

Geriatric and physiatric oriented rehabilitation after hip fracture temporarily improves the ability to live independently. A randomised comparison of 538 patients

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Background and purpose: Our objective was to examine the effects of three different rehabilitation settings on the clinical outcome following surgical treatment for hip fracture.

Methods: 538 consecutive, independently living patients with non-pathological hip fracture were randomised to physiatrically oriented rehabilitation (187 patients, mean age 77.5 years, PORG), geriatrically oriented rehabilitation (171 patients, mean age 79.1 years, GORG), and to routine rehabilitation in health centre hospitals (180 patients, mean age 77.7 years, Control Group = CG). The groups were evaluated 4 and 12 months after admission for age, sex, social status, associated diseases, physical and mental condition on admission, residential status, walking ability, use of walking aids, pain in the hip, activities of daily living (ADL), re-operation rate, hospital stay and mortality.

Results: At 4 months more patients of the PORG and GORG were able to live at home or sheltered housing than those of the CG ($P=0.0012$ and $P<0.001$, respectively) but the difference between PORG and GORG was not significant ($P=0.278$). Separate analysis of cervical and trochanteric fractures showed that the significant difference was true only for cervical fractures (PORG vs GORG $P=0.308$, PORG vs CG $P<0.001$ and GORG vs CG $P<0.001$). The effects of intensified rehabilitations had disappeared at 12 months. No significant impact on walking ability or ADL functions was observed. Mortality was significantly lower at 4 and 12 months in the PORG than in the GORG ($P=0.026$, $P=0.005$, respectively) or CG ($P=0.006$, $P=0.004$, respectively).

Interpretation: We found that both rehabilitation modalities significantly increased especially among the cervical fracture patients the number of patients able to live independently within a short follow-up (4 months) and thus reduced the need for institutional care as compared with routine after-treatment, however this effect was transient. Physiatric rehabilitation also seemed to reduce mortality.

Hip fracture patients who have been able to live independently before the fracture run a high risk of becoming institutionalized afterwards (1). To avoid this, the importance of postoperative rehabilitation has been emphasized. Many rehabilitation methods have been applied. Some studies have shown intensive

physiotherapy training during the postoperative period to improve the functional outcome (2,3) whereas no effect could be noted in some other studies (4–7). Some have compared intensive or geriatric rehabilitation with general rehabilitation (8), and some suggest that rehabilitation can prevent institutionalization and

improve the functional outcome (8–11). It was concluded from a Cochrane meta-analysis (2004) (12) that patients treated in a co-ordinated multidisciplinary in-patient rehabilitation setting tended to have better results regarding certain outcome measures (e.g. death, institutional care) than patients treated by traditional rehabilitation methods, but these results were heterogeneous and not statistically significant.

Rehabilitation modalities vary between studies and from one country to another, however, and many previous studies have been performed without randomization. In addition, the main rehabilitation schemes, geriatric and psychiatrically oriented rehabilitation, have not been evaluated within a single study. The aim here was to compare the impact of geriatric and psychiatric rehabilitation on the functional outcome and ability for independent living (vs. institutionalization) in home-dwelling hip fracture patients, using routine rehabilitation (the standard procedure after surgical treatment for hip fracture in Finland) as a control.

Material and methods

The material was obtained from 538 consecutive non-pathological hip fracture patients treated surgically at our hospital in 1997–2000. The patients were aged 50 or over and were living in their own home or in sheltered housing (comparable to a home of their own but controlled by a warden and with some assistance available) at the time of sustaining the fracture.

The patients were randomized to three rehabilitation modalities of after treatment, based on the following boundary conditions. About half of the hip fracture patients treated at Oulu University Hospital are admitted from the city of Oulu, which has a geriatric department and also a privately-based psychiatrically oriented rehabilitation unit to which they can apply, while the other half are admitted from surroundings and can only use the psychiatrically oriented rehabilitation unit. These facts determined the pattern of randomization. There were two randomisation lines based on blinded, numbered and opaque envelopes prepared by an individual person; one line for Oulu residents and the other for citizens from surrounding counties. Two thirds of the patients from the city of Oulu were randomized to the geriatric department (Geriatrically Oriented Rehabilitation Group, GORG,) and one third to the psychiatrically oriented unit (Psychiatrically oriented Rehabilitation Group, PORG), while one third of those from the surroundings were randomized to PORG and two thirds to the health centre hospitals (Control Group=CG) (Figure 1). Demographic and prefracture functional data on the groups are given in Table 1 and 2.

Psychiatrically oriented rehabilitation

Psychiatrically oriented rehabilitation took place in the rehabilitation unit (36 beds) of a private hospital, Oulu Deaconess Institute. The unit was chaired and run by a neurologist with a special qualification

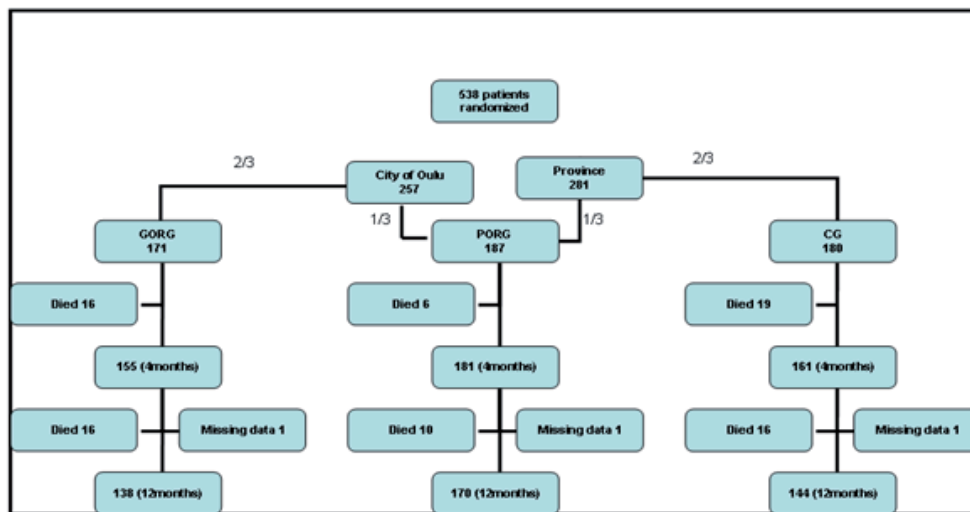


Figure 1: Flow chart of the patient randomization and a follow up protocol. PORG (Pysiatrically Oriented Rehabilitation Group), GORG (Geriatrically Oriented Rehabilitation Group), CG (Control Group).

Table 1. Prefracture patient characteristics. PORG (Pysiatrically Oriented Rehabilitation Group), GORG (Geriatrically Oriented Rehabilitation Group), CG (Control Group).

| | PORG | (N=187) | | GORG | (N=171) | | CG | (N=180) | P-value |
|---|-----------|---------|---|-----------|---------|---|-----------|---------|---------|
| Age | | | | | | | | | P=0,226 |
| Mean (SD) | 77,5 | (9,4) | | 79,1 | (9,4) | | 77,7 | (9,1) | |
| Range | 53,1-94,5 | | | 50,0-99,6 | | | 53,7-98,2 | | |
| Sex | | | | | | | | | P=0,560 |
| Males | 41 | 21,9 % | % | 30 | 17,5 | % | 34 | 18,9 % | |
| Females | 146 | 78,1 | % | 141 | 82,5 | % | 146 | 81,1 % | |
| Side of fracture | | | | | | | | | P=0,454 |
| Right | 86 | 46,0 | % | 90 | 52,6 | % | 88 | 48,9 % | |
| Left | 101 | 54,0 | % | 81 | 47,4 | % | 92 | 51,1 % | |
| Type of fracture | | | | | | | | | P=0,733 |
| Undisplaced intracapsular | 25 | 13,4 | % | 25 | 14,6 | % | 23 | 12,8 % | |
| Displaced intracapsular | 99 | 52,9 | % | 75 | 43,9 | % | 99 | 55,0 % | |
| Basocervical | 3 | 1,6 | % | 2 | 1,2 | % | 2 | 1,1 % | |
| Trochanteric two-fragment | 26 | 13,9 | % | 30 | 17,5 | % | 22 | 12,2 % | |
| Trochanteric multi-fragment | 27 | 14,4 | % | 34 | 19,9 | % | 30 | 16,7 % | |
| Subtrochanteric | 7 | 3,7 | % | 5 | 2,9 | % | 4 | 2,2 % | |
| Primary operation | | | | | | | | | P=0,358 |
| Three screws | 42 | 22,5 | % | 38 | 22,3 | % | 39 | 21,6 % | |
| Single screw with slide plate | 25 | 13,3 | % | 24 | 14,0 | % | 21 | 11,7 % | |
| Intramedullary nail | 41 | 21,9 | % | 50 | 29,2 | % | 42 | 23,4 % | |
| Hemiarthroplasty | 70 | 37,4 | % | 56 | 32,7 | % | 65 | 36,1 % | |
| Total hip arthroplasty | 9 | 4,8 | % | 3 | 1,8 | % | 13 | 7,2 % | |
| ASA grade | | | | | | | | | P=0,825 |
| I | 3 | 1,6 | % | 5 | 2,9 | % | 5 | 2,8 % | |
| II | 39 | 21,1 | % | 32 | 18,7 | % | 29 | 16,3 % | |
| III | 117 | 63,2 | % | 113 | 66,1 | % | 113 | 63,5 % | |
| IV | 25 | 13,5 | % | 21 | 12,3 | % | 30 | 16,9 % | |
| V | 1 | 0,5 | % | | | % | 1 | 0,6 % | |
| Discharged to | | | | | | | | | |
| Own home | 9 | 4,8 | % | 20 | 11,7 | % | 9 | 5,0 % | |
| Institutional care | | | % | 1 | 0,6 | % | | | |
| Permanent hospital inpatient | | | % | | | % | | | |
| Rehabilitation unit | 175 | 93,6 | % | 145 | 84,8 | % | 2 | 1,1 % | |
| Health centre hospital | 2 | 1,1 | % | 4 | 2,3 | % | 168 | 93,3 % | |
| Died | 1 | 0,5 | % | 1 | 0,6 | % | 1 | 0,6 % | |
| <i>P-value for discharged to rehabilitation unit which meant to be: p=0,004</i> | | | | | | | | | |
| Associated deceases | | | | | | | | | |
| Cardiovascular diseases | | | | | | | | | P=0,197 |
| Yes | 136 | 72,7 | % | 125 | 73,1 | % | 144 | 80,0 % | |
| No | 51 | 27,3 | % | 46 | 26,9 | % | 36 | 20,0 % | |
| Paralysis | | | | | | | | | P=0,446 |
| Yes | 27 | 14,4 | % | 30 | 17,5 | % | 23 | 12,8 % | |
| No | 160 | 85,6 | % | 141 | 82,5 | % | 157 | 87,2 % | |
| Respiratory organ diseases | | | | | | | | | P=0,329 |
| Yes | 31 | 16,6 | % | 37 | 21,6 | % | 29 | 16,1 % | |
| No | 156 | 83,4 | % | 134 | 78,4 | % | 151 | 83,9 % | |
| Urinary organ diseases | | | | | | | | | P=0,897 |
| Yes | 45 | 24,1 | % | 41 | 24,0 | % | 40 | 22,2 % | |
| No | 142 | 75,9 | % | 130 | 76,0 | % | 140 | 77,8 % | |
| Diabetes mellitus | | | | | | | | | P=0,783 |
| Yes | 36 | 19,3 | % | 37 | 21,6 | % | 34 | 18,9 % | |
| No | 151 | 80,7 | % | 134 | 78,4 | % | 146 | 81,1 % | |
| Rheumatism | | | | | | | | | P=0,848 |
| Yes | 23 | 12,3 | % | 24 | 14,0 | % | 22 | 12,2 % | |
| No | 164 | 87,7 | % | 147 | 86,0 | % | 158 | 87,8 % | |
| Parkinson's disease | | | | | | | | | P=0,374 |
| Yes | 9 | 4,8 | % | 4 | 2,3 | % | 9 | 5,0 % | |
| No | 178 | 95,2 | % | 167 | 97,7 | % | 171 | 95,0 % | |
| Malignant tumour or haemopathy | | | | | | | | | P=0,791 |
| Yes | 25 | 13,4 | % | 22 | 12,9 | % | 20 | 11,1 % | |
| No | 162 | 86,6 | % | 149 | 87,1 | % | 160 | 88,9 % | |

Table 2. Comparison of patients' functional capacity, and mortality, PORG (Psychiatrically Oriented Rehabilitation Group), GORG (Geriatrically Oriented Rehabilitation Group), CG (Control Group).

| | PORG | | GORG | | CG | | |
|--|------|------|------|------|-----|------|---------|
| | no | % | no | % | no | % | |
| Place of residence prefracture | | | | | | | P=0,897 |
| Own home | 163 | 87,2 | 147 | 86 | 154 | 85,6 | |
| Sheltered housing | 24 | 12,8 | 24 | 14 | 26 | 14,4 | |
| Total | 187 | 100 | 171 | 100 | 180 | 100 | |
| Residential status 4 months | | | | | | | P<0.001 |
| Own home | 131 | 72,8 | 100 | 64,5 | 100 | 62,5 | |
| Sheltered housing | 19 | 11,6 | 21 | 13,5 | 15 | 9,4 | |
| Health centre hospital | 9 | 5,0 | 5 | 3,2 | 11 | 6,9 | |
| Permanent institutional inpatient Rehabilitation unit | 10 | 5,6 | 16 | 10,3 | 8 | 5,0 | |
| Temporary stay in acute hospital | 2 | 1,1 | 5 | 3,2 | | | |
| Total | 9 | 5,0 | 8 | 5,2 | 26 | 16,3 | |
| Total | 180 | 100 | 155 | 100 | 160 | 100 | |
| Residential status 12 months | | | | | | | P=0.673 |
| Own home | 118 | 69,4 | 90 | 65,2 | 97 | 66,9 | |
| Sheltered housing | 20 | 11,8 | 15 | 10,9 | 20 | 13,8 | |
| Health centre hospital | 15 | 8,8 | 16 | 11,6 | 18 | 12,4 | |
| Permanent institutional inpatient Rehabilitation unit | 10 | 5,9 | 9 | 6,5 | 7 | 4,8 | |
| Temporary stay in acute hospital | 3 | 1,8 | 2 | 1,4 | | | |
| Total | 4 | 2,4 | 6 | 4,3 | 3 | 2,1 | |
| Total | 170 | 100 | 138 | 100 | 144 | 100 | |
| Walking ability prefracture | | | | | | | P=0,124 |
| Alone outdoors | 156 | 83,4 | 121 | 70,8 | 133 | 73,9 | |
| Outdoors only if accompanied | 5 | 2,7 | 9 | 5,3 | 10 | 5,6 | |
| Alone indoors but not outdoors | 26 | 13,9 | 40 | 23,4 | 36 | 20,0 | |
| Indoors only if accompanied | | | | | 1 | 0,6 | |
| Unable to walk | | | 1 | 0,6 | | | |
| Walking ability 4 months | | | | | | | P=0.169 |
| Alone outdoors | 87 | 48,3 | 57 | 36,8 | 69 | 43,1 | |
| Outdoors only if accompanied | 20 | 11,1 | 17 | 11,0 | 10 | 6,3 | |
| Alone indoors but not outdoors | 49 | 27,2 | 50 | 32,3 | 50 | 31,3 | |
| Indoors only if accompanied | 16 | 8,9 | 17 | 11,0 | 23 | 14,4 | |
| Unable to walk | 8 | 4,4 | 14 | 9,0 | 8 | 5,0 | |
| Total | 180 | 100 | 155 | 100 | 160 | 100 | |

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| | PORG | | GORG | | CG | | |
|---|------|------|------|------|-----|------|---------|
| Walking ability 12 months | | | | | | | P=0.775 |
| Alone outdoors | 94 | 55,3 | 80 | 58,0 | 78 | 54,2 | |
| Outdoors only if accompanied | 16 | 9,4 | 14 | 10,1 | 15 | 10,4 | |
| Alone indoors but not outdoors | 40 | 23,5 | 28 | 20,3 | 34 | 23,6 | |
| Indoors only if accompanied | 14 | 8,2 | 6 | 4,3 | 8 | 5,6 | |
| Unable to walk | 6 | 3,5 | 10 | 7,2 | 9 | 6,3 | |
| Total | 170 | 100 | 138 | 100 | 144 | 100 | |
| Walking aids prefracture | | | | | | | P=0,496 |
| Can walk without aids | 104 | 55,6 | 97 | 56,7 | 97 | 53,9 | |
| One aid | 39 | 20,9 | 23 | 13,5 | 30 | 16,7 | |
| Two aids | 3 | 1,6 | 1 | 0,6 | 4 | 2,2 | |
| Frame | 41 | 21,9 | 49 | 28,7 | 48 | 26,7 | |
| Wheelchair/Bedbound | | | 1 | 0,6 | 1 | 0,6 | |
| Walking aids 4 months | | | | | | | P=0.323 |
| No aids | 27 | 15,0 | 22 | 14,2 | 23 | 14,4 | |
| One aid | 36 | 20,0 | 18 | 11,6 | 23 | 14,4 | |
| Two aids | 7 | 3,9 | 5 | 3,2 | 12 | 7,5 | |
| Frame | 100 | 55,6 | 98 | 63,2 | 90 | 56,3 | |
| Wheelchair/bedbound | 10 | 5,6 | 12 | 7,7 | 12 | 7,5 | |
| Total | 180 | 100 | 155 | 100 | 160 | 100 | |
| Walking aids 12 months | | | | | | | P=0.657 |
| No aids | 42 | 24,7 | 28 | 20,3 | 30 | 20,8 | |
| One aid | 31 | 18,2 | 23 | 16,7 | 26 | 18,1 | |
| Two aids | 2 | 1,2 | 3 | 2,2 | 7 | 4,9 | |
| Frame | 83 | 48,8 | 72 | 52,2 | 68 | 47,2 | |
| Wheelchair/bedbound | 12 | 7,1 | 12 | 8,7 | 13 | 9,0 | |
| Total | 170 | 100 | 138 | 100 | 144 | 100 | |
| Pain in the injured hip 4 months | | | | | | | P=0.966 |
| Severe and spontaneous, even at rest | 5 | 2,8 | 2 | 1,3 | 3 | 1,9 | |
| Severe when walking and prevents all activity | 10 | 5,6 | 7 | 4,5 | 13 | 8,1 | |
| Tolerable, permitting limited activity | 28 | 15,6 | 25 | 16,1 | 29 | 18,1 | |
| Occurs only after some activity, disappears quickly at rest | 28 | 15,6 | 26 | 16,8 | 23 | 14,4 | |
| Slight or intermittent, alleviated in normal activity | 48 | 26,7 | 37 | 23,9 | 42 | 26,3 | |
| No hip pain | 56 | 31,1 | 52 | 33,5 | 45 | 28,1 | |
| Unable to answer | 5 | 2,8 | 6 | 3,9 | 5 | 3,1 | |
| Total | 180 | 100 | 155 | 100 | 160 | 100 | |

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| | PORG | | GORG | | CG | | |
|---|------|------|------|------|-----|------|---------|
| Pain in the injured hip 12 months | | | | | | | P=0.116 |
| Severe and spontaneous, even at rest | | | | | 2 | 1,4 | |
| Severe when walking and prevents all activity | 5 | 2,9 | 1 | 0,7 | 6 | 4,2 | |
| Tolerable, permitting limited activity | 17 | 10,0 | 11 | 8,0 | 18 | 12,5 | |
| Occurs only after some activity, disappears quickly at rest | 18 | 10,6 | 6 | 4,3 | 13 | 9,0 | |
| Slight or intermittent, alleviated in normal activity | 37 | 21,8 | 42 | 30,4 | 29 | 20,1 | |
| No hip pain | 92 | 54,1 | 75 | 54,3 | 74 | 51,4 | |
| Unable to answer | 1 | 0,6 | 3 | 2,2 | 2 | 1,4 | |
| Total | 170 | 100 | 138 | 100 | 144 | 100 | |
| Number of reoperation/No patients | | | | | | | |
| Implant removal | 3 | | 6 | | 3 | | |
| Hemi arthroplasty | 2 | | 2 | | 1 | | |
| Total arthroplasty | 6 | | 5 | | 9 | | |
| Reosteosynthesis | 6 | | 7 | | 4 | | |
| Girdlestone | 0 | | 2 | | 0 | | |
| Drainage of haematoma or infection | 0 | | 3 | | 0 | | |
| Reduction of dislocation | 6 | | 3 | | 9 | | |
| Other | 2 | | 1 | | 4 | | |
| Total | 25 | | 29 | | 30 | | |
| Mortality | | | | | | | |
| Mortality at 4 months | 6 | 3,2 | 16 | 9,6 | 19 | 10,6 | P=0.017 |
| Mortality at 12 months | 16 | 8,6 | 32 | 18,7 | 35 | 19,4 | P=0.005 |

Table 3: Impatient days in primary hospital, days in rehabilitation and hospital days after rehabilitation. PORG (Pysiatrically Oriented Rehabilitation Group), GORG (Geriatrically Oriented Rehabilitation Group), CG (Control Group), (SEM = Standard Error of Mean).

| Mean length of stay | PORG | | GORG | | CG | |
|--|------|-----------------|------|-----------------|-----|-----------------|
| | no | Mean days (SEM) | no | Mean days (SEM) | no | Mean days (SEM) |
| Primary hospital | 187 | 7,4 (0.3) | 171 | 8,9 (0.4) | 180 | 6,3 (0.2) |
| Rehabilitation clinic | 176 | 20,8 (1,3) | 145 | 31,4 (1,7) | | |
| Health care centre hospital | | | | | 157 | 31,0 (1,9) |
| Health care centre hospital after rehabilitation | 98 | 37,4 (3,6) | 61 | 57,8 (5,8) | 66 | 58,1 (5,3) |
| Total | 187 | 46.5 (2.7) | 171 | 56.1 (3.6) | 180 | 56.7 (3.5) |

in rehabilitation of disabilities in locomotor function. There was also a general practitioner and 1/2 a psychiatrist. Consultations with a psychiatrist were available daily and with other specialists as required. There were five physiotherapists on the ward, three occupational therapists, one hospital attendant, 18 registered and practical nurses and three rehabilitation attendants. The patients were given assistance in activities of daily living (ADL) and mobilization daily by the nurses. They also had rehabilitation physiotherapy for 1 hour daily, which included individual physical and balance exercises. Gym exercises were included in the physiotherapy (up to 3 times a week) as the patient's condition improved. Occupational therapy was also provided twice a week. The patients were evaluated by a physician, physiotherapist and rehabilitation attendant on admission and discharge. The duration of the rehabilitation was restricted to about a maximum of three weeks by the payers for the services, the City of Oulu and the counties. In some cases, the rehabilitation could not be continued until the patient was able to return to their original place of living, and therefore such patients had to be discharged to their respective health centre hospitals. The mean stay of the PORG in the primary hospital was 7.4 days, mean stay in rehabilitation unit 20.8 days and the mean stay after rehabilitation in health centre hospitals, of those patients which were not able to return to independent living from rehabilitations units, 37.4 days (Table 3).

Geriatrically oriented rehabilitation

The geriatric oriented rehabilitation occurred at the geriatric department containing 28 beds. It was chaired by a geriatrician and was focused on both the physical training as well as the associated geriatric problems. There was also a general practitioner. The remaining staff consisted of one physiotherapist, one hospital attendant, 17 registered and practical nurses and one rehabilitation attendant. Consultations with a psychiatrist were available daily and with other specialists as required. The patients were given assistance in ADL and mobilization daily by the nurses. The rehabilitation also included one hour of physiotherapy daily and one hour of group therapy on three working days in the week. In some cases, the rehabilitation could not be continued until the patient was able to return to their original place of living, and such patients were discharged to their respective health centre hospitals. The mean stay of the GORG in the primary

hospital was 8.9 days, in rehabilitation unit 31.4 days and after rehabilitation in health centre hospitals, of those patients which were not able to return to independent living from rehabilitations units, 57.8 days (Table 3).

Control group

The control group received routine basic level of rehabilitation which took place in the local health centre hospitals. This is considered the standard rehabilitation method for the majority of hip fracture patients in Finland. In this group there were 33 health centre hospitals, which are similar in regard to administrative structure, resources, and treatment protocols. The mean number of beds per ward was 32 (Standard Deviation = SD 12). The wards are run by general practitioners and mostly attended by registered and practical nurses. The availability of physiotherapists and consultations with other specialists is minimal and variable. The average staff of a ward consisted of one physiotherapist (SD 1), four hospital attendants (SD 2), 17 registered and practical nurses (SD 4) and 0.65 of a rehabilitation attendant. The patients were given an average of 67 min of mobilization therapy per day (SD 53). The active rehabilitation continued until the patient could be discharged to the prefracture place of living or when the responsible general practitioner considered that the rehabilitation did not have any response in the patient after which the patient received only basic care in the same hospital. The mean stay of the CG in the primary hospital was 6.3 days, in active rehabilitation in the health centre hospitals 31.0 days and after rehabilitation in the same health centre hospitals, 58.1 days (Table 3).

Assesment

The patients were assessed by a nurse involved in the research on admission and at four and 12 months after admission. Standardized forms (13,14) were filled in on admission, providing data concerning the patients' age, sex, place of residence, locomotor ability, use of walking aids, use of home help services, type of fracture, any pathological fractures, primary operation, ADL functions (Table 4), 15D (Health-Related Quality of Life) (15), social status (13,14,16), psychological status (13,14) cognition (MMSE, SPMSQ) (13,14,17), associated diseases (cardiovascular diseases, paralysis, respiratory diseases, urological diseases,

diabetes, rheumatism, Parkinson's disease, malignomas, Paget's disease, dizziness, use of corticosteroids), alcohol abuse, smoking and ASA grade,. The four-month follow-up was performed using an inquiry form (13,14) to be filled in by the patient and completed by the nurse by means of a telephone interview in the event of missing data. Data concerning the place of residence four months postoperatively, locomotor ability, use of walking aids, the patients' own evaluation of his/her walking ability and pain in the hip, use of home help services and ADL functions were recorded. At 12 months the patients were examined by an author (RW) and the same data were recorded as above for four months. ADL functions (dressing, bathing or showering, eating, toileting, shopping, household chores, laundry, preparation of meals, banking/finances, use of transportation) were recorded and analysed using a five-step classification (14,18), Mortality and re-operations (type and reason) up to 12 months postoperatively were recorded on a special form. The protocol was approved by the University's Ethical Committee and written informed consent was obtained from the patients. This study is registered in current controlled trials and the registration number is ISRCTN94467061.

Statistics

The statistical analysis was performed by a statistician using the SPSS package (version 9.0, Chicago, Illinois). ANOVA (Kruskall-Wallis, analysis of variance) was used with a subsequent χ^2 test to analyse the categorical variables, and the Mann-Whitney test for continuous variables. $P < 0.05$ was considered significant. The evaluation of the sample size was based on an estimate that 20% of the patients are in danger of being institutionalized. We postulated that a reduction in the institutionalization rate to 10% would be clinically important. A reduction of this size with a two tailed p-value of 0.01 and a power of 0.80 required a minimum sample size of 160 for each group. Due to possible loss of cases we increased this sample size to 180. Cox Regression analysis was used for the evaluation of the impact of age on differences in mortality.

Results

Background data

There were no significant differences between the groups in the demographic data, 15D (Health-Relat-

ed Quality of Life), social status, psychological status, cognition (MMSE, SPMSQ), associated diseases or other background data except for one ADL function – toilet ($P < 0.003$, Kruskal-Wallis test) in favour of PORG (Table 1, 2 and 4).

ADL

There were no significant differences between the groups in any ADL function at 4 or 12 months of follow-up (Table 4).

Residential status

Significantly more patients in the PORG ($P=0.0012$, Mann-Whitney U test) and GORG ($P < 0.001$, Mann-Whitney-U test) were able to live in their own homes or sheltered housing (independent living) at four months than in the CG but the difference between PORG and GORG was not significant ($P=0.278$), (Table 2). Separate analysis of cervical and trochanteric fractures showed that the significant difference was true only for cervical fractures (PORG vs GORG $P=0.308$, PORG vs CG $P < 0.001$ and GORG vs CG $P < 0.001$) but not for trochanteric fractures ($P=0.299$), (Table 5). The differences were, however, no longer visible at 12 months (Table 2, 5). We also analyzed the results excluding the patients under 65 years of age but this did not change the result.

Walking ability and walking aids

There were no statistically significant differences between the groups at either four or 12 months (Table 2).

Pain in the injured hip

There were no significant differences between the groups after four or 12 months of follow-up (Table 2).

Mortality

Mortality was significantly lower in the PORG than in the GORG at four months ($P=0.026$, Mann-Whitney U test) or CG ($P=0.006$, Mann-Whitney U test) and at 12 months ($P=0.005$ and $P=0.004$, respectively), but no significant differences were observed between the GORG and CG (Table 2). Significant differences remained the same when only patients older than 64 years were analyzed. Because of the 1,6 years difference in the mean age between PORG and GORG Cox Regression Analysis was applied which showed that the difference remained significant ($p=0.011$).

Re-operation rate

There were no significant differences between the groups.

Discussion

This survey compares the outcomes of three rehabilitation settings in the same geographical area. Two of the settings were by nature different, highly specialised units while the third employed a standard rehabilitation therapy of hip fracture. The time used for physical training was slightly higher and was based on more experience and resources in the specialised units than in the standard treatment ones. Furthermore, the specialized units could provide more treatment aspects in addition to the physical training component, e.g. diagnostics and care of associated diseases in the geriatric department etc. which were not available on the same level in the standard treatment centres. Therefore it is not surprising that we could see differences in the effect of these rehabilitation modalities.

We found that both specialized rehabilitation modalities significantly increased the number of patients able to live independently after a short follow-up (4 months) and thus reduced the need for institutional care relative to routine after-treatment. This effect was transient, however, and had disappeared by 12 months. No such effect has been reported in other studies that have considered location of residence after 3 and 6 months of follow-up (6,11). It is noteworthy that patients with cervical fracture benefitted more of the rehabilitation than those with trochanteric fracture. This is probably due to the fact the hemiarthroplasty used in most cases with cervical fracture allows more efficient rehabilitation than the internal fixation of trochanteric fractures.

Physiatric rehabilitation seemed to reduce mortality, an effect that has not been seen in other studies at three (11), four (10), six (1,11,19) or 12 months (1,8,19) after the fracture, although the Cochrane meta-analysis performed in 2004 showed a tendency for a decrease in mortality in rehabilitation groups. Our results may be partly explained by the fact that the average age of the patients admitted to geriatrically oriented rehabilitation was slightly higher than in the other groups despite the randomization but according to the Cox Regression analysis the small age difference did not explain our finding. It can also be speculated that the physical training weighed rehabilitation may play a role. Any explanation based on differences in

background factors we can not give because the factors records here were very similar between groups

The treatment period at the primary hospital was shorter in the control group than in the intervention groups, as was also the case in the study by Naglie et al (11). On the other hand, in some other reports (8,10) the stay in the primary hospital was significantly shorter in the rehabilitation groups than in the control groups, due to the fact that rehabilitation took place in the primary hospital. Our finding is mainly explained by differences in the capacities of the rehabilitation centres and health centre hospitals to admit patients from the primary hospital. The health centre hospitals are sufficiently well equipped and their network sufficiently dense so that they were able to admit the patients at a very early postoperative phase and without queuing, which was a problem that affected the physiatric rehabilitation in particular. On the other hand, the mean stays in the different rehabilitations varied, with the PORG showing the shortest. This can be explained by the high cost of privately arranged physiatric rehabilitation. The local authorities paid an individual fee that covered a limited period of time, usually 2-3 weeks, although this could be extended on request when needed. Such limitations did not apply to the geriatric and standard (CG) rehabilitation, which was paid for out of public funds. Due to the strong influence of economical and administrative factors and the capacity to admit patients, the stays in different institutions could not be regarded as outcome factor.

Although the patients comprising the groups were obtained from several administrative regions, they all came from a geographically limited and relatively small area ensuring that the total study population was homogenous. However, due to the conditions of the randomization the patients from different administrative regions did not fall equally into the groups. All of the patients of the GORG were residents of the City of Oulu whereas the PORG and CG included patients from the surrounding 33 counties. Less than one fourth of the total population of the City of Oulu live in the downtown urban area. The suburban part of Oulu consists of small uptowns which are comparable to the central areas of the counties where the major part of the county residents live. We therefore believe that the slightly unequal distribution of the rural, suburban and urban patients may cause some bias but this bias should actually result in a stronger confirmation of our findings.

Table 4: Comparison of patients' ADL function. PORG (Psychiatrically Oriented Rehabilitation Group), GORG (Geriatrically Oriented Rehabilitation Group), CG (Control Group).

| | PORG | | GORG | | Control | | |
|--|------|------|------|------|---------|------|---------|
| | no | % | no | % | no | % | |
| Dressing | | | | | | | p=0.135 |
| <i>Able to dress completely without help</i> | 168 | 89,8 | 149 | 87,1 | 149 | 82,8 | |
| <i>Needs help to be dressed by others</i> | 19 | 10,2 | 22 | 12,9 | 31 | 17,2 | |
| Total | 187 | 100 | 171 | 100 | 180 | 100 | |
| Dressing 4 months | | | | | | | p=0.191 |
| <i>Able to dress completely without help</i> | 107 | 59,8 | 91 | 59,5 | 81 | 50,9 | |
| <i>Needs help to be dressed by others</i> | 72 | 40,2 | 62 | 40,5 | 78 | 49,1 | |
| Total | 179 | 100 | 153 | 100 | 159 | 100 | |
| Dressing 12 months | | | | | | | p=0,750 |
| <i>Able to dress completely without help</i> | 113 | 66,5 | 95 | 68,8 | 93 | 64,6 | |
| <i>Needs help to be dressed by others</i> | 57 | 33,5 | 43 | 31,2 | 51 | 35,4 | |
| Total | 170 | 100 | 138 | 100 | 144 | 100 | |
| Bathing or showering | | | | | | | p=0.330 |
| <i>Able to bath or shower</i> | 129 | 69,0 | 110 | 64,3 | 111 | 61,7 | |
| <i>Needs help to be bathed by others</i> | 58 | 31,0 | 61 | 35,7 | 69 | 38,3 | |
| Total | 187 | 100 | 171 | 100 | 180 | 100 | |
| Bathing or showering 4 months | | | | | | | p=0.187 |
| <i>Able to bath or shower</i> | 73 | 40,8 | 59 | 38,6 | 50 | 31,4 | |
| <i>Needs help to be bathed by others</i> | 106 | 59,2 | 94 | 61,4 | 109 | 68,6 | |
| Total | 179 | 100 | 153 | 100 | 159 | 100 | |
| Bathing or showering 12 months | | | | | | | p=0,247 |
| <i>Able to bath or shower</i> | 76 | 44,7 | 67 | 64,3 | 55 | 38,7 | |
| <i>Needs help to be bathed by others</i> | 94 | 55,3 | 71 | 35,7 | 87 | 61,3 | |
| Total | 170 | 100 | 138 | 100 | 142 | 100 | |
| Eating | | | | | | | p=0.312 |
| <i>Able to cut food and eat without help</i> | 184 | 98,4 | 169 | 98,8 | 174 | 96,7 | |
| <i>Needs help to cut food and eat</i> | 3 | 1,6 | 2 | 1,2 | 6 | 3,3 | |
| Total | 187 | 100 | 171 | 100 | 180 | 100 | |
| Eating 4 months | | | | | | | p=0.751 |
| <i>Able to cut food and eat without help</i> | 156 | 87,2 | 131 | 85,6 | 134 | 84,3 | |
| <i>Needs help to cut food and eat</i> | 23 | 12,8 | 22 | 14,4 | 25 | 15,7 | |
| Total | 179 | 100 | 153 | 100 | 159 | 100 | |
| Eating 12 months | | | | | | | p=0.490 |
| <i>Able to cut food and eat without help</i> | 157 | 92,4 | 122 | 88,4 | 131 | 91,0 | |
| <i>Needs help to cut food and eat</i> | 13 | 7,6 | 16 | 11,6 | 13 | 9,0 | |
| Total | 170 | 100 | 138 | 100 | 144 | 100 | |

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| | PORG | | GORG | | Control | | |
|---|------|------|------|------|---------|------|---------|
| | no | % | no | % | no | % | |
| Toileting | | | | | | | p=0.003 |
| <i>Able to get to the toilet, get on and off, manage clothing, etc.</i> | 185 | 98,9 | 164 | 95,9 | 165 | 91,7 | |
| <i>Needs help to get to the toilet, get on and off, manage clothing, etc.</i> | 2 | 1,1 | 7 | 4,1 | 15 | 8,3 | |
| Total | 187 | 100 | 171 | 100 | 180 | 100 | |
| Toileting 4 months | | | | | | | p=0.074 |
| <i>Able to get to the toilet, get on and off, manage clothing, etc.</i> | 148 | 82,7 | 118 | 77,1 | 115 | 72,3 | |
| <i>Needs help to get to the toilet, get on and off, manage clothing, etc.</i> | 31 | 7,3 | 35 | 22,9 | 44 | 27,7 | |
| Total | 179 | 100 | 153 | 100 | 159 | 100 | |
| Toileting 12 months | | | | | | | p=0,390 |
| <i>Able to get to the toilet, get on and off, manage clothing, etc.</i> | 141 | 82,9 | 113 | 81,9 | 111 | 77,1 | |
| <i>Needs help to get to the toilet, get on and off, manage clothing, etc.</i> | 29 | 17,1 | 25 | 18,1 | 33 | 22,9 | |
| Total | 170 | 100 | 138 | 100 | 144 | 100 | |
| Shopping | | | | | | | p=0.121 |
| <i>Able to do all shopping without assistance</i> | 84 | 44,9 | 67 | 39,2 | 62 | 34,4 | |
| <i>Needs help to do shopping</i> | 103 | 55,1 | 104 | 60,8 | 118 | 65,6 | |
| Total | 187 | 100 | 171 | 100 | 180 | 100 | |
| Shopping 4 months | | | | | | | p=0.784 |
| <i>Able to do all shopping without assistance</i> | 24 | 13,4 | 19 | 12,4 | 24 | 15,1 | |
| <i>Needs help to do shopping</i> | 155 | 86,6 | 134 | 87,6 | 135 | 84,9 | |
| Total | 179 | 100 | 153 | 100 | 159 | 100 | |
| Shopping 12 months | | | | | | | p=0.718 |
| <i>Able to do all shopping without assistance</i> | 39 | 22,9 | 36 | 26,1 | 32 | 22,2 | |
| <i>Needs help to do shopping</i> | 131 | 77,1 | 102 | 73,9 | 112 | 77,8 | |
| Total | 170 | 100 | 138 | 100 | 144 | 100 | |
| Household chores | | | | | | | p=0.258 |
| <i>Able to manage housekeeping alone or with only occasional assistance</i> | 68 | 36,4 | 55 | 32,2 | 51 | 28,3 | |
| <i>Needs assistance to manage housekeeping alone</i> | 119 | 63,6 | 116 | 67,8 | 129 | 71,7 | |
| Total | 187 | 100 | 171 | 100 | 180 | 100 | → |

| | PORG | | GORG | | Control | | |
|---|------|------|------|------|---------|------|---------|
| | no | % | no | % | no | % | |
| Household chores 4 months | | | | | | | p=0.867 |
| <i>Able to manage housekeeping alone or with only occasional assistance</i> | 26 | 14,5 | 25 | 16,3 | 26 | 16,4 | |
| <i>Needs assistance to manage housekeeping alone</i> | 153 | 85,5 | 128 | 83,7 | 133 | 83,6 | |
| Total | 179 | 100 | 153 | 100 | 159 | 100 | |
| Household chores 12 months | | | | | | | p=0.634 |
| <i>Able to manage housekeeping alone or with only occasional assistance</i> | 31 | 18,2 | 20 | 14,5 | 26 | 18,1 | |
| <i>Needs assistance to manage housekeeping alone</i> | 139 | 81,8 | 118 | 85,5 | 118 | 81,9 | |
| Total | 170 | 100 | 138 | 100 | 144 | 100 | |
| Laundry | | | | | | | p=0.042 |
| <i>Able to do laundry</i> | 95 | 50,8 | 66 | 38,6 | 73 | 40,6 | |
| <i>Needs help to do laundry</i> | 92 | 49,2 | 105 | 61,4 | 107 | 59,4 | |
| Total | 187 | 100 | 171 | 100 | 180 | 100 | |
| Laundry 4 months | | | | | | | p=0.838 |
| <i>Able to do laundry</i> | 46 | 25,7 | 41 | 26,8 | 38 | 23,9 | |
| <i>Needs help to do laundry</i> | 133 | 74,3 | 112 | 73,2 | 121 | 76,1 | |
| Total | 179 | 100 | 153 | 100 | 159 | 100 | |
| Laundry 12 months | | | | | | | p=0.953 |
| <i>Able to do laundry</i> | 47 | 27,6 | 37 | 26,8 | 41 | 28,5 | |
| <i>Needs help to do laundry</i> | 123 | 72,4 | 101 | 73,2 | 103 | 71,5 | |
| Total | 170 | 100 | 138 | 100 | 144 | 100 | |
| Preparation of meals | | | | | | | p=0.146 |
| <i>Able to prepare meals</i> | 108 | 57,8 | 87 | 50,9 | 86 | 47,8 | |
| <i>Needs help to prepare meals</i> | 79 | 42,2 | 84 | 49,1 | 94 | 52,2 | |
| Total | 187 | 100 | 171 | 100 | 180 | 100 | |
| Preparation of meals 4 months | | | | | | | p=0.556 |
| <i>Able to prepare meals</i> | 57 | 31,8 | 53 | 34,6 | 46 | 28,9 | |
| <i>Needs help to prepare meals</i> | 122 | 68,2 | 100 | 65,4 | 113 | 71,1 | |
| Total | 179 | 100 | 153 | 100 | 159 | 100 | |
| Preparation of meals 12 months | | | | | | | p=0.789 |
| <i>Able to prepare meals</i> | 71 | 42,0 | 56 | 40,6 | 55 | 38,2 | |
| <i>Needs help to prepare meals</i> | 98 | 58,0 | 82 | 59,4 | 89 | 61,8 | |
| Total | 169 | 100 | 138 | 100 | 144 | 100 | |

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| | PORG | | GORG | | Control | | |
|--|------|------|------|------|---------|------|---------|
| | no | % | no | % | no | % | |
| Banking/finances | | | | | | | p=0.204 |
| <i>Able to manage all financial matters</i> | 84 | 44,9 | 78 | 45,6 | 67 | 37,2 | |
| <i>Needs help to manage all financial matters</i> | 103 | 55,1 | 93 | 54,4 | 113 | 62,8 | |
| Total | 187 | 100 | 171 | 100 | 180 | 100 | |
| Banking/finances 4 months | | | | | | | p=0.528 |
| <i>Able to manage all financial matters</i> | 34 | 19,0 | 23 | 15,0 | 31 | 19,5 | |
| <i>Needs help to manage all financial matters</i> | 145 | 81,0 | 130 | 85,0 | 128 | 80,5 | |
| Total | 179 | 100 | 153 | 100 | 159 | 100 | |
| Banking/finances 12 months | | | | | | | p=0.510 |
| <i>Able to manage all financial matters</i> | 46 | 27,1 | 41 | 29,7 | 34 | 23,6 | |
| <i>Needs help to manage all financial matters</i> | 124 | 72,9 | 97 | 70,3 | 110 | 76,4 | |
| Total | 170 | 100 | 138 | 100 | 144 | 100 | |
| Use of transportation | | | | | | | p=0.638 |
| <i>Able to travel independently on public transportation or drive a car.</i> | 73 | 39,0 | 61 | 35,7 | 62 | 34,4 | |
| <i>Needs assistance on public transportation</i> | 114 | 61,0 | 110 | 64,3 | 118 | 65,6 | |
| Total | 187 | 100 | 171 | 100 | 180 | 100 | |
| Use of transportation 4 months | | | | | | | p=0.740 |
| <i>Able to travel independently on public transportation or drive a car.</i> | 24 | 13,4 | 17 | 11,1 | 22 | 13,8 | |
| <i>Needs assistance on public transportation</i> | 155 | 86,6 | 136 | 88,9 | 137 | 86,2 | |
| Total | 179 | 100 | 153 | 100 | 159 | 100 | |
| Use of transportation 12 months | | | | | | | p=0.767 |
| <i>Able to travel independently on public transportation or drive a car.</i> | 30 | 17,8 | 26 | 18,8 | 30 | 21,0 | |
| <i>Needs assistance on public transportation</i> | 139 | 82,2 | 112 | 81,2 | 113 | 79,0 | |
| Total | 169 | 100 | 138 | 100 | 143 | 100 | |

Table 5. Comparison of patients' functional capacity in cervical and trochanteric fractures. . PORG (Pysiatrically Oriented Rehabilitation Group), GORG (Geriatrically Oriented Rehabilitation Group), CG (Control Group).

| Cervical fracture | | | | | | | |
|---|------|------|------|------|-----|------|---------|
| | PORG | | GORG | | CG | | |
| | no | % | no | % | no | % | |
| Admitted from | | | | | | | P=0,235 |
| Own home | 111 | 89,5 | 82 | 82,0 | 102 | 83,6 | |
| Sheltered housing | 13 | 10,5 | 18 | 18,0 | 20 | 16,4 | |
| Total | 124 | 100 | 100 | 100 | 122 | 100 | |
| Residential status 4 months | | | | | | | P=0,004 |
| Own home | 92 | 76,7 | 59 | 64,8 | 67 | 61,5 | |
| Sheltered housing | 11 | 9,2 | 14 | 15,4 | 7 | 6,4 | |
| Health centre hospital | 5 | 4,2 | 2 | 2,2 | 7 | 6,4 | |
| Permanent institutional inpatient | 6 | 5,0 | 10 | 11,0 | 8 | 7,3 | |
| Rehabilitation unit | 1 | 0,8 | 1 | 1,1 | | | |
| Temporary stay in acute hospital | 5 | 4,2 | 5 | 5,5 | 20 | 18,3 | |
| Total | 120 | 100 | 91 | 100 | 109 | 100 | |
| PORG vs GORG P=0.308, PORG vs CG P<0,001 and GORG vs CG P<0.001 | | | | | | | |
| Residential status 12 months | | | | | | | P=0.964 |
| Own home | 82 | 71,9 | 53 | 65,4 | 70 | 71,4 | |
| Sheltered housing | 13 | 11,4 | 11 | 13,6 | 12 | 12,2 | |
| Health centre hospital | 8 | 7,0 | 8 | 9,9 | 8 | 8,2 | |
| Permanent institutional inpatient | 9 | 7,9 | 5 | 6,2 | 6 | 6,1 | |
| Rehabilitation unit | 2 | 1,8 | 2 | 2,5 | | | |
| Temporary stay in acute hospital | 2 | 1,8 | 2 | 2,5 | 2 | 2,0 | |
| Total | 114 | 100 | 81 | 100 | 98 | 100 | |

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| Trochanteric fracture | | | | | | | |
|--|------|------|------|------|----|------|---------|
| | PORG | | GORG | | CG | | |
| | no | % | no | % | no | % | |
| Admitted from | | | | | | | P=0,683 |
| <i>Own home</i> | 51 | 81,0 | 61 | 85,9 | 47 | 81,0 | |
| <i>Sheltered housing</i> | 12 | 19,0 | 10 | 14,1 | 11 | 19,0 | |
| Total | 63 | 100 | 71 | 100 | 58 | 100 | |
| Residential status 4 months | | | | | | | P=0,299 |
| <i>Own home</i> | 39 | 65,0 | 41 | 64,1 | 33 | 64,7 | |
| <i>Sheltered housing</i> | 8 | 13,3 | 7 | 10,9 | 8 | 15,7 | |
| <i>Health centre hospital</i> | 4 | 6,7 | 3 | 4,7 | 4 | 7,8 | |
| <i>Permanent institutional inpatient</i> | 4 | 6,7 | 6 | 9,4 | | | |
| <i>Rehabilitation unit</i> | 1 | 1,7 | 4 | 6,3 | | | |
| <i>Temporary stay in acute hospital</i> | 4 | 6,7 | 3 | 4,7 | 6 | 11,8 | |
| Total | 60 | 100 | 64 | 100 | 51 | 100 | |
| Residential status 12 months | | | | | | | P=0,511 |
| <i>Own home</i> | 36 | 64,3 | 37 | 65,0 | 27 | 57,4 | |
| <i>Sheltered housing</i> | 7 | 12,5 | 4 | 7,0 | 8 | 17,0 | |
| <i>Health centre hospital</i> | 9 | 16,1 | 8 | 14,0 | 10 | 21,4 | |
| <i>Permanent institutional inpatient</i> | 1 | 1,8 | 4 | 7,0 | 1 | 2,1 | |
| <i>Rehabilitation unit</i> | 1 | 1,8 | | | | | |
| <i>Temporary stay in acute hospital</i> | 2 | 3,5 | 4 | 7,0 | 1 | 2,1 | |
| Total | 56 | 100 | 57 | 100 | 47 | 100 | |

We did not find any significant differences in ADL functions or walking ability at either 4 months or 12 months postoperatively. The results of rehabilitation interventions in the case of hip fracture patients vary considerably in the literature, as do the settings in which they were obtained. Koval et al. (19) found that an in-patient rehabilitation programme significantly improved ADL functions at three months but that this effect had disappeared at 6 and 12 months, while Naglie et al. (11) reported that postoperative interdisciplinary care had no effect on ADL functions when evaluated at three and six months. Kramer et al. (6) did not find any significant differences between the ADL scores at 6 months achieved after rehabilitation given in rehabilitation hospitals, subacute nursing homes or traditional nursing homes, whereas Binder et al. (20) noted that extended outpatient rehabilitation resulted in an improvement in ADL functions at six months and Hagsten et al. (21) observed that early individualized postoperative occupational training improved dressing, toilet and bathing functions at two months, but they did not have any later follow-up. Huusko et al. (8) reported that immediate rehabilitation at a geriatric clinic speeded up the regaining of instrumental ADLs at three months but that this difference had disappeared at 12 months. It thus seems that postoperative rehabilitation has no effect on ADL functions, or only a weak early transient effect. Rehabilitation was not found to improve walking ability in the other studies, either (11,19,21).

Despite the facts mentioned above that may have biased the initial randomization of the patients, our data show that psychiatric and geriatric modalities significantly increased the numbers of patients able to live independently after a short follow-up (4 months) and thus reduced the need for institutional care as compared with routine after-treatment. Psychiatric rehabilitation also seemed to reduce mortality among the patients. Further studies are needed to show whether these findings have any effect on economic cost-benefit calculations.

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