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Mini Nutritional Assessment in Nursing Home Residents

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Our aim in this study was to evaluate the MNA in a population of institutionalized elderly people, and its correlation with functional and nutritional variables.

The study group included 100 subjects, 24 men and 76 women, with mean age 85.4 ± 9.2 (SD) years; their mean period of stay in a nursing home was 5.3 years. The score of the sample in the short portable mental status questionnaire (SPMSQ) was 6.7 ± 2.9, and in the activities of daily living (ADL) scale the lost functions were 4.7 ± 1.5.

Serum albumin, transferrin, total cholesterol, triglycerides, hemoglobin, and lymphocyte count were evaluated. Linear correlation coefficient analysis (SPSS/PC) was performed.

The malnutrition indicator score identified 19 well-nourished subjects while 60 were at risk of malnutrition and 21 were malnourished. The total assessment score was positively correlated with serum albumin ($r = +0.392; p < 0.001$), transferrin ($r = +0.346; p < 0.001$), and hemoglobin ($r = +0.270; p < 0.01$). A negative correlation was found with age ($r = −0.271; p < 0.01$), mental impairment based on the SPMSQ score ($r = −0.589; p < 0.001$), and loss of autonomy expressed by the number of lost functions in the ADL ($r = −0.602; p < 0.001$).

With regard to each item of the MNA, body mass index was negatively correlated with the SPMSQ score ($r = −0.272; p < 0.01$) and the number of dependent ADL functions ($r = −0.273; p < 0.01$). Calf circumference was negatively correlated with age ($r = −0.350; p < 0.001$), the SPMSQ score ($r = −0.369; p < 0.001$), and the number of dependent ADL functions ($r = −0.261; p < 0.01$). The absence of psychological stress or acute disease in the past 3 months was positively related to serum albumin ($r = +0.257; p < 0.01$) and transferrin ($r = +0.239; p < 0.01$). Mobility was positively correlated with serum albumin ($r = +0.293; p < 0.01$) and negatively with the number of dependent ADL functions ($r = −0.561; p < 0.001$).

Protein intake was negatively related to the number of dependent ADL functions ($r = −0.254; p < 0.01$); the mode of feeding showed a negative correlation with the SPMSQ score.
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$(r = -0.487; p < 0.001)$ and the loss of autonomy in the ADL $(r = -0.548; p < 0.001)$, while it positively influenced serum albumin $(r = +0.368; p < 0.001)$ and hemoglobin $(r = +0.254; p < 0.01)$. Finally, age $(r = -0.240; p < 0.01)$ and mental impairment $(r = -0.429; p < 0.001)$ were significantly related to the daily intake of fluids.

Our study shows that there are significant correlations between MNA items and functional and nutritional variables. MNA is a useful tool for evaluating nutritional status in elderly people living in nursing homes.

Malnutrition in Elderly Care – An Expression of Aging and Disease or of Insufficient Nutritional Routines?

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Aims – Almost 100,000 people in Sweden, who require various degrees of help, live in “special housing forms” run by local municipalities, that is, service flats (SF), sheltered homes (SH), old people’s homes (OPH), and nursing homes (NH). In this investigation we used the MNA technique to assess the nutritional status of a representative sample of this population, who are often elderly and have chronic diseases.

Methods – The study population consisted of all individuals in special housing in the municipalities of Falkenberg (n = 551), Robertsfors (n = 198), and Katarina-Sofia in Stockholm (n = 286). In the three study areas, 8%, 16%, and 18%, respectively, dropped out. The average age of the 872 individuals examined was 84.5 ± 8 years; 69% were women, and 349 (40%), 96 (11%), 261 (30%), and 166 (19%) of the individuals lived in SF, SH, OPH, and NH, respectively. Nutritional status was assessed using the MNA scale, consisting of 18 point-weighted questions divided into four categories. These include anthropomorphic measurements (for example, body mass index (BMI, kg/m², normal range 20–25)), “global assessment,” dietary assessment (for example, menus, appetite), and the individual’s subjective assessment. The maximum number of points is 30; <17 is viewed as “malnutrition” and 17–23.5 as “risk for malnutrition.”

Results – MNA <17, that is, “malnutrition,” was noted in 36% of the study population. Divided by housing type, the MNA score was <17 in 21% (SF), 38% (SH), 33% (OPH), and 71% (NH). The corresponding percentages for MNA score of 17–23.5 (“risk for malnutrition”) were 49%, 51%, 57%, and 29%, respectively. For MNA scores of ≥24, the percentages were 30%, 10%, 10%, and 0%, respectively. Average BMI values were 24.2 ± 5 (SF), 23.9 ± 4 (SH), 22.6 ± 5 (OPH), and 22.3 ± 4 (NH). BMI values ≤20 were found in 18% (SF), 19% (SH), 25% (OPH), and 33% (NH), respectively $(p < 0.001)$. The coefficient of correlation between MNA and BMI was $r = 0.5, p < 0.001$. The age of the individuals in the four housing types was 84 ± 9 (SF), 83 ± 7 (SH), 86 ± 7 (OPH), and 84 ± 8 years (NH), $p < 0.05$. The correlations between age and MNA and between age and BMI were significant but low, $r = 0.1 (p < 0.01)$ and $r = 0.14 (p < 0.001)$, respectively.

Conclusions – According to the MNA, the occurrence of malnutrition appears to be high within elderly care as run by local municipalities. The highest prevalence is in NH (70%) and the lowest in SF (20%). Age and disease mean that malnutrition is probably unavoidable to a certain extent. The results point to the need for reappraisal of the nutritional routines within elderly care but further studies are necessary to assess the degree to which the nutritional disturbances shown are reversible.
Mini Nutritional Assessment in Elderly People Living at Home in Warsaw

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Aim – The purpose of this study was to assess the predicting capacity of the MNA instrument for the rapid evaluation of malnutrition in the present economic and social situation in Poland. The study was carried out in 1997 among a random selection of 43 males and 59 females aged 75 years, living freely at home in Warsaw.

Methods – The following were assessed: MNA score, energy and nutrient intakes by the 24-hour recall method, health status, anthropometry, and biomedical analyses (for example, hemoglobin, vitamin C).

Results – Average body mass index (BMI) was 27.6 kg/m² in males and 28.5 kg/m² in females; energy intake was 2,065 kcal in males and 1,494 kcal in females; protein intake was 0.9 g/kg and 0.8 g/kg; fat intake was 83 g and 58 g (cholesterol 290 mg and 253 mg), respectively. Intakes below the recommended daily allowances (RDA) were found for Ca, Mg, Fe, vitamin B2, vitamin B6, and free folacin. MNA scores were: malnourished, 0% males and 2% females; at risk of malnutrition, 14% males and 17% females; well-nourished, 86% males and 81% females. The frequency of health disorders, anemia, deficient levels vitamin C, and low intakes of energy and nutrients were analyzed in these three groups.

Conclusions – This study confirms the value of the MNA in free-living elderly Polish people. However, there is a need to undertake further validation of score indicators, especially high BMI, for the subjective assessment of self perceived health, and also to discuss thresholds.

Evaluating the NSI (Nutrition Screening Initiative Checklist) and MNA as Tools for Assessing the Nutritional Situation of Elderly People

C.P.G.M. de Groot, A. van Lier, J. Prompers and W.A. van Staveren for the SENECA investigators

Two short questionnaires aiming at a rapid assessment of the nutritional status of elderly people have been tested by comparing cumulative scores with data on dietary intake, anthropometric measurements, blood biochemistry, lifestyle, and physical and mental performance. The questionnaires of interest are the nutrition screening initiative checklist (NSI) from the United States and the MNA as developed in France. Information similar to the questions of the NSI and MNA lists was collected by the Survey in Europe on Nutrition and the Elderly, a Concerted Action (SENECA). This study included 1,161 elderly men and women born between 1913 and 1918, mostly living at home, whose diet, lifestyle, and health have been studied twice: in 1989 and in 1993. The MNA classified 55% of the examinees as well-nourished, 44% as at risk of malnutrition, and 1% as undernourished. The NSI categorized the elderly people differently: 11% as well-nourished, 42% as at moderate nutritional risk, 48% as at high nutritional risk. Incidental differences emerged for biochemical indices (serum albumin, hemoglobin, lymphocyte count, serum lipids, serum vitamins), intakes of energy and protein, and anthropometric characteristics between MNA categories and between NSI categories. Using serum albumin values (<30 g/l) and lymphocyte counts (<1,500/ml³) as standards, the specificity and sensitivity of both instruments for identifying
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at-risk groups were below 0.6. Only with body weight loss (>10%) as a criterion were higher sensitivities (0.96 (MNA), 0.75 (NSI)) and specificities found (0.60 (MNA), 0.54 (NSI)). It is concluded that the usefulness of both assessment tools for a healthy elderly population needs further evaluation.

**Monitoring Malnutrition in Home Nursing: A Three-Step Model Using ADL and MNA**

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**Aims** – The White and Yellow Cross of Belgium carried out a study on patients receiving home nursing, the so-called Nutritional Assessment and Monitoring of Elderly study (NAME study) [Wouters, Vandenbroele, et al., 1997]. The aim of this study was to determine whether a three-step monitoring model in home nursing is feasible: (1) case finding using the activities of daily life scale (ADL) [Katz, 1961]; (2) screening using the MNA [Guigoz et al., 1994], and (3) applying a nursing protocol for malnutrition. This paper deals with the validity study of steps one and two.

**Methods** – In a random cluster sample of elderly patients over 60 years of age, interviews were carried out in November 1995 by trained nurses. This survey included sociodemographic data, nursing data, ADL, instrumental ADL, and dietary intake. Research questions were aimed at: (1) the prevalence of malnutrition according to the MNA; (2) the dietary intake of the home nursing patients according to a memory-friendly food frequency questionnaire [De Ridder, 1997] as a concurrent validation of the MNA, and (3) validating case finding on the basis of ADL, using the MNA as the criterion. For the statistical analysis we used SAS software, and food consumption was converted into energy and nutrients using the Dutch food tables.

**Results** – **GENERAL FINDINGS**: 529 patients (69% women); age 77.7 ± 8.8 years, BMI 25.7 ± 4.8 kg/m². The mean energy intake was 1,722 ± 571 kcal. On average, 35% did not reach a daily intake of 1,500 kcal. Separate results of the intake of protein, vitamin B1, vitamin B2, vitamin B6, vitamin C, Fe, Ca, Zn, food fiber, and liquid are available. We observed a high mean protein intake of 75 ± 28 g/day. Insufficient intakes were observed for vitamins, minerals, and fluids (a daily average of 1 liter of fluid less than recommended). According to the MNA screening, 6.2% of the patients have malnutrition (MNA < 17), 45.5% are at risk of malnutrition (MNA 17–23.5), and 48.3% are well-nourished (MNA ≥ 24).

**SPECIFIC RESEARCH FINDINGS**: We showed that case finding for the MNA can easily be done using an ADL score of ≥ 15 as an indicator for MNA, with a sensitivity of 79% and a specificity of 82%. If this ADL score criterion is used, we found that MNA was indicated in 32% of our patients. If we used the MNA in this group without selection by ADL score, we found a maximum of 6.2% undernutrition; in the group with an ADL score of ≥ 15 we found 15% malnutrition. In the same way, without a preliminary ADL score we found that 48.3% were well-nourished; in the group with an ADL score ≥ 15, we found only 27% were well-nourished.

**Conclusions** – For systematic screening with the MNA, the scope of the screening can be reduced to one third of all elderly patients in Belgian home care by selecting only individuals with an ADL score ≥ 15. Future research should validate the use of a nursing protocol for malnutrition in the proposed three-step framework.
**Nutritional Assessment in Primary Care – A Pilot Study**

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Nutritional intervention should occur early in the course of undernutrition to be effective. In elderly outpatients, however, nutritional screening is rarely carried out routinely. Strategies are therefore needed to increase the physician’s awareness of this assessment. The objectives of this pilot study were: (1) to determine the nutritional status of a population of community-dwelling elderly people visiting a university teaching hospital medical outpatient clinic, and (2) to test the feasibility of the use of the MNA in an outpatient setting. All patients aged 65 years or older scheduled for an appointment at the clinic during a period of 1 week were offered the opportunity to have a MNA. The assessment was conducted by a nurse specialized in nutrition. Fifty-three of 67 eligible patients participated in the study, 33 women and 20 men. Mean age was 79.9 ± 6.8 years. One man was malnourished according to the MNA score (MNA <17) and 22.6% (four men and eight women) were at risk of malnutrition (MNA 17–23.5). The proportion of subjects malnourished or at risk increased with age from 9.1% to 32% and 50% in the 65–74, 75–84, and 85+ year age groups, respectively. In addition, in only one of these patients did the medical file specially mention the patient’s nutritional status. We conclude that risk of malnutrition is common in this elderly population visiting a primary care facility, but the problem is rarely identified. Strategies to increase recognition of this condition in primary care settings are therefore needed.

**Copper, Zinc, and Magnesium Blood Levels in Healthy People: Comparison between Elderly People and Younger People**


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Nutrition plays a central role in the maintenance of health in elderly people, who are sometimes at risk of inadequate nutrient intake. The aim of this study was to clarify the influence of age on blood levels of copper (Cu), zinc (Zn), and intracellular and extracellular magnesium (iMg; eMg).

**Inclusion criteria** – Healthy subjects, males (M) and females (F), of any age. Cu values (70–140 µg/dl for M, 85–155 µg/dl for F), Zn (55–120 µg/dl), and iMg (1.97–2.96 mmol/l) were measured by atomic absorption spectrophotometry, eMg (0.74–1.23 mmol/l) by a colormetric method, and the ceruloplasmin (0.99–3.96 µmol/l) by nephelometry.

**Statistical analysis** – Data are expressed as mean ± SD, and were analyzed by Student’s t test for unpaired data, χ² test, and simple linear regression.

**Results** – 143 subjects (20–102 years) were enrolled in two groups, above and below 65 years: 107 younger subjects (67 M, 43.8 ± 11.7 years, and 40 F, 40.2 ± 10.1 years); 36 elderly subjects (22 M, 70.5 ± 5.5 years, and 14 F, 87.7 ± 10.5 years), with a homogeneous sex distribution (χ² 0.97; NS). Micronutrient levels in the elderly and the younger subjects, respectively, were: Cu 117.5 ± 17.0 and 102.5 ± 19.6 µg/dl (p < 0.001); Zn 133.3 ± 14.9 and 118.0 ± 17.3 µg/dl (NS); iMg 2.12 ± 0.20 and 2.07 ± 0.20 mmol/l (NS); eMg 0.89 ± 0.10 and 0.84 ± 0.10 mmol/l (p < 0.05). We found abnormal levels of Cu in 5%, of Zn in 36%, of iMg in 23.3%, homogeneously distributed in the two groups (NS; χ² 0.08, 0.17, and
All subjects with abnormally low Cu were in the younger group. Abnormal levels of eMg were found in 18%, mostly low values (89.5%), especially in younger subjects ($\chi^2 4.06; p < 0.05$). In the two groups, RBC, Hb, iron, transferrin, and ferritin were homogeneously distributed by gender; total proteins and albumin were higher in the younger subjects ($p < 0.05$ and $p < 0.01$, respectively). Body mass index values in the older and in the younger subjects, respectively, were: (M) $24.0 \pm 2.8$ and $24.2 \pm 2.7$ kg/m$^2$ (NS), (F) $29.4 \pm 8.3$ and $21.3 \pm 2.9$ kg/m$^2$ ($p < 0.01$). No correlation was found between any micronutrient and age. Splitting by gender in the total population, Cu levels were higher in the elderly and ceruloplasmin higher only in old males; in the younger group, Cu levels were homogeneous and ceruloplasmin was higher in females; in the older group Cu levels were higher in females and ceruloplasmin in males. Although the elderly group seemed at risk for low intakes of micronutrients, we found no deficit of micronutrients and nutritional indices were normal in all subjects.

Published data are contradictory, probably because it is difficult to find really healthy elderly people and to prove micronutrient deficiency using current laboratory tests. The already described age-related increase in Cu may cause faster atherosclerosis and fibrosis of small vessels, linked to enhanced lipid peroxidation. The contradictory data on the Cu/ceruloplasmin/gender relation cannot be explained by a hormone influence, but suggest that blood Cu and ceruloplasmin may not be markers of Cu status. The higher levels of eMg in the elderly group strengthens the possibility that the commonly found Mg deficiency is linked to drugs interfering with nutrient absorption and utilization and not to the aging process itself. Both the older and the younger subjects had Zn levels similar to those found in previous studies. These results suggest that healthy elderly people usually have a balanced diet; acute and chronic diseases and/or function impairment may cause undernutrition or malnutrition.

### MNA in a Population of Frail Elderly People

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The predictive value of the MNA was evaluated in a population of frail elderly people admitted to long-term hospital care, in comparison with a nutritional global assessment (NGA). NGA is used as standard and is inserted into the comprehensive geriatric assessment that we carry out in all our patients on admission; it includes both anthropometric measurements (triceps skinfold, cutoff 10 mm for men, 13.2 mm for women, and muscle circumference, cutoff 20.2 cm for men, 18.6 cm for women) and biochemical indices (albumin, cutoff 30 g/l, transferrin, cutoff 2 g/l, and lymphocyte count, cutoff 1,500/mm$^3$) [Donini LM, et al: *Age Nutr* 1994; 3: 182].

All patients admitted consecutively to our institute from January to July 1997 were entered into the study. There were 45 men aged 76.8 ± 12 years and 54 women aged 80.8 ± 9 years. All had multiple organ disease (3.8 ± 1) and for this reason were taking 4.7 ± 2 drugs daily; most (72%) were functionally impaired and 55% were moderately or severely demented.

The prevalence of malnutrition by NGA evaluation was 78.8%. Twenty subjects were classified as “at risk of malnutrition” by MNA; of the remaining 79 subjects, 13 (16.5%) were misclassified by MNA. The sensitivity and positive predictive value of MNA were 98.5% and 84.4%, respectively.

We had 12 (15.2%) false-positive MNA assessments; for these subjects MNA scores, especially in the “general” and “self-assessment” sections, were very low and not different...
from the scores for malnourished patients in the same sections. We believe that functional and cognitive impairment can affect the scores of these sections. On the other hand, as was observed in our sample, these impairments are not necessarily correlated with malnutrition, at least in their early stage. In spite of this, MNA is a valid tool for evaluating elderly people at risk of malnutrition because of its high sensitivity and ease of administration (since it does not require a specialized nutritional assessment team).

**Study of Determinants of the Response to Influenza Vaccine in Institutionalized Elderly People**

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Influenza is a major health problem among elderly subjects in industrialized countries, mainly among nursing home residents. The aim of this study was to evaluate some aspects of the nutritional status of institutionalized elderly people in relation to the response to influenza vaccination. Certain aspects of the cellular immune response were also investigated. Twenty-three patients participated in the study. All the patients were vaccinated on day 0. The vaccination was done with Fluviral®, 1994–95 preparation: A/Shangdong/09/93, A/Texas/36/91, B/Panama/45/90. We assessed prevaccination antibody titer, nutritional status by MNA and by biochemical indices, and lymphocyte proliferation at the same time. On day 28, the postvaccination antibody titer was determined. Determination of antibody titers against the various influenza antigens in the pre- and postvaccination period was carried out by hemagglutination. Eleven elderly people were responsive (a fourfold increase in any of the virus antigens), while 12 were not. We have shown that hemoglobin, hematocrit, total protein, iron and vitamin E levels, DHEA level, and the cellular immune response were significantly decreased in the nonresponsive group. These variables might play a role in the influenza vaccine responsiveness of the elderly. These results may help in the design of intervention studies for improving the immune response by achieving optimal nutritional status, mainly in frail elderly people.

**Diagnostic and Prognostic Efficiency of the MNA Nutritional Scale in Geriatric Medicine**

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**Aims** – (1) to estimate the prevalence of undernutrition in a geriatric population hospitalized with an acute illness; (2) to study the correlation between the MNA score and the autonomy score measured by the Katz scale; (3) to establish the reliability of the MNA score in predicting admission to nursing homes after discharge from hospital; and (4) to compare the MNA score between groups, survivors and nonsurvivors.

**Methods** – MNA was determined in 175 hospital inpatients (113 women and 62 men) aged 79.7 ± 8.45 years. The Katz score on admission and at discharge, the number of
different medications, and clinical course of the patients were recorded by two geriatricians.

**Results** – The mean MNA score was 20.5 ± 5.1. There was no significant correlation between MNA score and age, sex, or height, but there was a correlation between MNA score and weight ($r = 0.45; p < 0.01$) and body mass index (BMI; $r = 0.44; p < 0.0001$). A significant inverse relation was found between MNA and Katz score on admission ($r = -0.37; p < 0.0001$) and on discharge ($r = -0.52; p < 0.0001$). The mean number of drugs taken was 5.17 ± 2.82 and this number was negatively correlated with the MNA score ($r = -0.23; p < 0.05$); poor values on the MNA score were related to steroids, laxatives, and sedative drugs. The MNA score was significantly lower in elderly people who came from a nursing home than in those who lived at home: 18.4 ± 5.1 vs. 22.3 ± 4.7 ($p < 0.001$). During hospitalization, 6.3% died. There was a significant difference between the survivors and nonsurvivors in terms of age ($p = 0.045$) and weight ($p = 0.022$). The MNA value for the group which died was significantly lower (14.1) than for the group which survived (20.9). Finally, our study showed that the MNA score was not a good predictor of disposal on discharge from hospital.

**Conclusions** – The MNA assessment is a reliable tool. Our study showed an inverse correlation between MNA and Katz score, as well as between MNA score and the number of different drugs taken (steroids, laxatives, and sedatives). The MNA scores were better in subjects living at home than in those living in nursing home. There was a significant correlation between MNA score and the risk of death during hospital admission. The MNA can hardly be used as a hint for future placement.

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**Malnutrition Risk Screening by the MNA for Elderly Patients in a Rehabilitation Ward after Femoral Neck Fracture**

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**Aims** – Postoperative care in elderly populations with femoral fractures requires re-education and rehabilitation, but malnutrition needs to be detected because of its effects in retarding healing and reducing muscular strength.

**Methods** – In a prospective study, we estimated nutritional risk by MNA in 15 elderly patients (mean age 86.8 ± 4.7 years) hospitalized in a rehabilitation ward after surgery for femoral neck fractures, and compared them with a control group of 15 patients in the same age range (mean age 81.9 ± 5.7 years) in a day-stay hospital for minor procedures.

**Results** – The operated patients were more likely to be malnourished than the day-case patients. Operated patients had a mean body mass index of 19.9 ± 3.5 vs. 24.3 ± 4.6 in the controls ($p = 0.006$). Weight in the fracture group was 50.6 ± 9.3 kg vs. 60.3 ± 12.2 kg in the controls ($p = 0.02$). The mean MNA of the fracture group was 15 ± 4.8, that is, in the frank malnutrition range, compared with 24.3 ± 4.5 in the control group ($p = 0.001$) – nearly in the well-nourished range (MNA > 24). There was a greater difference in calf circumference (fracture group 26.5 ± 2.8 cm vs. controls 32.9 ± 4.8 cm; $p = 0.001$) than in arm circumference (21.9 ± 3.4 cm vs. 24.7 ± 4 cm; $p = 0.03$).

**Conclusions** – The MNA is a practical tool for nutrition screening. It is possible to identify undernutrition in surgical patients. This assessment is essential to identify the need for protein supplementation and to optimize functional capacity.
Validation of a Spanish Version of the MNA in a Mexican Population

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Aim – Nutritional disorders are common in the elderly. About 60% of individuals in our clinic show evidence of a nutritional disorder, but since anthropometric, biochemical and dietary assessments are expensive and time consuming, and since physicians usually do not have the skills needed to perform a satisfactory nutritional assessment in their patients, there is a need for simple screening instruments in Spanish for this purpose.

Methods – The study was a diagnostic test evaluation in a geriatric population from a geriatric consultation clinic (60 years of age and over). Sample size, calculated from a diagnostic test evaluation formula, was 219. These patients underwent a global nutritional assessment (GNA), including anthropometric assessment, dietary assessment, serum albumin, cholesterol, lymphocyte count and hemoglobin level, together with “blind” scoring of the MNA.

Results – 65 men and 164 women were assessed; mean age of the sample was 79 years, and 51% were between 75 and 85 years. On GNA evaluation we found that 23% of our population fulfilled diagnostic criteria for malnutrition and 77% were normal or overweight. When correlating the results of the GNA with the MNA we found that all cases who were malnourished on GNA scored <23.5 points on MNA. Of these, 47% had a score of <17 and 53% between 17 and 23.5. In contrast, 77% of subjects classified as being normal or overweight had MNA scores of between 17 and 23.5, putting them in the risk category according to the originally proposed scoring system. Only 9% identified as “normal” had scores <17 which misclassified them as malnourished.

Conclusions – The MNA seems a useful instrument for screening of undernutrition. When performing an ROC analysis the best cutoff point for our results was 19. With this cutoff point we had a sensitivity of 89% and a specificity of 60%. It must be stressed that 77% of our normals had low scores which would classify them as at risk. We are conducting a follow-up of these patients to identify whether there is a deterioration in their nutritional status, since the low MNA score could mean that there are risk factors present that could eventually lead to malnutrition. It must nevertheless be emphasized that 100% of patients with malnutrition had scores of <23.5, showing very good discrimination, and also that the MNA is a fast and cheap instrument.

Nutritional Status, Pathology, and Outcome in a Geriatric Hospital Inpatient Population

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The nutritional status of 155 consecutive geriatric patients (mean age 83 years, 51 males and 104 females) was assessed on admission by means of MNA, dietary intake, anthropometric methods (body mass index, BMI; triceps skinfold, TSF; mid-upper arm circumference, MAC) and laboratory (serum albumin) measurements. The aim of the study was to correlate the MNA with: (1) the principal clinical diagnosis on admission; (2) a long stay (≥30 days) in hospital, and (3) in-hospital survival. According to the MNA, 40 patients (26%) were undernourished on admission (score <17), 81 (52%) were at risk (score between
17 and 23.5), and 34 (22%) were well-nourished (score >23.5). The table shows the distribution of albumin, BMI, MAC, and TSF (<10th percentile of a healthy elderly control group), and mean energy intake, according to nutritional status.

<table>
<thead>
<tr>
<th>MNA score</th>
<th>Albumin &lt;3.5</th>
<th>BMI &lt;20 kg/m²</th>
<th>MAC &lt;P10</th>
<th>TSF &lt;P10</th>
<th>Mean energy intake (SD), kcal/day</th>
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<td>&lt;17</td>
<td>23/40</td>
<td>17/40</td>
<td>34/40</td>
<td>21/40</td>
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<td>≥17 to 23.5</td>
<td>28/81</td>
<td>9/81</td>
<td>47/81</td>
<td>18/81</td>
<td>1,970 (458)</td>
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<td>≥24</td>
<td>14/34</td>
<td>1/34</td>
<td>13/34</td>
<td>4/34</td>
<td>2,305 (490)</td>
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</tbody>
</table>

Of the 155 patients, 32 had a cardiovascular disorder, 29 an acute infection, 18 a malignant tumor, 11 dementia/depression, and 65 another disorder. The mean (SD) MNA score in these subgroups was 20.6 (4.5), 18.4 (6.2), 16.8 (4.3), 17.9 (5.4), and 20.4 (4.5), respectively (NS). The mean MNA score in the 12 patients who died during hospitalization (17.7) was comparable with the MNA score in the survivors (19.6; \( p = 0.18 \)), and seven patients in the former group had an MNA score of >17. The MNA score of the patients with a hospital stay of ≥30 days (19.6) was also comparable with that of the patients with a stay of <30 days (19.2), and the proportion of patients who were malnourished, at risk, and well-nourished was comparable in the two subgroups. There were 17 patients with iron deficiency anemia, 29 with anemia of chronic disease, 14 with another cause of anemia, and 95 were not anemic. The mean MNA scores and the proportions of patients in the three MNA categories were comparable between these four groups.

Conclusions – Using the MNA test, the prevalence of patients who are undernourished or at risk of malnutrition is substantial in a geriatric hospital inpatient population. However, the MNA score was comparable between the main disease categories, and nutritional status did not seem to influence survival and length of hospital stay.

Role of Immune Status in MNA in the Elderly

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The purpose of this study was to investigate immune indices in geriatric patients of various nutritional status. One hundred and twenty patients (30 males and 90 females) aged 60–85 years were divided into two groups according to MNA score. The patients in the first group were malnourished (score <17), and the second group was well-nourished (score ≥24).

All patients had investigations of immune indices (CD3, CD4, CD8, CD4/CD8, CD20, Con A-induced leukocyte migration inhibition test, PHA-induced PBMC proliferation test, phagocytic reactions).
The results showed a decrease in lymphokine production in the malnourished patients (Con A-induced leukocyte migration inhibition reduced by 27% and PHA-induced PBMC proliferation by 34%; CD4/CD8 index decreased by 38% comparing with a standard).

Thus there are diagnostic immunological signs in elderly people identified as malnourished by the MNA.

**MNA in Residential Home Residents**

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One hundred elderly people (20 men and 80 women) over 65 years living in a residential home were assessed by the MNA.

41% were at risk of malnutrition and 5% were malnourished. Malnutrition was more frequent in men (65% vs. 35%). More than three drugs were used by 75.6% persons at risk of malnutrition, by 60% of malnourished individuals, and by 40.7% of those not at risk. Low meat consumption was found in 65.8% of people at risk of malnutrition, in 75% of malnourished individuals, and in 53.7% of well-nourished individuals. Low milk consumption was found in 51% of persons at risk, in 60% of malnourished people, and in 24.1% of people not at risk. A low intake of fruit and vegetables was found in 43.9% of persons at risk, in 20% of malnourished people, and in 29.6% of well-nourished people. A low intake of fluids was found in all the malnourished people, in 90% of the people at risk, and in none of the well-nourished people. A low body mass index was found in 75% of malnourished people, in 33.8% of those at risk, and in 3.7% of those not at risk. Decreased appetite was found in 75% of malnourished people, in 19.5% of those at risk, and in 7.4% of those not at risk. Poor health status self-assessment was found in 20% of malnourished people, in 51.2% of those at risk, and in 11.1% of those not at risk.

**Health and Nutritional Status of Retirement Home Residents**

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The aim of the study was to define the state of health and nutritional status in residents of retirement homes. One hundred and seven subjects, aged 65–104 years, living in selected welfare facilities in the Kraków region, were asked about their health complaints, medical history, mobility and daily activity, dietary patterns, and their self-assessment of their health. They were also examined and had anthropometry.

The most common health disorders were atherosclerotic hypertension, coronary heart disease, congestive heart failure, peripheral vascular disease, and arthroses. Mobility was at a satisfactory level but there was a low level of physical and daily living activity.

Body mass index (BMI) values often exceeded recommended levels: BMI > 25 (below 30) was found in 27% of the subjects, and BMI > 30 in 25%. Other anthropometric measures (triceps skinfold, midarm circumference) did not confirm such a high prevalence of obesity. On the basis of the MNA, most of people examined were at risk of malnutrition (62%) or malnourished (21%); only 17% were assessed as well-nourished.
In conclusion, health disorders diagnosed in this group were typical diseases of the elderly. Nutritional status was poor, and the low level of activity calls for action to increase the physical and mental engagement of these retirement home residents.

With respect to methodology, the BMI seemed insufficient as an index of nutritional status in the elderly, mainly owing to posture changes; substitution of knee height or arm length might be required. It would also be useful to widen the MNA scale, with higher values reflecting cases of energy overnutrition.

**Nutritional Status in the Jerusalem 70-Year-Olds Longitudinal Study: Relation to Cognitive Function, Mobility, Morbidity, and Mortality**

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The first stage of the Jerusalem Longitudinal Cohort Study gathered extensive demographic, social and health data on a large representative sample of the city's 70-year-olds, including nutritional variables. Medical examination, anthropometric profile, functional testing, cognitive status, and laboratory investigations were included. Morbidity was assessed, including hospital admission and emergency room attendance rates. This information was used to establish a numerical nutritional assessment (NA) score, a modified form of the MNA, the reliability of which has already been validated.

Based on an NA score of ≥24, 91% of the study population were in good nutritional state, 8.3% were at risk of malnutrition, and 0.7% were malnourished. There was a significant positive relation between NA score and ADL, as well as cognitive status, and a strong relation between NA score and visits to the family physician, visits to the emergency room in the preceding year, and hospital admissions in the 2 years after the study. A reverse relation, although not statistically significant, was found between NA score and the 2-year post-study mortality.

We propose that the nutritional state is a major determinant of quality of life in the elderly and therefore should be part of any geriatric assessment. Population surveys of elderly people are needed to identify and treat those at risk.

**Decreased Activities of Daily Living Are Associated with Measures of Undernutrition in Community-Living Elderly Subjects**

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\(^b\)Department of Geriatric Medicine, Queen’s University of Belfast, Northern Ireland

In community-living elderly people >85 years of age, we have previously identified evidence of malnutrition using the MNA. In this pilot study we investigated whether socioeconomic factors had any role in nutritional compromise.

Nutritional status was assessed using the MNA method in a group of 17 elderly subjects living at home (four males, 13 females, mean age 85 years) and 13 students (seven males, six females, mean age 21 years). Subjects were categorized as well-nourished, at risk, or malnourished. All subjects completed a simple questionnaire about living alone, mobility indicators, food preparation and eating, teeth, swallowing, food expenditure, milk delivery,
smoking, alcohol, and previous health. The MNA showed two elderly subjects to be malnourished, three to be at risk of malnutrition, while one student was malnourished and another was at risk. Categorical variables were compared between elderly and young groups and showed elderly people more likely to live alone (\( p = 0.0007 \)), to have reduced mobility (\( p = 0.06 \)), to have no teeth (\( p < 0.0001 \)), and to drink less alcohol (\( p = 0.0006 \)) than the students, but to show no significant differences in food expenditure (\( p = 0.65 \)), delivery of milk to the home (\( p = 0.08 \)), or smoking (\( p = 0.55 \)). MNA categories of nutritional assessment were entered into a logistic regression model together with categorical variables. The most important factors influencing nutrition category were the food preparation index and mobility factors, or both.

Nutritional compromise occurs in apparently well elderly people who live in the community and is related to their functional status rather than to economic factors.

**Prevalence of Malnutrition in HIV-Positive Outpatients:**

**Evaluation of the MNA**

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**Aim** – To examine the prevalence of malnutrition in an AIDS outpatient population with a view to finding a reasonably accurate, noninvasive method of assessing malnutrition in these patients for use in the clinical setting.

**Methods** – A nutritional assessment was made in 100 consecutive HIV-positive patients using body mass index (BMI), mid-arm muscle circumference, bioelectric impedance analysis, and two questionnaires: the MNA and the nutrition risk score (NRS).

**Results** – 19% of the patients were malnourished, 20% were at risk of malnutrition, and 61% were well-nourished. Nutritional status was not related to age, sex, ways of HIV transmission, or number of years since diagnosis. Nutritional status was positively correlated with AIDS stages, assessed by CDC staging. All but one of the malnourished and at-risk patients had a CD4 count of \(< 500/\text{mm}^3\). Using bioelectric impedance analysis as a reference, the sensitivities of MNA and NRS were 67% and 41%, respectively. BMI and mid-arm muscle circumference showed excellent correlation with dry lean body mass assessed by bioelectric impedance analysis (\( r = 0.72 \) and \( r = 0.75 \)), respectively, while the correlation with MNA and NRS was poor (\( r = 0.47 \) and \( r = 0.46 \), respectively).

**Conclusions** – The prevalence of malnutrition is high in HIV-positive outpatients. The MNA and NRS questionnaires are not useful in assessing nutritional status in these patients.

**The Efficacy of Quick Nutritional Screening**

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A quick nutritional screen combined with 24-hour recall methodology allows an evaluation of nutrition and health status in a large population. We studied 157 elderly people (60+ years of age) living with their families. The average age of the men was 72 years and of the women, 74 years.
Methods – The 24-hour recall method and a specially devised questionnaire were used to study nutrition and health status. The criterion for risk of inadequate nutrition was an energy intake below accepted norms in Ukraine, that is, <2,100 kcal/day for men and 1,800 kcal/day for women, a dietary protein intake of <0.8 g/kg of body weight, or a combination of these two.

Results – Based on the 24-hour recall method, we found a high risk of inadequate nutrition as reflected in low energy intake: 59% of the men and 56.4% of the women. An insufficient protein intake confirmed the inadequacy of nutrition in 59.6% of the men and 59% of the women.

Conclusions – In evaluating the risk of nutritional deficit, the criterion of energy intake alone was sufficient in the case of males, while we also had to consider protein intake in females.

Nutrition and Health of Elderly Lonely Disabled People Dependent on Social Welfare Services

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Institute of Gerontology, Kiev, Ukraine

Socioeconomic changes in Ukraine, which have reduced social guarantees, have affected the quality of life of elderly citizens, especially those living alone. We studied the nutrition of 226 elderly people (60+ years of age) living alone and being served meals in their homes.

Methods – Nutritional status was estimated by the 24-hour recall method plus a questionnaire devised to examine health status, and data from medical examinations.

Results – We found a decrease in consumption of milk products on average by 45%, vegetables by 34%, meat by 60%, and fish by 82% compared with geriatric dietetic norms. As a result, protein intake fell by 35%, fat intake by 48%, and carbohydrate intake by 16%. The dietary provision of vitamins and minerals was reduced. Deficit of vitamin C was 73% and of calcium 71%. In addition, 76% of cases had marked atherosclerotic lesions of the heart and vessels, 73% suffered from ischemic heart disease, 26% had hypertensive disease, and 45% had bone and joint diseases.

Conclusions – Overall, the provision of meals for elderly people in their homes did not meet their nutritional requirements. There is a need to improve the medico-social services for elderly people.

Assessment of the Nutritional State of Elderly Surgical Patients by MNA after Aorto-Coronary Bypass

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The prevalence of undernutrition is high in frail elderly people admitted to hospital, as well as in those receiving ambulatory care. Geriatric evaluation should therefore include nutritional assessment. We chose the MNA as a simple, reliable and inexpensive screening tool for nutritional evaluation of ambulatory care patients with hyperlipoproteinemia after aorto-coronary bypass. The patients were studied at least 6 months after their open heart surgery.
Elderly patients (seven women and 18 men) aged over 60 years, with regular control of prothrombin time and plasma lipid levels in our laboratory, were also screened for risk of malnutrition by MNA. Results showed that eight (32%) had scores below 24 (19–23.5), which required additional investigation with biochemical markers such as albumin and cholesterol. In six of the eight cases the risk of malnutrition was confirmed.

Further analyses should be done to evaluate the effects of key factors on the total MNA score from a greater number of patients.

**Metabolic and Thermic Responses to Diet and Cold Environment (4°C) in Obesity during Aging**

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To determine the effects of obesity on metabolic and hormonal responses and the capacity for non-shivering thermogenesis during aging, groups of lean and obese LA/Ntulı/ı-cp rats were subjected to measures of VO₂ in the young (3–6 months), middle aged (12–16 months), old (24–30 months), and aged (32–36 months; lean only) stages under conditions of thermal neutrality. The VO₂ of lean rats was greater than that of obese, and decreased progressively in both phenotypes at each age studied. In addition, the thermic responses to norepinephrine (100 and 250 μg/kg body weight s.c.), feeding, and acute cold exposure (2–4°C) also decreased progressively, such that, at the oldest ages, the responses to both diet and environment were no longer present. Food and fluid intakes were consistent with greater lipid utilization with progressive aging, while thyroidal responses were indicative of an age-related T3 resistance in obese animals. Thermic and cold responses to carbohydrate feeding also declined toward zero with progressive aging in both phenotypes.

These results indicate that aging is associated with a progressive decline in the normal dietary and metabolic responses to diet and environment. Moreover, the effects of obesity further exacerbate that decline, and the impact of these physiologic changes of aging and obesity could affect the MNA in aging.

**A Nutrition Survey of Elderly People in Estonia**

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The aim of this study was to estimate nutrient intake in elderly people living in social care homes in Estonia. Daily menus were analyzed using an upgraded computer program (Micro NUTRICA – a Finnish database, 1991). The nutrition survey was carried out in three institutions, and 429 persons aged 61–98 years were involved. The consumption of food energy, macro- and micronutrients (including 12 vitamins and 19 minerals) was calculated and compared with Estonian and Scandinavian nutrition recommendations.

An insufficient intake of dietary fiber, vitamins A, C, and D, calcium, and zinc was found. There was overconsumption of saturated fatty acids and sodium.

On the basis of the analysis of the daily menus, recommendations are made for improving nutrient intakes in these elderly people.
Analysis of Hospital Cost and Morbidity in Relation to Nutritional Status of Patients More Than 65 Years Old in a General Surgery Unit

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¹General Surgery Unit and ²Gastroenterology Division, CHUV, Lausanne, Switzerland

Many studies have shown a correlation between presurgery nutritional status and postsurgery morbidity. A malnourished patient has more nosocomial problems and stays longer in hospital, with an increase in global hospital cost. European and North American studies show a malnutrition incidence of 30–40% in medical and surgical patients. The Swiss malnutrition incidence is not known.

Patients and Methods – During 1 month, every consecutive patient aged over 65 admitted to the general surgery unit of CHUV in Lausanne was included in the study (37 females and 41 males, average age 76 years). During this period, 261 patients were admitted to the unit. Nutritional evaluation of the patients was conducted using the MNA, with classification into three groups: satisfactory nutritional status; at risk; and malnourished. The two last groups were regrouped by us into a single category: unsatisfactory nutritional status.

Results – The results are shown in the table.

<table>
<thead>
<tr>
<th>Nutritional status</th>
<th>unsatisfactory</th>
<th>satisfactory</th>
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<tbody>
<tr>
<td>Incidence (n = 78)</td>
<td>28 (36%)</td>
<td>50 (64%)</td>
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<tr>
<td>Emergency admission (n = 39)</td>
<td>20/28 (71%)</td>
<td>19/50 (38%)</td>
</tr>
<tr>
<td>Digestive and liver/biliary pathology (n = 49)</td>
<td>22/28 (79%)</td>
<td>27/50 (54%)</td>
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<tr>
<td>Postsurgery complications (n = 18)†</td>
<td>11/28 (39%)</td>
<td>7/50 (14%)</td>
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<tr>
<td>Hospital mortality (n = 3)</td>
<td>2/28 (7%)</td>
<td>1/50 (2%)</td>
</tr>
<tr>
<td>5-month follow-up mortality (n = 8)</td>
<td>5/28 (18%)</td>
<td>3/50 (6%)</td>
</tr>
<tr>
<td>Hospital average stay, days</td>
<td>18 ± 15</td>
<td>12 ± 7*</td>
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</tbody>
</table>

* p < 0.05.
† Post-surgery complications: parietal abscess, urinary infection, anastamosis leak, transit problem, subdiaphragmatic abcess, infection.

Comment – The incidence of malnutrition in elderly patients in our surgical unit is high, of the same order of magnitude as described in other countries. The majority of patients admitted as emergencies are malnourished. Patients with unsatisfactory nutritional status suffer principally from digestive and liver or biliary tract diseases. These patients will show more nosocomial diseases and will stay longer in hospital. An additional study will be conducted to find out if early nutritional care can decrease morbidity and reduce costs incurred by these malnourished patients.
Nutritional Status in Patients with Leg Ulcers

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The aim of this study was to assess nutritional status in patients with leg ulcers. The patients were living in their own homes and treatment was given in primary health care. The MNA was used in 50 women and 20 men, mean age 79.7 ± 6.3 years and 77.9 ± 7.0 years, respectively. Thirty-two patients were classified as at risk of malnutrition and two were malnourished. The women had a significantly lower mean total MNA score (22.8 ± 3.0) than the men (24.7 ± 2.4). Patients classified as at risk of malnutrition or malnourished were more often living alone and were more dependent on social home help services compared with the well-nourished. There were no significant differences between the well-nourished patients and those classified as at risk of malnutrition or malnourished with regard to the number and the duration of open ulcers. This study shows that nearly 50% of the patients with leg ulcers were classified as at risk of malnutrition or were malnourished, which may have a negative impact on wound healing.

Conclusion: The MNA Research and Practice

B. Vellas

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When we decided to work on nutrition and aging 10 years ago, we first studied how to assess nutritional status. We found published reports on many kinds of biological, anthropometric, and dietary nutritional indices. In fact, we had problems very similar to those arising with Alzheimer’s disease, which is so common in elderly patients – there is no unique marker to assess dementia, but many different measures. However, there is one very valuable aid, a screening tool created by Folstein, the Mini-Mental State examination or the MMS. We decided to use the same kind of approach for nutrition and we designed a tool to assess nutritional status in the elderly: the MNA [1, 2].

The MNA is not a perfect tool for assessing nutritional status in the elderly. It certainly has some deficiencies. However, it is easy to use, cheap, standardized, and can help as a comparative tool as well as a teaching tool for medical students. We should remember that, as with other geriatric assessment tools, it was first created for use with frail elderly people.

We know that malnutrition is very common in elderly people in hospital or living in nursing homes. However, malnutrition is not usually diagnosed in the elderly, and as a result nutritional support is not usually prescribed. To assess frail elderly people we needed a specific and validated tool like the MMS for cognitive function, the geriatric depression scale, the Tinetti gait and balance disorders scale, and the activities of daily living scales (ADL and IADL). Because in the past we did not have tools to assess nutritional status, nutritional evaluation and intervention were not integrated into most of the comprehensive geriatric assessment programs. That is why we decided to create the MNA.

Medicine in the past was purely clinical; physicians had only their hands to examine their patients. Today medicine involves an excessive number of investigations, sometimes dangerous for frail elderly patients and always costly. Intermediate between the medicine of
the past and the medicine of today we have the opportunity to introduce a new kind of medicine – modern gerontology, with tools that the primary care physician can use before embarking on more complex investigations. These tools are our new technology. As was shown in the past by Rubenstein [1], geriatric assessment gives us the possibility of reducing morbidity in elderly people and decreasing health care costs (hospital admissions, medical complications, nursing home use), while improving functional capacities and quality of life for frail elderly people. These assessment tools are cheap to use and have resulted in some very important research, as we have seen in this symposium.

Geriatric assessment permits early detection, early intervention, and better results with a decrease in health costs. For example, we know now that, with an MNA score between 17 and 23.5, we can detect elderly persons who are at risk of malnutrition before there is a decrease in weight or plasma albumin. Those with an MNA < 17 are more likely to have protein-energy malnutrition with low plasma albumin and weight loss. It will be important for these patients to have oral or enteral nutrition intervention. After every nutritional assessment with the MNA, physicians must check where patients lose points. It will then be possible to understand the causes of malnutrition and to propose an appropriate intervention: dietary supplements, help at home, decrease in drug treatment, and so on.

As we can see from this symposium, we now have much data showing that we can include the MNA as part of the comprehensive geriatric assessment. We need now to increase the numbers of geriatric assessment teams so that there is one in every hospital and to teach the family practitioner and primary care physician how to use the MNA in clinical practice for those of their patients who are frail, who live alone, or who have anorexia or weight loss.

References