Hip Fracture in the Elderly

Impact, recovery, and early geriatric nursing home rehabilitation

Heupfracturen bij ouderen

Gevolgen, herstel en vroege revalidatie in het verpleeghuis

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"One more cup of coffee for the road
One more cup of coffee before I go
To the valley below"

(Bob Dylan)

Contents

The main results of this thesis are reported in the following papers:

Balen R van, Cools HJM, Steyerberg EW, Habbema JDF. Hip fracture in the elderly: epidemiology and rehabilitation. A review.
Submitted

Balen R van, Steyerberg EW, Polder JJ, Ribbers MTLM, Habbema JDF, Cools HJM. Hip fracture in elderly patients: Outcomes for function, quality of life, and type of residence.
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Balen R van, Steyerberg EW, Cools HJM, Polder JJ, Habbema JDF. Early discharge of hip fracture patients from hospital. Transfer of costs from hospital to nursing home.
Acta Orthop Scand 2002;73(5): 491-495.

Polder JJ, Balen R van, Steyerberg EW, Cools HJM, Habbema JDF.
A cost-minimisation study of alternative discharge policies after hip fracture repair.
Health Economics. In press.

Balen R van, Steyerberg EW, Habbema JDF, Cools HJM. Hip fracture in elderly patients:complications after hospital discharge.
Submitted

Balen R van, Essink-Bot ML, Steyerberg EW, Cools HJM, Habbema JDF. Quality of life after hip fracture: A comparison of 4 health status measures in 208 patients.
Submitted

Chapter 1.

Introduction

1.1 Background

A hip fracture is an injury with serious consequences for life expectancy, recovery, and quality of life. It especially affects elderly women. The management of treatment, rehabilitation, and after care is a challenge for orthopedic surgeons, geriatricians, and health care administrators.

Because of demographic changes the incidence of hip fractures is expected to increase for the next decades. Therefore, hip fracture patients will increasingly need orthopedic and surgical beds in hospitals and rehabilitation beds in other institutions.

In treating hip fracture, surgeons use techniques aimed at unrestricted weight bearing as soon as possible. Although the results of this surgical intervention are expected to improve with newly developed osteosynthesis material, a major improvement in recovery and quality of life of the elderly hip fracture patient is not likely.

Cost considerations have pressed hospital administrators to shorten the hospital stay of hip fracture patients. This has shifted the rehabilitation process to locations outside the hospital. In the Netherlands, elderly hip fracture patients are rehabilitated in a nursing home when discharge to their own home is not possible. Almost all hospitals in the Netherlands have an agreement with neighbouring nursing homes to transfer hip fracture patients for rehabilitation. Because of this policy, the average hospital stay has decreased from 26 days in 1993 to 23 days in 1998. A further decrease is expected.

The consequences of early discharge of hip fracture patients on recovery and quality of life remain unclear. We also do not know whether early discharge results in cost saving. These aspects therefore require further investigation.

1.2 Study Objectives

The *main objective* of the present study was to assess the function and quality of life of elderly hip fracture patients and the costs to the health care sector when these patients are discharged early from the acute hospital to a rehabilitation ward

of a nursing home.

Secondary objectives were to prospectively investigate characteristics and outcomes of elderly hip fracture patients in detail and to determine which measurement instruments are most appropriate for assessment of outcome during follow-up.

The study therefore aims at answering the following *questions:*

Q 1. What is the *outcome* of elderly hip fracture patients in regard to mortality, recovery of function and quality of life?
Q 2. What are the *effects of early discharge* from hospital on mortality, recovery of function and quality of life?
Q 3. Does accelerated discharge result in a *reduction of costs*?
Q 4. What *complications* occur after surgery for hip fracture and does early discharge change the number and nature of complications?
Q 5. Which *measurement instruments* are appropriate to measure recovery in regard to function and quality of life?

1.3 Study Design

In order to address the study questions, a " before and after" study design was developed that corresponded to an organisational change from conventional to accelerated discharge arrangements. Randomisation of patients was not considered feasible since the change from conventional to accelerated discharge arrangements required organisational adjustments that made a simultaneous offer of both service models not possible.

A sample size of 2 x 100 patients was calculated to provide 80% power to detect a reduction in hospital stay of 5 days. Between October 1996 and October 1998, we prospectively recruited consecutive patients, who had been admitted with a fresh hip fracture to the University Hospital or a general hospital (Havenziekenhuis) in Rotterdam, the Netherlands. Patients under 65 years of age and patients with a hip fracture because of metastatic cancer or multitrauma were excluded.

A group of 100 patients were followed up to 4 months after hospital admission with the conventional discharge policy. Thereafter the discharge policy was changed for the next 100 studied patients (actually, the realized number was not exactly 100 but 102 and 106 respectively). Discharge was accelerated by measures, which were

initiated by the investigator and executed by the hospital staff. These included a protocol in which ward physicians were encouraged to make a decision regarding the discharge destination on day 5 postoperatively. Procedures for the indication for type of care both for discharge home or transfer to the rehabilitation ward of the nursing home were speeded up (only one nursing home was involved: Antonius-Binnenweg, Rotterdam).

We selected a follow-up of 4 months because no further recovery could be expected after this period. Moreover, mortality declines in line with the general population mortality rate at 3-8 months after injury. One investigator interviewed and evaluated all patients at 1 week, 1 month, and 4 months after admission to the hospital. Walking ability, basic and instrumental activities of daily living, and health-related quality of life were evaluated. Two functional status measure instruments (Rehabilitation Activities Profile and Barthel Index) and two generic health-related quality of life instruments (Nottingham Health Profile and COOP/WONCA charts), were compared on their performance in regard to score distribution, internal consistency, construct validity, and sensitivity to change.

All medical events up to 4 months after surgery that required nurse-physician monitoring or therapeutic intervention were recorded as complications.

Costs were studied from a societal perspective. Real costs were estimated based on a detailed measurement of investments in manpower, equipment, materials, housing and overhead. Fees and charges were only used in case of uncommon interventions and standard laboratory analyses. Medical costs were included as well as the costs borne by the patient and family (e.g. costs of informal care and travelling). Costs were estimated for a 7-month period, 3 months pre-operatively and 4 months post-operatively.

1.4 Structure of the thesis

Chapter 2 is a literature review on incidence, determinants, length of hospital stay, rehabilitation programmes and costs of hip fracture patients.

The remaining chapters contain the results of our study. First the characteristics and outcomes of a group of 102 elderly hip fracture patients are described which are discharged from hospital according to the current policy in the Netherlands

(chapter 3). Next, the intervention study results are described, in which the 102 conventionally managed patients are compared with a group of 106 patients with an early discharge policy (chapter 4). Costs of conventional and early discharge policy are compared in chapter 5. Complications during the first four months after surgery are reported in chapter 6. Finally, we compared the performance of four health status measures in the evaluation of health-related quality of life after hip fracture (chapter 7). The results of chapters 2 to 7 are discussed in chapter 8. Summaries of the thesis in Dutch and English are included.

Because the results of the study are presented in the form of papers (published in, or submitted to, medical journals) that address different aspects of the same study, it is unavoidable that there is some overlap in the information, especially between chapters 3, 4, and 5.

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]

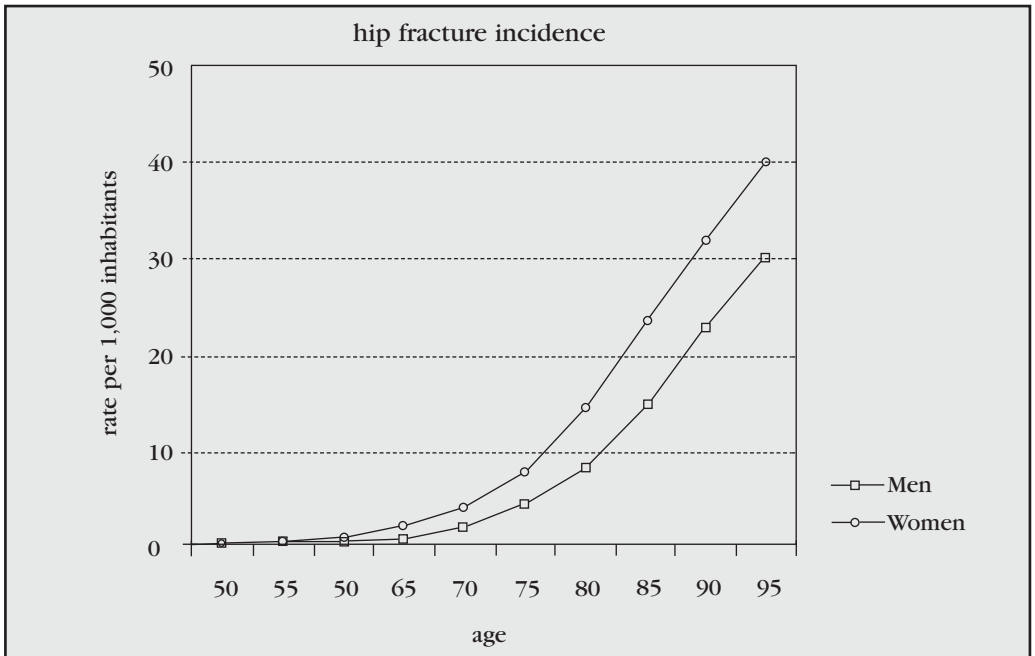

Figure 1. Incidence of hip fractures in the Netherlands, 1999

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

series of patients who were hospitalized, including patients previously living in institutions.

3.2 Materials and Methods

Between October 1996 and December 1997 102 consecutive patients, aged 65 years and older, who were admitted with a fresh hip fracture to a university and a general hospital in Rotterdam, the Netherlands, were recruited for this study. Patients with a hip fracture because of metastatic cancer or multitrauma were excluded. Twenty-eight patients (22%) refused to participate. There were no differences in age and gender between participants and nonparticipants. More nonparticipants lived at home before admission (80% versus 60%).

Patients underwent surgery within 1-2 days after hospital admission and were mobilized as soon as possible (1-2 days after surgery). All patients received thromboembolic prophylaxis unless contraindications were present.

The same investigator interviewed and evaluated all patients at 1 week, 1 month, and 4 months after admission to hospital. Walking ability was evaluated on a five-point scale (ranging from not able to walk to walk without walking aids) and activities of daily living/ instrumental activities of daily living by the Rehabilitation Activities Profile (Appendix).[2] Walking ability and Rehabilitation Activities Profile also were estimated for the time before the fracture occurred. Health-related quality of life was measured by the Nottingham Health Profile [18] and the Dartmouth COOP Functional Health Assessment Charts revised by the World Organization of National Colleges, Academies and Academic Associations of General Practitioners and Family Physicians (Appendix).[29] In cases of severe cognitive impairment or physical disablement, a proxy was interviewed. Reference values from the literature, after matching for age and gender, were used for comparison.[17,26] Cognitive status was measured with the Mini Mental State Examination.[14]

Information regarding comorbidity, type of fracture and surgery, complications, and length of stay was obtained from medical charts and health professionals. Comorbidity and complications were classified using a severity rating scale (Appendix).[3] To determine predictive factors at 4 months for being at home, death, and functioning, bivariate and multivariate analyses were performed using the following variables: age, functioning before fracture, cognitive status at 1 week, number of comorbidities, dementia, type of residence lived in before fracture, and type of fracture and surgery.

Table 1.
Characteristics of Patients with a Hip Fracture Admitted to Hospital (n = 102)

Variable		Value
Mean age (years)		83
	median (25th -75th percentile)	83 (77-88)
Percentage female		84%
Admitted from (%)		
	own home	58%
	home for the elderly	26%
	nursing home	14%
	hospital/other	2%
Fracture type (%)		
	cervical	43%
	trochanteric	49%
	subtrochanteric	8%
Operation type(%)		
	hemiarthroplasty	25%
	dynamic hip screw	19%
	Hansson pins	13%
	gamma nail	37%
	other/not operated	7%
Comorbidity		
% of patients (with functional limitation)		
	musculoskeletal disorder	42% (29%)
	cardiovascular disorder	45% (12%)
	neuropsychiatric disorder	38% (35%)
	neurologic disorder	26% (11%)
	respiratory disorder	16% (6%)
	metabolic and endocrine disorder	16% (0%)
	urogenital disorder	8% (1%)
	gastrointestinal disorder	9% (0%)
Number of comorbidities (% of patients)		
	0	6%
	1	27%
	2	20%
	3	30%
	>3	17%
	mean per patient	2.4

To calculate real individual costs of professionals (doctors, nurses, and physiotherapists), their activities were registered in minutes per day. Laboratory and radiology examinations and other interventions were elicited from the hospital administration. Total costs in hospital, nursing home, or home for the elderly were calculated by adding hotel costs. Costs to 3 months before admission were calculated according to information from the patient or proxy. Costs were expressed in Euros (broadly equivalent to a US Dollar).

Student's t test, Wilcoxon matched pairs signed rank test, Mann-Whitney U test, chi square test, logistic regression analysis, and linear regression analysis were used in the statistical analysis. Significance testing was two-tailed with $p < 0.05$ accepted as statistically significant. Statistical evaluations were done using SPSS 6.1 (SPSS, Chicago, IL).

3.3 Results

Nonparticipants

Twenty-eight patients refused to participate. The patients' mean age was 82 years and 82% were women. Twenty-three patients who refused to participate came from home, and five came from a home for the elderly. There were no significant differences in age and gender between patients who participated and those who did not participate, but more patients who did not participate came from home ($p = 0.03$). Residence at 4 months was not different from the 4- month residence of participants: six patients died, 13 patients were at home, four patients were in a home for the elderly, four patients were in a nursing home and one patient still in the hospital.

Hospitals

Except for type of surgery (more dynamic hip screws and less gamma nails in the university hospital, chi square test, $p< 0.01$) patients did not differ in terms of discharge destination, functional outcome, and quality of life. Thus, results are given for the total group of patients.

Primary characteristics

Descriptive information is presented in Table 1. Patients were on average 83 years of age, predominantly female (84%), and admitted from home (58%). Sixty-seven percent had two or more diagnoses in addition to the hip fracture, of which 46% caused functional limitation before fracture. Thirty-four percent of patients had dementia, 54% of patients had musculoskeletal disorders and 11% had concurrent wrist or

Table 2.
Length of Stay in Hospital and Nursing Home, Discharge Arrangements and Type of Residence (n=102).

Variable		Outcome
Days in hospital		
	mean	26
	median (25th-75th percentile)	18 (13-29)
Discharge from hospital to (%)		
	died in hospital	6%
	own home	26%
	home for the elderly	17%
	nursing home	51%
	not discharged	1%
Days in nursing home until discharge (n=25)		
	mean	43
	median (25th-75th percentile)	40 (19-57)
Days in institution (hospital + nursing home)		
Until discharge (n=102)		
	mean	38
	median (25th-75th percentile)	24 (14-53)
Type of residence at 1 month (%)		
	died	4%
	own home	23%
	home for the elderly	15%
	nursing home	35%
	hospital	23%
Type of residence at 4 months (%)		
	died	20%
	own home	36%
	home for the elderly	17%
	nursing home	26%
	hospital	1%

upper arm fractures.

Eighty-seven patients underwent surgery within 1 day after hospital admission, nine patients within two days, and only 3 patients thereafter. At 1 week after surgery 73% of patients were allowed unrestricted weightbearing (at 1 month, 84%; at 4 months, 99%).

Length of stay, Discharge arrangements, Type of Residence, and Costs
Most (74%) patients left the hospital within 28 days (Table 2) but there was wide variation in the time (10% less than 1 week; 10% more than 7 weeks). On discharge from hospital, only 47% were discharged to their type of residence as before fracture. At 4 months, this percentage had increased to 57%. Four months after admission 63% of patients were back home. Figure 1 shows the type of residence where patients were living before and 4 months after hospital admission, with the average length of stay in the hospital and nursing home.
The mean stay in the hospital and nursing home until discharge to home or home for the elderly was 38 days.
Average costs amounted to € 15.338 (which at that 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. Compared with costs before fracture, extra costs caused by hip fracture were € 9306 during a 4-month period.
In multivariate analysis, age, cognitive status at 1 week and number of comorbidities were predictive factors for mortality and being home at 4 months (Table 3).

Walking Ability, Activities of Daily Living, and Instrumental Activities of Daily Living Management.

Walking ability, activities of daily living, and instrumental activities of daily living management are shown in Table 4. Walking ability (Wilcoxon matched pairs signed ranks test, $p = 0.001$) and activities of daily living ($p < 0.0001$) improved significantly between followups, but only 43% of surviving patients had reached the same level of walking ability as before at 4 months, and only 17% of patients had achieved the same level of activities of daily living as before fracture.
Patients, who were admitted to the hospital with acute concurrent wrist and upper arm fractures, did not differ from others in function at 1 month and at 4 months.

Complications

Table 3.
Type of Residence at 4 Months Related to Age, Functioning Before Fracture, Cognitive Status, Number of Comorbidities, and Residence Before Admission.

Variable	Habitat at 4 Months: Died	Own Home Elderly	Home for the Home	Nursing	Total
	n = 20	n = 37	n = 17	n = 28	n = 102
	N (%)	N (%)	N (%)	N (%)	N (%)
Age (years)					
65-79	4 (11%)	21 (58%)	5 (14%)	6 (17%)	36 (100%)
80-89	9 (18%)	16 (33%)	8 (16%)	16 (33%)	49 (100%)
>= 90	7 (41%)	0 (0%)	4 (24%)	6 (35%)	17 (100%)
Rehabilitation Activities Profile communication - mobility - personal care before admission					
0 -4	3 (8%)	24 (65%)	5 (14%)	5 (14%)	37 (100%)
5- 14	6 (11%)	12 (32%)	7 (19%)	12 (32%)	37 (100%)
15-36	11 (39%)	1 (4%)	5 (18%)	11 (39%)	28 (100%)
Mini Mental State Examination score at 1 week					
missing	5 (83%)	0 (0%)	0 (0%)	1 (17%)	6 (100%)
0 -12	9 (38%)	1 (4%)	1 (4%)	13 (54%)	24 (100%)
13-18	2 (12%)	6 (35%)	4 (24%)	5 (29%)	17 (100%)
19- 22	3 (23%)	2 (15%)	4 (31%)	4 (31%)	13 (100%)
23-29	1 (2%)	28 (67%)	8 (19%)	5 (12%)	42 (100%)
Number of comorbidities					
0	0 (0%)	5 (83%)	0 (0%)	1 (17%)	6 (100%)
1	1 (4%)	14 (50%)	3 (11%)	10 (36%)	28 (100%)
2	3 (15%)	9 (45%)	6 (30%)	2 (10%)	20 (100%)
3	8 (26%)	6 (19%)	7 (23%)	10 (32%)	31 (100%)
4+	8 (47%)	3 (18%)	1 (6%)	5 (29%)	17 (100%)
Residence before admission					
own home	7 (12%)	36 (61%)	3 (5%)	13 (22%)	59 (100%)
home for the elderly	6 (22%)	0 (0%)	14 (52%)	7 (26%)	27 (100%)
nursing home	7 (44%)	1 (6%)	0 (0%)	8 (50%)	16 (100%)

Table 4
Followup in Walking Ability, (Instrumental) Activities of Daily Living Management, Quality of Life and Cognitive Status.

Variable	Before Admission to Hospital n = 102	1 Week After Admission n = 102	1 Month After Admission n = 97	4 Months After Admission n = 82
walking ability (%)				
not	0%	39%	29%	15%
with personal help	3%	29%	18%	10%
with walking frame		26%	28%	47% 42%
crutches	8%	2%	3%	6%
walking without aids	64%	1%	2%	27%
RAP- communication-mobility-personal care score				
(mean) 0-36	9.3	22.6	18.9	14.5
RAP occupation 0-9	5.0	--	7.3	6.2
MMSE (mean) 0-29		17.7	18.9	20.8
NHP (mean) 0-100				
physical mobility		83	73	57
pain		55	42	27
sleep		33	30	22
energy		63	59	44
social isolation		34	28	28
emotional reaction		34	30	26
COOP/WONCA charts (mean) 1-5				
physical condition		4.9	4.8	4.5
emotional condition		2.6	2.4	2.2
daily work		--	4.1	3.5
pain		2.8	2.9	2.4
overall condition		3.8	3.4	3.3
change in condition		4.0	2.5	2.9
social activities		--	2.6	2.0

RAP = Rehabilitation Activities Profile
MMSE = Mini Mental State Examination
NHP = Nottingham Health Profile
COOP/WONCA charts = Dartmouth COOP Project Charts revised by The World Organiziton of National Colleges, Academies and Academic Associations of General Practioners/Family Physicians (WONCA).

Complications are shown in Table 5. Local complications with osteosynthesis material, such as loosening, luxation or break of screw (eight times in six patients), led to reoperation in all patients and limitation in function until 4 months after fracture in five patients. Wound infections occurred in 11 patients (of whom four died), and reoperations were necessary in six patients (of whom two died). A frequently occurring general complication was anemia (47%). Forty-four patients (43%) were given a blood transfusion. Urinary tract infection occurred in 44% of patients (treated with antibiotics).
Lethal general complications were pneumonia (three patients), dehydration (three patients), stroke (two patients), pulmonary embolism (two patients), myocardial infarct (two patients), shock (two patients),sepsis (two patients), heart failure (one patient), mamma carcinoma (one patient), cachexia (one patient) and intestinal obstruction (one patient).

Health-Related Quality of Life

Nottingham Health Profile scores were obtained from the patient (75%) or by a proxy (25%). Significant improvement of physical mobility and pain ($p < 0.0001$) occurred between 1 week and 1 month and between 1 month and 4 months (Table 4). All other dimensions improved between 1 week and 4 months.
Compared with reference values at 4 months, significant differences were found in physical mobility ($p < 0.001$), social isolation ($p = 0.001$), sleep ($p = 0.008$), and emotional reactions ($p = 0.02$). The Dartmouth COOP Functional Health Assessment Charts indicated that pain decreased between 1 month and 4 months ($p = 0.001$). Physical mobility improved between 1 week and 1 month ($p = 0.01$) and between 1 month and 4 months ($p = 0.006$). Patients felt better overall between 1 week and 1 month but not after 1 month. Compared with reference values, significant differences at 4 months were found in daily housekeeping and physical condition ($p < 0.001$).

3.4. Discussion

Patient Characteristics

This elderly cohort study included patients living at home, those living in nursing homes, and those living in homes for the elderly. This accounted for the advanced

Table 5.
Complications occurring in 102 patients until 4 months after hospital admission for hip fracture by severity.

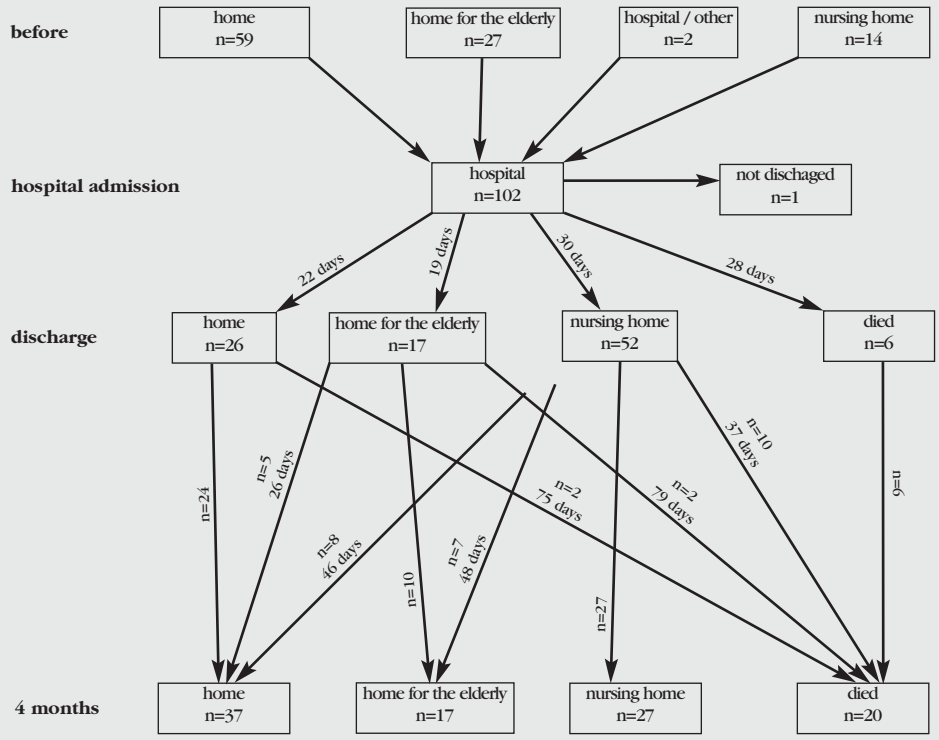
Diagnosis	Number of Complications			
	Moderate	Severe	Total	% of Patients
Local disorders	14	15	29	22%
wound infection/hematoma	11	4	15	
loosening osteosynthesis/luxation	1	7	8	
Circulation disorders	55	7	62	54%
sepsis/dehydration	4	5	9	
anemia	49	1	50	
Cardiovascular disorders	24	15	39	31%
myocardial infarction, heart failure, arrhythmias	17	8	25	
pulmonary embolism/thrombosis	2	2	4	
cerebrovascular accident	1	5	6	
Pulmonary disorders	12	5	17	15%
pneumonia	10	4	14	
Urinary tract disorders	70	3	73	50%
infection	60	1	61	
Pressure ulcers	17	12	29	28%
Gastrointestinal disorders	16	7	23	22%
bleeding	4	2	6	
Psychiatric disorders	13	13	26	23%
delirium	9	5	14	
Other	28	9	37	28%
Total	249	86	335	92%

age and the high proportion of patients with a diagnosis of dementia (34%).

Length of Stay, Discharge Arrangements, Type of Residence, and Costs

Hospital length of stay was considerable (26 days), and only 47% of patients were discharged to the residence they had occupied before fracture. These aspects depend on the way geriatric rehabilitation and long-term care of the elderly is orga-

Fig 1.
Residence of 102 Patients with Hip Fracture Before and 4 Months After Hospital Admission.



nized. This differs between countries. For instance, hospital length of stay in the United States fell from 22 to 13 days after implementation of the prospective payment system, with the result that more patients were discharged to nursing homes and that more patients remained in the nursing home 1 year after hospitalization.[12] The patients were followed up for 4 months because no additional recovery is expected after this time.[9,19] Mortality at 4 months was 20%, similar to figures reported in the Netherlands[21,34] and in the United Kingdom.[35]

In agreement with other studies, age, number of comorbidities, and cognitive state at 1 week predicted mortality at 4 months.[4,10,25,27,35] Contrary to other studies, gender was not found to be clearly related with mortality. This probably is because of the high mean age and high percentage of women included in this study. Nearly 40% of the patients with dementia, of whom 80% were living in institutions, died within

4 months. This finding is in agreement with the earlier reported relationship between poor cognitive state and mortality.[4,11,27] The predictive factors found in this study (age, cognitive status, and number of comorbidities) for those returning home and functioning 4 months after fracture are consistent with results from previous research.[22,24,28,31,37]

Borgquist et al[5] reported average costs up to 4 months after fracture to be € 11.500 per patient (1991, corrected for inflation € 13.000 in 1998) and, as in the current study, 80% of total costs accrued in institutions (50% in the hospital and 30% in nursing homes). Especially patients who are frail and elderly incur health care costs without sustaining a hip fracture. The incremental costs can be estimated by a comparison of postoperative and preoperative costs. Brainsky et al[7] showed that the costs increased for the first 6 months and then decreased so that they approached levels before fracture by the end of the first year. Health care costs before fracture in the current study were substantial, because of the older mean age of the patients.

Walking Ability and Activities of Daily Living

Only 43% of surviving patients recovered at 4 months to the same level of walking ability as before fracture which is consistent with some other studies.[21,23] Only 17% of patients regained their previous performance of activities of daily living, which is similar to reported recovery in elderly patients living in an institution.[13] It is difficult to answer whether more aggressive rehabilitation would have improved function in this group of patients or in a subset of them. Certainly, for a subset of them, especially the patients who have dementia and are very old, the outcome was expected to be poor, and efforts at rehabilitation may have been futile. All patients were rehabilitated in the hospital and after discharge in the nursing home or at home with the help of physiotherapists. The current authors do not know whether the patients who have dementia and are very old would have had even worse outcomes without these rehabilitation efforts. However, the authors also do not know whether more aggressive rehabilitation of the patients with more potential for improvement (the younger, cognitively intact patients with limited comorbidity) would have improved their outcome. Because inclusion in this study was unselected, both types of patients were represented (Table 3). Additional study is needed to answer these questions.

Complications

Only 8% of patients had no medical complications within 4 months, in contrast with the findings of Koot[21] in a followup of 1 month (60% no complications) and Vajanto et al[36] in a followup of 1 year (72% no complications). Frequently occurring complications were postoperative anemia and urinary tract infection.

Some investigators may accept a blood transfusion as a normal postoperative procedure. In a large French study, urinary tract infection occurred in only 22% of patients.[1]

Equal percentages of serious complications such as myocardial infarction and pulmonary embolism, have been reported, but lower percentages of respiratory complications, pressure sores and stroke have been reported.[32] Differences may be attributable to any complication leading to treatment, not only those directly related to the fracture, being recorded in the current study. The high occurrence of general complications also could be because of the frailty of the patients included in the study.

Health-Related Quality of Life

The Nottingham Health Profile and Dartmouth COOP Functional Health Assessment Charts have been used previously in measuring subjective health in chronic conditions but not frequently in followup of patients with hip fracture.[6,8,30]

As expected, a large proportion of patients experienced problems with physical mobility and pain, but the patients also seemed to experience more subjective social isolation and emotional problems than in a reference population.

It is possible that patients had reduced quality of life before their fracture. Patients or their relatives were asked about functioning before the fracture. Only 64% of all patients walked without aids before their fracture. It is likely that this had some influence on quality of life (social isolation). Unfortunately, it is difficult to measure quality of life retrospectively with the Nottingham Health Profile or the Dartmouth COOP Functional Health Assessment Charts. An important observation in this study was that both instruments were sensitive to changes in time in nearly all dimensions and seem to be valuable in the evaluation of hip fracture rehabilitation.

Limitation in Study Design

A limitation of the current study is that the number of patients was relatively small. This is because of the time-consuming followup to assess the patients' function and type of residence.

Patients in institutions before fracture were included and this made the total group

fairly heterogeneous. However, this study tried to give a comprehensive account of outcome after hip fracture, and in the Netherlands 40% of patients are institutionalized before experiencing a fracture. This does not differ from the proportion reported from Scandinavian countries,[34] but fewer patients are institutionalized before their hip fracture in the United States and England (20%-30%).[16,35]

In the Netherlands, elderly people live in homes for the elderly when they need assistance with structuring their daily life or have problems with their activities of daily living. Patients are admitted to nursing homes when they need 24- hour nursing care because of dementia or physical disability. Other studies from the Netherlands reported the same percentage of patients living in a home for the elderly (25%) or nursing home (15%) before hip fracture as were seen in the current study.[21,34]

Another potential compromising factor for interpreting the results was the 22% nonparticipation rate. Although more nonparticipants came from home, their age and gender were not different from the participants. In addition, mortality (21%) and type of residence at 4 months of the nonparticipants did not differ from the participants. Thus, the current authors expect that other outcomes of nonparticipants, such as function and quality of life, also would not have been very different.

In the current series of patients with a fresh hip fracture, the high proportion of patients with dementia, the high proportion of patients who lived in an institution, and the severity of comorbidity was accompanied by substantial mortality and poor rehabilitation results. The high occurrence of medical events and the fact that 1/4 of the patients subsequently suffered functional impairment, support the need for intensive medical attention in rehabilitation after hip fracture. Early specialized rehabilitation could lead to better outcome. The effect on outcome and costs of earlier discharge of patients with hip fracture from the hospital to home or to surroundings with special rehabilitation facilities should be investigated.

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Appendix

1. Rehabilitation Activities Profile

activity		score	activity		score
Communication			Personal care		
	expressing	0-3		eating/drinking	0-3
	comprehending	0-3		washing/grooming	0-3
Mobility				dressing	0-3
	maintaining posture	0-3		undressing	0-3
	changing posture	0-3		maintaining continence	0-3
	walking	0-3	Occupation		
	using wheelchair	0-3		providing for meals	0-3
	using transport	0-3		household activities	0-3
				leisure activities	0-3

response options : performs activity with : no difficulty (0); some difficulty (1);much difficulty/help (2); not (3)

2. Severity rating scale

Comorbidity

0. **Complete Health**: Neither complaints about symptoms nor evidence of signs or functional limitation
1. **Good Health** : Evidence only of signs without related symptoms (spontaneous complaints or complaints when asked); no functional limitation
2. **Disturbed Health Without Functional Limitation** :
    A. Patient complains about symptoms without related signs that disturb his/her daily activities without functional limitation.
    B. Patient complains about symptoms accompanied by evidence of signs that disturb his/her daily activities without functional limitation
3. **Moderate Functional Limitation**: Evidence of symptoms and related signs; patient refers to some functional limitation that interferes with instrumental activities of daily living (he/she experiences some change in his/her normal roles or habits).
4. **Severe Functional Limitation** : Evidence of symptoms and related signs; additionally, there is need for supervision or assistance in one or more basis activities of daily living because of functional limitation.

Complications

Nurse-physician monitoring (N-PM)

therapeutic intervention (TI)

residual functional impairment (RFI)

Class A: complication requiring < 1 day of N-PM, without TI, without evident RFI

Class B: complication requiring TI and 1-7 days of N-PM, without evident RFI

Class C: complication requiring TI and 8-21 days of N-PM, without evident RFI

Class D: complication associated with RFI and requiring TI, regardless of duration of N-PM

3. COOP/WONCA charts

Physical Condition

What was the most strenuous level of physical activity you could do for the last 2 minutes ? 1. very heavy; 2. heavy; 3. moderate ; 4.light ; 5. very light.

Emotional Condition

How much have you been bothered by emotional problems such as feeling unhappy, anxious, depressed, irritable? 1. not at all; 2.slightly; 3.moderately; 4.quite a bit; 5. extremely

Daily Work

How much difficulty did you have doing your daily work, inside and outside the house, because of your physical health or emotional problems ? 1.no difficulty at all; 2.a little bit of difficulty; 3.some difficulty; 4.much difficulty; 5.could not do.

Pain

How much bodily pain have you generally had ? 1.no pain; 2. very mild pain; 3. mild pain; 4. moderate pain; 5. severe pain.

Overall Condition

How would you rate your overall physical health and emotional condition ? 1 excellent; 2. very good; 3. good; 4. fair; 5.poor.

Change in Condition

How would you rate your physical health and emotional condition now compared with 4 weeks ago ? 1. much better; 2. a little better; 3. about the same; 4. a little worse; 5. much worse.

Social Activities

To what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbors or groups? 1. not at all; 2. slightly; 3. moderately; 4. quite a bit; 5.extremely.

Chapter 4.
Early discharge of hip fracture patients from hospital. Transfer of costs from hospital to nursing home

Abstract

Hip fracture patients occupy more and more hospital beds. One of the strategies for coping with this problem is early discharge from the hospital to institutions with rehabilitation facilities. We studied whether early discharge affects outcome and costs. 208 elderly patients with a hip fracture were followed up to 4 months after fracture. First, a group of 102 patients stayed in our hospital for the usual period (median 18 days). Then, 106 patients were assigned to a group for early discharge (median 11 days). We measured disabilities, health-related quality of life and cognition at 1 week, 1, and 4 months after hospitalization. To calculate total societal costs, inpatient days, the efforts of professionals in- and outside institutions, and interventions/examinations were recorded during this 4-month period. At 4 months, we found no differences in mortality, ADL level, complications, quality of life, and type of residence. More patients in the early discharge group were discharged to nursing homes with rehabilitation facilities (76% versus 53%) but the median total stay in hospital and nursing home was the same (26 days). Early discharge from hospital did not substantially reduce total costs (conventional management € 15.338 per patient and early discharge € 14.281 per patient), but merely shifted them from the hospital to the nursing home.

4.1 Introduction

The increased number of elderly people has markedly increased the need for hip fracture beds (Melton 1996). Various strategies, such as new surgical techniques, early mobilization of patients (Ceder et al. 1987), joint orthopedic-geriatric rehabilitation (Murphy et al. 1987), and "hospital at home" teams (Pryor et al. 1988) have reduced the length of hospital stay. However, conflicting results have been reported as regards mortality, discharge status, and functional outcome (Gilchrist et al. 1988, Kennie et al. 1988, Reid and Kennie 1989).
In a prospective study, we evaluated how early discharge from hospital to a special rehabilitation ward in a nursing home affected the outcome and costs.

4.2 Patients and methods

Between October 1996 and October 1998, we prospectively recruited consecutive patients over 65 years of age, who were admitted with a recent hip fracture to the university hospital and a general hospital in Rotterdam, the Netherlands. Patients with a hip fracture because of metastatic cancer or multitrauma were excluded. Of the first 130 eligible patients who formed the conventional management group, 102 (78%) agreed to participate in the study. Thereafter, the discharge policy was changed (early) for the next 124 eligible patients of whom 106 (85%) agreed to participate. A sample size of 2 x 100 patients was calculated to provide 80% power for a 5-day shorter hospital stay. Since we did not know what differences to expect in outcome or costs, no other power analyses were done.

Discharge was hastened by management measures, initiated by the investigator and implemented by the hospital staff. These included a decision protocol for discharge where ward physicians were encouraged to make a decision regarding the discharge destination on day 5 after surgery. Procedures were speeded up to indicate the type of care, both for discharge to home or transfer to a rehabilitation ward of a nursing home. One investigator interviewed and evaluated all patients, using a standard protocol at 1 week, 1 month, and 4 months after admission to the hospital. Walking ability was evaluated on a 5 grade-scale; ADL and instrumental ADL with the Rehabilitation Activities Profile (Bennekom et al. 1995); health-related quality of life with the Nottingham Health Profile (Hunt et al 1980) and the Dartmouth COOP Functional Health Assessment Charts (WONCA)(Nelson et al. 1990); cognitive status with the Mini-Mental State Examination (Folstein et al. 1975).

Comorbidity and complications were classified using a severity rating scale (Bernardini et al. 1995). All medical events during the 4-month follow-up period that required therapeutic intervention were recorded as complications. Type of fracture and surgery, and length of stay were obtained from medical charts and health professionals.

Activities of doctors, nurses, and therapists were recorded in minutes per day.

The number of laboratory and radiographic examinations and other interventions were obtained from the hospital administration. Total costs in hospital, nursing home, and home for the elderly were calculated by adding hotel costs. Hotel costs for inpatient days were estimated by including overhead and indirect costs but with the exclusion of all direct costs that were analyzed separately. We distinguished 6 categories of care: 1) inpatient days (hospitals, nursing homes and homes for the

elderly); 2) nursing (hospitals, nursing homes, homes for the elderly, and at home); 3) health practitioners (physicians, therapists and others); 4) medical procedures (therapeutic, diagnostic and laboratory); 5) travelling (ambulance, taxi, other); and 6) informal care and other costs, such as meal service at home and adjustment of the housing conditions. We also divided the data into 8 periods based on the location of the patient; 1) before hospital admission; 2) from admission to day 5 after hip surgery; 3) from day 6 until discharge from hospital; 4) nursing home; 5) home for the elderly; 6) home; 7) readmission to hospital or nursing home and 8) transfer from the two participating hospitals to other hospitals. Costs up to 3 months before admission were calculated according to information from patient or proxy. Costs were expressed in 1998 Euros.

Statistics

We used Student's t-test, ANOVA, Wilcoxon matched pairs signed rank test, Mann-Whitney U test, and the chi-square test in the statistical analysis. Logistic regression was used to analyze differences in mortality and type of residence at 1 month and 4 months and linear regression was used to analyze differences in function (RAP score at 1 month and 4 months) and total costs with the following independent variables: age, sex, type of fracture, type of treatment, number of comorbidities, the presence or absence of the diagnosis dementia on hospital admission, residence before fracture, type of discharge arrangement (conventional or early), function before fracture (RAP-score), and cognitive status after 1 week (MMSE score). Data were analyzed separately in the two groups of patients.

4.3 Results

There were no major differences in the characteristics of the two groups. Mean age was 83 years with a female predominance; 41% of patients were institutionalized before fracture. Cardiovascular diagnoses were recorded in half of the patients, musculoskeletal in almost half, and neuropsychiatric diseases in one third. Cognitive reduction was present in one fifth. Patients had, on average 2.3 comorbid conditions and only one fifth were totally ADL independent. On average, patients stayed 13 days less in hospital in the early discharge group; the median stay was 18 versus 11 days (Table 1, $p < 0.001$). At 1 month after fracture, more patients in the early discharge group were in a nursing home and more in the hospital in the conventional management group. However, this difference as regards residence completely

Table 1.
Length of hospital and nursing home stays, discharge arrangements, and residence. Comparison of conventionally-managed and earlier-discharged patients.

Variable	Conventional Management (n =102)	Early Discharge (n = 106)	Significance of Differences p-value
Days in hospital			
mean	26	13	0.001
median (25th-75th percentile)	18 (13-29)	11 (9-15)	
Discharged from hospital to (%)			0.001
died in hospital	6%	0%	
own home	25%	14%	
home for the elderly	17%	9%	
nursing home	53%	76%	
Days in nursing home until discharge			
mean	43 d	39 d	0.6
median(25th-75th)	40 d (27-52)	36 d (22-57)	
number of discharged surviving patients	17	42	
Days in institution *			
mean	38 d	34 d	0.5
median (25-75)	24 d (14-53)	27 d (12-51)	
Residence at 1 month (%)			< 0.001
dead	4%	3%	
own home	23%	21%	
home for the elderly	15%	8%	
nursing home	35%	62%	
hospital	23%	6%	
Residence at 4 months (%)			0.9
dead	20%	19%	
own home	36%	41%	
home for the elderly	17%	14%	
nursing home	28%	26%	

* hospital and nursing home

disappeared after 4 months. In both groups, patients stayed, on average, the same time (mean 36 days, median 26 days) in an institution (hospital and nursing home) until discharge. The mortality was 3% at 1 month and 19% at 4 months. Independent predictors for mortality were age, number of comorbidities, and cognitive status after 1 week.

The groups did not differ in walking ability at 4 months. Only one third had then regained their prefracture walking ability. No functional differences were found between the groups. Overall predictors for function at 4 months were age, number of comorbidities, cognitive status after 1 week, and function before fracture. At 4 months, only one fifth had achieved their previous ADL level. There were no clear differences in quality of life scores.

Patients had, on average, 3 complications. Only 8% of patients had no complication at all. The most frequent complications were postoperative anemia (half of the patients, mostly treated with blood transfusion) and urinary tract infection (half of the patients, all treated with antibiotics). As regards the consequences of functional impairment, psychiatric complications were severest (one fifth of the patients of whom half developed acute confusion or delirium). One fifth had local surgical complications. Readmission to the hospital was necessary for 8 patients in the conventional management group and for 16 patients in the early discharge group ($p = 0.2$). For 3 and 5 patients respectively the readmissions were due to surgical/orthopaedic complications.

Costs generated by early discharge patients were, on average, € 1057 less than by conventionally-managed patients (Table 2). After correction for costs before admission and function before admission, the estimated difference was € 1223. Overall predictors for costs were prefracture residency in an home for the elderly, number of comorbidities, function before fracture, and dementia. Transfer of costs occurred especially (5 days after surgery) from the hospital to the nursing home. Early discharge generated more costs up to day 5 after admission ($p = 0.003$), less from day 6 until discharge from hospital ($p < 0.001$), and more in the nursing home ($p = 0.02$).

4.4 Discussion

We found no clear advantage of discharging hip fracture patients 13 days earlier from the acute hospital. Unlike Fitzgerald et al. (1988) and Jalovaara et al. (1992) the type of rehabilitation protocol did not affect the outcome. Our study has several limitations. First, we had only relatively few patients (208) due to the time-consuming

Table 2.
Average Costs per Hipfracture Patient Up To 4 Months After Hospital Admission in Euros (€).

Period	Conventional Management	SD	25-75 percentile	% of Total Costs	Early Discharge	SD	25-75 percentile	% of Total Costs	Significance of Difference p - value
Hospital first 5 days	2,665	771	2,193 – 3,098	17.4%	3,064	960	2,369 – 3,738	21.4%	0.003
Hospital after 5 days	4,570	6,033	1,319 – 4,826	29.8%	1,360	1,262	606 – 1,796	9.5%	< 0.001
Nursing home	4,991	6,432	0 – 9,371	32.5%	6,281	6,108	1,016 – 10,338	44.0%	0.02
Home for the elderly	1,767	3,836	0 - 98	11.5%	1,436	3,694	0 - 0	10.1%	0.3
Own home	847	2,546	0 - 842	5.5%	692	1,311	0 – 1,106	4.8%	0.5
Readmission hospital	424	1,790	0 - 0	2.8%	887	3,021	0 - 0	6.2%	0.1
Readmission nursing home	74	835	0 - 0	0.5%	46	472	0 - 0	0.3%	0.97
Transfer to other Hospital	0	0	0 - 0		516	4,305	0 - 0	3.6%	0.2
Total	15,338	7,765	8,203 – 20,947	100%	14,281	7,647	7,742 –19,177	100%	0.3

follow up. More cases might have shown differences since the variations were usually large. Secondly, the design was not randomized and some variables (such as type of treatment and length of hospital stay) may have changed during the study independently of the intervention.

The shorter hospital stay was mainly achieved by discharging more patients who came from their homes (from 17% to 67%) or a home for the elderly (from 30% to 50%) to the rehabilitation ward of a nursing home. The stay of institutionalized patients did not change. We had expected that patients who came from home would particularly benefit from the early discharge program. Although their walking ability and ADL level were better at 1 month, no difference was found at 4 months.

The high frequency of general complications (on average 3) may be due to our operational definition and by the careful follow-up in this study; the incidence of adverse events is probably often underestimated.

Early discharge did not substantially cut costs, it merely transferred them from hospital to nursing home. After day 5 in hospital (when the discharge protocol started) hip fracture patients generated low medical costs in hospital. Secondly, the costs of medical interventions and examinations in the first 5 days after surgery were higher in the early discharge group. These patients apparently need a certain number of medical procedures and examinations. Therefore, cost savings from early hospital discharge can easily be overestimated by using average bed costs a day (Hollingworth et al. 1993, French et al. 1995). We found that the total costs per patient of early discharge were € 1,100 less, but this did not reach statistical significance, because of the wide variation in costs (Polder et al. in press). Therefore, we could not confirm the assumed cost-saving by earlier transfer to nursing homes (Laet et al. 1996). On the other hand, this study showed no increase in costs, as reported by Strömberg et al. (1997) who reported higher costs with earlier and more discharges to geriatric wards after changes in the reimbursement system.

An obvious advantage of early discharge from the hospital is the freeing of orthopedic and surgical beds, which may reduce the waiting lists for orthopedic surgery. 3-4 beds a year are now free for other admissions in each of the two participating hospitals. With an average stay of 13 days, it is theoretically possible to admit 100 more patients per hospital.

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Addendum:

The results of the prospective invention study comparing the outcome of the conventionally and the early discharged patients were presented in a journal article (chapter 4). For the interested reader 3 not published tables are added:

Table 1.
Patient Characteristics of Conventionally Managed and Early Discharged Patients with Hip Fracture.

Variable	Conventional Management n = 102	Early Discharge n = 106	Total n = 208	Significance. of Differences Between Groups (p - value)
Mean age years	83 y	84 y	83 y	0,3 (t-test)
median (25th-75th percentile)	83 (77-88)y	84 (79-90)y	84 y	
Percentage women	84%	74%	79%	0,06 (X^2)
Admitted from(%)				0,9 (X^2)
own home	58%	61%	60%	
home for the elderly	27%	25%	26%	
nursing home	16%	14%	15%	
Fracture type (%)				0,1 (X^2)
cervical	43%	51%	47%	
trochanteric	49%	47%	48%	
subtrochanteric	8%	2%	5%	
Operation type (%)				0,06 (X^2)
hemiarthroplasty	25%	29%	27%	
dynamic hip screw	19%	23%	21%	
hansson pins	13%	12%	13%	
gamma-nail	37%	20%	28%	
other		4%	11%	8%
not operated	3%	5%	4%	
Comorbidity (% of patients)				
cardiovascular	45%	44%	45%	
musculoskeletal	42%	41%	41%	
neuropsychiatric	38%	30%	34%	
neurologic	26%	30%	28%	
respiratory	16%	8%	12%	
metabolic and endocrine	16%	17%	16%	
gastrointestinal	9%	8%	8%	
urogenital	8%	6%	7%	
Number of comorbidities (% of patients)				0,6 (X^2)
0	6%	6%	6%	
1	27%	24%	25%	
2	20%	29%	25%	
3	30%	26%	28%	
>3	17%	15%	16%	
mean	2,4	2,2	2,3	0,8 (M-WU)
(with functional limitation)	(1,1)	(1,2)	(1,1)	0,7 (M-WU)

Addendum:

Table 2. Follow up in Walking Ability, (Instrumental) Activities of Daily Living Management, Quality of Life, and Cognitive Status. Comparison of Conventionally Managed (n= 102) and Early Discharged (n= 106) Patients.

outcome	Before Fracture		1 Week		1 Month		4 Months	
	Conventional Management n = 102	Early Discharge n = 106	Conventional Management n = 102	Early Discharge n = 106	Conventional Management n = 97	Early Discharge n = 102	Conventional Management n = 82	Early Discharge n= 86
Walking ability (%)								
not	0%	0%	39%	38%	30%	27%	15%	21%
with help	3%	5%	29%	31%	18%	18%	10%	8%
walking frame	26%	23%	29%	29%	47%	44%	42%	37%
crutches	8%	17%	2%	2%	3%	9%	7%	14%
no walking aids	64%	56%	1%	0%	2%	3%	27%	20%
RAP cmp score (mean) 0-36	9,3	9,9	22,6	22,5	18,9	18,3	14,5	14,9
RAP occupation (0-9)	5,1	5,3	-	-	7,4	7,1	6,2	6,2
NHP (mean) 0-100								
physical mobility	-	-	83	84	73	71	57	59
pain	-	-	55	52	42	35	27	27
sleep	-	-	33	36	30	27	22	26
energy	-	-	62	58	59	48	44	43
social isolation	-	-	35	34	28	29	27	29
emotional reaction	-	-	34	33	29	31	26	27
COOP/WONCA charts (mean) 1-5								
physical condition	-	-	4,9	4,9	4,8	4,7	4,5	4,5
emotional condition	-	-	2,6	2,6	2,4	2,3	2,2	2,4
daily work	-	-	-	-	4,1	4,1	3,5	3,8
pain	-	-	2,8	3,0	2,9	2,7	2,4	2,5
general condition	-	-	3,8	3,7	3,4	3,4	3,3	3,4
change in condition	-	-	4,0	4,0	2,5	2,6	2,9	2,9
social activities	-	-	-	-	2,6	2,2	2,0	2,3
MMSE (mean) 0-29			17,7	17,9	18,9	18,9	20,8	20,6

no differences between conventional management and early discharge with $p < 0,05$ (Mann Whitney U test)

RAP = Rehabilitation Activities Profile (higher figures indicate worse health status)

NHP = Nottingham Health Profile (higher figures indicate worse health status)

COOP/WONCA charts = Dartmouth COOP Functional Health Assessment Charts revised by the World Organization of National Colleges, Academies and Academic Associations of General practitioners and Family Physicians (WONCA)

MMSE = Mini-mental State (higher figures indicate better cognitive status)

Addendum:

Table 3. Patients pre-fracture living at home. Follow up in Walking Ability, (Instrumental) Activities of Daily Living Management, Quality of Life, and Cognitive Status. Comparison of Conventionally Managed (n= 59) and Early Discharged (n= 65) Patients.

outcome	Before Fracture		1 Week		1 Month		4 Months	
	Conventional Management n = 59	Early Discharge n = 56	Conventional Management n = 59	Early Discharge n = 65	Conventional Management n = 57	Early Discharge n = 63	Conventional Management n = 52	Early Discharge n= 57
Walking ability (%)								
not	0%	0%	32%	29%	21%	9%	6%	10%
with help	2%	0%	25%	28%	14%	16%	8%	4%
walking frame	14%	12%	39%	40%	58%	56% *	37%	39%
crutches	8%	23%	3%	3%	5%	14%	10%	17%
no walking aids	76%	65%	0%	0%	2%	5%	40%	30%
RAP cmp score (mean) 0-36	5,6	6,3	21,2	20,2	16,3	14,7 #	11,4	11,0
RAP occupation (0-9)	3,8	3,9	--	--	7,0	6,4 #	5,3	5,3
NHP (mean) 0-100								
physical mobility	--	--	79	79	67	63	48	48
pain	--	--	52	51	36	32	24	24
sleep	--	--	38	39	33	28	22	26
energy	--	--	53	50	47	35	36	31
social isolation	--	--	29	28	23	22	18	22
emotional reaction	--	--	29	26	25	25	21	22
COOP/WONCA charts (mean) 1-5								
physical condition	--	--	4,9	4,9	4,7	4,5	4,3	4,3
emotional condition	--	--	2,4	2,4	2,1	1,8	1,9	2,0
daily work	--	--	--	--	3,9	3,8	3,2	3,3
pain	--	--	2,7	2,9	2,8	2,6	2,3	2,5
general condition	--	--	3,7	3,6	3,2	3,2	3,1	3,1
change in condition	--	--	3,9	4,0	2,3	2,2	2,8	2,9
social activities	--	--	--	--	2,2	1,8 *	1,8	1,7
MMSE (mean) 0-29			21,5	23,0	22,5	23,5	23,8	24,7

no differences between conventional management and accelerated discharge with p < 0,05 (Mann Whitney U test)

* p = 0,05

\# 0,05 > p < 0,1, after correction for differences in RAP score before fracture

RAP = Rehabilitation Activities Profile (higher figures indicate worse health status)

NHP = Nottingham Health Profile (higher figures indicate worse health status)

COOP/WONCA charts = Dartmouth COOP Functional Health Assessment Charts revised by the World Organization of National Colleges, Academies and Academic Associations of General practitioners and Family Physicians (WONCA)

MMSE = Mini-mental State (higher figures indicate better cognitive status)

Chapter 5.
A cost-minimisation study of alternative discharge policies after hip fracture repair

Summary

It is widely assumed that health care costs can be reduced considerably by providing care in appropriate health care institutions without unnecessary technological overhead. This assumption has been tested in a prospective study. Conventional discharge after hip fracture surgery was compared with an early discharge policy in which patients were discharged to a nursing home with specialised facilities for rehabilitation. We compared costs for both strategies from a societal perspective, using comprehensive and detailed data on type of residence and all kinds of medical consumption during a 4-month follow-up period.
As expected, early discharge reduced the hospital stay (with 13 days, $p = 0.001$). More patients were discharged to a nursing home (76% versus 53%). Total medical costs during follow-up were reduced from an average of € 15,338 to € 14,281, representing relatively small and not significant savings ($p = 0.3$). There are two explanations for this unexpected result. First, hip fracture patients were relatively cheap while in hospital. Hence nursing home costs almost equalled hospital costs per admission day. Second, compared to the conventionally discharged group early discharged patients received more medical procedures during the first post-operative days. We conclude that: 1) early discharge shifted rather than reduced costs; 2) the details of costing have a major influence on the cost-effectiveness of alternative discharge policies.

5.1 Introduction

Health technology assessment (HTA) is employed to optimise medical treatment in an economic way. Distinction is made between cost-effectiveness analysis (CEA) and cost-minimisation analysis (CMA). CEAs deal with the question whether new or additional treatment provides value for money compared to conventional treatment. In CMAs it is studied to what extent less intensive treatment is worthwhile regarding medical outcomes. It is assumed that optimising the chain of care can reduce health care costs, for instance by replacing more expensive health care institutions with cheaper ones, without worsening medical outcomes. We performed a prospective study to compare the societal costs of a conventional discharge policy after hip

fracture repair with the costs of an early discharge policy in which patients were rehabilitated in a specialised nursing home as example of a CMA.
Hip fracture incidence is rising exponentially with age. All over the world ageing has important consequences for costs of treatment and rehabilitation [1-6]. The main part of the rehabilitation process is completed in the first 4 months after hip fracture with estimated costs of around US$ 11,000 per patient [7-8]. Since a substantial part of these costs (50%) is made in the orthopaedic department of the hospital several strategies have been described to shorten hospital stay [8]. These strategies include joint orthopaedic-geriatric rehabilitation [9-10] and hospital-at-home schemes [11]. Because functional outcome is expected to be similar, cost-effectiveness of early discharge depends on costs, and boils down to cost-minimisation.
Shortening the length of the hospital stay could be expected to generate substantial cost savings, even with a similar total stay within institutions such as nursing homes and homes for the elderly, because of the higher costs per hospital day. Early discharge is also attractive because it provides possibilities for reducing backlogs and the waiting period for hip surgery. Potential drawbacks of early discharge, apart from medical outcomes, regard an unjustifiable shift to informal care and high capacity costs for the continuous availability of nursing home beds.
Although several prospective studies reported costs of hip fracture, few described the consequences of a change in treatment program [7, 12-14]. We compared the costs between a conventional discharge policy and a strategy in which patients were discharged earlier to a nursing home after day five of admission, if medically possible. We checked for equivalence of medical outcome in terms of functional status and cognitive performance. Costs were studied in detail, since there are indications that costs are highest during the first post-operative days, and decrease thereafter [15]. Using average charges or even average costs per hospital day would lead to an overestimate of the real costs per hospital admission, and by consequence to an overestimation of potential cost savings.

5.2 Data and methods

We performed a prospective study in a university and a general hospital in Rotterdam, the Netherlands. A "before and after" study design was chosen. Randomisation of patients was not considered feasible since the change from conventional discharge to early discharge arrangements required such organisational adjustments that both service models could not be offered simultaneously.

Patients, procedures and medical outcomes

Between October 1996 and October 1998 we invited for participation in both hospitals all patients, aged 65 years and older, with a fresh hip fracture. Excluded were patients with a hip fracture due to metastatic cancer or as part of a multi-trauma. The first 130 eligible patients formed the conventional discharge group of which 102 patients (78%) consented to participate in the study. Early discharge was proposed to the next 124 eligible patients, of whom 106 (85%) consented to participate. There were no clear differences in age and sex between participants and non-participants although slightly more non-participants lived at home before admission (85% versus 60%).

Patients with conventional discharge stayed longer in hospital for rehabilitation than early discharged patients. The treatment consisted of physical therapy, which was given two times per day by the hospitals' physical therapists under supervision of the ward physicians. Early discharge was implemented by a discharge protocol that started five days postoperatively. Administrative procedures were speeded up and the number of beds available on the rehabilitation ward of the participating nursing home was increased. Physical therapists, occupational therapists and social workers were involved in the rehabilitation process, supervised by a physician trained in geriatric medicine.

Clinical equivalence was checked for functional outcome and cognitive status using the Rehabilitation Activities Profile (RAP) and the Mini Mental State Examination (MMSE) [16, 17]. The RAP is based on the International Classification of Impairments, Disabilities and Handicaps (ICIDH) and measures disabilities in communication, mobility and personal care.

Costs: methods

Costs were studied from a societal perspective using a bottom-up methodology [18]. First, real costs were estimated based on a detailed measurement of investments in manpower, equipment, materials, housing and overhead. Fees and charges were only used in case of uncommon interventions and standard laboratory analyses. Second, all medical costs were included as well as the costs borne by the patient and the family, for instance costs of informal care and travelling. Costs of absence from work and related productivity losses were not taken into account, because all patients were old and retired from work.

Costs were calculated for the participating centres only. Hospital costs were estimated separately for a general and an academic hospital. Early discharge increased the proportion of patients discharged to a specialised rehabilitation ward of one particular nursing home. This nursing home had the disposal of a specialised rehabilitation ward with 30 beds. Because this ward existed already when our study started, we did not consider the investment costs of such a specialised rehabilitation ward. All capacity related costs were allocated to bed days using the real investments in the past and annual production figures. These figures included the occupation of nursing home beds. So the availability costs of these beds were discounted in the average costs per inpatient day.

We calculated integral costs per patient. All medical costs during a certain period were included, although from a differential point of view – comparison of the two discharge strategies – some items were not relevant. For these items, including hip surgery itself, we used charges instead of real cost estimates.

We distinguished six categories of care (Table 1): 1) inpatient days (in hospitals, nursing homes and elderly homes); 2) nursing provided by professional nurses (in hospitals, nursing homes and at home); 3) health practitioner activities (physicians, therapists and other); 4) medical procedures (therapeutic, diagnostic and laboratory); 5) travelling (ambulance, taxi and other); and 6) informal care and other costs as meal service at home and adjustment of the housing conditions.

Costs were estimated for a 7-month period, 3 months pre-operatively and 4 months post-operatively. We distinguished seven periods based on the location of the patient: 1) before hospital admission; 2) from admission to day five after hip surgery; 3) from day 6 until discharge form hospital; 4) nursing home; 5) elderly home; 6) home; 7) readmission to hospital or nursing home. For each period we calculated total costs per patient for the six categories mentioned before.

Costs were calculated by multiplying the volumes of health care use with the corresponding unit prices and are reported in 1998 Euros. Discounting was not relevant because of the limited time horizon.

Costs: volume of health care use

The volume of health care was observed in much detail. A research assistant registered for each patient the number of inpatient days, the time needed for nursing, care and therapy as well as the time spent by physicians and other health practitioners per admitted patient. Nursing time was registered in the patient files by the nurses

Table 1
Cost categories and data used in cost calculations

Cost category	Parameter	Data collection volume of care			Cost estimate (unit price)
		hospital registry	study registry	question naire	
Inpatient days					
hospital	days		*		real costs
nursing home	days		*		real costs
elderly home	days		*		real costs
Nursing					
hospital	minutes		*		real costs
nursing home	minutes		*		real costs
home care	minutes			*	real costs
Health practitioners					
physician (inpatient)	minutes		*		real costs
physician (outpatient)	visits		*		real costs
general practitioner	visits			*	fees
physical therapist	minutes		*		real costs
psychologist / social worker	visits		*	*	real costs
other health professionals	visits		*	*	fees
Medical procedures					
hip surgery	number by type (3)		*		charges
other therapy	number by type (30)	*			charges
X-ray hip	number			*	charge
X-ray thorax	number			*	charge
other radiology	number by type (30)	*			charges
laboratory	number by type (125)	*			charges
Travelling					
ambulance	rides			*	charge
taxi	rides			*	charge
other	rides			*	real costs
Informal care and other costs					
informal care	minutes			*	shadow price
day care (hospital)	number			*	charge
day care (nursing home)	number			*	charge
other costs	various			*	various

in the hospitals and the nursing homes. The research assistant took care of the completeness of the data. She also interviewed all caregivers about their time investments per patient and furthermore registered the type of hip surgery, the number of X-rays and the number of outpatient visits to physicians and general practitioners. Detailed information on medical consumption in hospital was derived from the hospital information systems of the participating hospitals. These data included medical interventions other than hip replacement (30 categories), radiology (30 categories) and laboratory analyses (125 types). Data on nursing time and costs of home care were obtained from the largest provider covering 65% of the included patients. Data on outpatient care were collected by questionnaires.
Medical consumption in hospital and nursing home was registered on a daily basis. Discharged patients were visited by the research assistant one month after inclusion and at the end of the follow-up period. She assisted the patients with questionnaires on medical consumption. If needed, for instance because demented people could not answer the questions, the research assistant gathered information from personnel in the nursing home or elderly home in which the patients lived, or otherwise from the relatives of patients at home.

Costs: unit prices and cost calculation

Unit prices for inpatient days were estimated as real, basic costs per day using detailed information from the financial accounts of the hospitals, nursing homes and homes for the elderly that participated in the study. These estimates included overhead and indirect costs but excluded all direct costs that were analysed separately. Hence nursing costs and cost of all diagnostic and therapeutic interventions and laboratory examinations, as well as all costs of health practitioners that are normally included in average day prices were calculated separately. We calculated average costs per hospital day for each patient in the study population by summing up all costs per category of health care use. For readmissions in hospitals and nursing homes, partly not participating in the study, no detailed data on health care use per inpatient day were available. For these readmissions we therefore used all-in average prices per inpatient day.
The salary schemes of hospitals and other health care suppliers were used to estimate costs per hour for each type of care giver. Taxes, social securities and vacations were all included, as well as the costs for the time that could not be assigned to individual patients.

In the Netherlands a detailed 'fee for service' system is used for the remuneration of medical interventions and diagnostic procedures. For these categories we used the fees as a proxy of real costs. There are several reasons for not calculating real costs. First, the hip surgery as such was not the focus of our study but the discharge strategy after surgery. Second, the list of diagnostic procedures is long, but total costs are relatively small and the Dutch charges for laboratory procedures can be seen as a good proxy of real cost [19].
Bottom-up cost estimates were made. In this paper we will reverse the order of presentation. First, estimates on average costs at aggregate level are presented, and the cost differences between conventional and early discharge analysed (using the Mann-Whitney U test). Second, we show detailed figures for different periods and categories.

Explanatory factors

This paper will also deal with a number of explanatory factors, including age, number of comorbidities, cognitive status, functioning before fracture, residence before admission and costs before admission. These factors were tabulated to indicate the major determinants of health care costs within this population. These factors were further analysed with multiple linear regression.

5.3 Results

Patient characteristics

The baseline characteristics of the two groups of patients were similar (Table 2). Patients averaged 83 years of age, were predominantly female (79%) and most of them were living without partner (74%). All patients could walk before fracture, most of them without assistance or walking aids. The RAP score averaged 9.6 for all patients with small, not statistically significant differences between conventionally and early discharged patients. Many patients (41%) were institutionalised before fracture, and 94% had one or more comorbid conditions at time of hospital admission.

Medical outcomes

Medical outcomes at 4 months after hip fracture repair were equivalent for conventionally and early discharged patients. Nearly 20% of all patients died, with no

Table 2
Characteristics of conventionally and early discharged hip fracture patients

	Discharge policy		Total
	conventional (n=102)	early (n=106)	(n=208)
Demography			
Median age (years)	83	84	84
25th – 75th percentile (years)	77 – 88	79 – 90	78 – 89
Men/women	16/84%	26/74%	21/79%
With/without partner	24/76%	27/73%	26/74%
Residence before fracture			
Nursing home	16%	14%	15%
Home for the elderly	27%	25%	26%
Own home	57%	61%	59%
Walking ability			
Not	0%	0%	0%
With help	3%	5%	4%
With walking frame	26%	23%	24%
With crutches	8%	17%	12%
Without walking aids	64%	56%	60%
RAP score (0 – 36)	9.3	9.9	9.6
Fracture type			
Cervical	43%	51%	47%
Trochanteric	49%	47%	48%
Sub-trochanteric	8%	2%	5%
Number of comorbidities			
0	6%	6%	6%
1	27%	24%	25%
2	20%	29%	25%
3	30%	26%	28%
4 and more	17%	15%	16%
Average number	2.4	2.2	2.3

Table 3
Medical outcomes at 4 months after hip fracture repair

	Discharge policy		Total
	conventional	early	
Status at 4 months	(n=102)	(n=106)	(n=208)
Died	20%	19%	20%
Hospital	0%	0%	0%
Nursing home	28%	26%	27%
Home for the elderly	17%	14%	15%
Own home	36%	41%	38%
Walking ability	(n=82)	(n=86)	(n=168)
Not	15%	21%	19%
With help	10%	8%	9%
With walking frame	42%	37%	39%
With crutches	7%	14%	10%
Without walking aids	27%	20%	23%
RAP score (0 – 36)	14.5	14.9	14.7
MMSE score (0 – 29)	20.8	20.6	20.7

RAP = Rehabilitation Activities Profile (higher figures indicate worse health status)
MMSE = Mini-Mental State (higher figures indicate better cognitive status)

difference between both groups (Table 3). These results are consistent with the findings reported in literature [20-23]. Differences in residence (nursing home, home for the elderly and own home), walking ability, RAP score and MMSE were small and not statistically significant ($p < 0,05$ Mann Whitney U test).

Inpatients days and type of residence during 4-month follow-up

Early discharged patients stayed an average of 13.5 days less in hospital than conventionally discharged patients (12.7 versus 26.2 days, Table 4). The total time spent in a health care institution, however, was the same for both groups (75.7 days for

early discharged and 79.3 days for conventionally discharged patients). The main cause was the longer average stay in nursing homes of the early discharged group (46.4 versus 34.7 days).

Table 4 also shows the destination of patients at discharge from hospital. Most patients in the early group were discharged to a nursing home for rehabilitation (76%). Conventionally discharged patients were rehabilitated in hospital and discharged after their (longer) hospital stay, relatively more frequently to their own home or an home for the elderly compared to early discharged patients (42% versus 23%). Nevertheless, a good 53% of the patients in the conventional group were discharged to a nursing home, which is high given that before fracture only 16% of these patients lived in a nursing home.

At four months after hip fracture, these differences in residence had completely disappeared. Most patients lived in their own homes (36% and 41% among the conventionally and early discharged group, respectively, Table 3), although the number remained low compared to the living situation before fracture (57% and 61% respectively, Table 2).

Table 4
Average number of inpatient days in hospital, nursing home and elderly home, and discharge arrangements.

	Discharge policy	
	conventional (n=102)	early (n=106)
Inpatient days		
hospital	26.2	12.7
nursing home	34.7	46.4
elderly home	16.5	12.2
readmission to hospital / nursing home	1.9	4.4
Total days in institutions	79.3	75.7
Destination at discharge		
died in hospital	6%	0%
nursing home	53%	76%
elderly home	17%	9%
own home	25%	14%

Costs per patient

Average costs during the 4 months after incidence of hip fracture amounted to € 14,281 for early discharged patients, which was € 1,057 less compared to conventionally discharged patients (€ 15,338, Table 5). Unfortunately the cost savings were not statistically significant (p = 0.315). There was a wide variation in costs within both groups. Among conventionally discharged patients costs at 25th – 75th percentiles were € 3,511 – € 18,144. The variation among early discharged patients was somewhat smaller (€ 3,986 – € 16,968). It is not clear however, whether the statistic insignificance was caused by the large variation or the absence of a true difference. It is assumed that the effects of early discharge might be different for patients in different groups. We distinguished between patients living at home and patients living in an health care institution before fracture, and two equal groups based on the RAP score using the median as cut-off value. People living at home had significant (p < 0.001) lower costs compared to people in health care institutions (€ 12,925 versus € 17,567). These people seem more eligible for early discharge. Compared to conventional discharge, average costs in this group decreased by nearly € 2,100 (p = 0.313) due to early discharge. Opposite, average costs among people living in institutions increased (€ 864; p = 0.764), mainly due to a higher number of medical interventions in the post-operative days (see below). Similar results apply to RAP scores. Costs for people with low RAP scores (0 – 9) were on average € 4,535 lower compared to people with RAP scores >10 (p < 0.001). Average costs among people with lower RAP scores (better functional status) decreased substantially by early discharge (€ 3,351; p = 0.036), while for people with high RAP scores average costs increased (€ 1,006; p = 0.694).

Table 5 shows that early discharge causes a shift in costs from hospital to nursing home. Hospital costs were reduced by € 2,812 (p < 0.001), nursing home costs increased on average by € 1,290 (p < 0.001). The conventionally discharged patients incurred 47% of costs in the hospital, 33% in the nursing home, 12% in the home for the elderly and 6% at home. For early discharged patients these figures were respectively 31%, 44%, 10% and 5%. These figures exclude readmissions in hospital or nursing home. Because early discharged patients have a greater chance of readmission, this can bias the results in favour of early discharge. Table 5 shows a cost difference of € 952, resulting almost entirely from readmissions to hospital. When these costs are included the savings in hospital costs per early discharged patient decrease to around € 1,800. A second important shift in costs shown in table 5 regards an

increase of hospital costs during the first days after surgery among early discharged patients. Compared to the conventionally discharged group, average costs increased by € 399 ($p < 0.01$). Apparently the prospect of a short hospital stay cause physicians to speed up diagnostic and laboratory procedures. More or less substantial differences existed for the periods outside hospital and nursing home. These differences, however, neither reached statistical significance nor changed the general finding that the cost savings achievable with early discharge were limited.

Costs up to 3 months before admission amounted to € 4,517 in the conventional group and € 4,705 in the early group. After correcting for this pre-admission costs, the adjusted costs difference after hip fracture increased slightly to € 1,162 ($p = 0.25$). The costs caused by hip fracture in addition to the costs of care the patients received before the fracture, were estimated at € 9,316 for conventionally discharged and € 8,008 for early discharged patients.

Table 5
Average costs (€, 1998) per patient by period and discharge policy, cost difference between early and conventional discharge

Period	Discharge policy		Difference (early – conventional)		
	conventional (n=102)	early (n=106)	Average	95% CI	p-value
Before fracture (3 months)	€ 4,517	€ 4,705	€ 188	[-1,022 – 1,397]	p = 0.65
Hospital	7,235	4,423	-2,812	[-4,048 – -1,576]	p < 0.001
- until 5 days after surgery	(2,665)	(3,064)	(399)	[160 – 637]	p = 0.003
- from day 6 until discharge	(4,570)	(1,359)	(-3,211)	[-4,392 – -2,029]	p < 0.001
Nursing home	4,990	6,280	1,290	[-424 – 3,004]	p = 0.017
Elderly home	1,767	1,436	-331	[-1,360 – 699]	p = 0.34
Home	847	692	-155	[-708 – 397]	p = 0.54
Readmission in hospital or nursing home	498	1,450	952	[-140 – 2,043]	p = 0.047
Total costs after fracture	15,338	14,281	-1,057	[-3,164 – 1,051]	p = 0.32

CI = confidence interval

Costs per inpatient day

Average costs per inpatient day are shown in Table 6. These figures are based on the real medical consumption as registered in the study. The first 5 hospital days immediately after surgery were more expensive than later days due to more nursing time, more supervision by physicians and additional diagnostic and laboratory procedures. Average hospital costs for early discharged patients were higher than for conventionally discharged patients, as explained before. Average costs per inpatient day in nursing homes (about € 140) and homes for the elderly (about € 100) were substantially lower in comparison with hospitals.

In the Dutch health care system inpatient days are remunerated on daily basis by charges that represent average costs over all patients. These charges do not differentiate between types of care other than IC-units versus common nursing wards. Charges per hospital day vary among general and university hospitals from € 235 until € 350 [19]. Our detailed cost estimates show higher costs for the first post-operative days and lower costs for the remainder of the hospital stay. Hence, early discharge seems unprofitable from the perspective of hospital financing. It must be noted, however, that most of the included interventions and examinations can be charged separately.

Table 6
Average costs and charges paid by the health care system (€, 1998) per inpatient day in hospital and nursing home

	Real costs in study population				Charges in the Dutch health care system (€)
	Conventional discharge		Early discharge		
	Average costs (€)	CI (95%)	Average costs (€)	CI (95%)	
Hospital					235 – 350
- until day 5 after surgery	422	[206 – 638]	456	[91 –821]	-
- from day 6 until discharge	237	[-14 – 488]	264	[58 – 470]	-
Nursing home	143	[72 – 214]	134	[75 – 193]	130
Elderly home	101	[50 – 152]	119	[50 – 188]	60

CI = confidence interval

Costs by categories

Table 7 shows the average costs per patient by category, period and discharge policy. Costs before fracture were mainly incurred in the categories inpatient days, care, informal care and other costs, with only slight differences between both discharge groups. Total costs after hip fracture could mainly be attributed to inpatient days (50%, € 7,200) and nursing (30%, € 4,000). Costs for health practitioners (physicians, physical therapists and other) were limited to only 6 – 7% of total costs. This figure excludes hip surgery and all other medical procedures including diagnostic and laboratory assessment, that represented 12% of total costs. On aggregate level differences between both discharge policies were rather limited. Major differences were only observed in average costs from day 6 until discharge for inpatient days in hospital (lower costs for early discharge) and nursing home (higher costs for early discharge). The shorter stay in hospital and longer stay in nursing home explain this finding. Costs of medical procedures shifted to the first 5 days after surgery in the early discharge group, as mentioned before.

Explanatory factors

Relationships between several variables and average costs per patient are shown in Table 8. The difference between patients admitted to the general or to the university hospital was € 1,219 ($p = 0.26$) with higher costs for the university hospital. A larger number of co-morbid conditions, diminished cognitive status, deteriorated functioning before fracture, increased costs before admission, the presence of diagnosis dementia and the pre-fracture residency in a home for the elderly or nursing home were all associated with increased costs. In a multivariable analysis, the pre-fracture residency in an elderly home, the number of comorbidities, functioning before fracture (RAP score) and dementia were the most important explanatory factors for costs after fracture.

5.4 Discussion

We compared two discharge policies after hip fracture repair. Because the patients in both groups had on average the same characteristics before fracture and medical outcomes were equivalent, it was possible to perform a cost-minimisation analysis (CMA). We found that early discharge of hip fracture patients from hospital led to a limited, statistically non-significant reduction of total costs. We used a detailed calcu-

Table 7
Average costs (€, 1998) per patient by period, cost category and discharge policy

Period	Inpatient days		Nursing		Health practitioners		Medical procedures		Travelling		Informal care and other		Total costs per patient			
	conv	early	conv	early	conv	early	conv	early	conv	early	conv	early	conventional		early	
Before fracture	2,516	2,492	1,115	1,261	73	85	0	0	0	4	812	863	4,517		4,705	
Hospital																
-until 5 days after surgery	763	821	505	479	107	124	1,268	1,615	23	25	0	0	2,665	(17%)	3,064	(21%)
-from day 6 until discharge	2,330	675	1,350	293	212	74	566	150	113	169	0	0	4,570	(30%)	1,359	(10%)
Nursing home	2,518	3,414	2,008	2,163	421	633	0	0	28	62	15	8	4,990	(33%)	6,281	(44%)
Elderly home	1,125	829	571	529	45	40	0	0	14	3	12	35	1,767	(12%)	1,436	(10%)
Home	0	0	285	324	73	104	0	0	18	27	472	237	847	(6%)	692	(5%)
Readmission	477	1,437	-	-	-	-	-	-	21	13	0	0	498	(3%)	1,449	(10%)
Total costs after fracture	7,213	7,176	4,717	3,787	858	975	1,833	1,765	217	299	499	280	15,338	(100%)	14,281	(100%)
(Share)	(47%)	(50%)	(31%)	(27%)	(6%)	(7%)	(12%)	(12%)	(1%)	(2%)	(3%)	(2%)	(100%)		(100%)	

- Not available (costs included in inpatient days).

Table 8

Average costs (€, rounded to hundreds, 1998) per patient according to explanatory factors

Predictive factor	Costs per patient		Number of patients	Significance of difference
	€	Confidence Interval (95%)		
Hospital				
general hospital	14,100	[200 – 28,100]	90	p = 0.26
university hospital	15,300	[-600 – 31,200]	118	
Age in years				
65-79	14,100	[-2,400 – 30,600]	67	p = 0.26
80-89	14,900	[-600 – 30,300]	101	
>= 90	15,800	[4,300 – 27,400]	40	
Number of co-morbidities				
0	6,700	[-1,500 – 14,900]	12	p = 0.002
1	13,600	[-1,600 – 28,900]	53	
2	15,200	[1,200 – 29,200]	51	
3	17,000	[1,100 – 33,000]	59	
4 and more	15,000	[2,000 – 28,000]	33	
MMSE-score after 1 week				
missing	15,500	[2,900 – 28,100]	18	p < 0.001
0-12	18,300	[2,700 – 34,000]	48	
13-18	15,400	[3,200 – 27,700]	30	
19-22	16,300	[2,400 – 30,200]	31	
23-29	11,700	[-2,900 – 26,400]	81	
Dementia				
no	13,900	[-700 – 28,400]	166	p = 0.001
yes	18,400	[3,000 – 33,800]	42	
RAP cmp-score before fracture				
0 – 4	12,200	[-2,400 – 26,800]	78	p < 0.001
5-14	15,100	[1,600 – 28,600]	68	
15-36	17,800	[2,400 – 33,100	62	
Residence before fracture				
home	12,900	[-1,800 – 27,600]	124	p = 0.001
elderly home	17,700	[6,300 – 29,200]	53	
nursing home	17,300	[-700 – 35,300]	31	
Costs before fracture				
< _ 4,540	12,800	[-1,800 – 27,300]	116	p < 0.001
> _ 4,540	17,400	[3,100 – 31,700]	92	
Discharge policy				
conventional discharge	15,300	[100 – 30,600]	102	p = 0.32
early discharge	14,300	[-700 – 29,300]	106	

lation method to estimate real costs from a societal perspective. Therefore we were able to present estimates of costs in different categories and for different periods after hip fracture. Hence it was possible to observe some important shifts in costs. Finally, we identified a number of explanatory factors for costs after fracture.

Total costs: early discharge versus conventional discharge

Contrary to our expectations, early discharge did not significantly reduce costs. This was mainly due to the shift of costs from hospital to the nursing home. The total number of inpatient days in all institutions together was almost the same within both groups, and costs per day in a nursing home differed little from costs in hospital after the first 5 days post-operative. During the first days in hospital, the costs were initially high due to hip surgery, diagnostic and other medical procedures and intensive post-operative care, but subsequently decreased substantially [13].
Although the reduction in hospital stay by the early discharge programme was larger than in some Australian studies [7, 12, 24], we did not observe significant cost savings. Adjustment for costs incurred before hip fracture did not change this outcome. Some analyses, however, demonstrated that costs savings among people with good (low) RAP scores and for people being referred from their own homes were much greater and more significant.
Cost savings in the Australian studies resulted from a shorter hospital stay and were relatively modest (about € 650 per patient [7, 12]) or only reached statistical significance when costs per recovered patient were calculated separately [7]. We found a difference of € 1,057 per patient in favour of the early discharge programme but the cost savings were not statistically significant. It was not clear, whether the low level of statistic significance was caused by the large variation or a real absence of a difference. Another cost-cutting strategy was early discharge of patients to a 'hospital-at-home' scheme [13]. Again, the savings resulted from shorter stays in orthopaedic and geriatric wards, while costs at home did not increase substantially. The hospital-at-home scheme, however, was only suitable for about 40% of total patients in this study, while in another part of England only 18% of patients fitted the selection criteria [22].
In Sweden, the substitution of hospital care by geriatric care resulted in a cost increase of 12% [14]. In that study, the number of hospital days was approximately halved by earlier discharge to geriatric wards.

Hospital and incremental costs

Hospital costs in our study (€ 7,235 for conventionally discharged patients and € 4,432 for early discharged patients) fitted well within the range of costs reported by others. These range from € 3,600 – 8,400 in Great Britain [13, 15, 25], € 5,300 – 8,700 in Sweden [8, 14, 26] to € 10,300 in the United States [27]. Costs during the 4-month follow-up are more difficult to compare. Our estimate of € 15,000 is high compared to Borquist's estimate for Sweden (€ 10,700) [8], which, however, only included patients coming from home.
We estimated costs in the three months before fracture at € 4,600. Incremental costs attributable to hip fracture were therefore € 9,300 for conventionally discharged and € 8,000 for early discharged patients. These figures are in line with the € 8,600 of additional costs during the first year after hip fracture reported by De Laet for the Netherlands [28] and with the estimate of € 8,910 by Cameron et al. [7]. Others, however, found much higher figures: € 12,000 – 14,000 for the United States in 1993 [27] and € 17,000 in Sweden in 1994 [29]. This difference may partly be explained by higher hospital costs and more admissions to geriatric departments and nursing homes in the latter two studies.

Explanatory factors

The most important explanatory factors were the pre-fracture residency, the number of comorbidities, level of functioning (RAP score) before fracture and dementia. These factors also explain survival, which influences the cost estimates. For example, patients with dementia incurred higher costs, while their survival was worse compared to non-demented patients. On average, for surviving and deceased patients we estimated costs at € 15,300 and € 12,700 respectively.
The higher costs among institutionalised patients are in line with data from Sweden [29] but were not demonstrated in Scotland [15]. We could not confirm the relation with type of fracture or gender that was reported by Borquist [8].

Explanations for the disappointing cost savings

Owing to the detailed cost analyses available, we are able to provide some explanations for the disappointing cost reduction. First, comorbidity played an important role in our study population. People were old and had multiple diseases (Table 2). Comorbidity was an important explanatory factor for high costs (Table 8). The large

variation in costs between patients within both groups also indicate that hip fracture is but one cause of health care costs. People were old and needed care for different diseases and disorders. The total number of inpatient days was on average the same for both groups, irrespective whether the care was supplied by a hospital or a nursing home. In some sub-group analyses it was demonstrated that cost savings among people living at home and with better RAP scores were much greater.
Second, during the hospital days immediately after surgery the number and costs of medical interventions and examinations was higher among the early discharged group. Apparently hip fracture patients need a certain amount of medical procedures, mainly diagnostic and laboratory, which can not simply be skipped. Early discharge resulted in a concentration of medical procedures during the first post-operative days, which partially cancelled out its potential benefits. In addition the early discharged patients received more physical therapy in nursing home than the conventionally discharged received in hospital. This also decreased the cost difference between both groups.
Third, we confirmed that hospital costs per inpatient day decrease after day five. Shortening the hospital stay will always save the less costly days. Calculations that do not reckon with this phenomenon will overestimate the potential savings. The use of charges would even increase the difference, since for hip fracture patients the Dutch charges exceed real hospital costs but remain under real costs in nursing homes and homes for the elderly (Table 6).
The cost savings were disappointing, because they did not reach statistical significance, and we therefore could not reject the hypothesis that there were no savings at all. Furthermore the estimated savings, whether statistically significant or not, seemed to be small because the expectations were much higher. On the other hand, 7% saving might have a large economic impact since hip fracture incidence is quite high. Given the equivalence of medical outcomes one might argue that the estimated cost savings are not disappointing at all.

Opportunity costs

Most early discharge schemes are not set up with the single aim of reducing costs. An other important objective is to free orthopaedic surgical beds for other hip fracture patients. If the freed beds are indeed used for elective surgery of new patients, total costs from a societal perspective would increase. Health benefits, however, would also increase, because waiting lists reduce and more patients can be treated

in the same period. In our study three to four beds were free for other admissions in each of the two participating hospitals. With an average stay of 13 days it is theoretically possible to treat an additional 100 patients per hospital. These benefits can be considered as the opportunity costs of conventional discharge.

Real costs in the real world

We estimated real costs in the setting of the study. In the real world things might be different. It is assumed that early discharge causes a shift from formal to informal care. We could not confirm this assumption. Costs of informal care were relatively low. Costs among early discharged patients were rather lower than higher, although the difference reached not statistical significance. The large number of inpatient days plays an important role here. On average patients, whether early discharged or not, remained more than half of the 4-month study period in a health care institution. At the end of this period 54% of all patients stayed in a nursing home or elderly home, an increase of one third compared to the situation before fracture.
In our study the investment and capacity costs of a specialised rehabilitation ward in a nursing home were rather low. The ward already existed at onset of study, and due to an efficient planning of patients the occupation of this ward was high. Investment costs and capacity costs were integrated in the average costs per admission day. In real life, costs will be higher if specialised wards must be newly built. Capacity costs can also become high, if the ward is too large for an efficient occupation of beds, or too small for an efficient employment of physical therapists and other personnel. National application of early discharge would therefore require a careful planning of rehabilitation wards.

Limitations of the study

Our study has some limitations. First, the sample size was relatively small (102 and 106 patients). The difference in hospital stay (13 days), however, should have been large enough to show any clear economic advantage of the early discharge programme.
Second, the design was not randomised and it is possible that some variables such as the duration of hospital stay and discharge destination changed during the study independently from the intervention. The before and after design is most appropriate for these kind of studies, but has some specific drawbacks. It is likely that physicians become more familiar with the new discharge policy during the study period.

To analyse such an effect, we tested whether the first 53 patients in the early discharge group had higher hospital costs than the second 53 patients. Average hospital costs for patients in the first group amounted to € 4,573. Average costs in the second group were approximately 9% lower (€ 4,273), indicating the existence of a learning effect. The difference, however, did not reach statistical significance ($p = 0.122$).

Third, it is difficult to generalise the results for patients living in other countries because geriatric rehabilitation and long-term care of the elderly differ between countries. The rehabilitation ward of a Dutch nursing home probably compares best with a geriatric rehabilitation ward in a hospital or a Skilled Nursing Facility in the US.

5.5 Conclusions

This study shows that the details of costing highly influence the outcomes in a cost-minimisation analysis. Costs shifted from hospital to the nursing home because total institutional length of stay was similar and there was only a small difference in costs per inpatient day between hospital and nursing home. This latter phenomenon was caused by the relatively less intensive care of hip fracture patients among the hospital population and relatively more intensive care compared to other people in nursing and elderly homes. Furthermore, the early discharge regime evoked a concentration of diagnostic procedures in the few days prior to discharge, resulting in higher average costs that cancelled out some of the potential savings. For people with better health status before fracture the possibilities for early discharge and the potential savings seem to be better.

Our study emphasises the importance of a detailed cost analysis based on real resource use. Standard charges or average all-in prices would raise expectations about cost savings that can not be realised. This conclusion is not limited to our study or other early discharge studies but has relevance for the whole field of cost analysis in health care.

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Chapter 6.
Hip fracture in elderly patients: complications after hospital discharge.

Abstract

OBJECTIVES:. To investigate the effect of an early discharge program on mortality and complications of elderly hip fracture patients.
STUDY DESIGN: Follow-up until 4 months after hospital admission or death.
POPULATION: Two hundred and eight consecutively admitted patients, 65 years and older. First, a group of 102 patients remained in hospital for the conventional length of time (average stay 26 days); second, 106 patients were enrolled in an early discharge program (average stay 13 days).
OUTCOME MEASURES: All medical events that required therapeutic intervention were recorded as complications.
RESULTS: Hospital mortality was 3% and mortality at 4 months was 19%. There were no substantial differences between conventionally discharged and early discharged patients. Patients experienced on average 3 complications in the four-month period. Conventionally discharged patients experienced 334 complications and early discharged patients experienced 298 complications. Of the conventionally discharged patients, 64% of complications occurred during hospital stay, 24% in the nursing home and 12% at home. Of the early discharged patients, 45% of complications occurred during hospital stay, 45% in the nursing home and 10% at home. Complications were local in 22%, circulatory in 49%, cardiovascular in 29%, respiratory in 15%, urinary tract in 52%, psychiatric in 20%, gastrointestinal in 14%, and other in 27% of patients. Main predictive factors for complications and mortality were age, institutional residence before fracture, and number of comorbidities.
CONCLUSION: Elderly hip fracture patients experience many medical complications before and after discharge from the acute hospital. An early discharge policy did not affect the number or nature of complications but shifted the location of occurrence to outside the hospital.

6.1 Introduction

The length of stay in hospital of patients being treated for hip fracture has been reduced by new surgical and anaesthetic techniques with early mobilisation[1], joint

orthopedic-geriatric rehabilitation[2] and rehabilitation at home or in geriatric rehabilitation centers.[3]

In most follow-up studies, the description of hip fracture complications is limited to the direct postoperative period in hospital. For longer follow-up periods, complications are usually only reported when they lead to re-admission to hospital, and the exact time period between discharge and the occurrence of complications is often not mentioned [4-7]. More complications occurring outside hospital are anticipated as numbers of frail hip fracture patients increases and the length of their hospitalization is reduced. We describe all the complications experienced by consecutive elderly hip fracture patients during a follow-up period of four months. We also assess the influence of an early discharge program on the location of occurrence.

6.2 Methods

Between October 1996 and October 1998, we recruited consecutive patients, aged 65 years and older, who were admitted with a fresh hip fracture to a university hospital and a general hospital in Rotterdam, the Netherlands. Patients with a hip fracture because of metastatic cancer or multitrauma were excluded. Eighteen percent of the patients refused to participate. There were no clear differences in age and sex between participants (208 patients) and non-participants (46 patients). More non-participants lived at home before admission (85% versus 60%) but residence at 4 months or mortality did not differ from participants. Two groups of patients were consecutively included: first, a group of 102 patients who remained in hospital for the conventional length of time (average stay 26 days); second, 106 patients who were enrolled in an early discharge program (average stay 13 days). Patients underwent surgery within 1 to 2 days after hospital admission. Patient mobility was encouraged as soon as possible (1 to 2 days after surgery). All patients received thromboembolic prophylaxis unless contraindications were present.

The same investigator interviewed and evaluated all patients using a standard protocol at 1 week, 1 month and 4 months after admission to the hospital. After 4 months, no further recovery can be expected [5,8,9]. Furthermore, the mortality rate for the survivors becomes the same as the expected mortality rate for the population approximately three to eight months after injury.[10,11]

Information about comorbidity, type of fracture, surgery and length of stay was obtained from medical charts and health professionals. Function was assessed by the Rehabilitation Activities Profile.[12] All medical events that required nurse-physician

monitoring or therapeutic intervention were recorded as complications. During their stay in hospital and in the nursing home, medical and nursing charts were examined for the occurrence of complications. If necessary, health professionals were asked for clarification. In case of discharge either to home or home for the elderly, general practitioners were approached by phone or letter. Also, patients and relatives were asked about the occurrence of complications. A 100% complete follow-up was thus accomplished. All complications were recorded using a predefined classification list. Complications were classified using a severity rating scale[13] that divides complications into 4 classes:

Class A: complication requiring < 1 day of Nurse-Physician Monitoring (N-PM), without Therapeutic Intervention (TI), without evident Residual Functional Impairment (RFI);

Class B: complication requiring TI and 1-7 days of N-PM, without RFI;

Class C: complications requiring TI and 8-21 days of N-PM, without RFI;

Class D: complication associated with RFI and requiring TI, regardless of duration of N-PM.

Comorbid conditions were only registered if patients had complaints, had used medication, or experienced a functional limitation as a consequence of these comorbidities at hospital admission. Univariable and multivariable Cox regression analyses were carried out using the following variables to determine potential risk factors for the occurrence of first complications and mortality: age, gender, early discharge versus conventional discharge, general hospital versus university hospital, residence in home for the elderly and nursing home before admission, number of comorbidities, diagnosis of dementia before admission, and functioning before admission (as assessed using the Rehabilitation Activities Profile). Potential risk factors were entered together in a multivariable model with subsequent stepwise deletion of factors with $p > 0.20$. Factors with $p < 0.05$ were considered statistically significant. The calculated percentages of patients with complications were corrected for mortality. Statistical analysis was performed using SPSS (Chicago, IL).

6.3 Results

Patient Characteristics

Patients were of high mean age (83 years), predominantly female (79%), and a substantial proportion (41%) already lived in an institution before their hip fracture

Table 1.
Patient characteristics and outcome. 208 patients admitted to hospital with hip fracture.

Variable	Conventional Discharge N = 102	Early Discharge n = 106	Total n = 208
Mean age years	83	84	83
median (25th-75th percentile)	83 (77-88)	84 (79-90)	84
Percentage women	84%	74%	79%
Admitted from(%)			
own home	58%	61%	60%
home for the elderly	27%	25%	26%
nursing home	16%	14%	15%
Fracture type (%)			
cervical	43%	51%	47%
trochanteric	49%	47%	48%
subtrochanteric	8%	2%	5%
Operation type (%)			
hemiarthroplasty	25%	29%	27%
dynamic hip screw	19%	23%	21%
hansson pins	13%	12%	13%
Gamma-nail	37%	20%	28%
other	4%	11%	8%
not operated	3%	5%	4%
Comorbidity (% of patients)			
cardiovascular	45%	44%	45%
musculoskeletal	42%	41%	41%
neuropsychiatric	38%	30%	34%
neurologic	26%	30%	28%
respiratory	16%	8%	12%
metabolic and endocrine	16%	17%	16%
gastrointestinal	9%	8%	8%
urogenital	8%	6%	7%
Number of comorbidities			
mean	2,4	2,2	2,3
Days in hospital			
mean	26	13	
median (25th-75th percentile)	18 (13-29)	11 (9-15)	
Discharged from hospital to (%)			
died in hospital	6%	0%	
own home	25%	14%	
home for the elderly	17%	9%	
nursing home	53%	76%	
Residence at 4 months (%)			
died	20%	19%	
own home	36%	41%	
home for the elderly	17%	14%	
nursing home	28%	26%	

(Table 1). The group of patients who were discharged conventionally (n=102), stayed on average 26 days (median 18 days) in hospital while the group of patients whose discharge was accelerated (n=106), stayed on average 13 days (median 11 days) in hospital. There were no differences in age, sex, pre-fracture residence, comorbidity, type of fracture, and type of surgery between the two groups. Fifty-three percent of conventionally discharged patients and 76% of early discharged patients were discharged to a nursing and rehabilitation center from hospital. At 4 months after hospital admission, 19% of patients were dead and 27% were in a nursing home. There were no differences between the 2 groups. Of the patients who came from home, 63% were back at home at 4 months after fracture. Patients had on average 2.3 comorbid conditions at hospital admission and only 6% had no comorbid condition. The diagnosis of dementia was established before hospital admission for 20% of all patients.

Mortality

Forty patients died (19%) within 4 months. Of these, 7 patients died within 1 month. Seven patients died in the hospital, 26 in the nursing and rehabilitation center, 4 after discharge back to their home for the elderly and 4 at home. The average survival time of all deceased patients was 56 days after hospital admission. Cox regression analysis revealed 3 important predictive factors: higher age ($p < 0.01$), living in a nursing home before hospital admission ($p = 0.04$) and number of comorbid conditions ($p < 0.01$). Mortality was not associated with conventional discharge or early discharge. Causes of death were: pneumonia (8 patients with an average survival of 68 days), dehydration and cachexia (7 patients, 51 days), heart failure (6 patients, 45 days), myocardial infarction (4 patients, 41 days), stroke (3 patients, 65 days), sepsis (3 patients, 59 days), shock (2 patients, 71 days), pulmonary embolism (2 patients,12 days), and mamma carcinoma, epilepsy, COPD, intestinal obstruction, sudden death (each 1 patient).

All complications

Patients developed a total of 632 complications up to 4 months after hospital admission. Of these, 24% were severe (Table 2). Most frequently occurring complications were post-operative anemia (16% of total) and urinary tract infection (20%). Of all patients, 92% developed at least one complication. The average was 3.0 complications per patient. More than 1/3 of all complications occurred within 6 days after

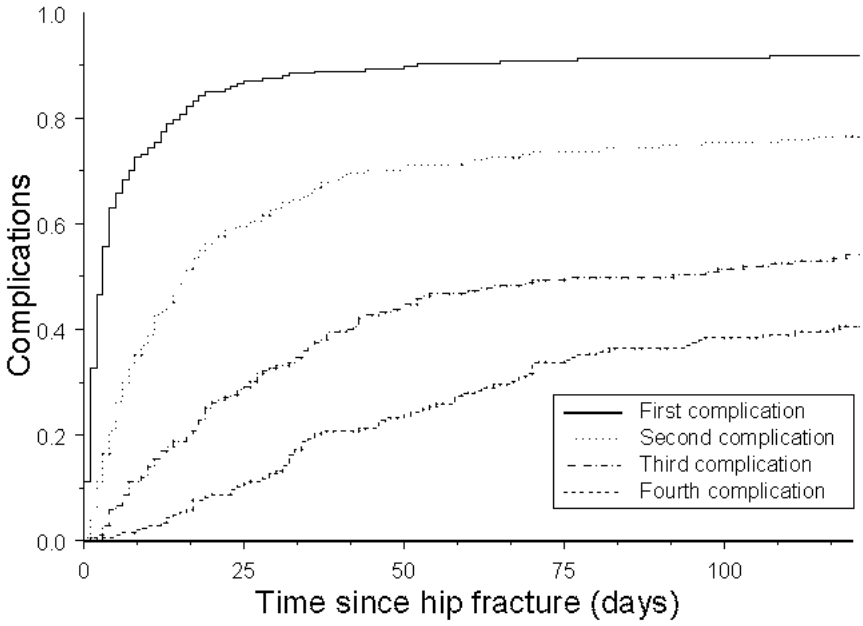
Table 2.
Number of complications. Four-month follow-up in 208 patients with hip fracture.

Complications	Number	% of Class D complications
Local		
Wound infection	19	
Wound haematoma	7	
Loosening and luxation	22	
Other	10	
Total of local complications	58	41%
Circulatory		
Sepsis	2	
Anemia	99	
Electrolyte imbalance	15	
Other	3	
Total of circulatory complications	119	5%
Cardiovascular		
Myocardial ischaemia ,infarction	8	
Cardiac arrhythmia	13	
Heart failure	25	
Pulmonary embolization	2	
Deep vein trombosis	5	
Cerebro vascular accident	10	
Other	8	
Total of cardiovascular complications	71	41%
Respiratory		
Pneumonia	24	
Exacerbation COPD	6	
Other	4	
Total of respiratory complications	34	32%
Pressure ulcers		
Heels	21	
Buttocks	36	
Other	1	
Total pressure ulcers	58	33%
Urinary tract		
Infection	124	
Retention	15	
Renal failure	2	
Other	7	
Total urinary tract complications	148	2%
Psychiatric		
Acute confusion, delirium	23	
Depression	9	
Other	15	
Total psychiatric complications	47	57%
Gastrointestinal		
Bleeding	7	
Other	26	
Total of gastrointestinal complications	33	28%
Other complications	64	25%
Total complications	632	24%

Class D: Complication associated with residual functional impairment and requiring therapeutic intervention.

hospital admission. On day 7 only 31% of patients had no complication, while 30% had 2 or more (Table 3). Within 4 months, 41% of patients had 4 or more complications (Figure 1).

Figure 1.
Occurrence of First, and Fourth Complication After Hip Fracture,



Early discharge versus conventional discharge

There were no clear differences in the occurrence of complications up to 4 months between early discharged patients and those discharged conventionally (298 versus 334, p = 0.11, Table 4). However, a shift occurred from hospital to nursing and rehabilitation center. Patients in the conventional discharge group experienced 64% of all complications during their hospital stay and 24% in the nursing home. The figures for early discharged patients were 45% and 45% respectively. The majority (87%) of all complications occurred when the patients stayed in an institution (hospital or nursing home) and only 11% after discharge to home or home for the elderly. In the conventional discharge group, 57 patients were discharged from hospital or nursing home to home or home for the elderly with a mean stay in these institutions of 38

days. Forty-two complications occurred at home or home for the elderly of which 10 were severe (Table 5). In the early discharge group, 64 patients were discharged from hospital or nursing home with a total average stay of 34 days. Twenty-nine complications occurred at home or home for the elderly of which 8 were severe.

Table 3.
Proportion of hip fracture patients (n= 208) with complications 7, 30, and 120 days after hip fracture.

	Days since hip fracture			
Complications	Day 7	Day 30	Day 120	t-50%*
First	69%	88%	92%	3
Second	30%	63%	76%	10
Third	9%	33%	54%	21
Fourth	1%	13%	41%	37
Local	9%	15%	22%	12
Circulatory	40%	46%	49%	3
Cardiovascular	13%	17%	29%	10
Respiratory	5%	10%	15%	17
Pressure ulcers	10%	22%	27%	9
Urinary tract	15%	39%	52%	16
Psychiatric	8%	15%	20%	11
Gastrointestinal	3%	9%	14%	19
Other	8%	14%	27%	23

* Number of days within which 50% of patients experienced a complication.

Subdivision of complications

A total of 58 local complications occurred in 44 patients (22% of total number of patients, Table 3). Twenty-two (38 %) were severe such as breakout of osteosynthesis material. These led in all cases to re-operation.
The severity of local complications was also reflected in the percentage (41%) which led to functional limitation (Table 2). Although most were diagnosed within 1 month, 18 local complications occurred between 1 month and 4 months (Figure 2),

50% within 12 days after hospital admission. Severe local complications (with residual functional impairment) were scarce in patients after discharge to home or home for the elderly. Patients treated with Hansson pins developed more local complications than patients treated with other osteosynthesis material (15 local complications in 26 patients versus 43 local complications in 174 patients, p = 0.009).
A total of 119 circulatory complications occurred in 102 patients (49%). The most frequent circulatory complication was postoperative anemia (83%) (treated in 90% of cases with a blood transfusion). Circulatory complications occurred predominantly in the first 7 days after surgery with few consequences for functioning of patients.
Seventy-one cardiovascular complications were diagnosed in 58 patients (29%). Cardiac complications (myocardial infarction, heart failure and arrhythmia) were the most important in this group. They occurred both in and outside the hospital

Table 4.
Number of complications that occurred in 208 patients until 4 months after hospital admission for hip fracture by diagnosis, residence, and group (conventional versus accelerated discharge).

Complications	Hospital Up to 5 days after admission		Hospital from Day 6 until discharge		Nursing home		Home for the elderly		Home		Readmisson		Total	
	Conv.	Early	Conv.	Early	Conv.	Early	Conv	Early	Conv.	Early	Conv.	Early	Conv.	Early
Local	9	10	8	2	6	11	1	2	5	3	-	1	29	29
Circulatory	47	40	7	2	6	13	2	1	-	-	-	1	62	57
Cardiovascular	15	12	6	2	7	14	5	2	3	2	3	-	39	32
Respiratory	3	7	6	1	4	7	3	1	0	1	1	-	1	17
Pressure ulcers	5	9	13	4	6	15	1	1	4	-	-	-	29	29
Urinary tract	13	15	25	8	28	46	5	2	2	1	-		73	75
Psychiatric	7	8	10	-	8	9	-	1	1	3	-	-	26	21
Gastrointestinal	5	2	8	-	6	6	1	1	3	-	-	1	23	10
Other	12	7	10	-	8	13	2	0	4	8	-	-	36	28
Total	116	110	93	19	79	134	20	11	22	18	4	6	334	298
Total All	226		112		213		31		40		10		632	

producing a high percentage (41%) of functional impairment. Although 50% of patients with cardiovascular complications experienced their first complication within 10 days after hospital admission, half of the total number of complications occurred outside the hospital. Pulmonary embolism (2 patients) and deep venous thrombosis (5 patients) were rare, as well as cerebrovascular accidents (10 patients).

A total of 34 respiratory complications occurred in 29 patients (15%). Pneumonia (24 times in 23 patients) was an important diagnosis in this group both in and outside the hospital but mostly occurring within 1 month after hospital admission. Forty-eight percent of patients with pneumonia died (11 patients).

Fifty-eight pressure ulcers were diagnosed in 56 patients (27%). One quarter of the pressure ulcers developed within 5 days post-operatively but a substantial portion of these ulcers (36%) was diagnosed during the stay in the nursing and rehabilitation center. Half of the pressure ulcers developed within 8 days after hospital admission and 81% within 1 month.

A total of 148 urinary tract complications occurred in 106 patients (52%). Within this group, urinary tract infection was most frequently found (124 treated infections in 94 patients). Urinary tract complications occurred especially in the first 30 days after hospital admission. Although women had more urinary tract infections than men, gender was not predictive for the occurrence of urinary tract complications as a whole because other complications, such as retention, occurred more frequently in men.

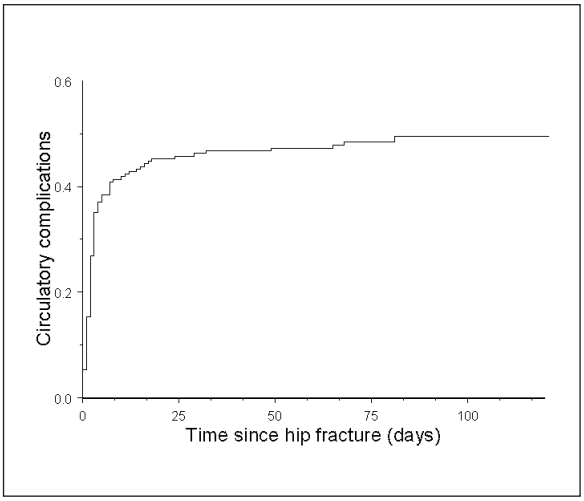
Forty-seven psychiatric complications were diagnosed in 42 patients (20%). Acute confusion (delirium) postoperatively comprised half of the psychiatric complications. Depression and other psychiatric illnesses occurred later especially in the nursing and rehabilitation center. After 1 month, patients had few new psychiatric problems. In regard to the consequences for functional impairment, these complications were the most severe.

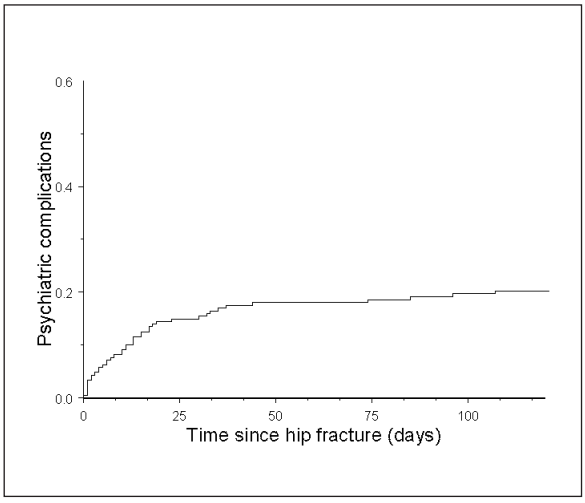
A total of 33 gastrointestinal complications occurred in 31 patients (14%), both inside and outside the hospital. One fifth of the gastrointestinal complications concerned bleeding (7 times in 6 patients). Four patients with bleeding died (causes of death 2 x shock, 1 x heart failure and 1 x pneumonia).

Other complications (not classified) occurred 64 times in 54 patients evenly divided over the total study period. A large proportion of these other complications consisted of muskuloskeletal disorders (19 x contusions, arthritis, and other), endocrine

Table 5.
Number of complications at home or home for the elderly in conventionally and early discharged patients by severity.

	Conventional discharge N = 57		Early discharge N = 64	
	Class B/C	Class D	Class B/C	Class D
Local				
Wound infection	3		1	
Wound haematoma			1	
Breakout/ luxation		2	1	1
Other		1	1	
Circulatory				
Anemia	1			
Electrolyte imbalance	1			1
Cardiovascular				
Myocardial ischaemia	1	1		
Heart failure	4		2	1
Deep vein thrombosis			1	
Other	2			
Respiratory				
Pneumonia	2			
Exacerbation COPD			1	
Other	1		1	
Pressure ulcers				
Heels	1	1	1	
Buttocks	2	1		
Urinary tract				
Infection	7		3	
Psychiatric				
Acute confusion				2
Other		1	1	1
Gastrointestinal				
Other than bleeding	1	3	1	
Other	6		6	2





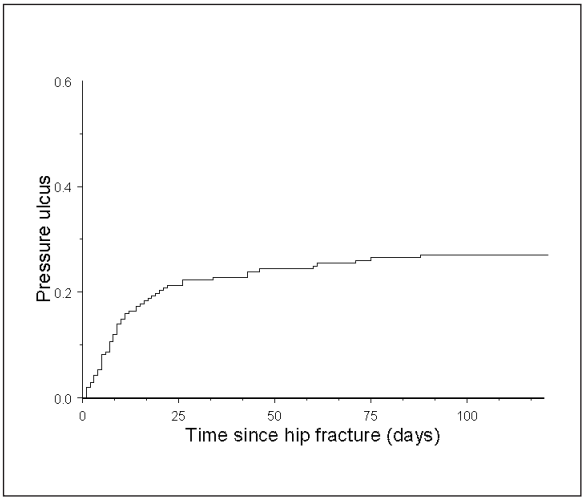


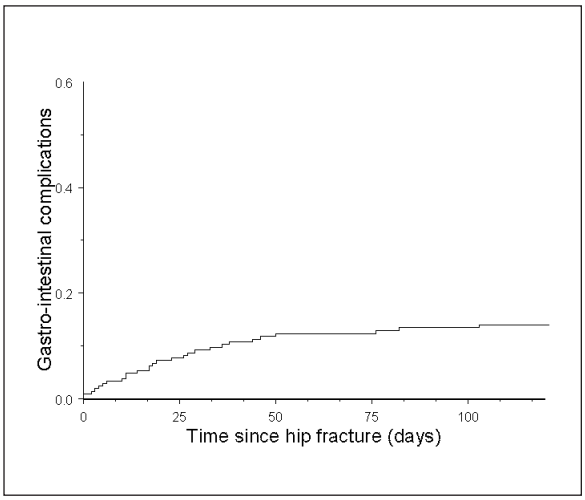
Figure 2: Occurrence of Complications by Diagnosis After Hip fracature

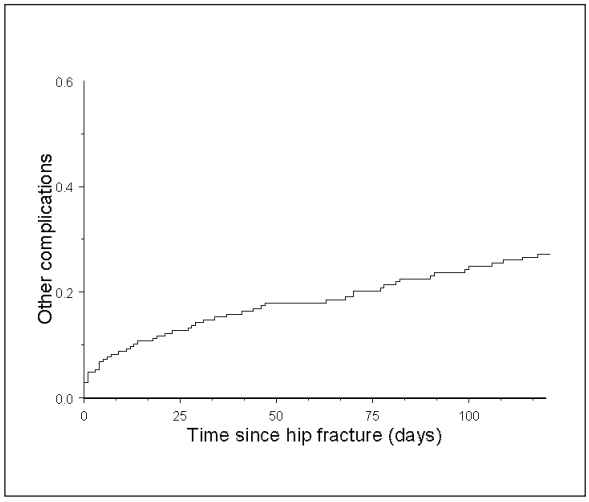
disorders (9 x derangement of diabetes or thyroid disorder), other infections (12 x skin), and side effects of medication (5x).

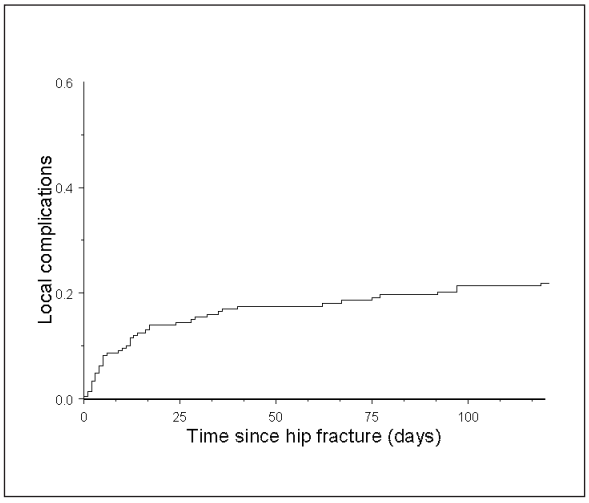
Predictors

Patients admitted to the general hospital (n = 90) experienced 311 complications and patients admitted to the university hospital (n = 118) 321 complications up to 4 months. The difference in occurrence of any first complication and a circulatory complication was significant (Table 6); patients who were admitted to the general hospital experienced more complications. This difference occurred mainly because more patients admitted to the general hospital (50%) were treated for anaemia (with a blood transfusion) than patients admitted to the university hospital (30%) in the direct postoperative period. Another predictor for the occurrence of all complications was the number of comorbidities at hospital admission. Comorbidity was also an important predictor of cardiovascular, respira-

tory, and gastro-intestinal complications. Higher age was associated with urinary tract problems and males were more likely to suffer from circulatory and respiratory complications. Pre-fracture institutional residence predicted the occurrence of respiratory complications and pressure ulcers. The presence of the diagnosis of dementia at hospital admission, and function before fracture, were not associated with the occurrence of complications between those patients in the conventionally discharged group or the accelerated discharge group.

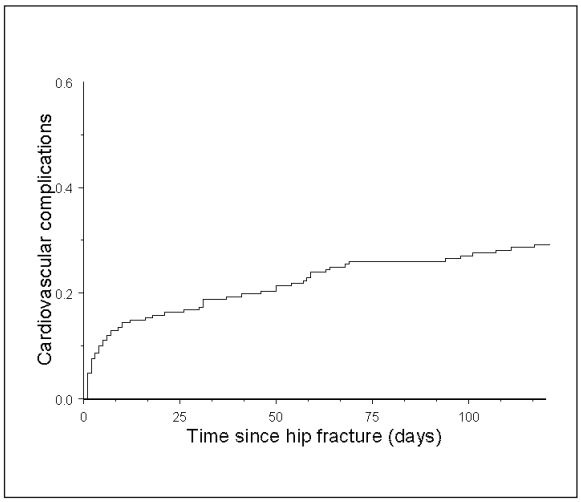


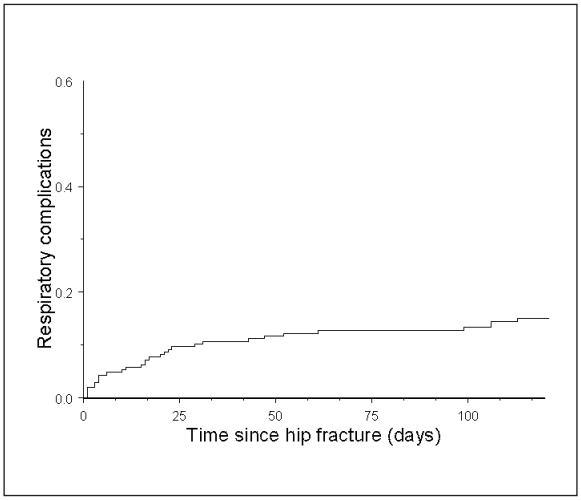


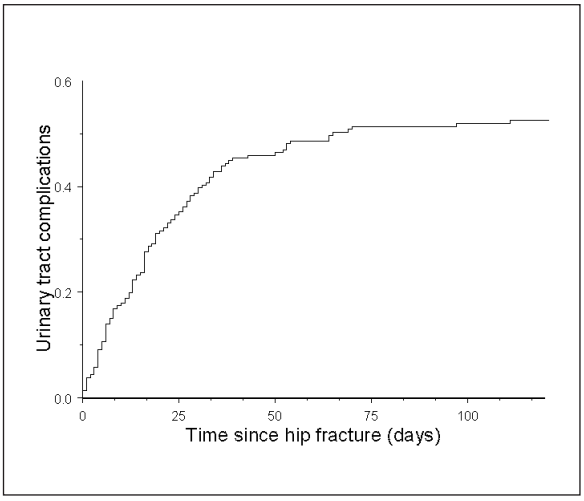


6.4 Discussion

This study included 208 patients with a high average age (83 years). In addition, many patients were included who already lived in a long-term care facility (41%) before their fracture and the number of patients with one or more comorbid conditions was high (94%, an average 2.3 comorbid conditions). These patient characteristics influence the occurrence of complications [4,14,15] and mortality [11,15-17] after hip fracture. Our results confirmed the importance of these predictive factors and the high number of







complications identified in this study should be considered in that light.

Occurrence of complications in relation to time and residence

The average length of hospital stay of hip fracture patients differs from approximately 13 days in Sweden[18] and the United States[19,20] to approximately 23 days in the Netherlands [18]. The present study includes both lengths of stay in the same country. Our results show that the occurrence of complications was by no means limited to the stay in hospital. This applied for serious and less serious complications.

Early discharge from hospital by 13 days did not clearly influence the total number of complications or mortality up to 4 months after fracture. The average number of complications that occurred in patients discharged conventionally was 3.3 and in early discharged patients 2.8. Mortality was 19% for both groups. However, accelerated discharge changed the location where these complications were diagnosed and treated. Thirty-six percent of the complications in the conventionally discharged group and 55% of the complications in the early

Table 6.
Relationship of patient characteristics with the occurrence of complications: Multiple regression analysis.*

Variable	Complications									
	Local p =	Circulatory p =	Cardiovascular p =	Respiratory p =	Pressure ulcers p =	Urinary tract p =	Psychiatric p =	Gastro-intestinal p =	Other p =	Any p =
(Higher) age	--	0.26	0.28	0.22	--	0.03	0.10	--	--	0.36
Male gender	--	0.009	0.11	0.001	--	0.29	0.96	--	--	0.18
Conventional discharge	--	0.15	--	--	0.74	--	--	0.10	--	0.30
General hospital	--	0.0001	--	--	0.08	--	--	0.82	--	0.001
Prefracture living Elderly home	0.26	--	--	0.012	0.009	--	--	--	--	0.11
	0.15	--	--	0.024	0.05	--	--	--	--	0.44
(Higher) number comorbidities	--	--	0.001	0.022	--	--	--	<0.0001	0.0006	0.06
Dementia	--	--	--	--	--	0.22	--	--	--	--
Function (decreased) before fracture	--	--	--	--	0.07	--	--	--	--	--

* Characteristics were only included if $p < 0.20$. If age and gender had $p < 0.20$, both were included.
If early versus conventional discharge or hospital had $p < 0.20$, both were included

discharge group developed outside the hospital. The location, where serious (i.e., associated with
impaired function) complications occurred, shifted even more: 44% outside the hospital in the conventionally discharged group and 80% outside the hospital in the early discharge group. The more serious complications (24% of total complications) were predominantly local, cardiovascular, psychiatric, or pressure ulcers. The treatment and care of patients who died within 4 months after hip fracture also took place mostly outside hospital: 13 of the 20 deceased patients in the conventionally managed group and all (20) deceased patients in the early discharged group.
In the Netherlands, patients are rehabilitated in nursing homes with skilled nursing and rehabilitation facilities (employing doctors trained in geriatric medicine). Accelerated discharge from the hospital will therefore result in more patients being discharged to nursing homes. Because, in the early discharge group, 70% of all patients coming from home were discharged to these skilled nursing and rehabilitation facilities and all patients coming from long-term care facilities in nursing homes were discharged back to the nursing home, 45% of complications and 67% of the deaths were recorded during the nursing home stay. Therefore, most complications were already diagnosed and treated in the hospital and nursing home before patients were discharged home, which limits the burden on general practitioners. However, a different health care system with earlier discharge to home (Sweden[1], United Kingdom[27]) than in the Netherlands will probably be accompanied by more and possibly more serious complications that will require diagnosis and treatment by general practitioners. Furthermore, in cases where general practitioners provide medical care in nursing homes to hip fracture patients discharged from hospital (United States[19]), it should be ensured that these practitioners have enough time and skills to prevent and treat complications.

Nature and number of complications

Nearly all patients (92%) developed complications within 4 months after the hip fracture. Such a large number (632 complications in 208 patients) of (especially general medical) complications has not been reported previously. However, the results of the present study do not differ from other studies in regard to the occurrence of serious medical in-hospital complications or surgical complications up to 4 months.
Serious medical in-hospital complications such as deep venous thrombosis (2

patients, 1%), pulmonary embolism (2 patients, 1%), myocardial infarction (2 patients, 1%) and cerebro vascular accident (5 patients, 2%) occurred with the same frequency as reported by other authors (1- 2% for each of the above-named complications).[7,16,21,22] The number of surgical complications in hospital (29 in 23 patients) and the total number of surgical complications within 4 months after admission (58 in 46 patients) were in agreement with numbers found in other studies.[4,5,7,14,23,24] We found no predictive factors for the occurrence of surgical complications. In contrast with the clear relationship between a high pre-operative risk score with mortality and medical complication rate, Miller et al could also find no relationship with surgical complications.[14] Pre-fracture living in an institute however, was found in France to be related to surgical complications after fracture.[4]
Most studies reporting surgical and medical complications after hip fracture only include the in-hospital period or register complications that lead to re-admission to hospital. In comparison with these studies, we found higher hospital incidences of medical complications such as urinary tract infections and pressure ulcers. Urinary tract complications were related to age and pressure ulcers were related to institutionalization before fracture. This is in agreement with other studies.[4,25]
Few researchers have compared studies with a follow-up that also included the period after hospital discharge (Broos et al [3] months[6], Baudoin et al 2 years[4] and Koot et al 1 month[5]). In comparison with these studies we found higher incidences of medical complications.
The high average age, many comorbid conditions and high proportion of already institutionalized patients present in our study population, could partly explain this finding. A second explanation for the high number of recorded general complications could be the careful, prospective method of registration. Patients were followed for 4 months with 3 interviews at 1 week, 1 month and 4 months. At these time points, patients or their relatives were asked about the occurrence of complications. In addition, medical and nursing records were investigated for recorded complications and, if necessary, health professionals were asked for clarification. We registered medical events as complications only when they were followed by treatment or reduced function. Despite this restriction, many complications were found (probably because our registration method allowed for very few complications to be missed). Findings from health outcomes research relying on administrative databases or solely on hospital facesheets have a tendency to be inaccurate. Fox et al.[26] showed that in 17% of charts, a complication after hip fracture identified in medical records,

was not coded in the hospital facesheet and that complications with low severity in particular were omitted.

Limitation of study design

In order to address the study questions, a " before and after" study design was developed that corresponded to an organisational change from conventional to early discharge arrangements. Randomisation of patients was not considered feasible since the change from conventional to accelerated discharge arrangements required organisational adjustments that made a simutaneous offer of both service models not possible.
We found high incidences of medical complications within 4 months after hospital admission. Because we did not compare the occurrence of complications in the studied population with the occurrence of medical ailments in a group of elderly patients with the same characteristics but without a hip fracture, we could not determine whether these complications were directly related to the hip fracture. However, the inclusion of elderly patients with a hip fracture in the current study was unselected. Consequently, all surgical and medical ailments that can be expected until four months after hip fracture were recorded.

6.5 Conclusion

Elderly hip fracture patients experience many medical complications after hip surgery. A substantial proportion of these complications occurs after discharge from hospital. An earlier discharge of two weeks shifted the location where these complications occurred, making them more likely to take place outside the hospital. With the increasing trend of reducing the hospitalization of these patients, it becomes more important to arrange adequate geriatric care after discharge from hospital. The number of comorbid conditions at hospital admission is the most important prognostic factor in identifying patients who are expected to develop complications. On the whole, the occurrence of medical complications does not depend strongly on type of fracture, surgery, or anaesthesia but on the pre-operative characteristics of patients such as age and comorbidity. The frequent occurrence of medical complications makes the treatment and care of these frail patients a challenge not only for surgeons but also for the geriatrician and general practitioner.

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Chapter 7.

Quality of life after hip fracture: A comparison of 4 health status measures in 208 patients.

Abstract

OBJECTIVES. We compared 4 health status measures for the evaluation of quality of life after hip fracture.

METHODS. 208 elderly hip fracture patients were followed up to 4 months after hospital admission. We used two interviewer-administered instruments (the Rehabilitation Activities Profile (RAP) and the Barthel Index (BI)) that focus on functional status, and two self-assessment instruments (the Nottingham Health Profile (NHP) and the COOP/WONCA charts) that additionally include psychological and social health domains. The score distribution, internal consistency, construct validity, and sensitivity to change were investigated.

RESULTS. At 4 months only 18% of surviving patients had reached the same level of functioning as before fracture and, compared with reference values, lower scores of health status were found in the areas of physical mobility and emotional reactions. The number of comorbidities at hospital admission was the most important prognostic factor for recovery of health status at 4 months. The RAP and the BI both performed well in the assessment of functional status in regard to score distribution, internal consistency and construct validity. In contrast to the BI, the RAP also assessed instrumental activities of daily living and perceived problems with existing disabilities. The generic health status measures produced no added value in the assessment of functional status. The NHP covered a wider range of psychological health dimensions (emotion, pain, energy, and sleep) and had better psychometric properties than COOP/WONCA. None of the 4 instruments performed well in assessing social functioning.

CONCLUSIONS. To assess health status after hip fracture, we recommend the RAP for functional status and the NHP for changes in emotion, pain, and energy. These instruments detected poor recovery in functional and emotional status at 4 months after fracture.

Key words: hip fracture; quality of life; instruments.

7.1 Introduction

Hip fracture is a serious condition. Patients experience considerable difficulties in return to their pre-fracture living situation and in achieving recovery of function.[1,2] The mean age of hip fracture patients is high; they usually have comorbid conditions, and are often cognitively impaired. The remaining quality of life for these frail elderly patients is important. In a time trade-off study of older women, Salkeld et al. reported that most women were prepared to trade off considerable length of life to avoid the reduction in quality of life after a hip fracture.[3]

To evaluate the consequences for health-related quality of life (in short: health status) after hip fracture at least 3 dimensions should be included : functional, psychological, and social health.[4] Functional health status comprises self-care, mobility, and physical activity. Comparison of generic health status measures, which additionally include psychological and social health status, has been undertaken[5] but not in regard to the follow-up of hip fracture patients.

We studied the performance of 4 health status measures. We chose the Nottingham Health Profile because it is short and easy to complete even for seriously ill or elderly patients [6] and has been used previously with hip fracture patients, [7-9] and the COOP/WONCA charts because we expected the charts to be easy to use with elderly, cognitively impaired patients.[10] To assess functional status we chose the widely used Barthel Index, which has been recommended for use as a standard assessment of activities of daily living for elderly people[11,12] and the less often used Rehabilitation Activities Profile.[13] The latter instrument was specially developed for the follow-up of rehabilitation patients.

The present article addresses the following research questions:

- What is the outcome in health-related quality of life of elderly hip fracture patients according to these instruments?
- Which patient characteristics predict the outcome?
- What are the differences or similarities in the content of the 4 measures; in other words which dimensions of health do they measure?
- How is their performance on reliability, construct validity and sensitivity to change over time in a group of frail elderly hip fracture patients?

7.2 Methods

Data Collection Procedures

Between October 1996 and October 1998, consecutive patients from a university hospital and a general hospital in Rotterdam, the Netherlands, were recruited. The patients were aged 65 years and older, and were admitted with a recent hip fracture. Excluded were patients with a hip fracture because of metastatic cancer or multitrauma. Of the eligible patients, 18% refused to participate. There were no clear differences in age and sex between participants (208 patients) and non-participants (46 patients). More non-participants lived at home before admission (85% versus 60%) but residence at 4 months or mortality did not differ from participants. Two groups of patients were consecutively included: first a group of patients discharged from the hospital with conventional arrangements (102 patients with an average hospital stay of 26 days) and second, a group of patients for which an early discharge policy was followed (106 patients with an average hospital stay of 13 days).
The same investigator interviewed and evaluated all patients using a standard protocol at 1 week, 1 month and 4 months after admission to the hospital. Functional status was assessed by the Rehabilitation Activities Profile (RAP)[13] and the Barthel Index (BI).[14] The latter was not used for the first 41 cases due to logistic problems. RAP and BI were also estimated retrospectively for the pre-fracture period by asking patient or proxy at 1 week after hospital admission to complete the questionnaires concerning the situation before fracture.
Generic health-related quality of life was evaluated by the Nottingham Health Profile (NHP)[15] and the Dartmouth Coop Functional Health Assessment Charts revised by the World Organization of National Colleges, Academies and Academic Associations of General Practitioners and Family Physicians (WONCA).[16] We used existing standard Dutch versions of the original instruments. In cases of severe cognitive impairment or physical disablement, a proxy was interviewed. A complete follow-up was therefore achieved.

Instruments

The Rehabilitation Activities Profile (RAP) is an evaluation instrument based on the International Classification of Impairments, Disabilities, and Handicaps.[13] Besides the disabilities and handicaps themselves, the RAP also assesses 'perceived problems', a novel concept in functional status measures. The RAP defines 18 activities

in 4 four domains: communication, mobility and personal care, occupation and relationships (Appendix). Response options per activity ranged from 0 (= no difficulty) to 3 (not able to) and per perceived problem from 0 (=none) to 3 (severe).[13] The disabilities were assessed by the investigator; the perceived problems with disabilities were self-reported.

The Barthel Index (BI) is a frequently used measure of mobility and personal care and was initially constructed for the evaluation of patients with neuromuscular and muskuloskeletal disorders. The BI consists of 10 activities focusing on the patient's dependency on help. The scores range from 0 (= completely dependent) to 20 (= independent).[14] The Barthel Index score was assessed by the investigator.

The Nottingham Health Profile (NHP) was developed as a measure of perceived health for use in population surveys. The NHP consists of 38 dichotomous items that are grouped into 6 scales (emotional reactions, social isolation, physical mobility, pain, energy, and sleep). Each scale ranges from 100 to 0 (0 = optimal health).[15,17] Patients or proxies answer 'yes or no' on the 38 NHP questions.

The COOP/WONCA charts were developed to assess the health-related quality of life of patients in primary care settings. Subjects are requested to score their functioning on each of the 7 items during the 2 weeks before assessment on 5-point scales (1 = optimal health). The levels on the items (feelings, physical fitness, daily activities, social activities, overall health, change in health, and pain) are illustrated with pictograms.[10,16] Patients or proxies select the level on every COOP/WONCA item.

Qualitative Analysis of Questionnaire Content.

A qualitative comparison was performed of the content of the RAP, the BI, the NHP, and the COOP/WONCA charts. Scales/items were considered comparable if their content was judged to refer to the same general health domain.

Quantitative Analysis of Questionnaire Content.

The following analyses were performed:

Features of score distribution. Mean scores, standard deviations, and the percentages of respondents with maximum possible scores and the minimum possible scores, respectively, were computed per scale (NHP, RAP, BI) or item (COOP/WONCA). The percentage of patients who scored positive (> 0) on every item of the RAP was calculated. Among those who scored positive, the percentage of patients who perceived problems with the activity (score > 0) was calculated.

Reliability. The internal consistency of the NHP, RAP and BI multi-item scales was determined with Cronbach's α-coefficient. An α-coefficient of 0.70 or higher was considered as sufficient for comparisons at group level. Internal consistency estimates could not be calculated for the COOP/WONCA charts because this instrument consists of 7 separate items with an ordered response.
Construct validity. Patterns of correlations between the scales of the NHP, items of the COOP/WONCA, the RAP scales and the BI were examined. It was hypothesized that those scales/items that are conceptually related (according to results of qualitative analysis) would be relatively strongly correlated, whereas those scales/items with less in common would exhibit weaker correlations.
Sensitivity to change. The Mann Whitney U test was used to detect differences between the scores of the 4 instruments for the total group of patients before fracture, 1 week after fracture, 1 month after fracture, and 4 months after fracture. When scores differed with p- values < 0.05 in the expected direction (much worsening between before and 1 week after hip fracture; thereafter gradual improvement), this was viewed as a sign of sensitivity to change of the studied instrument. Moreover, an effect size estimation was calculated which related the difference in mean scores to the dispersion in scores. The effect size (*d*) gives an impression of the clinical relevance of the statistically significant differences. A *d* of 0.2 was considered to indicate a small effect, a *d* of 0.5 a medium effect and a *d* of 0.8 a large effect. The formula employed to calculate *d* was: (mean change score T1-T2) / sd T1 score. Reference values for NHP and COOP/WONCA scores from the literature,[18,19] after matching for age and gender, were used for comparison purposes with scores at 4 months, assuming that these reference values were an errorfree estimate of scores in the population.

Analysis of predictive factors

To determine predictive factors for health status (NHP scores) and functioning (RAP score) at 4 months after hip fracture, multiple regression analyses were performed with the following independent variables: living in a nursing home or home for the elderly before fracture, gender, age, early discharge versus conventional discharge, type of fracture, number of comorbidities, and cognitive status after 1 week. Cognitive status was measured using the Mini Mental State Examination. Information regarding age, gender, comorbidity, type of fracture and surgery, discharge destination, and living situation before fracture was obtained from medical charts and health professionals.

7.3 Results

Patient Characteristics

Patients were of high mean age (83 years); predominantly female (79%), and a substantial proportion (41%) already lived in an institution before their hip fracture (Table 1). Nearly 2/3 of patients were discharged from the hospital to a nursing home. At 4 months after hospital admission, 19% were dead and 27% were staying in a nursing home. Of the patients who came from home, 63% were back at home at 4 months after fracture. Patients had on average 2.3 comorbid conditions at hospital admission and only 6% had no comorbid condition at all. Dementia had been diagnosed before hospital admission for 20% of all patients.

Recovery of Function and Quality of Life

Patients improved in functioning between 1 week and 1 month and between 1 month and 4 months after fracture (Table 2). Only 18% reached the same level of functioning

Table 1.
Patient characteristics and outcome. 208 patients admitted to hospital with hip fracture.

Variable	value
Age Mean	83 y
Median (25th-75th percentile)	84 y (77-89)
Percentage women	79%
Admitted from (%)	
home	60%
home for the elderly	26%
nursing home	15%
Days in hospital	
conventionally managed (n =102)	
mean	26d
median (25th-75th percentile)	18d (13-29)
early discharged (n=106)	
mean	13d
median (25th-75th percentile)	11d (9-15)
Discharged from hospital to (%)	
died	3%
own home	19%
home for the elderly	13%
nursing home	65%
Residence at 4 months	
died	19%
own home	39%
home for the elderly	15%
nursing home	27%
Comorbidity (% of patients)	
cardiovascular	45%
muskuloskeletal	41%
neuropsychiatric	34%
neurologic	28%
respiratory	12%
metabolic and endocrine	16%
gastrointestinal	8%
urogenital	7%
Number of comorbidities (% of patients)	
6%	
25%	
25%	
28%	
>3	16%
mean	2.3

as before fracture measured by the RAP and 33% when measured by the Barthel Index. The patient group improved in all dimensions of the NHP between 1 week and 4 months. Compared with reference values[18-19], lower scores of health were found at 4 months in physical mobility, emotional reactions and social isolation. Patients did not clearly differ from the reference population in energy and pain and scored better in regard to sleep.

The COOP/WONCA charts indicated that physical fitness improved between 1 week and 1 month and between 1 month and 4 months. Pain and daily activities improved between 1 month and 4 months. Patients improved in general health between 1 week and 4 months. Compared with reference values, lower appreciation of health at 4 months was found in physical fitness, feelings, daily activities and overall health.

The proportion of patients who scored > 0 per activity of the RAP at 4 months after fracture is shown in Table 3. Nearly all patients had difficulties with activities such as housekeeping, climbing stairs, using transport, and providing for meals. Many patients (for instance 88% for household activities), had already experienced difficulties with performing these activities before fracture. However on all items, with the exception of communication and relationship items, a significant decrease was found in performance, in comparison with the situation before fracture (data not shown). A large proportion of patients (64-76%) had difficulties with mobility and personal care activities. When asked for their perceived problems with existing disabilities, patients had most problems with reduced capacities in mobility such as maintaining posture (62%), walking (61%), changing posture (57%), maintaining continence (46%), and using transport (45%). Problems with household activities (10%) and providing for meals (10%) were far less important.

Important prognostic factors for reduced physical mobility at 4 months were living in a home for the elderly before fracture, larger number of comorbidities at hospital admission, older age, and lower cognitive status (Table 4). The same factors predicted reduced functioning (as assessed by the RAP communication-mobility-personal care) at 4 months after hip fracture. Living in an institution before fracture also predicted reduced energy and increased emotional reactions at 4 months. The only variable that predicted increased pain was the number of comorbidities at hospital admission. The most important prognostic factor for reduced health status was the number of comorbidities at hospital admission.

Table 2.
Quality of life in hip fracture patients. Nottingham Health Profile (NHP), COOP/WONCA charts, Rehabilitation Activities Profile (RAP) and Barthel Index (BI) scores of hip fracture patients 1 week, 1 month and 4 months after hospital admission.

Instrument	Before fracture (n =208)	1 week (n = 208)	1 month (n = 199)	4 months (n = 168)	Reference Values #	1 week versus 1 month		1 month versus 4 months		1 week versus 4 months		4 months versus reference
		score(SD)	score(SD)	score(SD)	score	p =	effect size	p =	effect size	p =	effect size	p =
NHP (0-100)												
Physical Mobility		83 (17)	72 (21)	58 (28)	31	***	.61	***	.57	***	1.48	***
Sleep		35 (33)	29 (31)	24 (30)	30	*	.17	n.s	.13	***	.35	**
Emotional Reaction		33 (29)	31 (27)	26 (27)	15	n.s	.07	n.s	.11	*	.16	***
Energy		60 (36)	54 (39)	43 (40)	39	n.s	.15	*	.13	***	.37	n.s
Social Isolation		34 (27)	29 (26)	27 (27)	11	**	.21	n.s	.02	*	.19	***
Pain		53 (26)	38 (27)	27 (25)	22	***	.55	***	.35	***	.95	n.s
COOP/WONCA (0-5)												
Physical Fitness		4.9 (0.3)	4.7 (0.5)	4.5 (0.7)	3.7	***	.56	***	.30	***	1.15	***
Feelings		2.6 (1.3)	2.4 (1.3)	2.3 (1.3)	1.8	*	.19	n.s	.05	*	.22	***
Daily Activities		n.a	4.1 (1.1)	3.7 (1.3)	2.1	n.a		***	.31	n.a		***
Social Activities		n.a	2.4 (1.6)	2.2 (1.6)	1.8	n.a		n.s	.08	n.a		n.s
Change in Health		4.1 (0.8)	2.6 (1.1)	2.9 (0.8)	3.0	***	1.8	***	.46	***	1.31	n.s
Overall health		3.8 (0.9)	3.4 (0.9)	3.3 (0.9)	3.0	***	.40	n.s	<.01	***	.48	***
Pain		2.9 (1.1)	3.0 (3.1)	2.5 (1.1)	n.a	n.s	.11	*	.21	**	.35	n.a
RAP												
Mobility + Personal care (0-30)	8.9 (7.6)	21.5 (4.5)	17.8 (6.5)	13.9 (8.0)	n.a	***	.80	***	.44	***	1.67	
Occupation (0-9)		n.a	7.3 (2.0)	6.2 (2.6)	n.a	n.a		***	.43	n.a		
Communication (0-6)	0.6(1.3)	1.0 (1.5)	0.8 (1.4)	0.7 (1.4)	n.a	n.s	.12	n.s	<.01	n.s	.06	
Relationships (0-9)		n.a	n.a	0.7 (1.1)	n.a	n.a		n.a		n.a		
BI (20-0)	15.8 (4.5)	6.9 (4.9)	9.8 (6.3)	12.8 (6.5)	n.a	***	.59	***	.32	***	1.05	

n.s = > 0.05
* = < 0.05
** = < 0.01
***= < 0.001

effect size:
.2 = small effect
.5 = medium effect
.8 = large effect

Table 3.
Rehabilitation Activities Profile scores and Perceived Problems at 4 months after hip fracture (n= 168)

RAP item	Score > 0 % of patients with	rank	% patients with perceived problem among patients with score>0	rank
Household activities	97	1	10	17
Climbing stairs	88	2	22	15
Using transport	85	3	45	7
Providing for meals	80	4	10	16
Changing posture	76	5	57	3
Walking	76	6	61	2
Dressing	75	7	42	8
Washing and grooming	74	8	46	5
Undressing	70	9	40	9
Maintaining Posture	64	10	62	1
Leisure Activities	53	11	32	14
Maintaining continence	51	12	46	6
Eating en Drinking	31	13	36	12
Comprehending	26	14	32	13
Friends/acquaintances	23	15	38	10
Expressing	21	16	37	11
Partner	09	17	53	4
Child(ren)	07	18	8	18

Comparison of instruments

Qualitative Comparison of Questionnaire Content. The dimensions of quality of life measured by the 4 instruments are shown in Table 5. All 4 instruments assess functional status in mobility (RAP, BI, NHP) or physical fitness (COOP/WONCA). Personal care items are represented in both RAP en BI with a relative overemphasis on toilet

function in the BI (Appendix). In addition to these basic activities of daily living, RAP and COOP/WONCA also assess instrumental activities of daily living (household, providing for meals, leisure activities) and the capacity to maintain social relationships. The label of the NHP scale Social Isolation suggests that it belongs to the social health domain. However, it contains 5 items, which focus on loneliness. Therefore, the scale does not assess social activities and more likely belongs to the psychological domain of health. The NHP covers a wider range of psychological health dimensions (emotional reactions, pain, energy, and sleep) than the COOP/WONCA charts.

The main difference in score options between RAP and BI lies in the possibility to score difficulty with performing a task in the RAP while the BI only assesses the dependency on help with performing a task. Therefore, a person might score positive on the RAP (indicating decreased health status) while BI scores indicate complete independence.

Feasibility. A complete follow-up was accomplished. There were no missing values. Because a substantial portion of the patients was cognitively impaired (42 out of 208 = 20% diagnosed with dementia at hospital admission), it was necessary to use proxies in 26% (297/1150) of interviews to answer the questions of the generic health status instruments. The time needed to fill in the questionnaires was less than 10 minutes per health status instrument per patient or proxy.

Features of Score Distribution. Descriptive statistics for each instrument are shown in Table 6. A relatively large proportion of patients scored the minimum on the NHP scales Sleep and Social isolation (indicating that they had no problems), as well as on the RAP scales Communication and Relationships, and on the COOP/WONCA chart Social Activities, resulting in a skewed score distribution. However, 60% of patients scored the maximum on the COOP/WONCA chart Physical Fitness (indicating severe problems). Sixteen percent of patients scored the maximum (20 = totally independent) on the Barthel Index and 2 % scored the minimum (0 = totally independent) on the RAP scale Mobility and Personal Care. Twenty-six percent of patients scored the maximum (9= totally dependent) on the RAP scale Occupation (instrumental activities of daily living) as could be expected with the patient population under investigation.

Reliability. The internal consistency of the 6 scales of the NHP, the 4 scales of the RAP and of the Barthel Index are shown in Table 6. The consistency of only one of the NHP scales (Social Isolation) and 2 of the RAP scales (Relationships and

Communication) was below the 0.70 standard recommended for group comparisons. The internal consistency of the RAP Mobility and Personal Care and the Barthel Index was very good (respectively α-coefficient of 0.94 and 0.92). The RAP scale Occupation (0.69) and especially the RAP Relationships (0.13) performances were worse, which may be also related to the fact that these scales contain only 3 items.

Construct Validity. The correlations of the scores on the 4 studied measurement instruments are presented in Table 7. The associations observed between the NHP and the COOP/WONCA were mostly as expected from the qualitative comparison. Physical Mobility (NHP) correlated best with Physical Fitness and Daily Activities (COOP/WONCA). Emotional Reactions (NHP) correlated best with Feelings (C/W), and Pain (NHP) correlated best with Pain (C/W). Sleep (NHP) did not correlate well with any COOP/WONCA scale. Energy and Social Isolation (NHP) exhibited moderate correlations with Daily Activities, Physical Fitness, Social Activities, and Feelings (C/W). High correlations were found between Physical Mobility (NHP), RAP Mobility and Personal Care, RAP Occupation, Barthel Index, Physical Fitness (C/W), and Daily Activities (C/W). Finally, Overall Health (C/W) correlated moderately with all other scales except Sleep and Social Isolation on the NHP and the RAP scales Communication and Relationships.

When the NHP scales were examined for intra-instrument correlations, the only strong correlation found was between Social Isolation and Emotional Reactions (Spearman correlation coefficient = 0.65). For the COOP/WONCA charts a strong correlation existed between Physical Fitness and Daily Activities. (0.68) [data not shown].

Sensitivity to change. The ability of the 4 instruments to discriminate between the 3 follow-up points (1 week, 1 month and 4 months) after admission is shown in Table 2. The RAP Mobility and Personal Care and the Barthel Index show highly significant improvement in functioning between 1 week and 1 month and between 1 month and 4 months with effect sizes ranging from 0.32 to 1.67. The generic health related quality of life instruments were expected to show change in the same direction. All scales of both NHP and COOP/WONCA were able to discriminate between health related quality of life of hip fracture patients 1week and 4 months after hospital admission with mostly small to medium effect sizes (*d* 0.19 to 0.48). Only the NHP scales Pain and Physical Mobility and the COOP/WONCA item Physical Fitness showed a larger effect size (*d* 0.94 to 1.48). Emotional reactions (NHP), Energy (NHP),

Table 4.
Prognostic factors for quality of life 4 months after hip fracture, as measured with the Notttingham Health Profile (NHP) and the Rehabilitation Activities Profile (RAP). Regression analysis with originally the following variables: living in a nursing home or home for the elderly, gender, age, early discharge versus conventional discharge, type of fracture, number of comorbidities, cognitive status after 1 week. + The tables give the regression coefficients, with the 95% confidence intervals.

	Living in a nursing home before fracture	Living in a home for the elderly before fracture	Number of comorbidities	Age at hospital Admission	MMSE-score 1 week after hospital admission
NHP					
Physical mobility	---	12.5 (3.1 – 22)*	5.2 (2.2 – 8.1)**	0.8 (0.2 – 1.4)*	– 1.0 (– 1.4 - – 0.6)***
Social isolation	19.2 (0.2 - 38)*	---	5.7 (1.8 – 9.7)**	--	– 0.8 (–1.4 - – 0.2)**
Energy	34 (14 - 54)**	20.4 (6.3 - 35)**	6.3 (1.4 – 11)*	--	--
Pain	---	---	3.2 (0.2 – 6.2)*	--	--
Emotional reactions	16.1 (2.4 –30)*	13.1 (3.1 - 23)*	--	--	---
Sleep	--	---	--	--	---
RAP-score	--	3.7 (1.2 – 6.2)**	1.1 (0.4 – 1.9)**	0.2 (0.1 – 0.4)**	– 0.5 (– 0.6 - – 0.3)***
Communication					
Mobility					
Personal care					

+ Gender, early versus conventional discharge, and type of fracture: all p- values > .05.
* p < .05 ; ** p < .01; *** p<.001.

and Pain (C/W) did not detect any change between 1 week and 1 month and Sleep (NHP), Emotional Reactions (NHP), Social Isolation (NHP), Feelings (C/W), Social Activities (C/W), and Overall Health (C/W) did not detect changes between 1 month and 4 months.

Table 5.
Qualitative comparison of the content of Rehabilitation Activities Profile (RAP), Barthel Index (BI), Nottingham Health Profile (NHP), and COOP/WONCA charts.

Dimension Of Health	RAP	BI	NHP	COOP/WONCA
Functional	Communication	--	--	--
	Mobility	Mobility	Mobility	--
	--	--	--	Physical Fitness
	Personal Care	Personal Care	--	--
	Occupation	--	--	Daily Activities
Social	Relationships	--	--	Social Activities
Psychological	--	--	Emot. Reactions	Feelings
			Social Isolation	
	--	--	Pain	Pain
	--	--	Energy	--
	--	--	Sleep	--
Overall	--	--	--	Overall Health
	--	--	--	Change in Health

7.4 Discussion

We prospectively evaluated quality of life and functioning until 4 months after hip fracture. We used two interviewer-administered instruments (RAP and BI) that focus on functional status, and two self-assessment instruments (NHP and COOP/WONCA charts) that additionally include psychological and social health domains. By using different instruments we were able to compare their performance in regard to reliability and (construct) validity. Moreover, we were able to make a judgement about their sensitivity to detect changes in health status, because we prospectively followed the patients until four months after hip fracture.

Recovery of pre-fracture health status

In agreement with other studies, [20,21] only a minority of the patients reached the same level of functioning (mobility, personal care and daily activities) at 4 months as before their fracture. Compared with a reference population, we also found more emotional distress, more feelings of loneliness and worse general health. Twenty percent of the patients indicated severe or very severe pain at 4 months after hip fracture, which did not differ from the age and sex matched population. Apparently, pain is a common phenomenon in the aged (> 80 years).

We showed that although a large proportion of patients was impaired in regard to household activities, preparing meals, leisure activities and transportation, perceived problems existed mainly in the field of basic activities such as maintaining posture, changing posture and walking.

The prognostic factors for poor recovery of function (institutionalization, higher age, and lower cognitive status) were reported previously.[22] The results of the present study show the importance of the number of comorbidities at hospital admission as a negative predictor of quality of life after hip fracture.

Comparison of RAP and BI

Many studies have been published about the consequences of hip fracture with mortality, discharge destination from hospital, and return to pre-fracture living situation as principal outcomes.[23] Studies that include the assessment of activities of daily living (ADL: mobility and personal care) and instrumental activities of daily living (IADL: housekeeping and preparing meals) are less frequent. In contrast to the BI, the RAP also assesses the capacity to perform instrumental activities of daily living. This is important in the evaluation of the consequences of hip fracture because the reduction in mobility and personal care in frail elderly patients will also influence these aspects of daily life. The RAP assesses disabilities in more detail than the BI, thus enabling the evaluation of specific intervention strategies. Another advantage of the RAP is the possibility to assess perceived problems of patients with existing disabilities. Obviously, in planning rehabilitation goals, this is an important concept.

The reliability and construct validity of both instruments were confirmed in the present study of elderly hip fracture patients. The BI and RAP were able to detect changes in mobility and personal care between 1 week, 1 month, and 4 months. These

changes occurred in the expected direction (improvement). The BI's reliability and validity has been established previously,[11, 24] An advantage of the BI is that it has been widely used in hip fracture rehabilitation studies,[12, 25-27] thus enabling comparisons of results. Good reliability and validity of the RAP was reported before in stroke patients. [13, 28-30] In comparison with the RAP, more patients scored totally independent with the BI before fracture (30% versus 19%) and 4 months after fracture (16% versus 2%) reflecting the relative lack of sensitivity of the BI to other than marked disability (ceiling effect). The RAP's sensitivity to detect minor disability is higher than the BI, probably because answer categories per item include observed difficulty with performing the activity and not only whether the respondent is dependent on help. However, in this frail elderly population the BI's performance was good in the assessment of recovery of mobility and personal care activities. The relative lack of sensitivity to change over time (compared to the RAP) and the omission of instrumental activities of daily living items probably make the BI less useful in the long-term follow-up of rehabilitation patients.

In hip fracture patients, the assessment of communication impairment with the RAP was not found to be very useful. More than 70% experienced no problems with communication and no changes were detected between follow-up points.

In conclusion, both the BI and the RAP measure recovery in personal care and mobility after hip fracture adequately. The RAP also assesses instrumental activities of daily living and seems to be a somewhat more appropriate instrument for the long-term follow-up of hip fracture patients and for the planning of rehabilitation goals.

Comparison of NHP and COOP/WONCA charts

Because hip fracture has such a profound influence on the post-fracture functional status of patients, one might expect that the fracture would also have consequences for the emotional status and general well being of the patients and their capacity to maintain social contacts. Generic health-related quality of life instruments such as the Sickness Impact Profile, [31] the SF-36, [32] the EuroQol, [3] and the Nottingham Health Profile[5-8] measure psychological, functional and social health and have been used in some studies. Both the NHP and the COOP/WONCA charts encompass functional status aspects. Physical mobility on the NHP and physical fitness and daily activities on the COOP/WONCA charts correlated strongly with the RAP and the BI. This confirms that all these scales measure mobility-related quality of life

Table 6:
Characteristics of the Nottingham Health Profile (NHP), COOP/WONCA charts, Rehabilitation Activities Profile (RAP) and Barthel Index (BI) in 168 patients 4 months after hip fracture.

Instrument and score range (number of items)	Mean	SD	%max	%min	Cronbach's α*
NHP score 0-100					
Physical Mobility (8)	58	28	12	2	0.80
Sleep (5)	24	30	4	44	0.79
Emotional Reactions (9)	26	27	2	27	0.80
Energy (3)	43	40	27	34	0.77
Social Isolation (5)	27	27	2	36	0.52
Pain (8)	27	25	3	18	0.78
COOP/WONCA score 1-5					
Physical Fitness (1)	4.5	0.7	60	0	
Feelings (1)	2.3	1.3	6	36	
Daily Activities (1)	3.7	1.3	39	7	
Social Activities (1)	2.2	1.6	16	57	
Change in Health (1)	3.0	0.8	5	3	
Overall Health (1)	3.3	0.9	7	5	
Pain (1)	2.5	1.1	5	21	
REHABILITATION ACTIVITIES PROFILE					
Communication score 0 – 6 (2)	0.7	1.3	1	71	0.91
Mobility + Personal care score 0-30 (10)	13.9	8.0	1	2	0.94
Occupation score 0 – 9 (3)	6.2	2.6	26	2	0.69
Relationships score 0 – 9 (3)	0.6	1.1	0	68	0.13
BARTHEL INDEX score 20-0 (10)	12.8	6.5	16	2	0.92

* values >.70 are considered to indicate adequate internal consistency

dimensions. When the RAP or the BI is used, the assessment of functional status by generic quality of life instruments has no added value. However, the generic quality of life instruments keep their value in the comparison of overall health status of patient groups with different diagnoses.
In our study, 5 of the 6 scales of the NHP showed adequate internal consistency (Cronbach's alpha from 0.70 to 0.80). With the exception of the social isolation scale, this is in agreement with the reported reliability in a group of Dutch patients in a general group practice. [6] Moreover, the NHP scales detected expected changes in health status over time and correlated well with counterparts in the other studied instruments, indicating adequate construct validity.
The pictograms of the COOP/WONCA charts did not make cognitively impaired patients able to answer the questions better than with the NHP. The NHP covered a wider range (emotion, pain, energy, sleep) of psychological health dimensions than the COOP/WONCA charts (only feelings). We could not assess the reliability of the COOP/WONCA charts because of their one item representation. The NHP detected larger changes in pain sensation than the COOP chart Pain probably because the NHP relates the pain to mobility. The COOP chart Overall Health seemed indeed to assess a general concept of health expressed by a good correlation with the RAP, the BI, and nearly all dimensions of the NHP. In evaluating the consequences of hip fracture, however, it does not give much additional information.
In conclusion, we recommend the use of the NHP in the follow-up of hip fracture patients in regard to the psychological dimension of health-related quality of life.

Social health

The RAP Relationships and the COOP/WONCA charts (Social Activities) assess whether the hip fracture influenced the ability to maintain social contacts with partner, children and friends/acquaintances. Qualitative analysis and correlation analysis revealed that the NHP scale Social Isolation was closely related to Emotional Reactions and therefore it may actually belong to the psychological dimension of health rather than to the social dimension. [5] The COOP chart failed to detect an expected improvement in social activities between 1 month and 4 months after hospital admission and the internal consistency of the RAP-relationships scale was low (α = 0.13). Moreover, the scales correlated moderately (Spearman coefficient = 0.31). Therefore, on the basis of our results, we are not able to give an opinion about which instrument to choose for the assessment of social activities after hip fracture.

Table 7.
Nottingham Health Profile (NHP), COOP/WONCA charts (COOP/W), Rehabilitation Activities Profile (RAP) and Barthel Index (BI); Correlations of scores at 4 months after hip fracture. N = 168.

Instrument	NHP Physical mobility	NHP Sleep	NHP Emotional Reactions	NHP Energy	NHP Social Isolation	NHP Pain	RAP Mobility+ Personal Care	RAP Occu-pation	RAP Commu-cation	RAP Relation-ships	BI
COOP/W											
Physical Fitness	.68	.15	.39	.41	.41	.41	.73*	.57	.40	.09	.65
Feelings	.38	.22	.65	.37	.57	.36	.44	.45	.32	.09	.49
Daily Ativities	.75*	.21	.48	.48	.54	.48	.79*	.60	.52	.21	.75*
Social Activities	.51	.08	.26	.41	.42	.31	.52	.48	.45	.31	.52
Change in Health	.23	.17	.15	.10	.12	.19	.25	.20	.13	.04	.22
Overall Health	.53	.09	.45	.50	.38	.58	.55	.47	.33	.08	.48
Pain	.33	.36	.35	.35	.24	.72	.29	.26	.05	.13	.18
RAP											
Mobility +											
Personal care	.87*	.12	.34	.48	.49	.47					
Occupation	.61	.09	.35	.43	.50	.38	.72*				
Communication	.47	.09	.05	.25	.27	.19	.62	.44			
Relationships	.25	.01	.20	.27	.18	.14	.19	.23	.09		
BI	.79*	.04	.33	.39	.47	.30	.91*	.67	.66	.17	

*: Spearman correlation coefficient >0.70

Limitation of study design

A substantial proportion of the studied group of hip fracture patients was cognitively impaired which meant that we had to use proxies in 26% of the interviews (family or health care providers) to answer the questions contained in the generic quality of life instruments. It is known that proxies tend to overestimate patient disability and pain intensity.[33-35] However, they evaluate patient's quality of life with a comparable degree of accuracy and appear to be more accurate when the information sought is concrete and observable. Therefore, the results of this study may have been biased by the use of proxies particularly in regard to the assessment of emotional reactions and pain but probably less so in regard to functional status.

7.5 Conclusion

We conclude that the RAP, BI, and NHP had adequate reliability, construct validity, and sensitivity to change over time in the assessment of function and health-related quality of life of elderly patients after hip fracture. Construct validity and sensitivity to change over time of the COOP/WONCA charts were also adequate.
Because, in contrast to the BI, the RAP assesses instrumental activities of daily living and because its sensitivity to detect minor disability was somewhat higher, we recommend the use of the RAP in the (group) evaluation of functional recovery of elderly hip fracture patients. For the evaluation of psychological health we recommend the NHP because it has better psychometric properties and covers a wider range of psychological health dimensions than the COOP/WONCA charts.

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Appendix

1.Rehabilitation Activities Profile

Activity	Score	Activity	Score
Communication		Personal care	
expressing	0-3	eating/drinking	0-3
comprehending	0-3	washing/grooming	0-3
Mobility		dressing	0-3
maintaining posture	0-3	undressing	0-3
changing posture	0-3	maintaining continence	0-3
walking	0-3	Occupation	
climbing stairs	0-3	providing for meals	0-3
using transport	0-3	household activities	0-3
		leisure activities	0-3
		Relationships *	
		Partner	0-3
		Child (ren)	0-3
		Friends/acquaintances	0-3

response options : performs activity with : no difficulty (0); some difficulty (1);much difficulty/help (2); not (3)
problem : none(0);light (1); moderate (2); severe (3)
* change : none (0); small (1); large (2); very large (3)

2. Barthel Index

Activity	Score	Activity	Score
Transfer	0-3*	Feeding	0-2**
Walking	0-3*	Grooming	0-1***
Stairs	0-2**	Bathing	0-1***
		Dressing	0-2**
Toilet use	0-2**		
Bladder control	0-2****		
Bowel control	0-2****		

response options :
* dependent (0); some help (1); much help (2); independent(3)
** dependent (0); some help (1); dependent (2)
*** dependent (0); independent (1)
**** incontinent (0); partly continent (1); continent (2)

3. Dartmouth COOP Functional Health Assessment Charts revised by the World Organization of National Colleges, Academies and Academic Associations of General Practitioners and Family Physicians

Physical Fitness

What was the most strenuous level of physical activity you could do for the last 2 minutes? 1. very heavy; 2. heavy; 3. moderate ; 4.light ; 5. very light.

Feelings

How much have you been bothered by emotional problems such as feeling unhappy, anxious, depressed, irritable? 1. not at all; 2. slightly; 3. moderately; 4. quite a bit; 5. extremely

Daily Activities

How much difficulty did you have doing your daily work, inside and outside the house, because of your physical health or emotional problems? 1. no difficulty at all; 2. a little bit of difficulty; 3. some difficulty; 4. much difficulty; 5 .could not do.

Pain

How much bodily pain have you generally had? 1. no pain; 2. very mild pain; 3. mild pain; 4. moderate pain; 5. severe pain.

Overall health

How would you rate your overall physical health and emotional condition? 1 excellent; 2. very good; 3. good; 4. fair; 5. poor.

Change in health

How would you rate your physical health and emotional condition now compared with 4 weeks ago? 1. much better; 2. a little better; 3. about the same; 4. a little worse; 5. much worse.

Social Activities

To what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbors or groups? 1. not at all; 2. slightly; 3. moderately; 4. quite a bit; 5. extremely.

4.Nottingham Health Profile

Energy:
I'm tired all the time
Everything is an effort
I soon run out of energy

Pain:
I have pain all the night
I have unbearable pain
I find it painful to change position
I'm in pain when I walk
I'm in pain when I'm standing
I'm in constant pain
I'm in pain when going up and down stairs and steps
I'm in pain when sitting

Emotional reactions:
Things are getting me down
I've forgotten what it's like to enjoy myself
I'm feeling on edge
The days seem to drag
I lose my temper easily these days
I feel as if I'm losing control
Worry is keeping me awake at night
I feel that life is not worth living
I wake up feeling depressed

Sleep:
I take tablets to help me sleep
I am waking up in the early hours of the morning
I lie awake for most of the night
It takes me a long time to get to sleep
I sleep badly at night

Social isolation:
I feel lonely
I'm finding it hard to make contact people
I feel there is nobody I am close to
I feel I am a burden to people
I'm finding it hard to get on with people

Physical mobility
I can only walk about indoors
I find it hard to bend
I'm unable to walk at all
I have trouble getting up and down stairs and steps
I find it hard to reach for things
I find it hard to dress myself
I find it hard to stand for long
I need help to walk about outside

Score options: yes (1); no (0)
Score are weighted per scale to range from 0-100

Chapter 8.

General Discussion

8.1 Introduction

The aim of the present study was to investigate the effect on outcome and costs of accelerated discharge of elderly hip fracture patients from hospital. We will answer and discuss the research questions one by one. Then, we will discuss the possible consequences of early discharge for waiting lists and misuse of hospital beds and nursing home beds and suggest to organize the care in a "hip fracture service". Finally, we summarize the general discussion in conclusions and recommendations.

8.2 Research questions

What is the outcome of elderly hip fracture patients in regard to mortality, recovery of function and quality of life?

The average age of the patients included in our study was high (83 years) and a large proportion (40%) was already institutionalized before fracture. In most previous studies, lower average age and more patients coming from home were reported. Both age and pre-fracture residence strongly predict mortality and functional outcome (see chapter 2, literature review). This could explain the poor recovery of function and relatively high mortality in our study population.

At 4 months after fracture, 19% of all patients in our study had died. This is in line with the range of 12-24% death rates previously reported.[1-5] Mortality was not confined to the hospital stay but mainly occurred after hospital discharge, e.g. in the nursing home. As expected, higher age, reduced cognitive status, and more comorbidities at hospital admission predicted mortality. Main causes of death were pneumonia, heart failure, myocardial infarction and stroke. Nearly one fifth of all deaths were due to " failure to thrive" (dehydration/cachexia) in demented patients. The outcome with regard to survival of patients, who had all 4 risk factors at hospital admission, was very poor. Of the 22 psychogeriatric patients in our study, who fractured their hip in the nursing home, 8 patients (36%) died within 4 months. Of the 6 nursing home patients, who in addition to dementia and hip fracture, had 2 or more comorbid conditions, 4 died within 4 months. Institutionalized patients, who

in addition to dementia had other comorbid conditions that reduced mobility and function before their hip fracture should receive conservative treatment with sufficient pain relief. These patients have a poor prognosis with regard to survival and recovery of function and may benefit more of conservative treatment and sufficient pain relief. A Cochrane Review revealed that for all patients the limited available evidence from randomised trials does not suggest major differences in long-term outcome between conservative and operative management programmes for extracapsular femoral fractures, but operative treatment appears to be associated with a reduced length of hospital stay and improved rehabilitation.[6]

At 4 months, only 18% of patients in our study had achieved their pre-fracture ADL level (as measured by the Rehabilitation Activities Profile) and 36% their previous walking ability. This outcome is similar or worse than that reported previously.[3,7-12] Higher age, reduced function before fracture, and reduced cognitive status (see chapter 2, literature Review) predict reduced function after fracture. In addition to these characteristics, we found the number of comorbidities at hospital admission to be predictive for the recovery of function at 4 months after fracture.
The health-related quality of life instruments (Nottingham Health Profile and COOP/WONCA carts) used in the study showed overall improvement in health-related quality of life between 1 week and 4 months after hospital admission. Unfortunately it was not possible to assess retrospectively the scores before the hip fracture. Therefore, we had to use reference values from literature for comparison. For the Nottingham Health Profile these were reported in a UK general population, divided in age and gender groups.[13] For the COOP/WONCA charts, Dutch general population reference values were used.[14] It was not surprising that the functional dimensions of these instruments showed poor recovery. At 4 months postoperatively, significant differences with the reference population were found in physical mobility (NHP), social isolation (NHP), physical fitness (C/W), and daily activities (C/W). Significant differences were also found in emotional distress (emotional reactions-NHP, feelings-C/W) and pain. For the COOP/WONCA charts, no reference values are available in regard to pain. At 4 months 20% of patients experienced severe to very severe pain (32% at 1 week and 26% at 1 month). The 4-month scores of the NHP dimension pain did not differ from the reference population. Apparently, pain is a common phenomenon in the aged (> 80 years). At 1 week and 1 month after hospital admission, patients experienced more pain ($p < 0.001$) than the reference population. We agree with other researchers [15] that the observation and

treatment of pain complaints after surgery for hip fracture requires more attention.

What are the effects of early discharge from hospital on mortality, recovery of function and quality of life?

We found that an early discharge policy of elderly hip fracture patients did not affect outcome in regard to survival, function, and quality of life at 4 months after hospital admission.

In the early discharge group, the hospital stay was reduced from on average 26 days to 13 days by using a decision protocol for discharge that started 5 days postoperatively, by speeding up procedures for discharge home or transfer to a nursing home and by increasing the availability of beds on the rehabilitation ward in an nursing home.

This intervention resulted in more patients going to a rehabilitation ward in a nursing home. Both hospital and nursing home provided medical care and physiotherapy. However, differences existed in primary care objectives. In the hospital, postoperative surgical care was provided and the physiotherapist tried to restore the function of the operated hip. In the nursing home, geriatric care was provided, aimed at the recovery of the ability to perform (instrumental) activities of daily living. In contrast to the hospital, the nursing home provided multidisciplinary care with weekly meetings of the multidisciplinary team. In the hospital patients received physiotherapy (2 x per day 5-10 minutes) under supervision of the ward physician. In the nursing home physiotherapists (2,4 full time equivalent (fte) for 30 patients with 20-30 min physiotherapy per day per patient), occupational therapists (0,5 fte) and social workers (0,7 fte) helped to ensure patients were rehabilitated under supervision of a physician trained in geriatric medicine (0,5 fte). Registered nurses in the hospital and nursing assistants in the nursing home provided nursing care (both approximately 90 minutes per day per patient). Despite this more intensive rehabilitation, the early discharge from hospital had no effect on survival, function, or quality of life at 4 months. Disappointing results of combined orthopedic-geriatric care have been previously reported.[7,9,10,16-18] The authors of two systematic reviews of geriatric rehabilitation and coordinated multidisciplinary care after hip fractures concluded that no conclusive evidence existed about the long-term improvement of function, morbidity, or quality of life in rehabilitation programs.[19,20]

While our results support this conclusion, it was shown that one month after hip fracture, early discharged patients coming from home showed some signs of better recovery. Their walking ability was better ($p = 0.05$) and the scores on the RAP-communication- mobility-personal care ($p= 0.06$) and RAP-occupation ($p = 0.08$) showed a trend in favor of the early discharged patients. Similar trends of better recovery at 1 month were found for all (including the pre-fracture institutionalized) patients on the Nottingham Health Profile pain dimension ($p = 0.09$) and the energy dimension ($p = 0.05$). With a greater number of patients, these differences could have reached statistical significance. Therefore, it is possible that the multidisciplinary approach and the extra efforts of therapists in the nursing home have some influence on the speed of recovery.

The two groups of patients showed at 4 months similar health-related quality of life as measured by NHP and COOP/WONCA charts. However, we cannot exclude that other quality of life concepts such as "happiness" or "satisfaction" are related to the change of environment (hospital vs. nursing home) in regard to where patients were rehabilitated. In retrospect, it would have been wise to measure satisfaction differences between groups.

Finally, although the residence of patients after hospital discharge shifted, the early discharge had no influence on total institutional stay and at 4 months the residence of "usual management" and ' early discharge" patients was similar.

In conclusion, early discharge did not influence the outcome of elderly hip fracture patients in an unfavorable way.

Does early discharge result in a reduction of costs?

Because most costs were made during hospital (conventional management 47% and early discharge 32% of total) or nursing home (32% and 44% respectively) we will first discuss institutional stay.

The length of hospital stay of hip fracture patients in the Netherlands is relatively long (23 days in 1998). Much shorter hospital stays were achieved in Sweden and the US (11-12 days). However, the length of hospital stay depends on the place and method of rehabilitation. When patients are transferred from the acute hospital to rehabilitation wards or nursing homes, total institutional stay should be compared together with the proportion of patients who return to their previous living situa-

tion. The intervention in our study resulted in, on average a two-week shorter stay in the acute hospital, but the average total institutional stay (hospital + nursing home) until discharge remained the same (38 days vs. 34 days, p = 0.5). Also, the proportions of patients who were back home at 4 months after fracture were similar. Of patients coming from home, 63% were back home, 21% stayed in the nursing home, and 4% were in an old people's home. These figures are comparable with those in the US, where patients are discharged from hospital after a stay of approximately 12 days, but a large proportion (60-70%) is rehabilitated in nursing homes with an average length of stay of 40 days.[21] We found similar lengths of nursing home stay in our study. A larger proportion of patients discharged directly home from hospital (80%) with relatively short stays (12-20 days) were reported in Lund, Sweden [22,23] and in Peterborough, UK.[4] Both centers, however, developed special "hip- fracture services" with extensive physiotherapy and nursing care at home.

Cost calculations based on average charges per (hospital or nursing home) day will overestimate potential savings.[24-27] Therefore, we estimated the real costs from a societal perspective measured as the value of investments in personnel, equipment, materials, housing and overhead. The real hospital costs per inpatient day decreased after day five. When we had used average charges per day for hospital (€ 300), nursing home (€ 130), and old people's home (€ 60) the savings would amount to approximately € 3000 per patient. Even when corrected for the more re-admission days in the early discharge group, the savings would be € 2000 per patient. With an incidence of 17.000 hip fractures per year in the Netherlands, total costs savings would amount to € 34 million per year. If we assume that our real cost estimation of € 1000 per patient could be confirmed in a larger study, this would imply a cost saving of € 17 million per year.

We found a real cost saving of 7% by early discharge. Explanations why the cost saving was not higher are:

- The early discharge caused a shift in costs from the hospital to the nursing home while total institutional stay did not differ between groups;
- The real costs per day after day 5 in hospital did not differ greatly from costs per day in the nursing home;
- The early discharge policy caused the first 5 days postoperatively to be more expensive probably because the prospect of early discharge caused physicians to speed up diagnostic and laboratory procedures;

- More re-admissions to hospital occurred in the early discharge group;
- There was a large variation in costs per patient.

We found the average real costs per patient per day in the nursing home (€ 130-140) to be approximately the same as the charges in the Dutch health care system. Therefore, a reduction of the present hospital stay of 23 days to 13 days with consequently earlier discharge to nursing homes does not seem to necessitate extra financing of the nursing homes. Apparently, the rehabilitation and care of hip fracture patients does not need more time from the nursing, medical, and therapeutic staff than the care of other admitted patients. Although the hip fracture patients received more physiotherapy than the usual admitted nursing home patient, these other patients probably received more in the way of other forms of therapy such as occupational therapy and activity training. However, a more accelerated discharge than the present one, for instance with an average hospitalization of 5-6 days, will increase the average costs per day in the nursing home. These earlier discharged patients will need more nursing and medical care and will incur more costs because of laboratory and other diagnostic procedures.

We calculated variable hospital costs from day 5 until discharge to be € 146 per day (Table 1). Fixed costs (housing and overhead) were € 118 per day. Assuming nursing homes have to make similar variable costs to take care of these patients, daily costs per patient would then amount to € 74 (= fixed nursing home costs) + € 146 = € 220. To stimulate nursing homes to admit these patients 5-6 days after surgery an extra reimbursement of € 90 (€ 220 minus € 130) per day per patient for 6 days seems reasonable. Moreover, nursing homes should be compensated for the necessary reservation of beds to guarantee admission and the extra administrative costs because of the increased turnover of patients.

Table 1.
Average hospital and nursing home real costs and charges per day (early discharge, average stay 13 days in hospital) in Euros

	Hospital	Nursing home
Fixed costs	118	74
Variable costs	146	60
Total costs	264	134
Charges per day	235-350	130

The real costs for the care of hip fracture patients in

old people's homes (€ 120) were twice the charges per day (€ 60). Health practitioners such as general practitioners and physiotherapists are not included in these charges but these incurred only very few costs (€ 3 per day). With a more accelerated discharge policy, the costs of health care professionals will increase. The costs of rehabilitating hip fracture patients in elderly homes then approach those incurred in nursing homes. Preferably these patients should be admitted to rehabilitation wards of nursing homes where they could be rehabilitated according to a coordinated rehabilitation program (similar to the Stroke Service). This could improve the outcome.

The incremental costs (total costs minus average pre-fracture incurred costs) of a hip fracture in our study amounted to € 10.821 for conventionally discharged and € 9.576 for early discharged patients. This is in agreement with reported incremental costs in the Netherlands by de Laet et al.[28] but lower than reported in studies from the US [29] and Sweden.[30] Total costs were € 15.338 for conventionally managed and € 14.281 for early discharged patients up to 4 months after surgery. Therefore, the prevention of hip fractures is not only important to prevent mortality and morbidity after hip fracture but will also substantially reduce health care costs. In the light of these facts the recent development of hip protectors seems promising [31] although their effectiveness has only been proven for a selected (institutionalized) population at high risk sustaining a hip fracture and is not known beyond this group. Compliance, particularly in the long term, is poor for people living at home. Moreover, it is possible that wearing the hip protector improves activity and reduces the fear of falling resulting in more hip fractures.

Because of the early discharge, the extramural health care costs at home (reflecting investment of nursing care at home, general practitioners, and physiotherapists) slightly increased. Surprisingly, this was not found for informal care. Probably, the rehabilitation at the nursing home and the careful discharge planning resulted in less demand of informal caregivers. This influence on the demand of caregivers at home is important to keep in mind when planning early discharge from hospital and nursing home.

What complications occur after surgery for hip fracture and does early discharge change the number and nature of the complications?

Hip fracture patients experience many complications both inside and outside the hospital. We registered on average 3 complications per patient in 4 months. Most of these (91%) concerned general medical complications. Prevention of local surgical complications remains important because re-operation (38%) and functional impairment (41%) followed a large proportion of these complications. Improvement of surgical technique and procedures could result in reduction of surgical complications. This belongs to the domain of orthopedic surgeons and quality improvement of hospital care.

The early discharge had no influence on the number and nature of complications but merely shifted the location of occurrence from the hospital to the nursing home. Patients in the conventional discharge group experienced 64% of all complications during their hospital stay, 24% in the nursing home, and 14% at home or old people's home. The figures for early discharged patients were 45%, 45%, and 10% respectively.

After the direct (postoperative) period, residents, general practitioners or nursing home geriatricians take over the medical care of these frail elderly patients. In this postoperative period, the prevention of complications such as urinary tract infections, pressure ulcers, pulmonary infection, and psychiatric complications, becomes important.
We found high incidences of urinary tract infections (in 45% of patients). More research is needed to establish whether disturbed bladder function with urine retention in these patients could have been the cause of the frequent postoperative urinary tract infections. We registered urinary tract infection as a complication if patients were treated with antibiotics. However, we do not know how the infections were diagnosed: e.g. on the basis of the presence of bacteriuria or also on the basis of symptoms? This diagnostic uncertainty could explain the variety of incidences, reported in other studies. Although the infections had few consequences for the functioning of patients, prevention certainly would reduce complaints, temporary illness, and delay of rehabilitation. To prevent urinary tract infections, the use of prophylactic antibiotics remains controversial.[32] Bladder catheterization increases the incidence of urinary tract infections and should be avoided as much as possible.[33]

Early mobilization and adequate nursing attention in regard to timely and sufficient bladder emptying could further reduce the incidence of urinary tract infections.

Pressure ulcers were frequent (in 27% of patients). Half of these were diagnosed within 8 days after surgery. It is probable that a substantial number of these pressure ulcers had already developed before surgery. Early mobilization, frequent turning (also preoperatively in the emergency department), treatment of anemia, and adequate food intake, are among the prophylactic measures which should be employed to prevent this painful and disabling complication.

An especially serious (and often lethal -- 50% in our study) postoperative complication after hip fracture is pneumonia. Prevention of pulmonary complications in elderly hip fracture patients requires careful preoperative instruction in coughing and breathing exercises, appropriate management of any preoperative chest infection, timely surgery, short operation, early postoperative mobilization, good oral hygienic care and prevention of aspiration, and vigorous postoperative physiotherapy.[34]

Finally, prompt return of psychogeriatric patients to the nursing homes and early proactive geriatric consultation could reduce psychiatric complications such as acute confusion (delirium).[35]

Which measurement instruments are appropriate to measure recovery in function and quality of life?

We prospectively evaluated health-related quality of life, including functioning, until 4 months after hip fracture. We used two interviewer-administered instruments (the Rehabilitation Activities Profile (RAP) and the Barthel Index (BI)) that focus on functional status, and two self-assessment instruments (the Nottingham Health Profile (NHP) and the COOP/WONCA charts) that additionally include psychological and social health domains. The score distribution, internal consistency, construct validity, and sensitivity to change over time, were investigated. We showed that, for research purposes (i.e. comparisons at group level), the RAP performs well in the assessment of (instrumental) activities of daily living and the NHP in the assessment of other health-related quality of life dimensions such as pain, emotional distress, and energy. The BI also assesses functional recovery but in contrast to the RAP, does not measure instrumental activities of daily living. Moreover, its sensitivity to detect

change over time and minor disability appeared to be lower. Contrary to our expectations, the pictograms of the COOP/WONCA charts did not help mildly cognitively impaired patients to complete the questionnaire. The NHP covered a wider range of psychological health dimensions and had better psychometric properties than the COOP/WONCA charts. Therefore, we recommend the use of the RAP and the NHP for the follow-up research of hip fracture patients.

Good psychometric properties for comparisons at patient group level do not necessary mean that a measure is also suitable for individual clinical follow-up of elderly hip fracture patients. The requirements of a measure depend on the purpose of the individual clinical follow-up. The use of a measure as a basis to make clinical decisions, for instance, requires higher demands of reliability than its use as a basis to discuss with a patient his/her recovery of or decline in health-related quality of life. Also, other health-related quality of life instruments such as the Short Form 36 may actually be more appropriate in the follow-up of hip fracture patients at group level. More research is needed to answer these questions. Furthermore, as previously mentioned, this type of research should also include satisfaction (with physical and emotional environment) measurement.

8.3 Effect of accelerated discharge on the misuse of hospital and nursing home beds (so-called "waiting lists" and "wrong" beds).

In 1994, van Vught et al [36] focused attention on the wrong-bed problem of hip fracture patients in the Netherlands. Especially the waiting for admission to somatic and psychogeriatric nursing homes was too long. The authors proposed that optimally patients should stay on average 9 days in hospital stay with a hip fracture. In the UK, Robbins et al [27] found that 28% of the hip fracture patients admitted to hospital were awaiting discharge after medical and surgical care was complete. These patients occupied surgical and orthopedic beds. Additionally, the hospital environment was often not the most appropriate environment for the rehabilitation of these frail elderly patients. Early discharge of hip fracture patients could facilitate the admission of more patients for treatment in the hospital without increasing the capacity for hospital bed provision. Table 2 shows that an accelerated discharge of 13 days and 17 days could free capacity for 20.000 and 27.500 respectively for elective surgery or treatment of hip fracture.

In 2000, 32.000 patients were waiting for orthopedic ward admission and 27.000

Table 2.
Proven and hypothetical effects of early discharge of elderly (> 65 years) hip fracture patients on capacity of hospitals and nursing homes in the Netherlands.

		Discharge		
		Conventional	Early (13 days)	Early (9days)
HOSPITAL	Number of hip fracyures in 2000	14.760	14.760	14.760
	Average stay	26 days	13 days	9 days [36]
	Number of bed-days	383.760	191.880	132.840
	Capacity (beds)	1168	583	364
	Extra number of patients for elective surgery/hip fracture with capacity of 1168 beds*	----------	20.032	27.531
NURSING HOME	Patients admitted to rehabilitation wards	5.748	8.996	8.996
	Average stay #	43 days	39 days	44 days
	Number of bed-days	247.164	350.844	394.504
	Capacity (beds)+	752	1066	1200

* with a bed occupancy rate of 90% and an average stay of 9.6 days for orthopedic wards
#: Average stay of discharged patients < 4 months; % of remaining (not successfully rehabilitated) patients was similar for conventional and accelerated discharge.
+: bed occupancy rate of 90%
[36] : van Vugt et al. 1994

patients for admission to surgery wards in the Netherlands with waiting times of 9-12 weeks.[37] The accelerated discharge of hip fracture patients could therefore greatly contribute to the reduction of waiting lists. This increased turnover in the hospital can only be achieved of course if there is sufficient theatre capacity,

sufficient medical and nursing staff in the hospital, and increased nursing home capacity available for rehabilitation (Table 2). This is in addition to the capacity required for patients already admitted in the nursing home before the fracture (n = 2200) and the capacity required for remaining patients because their rehabilitation failed (n = 2500). With an optimal average hospital stay of 9 days, the total institutional stay (hospital + nursing home) of hip fracture patients will probably not increase. Currently, 752 nursing home beds are required for the rehabilitation of elderly hip fracture patients. The extra capacity (beds) needed to optimally rehabilitate the additional number of patients are 550 beds, divided between 18 combined somatic-psychogeriatric nursing homes with rehabilitation wards of 30 beds. Because a large proportion of hip fracture patients is cognitively impaired, the admission of these patients should not be confined to somatic rehabilitation wards. Psychogeriatric beds (with a specialized rehabilitation program) should also be available. If this increased capacity involves a reduction of the number of available chronic somatic beds, it will result in about 300 less (1% of total) chronic somatic patients that could be admitted to Dutch nursing homes per year or an increase in average waiting times of a few days. Moreover, if more orthopedic hospital beds could be made free, more patients could be operated sooner for arthritis of the hip or knee, therefore helping to prevent dependence and nursing home admittance. We therefore advocate the early discharge of hip fracture patients.

8.4 Hip Fracture Service

The average hospital stay could possibly be even shorter than 13 days without compromising the outcome through organizing care facilities similar to that of a Stroke Service. This service (stroke unit) is characterized by coordinated multidisciplinary rehabilitation, programs of education and training in stroke, and specialization of medical and nursing staff, resulting in long term reductions in death rates, reduced dependency and need of institutional care.[38] Recently, the results of 3 stroke services in the Netherlands were reported. The stroke service in Delft proved to be the most successful in terms of improved health outcome, lower costs, increased feelings of satisfaction among patients and caregivers, and reduced length of stay in the hospital.[39] Important conditions for this success were admission guarantee to hospital and nursing home, care according to a protocol, concentration of stroke patients in hospital and nursing home, multidisciplinary meetings, organization of after-care at home, and a "transmural" patient file.[40]

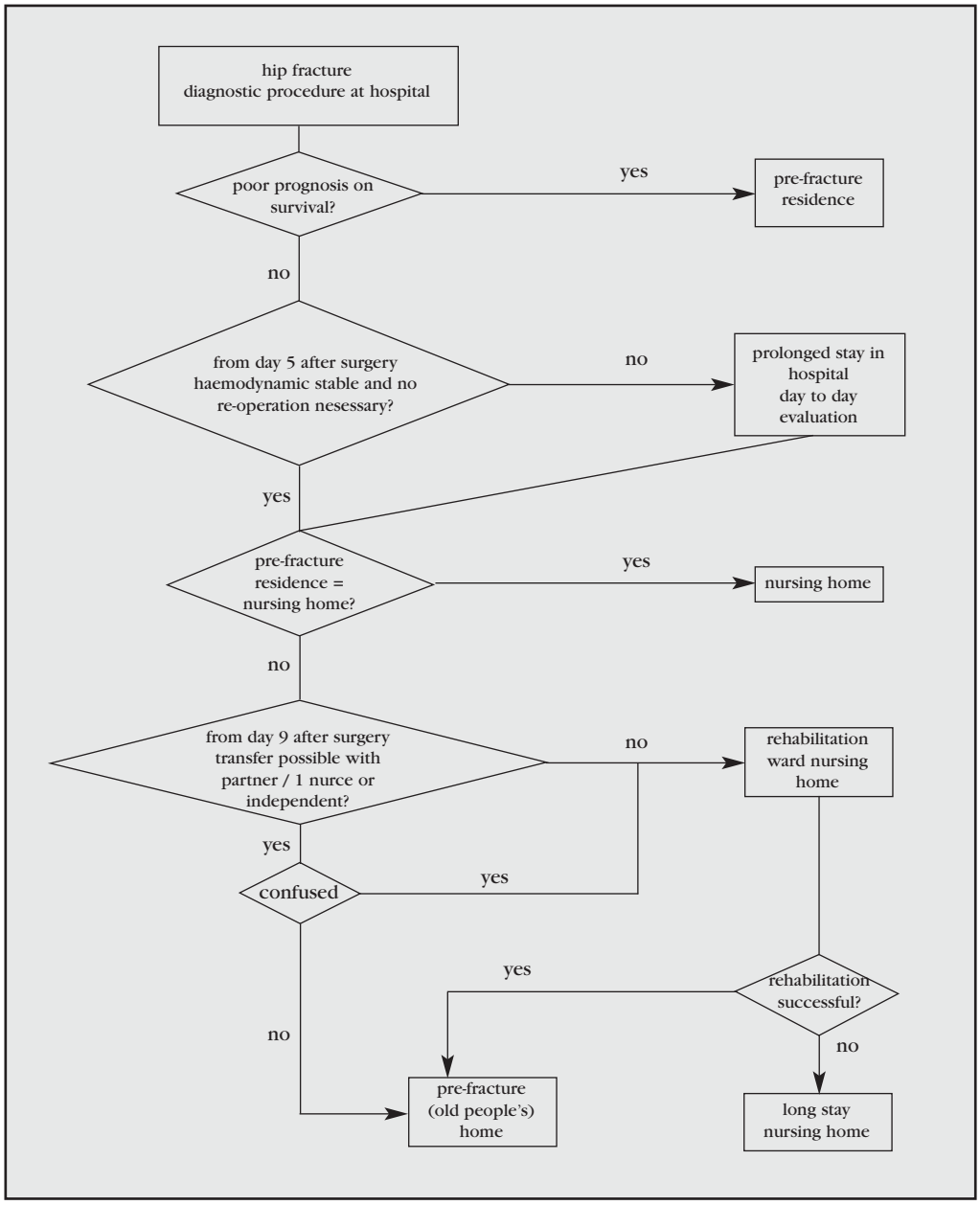
A similar project for hip fracture patients was developed in Peterborough (UK) with early operation by a designated theatre team and admission to a hip fracture ward where patients stay for their entire in-patient rehabilitation.[4] After surgery, early discharge of patients was encouraged and wherever possible the hospital-at-home community service was used. All patients were followed-up in a hip fracture clinic. This service resulted in a reduction of length of hospital stay, an increase in the proportion of patients discharged directly home and reduction in mortality rate over a period of 11 years after the introduction of the service. Other examples of hip fracture services are a multidisciplinary team caring for patients both in the hospital and at home in New Zealand [41] and a hip fracture unit in Sweden where patients remain until they could return home or until no further progress was recorded.[42] Both services resulted in shorter hospital stays and reduced costs.

In accordance with already established stroke services, hip fracture services could lead to better outcome in the Netherlands. Such a hip fracture service should include:

- prompt admission guarantee to a hip fracture unit in the hospital;
- concentration of hip fracture patients in the hospital;
- a designated hip fracture team of anesthesiologists, orthopedic surgeons, geriatrician, and physiotherapists;
- a discharge protocol with a fixed decision moment (5 days postoperatively, see Figure 1) where: patients coming from a nursing home should be discharged as soon as possible back to the nursing home; patients not able to make a transfer from bed to chair should be discharged to a rehabilitation unit of a nursing home; every patient able to make a transfer should be discharged home with additional nursing care and physiotherapy at home; every patient able to make a transfer with the help of one person should be discharged home when a partner is willing and able to give this help- or back to the old people's home. When discharge back to home or old people's home cannot be realized within 9 days postoperatively, these patients should be discharged to the nursing home. Confusion (delirium, cognitive deterioration) nearly always hampers early return to home. Therefore, all confused patients should be discharged to rehabilitation wards of nursing homes;
- weekly multidisciplinary meetings including nursing staff, medical staff,

physiotherapists and nursing home geriatrician, resulting in care according to protocol and efficient discharge policy;

- admission guarantee to rehabilitation units (both somatic and psychogeriatric) in nursing homes;
- transmural patient file going with the patient from one residence to the other;



- coordinated home care (nursing, physiotherapy, and medical) and the use of rehabilitation day-care centers after hospital or nursing home discharge;
- simplifying of (care) indication procedures: (orthopedic) surgeon indicates institutional care after discharge, and the regional indication committee warrants a maximum of 100 days to the nursing home for the rehabilitation.

8.5 Recommendations and conclusions

Recommendations for quality of care

- Emotional distress and pain after hip fracture are common and need more attention. We recommend frequent pain assessment and adequate treatment.
- Geriatric expertise is needed to prevent, diagnose, and treat the frequent general medical complications such as urinary tract infections, pressure ulcers, pulmonary complications, and delirium after hip fracture.
- To stimulate specialized nursing homes to admit hip fracture patients after a shorter hospital stay than on average 13 days, reimbursement of € 20 per day per patient (in addition to the usual charges) for the first six weeks of admission seems reasonable.
- The hip fracture patients should be concentrated on a (orthopedic) rehabilitation ward in the hospital and nursing home and the rehabilitation should be coordinated in a hip fracture service.
- In the follow-up of hip fracture patients the use of the Rehabilitation Activities Profile and the Nottingham Health Profile is recommended.

Recommendations for future research

The investigation of:

- The effect of a hip fracture service on length of stay, residence, function (as assessed by the RAP), quality of life (NHP), complications, and satisfaction. Preferably this should be studied in a randomized design;
- The effects of further shortening of hospital stay (on average < 9 days) on real costs. The study population should be sufficiently large enough to reach statistical significance, in view of the large variation in costs between patients;
- The performance of the RAP in the individual clinical follow-up of hip fracture patients;
- The benefit in terms of comfort/quality of life to operate on very old, severely

demented, long-term institutionalized hip fracture patients with multiple comorbidity.

Conclusions

1. A hip fracture has serious consequences for survival and for recovery of function and quality of life.
2. Early discharge from the hospital to nursing homes with rehabilitation facilities does not clearly improve the outcome although it does not worsen the outcome.
3. In accordance with developments in the US and Sweden, shorter lengths of stay in the hospital (average 9 days) should be possible in the Netherlands.
4. Early discharge caused in the present study a real cost saving (7%), which did not reach statistical significance.
5. Many medical complications occur after surgery for a hip fracture. Early discharge does not change the number or nature of these complications but merely shifts the location of occurrence from the hospital to other locations.
6. The Rehabilitation Activities Profile is an appropriate instrument to measure functional recovery after hip fracture. To measure other quality of life dimensions, such as pain, emotional condition, and energy, the Nottingham Health Profile performs well.

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Chapter 9.

Appendices

Summary

The aim of the study, described in this thesis, was to determine the effect of early discharge from the acute hospital of elderly hip fracture patients on functional status, mortality, quality of life, complications and costs. Secondary aims were to provide a detailed description of the consequences of hip fracture for the elderly in regard to survival, recovery of function, and the occurrence of complications and to determine which of the 4 used measurement instruments are most appropriate in the follow-up of function and quality of life after hip fracture.

Chapter 2 reviews the international literature concerning the consequences of a hip fracture. The increasing number of elderly people who sustain a hip fracture is causing immense management problems for Western European and North American countries in particular. A review is presented of solutions in several countries to shorten hospital stay and to relieve the pressure on orthopedic/surgical beds.

Joint orthopedic-geriatric collaboration and early discharge to home with additional home support have led to shorter hospital stays. Modest cost savings have been suggested. However, improvement of the still poor prognosis in regard to survival and long-term recovery of function and quality of life has not been achieved. In the Netherlands, the solution has been found in a collaboration between hospitals and nursing homes. Consequently, more hip fracture patients are discharged earlier to rehabilitation wards of nursing homes. This fact has led to the research questions of this study.

In chapter 3, a group of 102 elderly hip fracture patients, who were consecutively admitted to 2 hospitals in Rotterdam, is described. The outcome of these patients was poor: 20% died within 4 months and only 57% of surviving patients returned to their previous living situation. Only 43 % regained their pre-fracture walking ability and only 17% their pre-fracture level of activities of daily living. Their quality of life was worse than the quality of life reported in an age and sex matched reference population.

In chapter 4, the results are presented of the prospective study comparing the

outcome of the 102 patients, described in chapter 2, with the outcome of 106 patients whose discharge from hospital was accelerated. The intervention consisted of the implementation of a discharge protocol and speeding up of indication procedures both for discharge home and for transfer to a nursing home. The second group stayed on average 13 days shorter in the hospital and more patients were earlier discharged to the nursing home. Although the early discharge group showed a trend of slightly better recovery at 1 month, at 4 months no differences were found in survival, recovery of function or quality of life, and type of residence.

Chapter 5 concerns the results of a detailed cost study. The 2 groups of patients were compared in real costs during the stay in institutions (hospitals, nursing homes, and old people's homes) and at home. In addition to the fixed costs of hospitals and nursing homes, all variable costs of interventions, examinations and personnel were calculated on a daily basis and in great detail. The total average costs within 4 months per patient were somewhat lower for the early discharge group (€ 14.281) than for the group of patients who were conventionally managed (€ 15.328). This difference did not reach statistical significance probably because of the wide variability per patient. The early discharge caused a shift of costs from the hospital to the nursing home. The main reason for the absence of large cost savings was that most of the hospital costs were made in the first 5 days postoperatively and that thereafter the average daily hospital costs did not differ much from those in a nursing home. Moreover, the early discharge shifted costs that are needed before discharge and otherwise would have been made later (from interventions and examinations) to the first postoperative days.

In chapter 6 all complications are described that occurred within 4 months in all 208 patients. Probably because of our operational definition (all medical events that required therapeutical intervention) and because of our careful way of registration, more medical complications were found than reported in the literature. The early discharge caused a shift in the location of occurrence: more complications were diagnosed and treated in the nursing home. The accelerated discharge had no influence on the total number and nature of complications within 4 months.

Which measure instruments are appropriate in the follow-up of groups of hip fracture patients in regard to recovery of function and quality of life? Four instruments were used in a comparative study (chapter 7): The Rehabilitation Activities Profile

(RAP), the Barthel Index (BI), the Nottingham Health Profile (NHP), and The COOP/WONCA charts. The RAP was found to be most appropriate to measure recovery in function (mobility, personal care, and instrumental activities of daily living) and the NHP to measure changes in emotional condition, pain sensation, and energy. The total group had significant worse quality of life scores than reported in a reference population. The number of comorbidities at hospital admission was the most important predictor.

The results of these studies are discussed in Chapter 8. The main conclusions are:

1. A hip fracture still has serious consequences in regard to survival, recovery of function and quality of life, and postoperative complications;
2. Early discharge from hospital does not improve or worsen this outcome at 4 months after fracture;
3. Early discharge causes a modest real cost saving which did not reach statistical significance in the present study.

We recommend the intensification of the cooperation between hospitals and nursing homes with the aim of further reducing the hospital stay because of possibly favorable consequences for the waiting lists for orthopedic surgery. We suggest organizing the care of hip fracture patients in specialized hip fracture services.

Samenvatting

Inleiding

Het doel van de studie, beschreven in dit proefschrift, was om te bepalen welke invloed een versneld ontslag uit het ziekenhuis van oudere heupfractuur patiënten heeft op de functionele resultaten, mortaliteit, kwaliteit van leven en kosten. Afgeleide doelen waren om een gedetailleerde beschrijving te geven van de gevolgen van een heupfractuur op overlevingskans, functioneel herstel, kwaliteit van leven en optredende complicaties en om te bepalen welke van de 4 gebruikte meetinstrumenten geschikt zijn om het herstel in functie en kwaliteit van leven van heupfractuur patiënten te vervolgen.
De studie tracht de volgende vragen te beantwoorden:

1. Wat zijn de gevolgen van een heupfractuur voor oudere patiënten met betrekking tot mortaliteit, herstel van functie en kwaliteit van leven?
2. Wat zijn de effecten van vervroegd ontslag uit het ziekenhuis op mortaliteit, herstel van functie en kwaliteit van leven?
3. Vermindert vervroegd ontslag de kosten?
4. Welke complicaties ontstaan er na operatie wegens heup fractuur en verandert vervroegd ontslag hun aantal en aard?
5. Welke meetinstrumenten zijn geschikt om herstel in functie en kwaliteit van leven te meten?

Om de onderzoeksvragen te kunnen beantwoorden werd een onderzoek opgezet waarin deze uitkomsten werden gemeten in een groep patiënten vóór een organisatorische verandering gericht op vervroegd ontslag uit het ziekenhuis en in een groep patiënten na deze verandering. Randomisatie van patiënten werd wel overwogen maar als niet mogelijk verworpen omdat beide ontslagprocedures niet tegelijk in de deelnemende ziekenhuizen konden worden aangeboden.

Ten einde een vermindering van de gemiddelde ziekenhuisopnameduur van tenminste 5 dagen met voldoende zekerheid te kunnen aantonen, werd vooraf berekend dat daarvoor twee groepen van 100 patiënten nodig waren. Tussen oktober 1996 en oktober 1998 werden alle patiënten geïncludeerd die opeenvolgend met een heupfractuur werden opgenomen in twee Rotterdamse ziekenhuizen (Dijkzigt en Havenziekenhuis). Leeftijd jonger dan 65 jaar en een heupfractuur ten gevolge van metastasen of als onderdeel van een multi-trauma golden als exclusiecriteria.

Een groep van 102 patiënten, ontslagen volgens de gebruikelijke procedure, werd vervolgd tot en met 4 maanden na opname in het ziekenhuis. Daarna werd de ontslagprocedure veranderd voor de volgende 106 patiënten. Het ontslag werd versneld met verschillende maatregelen: een ontslagprotocol dat inging op 5 dagen postoperatief, een versnelde indicatieprocedure en een uitbreiding van de opnamemogelijkheid (vrijhouden van bedden) op de revalidatie afdeling van een verpleeghuis (Antonius-Binnenweg, Rotterdam).

We kozen voor een follow-up periode van 4 maanden omdat daarna geen verder herstel verwacht werd. Één onderzoekster interviewde en beoordeelde alle patiënten 1 week, 1 maand en 4 maanden na ziekenhuisopname op mobiliteit, beperkingen in het uitvoeren van (algemene en bijzondere) dagelijkse levensverrichtingen en ervaren gezondheidsgerelateerde kwaliteit van leven. Twee functionele beperkingen meetinstrumenten (het Revalidatie Activiteiten Profiel en de Barthel Index) en twee algemene gezondheidsgerelateerde kwaliteit van leven instrumenten (de Nottingham Health Profile en de COOP/WONCA kaarten) werden gebruikt in deze evaluatie en konden daardoor vergeleken worden in score verdeling, betrouwbaarheid en gevoeligheid voor verandering.
Alle optredende complicaties die leidden tot extra observatie of behandeling werden geregistreerd tot aan 4 maanden na ziekenhuisopname.

De werkelijk gemaakte kosten werden berekend met een gedetailleerde meting van investeringen in menskracht, materiaal, gebouwen en overhead. Standaard declaraties werden alleen gebruikt bij ongebruikelijke interventies en laboratoriumbepalingen. Medische kosten werden meegenomen in deze berekeningen evenals kosten gemaakt door patiënt en familie (bijvoorbeeld mantelzorg en reiskosten).

Hoofdstuk 2: literatuur overzicht

Hoofdstuk 2 geeft een overzicht van de internationale literatuur betreffende de gevolgen van een heupfractuur. Het toenemend aantal heupfracturen (ten gevolge van veroudering maar er is ook sprake van een leeftijdsonafhankelijke stijging) plaatst met name Westerse landen voor een groot probleem. In 1990 werd het totaal aantal heupfracturen wereldwijd geschat op 1,66 miljoen en de verwachting is dat dit aantal zal stijgen tot 6,26 miljoen in 2050.
De heupfractuur is vooral een probleem dat voorkomt onder oudere vrouwen: in Westerse landen is de man:vrouw verhouding ongeveer 1:3 en de gemiddelde

leeftijd ongeveer 80 jaar.
Heupfractuur patiënten zijn vaak al vóór de fractuur meer afhankelijk in algemene dagelijkse levensverrichtingen, meer beperkt in het gebruik van de onderste ledematen, zijn ook meer gehospitaliseerd in het jaar voor de fractuur en wonen meer in instituten zoals verpleeg-en bejaardentehuizen (20-40%) dan de gemiddelde bevolking van gelijk geslacht en leeftijd. Zij hebben ook vaak meerdere nevendiagnosen (gemiddeld 1,1 tot 2,5) zoals pulmonaire en cardiovasculaire aandoeningen en dementie.

De prognose ten aanzien van overleven en herstel van functie is matig: de mortaliteit 6 maanden na de fractuur is 16% tot 28% en 1 jaar na de fractuur 22% tot 37% terwijl maar 40-60% van de overlevenden herstelt in mobiliteit en minder dan 30% hetzelfde niveau van algemene dagelijks levensverrichtingen als voor de fractuur bereikt. De belangrijkste voorspellers voor overlijden en slecht herstel zijn meerdere nevendiagnosen, hoge leeftijd, slecht functioneren voor de fractuur, verblijf in een instituut voor de fractuur en verminderde cognitie voor de fractuur.

Chirurgische (in 2-7% van alle patiënten) complicaties, orthopedische complicaties (10-35% bij een follow-up van minstens twee jaar, afhankelijk van type fratuur) en ernstige levensbedreigende algemene complicaties die in het ziekenhuis optreden zoals pneumonie, longembolie, myocardischaemie en cerebrovasculaire accidenten (1-2%) worden uitgebreid in de literatuur beschreven. Dit is echter veelal niet het geval met minder ernstige algemene complicaties zoals urineweginfecten en decubitus, vooral als deze optreden buiten de ziekenhuisperiode.

De herkomst vóór en ontslagbestemming na de ziekenhuisopname verschilt per land en hangt af van hoe de gezondheidszorg is georganiseerd. In Zweden woont 30-40% van alle patiënten die met een gebroken heup in het ziekenhuis worden opgenomen voor die tijd in een instituut varierend van geriatrische ziekenhuizen tot verpleeghuizen en bejaardenhuizen. De gemiddelde ziekenhuisopname duur in het universiteitsziekenhuis te Lund daalde van 44 dagen in 1966 tot 27 dagen in 1972 en 16 dagen in 1982. Ten gevolge van een speciaal revalidatieprogramma kon 80% van alle patiënten die van huis kwamen weer naar huis ontslagen worden. Wanneer ontslag naar huis niet haalbaar is worden de patiënten in Zweden gerevalideerd op ziekenhuis revalidatieafdelingen, geriatrische afdelingen, of in verpleeghuizen. In Groot-Britannië woont 70-75% van de patiënten voor de fractuur thuis. De gemiddel-

de ziekenhuisopnameduur is relatief lang (30 dagen in 1997) omdat het merendeel in het ziekenhuis wordt gerevalideerd. Een "hip fracture service" in Peterborough, bestaand uit een een daarvoor ingerichte afdeling voor heupfractuur patiënten, teammanagement en een "hospital at home service" reduceerde de gemiddelde opname duur van 51 dagen in 1986 tot 21 dagen in 1997.
In de Verenigde Staten kreeg ongeveer 20% van de patiënten al verpleeghuiszorg voor de fractuur. De gemiddelde opnameduur verminderde sterk na de introductie van het Prospective Payment System en bedroeg landelijk 12 dagen in 1992 terwijl voor 1984 nog een gemiddelde opnameduur van 18-24 dagen werd gerapporteerd. Dit ging echter gepaard met een toenemend aantal patiënten (> 50% van diegenen die voorheen thuis woonden) die werden ontslagen naar verpleeghuizen voor verdere revalidatie.
In Nederland woont 25% van de patiënten voor de fractuur in een verzorgingshuis, 15% in een verpleeghuis en 60% thuis. De gemiddelde opnameduur daalde van meer dan 30 dagen in 1987 tot 26 dagen in 1994 en 23 dagen in 1998. Deze vermindering is waarschijnlijk het gevolg van meer samenwerking tussen ziekenhuizen en verpleeghuizen zodat steeds meer patiënten vroeger naar verpleeghuizen voor verdere revalidatie worden ontslagen.

Na de ziekenhuisopname en operatie zijn er verschillende manieren om de nazorg te organiseren: "traditionele zorg" in het ziekenhuis, samenwerking tussen geriatrie en orthopedie in het ziekenhuis, geriatrische revalidatie in een ander instituut, en vervroegd ontslag naar huis met extra thuiszorg.
Met traditionele zorg is er een grote kans dat met name meer gecompliceerde patiënten te lang in het ziekenhuis blijven. Dit is waarschijnlijk nadelig voor de revalidatie mogelijkheden maar houdt ook chirurgische en orthopedische bedden in het ziekenhuis onnodig bezet.
Het concept van de orthogeriatrische unit werd ontwikkeld in Groot-Brittannië in de zestiger jaren en heeft wel geleid tot een verkorting van de ziekenhuisopnameduur maar niet tot beter herstel van patiënten op de wat langere termijn. De meeste studies, met een enkele uitzondering, hebben ook van andere vormen van geriatrische revalidatie (zoals bemoeienis van een geriater en inschakeling van een multidisciplinair team) niet aangetoond dat op de langere termijn (> 4 maanden na fractuur) beter herstel van patiënten optreedt. Betere korte termijn resultaten zoals verkorting van de opnameduur en meer direct ontslag naar de oorspronkelijke woonomgeving zijn wel te bereiken met deze vormen van zorg.

In de Verenigde Staten (en in toenemende mate ook in Nederland) gaat een korte ziekenhuisopnameduur gepaard met een eerder en meer frequent ontslag naar verpleeghuizen. Dit heeft geleid tot de ontwikkeling van gespecialiseerde verpleeghuizen (Rehabilitative Nursing Homes). Er zijn aanwijzingen dat deze gespecialiseerde verpleeghuizen beter in staat zijn tot het revalideren en dus weer terug naar huis ontslaan van heupfractuurpatiënten dan de "gewone" verpleeghuizen.
Zowel in Zweden als in Groot-Brittannië hebben speciale thuiszorg programma's (extra inzet van verpleging en fysiotherapie) geleid tot verkorting van de ziekenhuisopnameduur en ook wel betere resultaten in herstel op korte termijn (6 weken). Deze programma's zijn echter alleen geschikt voor geselecteerde patiënten.
Twee systematische reviews van randomised controlled trials op het gebied van de heupfractuur revalidatie hebben als conclusie dat tot nu toe van geen enkel revalidatieprogramma is aangetoond dat het de resultaten met betrekking tot overleven of herstel in functioneren op de langere termijn verbetert.

De kosten van de behandeling van heupfracturen zijn hoog en worden wereldwijd geschat op US$ 23 miljard (1993) stijgend naar US$ 55 miljard in 2025 en US$ 87 miljard in 2050.
In kosten studies zou rekening gehouden moeten worden met verschillen in kosten tussen de eerste ziekenhuisdagen en daarna en dienen kosten gemaakt na ontslag uit het ziekenhuis te worden meegenomen. Ook is het belangrijk een onderscheid te maken tussen totale kosten en kosten alleen ten gevolge van de fractuur (dus boven op de gezondheidszorg kosten die al door patiënten gemaakt worden voor de fractuur). Op die manier berekende kosten zijn € 9200 (1993) in Nederland en €16000 in Zweden (1992) en de Verenigde Staten (1993) per patiënt. In Australië en Groot-Brittannië werd een bescheiden totale kosten vermindering bereikt door versneld ontslag uit het ziekenhuis. Echter, in Zweden resulteerde een verkorting van de opnameduur juist tot een kosten stijging door het verhoogde gebruik van geriatrische zorg afdelingen.

Hoofdstuk 3: Herstel in functie, kwaliteit van leven en woonomgeving

In Hoofdstuk 3 worden de 102 patiënten beschreven die op de gebruikelijke manier (dus vóór de interventie en met een gemiddelde opnameduur van 26 dagen) werden opgenomen in het ziekenhuis en ontslagen naar huis, verzorgingshuis of verpleeghuis.

De gemiddelde leeftijd was 83 jaar, 84% was van het vrouwelijk geslacht en 58% woonde thuis voor de fractuur. 67% had 2 of meer nevendiagnosen bij ziekenhuisopname, waarvan 46% belemmeringen veroorzaakte in functioneren. Slechts 47% werd uit het ziekenhuis ontslagen naar hun oorspronkelijke woonomgeving Vier maanden na ziekenhuisopname was 20% overleden, verbleef 36% thuis, 17% in een verzorgingshuis, 26% in een verpleeghuis en 1 % was nog steeds in het ziekenhuis. Voorspellers voor overlijden of verblijf thuis bij 4 maanden waren leeftijd, cognitieve status na 1 week en comorbiditeit. De gemiddelde opnameduur in ziekenhuis en verpleeghuis tot aan ontslag bedroeg 38 dagen. De gemiddelde totale kosten (tot aan 4 maanden) waren € 15.338 per patiënt waarvan bijna 50% werd gemaakt in het ziekenhuis en 30% in het verpleeghuis.
De mobiliteit en ADL functie verbeterden duidelijk tussen 1 week en 4 maanden. Echter, maar 43% van de overlevende patiënten bereikte hetzelfde niveau van mobiliteit en maar 17% hetzelfde niveau in ADL als voor de fractuur. Bloedarmoede na operatie waarvoor bloedtransfusie was een frequente complicatie (47%), evenals blaasontsteking (44%).
In 4 maanden tijd ondervonden de patiënten gemiddeld 3 complicaties, waarvan 26% ernstig.
De kwaliteit van leven verbeterde tussen 1 week en 4 maanden; echter, de kwaliteit van leven was slechter dan die gerapporteerd in een referentie populatie.
Conclusie: in deze serie van patiënten met een heupfractuur, ging het grote gedeelte van patiënten met de diagnose dementie, het grote gedeelte van patiënten dat al in een institutie verbleef en de ernst van de comorbiditeit gepaard met een aanzienlijke mortaliteit en slechte revalidatie resultaten. De veel voorkomende complicaties en het feit dat $^1/_4$ van de patiënten vervolgens functionele achteruitgang vertoonde, benadrukken de behoefte aan intensieve medische bemoeienis in de revalidatie na heupfractuur.

Hoofdstuk 4: Vroeg ontslag van heupfractuur patiënten uit het ziekenhuis.

In Hoofdstuk 4 worden de resultaten gepresenteerd van een prospectieve studie waarin de 102 patiënten, beschreven in Hoofdstuk 3, worden vergeleken met 106 patiënten die versneld uit het ziekenhuis werden ontslagen. De interventie bestond uit het hanteren van een ontslagprotocol, een versnelde indicatieprocedure en het vrij houden van bedden in het verpleeghuis. Daardoor verbleef de tweede groep gemiddeld 13 dagen korter in het ziekenhuis. Het versnelde ontslag had als gevolg

dat meer (76% vs 53%) patiënten vanuit het ziekenhuis naar het verpleeghuis ter verdere revalidatie werden ontslagen. De totale opnameduur in ziekenhuis en verpleeghuis tot aan ontslag bleef in beide groepen gelijk (gemiddeld 36 dagen, mediaan 26 dagen). Na 1 maand verbleven meer patiënten in het verpleeghuis en minder in het ziekenhuis in de versneld ontslag groep dan in de controle groep. Echter, dit verschil was geheel verdwenen na 4 maanden. De mortaliteit in beide groepen was gelijk (3% na 1 maand en 19% na 4 maanden). Onafhankelijke voorspellers voor mortaliteit waren leeftijd, aantal nevendiagnosen en cognitieve status na 1 week. Er werd geen verschil gevonden in mobiliteitscore, ADL en BDL afhankelijkheid (RAP) en gezondheidsgerelateerde kwaliteit van leven score (NHP en COOP/WONCA) na 1 week, 1 maand en 4 maanden na ziekenhuisopname tussen de twee groepen. Er werd eveneens geen verschil gevonden in werkelijk gemaakte kosten (zie hoofdstuk 5) en doorgemaakte complicaties (zie hoofdstuk 6).
In een subanalyse van patiënten die voor de fractuur nog thuis woonden werd er wel een verschil 1 maand na ziekenhuisopname gevonden in mobiliteitsscore ($p= 0.05$) en was er een trend in betere ADL ($p = 0.06$) en BDL ($p = 0.08$) scores ten gunste van de versneld ontslagen groep. Na 4 maanden was echter geen enkel verschil meer aantoonbaar.

Conclusie: Wij konden geen duidelijk voordeel (maar ook geen nadeel) aantonen van het vervroegd ontslaan van oudere heupfractuurpatiënten uit het ziekenhuis ten aanzien van overleven, herstel van functie en gezondheidsgerelateerde kwaliteit van leven. Een voordeel van vervroegd ontslaan is wel het vrijkomen van chirurgische en orthopedische ziekenhuisbedden hetgeen zou kunnen bijdragen aan de vermindering van wachlijsten. 3-4 bedden per jaar komen met vervroegd ontslag vrij in de twee deelnemende ziekenhuizen. Met een gemiddelde opnameduur van 13 dagen zou het theoretisch mogelijk zijn 100 extra patiënten per ziekenhuis op te nemen.

Hoofdstuk 5: Een kosten studie

Hoofdstuk 5 betreft de resultaten van een gedetailleerde kosten studie. De twee groepen patiënten werden vergeleken in de kosten die gemaakt werden gedurende het verblijf in instellingen (ziekenhuis, verpleeghuis en verzorgingshuis) en in de thuissituatie. De werkelijke kosten werden geschat door middel van een gedetailleerde meting van investeringen in mankracht, materiaal, behuizing en overhead. Standaard declaraties werden alleen gebruikt bij ongebruikelijke interventies en

laboratoriumbepalingen. Medische kosten werden meegenomen in deze berekeningen evenals kosten gemaakt door patiënt en familie (bijvoorbeeld mantelzorg en reiskosten). Er werd onderscheid gemaakt in 6 zorgcategorieën: 1/ opnamedagen (aantal in ziekenhuizen, verpleeghuizen en verzorgingshuizen) 2/ verpleging (in minuten per dag) 3/ andere zorgverleners (artsen, fysiotherapeuten etc.) 4/ medische procedures (behandeling, onderzoek en laboratorium) 5/ reiskosten (ambulance, taxi) en 6/ mantelzorg en overige kosten zoals maaltijdverzorging en huisaanpassingen. Daarnaast werd er een onderverdeling gemaakt in waar de patiënt verbleef: 1/ voor ziekenhuisopname 2/ vanaf opname tot en met dag 5 in het ziekenhuis 3/ vanaf dag 6 tot aan ontslag uit het ziekenhuis 4/ verpleeghuis 5/ verzorgingshuis 6/ thuis 7/ heropname in ziekenhuis of verpleeghuis.
De gemiddelde kosten gedurende de 4 maanden na fractuur bedroegen € 14.281 voor versneld onslagen patiënten hetgeen € 1.057 minder was dan voor de op de gebruikelijke manier ontslagen patiënten (€ 15.338). De kostenbesparing was niet statistisch significant. Het is onduidelijk of dit te wijten is aan de gevonden grote variatie aan kosten of aan een werkelijk niet bestaand verschil. Het versnelde ontslag veroorzaakte wel een verschuiving in kosten van het ziekenhuis naar het verpleeghuis. De op de gebruikelijke manier ontslagen patiënten veroorzaakten 47% van de kosten in het ziekenhuis, 33% in het verpleeghuis, 12% in het verzorgingshuis en 6% thuis. Dit was voor de versneld ontslagen groep respectievelijk 31%, 44%, 10% en 5%. Vervroegd ontslagen patiënten werden vaker heropgenomen hetgeen uiteraard ook kosten met zich meebracht en de kostenbesparingen verminderde. Een tweede belangrijke kostenverschuiving trad op bij de vervroegd ontslagen groep in de eerste 5 dagen postoperatief. Vervroegd ontslagen patiënten veroorzaakten meer kosten in de eerste 5 dagen dan de op de gebruikelijke manier ontslagen patiënten. Blijkbaar anticipeerden de artsen op het versnelde ontslag en versnelden aanvragen voor diagnostische onderzoeken en laboratorium.
De totale kosten na een heupfractuur zijn voornamelijk toe te bedelen aan opnamedagen (50%) en verpleging (30%). De (personeels) kosten voor (para)medici bleven beperkt tot maar 6-7% van de totale kosten. De operatie zelf en alle andere medische procedures zoals diagnostische onderzoeken veroorzaakten 12% van de totale kosten.
Voorspellende factoren voor hogere kosten waren een groter aantal nevendiagnosen, slechtere cognitieve status, verminderd functioneren voor de fractuur, verhoogde kosten voor de fractuur, de diagnose dementie en het al wonen in een verzor-

gingshuis of verpleeghuis voor de fractuur.
Conclusie: In tegenstelling tot onze verwachtingen werd er geen duidelijke vermindering in kosten gevonden door het versnelde ontslag. Dit is voornamelijk te wijten aan de verschuiving van kosten van het ziekenhuis naar het verpleeghuis. Het totale aantal opnamedagen in de verschillende instituten verschilde nauwelijks tussen de twee groepen en de kosten per dag in het verpleeghuis verschilde niet erg veel met de kosten per dag na de eerste 5 dagen in het ziekenhuis. Verder trad er een verschuiving van kosten op naar de eerste 5 dagen postoperatief in de versneld ontslag groep waardoor mogelijke besparingen weer te niet gedaan werden. De resultaten van deze studie benadrukken het belang van een gedetailleerde kosten analyse gebaseerd op werkelijk gemaakte kosten. Onderzoekers die gebruik maken van standaard gemiddelde "dagprijzen" zulllen de kostenvermindering door versneld ontslag uit het ziekenhuis overschatten.

Hoofdstuk 6: Complicaties

In Hoofdstuk 6 worden alle complicaties beschreven die in 4 maanden optraden bij de 208 heupfractuurpatiënten. Alle medische gebeurtenissen tot aan 4 maanden die leidden tot extra medische en verpleegkundige observatie of behandeling werden geregistreerd als complicaties en geclassificeerd in ernst.
In totaal traden 632 complicaties op waarvan 24% ernstig (dwz resulterend in overlijden of blijvende functionele belemmeringen). Slechts 8% maakte geen enkele complicatie door. Het gemiddelde was 3 per patiënt. De totale mortaliteit op 4 maanden was 19% en was geassocieerd met een hogere leeftijd, wonen in een verpleeghuis vóór de fractuur en aantal nevendiagnosen. Er bestond geen verband met vroeg of gebruikelijk ontslag. De belangrijkste doodsoorzaken waren pneumonie, dehydratie / cachexie en cardiovasculaire afwijkingen zoals decompensatio cordis, myocard infarct, beroerte en longembolie.
De versneld ontslagen patiënten maakten niet meer complicaties door dan de op de gebruikelijke manier ontslagenen (298 vs. 334, p = 0.11). Wel trad er een verschuiving op in de lokatie waar de complicaties werden gediagnosticeerd en behandeld. De op de gebruikelijke manier ontslagen groep kreeg 64% van alle complicaties in het ziekenhuis en 24% in het verpleeghuis. Voor de versneld ontslagen groep waren deze cijfers respectievelijk 45% en 45%. Het merendeel (87%)van alle complicaties trad in beide groepen op in een instituut (ziekenhuis of verpleeghuis) en slechts 11% thuis. De meest voorkomende complicaties betroffen de urinewegen (bij 52%

van de patiënten waarvan het overgrootste deel urineweginfecties) en de tractus circulatorius (49%, meestal bloedarmoede postoperatief waarvoor bloedtransfusie). Lokale (chirurgisch- orthopedische) complicaties deden zich voor in 22%, cardiovasculaire in 29%, respiratoire in 15%, decubitus in 27%, psychiatrische in 20% en gastrointestinale in 14% van de patiënten. De belangrijkste voorspellende factor voor het optreden van complicaties was het aantal nevendiagnosen bij opname in het ziekenhuis.
Conclusie: Heupfractuur patiënten maken vele complicaties door na de operatie. Deze complicaties beperken zich niet tot de ziekenhuisperiode maar komen ook voor in het verpleeghuis en thuis. Een sneller ontslag verandert aantal en aard niet maar verschuift de plaats van voorkomen naar het verpleeghuis. Hetzelfde geldt voor complicaties die leiden tot het overlijden. Waarschijnlijk door de nauwgezette manier van registreren vonden wij meer algemeen interne complicaties dan in de literatuur beschreven.
In Nederland zal versneld ontslag uit het ziekenhuis resulteren in meer en vroeger ontslag van patiënten naar het verpleeghuis alwaar de complicaties worden behandeld door een verpleeghuisarts. De belasting voor huisartsen blijft beperkt. In landen waar de medische zorg na het ontslag uit het ziekenhuis in verpleeghuizen of andere revalidatie-instituten verzorgd wordt door huisartsen zal er moeten worden gewaarborgd dat deze artsen voldoende tijd en deskundigheid hebben de veel voorkomende complicaties te diagnosticeren en behandelen.

Hoofdstuk 7: Meetinstrumenten

In Hoofdstuk 7 worden de resultaten beschreven van een vergelijking van de gebruikte meetinstrumenten in betrouwbaarheid en gevoeligheid voor verandering in deze groep oudere heupfractuur patiënten. We gebruikten 4 meetinstrumenten:

1. De Barthel Index (BI). De BI is een internationaal veel gebruikt instrument die aanbevolen wordt voor het vaststellen van beperkingen in de activiteiten van het dagelijks leven (ADL) bij ouderen.
2. Het Revalidatie Activiteiten Profiel (RAP). De RAP is een in Nederland in de revalidatiegeneeskunde ontwikkeld instrument dat gebaseerd is op de International Classification of Impairments, Disabilities, and Handicaps. Naast de beperkingen en handicaps zelf registreert de RAP ook de subjectief ervaren problemen met deze beperkingen en handicaps.
3. De Nottingham Health Profile (NHP). De NHP is een kort en eenvoudig

instrument voor het meten van gezondheidsgerelateerde kwaliteit van leven en was al eerder gebruikt in studies van heupfractuur patiënten.

4. De COOP/WONCA kaarten. Deze kaarten zijn ontwikkeld voor het meten van kwaliteit van leven in de huisartspraktijk. Doordat de keuze in score op elk van de kaarten wordt ondersteund door een illustratie wordt aangenomen dat de kaarten makkelijk zijn te gebruiken bij cognitief beperkte oudere patiënten.

We toonden aan dat, voor onderzoeksdoeleinden, de RAP het beste presteerde voor het meten van ADL en BDL beperkingen en de NHP voor het meten van gezondheid gerelateerde kwaliteit van leven dimensies zoals pijn, emotionele beleving en energie. De BI meet ook functionele beperkingen met voldoende betrouwbaarheid maar in tegenstelling tot de RAP meet de BI geen B (bijzondere) Dagelijkse Levensverrichtingen. Daarnaast is de gevoeligheid voor verandering over de tijd en de gevoeligheid om slechts weinig beperkingen te meten minder dan de RAP. In tegenstelling tot onze verwachtingen, hielpen de illustraties bij de COOP/WONCA kaarten matig cognitief beperkte patiënten niet beter de vragen te beantwoorden dan de ja/nee antwoorden op de NHP vragen. De NHP bestreek een breder gebied in de psychologische gezondheid dimensies en had ook wat betere psychometrische eigenschappen dan de COOP/WONCA kaarten.

Conclusie: Bij prospectief onderzoek van groepen heupfractuur patiënten worden de RAP en de NHP aanbevolen om ADL, BDL en gezondheid gerelateerde kwaliteit van leven te meten.

Hoofdstuk 8: Discussie

De resultaten van de studie worden besproken per onderzoeksvraagstelling en becommentarieerd in Hoofdstuk 8.

Vraag 1:
Wat zijn de gevolgen van een heupfractuur voor oudere patiënten met betrekking tot mortaliteit, herstel van functie en kwaliteit van leven?
De mortaliteit van 19% in 4 maanden komt overeen met literatuurgegevens. Zoals verwacht, waren hoge leeftijd, verminderd cognitief functioneren, en meerdere neven diagnosen voorspellend. Voor de fractuur geïnstitutionaliseerde demente patiënten met meerdere nevendiagnosen hadden een extra slechte prognose. De vraag is of deze patiënten niet beter af zijn met een conservatieve behandeling met voldoende pijn bestrijding.

Slechts 18% van de patiënten bereikte hun uitgangsniveau in ADL functie, slechts 36% hun niveau in mobiliteit en de kwaliteit van leven na 4 maanden was slechter dan een referentie populatie. Dit resultaat komt overeen of is slechter dan in eerder gepubliceerde onderzoeken. Mogelijk is dit te wijten aan de hoge leeftijd en het grote aantal geïnstitutionaliseerde patienten in de studie.

Vraag 2:

Wat zijn de effecten van vervroegd ontslag uit het ziekenhuis op mortaliteit, herstel van functie en kwaliteit van leven?

Vervroegd ontslag had geen duidelijk effect op mortaliteit, functioneren en kwaliteit van leven na 4 maanden ondanks dat in de interventie groep meer patiënten eerder naar het verpleeghuis ter revalidatie werden ontslagen met in tegenstelling tot het ziekenhuis multidisciplinaire zorg met uitgebreide fysiotherapie en bemoeienis van een verpleeghuisarts. Deze teleurstellende uitkomst komt echter overeen met eerder gepubliceerde resultaten van geriatrische revalidatie van heupfractuur patiënten. Onze resultaten lieten echter zien dat 1 maand na ziekenhuisopname patiënten die voorheen thuis woonden en versneld waren ontslagen wel een trend vertoonden tot betere mobiliteit, en betere ADL en BDL functie.

Een studie met grotere aantallen patiënten zou mogelijk wel een gunstig effect van multidisciplinaire verpleeghuis revalidatie kunnen aantonen op de snelheid van herstel.

Vraag 3:

Vermindert vervroegd ontslag de kosten?

Wij vonden een 7% werkelijke kosten vermindering die echter niet statistisch significant was. Redenen waarom deze kostenvermindering niet hoger is zouden kunnen zijn:

- het versneld ontslag veroorzaakte een verschuiving in kosten naar de eerste 5 dagen postoperatief
- het versneld ontslag veroorzaakte een verschuiving in kosten van ziekenhuis naar verpleeghuis terwijl de lengte van verblijf in instituten niet verschilde tussen beide groepen
- de werkelijke kosten per dag na de eerste 5 dagen postoperatief verschilde niet veel tussen ziekenhuizen en verpleeghuizen
- patienten in de versneld ontslagen groep werden meer heropgenomen
- de variatie in kosten per patiënt was hoog

Het versnelde ontslag met 13 dagen uit het ziekenhuis veroorzaakte niet meer

kosten per dag per heupfractuur patiënt voor verpleeghuizen dan de gemiddelde verpleeghuispatiënt. Een extra vergoeding lijkt dus niet noodzakelijk te zijn. Echter, bij een nog eerder ontslag uit het ziekenhuis (< 9 dagen) lopen de kosten per dag waarschijnlijk wel op. Wij berekenden dat dan een vergoeding van 20 € per dag voor de eerste 6 weken redelijk is.
De extra (dwz. totale minus al vóór de fractuur gemaakte kosten) kosten voor de behandeling van een heupfractuur bedroegen € 10.821 (1998) voor de gebruikelijk ontslagen groep en € 9.576 voor de versneld ontslagen groep. Preventie van heupfracturen is dus belangrijk niet alleen voor de vermindering van afhankelijkheid en overlijden maar ook ter vermindering van de totale gezondheidszorg kosten.

Vraag 4:
Welke complicaties ontstaan er na operatie wegens heup fractuur en verandert vervroegd ontslag hun aantal en aard?
Heupfractuur patiënten maken vele (gemiddeld 3) complicaties door waarvan de meerderheid (90%) algemene medische complicaties zoals bloedarmoede, urineweg infecten, pneumonie en delier. Vervroegd ontslaan uit het ziekenhuis verandert niet het aantal of de aard van de complicaties maar verschuift de locatie van voorkomen naar het verpleeghuis.
Een aantal van deze complicaties zijn mogelijk te voorkomen: urineweg infecten door het vermijden van catheterisatie, vroege mobilisatie en aandacht van de verpleging voor voldoende legen van de blaas, decubitus door vroege mobilisatie, frequent draaien (ook al voor de operatie), behandeling van anemie en voldoende inname van voedsel, pneumonie door instructie, adequate bestrijding van preoperatieve luchtwegontstekingen, verkorten van operatieduur en fysiotherapie, en delier door consultatie van geriaters.

Vraag 5:
Welke meetinstrumenten zijn geschikt om herstel in functie en kwaliteit van leven te meten?
Op grond van de resultaten van een vergelijkende studie raden we het gebruik van de RAP en de NHP aan voor onderzoekers die het herstel van functie en kwaliteit van leven van heup fractuur patiënten willen meten. Wij hebben echter maar 4 meetinstrumenten onderzocht en een ander kwaliteit van leven instrument zoals de SF-36 zou eveneens geschikt kunnen zijn.
Verder moet er bedacht worden dat het aanwezig zijn van goede eigenschappen op

groepsniveau nog niet wil zeggen dat deze instrumenten ook geschikt zijn voor het vervolgen van individuele patiënten bv. in de spreekkamer.

Vervolg discussie:

Welk effect heeft vervroegd ontslag op de "verkeerde" bedden in ziekenhuis en verpleeghuis?
Verschillende auteurs suggereren dat de gemiddelde ziekenhuisopname ongeveer 9 dagen zou moeten bedragen om effectief gebruik te maken van ziekenhuiscapaciteit.
Wij berekenden dat met het vervoegd ontslag van ongeveer 13 dagen 20.000 ziekenhuisbedden per jaar vrijkomen voor electieve chirurgie. Dit aantal loopt nog op naar 27.500 wanneer het ontslag nog meer versneld wordt tot een gemiddelde opname duur van 9 dagen. Daarentegen zou dit betekenen dat 550 meer bedden in verpleeghuizen moeten worden vrij gemaakt voor de opvang van deze patiënten.
Het versnelde ontslag zou dus bij kunnen dragen aan het verminderen van ziekenhuis wachtlijsten waardoor bv. meer patiënten vroeger aan heup en knie geopereerd kunnen worden. Dit zou als bijkomend effect kunnen hebben dat minder patiënten afhankelijk worden en dus verpleeghuisopname behoeven.

Hoe zou de zorg voor heupfractuur patiënten verbeterd kunnen worden?
Naar analogie van de succesvolle stroke service in Delft doen we een voorstel voor een "hip fracture service" met de volgende eigenschappen:

- opname garantie voor patiënten op een heupfractuur afdeling in het zieken huis
- speciaal opgeleid team van behandelaars in het ziekenhuis
- ontslag protocol ingaand 5 dagen na opname
- wekelijkse multidisciplinaire vergaderingen
- opname garantie op revalidatieafdelingen in verpleeghuizen (zowel somatisch als psychogeriatrisch)
- transmuraal zorgdossier dat de patiënt volgt van instelling naar instelling.
- gecoördineerde thuiszorg (verpleging fysiotherapie en arts) en het gebruik van dagbehandeling
- vereenvoudiging van indicatieprocedure

Dankwoord

Uiteraard is de voltooiing van een proefschrift niet het werk van 1 persoon. Het is juist de samenwerking met anderen buiten mijn normale werkomgeving die mij veel voldoening gaf. De universitaire wereld van wetenschappelijk onderzoek is in een aantal opzichten heel verschillend van het dagelijks bestaan van een verpleeghuisarts.

Het werk van een arts is over het algemeen maar voor een klein gedeelte "evidence based". Dit geldt nog sterker voor de verpleeghuisgeneeskunde, een vak dat nog in de kinderschoenen staat. Een bijdrage leveren aan de ontwikkeling van de verpleeghuisgeneeskunde was dan ook één van de belangrijkste drijfveren om aan het in dit proefschrift beschreven onderzoek te beginnen.

Ik prijs mij gelukkig in een organisatie te werken die mij de mogelijkheid heeft gegeven, zowel in tijd als in geld, dit onderzoek uit te voeren. Speciale vermelding verdienen daarbij Hans van den Berg, Minke de Jong, Jan Hubregtse en Bernhard Reuser. Tevens hebben mijn collegae me altijd ondersteund en zonodig werkzaamheden overgenomen. Inno, Jan, Tom, Marco, Rob en Annemieke, bedankt hiervoor. Erkentelijk ben ik ook de medisch secretariaat medewerkers (Maureen, Ilse ,Jeanneke en Loes) die het kopiëren en verzenden verzorgden van vele probeersels en altijd belangstellend waren naar de voortgang.

Zonder de inzet van de bewegingswetenschapper Margreet Ribbers, en in haar zwangerschapsverlof Maartje Bosman, was het nooit gelukt om alle gegevens te verzamelen en te registreren. Met bewondering en dankbaarheid heb ik van nabij kunnen zien hoe nauwgezet en volhardend Margreet patiënten opzocht in ziekenhuizen, verpleeghuizen en thuis. Aan haar is met name te danken dat er bijna geen gegevens aan het eind van het onderzoek ontbraken. Met mijn meer slordige aard zou dat ongetwijfeld anders gegaan zijn als ik dat zelf had moeten doen. Bovendien was het prettig en gezellig samenwerken met haar.

Vanaf het begin, zelfs toen het onderwerp van studie nog niet verder was gevorderd dan "iets met revalidatie in het verpleeghuis", heeft mijn promotor Herman Cools meegedacht en meegewerkt. Zijn kennis en inzicht in welke onderwerpen relevant zijn voor de verpleeghuisgeneeskunde hebben in grote mate bijgedragen aan de opzet van het onderzoek en de presentatie van de resultaten. Ik zal me de gesprek-

jes in de parkeergarage van de Erasmus medische faculteit na de vergaderingen met Dik, Ewout en Johan altijd blijven herinneren. Herman's enthousiasme en positieve instelling gaven me dan weer extra energie om door te gaan.

Mijn co-promotor, Ewout Steyerberg, is eveneens gedurende alle 6 jaren van het tot stand komen van dit proefschrift erbij betrokken geweest. Zijn analytisch vermogen en vooral ook zijn kennis en handigheid bij de verwerking van de gegevens zijn van grote waarde geweest. Nadat ik thuis weer dagen bezig was geweest om de gegevens in te voeren en te bewerken was het wel eens frustrerend hem dat in een half uur te zien doen. Maar ja " knoeien is groeien". De uren samen achter de computer waren genoeglijk en leerzaam. Daarnaast waren Ewout's aanwijzingen in het mede auteurschap van artikelen altijd helder en droegen bij tot verbetering.

Van enige afstand maar als het nodig was ook in detail (tabellen!) bewaakte Dik Habbema, mijn andere promotor, de methodologische opzet van het onderzoek en behield hij de "helicopter view" over de voortgang. De structuur van artikelen en proefschrift zijn onder zijn deskundige leiding regelmatig aangepast en verbeterd.

Als 4-de belangrijke co-auteur wil ik graag noemen econoom Johan Polder. Gewend als hij is te werken met cijfers en grote bestanden, kreeg hij het voor elkaar een helder overzicht te geven over het kosten onderdeel van de studie. Omdat hij in dezelfde periode bezig was een proefschrift af te ronden, schiep dat in gesprekken een band: " we zaten in hetzelfde schuitje".

Alle 4 heren wil ik hierbij hartelijk danken voor hun inzet en de inspirerende besprekingen op maandag om 17 uur op de Erasmus faculteit.

Een woord van dank gaat ook uit naar Marie-Louise Essink-Bot die mij geïntroduceerd heeft in de wereld van de kwaliteit van leven instrumenten. Zij was betrokken bij de keuze van deze instrumenten en heeft in grote mate bijgedragen aan het artikel betreffende de vergelijking van instrumenten.

Er zij nog twee mensen die belangrijk hebben bijgedragen aan dit proefschrift: Victor van Leeuwen verzorgde de mooie omslag en lay-out en Rosalind Rabin corrigeerde het Engels.

Mijn vader, helaas te vroeg gestorven, zou verguld geweest zijn met zijn zoons wetenschappelijk werk in de geneeskunde en dit geldt nu nog voor mijn moeder,

die wetenschap en ‘evidence based" handelen hoog in het vaandel heeft staan. Bij deze dank ik mijn ouders voor hun continue stimulans tot verdere studie en intellectuele verdieping.

Zeer tot mijn genoegen hebben mijn vrienden Dick en Tony toegezegd paranimf te willen zijn. Zij verblijven beiden echter permanent in het buitenland zodat de organisatie van de feestelijkheden toch weer neerkomt op mijn echtgenote Cathy. Zij doet dit echter graag.
Toen ik haar 6 jaar geleden voorzichtig mededeelde een wetenschappelijk onderzoek te willen beginnen was zij sceptisch en argwanend ten aanzien van wat dat voor het gezinsleven zou betekenen.Het is niet altijd meegevallen maar hoe meer zij zag hoe belangrijk het voor mij was, hoe meer steun en aanmoediging zij gaf.
Hoewel zij zelf dat vanzelfsprekend vindt, ben ik haar toch dankbaar.
Ik ben trots op mijn beide dochters Noortje en Inge, die ondanks te hebben gezien en ervaren hoeveel moeite het kost veel te willen weten van weinig, toch zijn gaan studeren.

Tenslotte, dit onderzoek had nooit uitgevoerd kunnen worden zonder de medewerking van de meer dan 200 oude mensen in een voor hen zo moeilijke periode.

Curriculum Vitae

Romke van Balen werd geboren op 21 juli 1953 te Tomohon, Indonesië. Hij volgde zijn middelbare schoolopleiding (gymnasium-ß) aan het Franciscus college in Rotterdam. In 1971 begon hij zijn studie geneeskunde aan de Rijksuniversiteit Leiden en behaalde het doctoraal examen in 1976. De studie werd daarna vervolgd aan de Erasmus Universiteit Rotterdam tot het behalen van het artsexamen in 1978. In de jaren daarna was hij als arts-assistent chirurgie werkzaam in het Oude en Nieuwe Gasthuis te Delft en als arts-assistent gynaecologie en verloskunde in het Clara ziekenhuis te Rotterdam.
In 1981 vertrok hij naar Kenya en was tot 1984 medical officer in charge van het Muthale Mission Hospital. Na terugkomst in Nederland volgde hij in 1984-1985 de huisartsopleiding in Rotterdam.
De in de huisartsopleiding opgedane belangstelling voor de verpleeghuisgeneeskunde leidde in 1985 tot een aanstelling als verpleeghuisarts in het verpleeghuis Antonius Binnenweg te Rotterdam. Tot op heden werkt Romke van Balen aldaar als verpleeghuisarts, de laatste jaren tevens als coördinator van de vakgroep verpleeghuisartsen. Dankzij de materiele en immateriele steun van directie en management van Antonius-Binnenweg en het bestuur van de Katholieke Verplegings- en Verzorgingsinstellingen (KVV, Rotterdam) kon in 1996 een aanvang gemaakt worden met wetenschappelijk onderzoek in samenwerking met de afdeling Huisarts en Verpleeghuisgeneeskunde, Leids Universitair Medisch Centrum , Leiden (Prof. Dr. H.J.M Cools) en de afdeling Klinische Besliskunde van het Instituut Maatschappelijke Gezondheidszorg, Erasmus Medisch Centrum, Rotterdam (Prof. Dr. J.D.F. Habbema).
Romke van Balen is getrouwd met Cathy de Graaf. Zij hebben twee dochters, Noortje (1980) en Inge (1984).