Chapter 2.

Hip fracture in the elderly: epidemiology and rehabilitation. A review.

Abstract

BACKGROUND: The number of elderly hip fracture patients is growing in Western countries.
OBJECTIVE: To review the epidemiological impact and coping strategies.
METHODS: We undertook a Medline search for English-language articles published from 1980 to 2000. To identify additional studies, we searched the reference lists of the selected articles.
RESULTS: The majority of fractures in western countries occur in females over 60 years and more than half of the patients are over 80 years old. 20-40% of patients are already institutionalised before fracture and the average number of concomitant illnesses ranges from 1,1 to 2,5 per patient. The prognosis in regard to survival and recovery of function remains poor: mortality at 6 months ranges from 16% to 28% and at 1 year from 22% to 37%; only 40-60% of surviving patients recover to pre-fracture walking ability and less than 30% reach the same level of activities of daily living as before fracture.
Joint orthopedic-geriatric rehabilitation programs have led to a shorter stay in the acute hospital, modest short-term improvement of function, and earlier return to pre-fracture residence. Earlier discharge from the hospital and continuation of rehabilitation in another institution did not result in better recovery in the majority of studies. Moreover, there is a danger of more patients remaining in nursing homes or other facilities. The best results were achieved by earlier discharge from the hospital to home with additional services at home (UK and Sweden). However, this was only possible for a subgroup of patients. A modest reduction of costs per patient has been suggested by earlier discharge to home. Until now, rehabilitation programs have not achieved long-term improvement of mortality and function.
CONCLUSION: In western countries, rehabilitation programs have reduced average hospital stay of hip fracture patients but have not achieved long term improvement of the still poor prognosis on survival and recovery of function.

2.1 Introduction

The incidence of hip fractures has been increasing over the last decades and is expected to increase in the near future. It is unlikely that efforts to prevent these injuries will have a substantial effect in the near future. Therefore, hip fracture patients will increasingly need orthopedic, surgical and rehabilitation beds. Increased numbers and cost considerations have pressed hospital administrators to shorten the hospital stay of hip fracture patients. Rehabilitation programs have been developed with an additional aim: improvement of outcome. However, length of hospital stay and organisation of care after hospital discharge differ between countries. This review paper focuses on the elderly hip fracture patient (in western countries) and addresses the following questions:

- Has the incidence of hip fractures increased the last decades?
- What types of fractures can be distinguished?
- What patient characteristics are associated with hip fracture?
- What is the current outcome after hip fracture on recovery of function and quality of life, complications, and mortality?
- What are the effects of the reduction of hospital stay on discharge destination and residence?
- Do rehabilitation programs and other changes of care improve the outcome in regard to survival and recovery of function?
- What are the costs of care after hip fracture?

2.2 Methods

We undertook a Medline search for English-language articles published from 1980 to 2000 using the terms: hip fracture in combination with aged, aged 80 years and over, rehabilitation, costs and cost analysis. To identify additional studies, we searched the reference lists of the selected articles. Studies were summarized qualitatively, without attempting a formal meta-analysis.

2.3 Results

Incidence of hip fracture

In 1990 there were an estimated 1,66 million hip fractures worldwide, approximately 1.197.000 in women and a further 463.000 in men.[1] Because of demographic

changes the number of hip fractures is expected to increase to 6,26 million in 2050.[2] The incidence rises with age and women have a higher incidence than men (See for example the incidence in the Netherlands in 1999, Fig 1).
Half of the fractures in 1990 occurred in Europe and North America and the highest age-adjusted hip fracture incidence rates for the elderly population (generally > 6 per 1000) were reported in Norway, Sweden, Denmark, the US and Canada.[3] The crude incidence rate in many developed countries is rising. This cannot only be attributed to simple population ageing; there is also evidence of an increase in age-specific incidence rates. In Oxford, UK, for instance, the number of hip fractures had doubled between 1958 and 1983 - more than could be accounted for by the rising number of elderly people in the population.[4] In an analysis based on 20.538 hip fractures in Stockholm County, Sweden, in the period 1972-1981, the incidence was found to double in 7 years for men and in 5.6 years for women.[5] Interestingly, recent reports from Sweden and the United States show a stabilising age-specific incidence.[6,7]

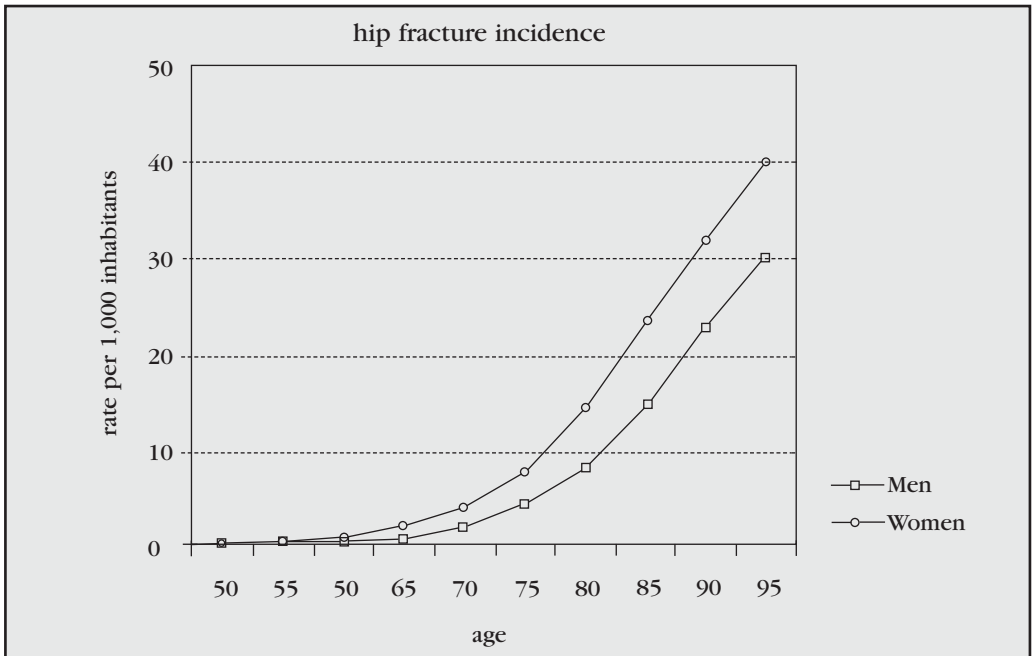

Figure 1. Incidence of hip fractures in the Netherlands, 1999

Epidemiological studies from North America have estimated the lifetime risk of hip fracture to be 17,5% for 50-year-old white women and 6% for men.[2] Fracture rates, however, are higher in the US and Scandinavia than in the UK and most of central

Europe. The age-adjusted incidence varies greatly between European countries; amongst women there is an 11-fold range in apparent incidence and a 7-fold range among men between the various countries. The highest incidence was found in the northern part of Europe and the lowest in the Mediterranean area.[8] Moreover, significant differences in incidence rates were found between districts in 1 country (Sweden).[9]

Differences in bone mass between races (for instance higher bone mass was found in blacks and hispanics) could partly explain the differences in incidence of hip fractures. Other hypothesized reasons are: variations in level of physical activity, diet, neuromuscular functioning, medication use, frequency of falls, and orientation of falls.[3]

Established risk factors for hip fracture (in women) are low bone density, history of falls, direction of fall (on hip), neuromuscular impairment, high age, low weight, white race, and non-use of hormone replacement therapy.[3] Cummings[10] reported that the incidence of hip fractures differed from 1,1 per 1.000 years in women with no more than 2 risk factors and a bone density that was normal for their age to 27 per 1.000 years in women with 5 or more risk factors and an abnormal bone density. Also of interest are racial and ethnic differences with respect to the female:male ratio of hip fracture incidence rate. Among white populations, this ratio usually exceeds 2 over the age of 50 years. There is a progressive decrease in the female: male incidence rate when moving from northern to southern Europe. The reasons for these differences are uncertain.[11]

Maintaining body weight, walking for exercise, avoiding long-acting benzodiazepines, minimizing caffeine intake, and treating impaired vision are among the steps that may decrease the risk. [11]

The average age of patients with hip fractures in developed countries ranges from 78 to 84 years in most studies. In a large study in the UK (1986-1997) the average age was 79 years and 78% was female.[12] In Sweden, 1990, the majority of hip fractures (70-80%) occurred in females over 60 years of age and more than half of the patients were over 80 years old.[13]

The incidence of hip fracture is far more frequent (adjusted for age and sex) among patients living in an institution compared to those living at home. This was found in the Netherlands,[14] New Zealand,[15,16] and the United States.[11,17]

In the Netherlands, incidence figures are comparable. The frequency of hospital

admissions rose from 26,6 per 100.000 in 1967 to 46 per 100.000 in 1979 for men and from 67,7 to 93 per 100.000 for women. This increase manifested itself mostly in the age group of 50 years and older. The number of hospital admissions due to hip fracture in women and men aged 65 years and older more than doubled (respectively from 3416 to 8075 and from 1167 to 2285) between 1972 and 1987.[18] The annual number of hip fractures in the Netherlands is expected to increase to 22.500 in 2010 and more than 30.000 in 2050.[19]

Types of fracture

Hip fractures may be divided into 3 types: femoral neck (cervical), trochanteric, and subtrochanteric. The first 2 account for 97% of hip fractures and are seen with approximately equal frequency. Subtrochanteric fractures are rarely seen in the elderly because they are more likely to occur after high-energy trauma.[20]
The proportion of trochanteric fractures increases with age.[7,21] This has public health implications since mortality, morbidity, and costs of trochanteric fractures are higher than those of cervical fractures.[22,23] Patients with cervical fractures are of lower average age, more mobile, less likely to use walking aids or live in residential accommodation; they also have considerable shorter length of hospital stay than for those patients with trochanteric fractures.[24]
Two consecutive series of hospital admitted hip fracture patients in the Netherlands [25,26] showed (in 1989-1990) a slight preponderance of cervical fractures (60%) but this is likely to change in the next decades.

Patients characteristics: comorbidity

The assessment of the number and nature of concurrent medical diagnoses at hospital admission is not easy because various definitions and classifications are used in different studies. For a few diagnoses, however, agreement exists about their prevalence (Table 1): pulmonary disease (COPD) ranges from 12% to 24% of patients, diabetes mellitus from 12% to 16%, and dementia from 15% to 22%. Hip fracture is associated with both Alzheimer's disease and vascular dementia in women over 85 years, probably because these patients have a defective neuromuscular regulation, gait apraxia, and use more antidepressants.[35]
The proportion of patients with at least one comorbid condition ranges from 50% [31] to 80% [36, 37] and the average number of concomitant illnesses per patient from 1,1[38] to 2,5.[32]

Table 1.
Comorbidity at hospital admission.

Diagnosis	Study 1 N=493	Study 2 N=767	Study 3 N=138	Study 4 N=1880	Study 5 N=3053	Study 6 N=406	Study 7 N=674	Study 8 N=215
Cardiovascular	26%			30%	8%			43%
Myocardial disease		44%	50%			61%	12%	
Hypertension		26%				21%	45%	
Heart failure							12%	
Thrombo-embolic						3%		
Vascular disorders		13%					2%	
Cerebrovacular Accid.			12%		6%		11%	
Pulmonary								14%
COPD	13%	24%	12%			21%	18%	
Metabolic								
Diabetes Mellitus	14%	12%				16%	12%	14%
Anemia							13%	
Muskuloskeletal				30%				
Osteoarthritis		15%				7%	30%	
Rheumatoid arthritis					2%			
Previous hip fracture							9%	
Neurologic-psychiatric		58%		12%		35%		23%
Dementia	20%		22%		17%		15%	
M Parkinson					3%		7%	
Other	17%				3%			
Gastrointestinal						11%	29%	29%
Urologic						9%		
Malignities		7%				6%	14%	

Study 1 : Boereboom et al. 1990 [27]
Study 2 : Broos et al. 1990 [28]
Study 3 : Farnworth et al. 1994 [29]
Study 4* : Hoenig et al. 1997 [30]
Study 5 : Holmberg and Thorngren 1985 [31]
Study 6 : Kenzora et al. 1984 [32]
Study 7* : Magaziner et al. 2000 [33]
Study 8 : Koot et al. 1997 [34]
* : only community dwelling patients

It is not clear, whether these comorbidity rates differ from those in a population with a comparable age and sex distribution. Sartoretti [39] compared the comorbidity

rate of patients with femoral fractures with patients admitted with proximal humeral fractures and found statistically higher rates in the femoral fracture patients. Wolinsky [40] reported that hip fracture patients were significantly more likely than control subjects to be older, female and white, to live alone and to have fractured a hip previously. They were also more likely not to have diabetes, to have more difficulties with activities of daily living, to have more lower body limitations, and to have been hospitalized in the year prior to the hip fracture. No differences were found however, in the occurrence of other comorbid conditions such as cardiopulmonary disorders, dementia, or osteoarthritis.
Elliot et al. [41] compared elderly patients with proximal femoral fractures with a normal elderly population and found reduced bone mineral density, lower body mass index, reduced mobility, more previous fractures, but no difference in mental status.

Outcome: function and quality of life

Recovery in physical functioning occurs in the first 4-6 months after hip fracture [20, 42-44] with little gain after 6 months. Recovery in social functioning continues up to 1 year after hip fracture.[33] A substantial portion of surviving patients does not reach the level of pre-fracture functioning. In a comparative study of Swedish and Dutch hip fracture patients, approximately one fifth of all patients regarded their walking ability at 4 months after the fracture to be as good as before.[25] Other authors reported walking ability recovery in 40-60% of patients at 1 year (Table 2). Study results of the recovery in activities of daily living differ, probably because different methods of measurement were used. When measured with well-known and validated instruments such as the Barthel Index or Frenchay Activities Index, 21- 27 % of patients regained the same level of physical independence as before fracture, in concordance with the regain in walking ability (Table 2).
The most important predictive factors for further reduced function after hip fracture reported in several studies are higher age and reduced physical function or walking ability before fracture. [25,36,48,50,52-60] Other reported predictors were: type of fracture (trochanteric),[28,48,53,58] reduced cognitive function, [46,50,51,56-58,60-62] social support before fracture, [46,50,59] comorbidities,[55,60] and depression.[56,57]
Koval et al.[55] found that patients who had three or more comorbidities were more likely to regain their pre-fracture level of functioning at follow-up in contrast with other studies that reported a negative association between reduced general medical

Table 2.
Recovery in walking ability and basic or instrumental activities of daily living (BADL and IADL)

Study	N =	Walking ability recovery	BADL recovery	IADL recovery
Berglund-Roden et al 1994 [25]	1115	20% (4 m)		
Borgquist et al 1990 [42]	298	59% (4 m)	86% (4 m)	75% (4 m)
Cameron et al 1993 [45]	252		27% (4 m) (Barthel Index)	
Cummings et al 1988 [46]	92	65% (6 m)	24% (6 m)	
Jalovaara et al 1992 [47]	788	20% (4 m)	76% (4 m)	
Jette et al 1987 [48]	80	53% (1 yr)	33% (1 yr) (Frenchay Activities Index)	21% (1 yr) (FAI index)
Keene et al 1993 [23]	1000	46% (1 yr)		
Koot et al 2000 [26]	215	36% (4 m) 39% (1 yr)	28% (4 m) 24% (1 yr) (Barthel Index)	
Koval et al 1998 [49]	451	19% (3 m) 36% (6 m) 43% (1 yr)	51% (3 m) 70% (6 m) 72% (1 yr)	32% (3 m) 42% (6 m) 44% (1 yr)
Koval et al 1995 [36]	336	41% (1 yr)		
Magaziner et al 2000 [33]	674		<50% (Functional Status Index)	< 50%
Magaziner et al 1990 [50]	536	40% (2 m) 60% (6 m) 60% (1yr)	25% (2 m) 45% (6 m) 46% (1 yr) (OARS*)	18% (2 m) 29% (6 m) 30% (1 yr)
Mossey et al 1989 [51]	211		28% (1 yr) (Multi Level Assessment instrument)	

* OARS : Older American Resources and Services Instrument

condition [42,63] and recovery of function. The authors attributed this surprising result to the restriction of their study to previously independent elderly people. This illustrates the importance of describing the exact case-mix of the studied population in order to compare results of studies.

Because of the profound influence of hip fracture on mortality and functional sta-

tus, it might be expected that other dimensions of quality of life such as emotional reactions and pain sensation would also be affected. However, few studies reported these quality of life dimensions as outcome. A comparison with quality of life before fracture is difficult, because it is not possible to measure the quality of life retrospectively with generic health-related quality of life instruments such as the Nottingham Health Profile (NHP) or Short Form-36 (SF-36).[64, 67]

Borgquist et al. [64] reported the scores on the NHP of patients 6 months after hip fracture and found that the impact of the hip fracture was most obvious in the sections likely to be affected by a fracture, i.e. physical mobility and pain. The authors questioned the additional value of the NHP to functional status measures. Feldt et al.[65] reported that one third of the hip fracture patients rated pain (as assessed with the Checklist of Nonverbal Pain Indicators) as severe between 2 and 5 days postoperatively and concluded that pain was not treated effectively in older postoperative patients. In a retrospective study of 287 patients, 1,5-5 years after treatment, Leung et al.[66] reported that 56% were totally pain-free while 15% had varying degrees of hip pain.
Finally, in a case-control study, Randell et al.[67] found that health-related quality of life, measured by the SF-36 or the revised Osteoporosis Assessment Questionnaire (OPAQ2), remained stable in controls. Hip fracture patients however, had a significant reduction in health-related quality of life at 12 weeks after fracture in the SF-36 domains physical function, vitality, and social function and in the OPAQ2 domains physical function, social activity, and general health. A similar study in Australia reported that an age and gender matched control group had a higher perception of their quality of life in all domains of the SF-36.[68]

Outcome: complications after surgery

Complications after surgery for hip fracture are classified as local-surgical or general-medical. Local-surgical complications such as wound infection and wound hemorrhage, occur mostly when patients are still hospitalized and occur in 2%-7%.[27,37,69,70] The assessment of orthopedic complications such as non-union (6% in nondisplaced femoral neck fractures, 14-35% in displaced femoral neck fractures, and < 10% in trochanteric fractures), avascular necrosis (16% in nondisplaced and 35% in displaced femoral fractures fractures), and dislocation, requires longer follow-up, with a minimum of 2 years.[20,71] The literature on these specific complications

in relation to used surgical techniques and type of fracture is abundant. [72] A detailed discussion is beyond the scope of this review.

Whereas local complications are obviously connected with the preceding surgery, this is not always clear with general-medical problems in the period after surgery. Urinary tract infection for instance, will also occur in an elderly population without preceding hip fracture. The incidence of bacteriuria in the elderly population has been investigated extensively, with rates in females of 18%.[73] However, some medical complications occur more often in hip fracture patients than in controls. Pressure ulcers for instance, were found in 30% of patients operated on for hip fracture and in 4% in patients with total hip replacement.[74]

Serious in-hospital complications such as deep venous thrombosis, pulmonary embolism, myocardial infarction, and cerebrovascular accident, are reported to occur in 1-2% of patients.[27,69,75,76] Because patients also die after hospital discharge (5-14 % in-hospital mortality and 20-30 % mortality within 1 year), these serious complications undoubtedly also occur after hospital discharge. However, few studies report the incidence of general medical complications with follow-up after the hospital admission period. Complications that do not lead to re-hospitalization (urinary tract infection, pressure ulcers) particularly escape attention.

In a review, Obrant [75] reports the incidence of postoperative complications to be 13% for urinary tract infections, 12% for pressure ulcers en 9% for pneumonia. Transient confusion and delirium were found to be very common (20-50%),[38,46,77] but were often not mentioned in papers reporting post-operative complications. Only one study was found with a follow-up of two years,[78] which reported total incidence of pressure sores of 31%, pulmonary infections 22%, and urinary tract infections 18%.
The occurrence of urinary tract infections was found to be related to higher age,[73,78] female sex,[78,79] and pre-fracture medical condition.[79] The occurrence of pulmonary infection was found to be related to male gender.[78,80] The occurrence of pressure ulcers was found to be related to male gender,[5] higher age,[78,80] and pre-fracture need for assistance with daily living or pre-fracture living in an institution.[78,80] Overall, an increased rate of complications was associated with pre-existing comorbid conditions, [39] cognitive status before fracture,[81, 82] and pre-fracture status in activities of daily living.[80]

Outcome: mortality after surgery

Mortality following hip fracture has been extensively studied. The in-hospital mortality ranges from 5 to 14%.[18,83-87] In the Netherlands, the in-hospital mortality rates decreased by 25% for men (from 14,6% to 10,1%) and by 33% for women (from 14,4% to 9,5%) between 1967 and 1979.[18] Hospital mortality rates depend to a large extent on the length of hospital stay. In the US for instance, patients stay for a relatively short period in hospital resulting in an in-hospital mortality of 4,9% in a national sample of Medicare patients (1986-89).[85]

Table 3.
Mortality after hip fracture

Study	N =	1 month	3-4 months	6 months	1 year	2-5 years
Broos et al. 1990 [28]	767	11%	24% (3 m)			
Parker et al. 2000 [12]	2846	7% (1997) 21% (1986)	15% (1997- 4 m) 35% (1986- 4 m)			
Shepherd et al.1996 [88]	337	7%		20%	29%	
Holmberg et al. 1987 [31]	3053		12% (3 m)	16%	22%	53% (5 yr)
Koot et al. 2000 [26]	215		18% (4 m)			
Todd et al. 1995 [37]	580		18% (3 m)			
Keene et al. 1993 [23]	1000			28%	33%	
Marottoli et al.1994 [89] (non institutionalized)	120			18%		
Pitto et al.1994 [86]	143			23%		46% (5 yr)
Weatherall 1994 [90]	182			16%	28%	
Miller 1978 [91]	360				27%	
Ray et al.1990 [92]	4368				24%	
Whithey et al. 1995 [87]	492				27%	
Baudoin et al. 1996 [78]	1459					39% (2 yr)
Tjeenk et al. 1998 [93]	117					55% (5 yr)
Jensen et Bagger 1982 [94]	518					35% (2 yr)

Mortality rates at fixed time periods after fracture are more easily comparable between studies. Mortality at 1 month ranges from 7% to 11%, at 3 months from 12% to 24%, at 6 months from 16% to 28%, and at 1 year from 22% to 37%. At 2 years postoperatively, only 60-65% are still alive and this proportion decreases to around

50% at 5 years (Table 3).

Several authors reported that the mortality risk is high within the first six to eight months after which the death rates approach expected rates for the general population.[40,86,91,93,95] Several predictive factors of increased mortality have been identified. Most authors agree that mortality increases with age,[27,28,37,53,59,78,85,,92,96,97] especially over 85 years.[84,86,95,98,99] Keene (UK,1989-92) [23] found that mortality at 1 year was lowest in patients under 60 years old (3%) and that it rose steadily to 51% among the nonagenerians. According to most studies, men who sustain a hip fracture have a higher mortality rate than women.[28,37,78,84,85,87,91,92,95,96,100] Boereboom et al. (1992) [27] reported a 1 year mortality of 24% in women and 33% mortality in men in a study of 493 consecutive patients in the Netherlands (4 year mortality: 45% respectively 55%).

A medical history of associated diseases (comorbidity) increases the risk of dying.[10,27,32,53,83,85,86,89,101] Svensson [60] found the 1 year mortality to be 0% for patients (n = 56) with no other diagnoses than the hip fracture, 14% when 1 or 2 additional conditions were present (n =125), and 24% with 3 or more additional diagnoses (n= 51). Cognitively impaired patients have an especially higher mortality rate.[24,53,86,87,89,96,101-103,104,105] Huusko et al [106] found a 1 year mortality rate of 28% for severely demented patients, 17% for moderately demented patients and 10% for mildly demented patients (pre-fracture institutionalized patients were excluded). Van Dortmont et al [61,107] reported a 4 month mortality of 12% for mentally normal and 33% for mentally impaired patients. A poor pre-fracture functional status [37,98,103,108,109] or reduced mobility at hospital admission [97,104] also was found to increase mortality. Parker [110] reported a mobility score on admission to have the greatest predictive value. Institutionalization before fracture is related to higher comorbidity and poorer pre-fracture functional status, and several authors found pre-fracture institutionalization to be predictive for mortality.[85,89,90,97,100,109] Holmberg et al [31] reported mortality to be 3 times higher for pre-fracture institutionalized patients. Koval [111] questioned the survival-benefit of an operation for elderly patients with several risk factors such as multiple medical comorbidities, dementia and institutionalization.

It is not surprising that the occurrence of complications [27,89,98,101] especially wound infection,[84] delirium,[95] pressure ulcers,[86] urinary tract infection,[86] and cardiopulmonary failure [39] increase the likelihood of mortality. A not so obvious predictor is delayed surgery after hospital admission.[30,32,84,86,109,112,114]. Finally,

trochanteric fractures have a worse prognosis than cervical fractures.[23,85]
The principal causes of death after surgery for hip fracture are bronchopneumonia, cardiac failure, myocardial infarction, pulmonary embolism, and stroke.[39,83,86,87,91,115] Because hip fracture is often the manifestation of a patients' deteriorating physical and mental state, it is frequently not possible to determine to what extent the hip fracture contributed to the death of the patient. In an attempt to assess this aspect, Parker and Anand [116] reviewed case notes, X-rays, post mortem results and the causes of death as entered on the death certificate of 709 patients of whom 37% had died in one year. For 9% of these patients the hip fracture was thought to have directly contributed to death. For 16% of patients, death was related to the hip fracture and for 12 % of patients death was totally unrelated to the hip fracture. The authors estimated the hip fracture attributable mortality as 15% in one year.

Residence before fracture, length of stay, and discharge destination.

We further reviewed how different countries cope with increasing numbers of hip fracture patients and the increasing demand on surgical/orthopedic beds in hospital. The focus is on Sweden, UK, US, and the Netherlands, since most literature is from these countries (Table 4).

Sweden
In Sweden, in 1966, 80% of hip fracture patients were admitted from their own homes, which gradually decreased to 50- 60% in 1982. [117] In the last decade approximately 15-20% of patients were admitted from institutions such as geriatric hospitals and nursing homes and another 15-20% from old people homes.[9,25,42,47,118] In comparison with age and sex matched controls, two thirds of hip fracture patients and over 80% of controls lived in their own homes.[119] The overall mean length of stay in the Lund University hospital decreased from 44 days in 1966 to 27 days in 1972 and 16 days in 1982. [63,120,121] In 1992, hospital stay in the orthopedic department in Stockholm was 11days.[118] This shorter stay was achieved after a change in the reimbursement system encouraging early discharge.[122]

Despite reduced hospital stay, the proportion of patients who could be discharged back home increased from 50% in 1970-1980 [63,123] to 60-70% in 1980-1990.[9,47,59,69] Due to a special home rehabilitation program, 80% of patients who were admitted from their homes were discharged back home in Lund (1982).[117,121] Most patients

Table 4:
Residence before fracture, length of stay, and discharge destination.

Study	year	N	Average stay in hospital (all patients)	% of patients coming from home	% discharged home of those coming from home
Sweden					
Ceder et al 1986	1966	76	44 days	80%	44%
	1972	94	26 days	67%	60%
	1977	135	22 days	70%	80%
	1981	121	16 days	56%	75%
	1982	157	16 days	51%	57%
Berglund-Rödén et al 1994	1989-90	605	18 days	62%	66%
Jalovaara et al 1992	1989	620	18 days	64%	65%
Zethraeus et al 1997	1992	1709	11 days	84%	48%
Holmberg & Thorngren	1975-77	3053		79%	36%
1985					
UK					
Parker et al 2000	1986	70	44 days	74%	50%
	1991	240	26 days	74%	67%
	1997	299	21 days	74%	86%
Keene et al 1993	1989-92	972		73%	
Hollingworth et al 1993	1987-91	1080	35 days	71%	
Fox et al 1993		335	22 days	66%	63%
Parker et al 1998	1990-91	580	29 days	75%	
Fox et al 1994	1990-91	142	31 days		84%
US					
Hoenig et al	1981-1986	2762		79%	50%
Marottoli et al 1994	1982	120		82%	58%
Gerety et al 1989	1982-86	180	11 days	85%	27%
Fitzgerald et al 1988*	1981	149	22 days*		62%
	1986	189	13 days*		40%
Palmer et al 1989*	1981	190	17 days		45%
	1987	196	13 days		45%
Netherlands					
Swiertra et al 1994	1989-90	378	33 days	56%	65%
Van Vugt et al 1994	1991-93	156	24 days *	62%	61%
De Laet et al 1996	1993	15107	26 days	60%	60%

* only patients coming from home

who cannot be discharged home, are rehabilitated in rehabilitation units, geriatric departments,[117,123,124] nursing homes or convalescent homes.[47] In Stockholm the mean stay in the geriatric department in 1992 was 23 days which resulted in a total institutional stay of 34 days (11 days in an acute hospital).[118] Approximately 80% of patients who came from home were back home at 4 months after fracture.[9,42,121,124,125] Of all patients admitted to Stockholm hospitals in 1992, 58% were at home, 19 % in an institution and 23% had died at 1 year after fracture.[118]

UK

In the UK (1982-1997), 70-75% of all patients with hip fracture are admitted to the hospital from home, about 15% from a residential home and the rest from nursing homes and long-stay hospitals.[12,23,58,126] Patients stay for a relatively long period (average 30 days) in hospital [71,127-129] because the recovery and rehabilitation takes place in the hospital on orthogeriatric or rehabilitation wards.[130] The stay on an orthopedic ward is 16-21 days (1988-1998).[129,131] After the introduction of a designated hip fracture service, which consisted of a "hip fracture ward" and team management, the mean length of hospital stay in Peterborough was reduced from 51 days in 1986 to 21 days in 1997.[12] Large differences (median 13-28 days) are possible in the duration of stay between hospitals.[129]
75% to 80% of patients are discharged from hospital back home.[12,84,128,130] In Peterborough the proportion of patients discharged directly home increased from 50% to 86% between 1986 and 1997.

A prospective study of 470 patients admitted from home to the same Peterborough hospital revealed that at 1 year 65% of patients were living at home, 10% had died during the primary hospital admission, 12% died after discharge from hospital, and a further 14% required residential or nursing home accommodation.[132]

US

Approximately 20% of patients admitted to hospitals (1982-86) with hip fracture received already nursing home care before fracture.[30,89,133] The length of stay in hospital was affected strongly by the introduction of the Prospective Payment System in 1984. Several authors reported a decrease in length of stay after 1984.[127,134-136] The national average length of hospital stay was 15 days in 1987, 13,5 days in 1988 and 11,9 days in 1992 [137] while before 1984 average stays of 18-22 days were reported.[48,138] Less than half of patients coming from home were dis-

charged directly home from hospital; the majority were rehabilitated in Skilled Nursing Facilities (nursing homes) or other sub-acute rehabilitation facilities. In a recent (1993-1995) study of elderly (> 65 years) non-demented, hip fracture patients living in the community, 66% were discharged to a sub-acute rehabilitation facility (including skilled nursing facilities) after a median stay of 9 days in hospital. They remained there with an average length of stay of 41 days.[139] Fitzgerald et al [134,140] expressed their concerns about an increasing proportion (38% before and 60% after) of patients being discharged to nursing homes and remaining there at 1 year (9% before and 33% after) after the implementation of the Prospective Payment System (1981-1985). However, Palmer et al (1981-1987) and Ray et al (1981-1986) found no differences: at 6 months the proportion of patients remaining in the nursing home was 20-25% with no differences after the implementation of the Prospective Payment System.[92,135]
Overall, at 6 months to 1year after hip fracture 65-75% of surviving patients were back at home or in residential care and 25-30% were still in the nursing home.[48,89,92,133,135,138,142,143]

the Netherlands
Approximately 60% of hip fracture patients admitted to Dutch hospitals come from home, 25% from old people homes and 15% from nursing homes. [34,144,145] The average length of hospital stay was in 1987-1990 more than 30 days, in 1994-1996 26 days and in 1998 23 days.[19,144] The decrease is probably because of more frequent and earlier discharge to nursing homes .The length of stay is related to the discharge destination. Van Vught reported the stay to be 14 days for patients coming from home and discharged home, 24 days for patients discharged to a somatic nursing home and 62 days for patients discharged to a psychogeriatric nursing home.[145]

60% of patients coming from home were discharged back home and the others to old people homes (7%) and nursing homes (26%); 7% died in hospital. [145,146] Of those discharged to nursing homes, 70% were back home within 3 months with an average stay in the nursing home of 42 days.[147] Of surviving patients coming from home 85% were back home or at a home for the elderly at 4 months.[148]

Other countries
A study in *Belgium* of patients, admitted from 1978 –1988 with hip fracture, reported that at 3 months, 60% were at home, 22% were in a nursing home and 18% were

dead. The average stay in the orthopedic department was 13 days.[28] In *Finland* only 50% of patients lived at home before fracture, 30% in an old people home and 20% in various other institutions.[47] The average length of hospital stay in Finland dropped from 18 to 5 days in the last decade and the proportion of patients discharged to home diminished from 22% to only 7%. The rest was discharged to local health centre hospitals for rehabilitation.[107,149] In *Switzerland* (1994), pre-fracture residence was 23% in a nursing home, 12% in old people homes and 66 % at home. The average length of stay was 30 days.[39] A study from *Japan* reported that 75% of patients came from institutions and 70% were not discharged from hospital after surgery.[103] Another large study found a mean length of stay of 67 days with an 81% discharge to pre-fracture residence.[150] In *Denmark* the length of stay diminished from 32 days to 21 days from 1970 to1985.[151,152] 26% were living in a nursing home before fracture and only 21% were discharged to their own home.[94] The rest were discharged to convalescent homes and rehabilitation clinics. In *Australia* (1990) and *New Zealand* (1991) lengths of hospital stay of 20-28 days have been reported.[29,45,90,153]

Predictors of length of hospital stay and discharge back home

The length of hospital stay increases with age,[17,19,28,90,129,131] and men stay longer than women.[130] Patients with trochanteric fractures stay longer than those with cervical fractures.[23,42,90,154] Complications such as pressure sores and wound infection[15,128] also prolong the stay.

The discharge back home is associated with better orientation and mental status,[20,60,82,100,116] younger age,[58,102,111,145] ability to bathe independently, family involvement,[59,111,121,143] ability to ambulate and transfer independently before fracture and in hospital,[58,102,111,121,143,148] incontinence,[143] and greater number of physical therapy hours.[138] Before fracture ability to visit friends and to shop also are positive factors for returning home[120,155] as well as the general medical condition before fracture[58,120,121,52,141,145,148] and the development of complications such as pressure sores.[139]

Fitzgerald[142] found 3 care-related factors associated with return to the community at 1 year: discharge to a nursing home with a large ratio of annual admissions to beds; achieving any in-hospital ambulation; and receiving conventional Medicare insurance.

Steiner [143] identified 4 risk factors as most important for institutionalization: being unmarried; incontinence; dependence in ambulation; and cognitive impairment.

Rehabilitation programs

After hospital admission and surgery a patient with a hip fracture is likely to encounter at least one after-care system. According to Parker [72] these are: "traditional" postoperative care on a surgical or orthopaedic ward until discharged when judged able to cope at home, or returned to, or accepted into, residential, nursing or other long-term care; the orthogeriatric unit concept; other forms of geriatric after care; and early discharge and home rehabilitation, utilizing augmented community support services.

Traditional care

When traditional care methods are employed, relatively healthy patients are likely to be discharged home without much delay but more complicated patients will stay long in the hospital without access to special rehabilitation facilities. In a study that analyzed stages of care in hospital stay for fractured neck of femur, several stages of care were identified.[156] Of the patient-days of acute hospital care, 10% were spent while awaiting surgery, 3% while being made fit for surgery, 51% while recovering from surgery without complications and 28% while awaiting discharge after medical and surgical care. This not only adversely affects the rehabilitation possibilities of patients but also blocks surgical and orthopedic beds. Several authors stress the fact that hip fracture patients occupy a substantial part of orthopedic beds (up to 25%).[48,124,126,145,151,157,158] If the length of hospital stay had not been reduced in the past decades, all now available surgical and orthopedic bed would be occupied by hip fracture patients.[117]

Orthogeriatric unit

The concept of an orthogeriatric unit has been advocated since the 1960's in the UK. Although not specifically set up for hip fracture patients this group of patients was always predominant. The design of such a unit was described by Boyd et al [159] The medical staff consisted of a full-time senior house officer in geriatrics with a geriatrician and orthopedic surgeon on consultant basis. The medical, nursing and paramedical staff works on a multi-disciplinary basis and discharges were planned at a weekly conference. The average length of hospital stay for hip fracture patients was reduced from 66 days in 1971 before the unit was opened to 48 days in 1979.

In a randomized controlled trial of two management regimes (allocation of hip fracture patients to orthopedic geriatric unit or orthopedic wards) no difference was found in length of stay, mortality, or destination on discharge (Glasgow, UK 1984-86)(Table 5).[130] A similar study in the UK (1990) showed a reduction in length of stay of 9 days but no difference in mortality and functional outcome at 6 months.[38] Murphy et al in the UK (1980-1985) [160] and Sainsbury et al in New Zealand (1983-85)[161] also reported a significant reduction in length of stay for patients admitted to a unit with joint orthopedic geriatric beds. In a study in Malmö, Sweden (1988-89), hip fracture patients were post-operatively randomized to rehabilitation at either the orthopedic or geriatric department. No significant differences were found in mortality within 1 year, destination at discharge, walking ability, or pain. Patients in the orthopedic group spent fewer days in the hospital, but had significantly more readmissions, primarily due to orthopedic-related diagnoses.[162] A recent Finnish study (randomization in discharge after surgery to local hospitals or a geriatric ward) showed a favorable effect on mortality and length of stay for mildly demented hip fracture patients (Table 5).[106] Finally, a trial randomizing elderly functionally impaired patients recovering from acute medical or surgical illnesses (not only hip fractures) to a geriatric assessment unit or usual care in the US revealed significant improvement in function at 6 months and more patients residing in the community.[163]

Other forms of geriatric after care

Discharge from the acute hospital to a nursing home is common in the US, particularly after the introduction of the Prospective Payment System. Some studies have reported an increased post fracture morbidity and mortality [134,140,164] but others have not confirmed this finding. [92,135] One third of the increased admissions to nursing homes were for convalescence and rehabilitation.[165] A new entity has evolved of this process: a more sophisticated nursing home providing more intensive rehabilitative services (the Rehabilitative Nursing Home). A comparison of the results of admission to rehabilitation facilities, rehabilitative nursing homes, or ordinary nursing homes, revealed that the best functional outcome for healthier hip fracture patients was associated with the use of a rehabilitation facility. However, for hip fracture patients who were relatively more ill before hospitalization, the location at which post-hospital care was provided did not make a clear difference in terms of their functional recovery.[137,166] In an analysis of post hospital care of hip fracture patients under Medicare, after adjusting for selection effects, the largest improvement in functional outcome was associated with discharge to home health

care (30% decrease in ADL dependency scores), followed by a rehabilitation facility (26% decrease), nursing home (19,3% decrease), and home without formal care (19,2% decrease).[166] Patients discharged to a facility with active physical rehabilitation were less likely to remain institutionalized than those in “ordinary" nursing homes and to ambulate more independently.[133]
Similar concerns about conventional nursing home care in the UK were expressed by Kennie and Reid.[167] Nursing home care was less effective in achieving discharge for elderly patient groups than hospital wards. Moreover, the quantity and quality of input from general practitioners to UK nursing homes was extremely variable. In a cross-sectional survey only 13% of patients received regular or routine review and 19% were not seen since admission.
Jette et al [48] investigated in a controlled trial whether intensive rehabilitation, consisting of patient and family education, geriatric team evaluation and weekly team meetings, and after care at home, would improve the 12- month outcome. No significant differences were found between experimental and control groups in survival, short and long term functional status, length of stay, or in eventual discharge disposition (Table 5). Koval et al [49] (US,1987-94) performed a study to assess the impact of intensive rehabilitation, which consisted of more intensive physiotherapy and occupational therapy and weekly multidisciplinary evaluations. No differences were found in hospital discharge status, walking ability, place of residence, need for home assistance, or independence in (instrumental) activities of daily living at 6, and 12 months.

The implementation of an interdisciplinary hospital care program in a hospital in New York resulted in fewer postoperative complications, fewer intensive care unit transfers, improved ambulatory ability at discharge and fewer discharges to nursing homes than a matched non-program group cared for before the initiation of the program.[70] No long-term outcomes were reported. A study that did find improved long-term results (in ADL capacity and return home) however, was a randomized controlled trial by Reid and Kennie in the UK. [168,169]
The study examined the effect of geriatric rehabilitative care. However, this study has been criticized because the group assigned to standard care had, despite randomization, considerably more mentally impaired patients, which is a major predictor of outcome.[170,171]

Early discharge and home rehabilitation

Early discharge from hospital to home has been strongly advocated and realized in Sweden.[117,123,172] The follow-up in primary health care (without radiography and orthopedic expertise) gave good functional results, provided that patients with pain and walking problems from the hip were guaranteed rapid specialist treatment.[42] Intensive rehabilitation and information in the hospital and early home visits by members of the rehabilitation team (physiotherapist and occupational therapist), seemed to be valuable in promoting independence.[117,124]

Good results were also reported from Peterborough, UK, regarding a policy where a single team, spanning the hospital and the community, manages all patients.[158] Each patient was assessed on admission to determine social and medical background in order to assess suitability for early discharge. Patients were operated on within 24 hours. After discharge, a hospital-at-home service provided intensive home nursing in addition to the usual community nursing service. 60% of the potential hospital-at-home patients were discharged under this scheme and their average length of hospitalization was 9,3 days.[132] Pryor et al [173,174] compared home rehabilitation with support with management in the hospital and found substantial savings in bed days and quicker and more effective recovery at 6 weeks. At 3 and 6 months however, the differences were not significant (Table 5). Hollingworth et al [126] followed more than 1000 hip fracture patients and reported that approximately 40% were suitable for early discharge. An evaluation of another hospital-at-home scheme in Southern Derbyshire confirmed that shortening hospitalization time by 7 days was feasible, but only 18% of all patients fitted the selection criteria and agreed to participation in the hospital-at-home scheme.[175]

Using a rapid transfer system it was possible to shorten the hospitalization time to a mere 3 nights for selected patients (in Australia).[176] This program consisted of immediate internal fixation or replacement of the fractured bone under spinal anesthesia, without sedation. Patients were mobilized within a few hours after surgery and sent home as soon as they could walk. The average length of stay of all hip fracture patients was reduced to 19 days compared with 28 days before the start of the program.[177] Furthermore in another Australian study, a 20% reduction of length of hospital stay was reported in a randomized controlled trial of accelerated discharge versus usual care.[45] A modest short-term improvement in level of physical independence and accommodation status after discharge was found but at 4 months there were no clear differences. Finally, a randomized trial performed in the US compared a home-based multicomponent rehabilitation program with usual home-based

care.[139] This program offered an intensive rehabilitation strategy, addressing both modifiable physical impairments and ADL disabilities (with the help of physiotherapists, occupational therapists, and rehabilitation nurses). No significant differences were found in self-care or home management ADL recovery at 6 months or 12 months.

Costs of care after hip fracture

Costs of hip fracture are immense and should be a major concern for governments. Randell et al [178] calculated the worldwide costs of hip fracture to be US$ 23 billion. He predicted that these would rise to US$ 55 billion in 2025 and US$ 87 billion in 2050. In 1994, the societal cost of hip fractures in the United States was approximately US$ 5,4 billion per year.[137] Estimated costs per patient differ widely between countries (Table 4).

Health care expenditures attributable to all osteoporotic fractures in the USA in 1995 were estimated to be US$ 13,8 billion of which 62% were spent for inpatient care, 28% for nursing home care and 10% for outpatient services.[136] In the UK, femoral neck fractures were estimated to cost the NHS US$ 460 million a year (1991,1992),[126] and in the Netherlands, de Laet calculated the total costs of hip fracture treatment to be US$ 210 million (1993).[146]

In-hospital costs primarily depend on the length of stay. Using the average daily costs of inpatient stay fails however to capture the subtleties of changing from the high-tech first days in hospital to the much lower cost of sustained postoperative rehabilitation.[20,127,156] French et al showed that the average cost method overstates the cost of a hip fracture by 23% for acute care and as much as 92% for rehabilitation.[180] It is considered better to use the cost apportionment approach, in which costs are broken down into its various components: e.g. hotel costs, theatre costs, medical costs, ward costs, overheads and other treatment expenses.[126]

Hip fracture costs encompass both in-hospital made costs and costs after discharge. While in Australia, Cameron et al [179] reported that 90-95 % of the costs were generated by inpatient hospital care, studies from Sweden,[9,118] the Netherlands,[182] and the US [40,137,181] showed that only 50% of total costs in the first year after the fracture were made in the hospital. Therefore, a shorter stay in the acute hospital will not always lead to reduced costs. A change in the reimbursement system in

Table 5.
Rehabilitation programs. Characteristics are shown of studies that evaluated rehabilitation programs with their main outcomes.

Study	Methods	Participants	Interventions	Outcomes
Gilchrist et al 1988	Randomization to either the orthopedic geriatric unit or theorthopedic wards	97 vs 125 patiens admitted to the university hospitalin Glasgow (UK)	Weekly combined ward round by ge-riatrician and ortho-pedic surgeon; weekly case conference	No difference in mortality, length of stay, or placement at 3 and 6 months; more medical conditions were recognized and treated in the orthopedic geriatric group
Hempsall et al 1990	Prospective comparison of two groups of patients; allocation by geographic location	115 patients > 65 years East Dorset, UK	Orthopedic geriatric unit versus standard care	Mean length of stay 9.5 days shorter (orthop. geriatric group). No difference at 6 months in terms of mortality, functional outcome, change in dependency or social status
Galvard et al 1995	Randomization to either the orthopedic or the geriatric department of the hospital	192 vs 179 community dwelling patients consecutively admitted to the general hospital in Malmo, Sweden	Patients allocated to further treatment at the geriatric department were transferred at the second postoperative day	No significant differences at 1 year in walking ability, use of walking aids, walking speed or pain in the operated hip
Huusko et al 2000	Randomization to geriatric ward or to local hospitals Pre-planned subgroup analysis of patients with dementia	348 community dwelling > 65 years patients (who had been able to walk independently before fracture) admitted to a Central Hospital in Finland	Assessment by geriatric team, weekly meetings, physiotherapy twice a day, occupational therapy, discharge plan, home visits by physiotherapistvs discharge to local community hospitals and usual care of GP and physiotherapist	Intervention group: shorter length of hospital stay, more patients living independently at 3 months for patients with moderate and mild dementia. No significant differences in mortality or residence at 1 year.
Jette et al 1987	Comparison of two groups allocated on a quasi-randomized basis according to the on-call roster of the hospital	75 patients > 54 years consecutively admitted to two general orthopedic units of the Massachusetts (US) General Hospital	Geriatric team evaluation, weekly meetings, home visits of the physio-therapist, patient and family education vs standard care	No significant differences in mortality, hospital discharge status or level of functional recovery at 12 months
Koval et al 1998	Comparison of groups of patients before and after the initiation of an inpatient rehabilitation program and comparison of patients discharged to the rehabilitation program after its initiation with patients not discharged to this program after its initiation	Inclusion of patients > 65 years, able to walk before fracture, cognitively intact, community dwelling, admitted to a general hospital in New York (US). 301 patients before initiation of program; 304 after initiation of which 204 were not and 104 were discharged to program	Intensive physiotherapy and occupational therapy, weekly conferences, discharge plan, family participation. Start of the program approximately 13 days after hospital admission.	No differences in hospital discharge status or walking ability, place of residence, need for home assistance, independence in basic and instrumental activities of daily living at 6 and 12 month follow-up.

z.o.z.

Table 5.
Rehabilitation programs. Continued

Study	Methods	Participants	Interventions	Outcomes
Kennie et al 1988 Reid & Kennie 1989	Randomization to continued stay in the orthopedic ward or transfer to another (peripheral)hospital with geriatric care	Women > 65 years, admitted to the district hospital in Stirling (UK) Exclusion: pathological fractures; early death; discharge within 7 days; unfit for transfer. 54 patients in the treatment group and 54 patients in the control group.	Day to day medical attention by a GP; consultation twice a week of a geriatrician; weekly conferences vs standard care on an orthopedic ward	Earlier discharge and greater independence at discharge in the intervention group. Greater independence and more patients living at home at 1 year follow-up in the intervention group. No differences in life satisfaction or strain on carers
Pryor &Williams 1989	Comparison of a group of patients suitable for early discharge home and living in the area served by a Hospital-at-Home (HAH) scheme with a group suitable for early discharge but living outside the HAH area	116 patients admitted to a general hospital in Cambridge (UK) coming from home and relatively independent before fracture. 68 patients living within the HAH area vs 48 living outside the area	Team (nurses, physiotherapists and occupational therapists) management at home	Higher proportions of patients that had returned to pre-injury support level and residence in the HAH-group at 6 weeks. No differences at 3 and 6 months
Cameron et al 1993	Randomization to accelerated discharge or conventional care groups. Stratification in three groups : nursing home patients; moderate to severe disability before fracture; limited disability before fracture	252 patients admitted to a general hospital in Sydney, Australia with uncomplicated fractures	Assessment by a physician experienced in rehabilitation and geriatric medicine, discharge plan, twice daily physiotherapy, occupational therapy, family involvement, social work-intervention, continued treatment at home vs conventional care	Length of stay shorter in the accelerated discharge group. Function better in the accelerated discharge group with limited pre-fracture disability at 2 weeks and 1 month; fewer discharge to nursing homes in the accelerated discharge group. No differences at 4 months.
Tinetti et al 1999	Randomization to a home based rehabilitation program or to usual home care	304 nondemented patients > 65 years who underwent surgical repair at two hospitals in New Haven (US), and returned home within 100 days	Specialized physical therapy and occupational therapy by a rehabilitation team; instruction of patients for self-exercise vs traditional physiotherapy	No significant difference in recovery of pre-fracture levels in self-care at 6 months or 12 months. No differences in social activity, mobility, balance, or lower extremity strength at 6 or 12 months

Stockholm, Sweden, resulted in increased total costs because of higher levels of discharge of patients to geriatric departments.[122]

Most of the published cost studies of hip fractures have relied on national survey data and other cross-sectional designs. Older persons at risk for hip fractures however, often have comorbid conditions and functional impairments and consume more medical and non-medical services before the fracture than the general population. Total costs after hip fracture should be adjusted for costs caused by other ailments than the hip fracture. It is nearly impossible to separate these costs per patient. A way to estimate the costs due to hip fracture is to adjust the post-fracture costs for costs generated by age- and sex matched controls (de Laet, the Netherlands 1999).[182] Another way is to assess pre-fracture costs per patient and to adjust the post-fracture costs accordingly. This was done in two studies in the US and Sweden[118,181] All three authors found substantial lower additional ("incremental") costs than the total costs.

Several authors reported a relationship between increased total costs per patient and older age [9,178,185,186] and higher costs for women.[9,178] Trochanteric fractures were more costly than cervical fractures [9,186] and a relationship was found between costs before fracture,[186] medical condition before fracture,[187] complications after fracture,[123,187] and function before fracture.[9] Patients admitted from home generally cost more than patients admitted from long-term care [179] because these institutionalized patients were discharged back with a short hospitalization time and low incremental cost. In calculating average costs per patient, it is also important to account for patients who die after hip fracture. These patients incur a low post-fracture cost and reduce the average per patient cost. Also, they have higher pre-fracture costs than most survivors.[181,186,188]

Two studies from Australia [29,179] and one from the UK [126] reported modest cost savings (1.000-1.500 Euro per patient) by accelerated discharge of hip fracture patients from hospital without compromising the quality of care. In these studies the major factor contributing to the cost saving was the reduction in hospital stay.

2.4 Discussion and conclusions

Many studies assessed the consequences of hip fracture on morbidity, mortality, change of residence, and health care costs. Data are much sparser on the conse-

Table 6:
Costs after hip fracture (in Euros, year as reported).

Study	Country	Year	In hospital	Total 4mnths/1yr.	Remarks
Cameron et al. [179]	Australia	1990	6330-7800	7060-8620 4 months	Accelerated vs. usual care
French et al. [180]	United Kingdom	1993	3440	4860 4 months	
Borgquist et al. [9]	Sweden	1986	6190	12380 4 months	
Brainsky et al. [181]	United States	1993	25460	33940 1 year	16000 incremental
Farnworth et al. [29]	Australia	1990	6050-7250		Before vs after program
Hollingworth et al. [126]	United Kingdom	1991	7600-8700		HAH vs usual
De Laet et al. [182]	Netherlands	1993	8600	11000 1 year	9170 incremental
Levi et al. [136]	United States	1990	8700	17430 1 year	
Randell et al. [178]	Australia	1992	10500		50% rehabilitation hospital
Schroder et al. [152]	Denmark	1985	10450		
Sernbo and Johnell [59]	Sweden	1993	5500	23850 1 year	
Zethraeus et al. [118]	Sweden	1992		34860 1 year	16500 incremental
Chamberlin et al. [77]	France	1995	4860		
Dolan et al. [183]	United Kingdom	1997		18800 1 year	
Reginster et al. [184]	Belgium	1996	8260		

quences for the broader dimensions of health-related quality of life. Medical complications after hospital discharge are not well documented.

Hip fracture is still associated with considerable mortality and loss of function. The majority of studies report a mortality of approximately 30%, a 40-60% recovery of walking ability, and a 25 % recovery of basic and instrumental activities of daily living , at 1 year post fracture.

The growing number of elderly hip fracture patients causes enormous management

problems in Europe and the US and is likely to have similar effects in other countries in the near future. Several studies have reported the results of changes in health care organization to cope with this problem. Geriatric after care and accelerated discharge programs can reduce total length of hospital stay and can achieve a higher rate of return to previous residential status. However, in some countries (e.g. US and the Netherlands) accelerated discharge has led to increased use of institutions (nursing homes) for rehabilitation. In the US, but also in the UK, doubts have been expressed about the ability of conventional nursing homes to rehabilitate these patients. There is a danger of more patients remaining in institutions. Therefore, the discharge to more sophisticated nursing homes that provide more intensive rehabilitative services has been advocated.

Until now, there is no conclusive evidence about the impact of any rehabilitation program on the long-term improvement of function, morbidity, or quality of life.[189.190] The best results in regard to shortening of hospital stay, short-term (6 weeks) recovery of function, and increased discharge to home, were realized by early discharge to home and effective organization of home care (Sweden and UK). This was possible for a subgroup of patients. The most important factors for selecting patients for a short stay in hospital and discharge home such as good mental status, good general medical condition, and the presence of family involvement, were already present at hospital admission. The development of a rehabilitation program, that results in improved long-term recovery of function and health-related quality of life for all hip fracture patients, remains a challenge.

Cost analysis of the treatment of hip fracture patients should take account of differences in costs between the first hospital days and subsequent days. Also, it is important to make a difference between total costs and incremental (additional to pre-fracture) costs. The cost analysis should not only be restricted to the initial hospitalization period but should include costs made in rehabilitation facilities and at home. A few studies from Australia and the UK reported modest total costs savings by accelerated discharge from hospital without compromising the quality of care.[29,126,179] On the other hand, increased total costs were reported from Sweden because of higher levels of discharge of patients to geriatric departments after a change in the reimbursement system.

We recommend further research of hip fracture rehabilitation programs aimed at (in comparison to the usual management) improvement of long-term function and quality of life with similar or reduced costs. The program preferably consists of a short

stay (< 2 weeks) in the acute hospital, early discharge home of selected patients with effectively organization of home care, and prompt return of pre-fracture institutionalized patients if rehabilitation in these institutions is possible. For the remaining patients a rehabilitation program on a geriatric hospital ward or a specialized

rehabilitation nursing home ward should be available. The registration of general medical complications needs more attention and should be included in these studies.

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Chapter 3.

Hip Fracture in Elderly Patients: Outcomes for Function, Quality of Life and Type of Residence

Abstract:

A prospective study was done to investigate functional outcome, quality of life and type of residence after hip fracture in patients 65 years and older. One hundred and two patients admitted consecutively to a university and a general hospital were followed up to 4 months after admission. The mean age of the participants was 83 years; 58% came from their own home and 42% came from institutions. Nearly 70% had two or more diagnoses other than the hip fracture. Cumulative mortality was 20% at 4 months after fracture. Of surviving patients, 57% were back in their original situation for accommodation, 43% reached the same level of walking ability, and 17% achieved the same level of activities of daily living as before fracture. Patients experienced on average three complications, 26% of which were severe. Quality of life improved up to 4 months; however, the quality of life at 4 months was worse than quality of life reported in a reference population. Average costs amounted to € (Euro) 15.338 (which at the time was nearly equivalent to the US dollar) per patient with nearly 50% of the costs attributable to hospital costs and 30% attributable to nursing home costs. The results of this study show a poor outcome after hip fracture in elderly patients.

3.1 Introduction

Although literature about mortality, morbidity, and prognostic factors for rehabilitation after hip fracture is abundant, few studies report health related quality of life [6,8,30] or give a detailed account of the type of residence in which the patient is living and the accompanying costs of treatment and living arrangements.[7,15,33] To provide a full description of the consequences of hip fracture for elderly patients for these aspects, it is important to include patients living in the community and patients living in institutions. The outcomes of patients with hip fracture were investigated with emphasis on quality of life and type of residence in a consecutive