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Original article

Does undernutrition still prevail among nursing home residents?☆

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SUMMARY

Background & aims: During recent years public awareness about malnutrition has increased and collective initiatives have been undertaken. Simultaneously, the number of older adults is increasing, and the elderly care has been placed under pressure. The aim was to assess the nutritional situation and one-year mortality among nursing home (NH) residents, and compare with historical data.
Methods: Mini Nutritional Assessment-Short Form (MNA-SF), ADL Barthel Index (BI), Short Portable Mental Status Questionnaire (SPMSQ), EQ-5D, Charlson Comorbidity Index (CCI), and blood samples were collected from 172 NH residents (86.3 ± 8 years, 70% women). Mortality data was taken from NH records. Nutritional data from 166 NH residents (83.8 ± 8 years, 61% women) examined in 1996 was retrieved for historical comparison.
Results: The prevalence of malnutrition was 30%, as compared to 71% in the historical data set, corresponding to a present average body mass index of 23.7 ± 5.1 compared with 22.3 ± 4.2 kg/m^2 ($p < 0.01$). Reduced nutritional status was associated with decline in function ($p < 0.001$) and cognition ($p < 0.01$). One-year mortality was 24%. Regression analyses indicated high age (OR = 1.09, 95% CI (1.03–1.16)), high scores in CCI (OR = 1.54, (1.19–1.99)), low BMI (OR = 2.47, (1.14–5.38)) and malnutrition (OR = 2.37, (1.07–5.26)) to be independently associated with one-year mortality.
Conclusions: Malnutrition still prevails and is associated with deteriorated cognition, function and increased mortality. A possible improvement in nutritional status in NH residents over time was observed.

1. Introduction

Nutritional problems among institutionalized older adults have been well documented over the last decades.[1–3] The negative consequences of malnutrition, i.e. morbidity, longer hospital stays,[4] mortality,[5] deteriorated functional ability,[1,2,5] cognitive dysfunction,[1,2] and reduced well-being[2,5] have also been reported in abundance. A recent compilation of international studies from various settings, performed after the year 2000,[6] showed that among 1500 nursing home (NH) residents approximately 14% were classified as malnourished and more than half were at risk of malnutrition. More than a decade ago we reported the nutritional situation of 166 NH residents in three Swedish municipalities.[3] At that time, Mini Nutritional Assessment (MNA) classified 71% as malnourished and 29% as at risk of malnutrition, i.e. none were reported as well-nourished.

Over recent years, national and international authorities and regulatory agencies have recognised the gravity of the situation. Many initiatives have been taken to promote good nutritional practice in elderly care. For example, the resolution on food and nutritional care in hospitals, published by the Council of Europe in 2003, was signed by 18 European countries. The annual European-based initiative of the Nutrition Day project aims at implementing the resolution into daily practice. The recent decision to include NH settings in the Nutrition Day project also reflects the increased awareness of this problem at the municipal care level.[7]

In Sweden, governmental decisions from 2007 onwards have provided incentive grants (altogether >440 million EURO) to municipalities and county councils to improve the quality of elderly care, including nutrition. A further Swedish example of quality improvement on a national level is the introduction of a national quality register, i.e. the Senior Alert, aimed at recording risks and measures taken to prevent and treat malnutrition, falls and pressure sores in caretakers ≥65 years.

Parallel with an increased awareness of nutritional problems in the old and frail population, there is an on-going demographic shift

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towards an increasing number of older adults. For example, 10 years from now >20% of the Swedish population will be >65 years of age and >5% will be >80. In addition, there is a continuous restructuring of elderly care, such as reduced institutionalized care in favour of care provided in the home. Consequently, the care burden increases among elderly care home residents. From 1996 to 2010, beds in special housing decreased by 33,000 concurrent with an increase of 194,000 individuals ≥65 years of age in Sweden.

Under these circumstances there is a relentless need to up-date knowledge of the nutritional situation within the elderly care system in affluent societies. The main objective of this study was to describe the nutritional situation and its relation to subsequent one-year mortality in an NH population in an affluent society in 2010. A secondary aim was to assess if gained knowledge and increasing awareness have made any difference regarding nutritional status among older adults residing in NHs by comparing the present data with historical data from 1996. The hypothesis was that the two trends, i.e. the modernized care and increased care burden, might counter balance each other.

2. Materials and methods

2.1. Study population

The eligible study population was 196 residents in four NH in Uppsala municipality in mid-eastern Sweden. Twenty-one (11%) subjects declined participation in the study and three (1%) were hospitalized, in poor general condition during the data collection or had just recently been admitted to the NH. Thus, in total 172 (88%) residents participated in the study. All ate orally, except one resident who was tube-fed.

The participants were interviewed and examined by one of the researchers (JT). Data collection took place during May 2009 until March 2010. Care staff were interviewed when the participant had cognitive impairments (scoring <5 on the SPMSQ, see below). Birth date, time spent in the nursing home, diagnoses and medications (defined as number of substances) were collected from the medical records at the NH units. Data on mortality one year after the baseline examination were taken from the NH records.

2.2. Nutritional assessment by Mini Nutritional Assessment-Short Form (MNA-SF)

The MNA-SF consists of six items, i.e. questions and anthropometric measures.[8,9] The questions cover the past three months and address food intake and weight loss, mobility, acute diseases or psychological stress and neuropsychological problems. Body Mass Index (BMI) was calculated from height and weight. Height was measured to the nearest 0.5 cm. Whenever possible, standing height was measured with a measuring tape. Otherwise, height was measured lying in bed with a sliding scale. Weight was measured to the nearest 0.1 kg with a digital chair scale or a lift scale. When measurements of height or weight could not be performed, these data were collected from medical records. BMI was calculated (kg/m^2). The maximum MNA-SF score is 14 points. A score of less than 7 points indicates malnutrition, 8–11 points indicates risk of malnutrition and 12–14 points indicates that the person has a normal nutritional status.

For the historical comparison, data on weight, height, body mass index (BMI) and Mini Nutritional Assessment (MNA) was retrieved from 166 NH residents (61% women) examined in 1996,[3] and compared with the present data. MNA-SF was recently validated against the full MNA, and proved to have good sensitivity (0.89) and specificity (0.82), and correlated well (0.90).[8]

2.3. Functional assessment by ADL Barthel Index (BI)

The BI measures the degree of independence in basic self-care in seven areas; feeding, bathing, grooming, toilet use, dressing, bowel and bladder control, transfers from bed to chair and back, mobility on level surfaces and stair climbing.[10] The scores range from 0 to 20, with higher scores indicating greater independence.

2.4. Cognitive assessment by Short Portable Mental Status Questionnaire (SPMSQ)

The SPMSQ consists of 10 items; current date, day of the week, current location, address, age, birth date, name of the prime minister, name of the past prime minister, maiden name of the resident's mother, and the task of counting backward from 20 by threes.[11] Maximum score is 10 points; eight or more errors indicate severe cognitive impairment, 5–7 errors indicate moderate cognitive impairment, 3–4 errors indicate mild cognitive impairment and 0–2 errors indicate normal mental functioning. The SPMSQ test was performed on all participants who were communicable, regardless of their cognitive ability.

2.5. Health-related Quality of Life (QoL) assessment by EQ-5D

The EQ-5D consists of a descriptive system and a VAS-scale.[12] The descriptive system comprises five dimensions: mobility, self-care, usual activities, pain/discomfort and anxiety/depression. Each dimension has three levels of perceived problems: no problems, some problems, severe problems. Subsequently, the respondent or the proxy is asked to self-rate the state of health on a vertical analogue scale. The VAS scale ranges from 0 to 100, where 100 is rated as "Best imaginable health state" and 0 as "Worst imaginable health state". A proxy version of the instrument was used for the two thirds of residents ($n = 108$) who were not able to answer for themselves due to cognitive impairments, poor general condition, or being non-communicable. EQ-5D index scores were calculated using preference scores generated from a large UK population (UK EQ-5D Index Tariff).[13] EQ-5D index scores range from 0.00 to 1.00, where 0.00 indicates the worst possible health state and 1.00 the best possible health state. Negative scores were given the value of 0.

2.6. Morbidity

Comorbidity was evaluated by the Charlson Comorbidity Index (CCI),[14] which takes into account both the number and the severity of 19 medical conditions, and gives weighted points from 1 to 6. Total scores range from 0 to 37, with high scores indicating more severe comorbidity.

2.7. Biochemical markers

Blood samples from 111 subjects were collected after a 12-h overnight fast. Reasons for not drawing blood from 61 residents were that the resident or their next of kin declined, having a poor general condition as assessed by the nurse at the NH, or that blood sampling was technically difficult. All samples were protected from light, centrifuged and stored at −70 °C until analysis for albumin, CRP, insulin-like growth factor 1 (IGF-1), creatinine and cystatin C using the standard procedures at the Department of Clinical Chemistry at Uppsala University Hospital.

2.8. Statistics and ethics

Data are presented as proportions, mean values ± standard deviation or median (interquartile range), as indicated. Descriptive analyses were performed to describe the study population and the prevalence figures. *T*-tests for independent samples and Mann–Whitney *U*-tests were performed according to data distribution in order to evaluate differences between the two groups. For corresponding analyses in more than two groups, ANOVA or Kruskal–Wallis tests were used according to data distribution. For correlation analyses, Spearman's rank correlation was conducted. The χ^2-test was used for nominal and ordinal variables. Survival analyses were performed with Kaplan–Meier curves and logistic regression to evaluate nutritional status and its effect on mortality. Logistic regression analyses were performed to determine independent covariates of mortality. Co-variables were chosen among those that showed a trendwise ($p < 0.10$) univariate correlation among gender, age, nutritional status, functional status, cognitive status, comorbidity (i.e. CCI-score), medications, time spent in the NH and BMI. *P*-values <0.05 were considered statistically significant. Statistica, version 10 (Stat Soft, Inc., Tulsa, OK, USA) was used for all statistical analyses.

The study was approved by the regional ethical review board at Uppsala University. Cognitively intact residents gave their informed consent before study entry. Corresponding consent was given by next of kin or other surrogates to individuals with cognitive impairments after oral information by phone.

3. Results

3.1. Basic characteristics, diagnoses and medications

Table 1 displays basic characteristics of the participants. There were no differences in gender distribution, age and time spent in the NH between the participants ($n = 172$) and the non-participants ($n = 24$), i.e. the non-participants were 84.1 ± 8.5 years old, 75% were females and they had spent a median time in the NH of 1.4 (2.1) years. All subjects had at least one disease and more than three quarters ($n = 135$) had multiple diseases, of which 41% had two, 38% three and 19% four diagnoses. Among the primary diagnoses (Table 2), dementia ($n = 55$) was the most common, whereof 33 subjects suffered from Alzheimer's disease. The median number of prescribed medications was 8 (4). The median CCI in the whole study group was 2 (2), corresponding to a medium severity of comorbidity.[15] A BI-score ≤10 was observed in two of three participants, and 21 (12%) subjects scored 0, indicating a high level of dependency in the study group. Cognitive impairment, i.e. >2 errors in the SPMSQ was registered in 78% of the 99 residents that were able to perform the test. About one third of these tested subjects had a diagnosis of dementia. Pain/discomfort and being anxious/depressed, according to EQ-5D, were reported by more than two-thirds of the tested participants.

Table 1
Basic characteristics of 172 nursing home residents.

Women, % (n)	70 (120)
Age, years mean ± SD	86.3 ± 7.7
Years in nursing home, median (IQR)	1.6 (3)
Charlson Comorbidity Index (CCI), median (IQR)	2 (2)
Mini Nutritional Assessment-Short Form (MNA-SF, 0–14), median (IQR)	9 (3)
Body Mass Index (BMI), kg/m^2 mean ± SD	23.7 ± 5.1
BMI <22, % (*n*)	41 (70)
BMI 22–27, % (*n*)	37 (64)
BMI >27, % (*n*)	22 (38)
Barthel Index (BI, 0–20), median (IQR)	8 (11.5)
Short Portable Mental Status Questionnaire (SPMSQ, 0–10), median (IQR) $n = 99$[a]	4 (5)
Normal mental functioning (0–2 errors on SPMSQ), % (*n*)	22 (22)
Mild cognitive impairment (3–4 errors on SPMSQ), % (*n*)	14 (14)
Moderate cognitive impairment (5–7 errors on SPMSQ), % (*n*)	36 (35)
Severe cognitive impairment (8 or more errors on SPMSQ), % (*n*)	28 (28)
EQ-5D$_{index}$ score (0–1),[b] median (IQR) $n = 161$[c]	0.20 (0.68)
EQ-5D VAS (0–100),[b] mean ± SD $n = 165$[c]	56.4 ± 19.5

SD = standard deviation; IQR = interquartile range.
[a] Cognitive test was only possible to perform in 99 subjects (58%) due to severe dementia ($n = 37$), poor general condition ($n = 3$), unwilling to perform the test ($n = 5$), discontinuation of the test because the person became anxious ($n = 6$), not speaking Swedish, poor hearing or severe aphasia ($n = 22$).
[b] Both self-rated and proxy-versions.
[c] Data missing when neither care staff nor the participant were able to assess health-related QoL.

3.2. Nutritional status and relationships with function, cognition, QoL and biochemistry

According to MNA-SF, 30% were assessed as malnourished, 63% as at risk of malnutrition and 7% were classified as well-nourished. Interestingly, four of five participants reported no decline in food intake. Close to half (43%) reported weight loss during the past three months. BMI ranged from 13.9 to 42.3 kg/m^2. A BMI <22 was observed in two fifths, and one in five had a BMI of >27 kg/m^2 (Table 1). BMI and MNA-SF in the various diagnosis groups are shown in Table 2. For example, subjects with neurological diseases ($n = 21$), exclusive of dementia and cerebrovascular disease, had the lowest BMI and scored the lowest on MNA-SF.

Table 3 shows age, comorbidity index, BMI, functional and cognitive status, health-related QoL assessment, as well as biochemical markers according to MNA classification. Functional status, according to BI, was severely reduced in the malnourished group (Table 3). As expected, BI correlated with MNA-SF ($r = 0.41$, $p < 0.001$). Two-thirds (69%) of all the participants displayed a need of assistance with feeding, e.g. cutting and spreading butter. Need

Table 2
Body Mass Index (BMI) and Mini Nutritional Assessment-Short Form (MNA-SF) scores in the primary diagnosis groups.

Primary diagnosis	*n*	BMI[b] (mean ± SD)	MNA-SF scores (0–14 p)[e] (median (IQR))
Dementia	55	22.6 ± 4.4[c]	8 (3)
Cerebrovascular diseases	43	24.1 ± 4.9	9 (3)
Neurological diseases	22	22 ± 5.3[d]	7 (3)[f]
Cardiac diseases	19	24 ± 6.5	9 (3)
Depression	7	26.5 ± 6.2	10 (3)
Psychiatric disorders	9	27.5 ± 4.3	8 (2)
Other diagnoses[a]	17	24.7 ± 4.3	10 (2)

Dementia = Alzheimer's disease (AD), Vascular dementia, Dementia NUD; Cerebrovascular diseases = Stroke, Transient ischaemic attack (TIA), Neurological diseases = Multiple sclerosis (MS), Parkinson's disease, Hydrocephalus, Epilepsy, Spinal stenosis, Narcolepsy, Intellectual disability, Post-polio syndrome (PPS), Alcoholic dementia, Paraplegia; Cardiac diseases = Myocardial infarction (MI), Chronic heart failure (CHF), Angina pectoris, Hypertension, Atrial fibrillation, Bypass surgery, Pacemaker, Hyperlipidaemia, Arrhythmias; Psychiatric disorders = Schizophrenia, Paranoid disorder/Hallucinations, Anxiety, Manic depression.
[a] Diagnoses were merged into this group when there were <5 subjects with a specific disorder.
[b] $p = 0.038$, ANOVA test for difference in BMI between primary diagnoses.
[c] $p < 0.05$, significant difference by post hoc test between dementia vs. psychiatric disorders.
[d] $p < 0.05$, significant difference by post hoc test between neurological diseases vs. depression and psychiatric disorders.
[e] $p = 0.022$, Kruskal–Wallis test for difference in MNA-SF between primary diagnoses.
[f] $p < 0.05$, significant difference by post hoc test between neurological disease and other diagnoses.

Table 3
Demography and various clinical outcomes, including biochemistry, divided by nutritional status according to Mini Nutritional Assessment-Short Form (MNA-SF).

	Reference value	MNA-SF ≤7 p	*n*	MNA-SF 8–11 p	*n*	MNA-SF ≥12 p	*n*	*p*[a]
Age, mean ± SD	–	85.2 ± 7.9	52	86.8 ± 7.1	108	86.6 ± 11.9	12	0.4843
Years in NH, median (IQR)	–	2.3 (3.8)	52	1.5 (2.8)	108	0.7 (1.9)	12	0.2848
CCI, median (IQR)	–	2 (1.5)	52	2 (2)	108	1 (1.5)	12	0.1886
BMI, mean ± SD	–	19.9 ± 4.1	52	24.9 ± 4.6	108	28.6 ± 4.1	12	<0.001[b,c]
BI (0–20), median (IQR)	–	3.5 (8.5)	52	9 (11)	108	18 (7.5)	12	<0.001[b,c,d]
SPMSQ (0–10), median (IQR)	–	3 (4)	26	4 (5)	62	9 (5)	11	<0.01[c,d]
EQ-5D VAS (0–100), mean ± SD	–	55.3 ± 19.3	50	55.6 ± 19.6	104	68.1 ± 17.3	11	0.1182
EQ-5D$_{index}$ score (0–1), median (IQR)	–	0.08 (0.42)	46	0.21 (0.71)	103	0.60 (0.43)	12	0.0544
P-CRP (mg/L), median (IQR)	<5	8.1 (11.1)	34	3.5 (6.5)	69	1.9 (5.1)	8	<0.05[b]
P-Creatinine (μmol/L), median (IQR)	Women: 45–90 Men: 60–105	65.5 (36)	34	78 (38)	69	94 (21.5)	8	<0.01[b,c]
GFR (mL/min/1.73 m2), mean ± SD	>50	52.6 ± 17.4	34	46.7 ± 18.7	69	41.5 ± 14.5	8	0.1704
P-Albumin (g/L), mean ± SD	34–45	32.4 ± 4.2	34	34.5 ± 3.4	69	36.5 ± 3.8	8	<0.01[b,c]
P-IGF-1 (μg/L), median (IQR)	71–75 y: 64–188 76–80 y: 59–177 81–85 y: 55–166	78.5 (32)	34	92 (53.5)	68[e]	110 (38)	8	0.0601

SD = standard deviation; IQR = interquartile range; CCI = Charlson Comorbidity Index; BMI = Body Mass Index; BI = ADL Barthel Index; SPMSQ = Short Portable Mental Status Questionnaire; GFR = Glomerular filtration rate calculated by Cystatin C (mL/min/1.73 m^2 bodysurface); IGF-1 = Insulin-like growth factor 1.
[a] ANOVA for continuous variables and normally distributed samples or Kruskal–Wallis test for categorical variables and/or samples with skewed distribution.
[b] $p > 0.05$, significant difference by post hoc test between MNA-SF 8–11 p and MNA-SF ≤7.
[c] $p < 0.05$, significant difference by post hoc test between MNA-SF ≥12 p and MNA-SF ≤7 p.
[d] $p < 0.05$, significant difference by post hoc test between MNA-SF ≥12 p and MNA-SF 8–11 p.
[e] One blood sample is missing.

of assistance during the meal was associated with worse MNA-SF status ($p < 0.001$) and lower BMI ($p = 0.002$). The well-nourished had a higher SPMSQ score than the malnourished ($p < 0.01$) (Table 3). Adequate cognition, i.e. 0–2 errors on the SPMSQ was observed in 12% of the malnourished, 19% of the subjects at risk of malnutrition and 64% of the well-nourished, respectively.

Health-related Quality of Life (EQ-5D) did not differ between the MNA groups (Table 3). There was a trend that the well-nourished subjects reported a higher EQ-5D index score than the malnourished. A similar trend in the EQ-5D index was noted for subjects with a BMI > 27 (0.34 (0.73)) vs. those with a BMI < 22 (0.09 (0.66)) ($p = 0.25$).

Plasma CRP, creatinine, albumin and IGF-I (Table 3) were within the reference range in the majority of the tested subjects. Still, plasma CRP was significantly elevated in the malnourished group, indicating ongoing inflammatory activity. Plasma creatinine, possibly indicating muscle mass was significantly reduced with worse nutritional status (Table 3). Moreover, creatinine and albumin correlated with MNA-SF; i.e. $r = 0.29$ ($p < 0.01$) and $r = 0.26$ ($p < 0.01$), respectively.

3.3. Mortality follow-up

About one fourth ($n = 41$, 24%) of the participants died within one year of the examination, with a median survival of 6 (6) months. Only one of the 12 subjects classified as well-nourished died. The small well-nourished group was merged with those classified as at risk of malnutrition, and the combined mortality rate among them was about one in five as compared with one in three in the malnourished group ($p = 0.055$, Fig. 1). Corresponding mortality rates in various BMI groups are shown in Fig. 2, i.e. 33% with BMI <22, 16% with BMI 22–27 and 21% with BMI >27 died, respectively.

By univariate logistic regression analyses with mortality as the dependent variable, high age, high CCI-score, BMI <22 kg/m^2 and malnutrition according to MNA-SF were associated ($p < 0.10$) with death within one year, whereas gender, BI, cognitive status, specific diagnoses, number of medications and time in the NH did not. In multivariate logistic regression analyses, high age and high CCI-score (indicating more severe comorbidity) remained independently related to subsequent death within one year, as did low BMI and malnutrition according to MNA-SF when included separately into the analyses (Table 4).

3.4. Historical comparison

MNA, BMI, the number of prescribed drugs, prevalence of acute disease, mobility and neuropsychological problems (as described in the MNA forms) were compared between the two NH samples from 1996 to 2010, respectively. In the 2010 sample, prescription of >3 drugs/day was more frequent (91% vs. 78%, $p < 0.001$), whereas suffering from acute diseases during the past three months was less frequent (27% vs. 42%, $p < 0.01$) and the proportion of bed- or chair-bound individuals was less as well (49% vs. 68%, $p < 0.001$). No differences in prevalence of dementia or depression, according to MNA, were noticed. The subjects in the 2010 cohort were approximately two years older (86.3 ± 7.7 vs. 83.8 ± 8.2, $p < 0.01$), they

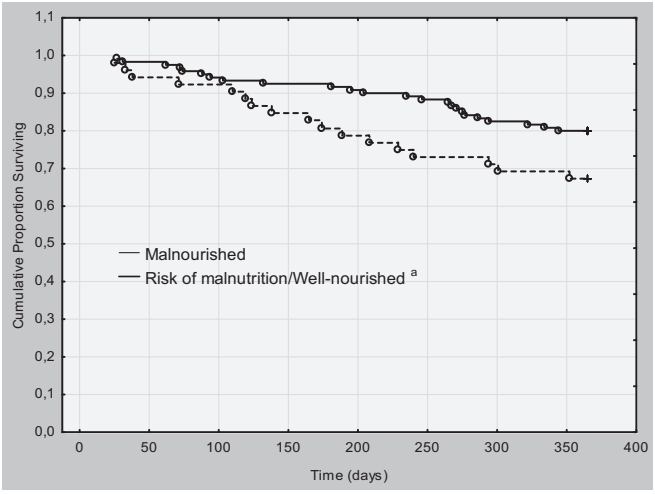

Fig. 1. One-year survival in Swedish nursing home residents in relation to nutritional status, i.e. malnourished vs. risk of malnutrition and well-nourished according to MNA-SF, $p = 0.0554$. [a]Those at risk of malnutrition and well-nourished were merged into one group as only one well-nourished subject had died at the follow-up.

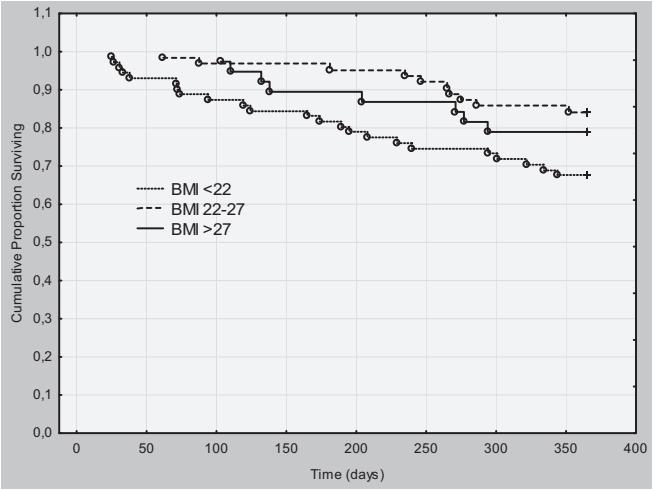

Fig. 2. One-year survival in Swedish nursing home residents with BMI < 22, 22–27 or >27 kg/m^2, $p = 0.04388$. BMI < 22 vs. BMI 22–27, $p = 0.0156$; BMI 22–27 vs. BMI > 27, $p = 0.4831$; BMI < 22 vs. BMI > 27, $p = 0.1738$.

weighed on average four kg more (62.9 ± 15.0 vs. 59.1 ± 12.0, $p < 0.05$) and had a corresponding higher mean BMI (23.7 ± 5.1 vs. 22.3 ± 4.2, $p < 0.01$). About equal proportions of participants in the two cohorts had a BMI ≤20, whereas the proportion of individuals with a BMI ≥27 was doubled in 2010 (Fig. 3). In the 2010 cohort the observed prevalence of malnutrition, according to MNA, was less and the proportion of well-nourished individuals was higher compared with the 1996 sample (Fig. 3).

4. Discussion

The study revealed that malnutrition still prevails in Swedish NH residents, and confirms previous reported associations between malnutrition, reduced function and cognition, and that malnutrition is independently related to one-year mortality. Nevertheless, these are interesting findings in the light of the ongoing demographic shift and reconstruction of elderly care in affluent societies. The observed current prevalence of malnutrition and risk of malnutrition indicated a better nutritional situation among Swedish NH residents in 2010 when compared with the corresponding situation more than a decade ago. Still, malnutrition was more common than was observed in a heterogeneous international NH setting.[6] The demographic situation in Sweden is characterized by a large proportion (18%) of the population being >65 years. Moreover, elderly care is continuously being restructured which has led to an increased care burden in NH. In general, increasing care needs and dependency are associated with deteriorated nutritional status in older adults. Probably due to variations of the organization of elderly care, the occurrence of malnutrition in institutionalized older adults varies largely between countries, which is illustrated by reported occurrences in 5–70% of residents.[8]

In the present study better nutritional status was significantly associated with better functional ability, including independent feeding,[16] and cognitive status. Health-related QoL was also assessed higher trendwise by the well-nourished subjects. These data are all in line with previous reports.[1,2,5]

The current overall mortality rate after one year was about one fourth, which is equal to findings in similar studies with the same follow-up period in other Northern European countries.[17,18] This indicates that average survival among the majority of NH residents exceeds one year which contradicts some popular beliefs that the contraction of elderly care has substantially reduced life expectancy in those admitted.

A higher mortality rate was observed among those classified as malnourished[5] and among those with a BMI <22 kg/m^2. Logistic regression analyses confirmed that malnutrition and a low BMI, when included separately into the analysis, were independently related to one-year mortality. Not surprisingly, high age and a high comorbidity score also predicted mortality within one year. Interestingly, NH residents with BMI between 22 and 27 kg/m^2 had the best one-year survival. This is in line with studies suggesting best survival among older adults with a somewhat elevated BMI.[17,18]

The comparison with a historical dataset[3] indicates possible improvements from 1996 to 2010 in nutritional status, at least according to MNA and BMI. It may be hypothesized that this is a result of an increased awareness of malnutrition in society as a whole and improved nutritional care over the years. However, such a historical comparison needs to be interpreted with caution. For example, it should be taken into account that the samples are from different Swedish municipalities. Moreover, although it has been demonstrated that the MNA-SF provides equivalent information as the full MNA,[9] it has to be taken into consideration that in 1996 the full MNA version was used.

As the number of NH beds have decreased while the number of older adults has increased it is reasonable to believe that the NH residents of today are more ill and dependent. The background characteristics, e.g. taking more medication and being two years older, of the 2010 sample were in line with this notion. However, in the 1996 sample, a greater proportion had suffered from acute diseases and displayed limited mobility. A possible interpretation of these somewhat contradictory findings is that when the number of malnourished residents was higher in 1996, this malnutrition may have induced a higher degree of morbidity and deteriorated function among the residents. Alternative explanations of potentially improved nutritional status over time also have to be considered. For example, the higher BMI in the current NH residents may mirror the increased prevalence of overweight and obesity in society in general. Trends of increasing weight and a prevalence of overweight in older adults in Sweden have been demonstrated.[19] Meanwhile, it is important to consider that overweight in older adults and especially in NH residents is not known to be harmful, as in younger subjects. On the contrary, overweight may even have a positive impact on survival, functional ability and QoL.[17,18] In the present study it was also shown that those with a BMI >27 assessed their health-related QoL higher than subjects with BMI <22.

Reasons for the prevailing high proportion of NH residents suffering from malnutrition might be organizational and political. There are many organizational factors suggested as barriers to optimal nutritional care in NH; e.g. poor management structures, lack of a clear distribution of responsibility,[20] lack of time, understaffing, adverse attitudes of staff, lack of teamwork and communication,[21] inadequate nutritional knowledge and training.[20,21] The economical and societal trends in Sweden since the mid 1990s have

Table 4
Odds ratio (OR) and 95% confidence intervals (CI) for one-year mortality using age (years), CCI score (0–37) and BMI ≥22 or <22, or MNA-SF 8–14 p or ≤7 p as covariates in multivariate logistic regression analyses.

		OR	95% CI	*p*
a	BMI	2.47	1.14–5.38	0.02
	CCI score	1.60	1.23–2.08	<0.001
	Age	1.08	1.01–1.14	0.02
b	MNA	2.37	1.07–5.26	0.03
	CCI score	1.54	1.19–1.99	<0.001
	Age	1.09	1.03–1.16	0.006

[a] BMI ≥22 or <22.
[b] MNA-SF 8–14 p or ≤7 p.

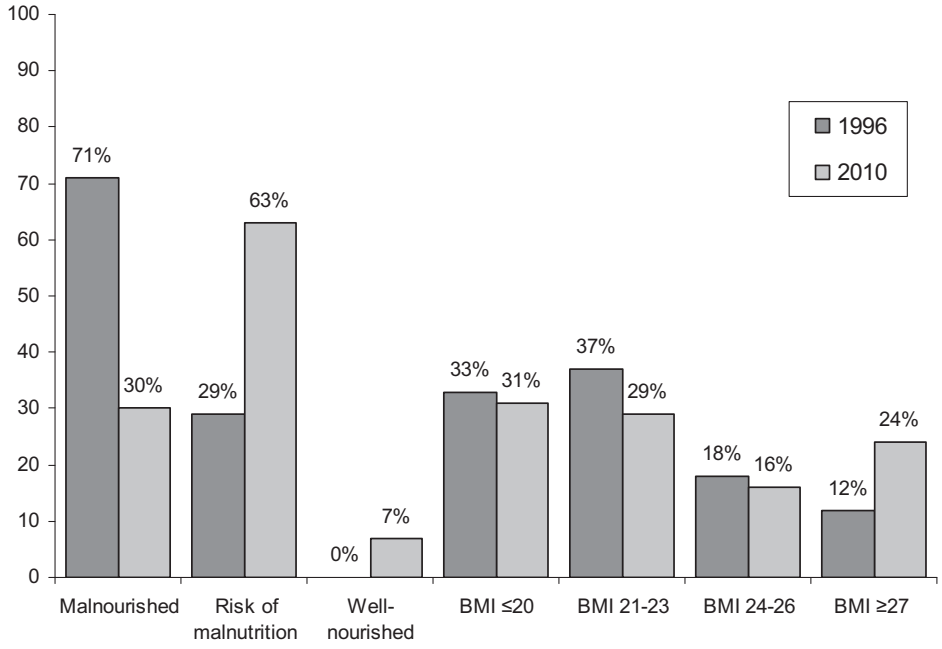

Fig. 3. Nutritional status according to MNA and proportion of individuals with BMI ≤20, 21–23, 24–26 and ≥27 in Swedish nursing home residents 1996 and 2010, respectively.

had a substantial impact on the organisation of the Swedish elderly care system. Reduction of beds in hospitals, reduction in length of hospital stay, transferring bed capacity from geriatric hospital care to municipal care, reduction of beds and apartments in municipal special housing have resulted in the transfer of advanced nursing to the municipalities.[22] This era was also influenced by the trend of New Public Management, which was characterized by the privatization of social services. Private providers of elderly care have increased from 1% in 1990 to 16% in 2010. Privatization is often criticised for prioritising cost savings over quality of care.[23] Coping with similar problems, an increased workload due to increased care-dependency of the residents, cost savings and rising expectations of quality improvements, are also seen in other European countries.[24]

Limitations of this study were that the study participants were recruited from a limited number of NH, located in the central part of Uppsala city. The criticism of "convenience sampling" is that it is not representative and generalization of the results may be limited. We managed to achieve 85% participation rate, which is rare in studies of older adults. No differences between the participants and the nonparticipants regarding age, gender and NH length of stay were observed. Data on oral health could have added better understanding of the outcome from the study,[25] but such data were not available. The performance of studies on older adults in general, and on an NH population in particular, is challenging, as the majority of the study participants are at a terminal stage of life. It was not possible to interview several of the study participants, why the data collection often relied upon information from care staff and proxies. Studies of the oldest part of the population are important because we are facing a dramatic demographical change with an increasing number of older adults. Whether this will result in increased future care needs is difficult to predict since contradictive data suggest both improved and deteriorated health among older adults.[26,27]

In conclusion, this study shows that nutritional problems in NH still prevail and are associated with consequences such as deteriorated function, cognition and increased mortality. At the same time, possible improvements in nutritional status during the past 15 years were demonstrated which may indicate that we are heading in the right direction. Authorities, both nationally and internationally, appear to have acknowledged that malnutrition is a problem and have taken action to improve nutritional care among older adults. High age, comorbidity and frailty are risk factors of malnutrition. Because of the increasing magnitudes of these conditions, well-functioning nutritional routines in elderly care are necessary. Thus, quality improvements in nutritional care will remain a challenge. Such actions have to be planned, implemented and monitored carefully and, finally, they have to be scientifically evaluated.

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Statement of authorship

All authors contributed to the conception, design of the study and interpretation of data. JT collected the data. Analyses were performed by JT with support from TC. JT and TC prepared the manuscript with input from all authors. The final version was read and approved by all authors.

Conflict of interest

None.

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