Prospective payment systems and hip fracture treatment costs

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We studied the health care consumption and costs after a hip fracture in 1,060 and 1,178 elderly patients admitted from their own home before and after the implementation of a prospective payment system in Stockholm. The total number of bed-days was estimated by merging the inpatient database and the municipal records of living accommodations for the elderly. By using a detailed patient-related accounting system and separating cost for surgery and "hotel" cost, we could compare costs in different types of rehabilitation. After the change in reimbursement system, the orthopedic stay was almost halved from 20 to 12 days. This was achieved by earlier and increased discharge to geriatric wards, where bed-day consumption doubled (107%), so that the total cost actually increased by 12%. This is not readily apparent from the official health care statistics, which depict a more favorable cost development, as diagnosis-related registration for a large part of the geriatric care is no longer included. In contrast, a rehabilitation program in one of the acute hospitals, emphasizing continuity in the postoperative phase, reduced the total cost for treatment and rehabilitation by 12%. A prospective reimbursement aiming at reducing the costs of acute care does not necessarily result in overall savings.

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In spite of an ever-increasing number of hip fracture patients during recent decades (Zetterberg et al. 1985, Mannius et al. 1987), the total number of bed-days used for the hip fracture diagnosis in hospitals and after-care facilities has actually decreased (Bauer 1995). However, today's strained economy together with the ongoing dramatic demographic change—an unprecedented increase in the number of old and very old people (The Economist, January 27 1996)—has prompted cut-backs in the health care expenditure. To reduce costs and the size of the acute hospital organization, the Stockholm County Council implemented a prospective payment system in 1992. This coincided with a change in the authority in charge of nursing homes and long-term care. Local municipal welfare authorities took over the responsibility for about 80% of the former geriatric beds. The aim was to make better use of available resources and to speed up patient-flow. Several authors (Holmberg 1985, Borgquist et al. 1991, Sernbo and Johnell 1993) have estimated health care consumption and costs for hip fracture patients, showing that most costs are generated after discharge from the hospital.

The aim of this study was to study the effects of the new systems for reimbursement and resource utilization on hip fracture care.

Patients and methods

Patients

We studied health care consumption and costs after a hip fracture in 1,060 consecutive patients in 1990 and 1,178 consecutive patients in 1992. The patients were initially treated in the orthopedic departments in 4 Stockholm hospitals. The patients were 65 years or older at the time of the injury, residents of the City of Stockholm and admitted from an independent living situation. Data were also calculated for 93 consecutive patients from 1992 who met the inclusion criteria but were treated in Huddinge Hospital in a hip fracture unit not using external rehabilitation facilities—such patients remained in this unit until they could return home or until no further progress was recorded. Therefore, length of stay and discharge destinations were not affected by the change in reimbursement system (Table 1).

Data collection

The patients were identified by use of the computerized diagnosis-based inpatient system. The identification of the first admission for a hip fracture was based on diagnosis codes (ICD-9), main diagnosis and up to 7 coexisting diagnoses per hospital stay and operation codes with dates for up to 5 registered surgical procedures per hospital stay. The number of bed-days dur-

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Table 1. Background data for hip fracture patients, 65 years or older and admitted for acute hospital care from an independent living situation

	Stockholm hospitals 1990	1992	Hip fracture unit 1992
Number of patients	1,060	1,178	93
Mean age	80.9[a]	81.9	82.5
Women (%)	81	81	72[a]
Cervical fracture (%)	51	48	46
Initially discharged to own home (%)	56[a]	43	83[a]
Initially discharged to institution (%)	36[a]	54	13[a]
Died during initial stay (%)	8[a]	3	4

[a] $p < 0.05$ compared with the Stockholm hospitals 1992.

ing the first year after the hip fracture, also including care under other diagnoses irrespective of type of care, was recorded for each patient. Moreover, residence on admission, discharge destination and residence 1 year after the injury were registered. For patients with serial hip fractures, only the year following the first fracture was included in the calculations. The base-line year 1990 was chosen to ensure that the 1-year follow-up was not affected by the changed reimbursement system and the new authority in charge of care of the elderly.

The hip fracture patients in 1992 were matched with the computerized records of residents in nursing homes, old people's homes and group living (the latter, in practice, almost exclusively because of dementia), kept by the welfare authorities of the City of Stockholm, as the inpatient database no longer included nursing home care after the administrative change. Data on health care consumption therefore had to be retrieved from different sources. The use of municipal home help was obtained from the municipal database for 1990 and 1992. For validation, the 93 "hip fracture unit"-patients were also individually followed with interviews and questionnaires.

For all calculations of costs for different types of care, we used the actual costs of 1994 (current exchange rate 1996-10-15 1 USD = 6.60 SEK) (Table 2). The hospital costs for acute care registered in the patient-related accounting system of Huddinge Hospital (at that time the only hospital with a patient-related accounting system) were used for all patients in the study. Surgical cost included use of operation and anesthesia facilities, including staffing, cost of surgeon and implant, postoperative and intensive care, diagnostic imaging and laboratory services. "Hotel" cost included hospital overheads (capital cost, maintenance and administration) and departmental overheads (staffing, cost of physiotherapy, occupational therapy and social workers, medicines and patient food, rent, cleaning, laundry and other non-patient-related use of medical and technical services). For orthopedic readmissions, we used the average bed-day cost, including cost of surgery for the elderly hip fracture patients. Cost of care in other "acute" hospital departments included the average bed-day cost of all specialities in Huddinge University Hospital. No patient or diagnosis-related geriatric bed-day cost is available, and therefore the average geriatric bed-day cost was used to express the cost of geriatric rehabilitation of orthopedic patients.

The costs of elderly care were estimated by the Stockholm welfare authorities. The municipal nursing home bed-day cost was also used to express the bed-day cost for 1990, when administratively integrated in the geriatric departments, although the care was given in the same institutions by the same personnel. Assuming that the need for permanent institutionalization of nursing home type was of similar magnitude before and after the change in the authority in charge of care, we subtracted the average number of municipal nursing home and group-living days measured in 1992 from the number of geriatric bed-days in 1990, and then added the estimated nursing-home bed cost to these bed-days. Thereby it is possible to compare geriatric rehabilitation in 1992 with 1990.

Accommodation in municipal old people's homes was not included in the municipal database in 1990, and therefore we have considered such homes as independent living (in 1992 <1% lived in old people's

Table 2. Costs of different types of care for hip fracture patients

Type of care/living accommodation	Cost (USD)
Patient-related cost for the treatment of the hip fracture (Surgical cost) [a]	3,316/patient
Hotel cost in the orthopedic dept. [a]	348/bed-day
Readmissions to the orthopedic dept. (Cost of reoperations included) [a]	648/bed-day
Care in other acute hospital department [a]	661/bed-day
Care in the geriatric department [b]	357/bed-day
Care in municipal nursing home (1992) [c]	173/bed-day
Group-living for demented [c]	134/bed-day
Old people's home [c]	103/bed-day
Municipal home help [c]	34/h
Care in geriatric nursing home (1990) [d]	173/bed-day

[a] The computerized patient-related accounting system of Huddinge University Hospital.
[b] Calculated cost. The geriatric department of Huddinge University Hospital (not included in the patient-related accounting system).
[c] Calculated cost. The welfare authorities of the City of Stockholm.
[d] Estimated cost. Based on the municipal calculations for the same type of care.

Table 3. Actual consumption of health care resources determined during the first year after hip fracture. Patients 65 years or older and admitted for acute hospital care from an independent living situation. Mean (95% confidence interval) days

	Stockholm hospitals 1990	Stockholm hospitals 1992	Hip fracture unit 1992
Length of stay in the orthopedic department	20 (19–21)	12 (11–13)	16 (12–20)
Additional orthopedic costs	3.5 (2.9–4.1)	2.2 (1.7–2.8)	5.4 (3.4–7.4)
Other acute care	5.6 (4.2–6.9)	4.4 (3.1–5.6)	5.6 (1.0–10)
Total acute hospital care	29 (27–31)	18 (17–20)	27 (21–33)
Geriatric care registered in the inpatient database of the Stockholm County Council	44 (40–49)	33 (28–37)	8.6 (0.0–25)
Total care registered in the inpatient database of the Stockholm County Council	73 (68–79)	51 (46–56)	36 (18–54)
Municipal nursing home and group-living bed-days	–	29 (26–31)	25 (15–34)
Total consumption of health care resources during 1 year after hip fracture, regardless of authority in charge or diagnosis	73 (67–80)	79 (74–85)	60 (39–81)

homes before the injury, a number which had increased to 2% 1 year after the fracture). Group living arrangements were also rare in 1990 and we have included this newly developed type of care in the calculations of institutional bed-days in 1992.

The reimbursement systems

In 1990, acute hospital care, long-term care and nursing home placement were provided by the Stockholm County Council and the health care was budget-driven on the departmental level. Care of the elderly (old people's homes and home help) was given by local welfare authorities. In 1992, a prospective payment system for acute care, based on Diagnosis Related Groups (DRGs), was implemented. The treatment of each patient was individually paid for according to a preset reimbursement based on the main diagnosis. The reimbursement weights were adapted from the American Medicare DRG-system, as no local patient- or diagnosis-related cost information existed. The aim was to reduce health care costs and make the organization more efficient by introducing market forces. Furthermore, a penalty charge exceeding nursing home bed-day cost was introduced to stimulate a rapid transfer to a nursing home when the specialized acute or geriatric care was no longer considered necessary.

Analysis of variance and the chi square-test with a rejection level of 5% were employed for the statistical analysis.

Results

Even in the first year of the reform, the length of stay in the orthopedic department after hip fracture decreased by 42% (Table 3). Including the surgery-related cost, the estimated cost of hip fracture for the orthopedic departments decreased by 28% (Table 5). The percentage of patients discharged to institutions instead of to their own home increased substantially (Table 1). This contrasted with the results of the hip fracture unit, where the length of stay also decreased, though not as much (Table 3), while the percentage initially discharged to institutions was much lower (Table 1).

43% of the patients in 1992 were discharged directly to their own home and the average stay in the orthopedic department for this category was 11 (10.2–10.9) days [mean (95% confidence interval)]. We assumed that these 43% were the most able of the patients. To find a comparable group, we selected the 43% with the shortest hospitalization of all admitted patients among those discharged to their homes in 1990. In that subgroup, hospital stay was 11 (10.5–11.2) days and in the hip fracture unit the corresponding figure was 8.8 (7.5–10.0) days.

The hospital stay in connection with readmissions to the orthopedic department and admissions to other hospital departments for acute care during the post-fracture year was shortened between 1990 and 1992, almost as much as the initial stay. Thus the total number of such hospital bed-days decreased by 37% (Table 3). Geriatric care also decreased by 26% and,

Table 4. Consumption of geriatric care during the year after hip fracture. Patients 65 years or older and admitted for acute hospital care from an independent living situation

	Stockholm hospitals 1990	1992	Hip fracture unit 1992
Bed-day consumption	15.8 [a]	32.7	8.6

[a] The 1990 figure was obtained after subtraction of the number of nursing home bed-days in 1992 from the number of geriatric days registered in the Stockholm County Council database of 1990.

Table 5. Mean health care costs (USD) during the first year after hip fracture. Patients 65 years or older and admitted for acute hospital care from an independent living situation

	Stockholm hospitals 1990	Stockholm hospitals 1992	Hip fracture unit 1992
Patient-related cost pf surgical procedure	3,316	3,316	3,316
Initial stay in the orthopedic department	6,970	4,042	5,611
Additional orthopedic costs	2,267	1,425	350
Other acute care	3,703	2,909	3,703
Nursing home placement and group living accommodation	–	4,853	4,249
Geriatric bed-days in 1990 assumed to be of permanent nursing home type	4,923	–	–
Geriatrics	5,640 [a]	11,673	3,070
Cost of increased staffing in the Hip fracture unit	–	–	480
Estimated total health care cost	26,817	28,218	23,925

[a] Calculation of geriatric bed-days, see Table 4.

Table 6. Non-acute care. Geriatrics with nursing home beds included in 1990 and geriatrics in 1992 with municipal nursing home bed-days added. Consumption during the first year after hip fracture. Patients 65 years or older and admitted for acute hospital care from an independent living situation. Mean (95% confidence interval) days

	Stockholm hospitals 1990	Stockholm hospitals 1992	Hip fracture unit 1992
Mean hospitalization (days)	44 (38–50)	61 (56–67)	33 (14–53)
Cost (USD)	10,563 [a]	16,526	7,319

[a] For estimation of cost in 1990, see Table 4.

the total number of bed-days during the year following the hip fracture, as recorded in the in-patient database decreased by 31% (Table 3). But when adding the 27 nursing-home days and 1.8 group-living days in 1992, no longer registered in the health care database, we obtained a total of 79 bed-days per hip fracture patient during the postfracture year, an 8% increase, despite the dramatically shortened acute hospital stays.

The inpatient database was validated against hospital records. 150 patient records (7%) were randomly selected from the operation ledgers at 2 of the hospitals. All were found in the database under a hip fracture diagnosis, although 1 trochanteric fracture was incorrectly registered as a cervical fracture and 1 cervical fracture as a trochanteric fracture. Another 150 random patients from the 2 hospitals who were registered in the database were compared with the operation ledgers. Again, all hip fracture diagnoses corresponded, but 3 trochanteric fractures were registered as cervical fractures.

Consumption data for the hip fracture unit patients were also obtained by telephone interviews and questionnaires answered by the patients, relatives or caregivers. The individual follow-up gave 61 bed-days during the postfracture year (35 acute hospital and geriatric bed-days and 27 municipal bed-days).

It is reasonable to believe that the use of nursing-home type care provided in 1990 by the geriatric departments was similar to the amount provided in 1992 by the municipal authorities using the same beds. Therefore, we subtracted 29 nursing-home and group-living bed-days measured in 1992 from the geriatric bed-days in 1990, leaving 16 geriatric bed-days in 1990 that was comparable to the geriatric bed use in 1992. Thus geriatric care increased by 107% (Table 4). But also without this stipulation the combined geriatric and municipal care increased by 43% between 1990 and 1992 (Table 6). If only hospitalizations directly associated with the hip fracture are considered—i.e., initial orthopedics, geriatric rehabilitation and new orthopedic admissions also under other diagnoses—the number of bed-days increased from 39 to 47 (18%) and the cost, surgery included, increased by 15%. The corresponding figure for the hip fracture unit was a decrease to 30 (23%) and a cost reduction of 15%.

During the 12 months that followed the fracture, the percentage of the patients who received home help after discharge varied between 32% and 36% in

1990 and 33% and 39% in 1992. On average, the patients in 1990 received 202 h of home help during the year following the fracture compared with 207 h in 1992. When only patients initially discharged to their own home were included, the home help received became 210 h and 188 h, respectively. Among those residing in their own home at 1 year, both the 1990 and the 1992 patients had received 247 h. Thus, the average cost/patient for home help received did not change between 1990 and 1992. In the hip fracture unit, the average use of home help was 287 h.

In 1990, 7% of the cervical fractures were primarily treated with a prosthesis and 23% of those primarily treated with osteosynthesis had had a reoperation during the postfracture year. Corresponding figures for the 1992 patients were 4% and 18% and for the hip fracture unit patients 7% and 25%, respectively (not significant differences). Nor were there significant differences in 1-year outcome. In 1990, 68% resided in their own home after 1 year, 11% were institutionalized and 21% had died during the postfracture year. The corresponding figures in 1992 were 65%, 14% and 21%. In the hip fracture unit, the figures were 68%, 14% and 18%.

Discussion

The change in the economic system shortened the acute hospital stay to the same extent as after the implementation of the prospective payment system in the United States (Fitzgerald et al. 1988, Palmer et al. 1989, Kahn et al. 1990). In both countries, this was achieved by a quicker discharge of an increased number of patients to after-care facilities (Fitzgerald et al. 1988, Kahn et al. 1990), despite fundamental differences in organization and financing. Previously Borgquist et al. (1991) calculated costs for the initial orthopedic stay including surgery-related cost as USD 6,409 and total costs during the first 4 months as USD 12,279. Sernbo and Johnell (1993) determined the initial treatment cost of a hip fracture in an orthopedic department at USD 5,000 and estimated total costs during the first year after the fracture, using the average cost for rehabilitation and elderly care, including home help at USD 26,000, figures in the same order of magnitude as in this study. After the change of reimbursement system, orthopedic care was replaced by geriatric care, traditionally considered less expensive. Holmberg and Thorngren (1988) set the proportions at 2:1, as in our calculations. But excluding the specific surgical cost, the two are actually about the same. The economic advantages gained by transferring postoperative rehabilitation to the geriatric department are thus largely a matter of accounting. Several studies show a shortened hospital stay when elderly hip fracture patients are treated in specialized geriatric rehabilitation units (Boyd et al. 1983, Sainsbury et al. 1986, Murphy et al. 1987, Kennie et al. 1988, Hempsall et al. 1990, Zidén et al. 1990). The results, however, are usually compared with historic data and patient selection probably occurs. 2 randomized studies show no differences in outcome (Gilchrist et al. 1988, Fretwell et al. 1990) when traditional acute care is compared with geriatric care. In our study, the stay in rehabilitation units in reality increased even more than the shortened acute hospital stay.

Even for the most active patients, the length of stay was not shortened after the reform, except in the hip fracture unit, indicating that rehabilitation time was not affected by the reform and that efforts to shorten the acute hospital stay per se do not necessarily reduce costs. On the other hand, in studies focusing on continuity and personal commitment (Ceder et al. 1980, Sikorski et al. 1985, Ogilvie-Harris et al. 1993, Zuckerman et al. 1993) several authors report decreased total costs without compromised treatment quality.

The use of municipal nursing-home bed-days by patients from the hip fracture unit did not differ from the traditionally treated patients in 1992, despite the fact that almost all were initially discharged to their home. Moreover, the percentage institutionalized after 1 year was not increased compared with 1990. Furthermore, availability of home help was unchanged between 1990 and 1992 and cannot explain increased hospitalization. These findings may indicate that the need for permanent institutionalization was not affected by the change in the authority responsible for the nursing homes. Thorngren et al. (1994) found that accommodation patterns during the first 4 months after a hip fracture did not change much between 1988 and 1992. This may be explained by the fact that the need among elderly hip fracture patients for permanent nursing home placement is mainly due to mental deterioration (Nordqvist 1974, Kuroda et al. 1990, Svensson et al. 1996).

Because of the change in the authority responsible for large parts of the geriatric care it became necessary to include also the nursing home care no longer registered under this diagnosis in the calculations. For the aged, a large number of impairments other than the hip fracture contribute to the need for care, and even in individual patients it is difficult to identify which factors are the most important. In addition, complications of the fracture—e.g., DVT, pressure sores or infections—are often treated in other depart-

ments and under other diagnoses. Furthermore, Fitzgerald et al. (1988) remark that transferrals between caregivers may be made for cost evasion purposes. Therefore, we have chosen to present total resource utilization for the entire year following a hip fracture, including all types of hospital care.

The reliability of the registered diagnoses in the Stockholm County inpatient database seems to have improved compared with previous investigations (Hedlund 1985, Holmberg 1985, Naessén et al. 1989), probably because of economic consequences of the entered data.

One might argue that it was premature to evaluate the changed economic system after only 1 year, but with respect to shortened acute hospital stay and decreased acute hospital costs the reform was successful. Without the additional information from the municipal database, it would have been easy to assume that the reform had also had a positive effect on total health care costs. We conclude that prospective reimbursement may be counterproductive if the acute hospital care of the elderly is regarded as an isolated phenomenon.

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