The cost of a hip fracture

Estimates for 1,709 patients in Sweden

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We calculated the costs related to hip fractures and estimated the potential cost savings from preventing hip fractures. Subjects for this retrospective study were 1,709 hip fracture patients admitted for a primary hip fracture during 1992 in Stockholm, Sweden. Direct costs were compiled for the services of hospital orthopedics, hospital geriatrics, nursing homes, home for the elderly, group living, other acute hospital care, and municipal home help. The direct costs per patient during 1 year after a fracture amounted to about USD 40,000. The county council was responsible for 59% of the direct costs during 1 year after a hip fracture, while the remaining 41% were referred to the municipality. In the morbidity group, the potential cost savings per patient from preventing hip fractures was about USD 22,000.

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Hip fractures are associated with the highest morbidity and mortality of all osteoporotic or age-related fractures, and in 1990, the number of hip fractures in Sweden amounted to about 17,000 (Stockholm inpatient register 1990, Cummings 1993, Population Statistics 1993). The risk of osteoporotic fractures may be reduced, for example, by altering certain behavioral factors, increasing calcium intake, and replacing sex steroids when they are deficient (Riggs and Melton 1992).

Earlier studies which have estimated the economic impact of hip fractures show that they entail large costs for the health care system and for society (Agarwal et al. 1986, Campion et al. 1987, Holmberg and Thorngren 1988, Borgquist et al.1991, Hollingworth et al. 1993). However, many of these studies have a limited time perspective: they cover only a short rehabilitation period, long-term costs are seldom included, and none of them calculated the extra costs of hip fractures in a comprehensive way, i.e., they did not consider that many of these patients may have a substantial health care consumption, even if they do not sustain a hip fracture. The potential cost savings from preventing a hip fracture are the extra costs that the hip fracture causes.

We calculated the costs—arising in the health care sector and the social welfare system—related to hip fractures and estimated the potential cost savings from preventing hip fractures.

Patients and methods

We collected detailed cost data for 1,709 hip fracture patients. Direct costs arising in the health care sector and social welfare system were available for each patient during 1 year before and 1 year after the fracture. The potential cost savings from preventing hip fractures are equal to the extra costs that the hip fracture causes compared to if the fracture had not occurred. To estimate the extra costs related to hip fractures we used the patient as his/her own control and the extra costs were estimated as the difference between direct costs 1 year after and 1 year before a hip fracture. We assumed that patients admitted from independent living had equal costs for independent living in the year before and the year after fracture. One problem in comparing the costs is that some persons die in the year after the fracture. To estimate potential cost savings, separate analyses were carried out for patients surviving and dying within 1 year after a fracture. All costs are in USD (1 USD = 6.6 SEK), expressed as means, and refer to 1994 prices.

Patients

The background population consisted of 552,430 persons registered in the city of Stockholm and subjects in the study were all patients admitted for primary hip fracture surgery during the year 1992 in the city of Stockholm (Statistics of Sweden 1992). Most patients

Table 1. Characteristics of the hip fracture patients. Frequencies and (%)

	Total (n 1,709)	Admitted from own living (n 1,427)	Admitted from institution (n 282)	Men (n 390)	Women (n 1,319)
Mean age	80	80	81	76	81
Fracture type					
Trochanteric	873 (51)	736 (52)	137 (49)	184 (47)	689 (52)
Cervical	836 (49)	691 (48)	145 (51)	206 (53)	630 (48)
Admitted from					
Own living	1427 (84)	1427 (100)	–	320 (82)	1107 (84)
Institution	282 (16)	–	282 (100)	70 (18)	212 (16)
Mean hospitalization days (initial stay in dept. of orthopedics)	11	12	5	11	11
Discharge destination after initial stay in dept. of orthopedics					
Own home	690 (40)	684 (48)	6 (2)	159 (41)	531 (40)
Institution	975 (57)	707 (50)	268 (95)	221 (57)	754 (57)
Died	44 (3)	36 (2)	8 (3)	10 (2)	34 (3)
Residence at 1 year after fracture					
Own home	997 (58)	939 (66)	58 (21)	221 (57)	776 (59)
Institution	322 (19)	195 (14)	127 (45)	54 (14)	268 (20)
Died	390 (23)	293 (20)	97 (34)	115 (29)	275 (21)

were operated on in 1 of 5 hospitals in Stockholm. The fractures were classified as either trochanteric or cervical fractures. The patients were mainly operated on with osteosynthesis, sliding screw-plate or screws. The mean age of the patients was 80 years (Table 1). All women and 95% of the men were 50 years of age or older. The annual incidence increased with age and was 392/10,000 for women aged 85 years or older (Table 2).

Direct costs

The direct costs identified are those for the orthopedic department, geriatric care, other acute hospital care, nursing home, home for the elderly, group living, and municipal home-help. Each cost item was quantified into days or hours during the year before and the year after the fracture. Data regarding days in orthopedic departments, geriatric care and other acute hospital care were extracted from the inpatient database of the Stockholm county council, while data regarding days in a nursing home, home for the elderly, group living, and hours of municipal home-help were extracted from the municipality's database. The quantified costs were then multiplied by the average unit costs (Table 3). The average unit costs include both variable and fixed costs. The average unit costs concerning orthopedic care and other acute hospital care were extracted from the Huddinge University Hospital patient-related accounting system, while the average unit cost for geriatric care was calculated by the geriatric department at Huddinge Hospital. The average unit costs for nursing home, home for the elderly, group living, and municipal home-help were collected from the social welfare authority.

Statistics

Mean values within samples were compared by using two-tailed paired t-tests. The paired t-tests assume normality of differences. When testing for normality, we used the Kolmogorov-Smirnov (KS) test. If normality was rejected by the KS-test, we tested for equality of means by the non-parametric Wilcoxon matched-pairs signed-rank test. Mean values between samples were compared by means of the two-tailed independent-samples t-test. The independent t-test is of value for non-normality, if the hypothesis of equal

Table 2. Annual hip fracture incidence per 10,000 in the city of Stockholm 1992 in different age groups, men and women

	Men	Women	Total
50–64	9	10	10
65–74	29	40	36
75–84	85	173	143
85–	268	392	365

Table 3. Average unit costs (USD) 1994

Municipal home-help (USD/hours)	34
Home for the elderly (USD/day)	103
Group living (USD/day)	134
Nursing home (USD/day)	173
Orthopedics (USD/day)	648
Geriatrics (USD/day)	357
Other acute hospital care (USD/day)	661

Table 4. Type of costs, quantified into number of days or hours (n 1,709). Every cost item is presented as mean number of days except for municipal home-help which is registered as mean number of hours

	QCB	QCA	QCA–QCB
Initial stay in dept. of orthop. after hip fracture	0	11	11
Readmission to dept. of orthop. after hip fracture	0	2	2
Dept. of orthopedics before hip fracture	1	0	–1
Total stay in dept. of orthoped.	1	13	12
Geriatrics	4	27	23
Nursing home	25	48	23
Home for the elderly	0	3	3
Group living	0	2	2
Other acute hospital care	10	6	–4
Municipal home-help	198	186	–12

QCA Quantified costs during 1 year after a fracture
QCB Quantified costs during 1 year before a fracture

Table 5. Type of direct costs (USD) per patient during 1 year after and 1 year before a hip fracture (n 1,709)

	CB	CA	CA–CB
Initial stay in dept. of orthop. after hip fracture	0	7,026	7,026
Readmission to dept. of orthop. after hip fracture	0	1,518	1,518
Dept. of orthopedics before hip fracture	680	0	–680
Total stay in dept. of orthop.	680	8,544	7,864
Geriatrics	1,557	9,768	8,211
Nursing home	4,325	8,384	4,059
Home for the elderly	25	342	317
Group living	39	340	301
Other acute hospital care	6,805	4,133	–2,672
Municipal home-help	6,734	6,356	–378
Total	20,165	37,869	17,704

CA Costs during 1 year after a fracture
CB Costs during 1 year before a fracture

Table 6. Mean direct costs (USD) related to hip fractures corrected for mortality and divided according to residence before admission and gender

	Patients surviving the first year (n 1,319)	Admitted from own living (n 1,427)	Admitted from institution (n 282)	Men (n 390)	Women (n 1,319)
CB	17,285	13,176	55,529	19,087	20,483
CA	39,610	35,289	50,923	32,460	39,468
CA–CB	22,325	22,113	–4,606	13,373	18,985
P-values for CA-CB [a]	p=0.0000	p=0.0000	p=0.2	p=0.0000	p=0.0000

CA Direct costs during 1 year after a fracture
CB Direct costs during 1 year before a fracture
[a] P-values according to the non-parametric Wilcoxon matched-pairs signed-rank test

variances in the two samples cannot be rejected. Equality of variances was compared by means of an F-test (Newbold 1991). If equality of variances was rejected, the non-parametric Mann-Whitney test was used. Statistical significance at the 5% level was accepted.

Results

1 year after fracture the mean period in nursing homes amounted to 48 days. The mean hospitalization stay after an initial period in the department of orthopedics amounted to 11 days, while the mean number of days in orthopedics, also including days in the same department because of re-operations, were 13 days. The mean number of days in geriatrics was about twice as long as the mean number of days in orthopedics. During 1 year after a hip fracture, geriatrics was the dominating cost item, followed by the total stay in the department of orthopedics and nursing homes (Tables 4 and 5). These three together constituted 70% of the direct costs.

The direct costs during 1 year before and 1 year after a fracture were higher for women than for men ($p = 0.01$; $p = 0.0005$), which is partly explained by a higher mean age for women (Table 6). Another explanation of the higher post-fracture costs is that the mean survival time in days for women was higher than for men (314 days vs. 298 days, $p = 0.001$). The costs 1 year before fracture were higher for patients admitted from an institution than for patients admitted from independent living ($p = 0.0000$). Although the mean survival time in days is lower for patients admitted from institutional living, this group also had a higher post-fracture consumption than patients admitted from independent living ($p = 0.0000$). The difference in direct costs 1 year after and 1 year before fracture

Table 7. Age-distributed mean direct costs during 1 year after and 1 year before a hip fracture and potential cost savings for men and women surviving the year after fracture

	n	CB	CA	CA–CB	P-values for CA–CB [a]
50–64 years					
Men	36	11,181	20,436	9,255	0.0001
Women	47	13,552	25,242	11,690	0.0000
65–74 years					
Men	74	12,171	28,477	16,306	0.0000
Women	149	17,532	30,189	12,657	0.0000
75–84 years					
Men	103	18,148	38,030	19,882	0.0000
Women	494	17,314	39,618	22,304	0.0000
85– years					
Men	44	14,901	43,015	28,114	0.0000
Women	347	19,830	51,005	31,175	0.0000

CA Direct costs during 1 year after a fracture
CB Direct costs during 1 year before a fracture
[a] P-values according to the non-parametric Wilcoxon matched-pairs signed-rank test

was statistically significant except for the institutional group where the difference in costs was negative.

To estimate potential cost savings by avoiding a fracture, the direct costs related to hip fracture were calculated for patients surviving the first year after a fracture both for men and women in age-stratified groups (Table 7). The potential cost savings were lowest for men aged 50–64 years and highest for women aged 85 years or older. The mean cost savings in the entire morbidity group were USD 22,273. The potential cost savings increased with age both for men and women.

Discussion

We found that the orthopedic, geriatric, and other acute hospital care accounted for 59% of the direct costs during 1 year after a hip fracture, while the remaining 41% were referred to the municipality. These figures could be compared to those reported by Borgquist et al. (1991), who calculated the direct costs during 4 months after a hip fracture and showed that 59% of the costs had been incurred in the department of orthopedics and in acute hospital care while 40% had been incurred in different types of after-care (nursing home, old people's home, communal home-help, and convalescent home). The direct costs during 1 year after a hip fracture also consist of costs not directly generated by the fracture. It may be that a hip fracture patient, due to an increased fragility, increases his/her general level of health care consumption due for other reasons.

Further, we showed that the potential cost savings from preventing hip fractures are large. These cost savings would be overstated if they were estimated as the direct costs during 1 year after fracture. This is explained by a considerable consumption of resources mainly provided by other acute hospital care, municipal home-help, and nursing homes, without a fracture. The potential cost savings in the morbidity group, related to age and gender, ranged from USD 9,000 to USD 30,000. The extra hip fracture cost has been partially estimated by Sernbo and Johnell (1993) at USD 21,000, but their estimates are based on assumptions instead of real costs and are incomplete. The extra costs for patients dying in the year after fracture are more difficult to calculate. If it is assumed that the mortality risk is not affected by the fracture, the extra costs can be estimated by subtracting the costs before fracture for the same period as the patient survives after fracture. For example, if a woman died 3 months after the fracture, we should subtract the direct costs for 3 months before the fracture to obtain the extra costs. The extra costs are then estimated at USD 22,000, which is almost the same as in the survival group. On the other hand, if the mortality rate is increased by the fracture, the avoidance of fractures implies more costs for the health care system due to a longer survival. Whether these costs, due to a longer life, should be included or not, is controversial (Weinstein 1990).

The difference between direct costs during 1 year after and 1 year before fracture in the morbidity group, exceeded the difference in direct costs in the entire patient group by USD 4,621. These higher costs are partly explained by lower mean direct costs during the year before the fracture in the morbidity group as compared to the mortality group (USD 17,285 vs. USD 29,905). Patients who die in the year following a hip fracture thus have higher pre-fracture direct costs than survivors. A further explanation is that the follow-up time in the morbidity group is 1 year, while the mean follow-up time for patients in the mortality group is 126 days.

To calculate the potential cost savings from avoiding a fracture we ideally need information on the magnitude of the costs if the fracture had not occurred for each patient. One alternative to estimating the costs without a fracture is to look at costs for a matched patient sample (according to age, gender, residence etc.). Hip fracture patients belong to a particularly fragile group of patients (Sernbo 1988). If such a fragility component cannot be accounted for in a matched sample, this may imply that costs without a fracture are underestimated and that potential cost savings are overestimated. Using the patient as his/her own control it could be argued that the potential cost savings may be overestimated due to the fact that the patient is one year older when calculating the direct costs during 1 year after the hip fracture. To test for this, the cost of a hip fracture in the patient group that survived the first year after the fracture was also further corrected for the age factor. When taking this into account, the extra hip fracture cost should be adjusted downwards by about USD 250, assuming a linear relationship between costs 1 year before fracture and age.

Due to limitations in the data it was not possible to include all relevant societal costs in the analysis. For example, no outpatient data are available in the study. However, according to Borgquist et al. (1991), the outpatient cost (in primary health care) is a relatively small part of the direct costs of hip fracture, amounting to about 1% of the direct costs during 4 months after a hip fracture. If this result is applied to our study, the primary health care cost during the year after a hip fracture would amount to about USD 400. Further, no data on the period of sick leave are available for the patients, which implies that no indirect costs could be calculated. The percentage of patients in the age group 20–64 years old amounted to 7% (n 116), and for these patients indirect costs should, if possible, be included (Drummond et al. 1987).

The costs were considered to be as average costs, including both variable and fixed costs. It is important also to include the fixed costs in a long-term perspective, because in the long run if fractures are prevented, for example, it may be possible to reduce the number of hospital beds. In the long run also, the fixed costs become variable, and thus, in a long-term perspective, both fixed and variable costs are included to reflect the costs associated with hip fractures. Finally, the average costs for orthopedic care, other acute hospital care, and geriatric care are extracted from Huddinge Hospital records. The reason for not using cost estimates from each hospital is the lack of data and that Huddinge was the only hospital with a patient-related accounting system at the time.

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