Health-related quality of life outcomes for older Taiwanese with hip fracture after an interdisciplinary intervention

Yea-Ing Lotus Shyu 18, Jersey Liang 2,3*, Chi-Chuan Wu 4*, Huey-Shinn Cheng 5*, and Min-Chi Chen 6*

1School of Nursing, Chang Gung University, 259 Wen-Hwa 1st Road, Kwei-Shan, Taoyuan 333, Taiwan
2School of Public Health, University of Michigan, 1420 Washington Heights, M3234, SPH II, Ann Arbor, MI 48109-2029, USA
3Institute of Gerontology, University of Michigan, 300 North Ingalls, 9th Floor, Ann Arbor, MI 48109-2007, USA
4Traumatological Division, Department of Orthopedics, Chang Gung Memorial Hospital, 5 Fu-Hsin Street, Kwei-Shan, Taoyuan 333, Taiwan
5Department of Internal Medicine, Chang Gung Memorial Hospital, 5 Fu-Hsin Street, Kwei-Shan, Taoyuan 333, Taiwan
6Department of Public Health & Biostatistics Consulting Center, Chang Gung University, 259 Wen-Hwa 1st Road, Kwei-Shan, Taoyuan 333, Taiwan

*These authors contributed equally to this work
8Corresponding author

Email addresses:

YILS: yeaing@mail.cgu.edu.tw
JL: jliang@umich.edu
CCW: ccwu@mail.cgu.edu.tw
HSC: hscheng@adm.cgmh.org.tw

MCC: mcc@mail.cgu.edu.tw
Abstract

Background
The effects of intervention programs on health-related quality of life (HRQOL) of patients with hip fracture have not been well studied. We hypothesized that older patients with hip fracture who received our interdisciplinary intervention program would have better HRQOL than those who did not.

Methods
A randomized experimental design was used. Older patients with hip fracture (N=162) from a medical center in northern Taiwan were randomly assigned to an experimental (n=80) or control (n=82) group. HRQOL was measured by the SF-36 Taiwan version at 1, 3, 6, and 12 months after discharge.

Results
The experimental group had significantly better overall outcomes in bodily pain (beta =9.38, p=0.002), vitality (beta =9.40, p<0.001), mental health (beta =8.16, p=0.004), physical function (beta =16.01, p<0.001), and role physical (beta =22.66, p<0.001) than the control group at any time point during the first year after discharge. Physical-related health outcomes (physical functioning, role physical, and vitality) had larger treatment effects than emotional/mental- and social functioning-related health outcomes.

Conclusions
This interdisciplinary intervention program may improve health outcomes of elders with hip fracture. Our results may provide a reference for health care providers in countries using similar programs with Chinese/Taiwanese immigrant populations.

Trial registration: NCT01052636
Background
Hip fracture is a serious health problem in the elderly because it leads to excess mortality of 5-20%, and morbidity that severely impedes health-related quality of life (HRQOL) for patients [1-4]. With an increasingly aging population [5], hip fracture represents a major and growing health care problem in Taiwan as in many other countries [6].

Elderly patients with hip fracture have been found to benefit from postoperative rehabilitation, rehabilitation on an ortho-geriatric unit, early discharge planning programs, transitional care programs, or extended outpatient rehabilitation [7-13]. However, only two of these studies reported benefits of the intervention programs on HRQOL from the patient’s perspective [12,13], although measures of self-rated HRQOL have supplemented traditional indicators of disease and treatment outcomes such as mortality and objective clinical parameters [14,15]. Similarly, no quality of life measures were reported in systematic reviews of clinical trials for multidisciplinary approaches to inpatient rehabilitation for elderly patients with hip fracture [16,17]. At the same time, the vast majority of interventional studies for hip-fractured elders were conducted in Western developed countries and few of them used data from more than two time points to examine the longitudinal effects of interventions up to 1 year after discharge. Little is known about the effects, specifically the long-term effects, of intervention programs on HRQOL for elderly patients with hip fracture in Chinese populations.

The short- and long-term effects of an interdisciplinary intervention program for elders with hip fracture in Taiwan were examined by our group in a randomized experimental study [18,19]. The interdisciplinary program consisted of geriatric consultation, continuous rehabilitation, and discharge planning. We found that the intervention program may benefit elders with hip fracture in Taiwan by improving their HRQOL within 3 months after
discharge. The purpose of this paper is to report the long-term effects of the intervention program on HRQOL of hip-fractured elders within 1 year after discharge. We hypothesized that subjects who received the interdisciplinary intervention would have better HRQOL throughout the first year after discharge.

Methods

Participants
Inclusion criteria for subjects were 1) ≥ 60 years, 2) admitted to hospital for an accidental single-side hip fracture, 3) receiving hip arthroplasty or internal fixation, 4) able to perform full range of motion (ROM) against gravity and against some or full resistance, and with pre-fracture Chinese Barthel Index (CBI) >70, and 5) living in northern Taiwan. Patients were excluded if they were 1) severely cognitively impaired and completely unable to follow orders (determined by a score <10 on the Chinese Mini-Mental State Examination) [20], or 2) terminally ill.

The sample was recruited and followed from September 2001 to November 2003 (Figure 1). Of those who met the criteria and agreed to participate (n=162), 80 were randomly assigned to the experimental, and 82 to the control group. Patients who declined to participate (n=134) and those who agreed (n=164) did not differ significantly in age (p=0.322) and gender (p=0.517). Based on our pilot study data, a power of 0.80, and an alpha of 0.50, we estimated a sample size of 65 subjects in each group to obtain an effect size of 0.50 for improved performance of activities of daily living (ADLs) and 61 subjects in each group for improved physical functioning from post-surgery to the third month after discharge. To allow for potential dropouts, we therefore aimed to recruit around 80 subjects in each group.
Routine care (control group)
Current practice in caring for elders with hip fracture in Taiwan lacks well-organized interdisciplinary care protocols and continuity of care. After a fall incident, patients usually are sent directly to the hospital emergency room (ER) and are cared for by orthopedists. Elderly patients with a femoral neck fracture of subcapital and transcervical types are treated with hip arthroplasty and the basal neck type is treated with closed reduction using dynamic hip screw fixation. Before surgery, referrals are occasionally made for internal medicine care. Routine examinations before surgery include EKG, blood chemistry tests and cell counts, and X-rays. In the first 2 to 3 days after surgery, patients receive antibiotics and pain medication, and are taught to exercise with caution while still in bed. Physical therapy usually starts on the second or third day after removal of the hemobag. The usual hospital stay following surgery is around 7 days and no in-home programs are provided. Adherence to clinical follow-ups at 1, 3, 6 and 12 months after surgery is poor.

Intervention program (experimental group)
The intervention program developed for this study included three components: geriatric consultation service, rehabilitation program, and discharge-planning service [18,19].

The geriatric consultation
Unlike routine care that provides no geriatric assessment, the intervention program offered geriatric consultation that was delivered by a geriatric nurse and a geriatrician. Before surgery, the geriatric nurse contacted the patient and completed the initial assessment to obtain medical and fall history, vital signs, physical examination, physical and cognitive functional assessment, nutritional status, preoperative risk assessment, current medications, and comorbidities. This information was reviewed by the geriatrician, who visited all subjects and conducted a geriatric assessment. Specific attention was paid to patients ≥ 80 years old, with high operative risk, poor nutritional status, cognitive impairment or disorientation, or those with unstable comorbid conditions. Based on this assessment, the geriatrician made
suggestions to the surgeon regarding time of surgery, antibiotics and thromboembolic prophylaxis, postoperative nutritional management, urinary tract management, and delirium management/prevention. On the first day after surgery, the geriatric nurse visited the patient to assess for signs of delirium, pain, and postoperative complications. Based on this assessment, the geriatric nurse revised suggestions for the postoperative care plan to the surgeon. Each pre-surgical nursing assessment and geriatrician visit lasted around 60 minutes and the post-surgical nursing visit lasted 30 minutes.

The rehabilitation program
Unlike routine care in which postoperative rehabilitation did not start until 2-3 days following surgery and no in-home rehabilitation was provided, the rehabilitation program in this study emphasized providing early postoperative rehabilitation and in-home rehabilitation. This rehabilitation program was delivered by the geriatric nurse, physical therapist, and rehabilitation physician. Both the in-hospital and in-home components of the rehabilitation program contained a hip fracture-oriented intervention and a general intervention for deteriorated physical fitness. The hip fracture-oriented rehabilitation emphasized pain relief, range of motion, muscle strength and endurance, proprioceptive enhancement, and balance challenges. The general intervention for deteriorated physical fitness rehabilitation emphasized exercises to increase physical fitness, including aerobic capacity, anaerobic capacity, muscle strength and endurance, and flexibility.

During hospitalization, rehabilitation started on the first day post-surgery and was delivered once a day by the geriatric nurse. According to patient’s condition, the exercise protocol progressed from ankle exercises in bed to knee and hip joint flexion and extension exercises, to walking, and then climbing up and down stairs using a walker. During this period, around 4 rehabilitation sessions were provided by the geriatric nurse. In addition, the physical
therapist made 2 visits to assess the patient’s condition and provide rehabilitation sessions. The rehabilitation physician also made one visit to provide consultation.

For in-home rehabilitation, according to the patient’s condition, the exercise protocol emphasized ankle dorsiflexion with knee extension, isometric full knee extension, gently bouncing vertical jump with knee semiflexed and foot on the floor, and ball rolling activities to enhance proprioception. During the in-home period, rehabilitation was delivered during 4 nurse visits for the first, and 4 visits for the second and third months. In addition, the physical therapist conducted one assessment within the first week after discharge, and at the third week and third month after discharge.

**Discharge planning**
In addition to the geriatric consultation and rehabilitation components, a discharge service component was delivered by geriatric nurses. Unlike routine care, in which discharge planning is not provided to all patients and does not include home assessment, the geriatric nurse in this study assessed patients at discharge for caregivers’ competence, resources, family function, patient self-care ability, patient and family caregiver needs for continuing health and social services, and made necessary referrals during hospitalization. The geriatric nurse also made a home visit before discharge to assess the home environment and suggested environmental modifications. The nurse also made phone calls to remind patients about follow-up visits to clinics.

**Measurement**

**Health-related quality of life (HRQOL)**
Generic HRQOL was measured by the Taiwan version [21] of the widely used Medical Outcomes Study Short-Form 36 (SF-36, [22, 23]), which would allow further comparison among patients across different countries and/or with different diseases [24,25]. The SF-36
consists of 36 items representing eight generic health concepts: physical functioning (PF), role disability due to physical health problems (RP); bodily pain (BP); vitality (energy/fatigue) (VT); general health perceptions (GH); social functioning (SF); role disability due to emotional problems (RE); and general mental health (MH). For each scale, reverse items are recoded, the simple algebraic sums are computed, and the raw scale scores are transformed to a 0 to 100 scale. The higher the final score, the better the implied HRQOL. In addition, the SF-36 included one item on self-reported health transition (HT), which asked respondents to rate on a 5-point scale the amount of change in their general health compared to 1 year earlier. The higher the score, the more respondents believe that their general health is worse now than 1 year ago. Scores of this item were not transformed. Good validity and reliability of the SF-36 have been reported for the US elderly population [24,25,26].

The SF-36 Taiwan version was translated and demonstrated good reliability and validity in a healthy adult sample [27,28]. The SF-36 Taiwan Version is identical to the original SF-36. The reliability and validity of the SF-36 have been examined and established in elderly persons with hip fracture in Taiwan [21].

**Pre-fracture self-care ability**
The pre-fracture self-care ability of hip-fractured elders was retrospectively assessed using the Chinese Barthel Index (CBI), which measures dependencies in eating, transferring, grooming, toileting, bathing, walking, climbing stairs, dressing, and bowel and bladder control [29]. Scores range from 0 (total dependence) to 100 (total independence). In this study, Cronbach’s alpha of the CBI was 0.87.

**Procedure**
This study was in compliance with the Helsinki Declaration. Before data were collected, the study was approved for human subject research by the study hospital (Chang Gung Memorial
Hospital; approval number 89-25). Subjects were recruited from the ER by research assistants who screened the list of ER admissions twice a day for patients who met the inclusion criteria. Those who agreed to participate were randomly assigned to either an experimental or control group by the flip of a coin. Coin flipping was done by a neutral third party not involved in delivering the intervention or assessing outcomes. Subjects in the experimental group then received routine hospital care plus the intervention program, while subjects in the control group received only routine hospital care. All subjects were then assessed for HRQOL at 1, 3, 6, and 12 months after discharge. Data were collected in face-to-face interviews by research assistants who did not deliver the interventions nor conducted the screening.

**Statistical analysis**

Differences in baseline characteristics between the experimental and control groups were assessed by two-sample t-tests or chi-square tests. Effects of the interdisciplinary intervention were evaluated using a generalized estimating equation (GEE) approach to account for correlations in repeated observations over time. For a given outcome variable, the GEE model includes the following predictors: treatment (1 = experimental group, 0 = control group), and three dummy variables representing measurements made at 3, 6, and 12 months after hospitalization (with 1 month after discharge as the reference). GEE analyses were carried out using SAS Win 8.0.

All analyses were undertaken according to the intention-to-treat approach [30]. Missing data due to attrition (i.e., mortality, loss to follow-up, and refusal to participate) after randomization were imputed using multiple imputation [31,32]. For instance, we imputed missing data on performance of ADLs for subjects who dropped out or refused to participate after randomization by using baseline data (e.g., age, gender, education, functional status
before fracture, functional status at discharge, and repeated observations of HRQOL if available).

For those who died during the trial, no imputation was made after death except for one subject in the experimental group who died before assessment at the first month after discharge. This decision was based on the principle of intent to treat, i.e., all randomized subjects should be included in the analysis [30]. In addition, the imputed value can be regarded as the outcome shortly before death. Furthermore, it should be noted that GEE allows partial information to be used in the analysis, i.e., data obtained before subjects’ death can still contribute to estimating parameters.

Three complete data sets were imputed using NORM software developed by Schafer [33], and each set was analyzed. Estimates were then averaged across the three imputations to derive a single point estimate.

Results

Subjects’ baseline characteristics
Of the 162 participants in the final sample, the majority (68.5%) were female, with an average age of 78.16 years (SD=7.76), around half were married (51.9%) and illiterate (48.8%), 63% received internal fixation, and 37% received arthroplasty. The mean pre-fracture CBI was 96.08 (SD=6.47), representing good independence in performing ADLs, and 84.6% could walk independently before the fracture. The experimental and control groups did not differ significantly in baseline characteristics (i.e., gender, age, marital status, education, type of surgery, pre-fracture performance of ADLs and walking ability) (Table 1).
**Outcome comparison**

Regression coefficients for overall effects by time and intervention are presented in Table 2. Outcomes for the experimental and control groups are compared according to the GEE approach using the first month and control group as baseline (Table 3). The intervention had a significant effect on subjects’ bodily pain, vitality, mental health, physical function, and role physical (Table 2). After controlling for time, the experimental group had significantly better overall outcome in bodily pain ($\beta=9.38$, $p=0.002$), vitality ($\beta=9.40$, $p<0.001$), mental health ($\beta=8.16$, $p=0.004$), physical function ($\beta=16.01$, $p<0.001$), and role physical ($\beta=22.66$, $p<0.001$) than the control group at any time point during first year after discharge (Tables 2 and 3). $\beta$ can be interpreted as representing the intervention effect on variables of HRQOL over the 12-month period after hospital discharge. In other words, the benefits of the interdisciplinary intervention program on bodily pain, vitality, mental health, physical function, and role physical lasted beyond 3 months after discharge. Furthermore, the benefits of the interdisciplinary intervention appeared to be greater for physical-related health outcomes such as physical function (Figure 2) and role physical (Figure 3).

For the time effect, bodily pain, social function, role emotional, physical function, and role physical were significantly better at the third, sixth, and twelfth months after discharge than at the first month after discharge. Mental health at the sixth month after discharge was significantly better than at the first month after discharge (Table 2).

**Discussion**

As we hypothesized, the benefits of the interdisciplinary intervention program on HRQOL lasted throughout the first year after discharge. The results of this study expand those of previous studies showing that the treatment effects of more intensive, home-based rehabilitation programs or multidisciplinary programs for hip-fractured elders can be maintained up to 1 year after discharge, especially for physical-related functioning [9-12,14].
Similar to our findings, quality of life has previously been found to improve as a result of intervention programs for hip-fractured elders [14,15]. Our study further describes the trends in treatment effects on different dimension of HRQOL. Our multidisciplinary intervention program for elders in Taiwan with hip fracture significantly improved their bodily pain, vitality, social function, mental health, physical function, and role physical more than those of the control group at any time point during first year after discharge.

We also noticed that the trends in treatment benefits appeared to larger for physical health-related outcomes such as physical function and role physical than other dimensions of the HRQOL. These trends might be due to physical-related functioning of hip-fractured elders, except bodily pain, having poorer performance than mental/social-related dimensions of HRQOL after discharge, thus having greater room for improvement [4]. Another possible reason for the apparent improvement in performance of physical function is that the physical function subscale of the SF-36 Taiwan version shows the best responsiveness to clinical changes [21].

Our study supports the long-term effects of an interdisciplinary intervention program for elders with hip fracture, but it had several limitations. First, the study design was singled blinded. Patients and their families were blind to subjects’ group assignment, but not the personnel delivering the intervention and assessing outcomes. However, these personnel were intentionally assigned different research duties to minimize the potential influence of bias. Second, this study lacked baseline measures for HRQOL before implementing the intervention program. However, the lack of significant differences in demographic characteristics and pre-fracture self-care ability of the experimental and control groups supports our assumption that the two groups had equivalent pre-intervention qualities of life.
and qualities of care. At the same time, our study’s longitudinal design was able to demonstrate trends in changes for outcome variables and differences between the experimental and control groups, thus establishing the long-term effects of the treatment. It is also worth noting that although subjects were lost in the study period, the results obtained by intention-to-treat and on-protocol analyses were similar.

Our criteria for selecting subjects excluded elders with severe cognitive impairment and weak muscle power. Thus, our sample may have had better function than the general population of elders with hip fracture in Taiwan. The effect of this intervention program can therefore only be generalized for hip-fractured elders without severe cognitive impairment and with adequate muscle power in their extremities.

**Conclusions**
An interdisciplinary intervention with a geriatric hip-fracture program and discharge support component appeared to benefit elderly persons with hip fracture in Taiwan by improving their HRQOL throughout the first year after discharge. The results of this study may provide a reference for health care providers in countries using similar programs with Chinese/Taiwanese immigrant populations.

**Competing interests**
The authors declare that they have no competing interests.

**Authors' contributions**
YS carried out the study and drafted the manuscript. JL conceived of the study design, participated in data analysis and helped to draft the manuscript. CW participated in designing and coordinating the study and helped to draft the manuscript. HC participated in designing
and coordinating the study and helped to draft the manuscript. MC performed the statistical analysis and helped to draft the manuscript. All authors read and approved the final manuscript.

Acknowledgements
This work was funded by the National Health Research Institute, Taiwan (grant number: NHRI-EX92-9023PL). The funding agency had no role in study design; in data collections, analysis and interpretation of data; in the writing of the manuscript; and in the decision to submit the manuscript for publication.

References

2. Tsai YJ, Lin HS, Chow LP: A Pilot study on Health Sector Priority Review in Taiwan: By Retrospective Study on the Elderly Hip Fracture. Taichung, Taiwan: Taiwan Provincial Institute of Family Planning; 1995.


Figures

**Figure 1 - Study flow diagram**
Sample recruitment process.

**Figure 2 - Changes in Physical function (PF) and regression coefficient (p-value) of intervention effect**
Physical function (PF) at different time point and regression coefficient (p-value) of intervention effect on physical function.

**Figure 3 - Changes in Role physical (RP) and regression coefficient (p-value) of intervention effect**
Role physical limitations due to physical health problems (RP) at different time point and regression coefficient (p-value) of intervention effect on role physical.

Tables

**Table 1 - Demographic characteristics of hip-fractured elderly in the experimental group and the control group**

**Table 2 - Regression coefficients of overall effects: time and Intervention**

**Table 3 - The outcome comparisons at different time point**
Table 1: Demographic characteristics of hip-fractured older adults in the experimental and control groups

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Experimental group (n=80)</th>
<th>Control group (n=82)</th>
<th>P²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years), mean ± SD</td>
<td>77.36 ± 8.19</td>
<td>78.94 ± 7.28</td>
<td>0.20</td>
</tr>
<tr>
<td>Gender, n (%)</td>
<td></td>
<td></td>
<td>1.00</td>
</tr>
<tr>
<td>Female</td>
<td>55 (68.8)</td>
<td>56 (68.3)</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>25 (31.3)</td>
<td>26 (31.7)</td>
<td></td>
</tr>
<tr>
<td>Marital status, n (%)</td>
<td></td>
<td></td>
<td>0.40</td>
</tr>
<tr>
<td>Single</td>
<td>1 (1.3)</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>38 (47.5)</td>
<td>46 (56.1)</td>
<td></td>
</tr>
<tr>
<td>Widowed</td>
<td>40 (50)</td>
<td>36 (43.9)</td>
<td></td>
</tr>
<tr>
<td>Divorced</td>
<td>1 (1.30)</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>Educational background, n (%)</td>
<td></td>
<td></td>
<td>0.66</td>
</tr>
<tr>
<td>Illiterate</td>
<td>41 (51.3)</td>
<td>38 (46.3)</td>
<td></td>
</tr>
<tr>
<td>Primary school</td>
<td>22 (27.5)</td>
<td>30 (36.6)</td>
<td></td>
</tr>
<tr>
<td>High school</td>
<td>10 (12.5)</td>
<td>8 (9.8)</td>
<td></td>
</tr>
<tr>
<td>College or above</td>
<td>7 (8.8)</td>
<td>6 (7.3)</td>
<td></td>
</tr>
<tr>
<td>Type of surgery, n (%)</td>
<td></td>
<td></td>
<td>0.15</td>
</tr>
<tr>
<td>Internal fixation</td>
<td>55 (68.8)</td>
<td>47 (57.3)</td>
<td></td>
</tr>
<tr>
<td>Arthroplasty</td>
<td>25 (31.3)</td>
<td>35 (42.7)</td>
<td></td>
</tr>
<tr>
<td>Length of hospital stay (days), mean ± SD</td>
<td>10.12 ± 3.53</td>
<td>9.63 ± 4.83</td>
<td>0.14</td>
</tr>
<tr>
<td>Patients independent in walking ability, n (%)</td>
<td>68 (85)</td>
<td>69 (84.1)</td>
<td>1.00</td>
</tr>
<tr>
<td>Pre-fracture performance of ADLs, mean ± SD</td>
<td>95.94 ± 6.56</td>
<td>96.22 ± 6.41</td>
<td>-0.78</td>
</tr>
</tbody>
</table>

²Determined by chi-square test
Scores determined by Chinese Barthel Index, ranging from 0 (total dependence) to 100 (total independence).

ADLs = activities of daily living; scores determined by CBI.
<table>
<thead>
<tr>
<th>Outcome variables</th>
<th>Time after discharge (months)</th>
<th>Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Bodily pain (BP)</td>
<td>7.49†</td>
<td>8.65‡</td>
</tr>
<tr>
<td>General health perceptions (GH)</td>
<td>-1.11</td>
<td>-3.30</td>
</tr>
<tr>
<td>Vitality (energy/fatigue) (VT)</td>
<td>2.28</td>
<td>3.92</td>
</tr>
<tr>
<td>Social functioning (SF)</td>
<td>9.87†</td>
<td>15.71‡</td>
</tr>
<tr>
<td>Role limitations due to emotional problems (RE)</td>
<td>12.25†</td>
<td>11.36‡</td>
</tr>
<tr>
<td>General mental health (MH)</td>
<td>1.62</td>
<td>4.24*</td>
</tr>
<tr>
<td>Physical functioning (PF)</td>
<td>14.55‡</td>
<td>21.37‡</td>
</tr>
<tr>
<td>Role limitations due to physical health problems (RP)</td>
<td>12.14*</td>
<td>26.25‡</td>
</tr>
</tbody>
</table>

Using 1-month data (after discharge). Group: using control group as baseline.

*p < 0.05; †p < 0.01; ‡p < 0.001
Table 3: The outcome comparisons at different time point

<table>
<thead>
<tr>
<th>Quality of life subscales</th>
<th>Mean (SD)</th>
<th>Experimental group</th>
<th>Control group</th>
<th>$P$ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bodily pain (BP)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 1st month</td>
<td>76.70 (26.66)</td>
<td>59.32 (25.86)</td>
<td></td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>At 3rd month</td>
<td>76.39 (22.91)</td>
<td>65.43 (25.88)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 6th month</td>
<td>76.99 (23.44)</td>
<td>68.73 (27.78)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 1st year</td>
<td>81.20 (22.73)</td>
<td>70.93 (26.94)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General health perceptions (GH)</td>
<td></td>
<td></td>
<td></td>
<td>0.25</td>
</tr>
<tr>
<td>At 1st month</td>
<td>48.21 (24.38)</td>
<td>50.22 (25.33)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 3rd month</td>
<td>52.74 (24.29)</td>
<td>46.01 (24.53)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 6th month</td>
<td>50.91 (25.05)</td>
<td>44.36 (24.06)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 1st year</td>
<td>48.03 (26.81)</td>
<td>44.15 (22.82)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vitality (energy/fatigue) (VT)</td>
<td></td>
<td></td>
<td></td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>At 1st month</td>
<td>57.91 (24.50)</td>
<td>50.89 (23.45)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 3rd month</td>
<td>63.87 (19.91)</td>
<td>51.93 (18.54)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 6th month</td>
<td>64.37 (20.18)</td>
<td>54.71 (17.57)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 1st year</td>
<td>60.86 (19.18)</td>
<td>51.32 (17.53)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social functioning (SF)</td>
<td></td>
<td></td>
<td></td>
<td>0.09</td>
</tr>
<tr>
<td>At 1st month</td>
<td>51.30 (28.74)</td>
<td>48.87 (30.34)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 3rd month</td>
<td>66.36 (27.62)</td>
<td>57.01 (26.93)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 6th month</td>
<td>72.41 (28.42)</td>
<td>65.70 (28.56)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 1st year</td>
<td>72.57 (28.17)</td>
<td>67.44 (27.87)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1&lt;sup&gt;st&lt;/sup&gt; month</td>
<td>3&lt;sup&gt;rd&lt;/sup&gt; month</td>
<td>6&lt;sup&gt;th&lt;/sup&gt; month</td>
<td>1&lt;sup&gt;st&lt;/sup&gt; year</td>
</tr>
<tr>
<td>--------------------------</td>
<td>-----------------------</td>
<td>----------------------</td>
<td>----------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td><strong>Role limitations due to emotional problems (RE)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 1&lt;sup&gt;st&lt;/sup&gt; month</td>
<td>72.34 (39.89)</td>
<td>71.07 (40.76)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 3&lt;sup&gt;rd&lt;/sup&gt; month</td>
<td>84.31 (33.36)</td>
<td>84.76 (29.40)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 6&lt;sup&gt;th&lt;/sup&gt; month</td>
<td>86.81 (28.83)</td>
<td>82.05 (33.76)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 1&lt;sup&gt;st&lt;/sup&gt; year</td>
<td>92.89 (19.98)</td>
<td>87.36 (28.35)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>General mental health (MH)</strong></td>
<td></td>
<td></td>
<td></td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>At 1&lt;sup&gt;st&lt;/sup&gt; month</td>
<td>61.44 (24.85)</td>
<td>54.06 (21.39)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 3&lt;sup&gt;rd&lt;/sup&gt; month</td>
<td>64.05 (21.25)</td>
<td>56.75 (20.55)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 6&lt;sup&gt;th&lt;/sup&gt; month</td>
<td>67.86 (20.28)</td>
<td>58.32 (20.09)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 1&lt;sup&gt;st&lt;/sup&gt; year</td>
<td>64.52 (19.03)</td>
<td>55.81 (18.70)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Physical functioning (PF)</strong></td>
<td></td>
<td></td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>At 1&lt;sup&gt;st&lt;/sup&gt; month</td>
<td>26.13 (22.42)</td>
<td>19.80 (21.32)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 3&lt;sup&gt;rd&lt;/sup&gt; month</td>
<td>49.12 (29.57)</td>
<td>29.12 (24.56)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 6&lt;sup&gt;th&lt;/sup&gt; month</td>
<td>60.30 (28.02)</td>
<td>35.00 (24.58)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 1&lt;sup&gt;st&lt;/sup&gt; year</td>
<td>62.19 (28.08)</td>
<td>43.50 (28.47)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Role limitations due to physical health problems (RP)</strong></td>
<td></td>
<td></td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>At 1&lt;sup&gt;st&lt;/sup&gt; month</td>
<td>36.76 (38.68)</td>
<td>22.13 (38.12)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 3&lt;sup&gt;rd&lt;/sup&gt; month</td>
<td>54.62 (40.58)</td>
<td>30.38 (36.28)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 6&lt;sup&gt;th&lt;/sup&gt; month</td>
<td>69.59 (37.33)</td>
<td>45.76 (40.78)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 1&lt;sup&gt;st&lt;/sup&gt; year</td>
<td>82.96 (28.96)</td>
<td>54.23 (40.04)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p* values were obtained from GEE models, after controlling for time.
Enrolment

Patients with hip fracture (n=935)

Excluded (n=773)
- Did not meet inclusion criteria (n=590)
- Refused to participate (n=183)

Randomized (n=162)

Allocation

Allocated to intervention program group (n=80)

1-month follow-up (n=71)
- Dropped out (n=9)
- Died (n=1)
- Refused to participate (n=8)

3-month follow-up (n=67)
- Dropped out (n=4)
- Refused to participate (n=4)

6-month follow-up (n=65)
- Dropped out (n=2)
- Refused to participate (n=2)

1-year follow-up (n=60)
- Dropped out (n=5)
- Died (n=3)
- Refused to participate (n=2)

Allocated to control group (n=82)

1-month follow-up (n=76)
- Dropped out (n=6)
- Refused to participate (n=6)

3-month follow-up (n=70)
- Dropped out (n=6)
- Died (n=3)
- Refused to participate (n=3)

6-month follow-up (n=68)
- Dropped out (n=2)
- Refused to participate (n=1)
- Died (n=1)

1-year follow-up (n=62)
- Dropped out (n=6)
- Died (n=2)
- Refused to participate (n=4)
Figure 2
Figure 3

![Graph showing the mean of RP (Response to Pain) over time after hospital discharge for experimental and control groups.](image)

- Experimental group
- Control group

- Time after hospital discharge (months)
- RP mean

- $P < .001$
- $\beta = 22.66$