Chapter 7.

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

Abstract

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

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

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

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

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

7.1 Introduction

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

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

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

The present article addresses the following research questions:

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

7.2 Methods

Data Collection Procedures

Between October 1996 and October 1998, consecutive patients from a university hospital and a general hospital in Rotterdam, the Netherlands, were recruited. The patients were aged 65 years and older, and were admitted with a recent hip fracture. Excluded were patients with a hip fracture because of metastatic cancer or multitrauma. Of the eligible patients, 18% refused to participate. There were no clear differences in age and sex between participants (208 patients) and non-participants (46 patients). More non-participants lived at home before admission (85% versus 60%) but residence at 4 months or mortality did not differ from participants. Two groups of patients were consecutively included: first a group of patients discharged from the hospital with conventional arrangements (102 patients with an average hospital stay of 26 days) and second, a group of patients for which an early discharge policy was followed (106 patients with an average hospital stay of 13 days).

The same investigator interviewed and evaluated all patients using a standard protocol at 1 week, 1 month and 4 months after admission to the hospital. Functional status was assessed by the Rehabilitation Activities Profile (RAP)[13] and the Barthel Index (BI).[14] The latter was not used for the first 41 cases due to logistic problems. RAP and BI were also estimated retrospectively for the pre-fracture period by asking patient or proxy at 1 week after hospital admission to complete the questionnaires concerning the situation before fracture.

Generic health-related quality of life was evaluated by the Nottingham Health Profile (NHP)[15] and the Dartmouth Coop Functional Health Assessment Charts revised by the World Organization of National Colleges, Academies and Academic Associations of General Practitioners and Family Physicians (WONCA).[16] We used existing standard Dutch versions of the original instruments. In cases of severe cognitive impairment or physical disablement, a proxy was interviewed. A complete follow-up was therefore achieved.

Instruments

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

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

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

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

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

Qualitative Analysis of Questionnaire Content.

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

Quantitative Analysis of Questionnaire Content.

The following analyses were performed:

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

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

Analysis of predictive factors

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

7.3 Results

Patient Characteristics

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

Recovery of Function and Quality of Life

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

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

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

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

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

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

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

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

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

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

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

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

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

Comparison of instruments

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

7.4 Discussion

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

Recovery of pre-fracture health status

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

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

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

Comparison of RAP and BI

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

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

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

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

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

Comparison of NHP and COOP/WONCA charts

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

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

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

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

dimensions. When the RAP or the BI is used, the assessment of functional status by generic quality of life instruments has no added value. However, the generic quality of life instruments keep their value in the comparison of overall health status of patient groups with different diagnoses.

In our study, 5 of the 6 scales of the NHP showed adequate internal consistency (Cronbach's alpha from 0.70 to 0.80). With the exception of the social isolation scale, this is in agreement with the reported reliability in a group of Dutch patients in a general group practice. [6] Moreover, the NHP scales detected expected changes in health status over time and correlated well with counterparts in the other studied instruments, indicating adequate construct validity.

The pictograms of the COOP/WONCA charts did not make cognitively impaired patients able to answer the questions better than with the NHP. The NHP covered a wider range (emotion, pain, energy, sleep) of psychological health dimensions than the COOP/WONCA charts (only feelings). We could not assess the reliability of the COOP/WONCA charts because of their one item representation. The NHP detected larger changes in pain sensation than the COOP chart Pain probably because the NHP relates the pain to mobility. The COOP chart Overall Health seemed indeed to assess a general concept of health expressed by a good correlation with the RAP, the BI, and nearly all dimensions of the NHP. In evaluating the consequences of hip fracture, however, it does not give much additional information.

In conclusion, we recommend the use of the NHP in the follow-up of hip fracture patients in regard to the psychological dimension of health-related quality of life.

Social health

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

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

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

*: Spearman correlation coefficient >0.70

Limitation of study design

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

7.5 Conclusion

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

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Appendix

1.Rehabilitation Activities Profile

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

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

problem : none(0);light (1); moderate (2); severe (3)

* change : none (0); small (1); large (2); very large (3)

2. Barthel Index

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

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

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

Physical Fitness

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

Feelings

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

Daily Activities

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

Pain

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

Overall health

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

Change in health

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

Social Activities

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

4.Nottingham Health Profile

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

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

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

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

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

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

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