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The nutritional situation in Swedish nursing homes – A longitudinal study

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ABSTRACT

Poor nutritional status is widespread among the elderly and is associated with increased morbidity and mortality. The aim of this study was to longitudinally describe the nutritional status in elderly people living in nursing homes. Nutritional status was recorded longitudinally in elderly people living in 11 different nursing homes in Sweden. Participants were examined at baseline by specially trained nurses who also assisted with questionnaires and collected data for current medical treatment from patient records. Nutritional status was evaluated at baseline and after 24 months with the mini nutritional assessment (MNA). The study included 318 subjects. The mean age of the participants was 85.0 years (range 65–101). At baseline, 41.6% were well nourished, 40.3% at risk of malnutrition, and 17.7% malnourished according to the MNA. Survival was significantly lower in the malnourished group. After 24 months, almost half of the population had died. The group of participants who survived at 24 months represents a population of better nutritional state, where 10.6% were malnourished at baseline increasing to 24.6% after 24 months. After 24 months, 38.7% of the participants showed a decline in nutritional state. The group with deteriorating MNA scores had higher weight, BMI values, and a higher hospitalization rate. The prevalence of malnutrition in nursing home residents increased over time and it is important to evaluate nutritional state regularly. Nutritional interventions should be considered in better nourished groups, as well as in malnourished individuals, to prevent a decline in nutritional state.

1. Introduction

The proportion of the Swedish population that is over 80 years of age is continually rising and at present accounts for around 5% of Sweden's population of 9.6 million inhabitants (National Board of Health & Welfare, 2013). In spite of this, the number of nursing homes in Sweden is limited, and only 5.2% of persons aged 65 and over live permanently in nursing homes (National Board of Health & Welfare, 2012). Elderly subjects living in nursing homes represent the most frail part of the elderly population and the part in most need of care (Lagergren, 2002). With advanced age, hormonal and neurohormonal transmitter regulation of food intake become altered, which leads to physiologic anorexia of aging (Morley, 1997). Normal aging is characterized by changes in body composition, with loss of lean body mass, loss of bone density, loss of proprioception, and declining sensory function (Chen, Schilling, & Lyder, 2001; Toffanello et al., 2013). Also, non-physiologic causes of weight loss in older persons are common. Social factors such as the monotony of institutional food, psychological factors such as depression, and medical factors such as polypharmacy and co-morbidities are also related to anorexia (Morley, 1997). Malnutrition is defined as inadequate nutritional status characterized by insufficient dietary intake, poor appetite, muscle wasting, and weight loss (Chen et al., 2001). The consequences of malnutrition are widely documented as pressure ulcers, poor wound healing, infectious complications, and hospital readmissions, which lead to increased morbidity and mortality (Pauly, Stehle, & Volkert, 2007; Torma, Winblad, Cederholm, & Saletti, 2013; Verbrugghe et al., 2013). Apart from illness, many other factors, such as impaired cognitive function, polypharmacy, eating difficulties, and female gender, are associated with malnutrition (Ji, Meng, & Dong, 2012; Verbrugghe et al., 2013). The consequences of malnutrition are very harmful and the fact that it increases health care costs cannot be ignored (Elia, 2006).

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Malnutrition is common among nursing home residents all over the world, with recent reports showing a prevalence of 15–40% (Carlsson, Gustafson, Eriksson, & Haglin, 2009; Chan, Lim, Ernest, & Tan, 2010; Diekmann et al., 2013; Verbrugghe et al., 2013). The reported prevalence of malnutrition varies greatly partly due to the different screening tools used to assess nutritional status (Diekmann et al., 2013; van Bokhorst-de van der Schueren, Guaitoli, Jansma, & de Vet, 2014). Since nutritional status depends on many different factors, one single parameter is not enough to identify malnutrition. Therefore, screening tools have been developed to assess nutritional status, considering several aspects simultaneously (Volkert, 2013). The European society for Clinical Nutrition and Metabolism (ESPEN) has recommended three different screening tools for nutritional assessment in different settings (Kondrup, Allison, Elia, Vellas, & Plauth, 2002), of which the mini nutritional assessment (MNA) seems to be best suited for nursing home residents (Diekmann et al., 2013). The MNA was designed and validated to assess nutritional status in elderly individuals, with the capacity to detect risk of malnutrition at an early stage (Vellas et al., 1999, 2006). There are few studies on factors that can change nutritional status over time. We considered it important to longitudinally evaluate nutritional status in the elderly to identify factors associated with changes in nutritional status.

2. Material and methods

2.1. Study population

Nutritional status was recorded longitudinally in elderly people living in 11 different nursing homes in three cities in Sweden (Linköping, Jönköping, and Eslöv), as a part of the Study of Health and Drugs in the Elderly (SHADES). The aim of the SHADES was to map mortality, morbidity, nutritional status, and pharmaceutical treatment in elderly residents in nursing homes and to use the data collected to improve health care in the elderly (Ernsth Bravell et al., 2011). All residents of the 11 selected nursing homes were invited to join the study and were included in two periods during spring 2008 and autumn 2008. In total, 318 residents were included in the SHADES in 2008. Patients who were staying at the nursing home temporarily for short-term rehabilitation or palliative care were excluded. Persons with language difficulties and persons under the age of 65 were also excluded.

2.2. Methods of investigation

Participants were examined at baseline by specially trained nurses who also collected data from patient records for diagnoses and current medical treatment. Diagnoses collected from the patients records were coded according the Swedish version of the 10th version of the International Classification of Diseases (ICD-10) (National Board of Health & Welfare, 2010). The testing of participants included measurement of pulse, blood pressure, and weight, and questionnaires. It was performed by the study nurses with assistance from the staff at the nursing home. Blood pressure was measured three times at 1 min intervals in the right arm in a sitting position. The mean value of the three measurements was used for blood pressure analyses. Weight was measured to the nearest 0.1 kg with scales available at the nursing home. Information about height was given by the resident or collected from medical records or other documents. If there was no knowledge about height, it was measured at inclusion. Nutritional status was evaluated with the MNA (Vellas et al., 1999). The MNA is a validated test composed of simple measurements and brief questions specially designed for a geriatric population (Vellas et al., 1999, 2006). For measures in the MNA such as mid-arm circumference (MAC) and calf circumference (CC), as well as for questionnaire responses, a specific MNA manual developed for Swedish settings was used (Unosson, 2004). Residents were assessed with the MNA assessment at baseline and at 24 months after inclusion. Nutritional status was assessed in a two-step process. In the first step the MNA-SF (Mini Nutritional Assessment-Short Form) was used (Rubenstein, Harker, Salva, Guigoz, & Vellas, 2001). The MNA-SF is a screening tool developed from the MNA. The threshold for well-nourished subjects is $\geq$11. Subjects with scores less than 11 were then further evaluated with the full MNA to confirm the nutritional status as at risk of malnutrition (MNA score between 17 and 23.5) or malnourished (MNA $<$17). To measure cognitive function, the Mini Mental State Examination (MMSE) was used (Folstein, Folstein, & McHugh, 1975). The MMSE consists of 21 questions that measure orientation, memory, naming, constructional ability, and attention. Scores range from 0 to 30, with a score of 23 or lower indicating cognitive dysfunction. Blood samples were drawn according to a standard procedure and were stored at -70 °C in a freezer. Hemoglobin- and transthyretin levels were analyzed from the blood samples at the Hospital in Jönköping, Sweden by high-pressure liquid chromatography. For survival calculations, mortality dates were collected from the Swedish Total Population Register on September 15th 2011.

2.3. Ethics

The study protocol was approved by the Regional Ethics Review Board at Linköping University (case number M150-07). Informed consent was obtained from all participants. If the patient could not understand the information and give informed consent, consent was obtained from their next of kin.

2.4. Statistical analysis

The data collected in the study were analyzed using SPSS Statistics 20 (SPSS Inc., Chicago, IL). Differences between pairs of groups were tested using independent-samples *t*-test and the Mann–Whitney *U* test for continuous variables and the chi-square test for discrete variables. To calculate differences between multiple groups, one-way ANOVA was used for continuous variables and the chi-square test for discrete variables, with Bonferroni correction for mass significance (Bland & Altman, 1995). With Bonferroni calculation when three comparisons were made, the alpha value for significant differences was changed to $p < 0.017$.

Survival functions are presented as Kaplan–Meier survival curves. Differences in survival between groups were tested with the log-rank test.

3. Results

3.1. Population characteristics

The study included 318 subjects, of whom 308 had complete MNA/MNA-SF data (Fig. 1). The mean age of the participants was 85.0 years (range 65–101 years).

At inclusion in the study, 41.6% of the participants ($n = 128$) were well nourished, 40.3% ($n = 124$) were at risk of malnutrition, and 17.7% ($n = 56$) were malnourished according to the MNA results. The baseline characteristics of the subjects in the different MNA groups are presented in Table 1. Malnourished subjects were older, had lower weight, BMI, hemoglobin levels, diastolic blood pressure, and MMSE scores, and were more likely to have a dementia diagnosis and/or Parkinson's disease.

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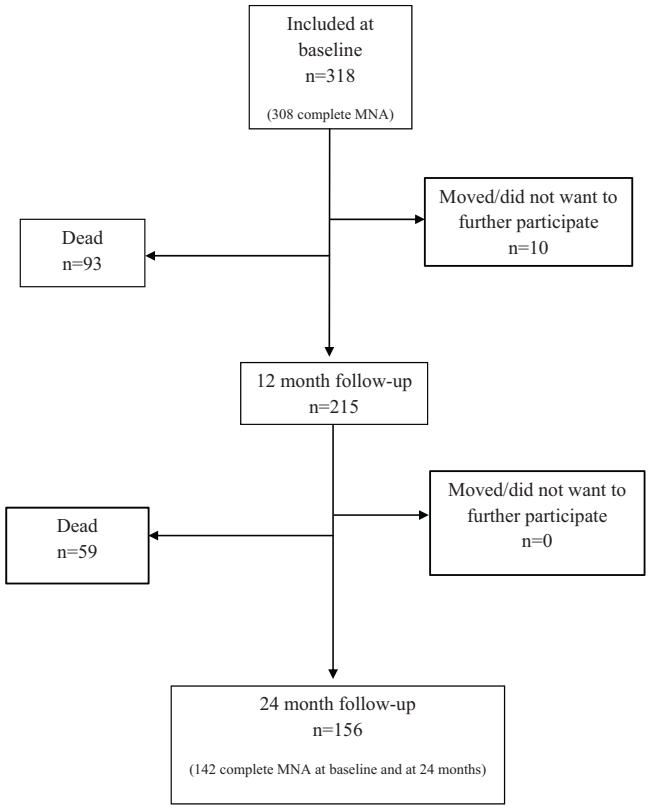

Fig. 1. Flow chart of the patients in the study.

3.2. Longitudinal results

After 24 months 153 residents had died, and 10 did not want to further participate (Fig. 1), leaving 142 participants with complete MNA data at baseline and after 24 months. The group of participants who survived 24 months represents a population of better nutritional state at baseline, where only 10.6% were malnourished, 43.0% were at risk of malnutrition, and 46.5% were well nourished at baseline. The results of the longitudinal follow-up of the subjects are presented in Table 2. Over time, there was a shift toward lower MNA scores, where 28.2% of participants ($n = 40$) were well nourished, 47.2% ($n = 67$) were at risk of malnutrition, and 24.6% ($n = 35$) were malnourished after 24 months.

After 24 months, 38.7% of the participants showed a decline in nutritional state; 61.3% had an improved or stable nutritional state. The characteristics of the patients in these two different groups are presented in Table 3. The factors that significantly differed between the groups were weight and BMI: weight and BMI were higher in the group with a decline in nutritional state. In addition, diastolic blood pressure and hemoglobin levels were higher in this group. Hospitalization during the 24-month observation period was more common in the group with deteriorating MNA status.

The survival rate differed significantly between the three groups, as shown in Fig. 2.

4. Discussion

We found that the prevalence of malnutrition at nursing homes in Sweden was 17.7% and that the survival rate was significantly lower in malnourished residents. After 24 months of follow up, about half of the study population had died. Among the survivors, the prevalence of malnutrition had increased from 10.6% to 24.6%

The population in this study was old, with a mean age of 85 years. This part of the Swedish population is currently growing and will be in need of a significant proportion of health care resources in the future. Our study followed elderly subjects over time in their regular care setting, while most other studies have been either cross-sectional (Verbrugghe et al., 2013) or confined to hospitalized patients (Drescher et al., 2010; Van Nes, Herrmann, Gold, Michel, & Rizzoli, 2001), the latter a different population with limited possibilities of follow-up. With respect to the study setting, our population sample was fairly large and with regard to the high mortality rate in this age group, our longitudinal study is unique. The study is limited in that the sample of nursing homes used was not randomly selected, but rather selected for reasons of convenience from three different areas in Sweden, with persons living in nursing homes whose staffs were interested in joining the project being asked to participate. However, the nursing homes included did not differ notably from other nursing homes in Sweden (Ernsth Bravell et al., 2011). There is limited access to nursing homes in Sweden and consequently the population in nursing homes represents the group of elderly individuals in

Table 1
Baseline characteristics according to MNA nutritional status.

Variables	1. Normal (MNA-SF ≥12 or MNA >23.5) $n = 128$	2. At risk of malnutrition (MNA ≥17 and ≤23.5) $n = 124$	3. Malnutrition (MNA <17) $n = 56$	p-Value
Age (years), mean ± SD	84.7 ± 6.4	84.2 ± 7.5	87.5 ± 6.8	0.010 (b, c)
Female, % (n)	74.2 (95)	66.1 (82)	80.4 (45)	0.110
Weight (kg), mean ± SD	72.8 ± 14.1	67.0 ± 14.9	55.5 ± 10.9	<0.001 (a, b, c)
BMI (kg/m^2), mean ± SD	27.4 ± 4.5	24.8 ± 5.1	21.0 ± 3.8	<0.001 (a, b, c)
Hemoglobin (g/L), mean ± SD	127.9 ± 12.9	124.0 ± 14.8	122.3 ± 11.8	0.022 (b)
Transthyretin (g/L), mean ± SD	0.22 ± 0.057	0.22 ± 0.056	0.19 ± 0.064	0.001 (b, c)
Systolic blood pressure (mmHg), mean ± SD	139.4 ± 21.7	131.9 ± 20.4	124.7 ± 30.4	0.001 (a, b)
Diastolic blood pressure (mmHg), mean ± SD	75.1 ± 10.7	72.1 ± 12.0	68.2 ± 11.3	0.001 (b)
MMSE, mean ± SD	19.6 ± 6.1	16.4 ± 6.1	11.7 ± 5.2	0.001 (a, b, c)
Number of medications, mean ± SD	6.8 ± 2.9	7.2 ± 3.2	6.9 ± 3.1	0.580
Diabetes, % of MNA group (n)	21.8 (28)	15.3 (19)	17.8 (10)	0.586
Dementia, % of MNA group, (n)	29.2 (35)	43.0 (49)	46.9 (23)	0.033 (–)
Heart failure, % of MNA group (n)	14.1 (18)	15.3 (19)	12.5 (7)	0.878
Cerebrovascular disease, % of MNA group (n)	21.1 (27)	21.8 (27)	25.0 (14)	0.837
Ischemic heart disease, % of MNA group (n)	11.7 (15)	14.5 (18)	16.1 (9)	0.683
COPD % of MNA group (n)	3.1 (4)	4.8 (6)	5.4 (3)	0.713
Parkinson's disease, % of MNA group (n)	1.6 (2)	10.5 (13)	10.7 (6)	0.009 (a, b)

a = significant difference between 1 and 2.
b = significant difference between 1 and 3.
c = significant difference between 2 and 3.
Differences were calculated by independent-samples t-test and chi-squared test, with Bonferroni correction for mass significance.

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Table 2
MNA status at baseline and at 24 month follow-up.

MNA at baseline		MNA at 24 months		
		Malnourished	At risk of malnutrition	Well nourished
Malnourished				
Number of participants	15	8	6	1
% of baseline MNA group	100.0	53.3	40.0	6.7
At risk of malnutrition				
Number of participants	61	16	33	12
% of baseline MNA group	100.0	26.2	54.0	19.7
Well nourished				
Number of participants	66	11	28	27
% of baseline MNA group	100.0	16.7	42.4	40.9
		Total malnourished at 24 months	Total at risk of malnutrition at 24 months	Total well nourished at 24 months
Total number of participants	142	35	67	40

Table 3
Baseline and 24 months follow-up characteristics of participants with improved/stable or deteriorating MNA status.

Variables	Improved/stable MNA status, $n=87$	Deteriorating MNA status, $n=55$	p-Value
Age (years), mean ± SD	83.6 ± 7.3	82.7 ± 7.1	0.469
Female, % (n)	72.4 (63)	70.9 (39)	0.846
Weight (kg), mean ± SD	65.7 ± 13.7	70.6 ± 14.8	0.045
BMI (kg/m^2), mean ± SD	24.6 ± 4.4	27.0 ± 5.3	0.007
Hemoglobin (g/L), mean ± SD	124.5 ± 13.7	129.2 ± 12.8	0.048
Transthyretin (g/L), mean ± SD	0.22 ± 0.06	0.22 ± 0.05	0.549
Systolic blood pressure (mmHg), mean ± SD	133.6 ± 20.4	138.9 ± 22.0	0.153
Diastolic blood pressure (mmHg), mean ± SD	70.6 ± 9.7	76.4 ± 12.0	0.003
MMSE, mean ± SD	17.9 ± 6.4	17.1 ± 6.5	0.509
Number of medications, mean ± SD	6.3 ± 3.0	6.6 ± 3.0	0.551
Hospitalization during the 24 months period, % of total (n)	27.5 (24)	47.2 (26)	0.017
Dementia diagnosis, % of group (n)	40.2 (35)	41.8 (23)	0.851
Cerebrovascular disease, % of group (n)	26.4 (23)	23.6 (13)	0.824
Heart failure, % of group (n)	5.7 (5)	10.9 (6)	0.262
Ischemic heart disease, % of group (n)	12.6 (11)	12.7 (7)	0.988
COPD, % of group (n)	4.6 (4)	1.8 (1)	0.381
Parkinson, % of group (n)	4.6 (4)	5.5 (3)	0.818
Diabetes, % of group (n)	14.9 (13)	16.3 (9)	0.820

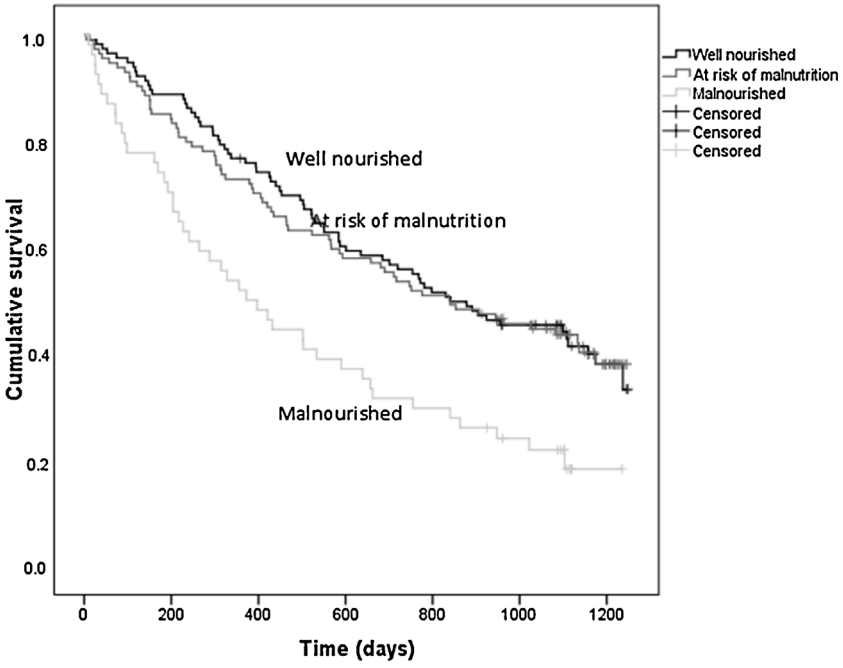

Fig. 2. Kaplan–Meier survival curves according to mini nutritional assessment category at baseline ($p < 0.001$, log rank test).

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society in greatest need of care (Lagergren, 2002). Therefore, the results cannot be generalized to the overall population in this age group. The prevalence of malnutrition of around 18% in our study is in concordance with the findings in Guigoz's review from 2006, including a large sample of studies of patients in different settings and in different countries, which showed a prevalence of malnutrition of $21 \pm 0.5\%$ in institutionalized elderly people, (Guigoz, 2006), as well as the findings of a previous Swedish study (Carlsson et al., 2009). The prevalence of malnutrition can vary even if the same method is used to assess nutritional status. This can partly be explained by different types of settings, differences in exclusion and inclusion criteria in the cohorts, and geographic differences. "Frail elderly" syndrome is a frequently used term that has many definitions but that is clinically characterized by muscle wasting, poor balance and mobility, and decreases in cognitive performance. With the complexity of its clinical manifestations, Parkinson's disease is suggested to be the prototype of this condition (Lauretani et al., 2012). Our results show that both dementia and Parkinson's disease were more common in the malnourished group of patients, which concurs with the concept of frailty in this group. As both overweight and underweight have been shown to indicate poor nutritional status (de Morais et al., 2013), it is not contradictory that our longitudinal results show that the group with higher BMI and higher weight were more likely to experience a deterioration in MNA status. The fact that the group of survivors had a better nutritional state also makes it more logical that the participants who lost weight during the period were those with higher baseline BMI values and weights. According to a recent Asian study, deteriorating MNA is associated with poor basic ADL (activities of daily living) status and hospitalization (Izawa, Enoki, Hasegawa, Hirose, & Kuzuya, 2014). This was also seen in our study and it should be noted that acute disease or psychological stress is an item in the MNA that could influence this association. Nutritional intervention is important, and individualized nutritional care was shown to give positive results, both regarding nutritional status and quality of life in malnourished patients (Starke, Schneider, Alteheld, Stehle, & Meier, 2011). However, as nutritional care is expensive and difficult to achieve in patients who are already malnourished it is important to identify individuals at risk of malnutrition and to act to avoid deterioration in nutritional state (Volkert, 2013). Further randomized, longitudinal intervention studies of nutritional optimization in this setting would be valuable.

5. Conclusions

We found that malnutrition and risk of malnutrition were common in elderly nursing home residents. Moreover, the prevalence of malnutrition and risk of malnutrition increased over time and was associated with lower survival. As BMI and weight were higher in the group with deteriorating MNA status, it is important to evaluate nutritional state with validated assessment tools. Nutritional interventions should be considered in better nourished groups, as well as in malnourished individuals, to prevent a decline in nutritional state over time.

Conflict of interest

The authors declare that they have no competing interests.

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