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SHORT REPORT

Factors Associated with Health-Related Quality of Life in Older Persons Residing in Nursing Homes

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Purpose: Health-related quality of life (HRQoL) is an important patient-related outcome for the assessment of interventions and treatments in older people. Understanding underlying mechanisms for HRQoL is crucial for improving care, rehabilitation and symptom relief. This study examined the associations between HRQoL and frailty, sarcopenia, dependence of ADL, physical function and nutritional status in older nursing home (NH) residents.

Patients and Methods: This is a cross-sectional study employing baseline data from the Older Person's Exercise and Nutrition (OPEN) study. Residents ≥75 years and able to stand up from seated position, residing in eight nursing homes in Sweden, were recruited. The EuroQoL 5-dimension Questionnaire (EQ-5D-5L, 0–1) was used to assess HRQoL. For exposure, the FRAIL and SARC-F questionnaires, Bergs Balance Scale, Functional Independence Measure (FIM), and Mini Nutritional Assessment-Short Form (MNA-SF) were used, including chair-stand test, walking speed and some biochemical markers. Descriptive and inferential statistics including linear regression models were applied.

Results: Data from 113 residents (59% women, mean age 85 years) revealed a mean EQ-5D index of 0.76. After relevant adjustments, factors associated with low HRQoL were sarcopenia ($p<0.001$), cognitive function ($p<0.001$), dependence in ADL ($p=0.002$), low plasma-albumin ($p=0.002$) and impaired nutritional status ($p=0.038$).

Conclusion: This study displays evidence that modifiable conditions like sarcopenia and malnutrition are related to HRQoL in older NH residents. Such findings indicate a potential for physical exercise, including muscle training, and improved nutritional routines, including protein supplementation, to enhance nursing home care. Future studies, in larger NH populations, on exercise and nutrition for effects on HRQoL are needed.

Keywords: quality of life, EQ5D-5L, sarcopenia, physical function, nutritional status

Introduction

Health-related quality of life (HRQoL) is an important patient-related outcome for the improvement of care for older people, and for assessing the impact of interventions and treatments.[1] Patient-reported outcomes capture the patient's perspective of care and may reflect the quality of communication between patients and staff.[2] Factors such as a high symptom burden, depressive symptoms, and lower activities of daily living (ADL) are reported to be negatively associated with HRQoL in community-dwelling older people with high healthcare consumption.[3] Understanding underlying mechanisms for HRQoL is crucial for improving care, rehabilitation and symptom relief.

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Nursing home (NH) residents often suffer from physical and cognitive decline and need assistance in completing ADL due to increasing frailty.[4] Frailty is estimated to be present in 25% of people >85 years and is strongly related to functional decline and early mortality. HRQoL is associated with maintained independence in ADL.[5] Malnutrition contributes to frailty, and a systematic review has reported a prevalence of malnutrition in 18% of older NH residents and 48% "at risk of malnutrition".[6] Nutrition has an essential impact on HRQoL among older NH residents.[7]

Sarcopenia is defined by reduced muscle strength and impaired muscle mass and physical function according to the European Working Group on Sarcopenia in Older People (EWGSOP2).[8] Sarcopenia is a growing concern among older populations. There are substantial overlaps between malnutrition and sarcopenia and between frailty and sarcopenia in older NH residents.[9] The link between sarcopenia and HRQoL among older people is fairly well established, but further research is warranted.[10] Based on current knowledge we hypothesized that frailty, sarcopenia, dependence of ADL, reduced physical function, and impaired nutritional status are associated with low HRQoL in older NH residents.

Material and Methods

In this cross-sectional study, baseline data from the Older Person's Exercise and Nutrition (OPEN) study were used. The setting was 62 units in eight NH in Stockholm County, Sweden. The study is registered under ClinicalTrials.gov; Identifier: NCT02702037. For details, see the study protocol.[11]

Study Sample

Eligible residents were 75 years or older and able to rise from seated position. Exclusion criteria were treatment with protein-rich oral supplementation, body mass index (BMI) exceeding 30 kg/m^2, dysphagia, tube-feeding, being bedridden, and suffering from severe kidney disease. None of them were in a terminal stage of life. The eligible residents were able to follow instructions and did not display anxiety or risk for behavioral problems due to challenges of everyday life. Screening for potential participants was performed by registered nurses in collaboration with the research staff.

Measurements

Outcome Variable

HRQoL was measured by the EQ-5D-5L, comprising five items (mobility, self-care, usual activities, pain/discomfort, and anxiety/depression), and each item is scored in five levels. EQ-5D was administered to the participants for their self-rating. Based on the algorithm developed by the EuroQol-group, the scoring was expressed in terms of utilities between 0 and 1, where 0 represents dead and 1 a perfect health-related quality of life (0–1).[12]

Exposure Variables

Frailty was screened using the FRAIL questionnaire screening tool consisting of five items assessing fatigue, resistance, ambulation, illness and loss of weight (0–5p; 0=robust; 1–2=pre-frail and 3–5=frail).[13] Sarcopenia was assessed by the SARC-F questionnaire estimating strength, assistance with walking, rise from a chair, climb stairs and accidental falls; (0–10p; ≥4=increased risk).[14] Furthermore, we used the EWGSOP2 sarcopenia diagnosis set-up combining impaired chair stand capacity (probable sarcopenia) and low fat free mass index (FFMI) (confirmed sarcopenia).[8] The residents performed a modified timed chair-stand test with arms folded over the chest or with support from the chair arm rests or walking aid.[15] The test was considered impaired when <10 and <8 chair stands were performed in 30 sec in residents <85 years and >85 years, respectively.[8] Severity of sarcopenia was graded by gait speed (m/sec), measured over a distance of 10 m indoors. Gait speed below ≤0.8 m/sec indicated severe sarcopenia.[8]

Physical function was assessed using the chair-stand test described previously.[16] Functional balance was measured by the Berg Balance scale,[17] which consists of 14 tasks of relevance for everyday life. Each item is scored from 0 to 4 points providing a maximum score of 56 points. ADL was measured with the 13 motor items of self-care, transfer and locomotion from the Functional Independence Measure (FIM) tool.[18] Each item is scored on a 7-point scale from 1 (dependent) to 7 (independent), providing a total sum ranging from 13 to 91 points.

Nutritional status was assessed according to the Mini Nutritional Assessment-Short Form (MNA-SF) (0–14; 12–14=normal nutritional status; 8–11=at risk for malnutrition; 0–7=malnourished).[19] We also used the two-step procedure as suggested by the GLIM consortium.[20] Then MNA-SF was used for screening, and the diagnosis of malnutrition was confirmed accordingly by the fulfilment of at least one phenotypic criterion; ie, weight loss, underweight or low muscle mass, combined with at least one etiologic criterion; ie, reduced food intake or severe disease burden. Underweight is indicated by BMI <22kg/m^2, whereas <20kg/m^2 indicates severe malnutrition. Bioelectric impedance analysis (BIA) (ImpediMed SFB7) was performed to estimate FFMI (in kg/m^2). An FFMI of 17 kg/m^2 for men and 15 kg/m^2 for women indicated reduced lean body mass.[17] Plasma albumin was analyzed according to routine methods at the Laboratory of Clinical Chemistry, Karolinska University Hospital, Stockholm, Sweden. Plasma albumin is a negative acute phase reactant where low values indicate inflammation, catabolism and disease severity, as well as potential renal losses or reduced synthesis in the liver.

Demographic data on age and sex were collected. Cognitive function was assessed by Short Portable Mental Status Questionnaire (SPMSQ)[21] for nine participants (in the pilot-test), and by Mini Mental State Examination (MMSE; 0–30p)[22] for the remaining participants. The scores from SPMSQ and MMSE were categorized into four groups; ie, normal cognition defined by SPMSQ>7 or MMSE 24–30, mild cognitive dysfunction by SPMSQ 6–7 or MMSE 20–23; moderate cognitive dysfunction by SPMSQ 3–5 or MMSE 11–19; and severe cognitive dysfunction by SPMSQ 0–2 or MMSE 0–10.[22,23]

Statistical Analysis

Data are presented as mean (SD), or absolute numbers and percentage, as appropriate. Correlation analysis by Pearson was performed to identify factors correlated with the outcome variable HRQoL, as measured by the EQ-5D-5L index. Since the residuals were normally distributed, relevant and significantly correlated variables for HRQoL were included in a linear regression (backward method) to identify factors independently related with HRQoL. A multi-collinearity analysis was performed to rule out collinearity between variables in the regression (using variance inflation factor range). A p-value of <0.05 was considered as statistically significant. Data analyses were performed using IBM SPSS (version 27, Chicago, Illinois, USA).

Ethical Considerations

The study complies with the Declaration of Helsinki, and the study was approved by the Regional Ethical Review Board in Stockholm, Sweden (2013/1659-31/2, 2015/1994-32 and 2016/1223-32). Verbal informed consent was obtained before study inclusion, and in few cases, strengthened by a legal representative, which was approved by the Regional Ethical Review Board.

Results

The original sample consisted of 120 participants. Seven residents lacked data for the outcome variable HRQoL, leaving an analytic sample of 113 participants (Table 1). The mean age was 86 years, and the majority were women. On average the participants rated a relatively high HRQoL; ie, 0.76. Three quarters of the sample displayed either probable or confirmed sarcopenia, and 17% were identified as malnourished.

Table 2 presents bivariate correlations with HRQoL. Eight variables were significantly associated with HRQoL, ie, sarcopenia by SARC-F, frailty, functional balance, activities of daily life, cognitive function, plasma albumin, chair-stand test, and nutritional status according to MNA-SF. These variables together with sex and age were included in the linear regression model.

Table 3 shows the results of the linear regression model which indicate that the following conditions were significantly and independently associated with reduced HRQoL; ie, occurrence of sarcopenia (SARC-F) (p<0.001), cognitive function (p<0.001), low activities of daily life (p=0.002), low plasma albumin (p=0.002) and undernutrition (MNA-SF) (p=0.038). Altogether, the five variables explained 66.9% of the variance in the model.

Table 1 Sociodemographic and Clinical Characteristics in Older Nursing Home Residents (Total Sample) as Well as Men and Women and Differences Between Sex

Variables	Total Sample N=113	Missing	Women N=67	Men N=46	p-value
Dependent variable					
Health-Related Quality of Life (EQ5D-index, 0–1) Independent variables	0.76 ± 0.26	0	0.77 ± 0.26	0.74 ± 0.27	0.579
Age (years) Women (n (%))	86.0 ±5.4 67 (59%)	0 0	85.8 ± 5.1	86.2 ± 5.8	0.750
Cognition Normal Mild dysfunction Moderate dysfunction Severe dysfunction	 22 (24%) 22 (24%) 40 (43%) 9 (9%)	20	 10 (18%) 11 (20%) 27 (49%) 7 (13%)	 12 (31%) 11 (29%) 13 (35%) 2 (5%)	 0.178
Frailty (FRAIL[a] total sum 0–5 p) Non-frail (0) Pre-frail (1–2) Frail (3–5)	1.0 ± 1.2 52 (48%) 41 (37%) 16 (15%)	4	0.92± 1.1 32 (49%) 25 (39%) 8 (12%)	1.2 ± 1.3 20 (46%) 16 (36%) 8 (18%)	0.283 0.696
Sarcopenia (SARC-F[b], 0–10 p) No risk (0–3) At risk (≤4)	3.4 ± 2.9 44 (40%) 66 (60%)	3	3.4 ± 2.8 26 (40%) 39 (60%)	3.4 ± 3.0 18 (40%) 27 (60%)	1.000 1.000
Sarcopenia (EGWSOP2[c]) No Probable Confirmed Severe	 28 (25%) 58 (51%) 3 (3%) 24 (21%)	0	 16 (24%) 35 (52%) 2 (3%) 14 (21)	 12 (26%) 23 (50%) 1 (2%) 10 (2%2)	 0.984
Berg Balance Scale (0–56 p) FIM[d] (motor subscale, 13–91 p) Chair-stand-test, n	27.5 ± 15.2 67.3 ± 20.3 6.2 ± 3.1	0 0 0	27.0 ± 15.4 68.0 ± 20.5 5.9 ± 2.7	27.0± 15.1 66.4 ±20.2 6.5 ± 3.6	0.770 0.684 0.315
Nutritional status (MNA –SF[e], 0–14 p) Well-nourished At risk for malnutrition Malnourished	11.7 ± 1.8 76 (67%) 34 (30%) 3 (3%)	0	11.6 ± 1.8 43 (64%) 23 (34%) 1 (2%)	11.9 ± 1.8 33 (72%) 11 (24%) 2 (4%)	0.322 0.358
Malnourished (GLIM[f]) Not malnourished Malnourished	 93 (84%) 18 (16%)	2	 56 (84%) 11 (16%)	 37 (84%) 7 (16%)	 0.943
Weight (kg)	68.2 ± 12.9	0	62.6 ± 10.0	76.4 ± 12.1	<0.001
Body mass index	25.5 ± 3.8	3	25.3 ± 4.0	25.7 ± 3.4	0.572
Fat free mass index	16.3 ±2.3	18	15.7 ± 2.1	17.3 ± 2.4	<0.001
P-Albumin	34.1 ±3.2	8	34.1 ± 3.1	34.1 ± 3.3	0.998

Notes: [a]SARC-F questionnaire; [b]FRAIL questionnaire; [c]European Working Group on Sarcopenia in Older People2 (EWGSOP2); [d]Functional Independence Measure (FIM); [e]Mini Nutritional Assessment-Short Form (MNA-SF); [f]Global Leadership Initiative on Malnutrition (GLIM).

Discussion

Our hypothesis that sarcopenia, dependence in ADL and impaired nutritional status are associated with low HRQoL was confirmed, whereas a corresponding association for frailty and reduced physical function (by chair-stand test) with HRQoL was not confirmed. However, we observed that cognitive function and low plasma albumin were significantly

Table 2 Correlation Between Independent Variables and Health-Related Quality of Life (HRQoL), Measured by EuroQoL EQ-5D-5L Index in Older Nursing Home Residents

Variables Tested	*R*	*P*-value
Sarcopenia (SARC-F)[a]	−0.74	<0.001
Frailty (FRAIL)[b]	−0.59	<0.001
Functional balance[c]	0.53	<0.001
Activities of daily life[d]	0.42	<0.001
Cognition	0.38	<0.001
P-Albumin	0.34	<0.001
Chair-stand-test	0.27	0.004
Nutritional status (MNA-SF)[e]	0.21	0.023
Body mass index	0.18	0.06
Sarcopenia (EWGSOP2)[f]	−0.16	0.10
Nutritional status (GLIM)[g]	0.10	0.27
Fat free mass index	−0.07	0.49
Gender	0.05	0.58
Age	−0.05	0.60
Weight	0.03	0.73

Notes: Measurements: [a]SARC-F questionnaire; [b]FRAIL questionnaire; [c]Berg Balance Scale (BBS); [d]Functional Independence Measure (FIM); [e]Mini Nutritional Assessment-Short Form (MNA-SF); [f]European Working Group on Sarcopenia in Older People2 (EWGSOP2); [g]Global Leadership Initiative on Malnutrition (GLIM).

Table 3 Linear Regression Model (Backwards Model) Showing Variables That Were Independently Associated with Health-Related Quality of Life

Variable	Unstandardized Beta	CI Lower	CI Upper	t-value	P-value
Sarcopenia[a]	−0.034	−0.050	−0.017	−4.140	<0.001
Cognition	0.076	0.037	0.116	3.884	<0.001
Activities of daily life[b]	0.004	0.002	0.006	3.232	0.002
P-Albumin	0.018	0.007	0.029	3.220	0.002
Nutrition status[c]	0.022	0.001	0.044	2.114	0.038

Notes: Measurements: [a]SARC-F questionnaire; [b]Functional Independence Measure (FIM); [c]Mini Nutritional Assessment-Short Form (MNA-SF). Model fit R 0.830 (Adj R Square 0.669).

associated with low HRQoL. The unexpected finding of no association for frailty and reduced physical function with HRQoL may be explained by the possible overlap between these two conditions with sarcopenia and independence in ADL. Still, the five variables significantly associated with HRQoL were able to explain two thirds of the variance in the model.

Independence in ADL is reported to be associated with high HRQoL in older persons.[3] We used FIM to assess independence that reflects physical function and capability of the assessed person. Sarcopenia, ie, loss of muscle strength and mass, threatens the older person's physical function and independence.[24] To prevent sarcopenia in older persons, increased physical activity and exercise is vital. Such activities promote healthy aging in older adults and has the potential to play an important role in improving HRQoL.[25]

In older NH residents, malnutrition or risk of malnutrition is common. Especially deficiency of protein may negatively affect physical functioning and reduce effects of exercise and strength training. In the OPEN study, high

adherence to protein-rich oral nutritional supplement increased the odds for response in the primary outcome that was chair-stand test.[26] Other studies have also shown that nutrition is important for physical function.[27]

EQ-5D was utilized for self-report and not proxy report, which has pros and cons. When proxies are used for rating HRQoL it can be difficult to discriminate whether the rating reflects the person's views or the proxy rater's perception.[28] The validity of self-reported ratings by people with dementia may be questioned. However, there are patterns in ratings by people with dementia that are rather consistent: they tend to rate HRQoL higher than their proxies.[29,30] In line with this assumption is the fact that lower scores in the cognitive functional tests are independently related to better HRQoL. Otherwise, it is interesting that the results indicate associations of domains that are in line with corresponding research among people without dementia.

Strengths of this study are the use of tests and screening instruments validated for the NH population. However, we were limited to the data collected in the OPEN study, and variables regarding depression and pain, which could be of interest in assessing factors associated with HRQoL, were not collected. Also, data regarding contextual factors related to the NH and NH staff were not collected. The inclusion of such factors might have increased the explanatory value of the model to even higher levels. Another limitation is that the study criteria excluded nearly 65% of the residents in the eight NH for eligibility, mainly due to lack of ability to rise from a chair. Thus, the generalizability of the findings to the NH population at large should be interpreted with caution.

Conclusion

This study displays evidence that the modifiable conditions of sarcopenia and malnutrition are associated with reduced HRQoL in older NH residents. Such findings indicate a potential for physical exercise, including muscle training, and improved nutritional routines, including protein supplementation, to enhance nursing home care. Studies, in larger NH populations, on exercise and nutrition for effects on HRQoL are needed.

Abbreviations

ADL, Activities of daily living; BIA, Bioelectric impedance analysis; BMI, Body mass index; EWGSOP, European Working Group on Sarcopenia in Older People; FFMI, Fat free mass index; FIM, Functional Independence Measure; HRQoL, Health-Related Quality of Life; MMSE, Mini Mental State Examination; MNA-SF, Mini Nutritional Assessment – Short Form; NH, Nursing home; OPEN, Older Person's Exercise and Nutrition study; SPMSQ, Short Portable Mental State Questionnaire.

Data Sharing Statement

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

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