		246 (160; 0–888)	309 (142; 0–1510)
Total costs of care		3062‡ (2640; 1646–5599)	4382 (4226; 1870–7524)

Values are means (median, 95-interpercentile range). *$P=0.0001$, †$P<0.0001$, ‡$P=0.0007$.

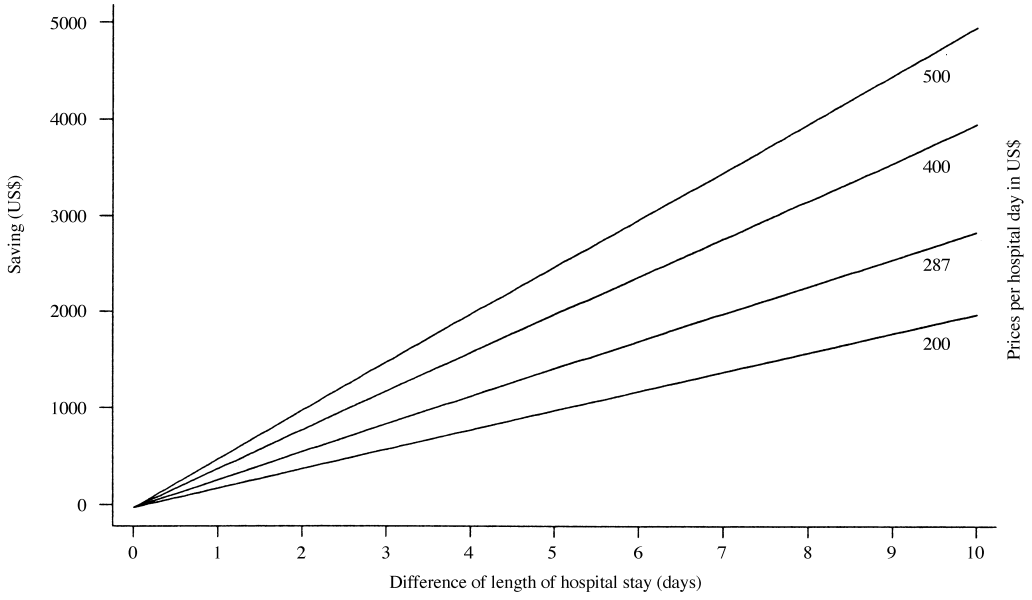

Figure 1. Sensitivity analysis. 200-287-400-500: prices per hospital day in US$.

home care costs because of the much higher costs of hospital care compared with home care.

Financial perspective

The average cost per hospital day charged was US$547, resulting in mean total hospital costs of US$2243 (for 4.1 days—see Table 2) for a patient in the short stay group and US$4923 (for 9 days—see Table 2) for a patient in the long stay group.

Sensitivity analysis

Sensitivity analyses were performed to assess the effect of changes in the number of days in hospital and the cost per hospital day (Figure 1). The cost per hospital day used in the study was US$287. For the sensitivity analysis it was varied from US$200 to US$500. Because hospital stay is the main cost determinator, a reduction of the length of stay always resulted in cost reduction, independent of the cost per hospital day.

DISCUSSION

In this study, the effect of shortening the stay in hospital after surgery for breast cancer on the consumption and the cost of care was studied by means of a prospective randomised trial. The shortening of hospitalisation resulted in a potential cost reduction of 30% of the total cost of postoperative care. We analysed costs from the 'societal' perspective. This implies that not only costs made within the health care system are taken into account, but also the costs of informal care and costs incurred by the patient [11]. Exclusion of these indirect costs may lead to an underestimation of the total costs of healthcare [14] and to an overestimation of savings. In our study, there was a significant increase in use of professional home care by the short stay patients during the first postoperative weeks, but there was no increase in ambulatory hospital care nor in the use of informal care. Care substitution was limited to nursing care and home help, which have much lower costs than traditional care in hospital.

The costs were calculated by means of units based on the real use of resources, multiplied by unit costs. This method has been recommended for costing diseases in a surgical ward [15, 16] and evaluating the cost of cancer treatment [12]. In other studies on early hospital discharge after surgery for breast cancer, the savings of hospital charges were calculated [4–8]. In our study, the savings based on a calculation of real costs were substantially lower than the savings of hospital charges (US$1320 and US$2680, respectively).

There are some methodological limitations to our study design. Unit prices were based on local or national data, making generalisation of the results to other countries difficult. However, in the sensitivity analysis the price per hospital day was varied and it was demonstrated that there is a linear function between the costs of a hospital day and the total costs. The highest savings can be achieved when the hospital stay is reduced considerably and the costs per hospital day are high.

In our study protocol, standard care of the community nurse was provided for the short stay patients to guarantee continuity of care. In many countries, however, patients and their families are instructed in wound and drain care and professional home care is not a common practice. Because the cost of community care was rather low in proportion to the high hospital costs, the use of the district nursing care only slightly influenced the results. Our economic analysis was conducted alongside a prospective randomised trial into the effects of shortened hospital stay on complication rate, patient satisfaction and psychosocial outcome [9]. One may object that the rigorous protocol design gives no insight into real costs in general practice and that in our study the home care may have been improved by the protocol, in particular the use of the patient diary. Nevertheless, we think that the treatment in our long stay condition represents a realistic situation: patients in this group had no predetermined length of stay or home care procedures. The postoperative care of the long stay group is similar to that used in many European countries: discharge after drain removal [17, 18].

The study population used for the cost analysis was smaller than for the clinical study, due to a later start of the economic evaluation. We compared the group who had completed a daily diary ($n = 120$) with the group who completed both a daily and a weekly diary ($n = 75$) with regard to the total cost of hospitalisation, out-patient care and home care during the first month, and found no statistically significant differences between the groups. The diaries that were not used for the cost analysis were not centre-related and were randomly distributed among the two study arms so it is very unlikely that, as a consequence of this, a bias would have been introduced.

Early discharge can be implemented on condition that there is no increase in complications and that the quality of care is guaranteed. In our randomised trial, it was demonstrated that the wound complication rate remained unchanged, that there were only minor drain complications for both groups and that patient satisfaction with a short length of stay was high [9]. In our opinion, it is the task of the hospital to arrange home care facilities. It is widely recognised that intensive postdischarge care leads to higher out-patient costs but lower in-patient costs, due to shorter hospital stays and fewer re-admissions [19]. Our results demonstrate the same trend.

In conclusion, early discharge after breast cancer surgery increases the use of professional nursing care and home help, but does not lead to an increase of consumption of outpatient medical care. Informal home care is used frequently by both groups. The shifting of care results in a potential cost saving; but these savings are not as high as would be expected from a calculation of the savings in hospital charges. This study can be used as a model for estimating the savings achieved by substituting hospital care for home care.

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