ORIGINAL ARTICLE

Determinants of health-related quality of life in older patients after acute hospitalisation

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ABSTRACT

Background: To assess the association between demographics, comorbidity, geriatric conditions, and three health-related quality of life (HRQOL) outcomes one year after acute hospitalisation in older patients.

Methods: A prospective cohort study conducted between 2006 and 2009 with one-year follow-up in 11 medical wards at two university hospitals and one teaching hospital in the Netherlands. Participants were 473 patients of 65 years and older, acutely hospitalised for more than 48 hours.

Demographics, Charlson Comorbidity Index (CCI), and data on 18 geriatric conditions were collected at baseline. At baseline and 12 months post-admission, the EuroQol-5D was administered. Based on a population-derived valuation (Dutch EuroQol-5D tariff), utilities (range -0.38–1.00) were determined, which were used to calculate quality-adjusted life years (QALY) over one year (max QALY score 1). The EuroQol-5D visual analogue scale (VAS) (range 0-100) was also used. Linear regression analyses were performed to explore the association between the independent variables and the three HRQOL outcomes.

Results: CCI was most consistently significantly associated with HRQOL outcomes: Beta -0.05 (95% CI -0.06–-0.03) for utility, -0.04 (95% CI -0.05-0.03) for QALY, -1.03 (95% CI -2.06-0.00) for VAS, $p < 0.001$, < 0.001, 0.05, respectively). Baseline utility was significantly associated with one-year utility (beta 0.25, 95% CI 0.11-0.39, $p < 0.01$) and QALY (beta 0.31, 95% CI 0.17-0.45, $p < 0.001$). The number of geriatric conditions at baseline was more strongly associated with one-year utility than any individual geriatric condition.

Conclusion: Less comorbidity, better utility and less geriatric conditions at baseline were associated with better HRQOL one year after acute hospitalisation in older patients.

KEYWORDS

Aged, aged 80 and over, geriatric assessment, HRQOL, quality of life

INTRODUCTION

In older patients, the acute illness leading to hospitalisation is often accompanied by geriatric conditions such as impairment in activities of daily living, cognitive impairment, delirium, falls, and malnutrition.[1] Moreover, during hospitalisation older people often experience increased dependence.[2] The prognosis of patients aged 65 years and older after hospitalisation is poor: three months after acute admission, 20-30% of them have died, and of those still alive, 30% have persistent functional impairment.[1,3]

Health-related quality of life (HRQOL) is an important indicator of a patient's well-being. HRQOL can be defined in multiple ways, but there is agreement that HRQOL is the functional effect of a medical condition and/or its treatment upon a patient's physical, social, and emotional well-being (quality of life).[4,5] Research has shown that factors associated with HRQOL in older adults can be divided into three categories. First, demographic factors such as higher age, female sex and lower education levels are associated with decreased HRQOL.[6] Secondly, factors related to a patient's disease burden, such as specific diseases and therapy,[4-8] higher self-rated disease severity[7] and a higher number of chronic conditions[9] are associated with decreased HRQOL. Thirdly, geriatric conditions including polypharmacy,[10] falls,[11] cognitive and functional impairment,[8,10,12] are associated with decreased HRQOL in community-dwelling older adults.

However, it is unclear to what extent these factors are associated with HRQOL in acutely admitted older hospital patients. Therefore, we aimed to explore the association between these factors and HRQOL outcomes (expressed in utility, visual analogue scale (VAS) and quality-adjusted life years (QALY)) in older patients, one year after acute hospitalisation.

METHODS

Design and setting

This study was part of a multicentre prospective cohort study of acutely admitted older patients, the DEFENCE study (Develop strategies Enabling Frail Elderly New Complications to Evade). The methods of this study (design and setting, patients, data collection and follow-up) were reported in detail by Buurman *et al.*[13] Briefly, DEFENCE was conducted between 2006 and 2009 in three hospitals in the Netherlands: the Academic Medical Center in Amsterdam; the University Medical Center Utrecht in Utrecht; and the Spaarne Hospital in Hoofddorp. Patients were recruited from general medical wards. All hospitals had a geriatric consultation team. The medical ethics committees of all hospitals approved the study.

Study participants

All consecutive patients aged 65 years and older, who were acutely admitted to one of the participating wards and hospitalised for at least 48 hours, were enrolled (n = 639). The analytic sample for this substudy included patients with a Mini Mental State Examination (MMSE) score of 16 and higher, because people with lower scores were considered unable to complete the EuroQol-5D (EQ-5D).[14,15] Of the 639 DEFENCE participants, 104 (13.7%) had an MMSE score below 16 and were excluded from this substudy. For an extra 62 (9.7%) DEFENCE participants (complete) EQ-5D scores were not available at baseline. In 12.9%, this was due to a delirium at admission or fatigue at the end of the Comprehensive Geriatric Assessment (CGA). In 87.1% this was due to the DEFENCE protocol that stated that a full CGA was not to be administered on odd days. Thus, the total analytical sample included 473 patients.

Data collection

After written informed consent was obtained, trained geriatric research nurses administered the CGA to the patient and the patient's primary informal caregiver within 48 hours of admission. Data were also extracted from the medical records. Follow-up data were collected at three and 12 months after hospital admission. For follow-up, the municipal data registry was checked to determine whether participants were still alive. Subsequently, follow-up information was collected from living participants and their proxy by telephone. When applicable, we tried to retrieve the date of death from the hospital registry, municipal data registry and/or proxy.

Health-related quality of life outcomes

We evaluated three HRQOL outcomes based on the EQ-5D:[15] utility, QALY, and VAS score one year after admission. The research nurse administered the EQ-5D to the patient during the interview at baseline (face-to-face) and three and twelve months later by telephone (both based on self-report). During the assessment by telephone, the research nurse reminded the patient of the VAS as it was assessed during the hospitalisation and asked whether they still remembered it. Before administering the VAS, they explained it to all the patients and in case of doubt, the explanation was repeated. In the course record form (CRF), there was space to make remarks about any irregularities. When checking these remarks, it was clear that some patients did not want to, or could not answer the VAS. If this was the case, their answer was left out.

The EQ-5D is the most widely used preference-based generic HRQOL instrument and it has well-established psychometric properties.[15] It has also been validated in patients with mild-moderate dementia.[16] The EQ-5D includes five dimensions: mobility, self-care, usual activities, pain/discomfort and anxiety/depression. The respondent answers each of the EQ-5D's five dimensions with one of three possible responses: 'no problems', 'some problems' or 'severe problems'. The unique set of five responses defines a health state. The 243 (3^5) possible health states are weighted using a population-derived valuation from a sample of the Dutch general population known as the Dutch EQ-5D tariff. These values or utilities reflect the relative desirability of the health state and are measured on a scale where 1 refers to full health and 0 refers to death. Some health states are regarded as being worse than death, resulting in negative utilities with a minimum of -0.38.[17]

QALY is the product of a health state utility multiplied by the time the patient spent in this health state and then summed up to calculate the QALY.[18] An advantage of QALY is that the deceased participants could remain included in the analyses. For patients who died, we calculated QALY by using the retrieved dates of death and an utility score of 0 from that date on.

The VAS records the respondent's self-rated health on a scale from 0-100, where '100' refers to the best possible health state, and '0' to the worst. Respondents draw a line to the scale's point that best indicates their health state on that specific day.

Predictor variables

Predictor variables were factors previously found to be associated with decreased HRQOL, and variables that

we considered to be of clinical importance.[6-12,19] We divided these factors into three categories: 1) demographic characteristics, 2) comorbidity and 3) geriatric conditions.

Demographic characteristics

We extracted patients' age and sex at baseline from the medical records. During the interview, patients were asked about their living situation, ethnicity and education (in years).

Comorbidity

Comorbidity was retrieved from the discharge letter and systematically scored with the Charlson Comorbidity Index (CCI).[20] Scores range from 0 to 31, with higher scores indicating more and/or more severe comorbidity.

Geriatric conditions

Table 1 shows geriatric conditions as assessed during the systematic CGA, including internationally applied measurement instruments, score ranges and the cut-off scores used. Because a previous study suggested that the total number of geriatric conditions might have an impact on functional impairment,[21] we also created a variable 'number of geriatric conditions' by counting all geriatric conditions at baseline for individual patients.

Table 1. *Content of the comprehensive geriatric assessment*

Geriatric condition	Measurement instrument	Range of scores	Cut-off score
Somatic domain			
Number of medications	Counting the number of different medications	Continuous	≥5 indicates polypharmacy
Malnutrition	Short Nutritional Assessment Questionnaire (SNAQ)[35]	0-7	≥2 malnourished
Obesity	Body mass index = weight/length^2	13-64	> 30 indicates severe overweight
Pain	Visual analogue scale	0-10	≥ 4
Fall risk	Have you fallen two or more times in the past three months?	Yes or no	Yes
Presence of a pressure ulcer	Prevention and Pressure Ulcer Risk Score Evaluation (prePURSE)[36]	0-46	≥ 20
Indwelling urinary catheter	Presence of a catheter at admission	Yes or no	Yes
Constipation	Self-report of constipation at admission	Yes or no	Yes
Psychological domain			
Cognitive impairment	Mini-Mental State Examination (MMSE)[15]	0-30	≤ 24
Pre-existent cognitive impairment	Informant Questionnaire COgnitive DEcline – Short Form (IQCODE-SF)[37-38]	16 items, 1 – 5	≥ 63/80
Depressive symptoms	GDS-2, Geriatric Depression Scale-2[39]: two questions: 1. Have you felt sad, depressed or hopeless in the past month? 2. Have you lost interest in daily activities?	0-2	2
Delirium	Confusion Assessment Method[40]	0-4	Item 1 and 2, and item 3 and/or 4 are present
Functional domain			
Premorbid ADL and IADL functioning	Katz ADL index score and modified Katz ADL index score[41]	0-15	≥ 1
Vision impairment	Do you have problems with your vision, regardless of the use of glasses?	Yes or no	Yes
Hearing impairment	Do you have problems with hearing, regardless of the use of a hearing aid?	Yes or no	Yes
Mobility difficulty	Are you using a walking device?	Yes or no	Yes
Incontinence	Self-report of incontinence for urine or faeces at admission	Yes or no	Yes
Social domain			
High perceived burden of caregivers	Experienced burden of Informal Care (EDIZ)[42]	0-9	≥ 4

STATISTICAL ANALYSIS

Baseline characteristics

Demographic characteristics, comorbidity, prevalence and total of geriatric conditions and HRQOL scores were summarised using descriptive statistics. Ethnicity was dichotomised because there were few patients of non-Caucasian ethnicity (Surinamese, Moroccan or other). We compared patients who survived and those who died during the study using independent t-tests for continuous variables and chi-square tests for categorical and dichotomous variables.

EQ-5D domains

Domain-specific level of functioning according to the EQ-5D at baseline was summarised descriptively. We compared patient-reported problems in each domain of the EQ-5D between patients who survived and those who died during the study using chi-square tests.

Association of predictor variables with HRQOL at one year

The predictor variables were chosen prior to analyses. We pre-specified that if the correlation between two variables was more than 0.80, the least relevant one would be excluded to avoid collinearity. Univariate linear regression analysis and multivariable regression analysis (backward elimination approach) were used to determine the relationship between the baseline predictor variables and HRQOL outcomes at one year. We included variables with $p < 0.20$ from the univariate analysis, in the multivariable regression analyses and included utility at baseline as a covariate in all analyses. In the multivariable linear regression model, we set statistical significance at a two-sided p value of 0.20. The residuals versus predicted values were plotted to check the model fit. Sensitivity analyses were done with somatic diagnosis at admission and with specified comorbidity for all HRQOL outcomes (data available upon request). We performed all analyses using the Statistical Package for the Social Sciences (SPSS) version 19.0 (SPSS Inc, Chicago, IL).

RESULTS

Baseline characteristics

We included 473 patients in this HRQOL study. *Table 2* presents the baseline characteristics of the research population. Within one year, 146 patients had died (30%). Among the deceased patients there were more men compared with those who survived (54.1 vs. 41.3%, $p = 0.01$). Compared with survivors, the deceased patients demonstrated a higher frequency of malnutrition (63.3 vs. 40.8%, $p < 0.001$), delirium (13.1 vs. 6.2%, $p = 0.01$), a higher mean CCI (5.1 vs. 3.2, $p < 0.001$) and a higher number of geriatric conditions at baseline (6.1 ± 2.5 vs. 5.1 ± 2.4, $p < 0.001$). Among the deceased, more patients had diagnosed malignancies (18.6 vs. 4.6%) and less had infectious diseases (26.4 vs. 42.3%), $p < 0.001$. Baseline mean utility (0.701 vs. 0.575) and VAS scores (56.5 vs. 63.0) were significantly lower for deceased compared with survivors ($p < 0.001$).

EQ-5D domains

Figure 1 shows the EQ-5D domains at baseline. Participants who survived were more likely to score 'no problems' and less likely to score 'moderate' or 'severe problems' in all domains, except for the domain 'anxiety/depression', where survivors more often scored 'severe problems'.

Association of predictor variables with HRQOL at 12 months

No collinearity between predictor variables was detected, with all correlations being well below 0.80 (range 0.15 to 0.67). *Table 3* shows the results of the univariable regression models. Variables printed in bold were included in the multivariable analyses. In the multivariable analyses (*table 4*), Caucasian ethnicity, higher malnutrition score, higher CCI and number of geriatric conditions were associated with lower one-year utility. Obesity and higher baseline utility were associated with higher one-year utility. The final model explained 33.4% of the variance.

For QALY, higher malnutrition score, higher delirium and depression scores, impaired hearing and worse premorbid functioning were associated with lower QALY. Higher baseline utility was associated with higher QALY. This final model accounted for 42.4% of the variance.

More medication, impaired hearing, higher CCI and lower VAS score at baseline were significantly associated with a lower VAS score at one-year follow-up. For the VAS score at one year, explained variance was 15.9%.

Sensitivity analyses showed similar results. From these analyses it became clear that CCI was a good measure for comorbidity. Introducing individual comorbid diseases did not change the models, nor did the different reasons for admission. The residuals versus predicted values plotted for utility and VAS at one year and QALY looked normal.

DISCUSSION

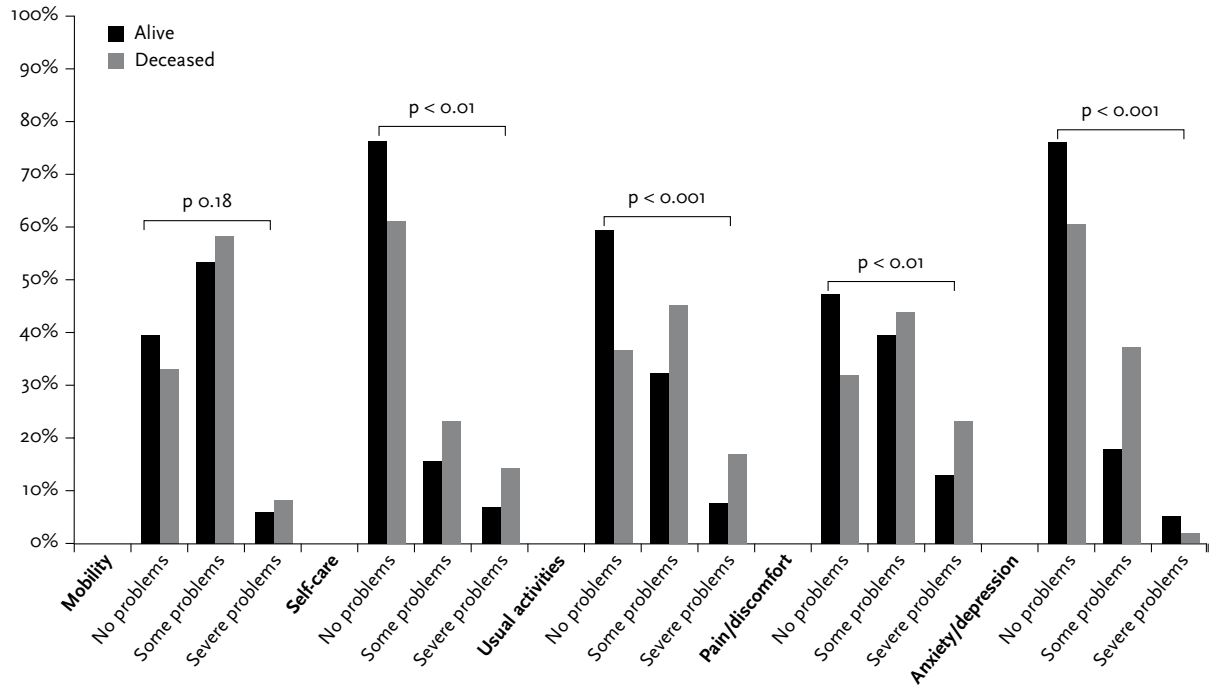
This multicentre prospective cohort study demonstrates that, in acutely admitted older patients, utility and VAS score at baseline were significantly higher for patients who survived than for patients who died during one year of follow-up. Higher baseline utility, reflecting better HRQOL, was associated with higher one-year utility and QALY. Higher CCI, malnutrition and pressure ulcers were associated with lower HRQOL outcomes at one year. A higher number of geriatric conditions at baseline was

Table 2. *Baseline description of acutely admitted older patients with utility score at baseline (n = 473)*

Variable	Missing values n (%)	All participants n = 473	Surviving participants n = 327	Deceased participants n = 146	P*
Demographic					
Age, mean (SD)	0 (0.0)	77.8 (7.6)	77.7 (7.4)	78.1 (7.9)	0.60
Female sex	0 (0.0)	54.8	58.7	45.9	0.01
Ethnicity: Caucasian	1 (0.2)	94.1	92.6	97.9	0.02
Social status: single	1 (0.2)	48.5	50.9	43.2	0.14
Living situation: independent	1 (0.2)	88.3	89.3	86.3	0.36
Years of education, mean (SD)	7 (1.5)	10.1 (4.0)	10.2 (4.0)	10.1 (3.8)	0.79
Somatic domain					
No. medications, mean (SD)	2 (0.4)	5.9 (4.2)	5.8 (4.2)	6.0 (4.0)	0.52
Malnutrition†	1 (0.2)	47.7	40.8	63.3	< 0.001
Obesity‡	40 (8.5)	13.6	17.4	5.2	< 0.001
Pain§	1 (0.2)	43.0	43.4	42.1	0.78
Fall risk, ≥ 2 falls in last 3 months	23 (4.7)	19.8	17.7	24.5	0.10
Presence of a pressure ulcer‖	7 (1.5)	13.7	13.0	15.4	0.49
Indwelling urinary catheter	3 (0.6)	19.8	18.4	22.9	0.26
Constipation	4 (0.8)	18.8	17.3	22.1	0.25
Psychological domain					
Cognitive impairment at admission¶	0 (0.0)	30.2	29.4	32.2	0.54
Depressive symptoms**	2 (0.4)	21.2	18.7	26.9	0.05
Delirium††	5 (1.1)	8.3	6.2	13.1	0.01
Functional domain					
Functional impairment‡‡	0 (0.0)	85.4	83.8	89.0	0.14
Impaired vision	15 (3.2)	20.3	20.7	19.6	0.80
Impaired hearing	34 (7.2)	18.0	16.2	22.1	0.14
Use of walking device	0	56.2	52.9	63.7	0.04
Incontinence	17 (3.6)	19.5	19.0	20.6	0.70
Social domain					
High burden informal care giver§§	75 (15.6)	38.2	33.7	48.0	0.01
Diagnosis at admission, n (%)	26 (5.5)				< 0.001
Cardiovascular disease		8.9	8.1	10.7	
Disease of the digestive system		22.6	23.1	21.4	
Infectious disease		37.4	42.3	26.4	
Malignancy		8.9	4.6	18.6	
Water and electrolyte disturbance		7.2	7.5	6.4	
Other diagnosis at admission		15.0	14.3	16.4	
Comorbidity index‖‖, mean (SD)	45 (9.5)	3.8 (2.5)	3.2 (2.1)	5.1 (2.7)	< 0.001
Number of geriatric conditions¶¶, mean (SD)	0 (0.0)	5.4 (2.5)	5.1 (2.4)	6.1 (2.5)	< 0.001
Utility at baseline, mean (SD)	0 (0.0)		0.70 (0.29)	0.58 (0.32)	< 0.001
VAS at baseline, mean (SD)	8 (1.7)	61.0 (18.4)	63.0 (18.5)	56.5 (17.6)	< 0.001

Values are percentages unless stated otherwise.
*p: independent t-test for continuous variables, chi-square for categorical variables. †Short Nutritional Assessment Questionnaire (SNAQ), score 2-7; ‡Body Mass Index (BMI)= weight/length^2 ≥ 30; §Visual analogue scale for pain, score ≥ 4; ‖Prevention and Pressure Ulcer Risk Score Evaluation (prePURSE), score ≥ 20; ¶Mini Mental State Examination (MMSE), ≤ 24; **Geriatric Depression Scale-2, 2 questions, depressive symptoms present when both positive; ††Confusion Assessment Method, score 3 or 4; ‡‡ (modified) KATZ-ADL index, score ≥ 1; §§Experienced Burden of Informal Care (EDIZ), score ≥ 4; ‖‖Charlson comorbidity index score, higher score indicates more and/or more severe comorbidity; ¶¶Total number of geriatric conditions, 0-18, a higher score indicates more geriatric conditions present.

Figure 1. *EQ5D domain-specific responses at baseline for patients who survived (n = 327) and for patients who died during the study (n = 146)*



Panel shows percentages of patient-reported severity of problems at EQ-5D domains at baseline. Black bars represent the 327 patients who survived during the study; grey bars represent the 146 patients who died within one year.

associated with lower one-year utility, and this association was stronger than for any individual geriatric condition. More depressive symptoms, higher delirium score and worse premorbid functioning were associated with worse QALY. Our results suggest that besides the acute illness and comorbidity, geriatric conditions highly influence HRQOL one year after admission, and that they should be assessed at hospital admission.

In our study, baseline EQ-5D domain scores, mean utility and VAS scores were lower than in European and Dutch norm-population studies.[6,22] This confirms that our research population forms a very vulnerable patient group, which is also reflected by the high number of geriatric conditions at baseline and by the high mortality rate after one year. At baseline, deceased patients had a higher number of geriatric conditions, higher CCI and worse scores on most individual EQ-5D domains than patients who survived. This is in agreement with previous studies evaluating older patients.[23-25] A hypothesis for the fact that surviving patients more often scored 'severe problems' on the 'anxiety/depression' domain at baseline, might be that their better cognitive function at admission (as measured by MMSE), may have resulted in more awareness of their situation, and thus anxiety.

To our knowledge, the association between a higher number of geriatric conditions at baseline and lower one-year HRQOL expressed in utility has not been demonstrated before in acutely hospitalised patients, although prior research confirmed the influence of individual geriatric conditions on mortality,[3] and thus indirectly on QALY. Some demographic variables, which were previously shown to be associated with HRQOL, were not associated with HRQOL in our multivariable analyses. This might be due to the many geriatric conditions and the high comorbidity rate in our population, which may overrule the effects of these variables. Patients who were obese were more likely to survive and they had higher utility scores at one year than patients who were not obese. This may be an example of the obesity paradox, which describes the unexpected phenomenon that in some cases overweight and obese patients have better outcomes and less mortality compared with their normal-weight counterparts. For patients older than 70 years, a protective effect of overweight and obesity has been observed before.[26-28]

Explained variance of the final models for utility and QALY were good. This means that the geriatric conditions, CCI and lower utility at baseline explained 33.4 and 42.4%,

Table 3. *Univariable analyses for utility, VAS score and QALY at one year*

	Utility at one year (n = 423)			VAS score at one year (n = 260)			QALY at one year (n = 380)		
Variables	**B**	**95% CI**	**P**	**B**	**95% CI**	**P**	**B**	**95% CI**	**P**
Demographic									
Age	0.00	-0.01 – 0.00	0.48	-0.05	-0.30 – 0.19	0.67	-0.00	-0.01 -0.00	**0.08**
Male sex	0.11	0.05 – 0.18	**< 0.01**	1.68	-1.97 – 5.33	0.37	-0.02	-0.09 – 0.06	0.64
Caucasian ethnicity	-0.10	-0.24 – 0.03	**0.13**	1.68	-5.53 – 8.89	0.65	0.04	-0.03 – 0.12	0.23
Social status: single	0.08	0.02 – 0.15	**0.01**	-1.57	-5.13 – 2.00	0.39	-0.01	-0.07 – 0.06	0.87
Living independently	0.16	0.05 – 0.28	**0.01**	6.22	0.22 – 12.22	**0.04**	-0.05	-0.09 – -0.01	**0.01**
Education, years	0.01	0.00 – 0.01	**0.26**	0.03	-0.42 – 0.47	0.91	0.01	0.00 – 0.02	**0.10**
Somatic domain									
No. medications	-0.02	-0.03 – -0.01	**< 0.01**	-0.80	-1.40 – -0.20	**0.01**	-0.01	-0.02 – 0.00	**0.10**
Malnutrition score†	-0.02	-0.03 – 0.00	**0.06**	-0.89	-1.78 – 0.01	**0.05**	-0.05	-0.06 – -0.03	**< 0.001**
Obesity‡	-0.09	-0.18 – -0.01	**0.04**	-2.43	-7.12 – 2.26	0.31	-0.06	-0.18 – 0.06	0.30
Pain score§	-0.03	-0.04 – -0.02	**< 0.001**	-0.83	-1.46 – 0.19	**0.01**	-0.02	-0.04 – -0.01	**< 0.01**
Fall risk	-0.08	-0.17 – 0.02	**0.11**	-4.63	-9.36 – 0.38	**0.07**	-0.14	-0.23 – -0.04	**< 0.01**
Pressure ulcer score‖	-0.01	-0.02 – 0.00	**0.01**	-0.26	-0.59 – 0.07	**0.12**	-0.01	-0.02 – -0.01	**< 0.001**
Indwelling urinary catheter	-0.07	-0.17 – 0.03	**0.15**	-2.22	-7.02 – 2.58	0.36	-0.04	-0.12 – 0.04	0.36
Constipation	-0.07	-0.16 – 0.02	**0.10**	-0.84	-5.59 – 3.90	0.73	-0.08	-0.17 – 0.01	**0.09**
Psychological domain									
MMSE score¶	0.01	0.00 – 0.02	**0.05**	-0.17	-0.70 – 0.37	0.55	0.02	0.01 – 0.03	**< 0.001**
Depressive symptoms**	-0.09	-0.13 – -0.05	**< 0.001**	-3.45	-5.77 – -1.12	**<0.01**	-0.11	-0.15 – -0.06	**< 0.001**
Delirium, CAM score††	-0.03	-0.08 – 0.01	**0.18**	0.82	-1.59 – 3.29	0.50	-0.08	-0.13 – -0.03	**< 0.01**
Functional domain									
Premorbid functioning‡‡	-0.03	-0.04 – -0.02	**< 0.001**	-0.79	-1.33 – -0.25	**<0.01**	-0.04	-0.05 – -0.03	**< 0.001**
Impaired vision	-0.11	-0.19 – -0.03	**0.01**	-3.73	-8.04 – 0.58	**0.09**	-0.06	-0.14 – 0.03	0.22
Impaired hearing	-0.02	-0.11 – 0.08	0.69	-0.35	-8.58 – 1.53	**0.17**	-0.10	-0.19 – 0.00	**0.05**
Use of walking device	-0.08	-0.11 – -0.05	**< 0.001**	-2.04	-3.80 – -0.27	**0.02**	-0.07	-0.10 – -0.05	**< 0.001**
Incontinence	-0.07	-0.16 – 0.02	**0.11**	-1.62	-3.19 – 6.44	0.51	-0.08	-0.18 – 0.01	**0.08**
Social domain									
Burden care giver§§	-0.02	-0.03 – -0.01	**< 0.01**	-0.77	-1.43 – -1.12	**0.02**	-0.04	-0.05 – -0.02	**< 0.001**
Comorbidity index‖‖	-0.06	-0.07 – -0.04	**< 0.001**	-1.05	-1.99 – -0.12	**0.03**	-0.05	-0.06 – -0.03	**< 0.001**
No. geriatric conditions¶¶	-0.05	-0.07 – -0.04	**< 0.001**	-1.74	-2.24 – -1.03	**<0.001**	-0.06	-0.08 – -0.05	**< 0.001**
Utility baseline	0.39	0.28 – 0.50	**< 0.001**	10.81	4.76 – 16.95	**<0.01**	0.55	0.44 – 0.65	**< 0.001**
VAS baseline	0.00	0.00 – 0.01	**< 0.001**	0.24	0.14 – 0.34	**<0.001**	0.01	0.00 – 0.01	**< 0.001**

CI = confidence interval; †Short Nutritional Assessment Questionnaire (SNAQ), score 2-7; ‡Body Mass Index (BMI)= weight/length² ≥ 30; §Visual analogue scale for pain, score ≥ 4; ‖Prevention and Pressure Ulcer Risk Score Evaluation (prePURSE), score ≥ 20; ¶Mini Mental State Examination (MMSE), ≤ 24; **Geriatric Depression Scale-2, 2 questions, depressive symptoms present when both positive; ††Confusion Assessment Method, score 3 or 4; ‡‡(modified) KATZ-ADL index, score ≥ 1; §§Experienced Burden of Informal Care (EDIZ), score ≥ 4; ‖‖Charlson comorbidity index score, higher score indicates more and/or more severe comorbidity; ¶¶Total number of geriatric conditions, 0-18, a higher score indicates more geriatric conditions present.

Table 4. *Multivariable analyses for utility, VAS score and QALY at one year*

	Utility at one year (n = 423)			VAS score at one year (n = 260)			QALY at one year (n = 380)		
Variables	**B**	**95% CI**	**P < 0.20**	**B**	**95% CI**	**P < 0.20**	**B**	**95% CI**	**P < 0.20**
Demographic									
Age	-	-	-				-	-	-
Male sex	-	-	-						
Caucasian ethnicity	-0.24	-0.40 – -0.08	< 0.01						
Social status: single	-	-	-						
Living independently	-	-	-	-	-	-	-	-	-
Education, years.							-	-	-
Somatic domain									
No. medications	-	-	-	-0.59	-1.06 – -0.11	0.02	-	-	-
Malnutrition score†	-0.02	-0.04 – 0.00	0.08	-	-	-	-0.02	-0.04 – -0.01	0.01
Obesity‡	0.11	0.01 – 0.22	0.04						
Pain score§	-	-	-	-	-	-	-0.01	-0.02 – 0.00	0.05
Fall risk	-	-	-	-	-	-	-	-	-
Pressure ulcer score‖	-0.01	-0.02 – 0.00	0.05	-	-	-	-0.01	-0.02 – 0.00	0.01
Indwelling urinary catheter	0.09	-0.01 – 0.20	0.08						
Constipation	-	-	-				-	-	-
Psychological domain									
MMSE score¶	-	-	-				-	-	-
Depressive symptoms**	-	-	-	-	-	-	-0.03	-0.07 – 0.01	0.20
Delirium, CAM score††	-	-	-				-0.05	-0.10 – -0.01	0.02
Functional domain									
Premorbid functioning‡‡	-	-	-	-	-	-	-0.02	-0.03 – -0.01	< 0.01
Impaired vision				-	-	-			
Impaired hearing	-	-	-	-3.51	-8.68 – 1.66	0.18	-0.09	-0.17 – -0.01	0.03
Use of walking device	-	-	-	-	-	-	-	-	-
Incontinence	-	-	-				-	-	-
Social domain									
Burden care giver§§	-	-	-	-	-	-	-	-	-
Comorbidity index‖‖	-0.05	-0.06 – -0.03	< 0.001	-1.03	-2.06 – 0.00	0.05	-0.04	-0.05 – -0.03	< 0.001
No. geriatric conditions¶¶	-0.03	-0.05 – -0.01	< 0.01	-	-	-	-	-	-
Utility baseline	0.25	0.11 – 0.39	< 0.01	3.58	-3.70 – 10.86	0.33	0.31	0.17 – 0.45	< 0.001
VAS baseline				0.19	0.08 – 0.30	< 0.01	-	-	-
Variance explained R2	33.4%	15.9%	42.4%						

CI = confidence interval; †Short Nutritional Assessment Questionnaire (SNAQ), score 2-7; ‡Body Mass Index (BMI)= weight/length² ≥30; §Visual analogue scale for pain, score ≥4; ‖Prevention and Pressure Ulcer Risk Score Evaluation (prePURSE), score ≥20; ¶Mini Mental State Examination (MMSE), ≤ 24; **Geriatric Depression Scale-2, 2 questions, depressive symptoms present when both positive; ††Confusion Assessment Method, score 3 or 4; ‡‡(modified) KATZ-ADL index, score ≥1; §§Experienced Burden of Informal Care (EDIZ), score ≥4; ‖‖Charlson comorbidity index score, higher score indicates more and/or more severe comorbidity; ¶¶Total number of geriatric conditions, 0-18, a higher score indicates more geriatric conditions present.

respectively, of the variance and contributed to lower HRQOL. Because many of the geriatric conditions assessed in our study can be adequately treated during and after admission, it is of clinical importance to assess the geriatric conditions and other predictor variables included in our models upon acute admission of a patient of 65 years and older. A systematic approach in detecting these geriatric conditions by means of a CGA might significantly improve the patient's HRQOL. For the VAS score, the explained variance was lower. This might be because it is the patient's own reflection on her or his HRQOL, which is mainly influenced by individual coping style and adaptation, and not so much by the objective CGA variables.[29]

There are some limitations to our study. First, patients with an MMSE score below 16 were excluded, because their HRQOL could not be measured reliably with the EQ-5D.[14-16,30] Because they had a significantly higher number of geriatric conditions at baseline in comparison with patients with an MMSE score above 16, we expect their HRQOL would have been even lower.[31] Several instruments are available for measuring HRQOL in dementia patients, but none is validated for severely demented patients.[32,33] Secondly, we administered the EQ-5D by telephone during follow-up. The lack of a visual representation of the VAS might have resulted in participants scoring whole numbers, or numbers that could be divided by five, instead of using a continuous count (e.g. 80 or 85, instead of 83), but no evidence of this could be found in the literature. However, the nature of EQ-5D instructions in the face-to-face and telephone administration is similar, and McPhail *et al.*, found that telephone administration of EQ-5D provided comparable results to face-to-face administration amongst older adults who seemed to have intact cognitive functioning at baseline.[34] Thirdly, we did not ask our patients' opinion regarding the relevance of their HRQOL, which might provide an even better understanding of HRQOL in acutely admitted older patients. Therefore, future research could study minimal clinically important changes in HRQOL and the effect of baseline HRQOL on outcome in terms of functionality and survival, possibly enabling advice to be further tailored to the individual.

In conclusion, for acutely admitted older patients, less comorbidity and geriatric conditions and better baseline HRQOL are associated with better HRQOL one year after admission. In this vulnerable, but very common patient group, comorbidity can generally not be modified by medical treatments, so it is of utmost importance to try and concentrate on factors that can be improved, such as delirium, malnutrition, pressure ulcers and hearing impairment. Baseline evaluation of these factors at admission by means of a CGA could guide patient, family, and professionals in determining goals to achieve during admission with the ultimate goal of improving HRQOL after discharge.

PREVIOUS PRESENTATION

Oral presentation at the 9th International Congress of the European Union Geriatric Medicine Society (EUGMS), in Venice, Italy, 2-4 October 2013. http://www.eugms2013.it/

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