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NUTRITIONAL STATUS IN ELDERLY PEOPLE ADMITTED TO COMMUNITY RESIDENTIAL HOMES: COMPARISONS BETWEEN TWO COHORTS

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Abstract: The aim was to describe nutritional status and socio-demographic and medical data in people who were newly admitted to community residential homes (cohort 2), and to compare the results with a previous study performed in the same municipality four years earlier (cohort 1). One hundred and twenty-seven people, 65 years of age, or older, newly admitted to residential homes in a municipality in the southern part of Sweden, were consecutively included. Nutritional status was assessed, using a combination of anthropometry and serum protein measurements and by Mini Nutritional Assessment (MNA). The results showed that 32 % of the residents in cohort 2 were assessed as protein-energy malnourished (PEM), compared with 38 % in cohort 1. Body mass index, psychological stress or acute disease, and reduced fluid intake were items in MNA which had power to predict PEM. Residents in cohort 2, diagnosed as having severe medical diseases, increased as well as residents with neuropsychological problems. Simultaneously, the number living in residential homes decreased, as compared to cohort 1. These differences indicate that the admission criteria have changed between cohorts 1 and 2.

Key words: Elderly people, nutritional status, entering community care, comparison.

Introduction

The present study is a part of an ongoing research project aiming to describe nutritional status, to identify factors associated with nutritional issues and to investigate the effects of individualised nutritional care, in elderly people newly admitted to community residential homes in Sweden. The project has been ongoing since 1996 in a municipality in the southern part of Sweden (1).

The most common variant of malnutrition in elderly people 65 years of age or older in Sweden, is a combination of protein and energy deficiency, so called protein-energy malnutrition (PEM) (2). Using a combination of anthropometric and biochemical measurements, PEM was found in 33 % of the residents who were newly admitted to residential homes (1) and in 38 % of elderly patients with hip fractures at the time of entering hospital care (3). Saletti et al. (4) used a subjective method, the Mini Nutritional Assessment (MNA) (5,6) and observed that 36 % of residents in residential homes were malnourished. Protein energy malnutrition is associated with an increased predisposition to illness, morbidity and mortality (7) and quality of life may change for the worse (8). Hence it is important to identify elderly people who would benefit from early detection of PEM (5,6).

Out of 8.9 million people in Sweden in December 2000, approximately 17 % were 65 years of age or older and 5 % 80 or older (9). In those 80 or older, 40 % were in need of home service and nursing care (10). After a reform in 1992, the municipalities in Sweden have the responsibility for all service and care of elderly people. The intention of the reform was to create continuity of health and medical care. The guiding principles focus on autonomy, privacy, safety and freedom of choice. Elderly people in need of care are offered assistance in their own homes or in special types of residential homes, with service at different levels according to individual requirements (11), such as nursing homes, group-dwellings for elderly people with dementia, retirement homes and service buildings (12).

The care of elderly people has gradually changed since the reform was introduced. During the late 1990s, palliative care given to residents in the final stage of life was established, as well as, short-term stays being introduced. The aim of short-term stays is to provide support for elderly people, so that they can continue to live in their own homes as long as possible. This is achieved by giving temporary care to residents in need of further rehabilitation after hospital care, and to residents whose next of kin need to receive temporary support. In December 2000, 127 000 residents in Sweden lived in special types of housing, which was 10 000 less than in 1996. Elderly people, who enter special types of housing, are mostly in great need of comprehensive care, day and night, and the assistance offered in their own homes does not fulfil their needs any longer (10). Hence it is important to study whether these changes have had an impact on the admission criterion.

The aim of the present study was to examine nutritional status and socio-demographic and medical data, in people who were newly admitted to community residential homes. A further aim was to compare the results with a previous study performed in the same municipality.

Material and method

Subjects

The residents included in both the present and the previous study were 65 years of age, or older. They were newly admitted

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to one of eight residential homes in a municipality in the southern part of Sweden. Exclusion criteria were terminal stage, malignant diseases and kidney- and liver disease. The residents were consecutively included.

The present study (cohort 2) was carried out from October 2000 to April 2002 and 127 residents (40 men, 87 women) were included. During this period, 134 residents, who fulfilled the criteria, entered the residential homes. Of those six did not wish to participate and one died before the examination. The residential homes lodged 277 residents at that time.

The previous study (cohort 1) was carried out from October 1996 to October 1997 and included 208 residents (94 men, 114 women). During this period, the residential homes comprised 334 accommodation places. To minimise threats to internal validity, the same inclusion- and exclusion criteria were used in both cohorts. The cohort 2 study was carried out in the same municipality as the cohort 1 study, with the same residential homes and the same definitions of PEM. The previous study, however, had also included residents admitted to service buildings. When comparing the two cohorts in this paper, these residents were excluded, in order to make the cohorts comparable. During the 12 month period, fewer residents were admitted to the residential homes and consequently fewer were included in cohort 2 compared with cohort 1. To increase the number of residents, the study continued for another six months.

The residents, or their next of kin, gave informed consent after receiving oral and written information about the study. The studies were approved by the Research Ethics Committee, Faculty of Health Sciences, Linköping University (Dnr 00-243).

Methods

To assess whether the residents in the two cohorts were PEM or non-PEM, body weight, height, mid-arm circumference (MAC), triceps skinfold thickness (TSF), arm muscle circumference (AMC), serum albumin and transthyretin, were measured (Table 1). Each resident´s body weight was measured to the nearest kg by a mechanical balance chair and height was estimated to the nearest cm, with the resident in the supine position on a flat bed, using a measuring instrument with a fixed foot plate and an adjustable head plate. Weight index (WI), in percent, was calculated from actual weight on admission divided by the reference weight and multiplied by 100. The reference weight for women was calculated to be 0.65 x height (cm) - 40.4 (kg), and for men 0.80 x height (cm) - 62.0 (kg) (13,14). The correlation coefficient between WI and body mass index (BMI) [weight (kg)/height (m^2)] was 0.99 according to Pearson´s correlation analysis. A WI of 80 % is equivalent to a BMI of approximately 20.0.

Table 1

Criteria used to determine protein- energy malnourishment (PEM). A resident was defined as being PEM if two or more of the nutritional variables were subnormal, including at least one anthropometric and one biochemical measurement

		Men	Women
Anthropometry			
WI		< 80 %	< 80 %
TSF		≤ 6 mm	≤ 12 mm
AMC	≤ 79 years	≤ 23 cm	≤ 19 cm
	> 79 years	≤ 21 cm	≤ 18 cm
Serum proteins			
Albumin		< 36 g/l	< 36 g/l
Transthyretin		< 0.23 g/l	< 0.23 g/l

WI = Weight Index, TSF = triceps skinfold thickness, AMC = arm muscle circumference

Mid-arm circumference was measured to the nearest mm with a measuring-tape and TSF, to the nearest mm, with a Harpenden skinfold calliper at the midpoint of the arm between the process of acromion and olecranon (15). The mean of three measurements was used and the non-dominant arm was measured, unless the arm was paralysed or otherwise injured. Arm muscle circumference was calculated: AMC = MAC - 0.1 (π x TSF). Serum albumin and transthyretin were measured, and local reference values were used. A resident was defined as being PEM if two or more of the nutritional variables were subnormal, including at least one anthropometric and one biochemical measurement (1,3,15) (Table 1).

Socio-demographic information included the type of dwellings the residents moved from. Medical data included medical diseases, physical and mental factors and current medication upon admission. Medical diseases were classified according to the international classification system (ICD-9) (16).

In the cohort 2 study, nutritional status was also assessed by the Mini Nutritional Assessment (MNA) tool (5,6). Mini Nutritional Assessment has been specially developed to evaluate the risk of malnutrition in frail elderly people. It is a non-invasive tool divided into a screening and an assessment part. In total, MNA comprises 18 weighted items including anthropometric measurements and questions related to lifestyle, medication and mobility, a dietary assessment and questions related to self-perception of health and nutrition. The maximum score of the MNA is 30 points. The sum of the MNA score classifies the residents in the following manner: Well-nourished ≥ 24 points (MNA 1); at risk of malnutrition, 23.5 to 17 points (MNA 2); malnourished, < 17 points (MNA 3).

In order to compare the presence of issues important for the development of PEM between the residents in the studies, MNA items with significant association with PEM from the cohort 1 study were used. These MNA items were: Ability to walk; neuropsychological problems, e.g. depression, dementia

or confusion; having suffered psychological stress or acute diseases in the previous three months; having skin ulcer, e.g. pressure sores or leg ulcer; need of help during meals; and fluid intake per day (1).

The overall cognitive function was assessed in cohort 2, but not in cohort 1. The Mini Mental State (MMS) examination was used (17). It is a 30-item test, where orientation, short-term memory, attention, language, comprehension, writing and a visual task are assessed. Every item carried out in the correct way gives one point, otherwise no point is assigned, with 20 or less points as the limit for cognitive disability. Seven residents were not tested according to MMS, due to aphasia in six residents and unwillingness to participate in one resident. The medications were classified according to the Anatomical Therapeutical Chemical Classification system (ATC).

Data were obtained from the residents´ records, relatives and the staff. If necessary, a proxy and a member of staff who knew the resident well answered the questions. The interview and nutritional assessment were performed during the first two weeks after admission.

Statistics

The results are given as frequencies or percentages and as arithmetic means and standard deviations. Differences between the cohorts and subgroups were determined using t-test and chi-square test. A p-value below 0.05 was considered significant. Multiple logistic regression forward stepwise analysis (WALD) was used to estimate the MNA items´ association with PEM (18). All MNA items and their weighted scores constituted independent variables. The MNA classes were dichotomised into well nourished (MNA 1) or at risk of malnutrition and malnourished (MNA 2 and 3). Sensitivity, specificity and diagnostic predictivity were tested regarding the dichotomised MNA classes towards PEM/non-PEM. When the MNA items were compared between the cohorts, the items were dichotomised into yes or no. In order to test the correlation coefficient between MMS and the item neuropsychological problems in MNA, Spearman´s rank correlation was used. Mini mental state was dichotomised into good cognitive ability (more than 20 points) or poor (20 points or lesser) (17). The statistics program SPSS, version 11.5 was used.

Results

Cohort 2

In cohort 2, 127 residents (40 men, 87 women) were included during the 18 month period. Thirty-two per cent of the residents were assessed as PEM (11 men, 30 women). In PEM residents, the mean values of serum albumin and transthyretin, in men and women, and TSF in women were below the reference values (Table 2).

Table 2
Anthropometry and serum proteins in PEM (11 men, 30 women) and non-PEM residents (29 men, 57 women) admitted to community residential homes in cohort 2. Each result is given as the mean (SD).

		PEM	non-PEM
Anthropometry			
WI %	all	81.0 (9.1)	99.5 (14.0)
TSF mm	men	6.3 (2.3)	10.7 (3.5)
	women	8.7 (2.1)	15.4 (4.6)
AMC mm	men	22.0 (2.4)	24.9 (2.4)
	women	21.4 (2.6)	22.9 (2.3)
Serum proteins			
Albumin g/l	all	34.2 (3.9) 1	38.3 (4.3)
Transthyretin g/l	all	0.20 (0.06) 1	0.24 (0.06)

PEM = protein- energy malnutrition, WI = weight index, TSF = triceps skinfold thickness, AMC = arm muscle circumference, SD = standard deviation, 1 = 2 missing values

In those residents who were assessed as PEM, 17 (41%) had skin ulcers, as compared to 14 (16 %) in residents assessed as non-PEM ($p < 0.01$). The mean values of serum albumin and transthyretin in residents with skin ulcer were 33.7 g/l and 0.20 g/l, as compared to 37.9 g/l ($p < 0.001$) and 0.23 g/l ($p < 0.05$), in residents without skin ulcer, respectively. Among residents with skin ulcer, 15 (52 %) were able to walk compared with 68 (78 %) among those without skin ulcer ($p < 0.01$).

With regard to MNA, 38 of the residents (30 %) were classified as well nourished (MNA 1), 64 (50 %) as at risk of malnutrition (MNA 2) and 25 (20 %) as malnourished (MNA 3).

The multiple logistic regression analysis showed that MNA item BMI, had the highest impact on being assessed as PEM (OR 4.9, $p <0.001$). To be exposed to psychological stress or acute disease (OR 2.2, $p < 0.05$) and to have reduced fluid intake (OR 18.9, $p < 0.05$) were the second and third best predictors of PEM.

When MNA classes were dichotomised, agreement between MNA and PEM/non-PEM was 45 %. In those 41 residents assessed as PEM, 30 were simultaneously categorised as MNA 2 or MNA 3, implying a sensitivity of 73 %. Eighty-six residents were assessed as non-PEM, of whom 27 were categorised as MNA 1. Specificity was 31 % and diagnostic predictivity 33 %.

The mean age of the residents was 85.4 (men 84.4, women 85.8). Sixty-five residents in cohort 2 were admitted from another permanent community dwelling, 36 from their own homes, and 26 from short-term stay accommodation. The mean number of prescribed medications was 5.6. A total of 82 % of the residents were on medications affecting the nervous system, while 65 %, 65 % and 39 % were on medications affecting the heart and circulatory system, the blood and blood-producing organs, and the digestive organs and metabolism, respectively. Dementia, cerebrovascular disease and symptomatic heart

failure were the most common diseases among the residents. Each of these three diseases was present in one-third of the residents, some residents having more than one of the diseases. Cerebrovascular disease was most frequent among residents admitted from short-term stay (58 %), compared to residents entering municipal care from their own homes (17 %) or those who moved within municipal care (32 %) ($p < 0.05$). Diabetes mellitus and ischaemic heart disease were present in 16.5 % and 13.4 % of the residents, respectively. No socio-demographic or medical data were significantly associated with PEM.

The MMS mean score in men was 11.6 (±9.6) and in women 14.1 (±10.3) ($p < 0.001$).

Thirty-one per cent of the residents scored more than 20 on MMS and 69 % had a score of 20 or less, of whom 36 % scored 0. No significant differences were seen between PEM and non-PEM residents with regard to MMS. The correlation coefficient between the MMS sum and the item neuropsychological problems in MNA (n = 120) was 0.56 ($p < 0.001$).

Comparison between the two cohorts

Thirty-eight per cent of the residents in cohort 1 were assessed as PEM, as compared to 32 % in cohort 2 (ns). The serum albumin levels were significantly lower in residents in cohort 1 compared with those in cohort 2 (Table 3).

Table 3
Anthropometry and serum proteins assessed in residents newly admitted to community residential homes in cohort 1 (n = 208) and 2 (n = 127). Each result is given as the mean (SD).

		Cohort 1	Cohort 2
Anthropometry			
WI	all	93.1 (18.1)	93.5 (15.3)
TSF mm	men	9.1 (3.6)	9.5 (3.7)
	women	12.6 (4.9)	13.1 (5.1)
AMC mm	men	23.6 (2.7)	24.1 (2.7)
	women	21.6 (3.0)	22.4 (2.5)
Serum proteins			
Albumin g/l	all	33.3 (5.4)	36.9 (4.6)[1] ***
Transthyretin g/l	all	0.22 (0.06)	0.22 (0.06)[1]

WI = weight index, TSF = triceps skinfold thickness, AMC = arm muscle circumference, t-test for independent samples, SD = standard deviation, [1] = 2 missing values, *** = p-value < 0.001

The highest frequency of PEM in cohort 1 was seen in residents admitted from hospital care, where 22 residents out of 53 (45 %) were assessed as PEM. In cohort 2, the highest frequency was seen among residents transmitted from short-term stay, where 10 residents out of 26 (38 %) were assessed as PEM (Table 4).

Table 4
Type of dwelling/stay before admission to the community residential homes and protein- energy malnourished (PEM) residents in cohorts 1 (n = 208) and 2 (n = 127)

Type of dwelling/stay before admission	Cohort 1 PEM n	Cohort 1 non-PEM n	Cohort 2 PEM n	Cohort 2 non-PEM n
Another permanent community dwelling	21	37	19	46
Own home	36	61	12	24
Short-term stay	-	-	10	16
Hospital care	22	31	-	-
Total	79	129	41	86

Seventy-nine out of 208 residents were assessed as PEM (38 %) in cohort 1 and 41 out of 127 residents (32 %) in cohort 2. There was no significant difference between PEM residents in the two cohorts (chi-square test)

The mean age of residents in cohort 1 was 83.9 and 55 % were women, as compared to cohort 2 where the mean age was 85.4 (ns) and 68 % were women ($p < 0.05$). The average number of prescribed medications in cohort 1 was 5.8, which was not significantly different from cohort 2. In cohort 2, more residents had neuropsychological problems, more were able to walk and less had been exposed to stress or acute disease in the previous three months, compared to the residents in cohort 1. Residents with skin ulcer were similar in both cohorts (Table 5). Insufficient fluid intake/day was more common in PEM residents compared to non-PEM residents in both cohorts 1 ($p < 0.05$) and 2 ($p < 0.01$).

Table 5
Physical and mental items in residents newly admitted to community residential homes in cohorts 1 (n = 208) and 2 (n = 127)

Variable	Cohort 1 %	Cohort 2 %
Drink less than 6 glasses/cups of fluid/day	20.7	12.6
Need of help during meals	44.2	36.2
Having neuropsychological problems	44.7	64.6 ***
Inability to walk	34.6	22.8 *
Stress or acute disease in the previous 3 months	40.9	22.8 **
Skin ulcer	25.0	24.4

Chi-square test, * = p-value < 0.05, ** = p-value < 0.01, *** = p-value < 0.001

The frequency of residents diagnosed as having dementia diseases, cerebrovascular diseases and symptomatic heart failure, was significantly higher in the cohort 2 study, as compared to the cohort 1 study (Table 6). In cohorts 1 and 2 the mortality rate six months after admission was 25 % and 13 %,

respectively ($p < 0.05$).

Table 6
Medical diseases according the international classification system (ICD-9) in residents newly admitted to community residential homes in cohorts 1 (n = 208) and 2 (n = 127). Some residents had more than one disease.

Diseases	Cohort 1 %	Cohort 2 %
Dementia disease	21.6	33.1 *
Cerebrovascular disease	20.2	33.1 **
Symptomatic heart failure	20.7	32.3 *
Diabetes mellitus	19.2	16.5
Ischaemic heart disease	19.2	13.4

Chi-square test, * = p-value < 0.05, * = P-value < 0.01

Discussion

One-third of the residents in both cohorts was assessed as PEM and this indicates a comprehensive need for nutritional intervention. Despite awareness of this nutritional problem, the number has not significantly decreased during the years. Other studies in nursing home residents have shown a similar prevalence during recent years (19,20,21).

Among MNA items, BMI was found to have the highest power to predict PEM. This reflects body weight and length being integrated parts of the assessment of nutritional status. As WI was used as one criterion defining PEM and that the correlation coefficient between WI and BMI was high (0.99), may be seen as a circular argument. However, this is in concordance with other studies, where low BMI shows a strong relation to PEM (22,23).

Having been exposed to psychological stress, or acute disease in the previous three months had the second highest impact on the odds of being assessed as PEM. Psychological stress has been found to reduce the nutrient intake in elderly people by affecting their appetite negatively. Such stress may involve loss of spouse, independent living, liberty of action and control over their lives (24). Social and medical conditions, such as bereavement, depression, isolation, alcoholism, eating difficulties and acute illness, have been found to affect nutritional status in elderly people. Acute illnesses, such as infections, inflammatory states and trauma lead to metabolic changes and decrease food intake due to lack of appetite (25). Reduced fluid intake had the third highest impact on being assessed as PEM. Fluid intake is an integrated part of food intake and when elderly people´s nutrient intake is insufficient, their fluid intake is usually insufficient (26).

Skin ulcers were present in a fourth of all newly admitted residents in both cohorts. In cohort 2, the frequency of skin ulcer was significantly higher in PEM residents, as compared to non-PEM residents. Significantly more residents in cohort 2 with inability to walk had skin ulceration, compared to those who were able to walk. In earlier studies, it has been noticed that PEM is associated with development of pressure sores (27,28) and subsequent decreased healing of pressure sores (29,30). Leg ulcer healing in elderly people might be related not only to insufficient nutrient intake, but also to decreased mobility and ADL function. Immobility and poor blood circulation may contribute to development of leg ulcers as well as poor leg ulcer healing (31).

The highest prevalence of PEM in cohort 1 was found in residents who were newly admitted from hospital care (45 %), while in cohort 2, it was found in residents who were admitted from short-term stay (38 %). When including residents in cohort 2, no residents were admitted directly from hospital care. This group of residents was admitted to short-term stay to receive further rehabilitation. The aim of this type of care is to provide support to the residents, in order to increase the possibility of them living in their own homes as long as possible. Consequently, after a few weeks, the aim is that the residents move back home or enter a residential home permanently.

The differences in serum albumin level between cohorts 1 and 2 may, to a certain extent, be explained by none of the residents in cohort 2 having been admitted directly from hospital care, compared with 25 % in cohort 1. Reasons for hospital care, such as infections, gastrointestinal or cardiac diseases, wounds and increased vascular permeability may be as equally as likely as PEM to cause decreased serum albumin levels (32).

Changes in the organisation of elderly care, which took place during the four years between the two studies, may have affected the admission criteria. During this period, there was a reduction in the total number of permanent accommodation places, while short-term was introduced. More residents in cohort 2 had severe medical diseases and more had neuropsychological problems. At the same time, less residents had suffered psychological stress or acute disease in the previous three months and more were able to walk, as compared to cohort 1. The residents, supported by home care service, would seem to be able to manage physically, while when cognitive function fails, a resident requires institutional care. The support of elderly people within their own homes, rather in institutional settings, is a trend seen over the western world (33).

Even though the cohort 2 study continued for another six months, 82 fewer residents were admitted to residential homes, as compared to cohort 1. This may be due to the expansion of the home care service, fewer accommodation places, as well as a lower mortality rate during that time period. Since the mortality rate can vary from year to year, the differences might be random (34).

In the cohort 1 study, approximately every second resident was assessed as having neuropsychological problems, of whom merely half were diagnosed as having dementia diseases. In the cohort 2 study, MMS [16] examination was used as a complement to describe overall cognitive function. A significant correlation was seen between the MNA item neuropsychological problems and MMS. This indicates that dementia diseases were under reported in the medical records in the cohort 2 study. Thus, there is reason to suppose that residents with neuropsychological problems in cohort 1 also had impaired cognitive function. The high number of residents with cognitive impairment in both cohorts indicates a high degree of vulnerability among these residents (35).

Out of 41 PEM residents, 30 were simultaneously classified as at risk of malnutrition or as being malnourished according to MNA, which is a rather high degree of sensitivity. The transformation from the original three MNA classes into two was probably the main cause of low specificity and diagnostic predictivity. Emphasising that residents assessed as being at risk of malnutrition are in need of nutritional intervention may be seen in different ways. On one hand, these residents might withdraw resources from those in real need of nutritional resources. On the other hand, these residents often have decreased calorie intakes, which can be easily corrected by nutritional intervention (5,36).

Senile dementia, cerebrovascular diseases and symptomatic heart failure were common medical diseases among the residents in cohort 2. Most of the residents were in need of comprehensive care day and night, due to physical and cognitive problems and they were in need of assistance during meals. According to Guigoz et al. (5) newly admitted residents are often frail, with multiple problems and at risk of PEM and functional decline. Christensson et al. (37) have found that care programmes, based on individual nutritional requirements, resources, and desires, improved nutritional status and functional capacity in a group of PEM residents (37). Identification of elderly people in need of nutritional intervention should be a key component of geriatric assessment, where MNA has been found to be a useful tool for early detection of those at risk [6,38].

Conclusions

The number of residents assessed as PEM was high in cohort 1 (38 %) and remained high four years later in cohort 2 (32 %). In cohort 2, BMI had the highest power to predict PEM, with psychological stress or acute disease in the previous three months and reduced fluid intake as the second and third predictors. The number of residents with severe medical diseases and neuropsychological problems was significantly higher in cohort 2 compared with cohort 1. During the interval between the two studies, the number of accommodation places in residential homes decreased. In the cohort 2 study, cognitive disability seemed to be a more important criterion for admission, in comparison with the study four years earlier.

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