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Effects of Geriatric Interdisciplinary Home Rehabilitation on Walking Ability and Length of Hospital Stay After Hip Fracture: A Randomized Controlled Trial

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Abstract

Objective: To evaluate if Geriatric Interdisciplinary Home Rehabilitation could improve walking ability for older people with hip fractures compared with conventional geriatric care and rehabilitation. A secondary aim was to investigate the postoperative length of hospital stay (LOS).

Design: Randomized controlled trial.

Setting: Geriatric ward, ordinary housing, and residential care facilities.

Participants: People operated on for a hip fracture (n = 205), aged 70 or older, including those with cognitive impairment, and living in the north of Sweden.

Intervention: Home rehabilitation with the aim of early hospital discharge that was individually designed and carried out by an interdisciplinary team for a maximum of 10 weeks. Special priority was given to preventive work, independence in daily activities, and walking ability both indoors and outdoors.

Measurements: Walking ability and the use of walking device were assessed in an interview during the hospital stay. These assessments were repeated along with gait speed measurements at 3- and 12-month follow-up. The length of the hospital stay after the hip fracture was recorded.

Results: No significant differences were observed in walking ability, use of walking device, and gait speed at the 3- and 12-month follow-up between the groups. At 12 months, 56.3% of the intervention group and 57.7% of the control group had regained or improved their prefracture walking ability. The median postoperative LOS in the geriatric ward was 6 days shorter for the intervention group (P = .003).

Conclusion: Participants receiving Geriatric Interdisciplinary Home Rehabilitation regained walking ability in the short- and long-term similar to those receiving conventional geriatric care and rehabilitation according to a multifactorial rehabilitation program. The intervention group had a significantly shorter postoperative LOS in the hospital.

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independence and confidence in performing ADLs without falling both in the short and long term.\textsuperscript{2,13–15} It improves physical activity\textsuperscript{2,16} and reduce the burden for caregivers.\textsuperscript{14} However, people were not included in these studies if they had severe cognitive impairment or dementia, serious medical conditions, or if they lived in residential care facilities. Therefore, the population previously studied is not representative of older people with hip fracture.

The aim of this study was to evaluate if Geriatric Interdisciplinary Home Rehabilitation (GIHR) for older people with hip fractures, including those with cognitive impairment and those living in residential care facilities, could improve walking ability compared with conventional geriatric care and rehabilitation. A secondary aim was to investigate if GIHR shortened the postoperative length of hospital stay (LOS).

**Methods**

**Design and Participants**

In total, 466 people with hip fractures were screened for eligibility, and 205 participants were included in this randomized controlled trial (RCT), which was undertaken at the Geriatric Department, Umeå University Hospital, Sweden (Figure 1). The inclusion criteria were acute hip fracture surgery (cervical or trochanteric fracture), aged 70 or older, and living in the municipality of Umeå in ordinary housing or in residential care facilities. People with cognitive impairment or dementia were included. People with pathological fractures and those who fractured their hips in the hospital were excluded. The group of people who declined to participate (n = 37) or were missing because the inclusion routines failed (n = 33) did not differ significantly in age or sex from those included in the study (Figure 1).

**Procedure**

The participants were consecutively randomized into the study from May 2008 to June 2011. The usual clinical pathway was followed; that is, before surgery, all patients were treated in the Orthopedic Department, and directly after surgery, patients with cervical fractures were referred to a ward in the Geriatric Department with special competence in orthopedics. Those with trochanteric fractures returned postoperatively to the Orthopedic Department, but were included in the study if they were referred to the geriatric ward for a rehabilitation period. The randomization was stratified into 2 categories according to type of housing (ordinary housing or residential care facilities) and type of fracture (cervical or trochanteric). Before arriving in the geriatric ward, the participants were randomized to either the intervention group (ie, conventional geriatric care and rehabilitation with GIHR after discharge) or to the control group (ie, conventional geriatric care and rehabilitation). The randomization was carried out using sequentially numbered lots in opaque, sealed envelopes drawn by a nurse at the ward, not involved in the study. The ward was divided with the intervention group in one wing and the control group in the other with different care teams in each wing. Study information was given to the participants both orally and in written form. When participants could not give their consent, for instance, in the presence of cognitive impairment, the next of kin was also consulted. The participants and their next of kin were informed that they could withdraw from the study at any time without any negative repercussions. Two experienced researchers assessed the participants during their hospital stay within 5 days after randomization, and later 3 and 12 months postoperatively in the participants’ homes. The assessments in hospital took place in a neutral room at the ward in order to keep the assessors blinded to group allocation and they had no other contact with the geriatric ward or access to patients’ medical records during the study period. The study was approved by the Regional Ethical Review Board in Umeå, Sweden, in 2008 (DNR 08–053M) and registered at Current Controlled Trials Ltd (ISRCTN 15738119).

**Control Group**

Conventional care and rehabilitation in the geriatric ward was based on a multifactorial rehabilitation program for patients with hip fracture that aimed to detect, prevent, and treat postoperative complications, such as delirium, pain, falls, malnutrition, and decubitus ulcers, and to improve rehabilitation. Briefly, the program consists of interdisciplinary rehabilitation using comprehensive geriatric assessment (CGA) with regular meetings and individual rehabilitation plans. The program has several important features, including early mobilization, participation of the whole staff in the patient’s everyday activities, specific training with the occupational therapist and physiotherapist, and thorough discharge planning. Participants living in ordinary housing and in need of further rehabilitation after discharge were referred to primary health care, and 3 months after the fracture, they could also receive rehabilitation at a geriatric outpatient rehabilitation unit connected to the Geriatric Department. For participants living in residential care facilities, the physiotherapists and occupational therapists in the facilities were contacted before discharge.

**Intervention Group**

Participants randomized to the GIHR group were also treated according to the multifactorial rehabilitation program, including CGA with focus on detection, prevention, and treatment of postoperative complications. However, the aim was early discharge from the hospital and continuation of rehabilitation in their homes. Discharge was possible when the participants had no medical obstacles, could manage basic transfers, and had the care they required at home. The GIHR team included a nurse, an occupational therapist, and 2 physiotherapists who visited the participants regularly. A geriatrician was medically responsible, and a social worker and a dietician could be consulted when necessary. Rehabilitation was individually designed according to the participants’ own goals (ie, team actions and number of home visits differed for each participant). During the first days after discharge, all participants received nearly daily home visits from someone in the GIHR team and later according to the participants’ needs. All team members encouraged the participants to increase their level of activity to resume their prefracture activities. Special priority was given to multifactorial actions so as to prevent falls. The physiotherapy intervention focused on walking ability indoors and outdoors, and functional strength and balance training according to the High-Intensity Functional Exercise program (HIFE).\textsuperscript{17,18} Exercise programs were designed for participants who had the capacity to exercise on their own or with support from others. The occupational therapist payed special attention to independence in personal and instrumental ADLs, trying out assistive devices, and modifications of the home environment with the objective to make everyday activities safer. The nurse and geriatrician were jointly responsible for medical issues, such as evaluation of pain, supervision of the operation wound, and the participants’ ability to handle their medicines safely. Interventions for other medical problems besides the hip fracture were planned together with the primary health care. The nurse also evaluated the participants’ nutrition. Different aspects that might have an effect on the nutrition were considered, for example, constipation, pain, or oral problems. All team members worked together to improve the participants’ nutritional status and in some cases a dietician was consulted. The GIHR team worked in close contact with the next of kin, social home service, or with the staff at the residential care facilities. The maximum duration in GIHR was 10 weeks. If additional care was...
466 people with hip fracture

209 randomized
108 to Geriatric Interdisciplinary Home Rehabilitation, 101 to Conventional Care and Rehabilitation

257 Excluded
- 187 did not meet inclusion criteria (152 lived outside Umeå, 13 fractured their hip in hospital, 4 had pathologic fractures, 18 were too young)
- 37 declined to participate
- 33 missing due to failure of inclusion routines

Geriatric Interdisciplinary Home Rehabilitation  
\( n = 107 \)

- 95 assessed at 3 months
  - 9 died
  - 1 declined to continue
  - 2 were lost to follow-up

- 80 assessed at 12 months
  - 12 died
  - 1 declined to continue
  - 1 moved to another town
  - 1 was lost to follow-up

107 included in primary analysis

Conventional Geriatric Care and Rehabilitation  
\( n = 98 \)

- 89 assessed at 3 months
  - 6 died
  - 3 declined to continue

- 79 assessed at 12 months
  - 10 died

98 included in primary analysis

Fig. 1. Flow chart showing the randomization and follow-up at 3 and 12 months.
needed after that time, then colleagues in primary health care or in the residential care facilities were contacted. The participants also could be referred to a geriatric outpatient rehabilitation unit.

**Baseline Descriptive Assessments**

The participant or, in the presence of cognitive impairment, the next of kin or a nurse’s aide, were questioned about ADLs using the Barthel Index, which ranges from 0 to 20. Participants who were unable to walk could not be assessed using the Mini Mental State Examination (MMSE), which ranges from 0 to 30. On the MMSE, a score of 17 or less indicates severe cognitive impairment. A geriatrician, who was not blinded to group allocation and employed at the ward, registered diagnoses by reading the patients’ charts after the study was finished. Assessments and documentations were analyzed to determine if the participants fulfilled the DSM-IV criteria for dementia, delirium, and depression. This analysis was performed by a geriatrician, who was unaware of the study-group allocation.

**Outcome Measures**

Walking ability indoors and outdoors was assessed in an interview during the hospital stay (prefracture status) and at 3 and 12 months on a scale of 1 to 7, where 1 indicates no functional ability or the need for the assistance of 2 people and 7 indicates normal function. The use of a walking device was also registered. Self-chosen and maximum gait speed (m/s) over a distance of 2.4 meters, was recorded at the 3- and 12-month follow-up visits in the participants’ homes. These measurements were performed with a standing start and the participant’s usual walking aid. The stopwatch was started on the command “Go” and was stopped when the first foot crossed the finish line. For self-chosen gait speed, the mean of 2 tries was used, and for maximum gait speed, the fastest value of 2 tries was used.

Postoperative LOS was recorded in 3 ways. The total LOS included the time in all departments in the hospital from after surgery until discharge. In addition, LOS from admission to the geriatric ward until discharge was measured, as well as LOS from admission to the geriatric ward until the discharge-ready date (DRD). At the DRD, the inpatient rehabilitation was completed and the participant was medically stable and ready for discharge, but the patient may have remained in the hospital after this date because the community could not offer sufficient social home services or a room in a residential care facility. The extent to which the participants received rehabilitation after discharge from the hospital was also recorded.

**Statistics**

A power calculation was carried out with the number of days that patients with hip fracture spent in the hospital during a year from a previous study. Assuming a power of 80% and with a 24% reduction in hospital days, the total sample size was estimated to be 206 participants. The Statistical Package for Social Sciences, SPSS version 22 (IBM SPSS Statistics, IBM Corporation, Chicago, IL) was used for statistical calculations, and all analyses were based on the intention-to-treat principle using available data from all participants, according to their original allocation, and regardless of level of attendance. Seven participants who were randomized to the GIHR group did not get HR; 6 participants were judged not to need HR due to long hospital stays, and 1 participant was missed, but they are included in the analysis. The Student t test, Pearson χ² test, or Mann-Whitney U test was used to analyze group differences in prefracture characteristics and for some of the outcomes. Data on physical assistance and walking devices were dichotomized, and a binary logistic regression method was used to analyze the odds ratio (OR) of walking ability and the use of walking devices for the groups. The regressions were adjusted for age, sex, and prefracture status of the outcome variable and for significant differences between the groups at baseline (antidepressants, analgesics). For postoperative LOS, the Mann-Whitney U test was used because the data were not normally distributed and because of differences between the groups in the extreme outliers. All tests were 2-tailed, and a level of P < .05 was considered statistically significant.

**Results**

The use of antidepressants and analgesics differed significantly between the groups at baseline, but no other differences were observed (Table 1).

There were no significant differences between the GIHR and control groups in independent walking ability either indoors or outdoors at 3 and 12 months, or in use of walking devices (Table 2). Walking ability deteriorated in both groups (Figures 2 and 3). At the 3-month follow-up, 49 (51.6%) participants in the GIHR group and 48 (54.5%) participants in the control group had regained or improved their prefracture walking ability level (P = .800). At 12 months, the totals were 45 (56.3%) and 45 (57.7%) in the GIHR and control groups, respectively (P = .982). Two participants in the GIHR group and 1 participant in the control group were not able to walk before the fracture. These numbers increased to 8 (8.4%) versus 3 (3.4%) at 3 months for the GIHR and control groups, respectively, and to 9 (11.3%) versus 8 (10.3%) at 12 months, but there were no significant differences between groups. The use of a walker indoors did not differ between the groups. Before the fracture, 45.8% of participants in the GIHR group and 43.9% of participants in the control group walked with a walker on wheels indoors, and 12 months after the fracture the proportions were 51.2% and 57.7% for the GIHR and control groups, respectively. Gait speed, both self-chosen and maximum, were almost identical for the groups at the 3- and 12-month follow-up visits (Table 3).

Postoperative LOS was significantly shorter for the GIHR group compared with the control group. LOS from admission to the geriatric ward until discharge was a median (Q1–Q3) of 17 days (12–26) versus 23 days (17–32) for the GIHR and control groups, respectively (P = .003). LOS from admission to the geriatric ward until DRD was a median (Q1–Q3) of 15 days (11–22) versus 21.5 days (16–29) for the GIHR and control groups, respectively (P < .001). Moreover, when analyzing total postoperative LOS after the hip fracture, the GIHR group had a significantly shorter LOS, with a median (Q1–Q3) of 22 days (15–34) compared with 26.5 days (19–38) for the control group (P = .021).

There were no differences between the groups in the 1-year mortality rate. The rates were 19.6% in the GIHR group and 16.3% in the control group (P = .666).

The GIHR team made an average 14.2 ± 10.5 visits in the participants’ homes (0–50). Number of days in the GIHR team was a median (Q1–Q3) of 21 days (11.0–35.5). One-third of the participants in the control group received a follow-up in primary health care or in outpatient rehabilitation during the year after discharge. In the GIHR group, approximately 10% of participants received additional rehabilitation after the intervention ended.

**Discussion**

The results of the present study showed no advantages in favor of GIHR on walking ability compared with conventional geriatric care and rehabilitation for older people with hip fractures. However, participants in the GIHR group had a significantly shorter postoperative LOS.

These data confirm that there is a deterioration in walking ability after hip fracture. Only 56.3% of the GIHR group and 57.7% of the control group had regained or improved their walking ability at the 12-month follow-up compared with their prefracture status. Similar
numbers were reported previously in a prospective follow-up study\textsuperscript{24} and in a rehabilitation intervention study.\textsuperscript{25} In contrast to our study, the prevalence of dementia was lower in the previous studies, and one of them did not include trochanteric fractures.\textsuperscript{25} Older people with dementia are less likely to receive rehabilitation following hip fracture, and their rehabilitation is shorter compared with older adults without dementia.\textsuperscript{26,27} Research indicates that people with dementia show benefits from team rehabilitation after hip fracture, such as improved functional recovery and ambulation and decreased risk of falls.\textsuperscript{26,27} Previous walking ability and the presence of complications, such as delirium or pressure ulcers, can affect functional recovery more in the short term than the degree of cognitive impairment.\textsuperscript{28}

Studies of team-based HR for older people with hip fractures have reported better long-term results on walking ability than the present study, but as mentioned previously, the populations studied have been different; that is, the participants lived in ordinary housing, met physical and mental conditions,\textsuperscript{14} or were not severely cognitive impaired.\textsuperscript{14} or were not severely cognitive impaired.\textsuperscript{14} A strength of the present study is that we did not exclude participants with cognitive impairment, and we also included people living in residential care facilities, which reinforces the external validity.

### Table 1
Participant Characteristics

<table>
<thead>
<tr>
<th></th>
<th>Total, n = 205</th>
<th>GIHR*, n = 107</th>
<th>Control, n = 98</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, mean ± SD</td>
<td>82.9 ± 6.7</td>
<td>83.2 ± 7.0</td>
<td>82.6 ± 6.4</td>
<td>.543</td>
</tr>
<tr>
<td>Females, n (%)</td>
<td>147 (71.7)</td>
<td>79 (73.8)</td>
<td>68 (69.4)</td>
<td>.582</td>
</tr>
<tr>
<td>Cervical fracture, n (%)</td>
<td>148 (72.2)</td>
<td>78 (72.9)</td>
<td>70 (71.4)</td>
<td>.938</td>
</tr>
<tr>
<td>Trochanteric fracture, n (%)</td>
<td>57 (27.8)</td>
<td>29 (27.1)</td>
<td>28 (28.6)</td>
<td>.938</td>
</tr>
<tr>
<td>Living in ordinary housing, n (%)</td>
<td>142 (69.3)</td>
<td>71 (66.4)</td>
<td>71 (72.4)</td>
<td>.428</td>
</tr>
<tr>
<td>Living in residential care facilities, n (%)</td>
<td>63 (30.7)</td>
<td>36 (33.6)</td>
<td>27 (27.6)</td>
<td>.428</td>
</tr>
<tr>
<td>Living alone, n (%)</td>
<td>147 (71.7)</td>
<td>78 (72.9)</td>
<td>69 (70.4)</td>
<td>.810</td>
</tr>
<tr>
<td>Functional performance before fracture</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S-COVS, need for assistance when walking (1–7) median, (Q1, Q3)</td>
<td>6 (5–6)</td>
<td>6 (5–7)</td>
<td>6 (5–6)</td>
<td>.932</td>
</tr>
<tr>
<td>Walking independently indoors, n (%)</td>
<td>180 (87.8)</td>
<td>95 (88.8)</td>
<td>85 (86.7)</td>
<td>.815</td>
</tr>
<tr>
<td>Walking independently outdoors, n (%)</td>
<td>141 (68.8)</td>
<td>70 (65.4)</td>
<td>71 (72.4)</td>
<td>.350</td>
</tr>
<tr>
<td>No walking device indoors, n (%)</td>
<td>100 (48.8)</td>
<td>53 (49.5)</td>
<td>47 (48)</td>
<td>.932</td>
</tr>
<tr>
<td>No walking device outdoors, n (%)</td>
<td>67 (32.7)</td>
<td>33 (30.8)</td>
<td>34 (34.7)</td>
<td>.661</td>
</tr>
<tr>
<td>Barthel ADL-index (0–20), mean ± SD, (n = 202)</td>
<td>15.8 ± 5</td>
<td>15.9 ± 4.8</td>
<td>15.6 ± 5.2</td>
<td>.665</td>
</tr>
<tr>
<td>Diagnoses and medical conditions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Previous hip fracture, n (%)</td>
<td>35 (17.1)</td>
<td>20 (18.7)</td>
<td>15 (15.3)</td>
<td>.647</td>
</tr>
<tr>
<td>Impaired vision*, n (%)</td>
<td>31 (16.2)</td>
<td>17 (17)</td>
<td>14 (15.4)</td>
<td>.916</td>
</tr>
<tr>
<td>Dementia, n (%)</td>
<td>103 (50.2)</td>
<td>57 (53.3)</td>
<td>46 (46.9)</td>
<td>.444</td>
</tr>
<tr>
<td>Depression, n (%)</td>
<td>77 (37.9)</td>
<td>47 (44.3)</td>
<td>30 (30.9)</td>
<td>.068</td>
</tr>
<tr>
<td>Previous stroke, n (%)</td>
<td>14 (6.8)</td>
<td>6 (5.6)</td>
<td>8 (8.2)</td>
<td>.655</td>
</tr>
<tr>
<td>MMSE (0–30), mean ± SD, (n = 199)</td>
<td>17.3 ± 8.6</td>
<td>17.3 ± 8.4</td>
<td>17.3 ± 8.9</td>
<td>.970</td>
</tr>
<tr>
<td>Delirium during hospitalization, n (%)</td>
<td>153 (74.6)</td>
<td>84 (78.5)</td>
<td>69 (70.4)</td>
<td>.242</td>
</tr>
<tr>
<td>Number of days with delirium, mean ± SD</td>
<td>4.3 ± 4.4</td>
<td>4.4 ± 4.4</td>
<td>4.3 ± 4.4</td>
<td>.924</td>
</tr>
<tr>
<td>Drugs at discharge</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of drugs used regularly, mean ± SD</td>
<td>8.5 ± 3.1</td>
<td>8.8 ± 3.0</td>
<td>8.3 ± 3.3</td>
<td>.322</td>
</tr>
<tr>
<td>Diuretics, n (%)</td>
<td>70 (34.1)</td>
<td>36 (33.6)</td>
<td>34 (34.7)</td>
<td>.991</td>
</tr>
<tr>
<td>Beta-blockers, n (%)</td>
<td>76 (37.1)</td>
<td>42 (39.3)</td>
<td>34 (34.7)</td>
<td>.596</td>
</tr>
<tr>
<td>Antidepressants, n (%)</td>
<td>75 (36.5)</td>
<td>49 (45.8)</td>
<td>26 (26.5)</td>
<td>.007</td>
</tr>
<tr>
<td>Neuroleptics, n (%)</td>
<td>23 (11.2)</td>
<td>10 (9.3)</td>
<td>13 (13.3)</td>
<td>.505</td>
</tr>
<tr>
<td>Analgesics (not ASA), n (%)</td>
<td>177 (86.3)</td>
<td>87 (81.3)</td>
<td>90 (91.8)</td>
<td>.047</td>
</tr>
<tr>
<td>Benzodiazepines, n (%)</td>
<td>27 (13.2)</td>
<td>15 (14.0)</td>
<td>12 (12.2)</td>
<td>.866</td>
</tr>
</tbody>
</table>

ASA, acetylsalicylic acid; S-COVS, Swedish Clinical Outcome Variables.

Numbers in parentheses after a characteristic indicate that there are missing values. Higher ADL scores indicate better status.

*Impaired vision: Not able to read 5-mm capital letters at reading distance, with or without glasses.

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**Table 2**
Walking Ability and Use of Walking Device for the 2 Groups Before Fracture and at the 3- and 12-Month Follow-up Visits

<table>
<thead>
<tr>
<th></th>
<th>GIHR, n = 107</th>
<th>Control, n = 98</th>
<th>OR\textsuperscript{a}</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walking independently indoors, n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before fracture</td>
<td>95 (88.8)</td>
<td>85 (86.7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 3-mo follow-up, n = 95/88</td>
<td>54 (56.8)</td>
<td>57 (64.8)</td>
<td>0.84</td>
<td>0.39–1.80</td>
</tr>
<tr>
<td>At 12-mo follow-up, n = 80/78</td>
<td>53 (66.3)</td>
<td>56 (71.8)</td>
<td>0.84</td>
<td>0.35–2.06</td>
</tr>
<tr>
<td>Walking independently outdoors, n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before fracture</td>
<td>70 (65.4)</td>
<td>71 (72.4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 3-mo follow-up, n = 95/88</td>
<td>41 (43.2)</td>
<td>39 (44.3)</td>
<td>1.76</td>
<td>0.83–3.75</td>
</tr>
<tr>
<td>At 12-mo follow-up, n = 80/78</td>
<td>39 (48.8)</td>
<td>38 (48.7)</td>
<td>1.50</td>
<td>0.69–3.28</td>
</tr>
<tr>
<td>No walking device indoors, n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before fracture</td>
<td>53 (49.5)</td>
<td>47 (48.0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 3-mo follow-up, n = 95/88</td>
<td>15 (15.8)</td>
<td>11 (12.5)</td>
<td>1.91</td>
<td>0.72–5.03</td>
</tr>
<tr>
<td>At 12-mo follow-up, n = 80/78</td>
<td>24 (30.0)</td>
<td>21 (26.9)</td>
<td>1.41</td>
<td>0.59–3.33</td>
</tr>
<tr>
<td>No walking device outdoors, n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before fracture</td>
<td>33 (30.8)</td>
<td>34 (34.7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 3-mo follow-up, n = 95/88</td>
<td>3 (3.2)</td>
<td>3 (3.4)</td>
<td>0.80</td>
<td>0.14–4.80</td>
</tr>
<tr>
<td>At 12-mo follow-up, n = 80/78</td>
<td>8 (10.0)</td>
<td>7 (9.0)</td>
<td>1.20</td>
<td>0.36–4.01</td>
</tr>
</tbody>
</table>

\textsuperscript{a}OR of being treated in the GIHR group.

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**Fig. 2.** Proportion of participants walking independently indoors, before fracture, and at the 3- and 12-month follow-up visits.
Inactivity is common after hip fracture, sometimes due to fear of falling. HR can offer task-specific training and individual support in the home environment to help participants resume their pre-fracture activities. Exercising at home can be of great value, especially for people with dementia (eg, Alzheimer disease) because they have an impaired ability to transfer skills and should practice activities in an environment that is similar to the one in which the skill will be used. One possible explanation might be that the participants had the ability to exercise on their own. They were living in ordinary housing and had no severe cognitive impairment. However, in our study, 50% of the participants were diagnosed with dementia, and 30% were living in residential care facilities. Our clinical experience is that these patients need supervised exercise because they have limited ability to exercise on their own.

The optimal duration, frequency, and intensity of HR interventions after hip fracture are still unclear. The number of home visits from the GIHR team was quite similar to an earlier study. In contrast, in a study by Zidén and colleagues, the number of home visits was 3 times less. Despite having fewer visits, they reported significant improvements in independence, balance confidence, and physical activity in the HR group. These results are surprising because the duration, frequency, and intensity of exercise have been shown to be important to achieve improvements in physical function. One possible explanation might be that the participants had the ability to exercise on their own. They were living in ordinary housing and had no severe cognitive impairment. However, in our study, 50% of the participants were diagnosed with dementia, and 30% were living in residential care facilities. Our clinical experience is that these patients need supervised exercise because they have limited ability to exercise on their own.

Postoperative LOS was significantly shortened for the GIHR group. For some people, it may be better to remain in the hospital longer to receive more frequent, specialized rehabilitation. In fact, it was recently reported that a short LOS (10 days or shorter) after hip fracture was associated with an increased risk of death after hospital discharge, but the underlying cause of death was not evaluated. In the present study, there was no significant difference between the groups in 1-year mortality, even though the LOS was 6 days shorter in the GIHR group.

The study has some limitations. During the hospital stay, both groups were treated at the same ward, and the staff was not blinded to group allocation. The geriatricians working at the ward were occasionally responsible for both the intervention and control groups, and because they are responsible for discharge, they could unintentionally have influenced the LOS. Another limitation is that no gait speed tests were performed at baseline because the in-hospital assessments took place soon after the participants had fractured their hips. Additionally, gait speed tests were performed with the participant’s usual walking device, which may limit the ability to detect initial gait and mobility deficits and changes over time. Furthermore, we do not know to which extent the participants in the control group, who were living in residential care facilities, received rehabilitation after discharge from the hospital. The residential care facilities have their own rehabilitation staff, and there was no access to their documentation.

There are also ethical considerations. For cervical fractures, the randomization was carried out before the participants had given their consent for participation in the study due to practical reasons. When participants were unable to provide consent, the next of kin was asked. We considered it very important to include people with cognitive impairment in this study, because a large number of people who suffer from hip fractures have dementia. For older people with hip fractures, GIHR seems to complement conventional geriatric care and rehabilitation. The presence of serious medical conditions and/or cognitive impairment as well as living alone was not an obstacle to receiving GIHR. In clinical practice, people should be individually selected for participation in GIHR. In the future, additional large RCTs are needed to study team-based HR that include the entire group of elderly people with hip fractures. It would be interesting to analyze the cost-effectiveness of team-based HR interventions, to perform subgroup analyses to investigate if dementia and types of housing affect walking ability, balance, and ADLs, and to investigate if a short LOS is connected to different medical complications.

Conclusions

Participants in the GIHR group regained walking ability in the short and long term, similar to those receiving conventional geriatric care and rehabilitation according to a multifactorial rehabilitation program. The intervention group had a significantly shorter postoperative LOS in the hospital.

Acknowledgments

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References


Table 3

Mean Self-Chosen and Maximum Gait Speed Over 2.4 m for the 2 Groups at the 3- and 12-Month Follow-up Visits

<table>
<thead>
<tr>
<th></th>
<th>GIHR</th>
<th>Control</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Self-chosen gait speed, m/s ± SD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 3 mo, n = 80/76</td>
<td>0.43 ± 0.19</td>
<td>0.43 ± 0.20</td>
<td>.899</td>
</tr>
<tr>
<td>At 12 mo, n = 68/70</td>
<td>0.49 ± 0.19</td>
<td>0.48 ± 0.17</td>
<td>.945</td>
</tr>
<tr>
<td>Maximum gait speed, m/s ± SD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 3 mo, n = 77/72</td>
<td>0.70 ± 0.31</td>
<td>0.69 ± 0.29</td>
<td>.845</td>
</tr>
<tr>
<td>At 12 mo, n = 67/68</td>
<td>0.74 ± 0.30</td>
<td>0.75 ± 0.27</td>
<td>.846</td>
</tr>
</tbody>
</table>

Fig. 3. Proportion of participants walking independently outdoors before fracture, and at the 3- and 12-month follow-up visits.