The Mini Nutritional Assessment (MNA) for Grading the Nutritional State of Elderly Patients: Presentation of the MNA, History and Validation

Yves Guigoz and Bruno Vellas

Nestlé Research Center, Nestec Ltd., Lausanne, Switzerland;

a Department of Internal Medicine and Clinical Gerontology,

CHU Purpan-Casselardit, Toulouse, France

The Mini Nutritional Assessment (MNA), which is composed of simple measurements and brief questions that can be completed in about 10 min, was designed and validated to provide a rapid assessment of the nutritional status of frail elderly people in order to facilitate nutrition intervention [1, 2].

The incidence of protein-energy malnutrition is rather low in people living at home (5–10%). The frail elderly population is, however, at increased risk of malnutrition, and protein-energy malnutrition reaches significant levels in older persons in hospital (20–60%) or who are institutionalized (10–85%; Fig. 1) [2–4]. This goes mainly unrecognized [5], owing to the lack of a specific, validated instrument to detect malnutrition in these elderly persons, and if recognized it is not taken into account (Table 1) [6]. Malnutrition in the elderly has been associated with greater susceptibility to infection, longer stay at hospital, and higher mortality [7, 8].

Use of valid and reliable instruments to assess nutritional status has been absent from most geriatric assessment programs. Simple and rapid screening tests are, however, in use in comprehensive geriatric assessment of cognitive problems, autonomy, gait and balance, and depression [9; see chapter entitled: Comprehensive Geriatric Assessment (CGA) and the MNA: An overview of CGA, Nutritional Assessment and Development of a Shortened Version of the MNA, in this volume]. Rubenstein has reported that the use of well-validated instruments makes geriatric assessment more reliable and easier [9]. Comprehensive nutritional assessment is long and complex, mainly composed of social and clinical history,
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Fig. 1. Prevalence of malnutrition in different elderly groups. UK = United Kingdom; Fr = France; NL = The Netherlands; S = Sweden; CH = Switzerland; D = Germany. (Adapted from Guigoz et al., 1996 [2].)

Table 1. Detection of malnutrition on admission to hospital (n = 121 patients, age 70–98 years)

<table>
<thead>
<tr>
<th></th>
<th>55%</th>
<th>36%</th>
<th>8%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malnourished (&lt; 90% of normal weight for height)</td>
<td>Recognized as malnourished on admission</td>
<td>Nutritional support</td>
<td></td>
</tr>
</tbody>
</table>

Adapted from Mowé & Bøhmer [6].

anthropometry, evaluation of dietary intakes, and clinical laboratory analysis [10, 11]. Therefore we decided to design and validate a tool to evaluate the nutritional status of the elderly.

The aim of the MNA is to evaluate the risk of malnutrition in order to permit early nutritional intervention when needed, without necessitating a specialized nutritional assessment team [1, 2]. The following requirements were necessary to obtain a simple and rapid evaluation test: a reliable scale, with definition of
thresholds, compatible with the skills of a generalist assessor with minimal bias on behalf of the data collector, acceptable to patients, and inexpensive.

The MNA test (for the MNA form, see Appendix at the end of this volume) is composed of simple measurements and rapid questions so that it can be performed in approximately 10 min or less [1, 2]:
1. Anthropometric measurements (weight, height, and weight loss);
2. Dietary questionnaire (eight questions, related to number of meals, food and fluid intake, and autonomy of feeding);
3. Global assessment (six questions related to lifestyle, medication, and mobility);

The scoring of each part allows elderly patients to be classified as: (a) adequately nourished; (b) at risk of malnutrition, and (c) malnourished.

The MNA test was validated on elderly populations (>600 elderly people) ranging in age from 65 to 90 years and above, from the very frail to the very active, in three successive studies [1, 2]: (i) a study on setting up the test in 155 elderly subjects, from very healthy to severely malnourished elderly patients (Toulouse, 1991); (ii) a study on validation and testing of the discriminatory potential of the MNA on 120 elderly subjects, from the frail to the healthy elderly (Toulouse, 1993), and (iii) a complementary validation study in a different cultural context on non-institutionalized elderly people from the New Mexico Aging Process Study [1, 12].

The MNA test was validated using two principal criteria: (i) clinical status – a nutritional assessment done independently by two physicians trained in nutrition, on the basis of the subject's clinical file, without knowledge of MNA results, and (ii) a comprehensive nutritional assessment including measure of the anthropometric markers (height, knee height, weight, body mass index (BMI), and skinfold thickness) according to Chumlea [13, 14], an evaluation of dietary intake (dietary history, three-day food record combined with an interview with frequency checklist of foods) [15], and measurement of biological markers (albumin, prealbumin, transferrin, retinol-binding protein, C-reactive protein, α1-acid glycoprotein, ceruloplasmin, cholesterol, triglycerides, vitamins A, D, E, B1, B2, B6, and B12, folate, copper, zinc, hematocrit, hemoglobin, and blood cell count) [1].

For this purpose, clinical status was used as the gold standard, and comparisons were done using descriptive statistics, principal component analysis, and discriminant analysis [1]. The specificity of the MNA was performed by cross-classification of the two populations (Toulouse, 1991 and Toulouse, 1993) using the equations from the discriminant analysis. These results showed that for these two studies the MNA without biochemical indices could definitely classify 70–75% of elderly people as normal or undernourished. However, 25–30% of the subjects were situated in a buffer zone between these two classes (normal and undernutrition) and should be classified as at risk of malnutrition (or as borderline). They need further assessment by biochemical indices or clinical evaluation [1].
Finally the threshold values for the MNA scale were set by cross-tabulation of the MNA scores with the serum albumin concentrations (excluding the subjects with inflammation, that is, serum C-reactive protein >20 mg/l) as independent variables. In this way the following threshold values were set for the MNA [1]:

<table>
<thead>
<tr>
<th>Score (maximum 30 points)</th>
<th>Nutritional status</th>
</tr>
</thead>
<tbody>
<tr>
<td>⩾ 24</td>
<td>Well-nourished / normal</td>
</tr>
<tr>
<td>17–23.5</td>
<td>At risk of malnutrition / borderline</td>
</tr>
<tr>
<td>&lt; 17</td>
<td>Malnourished</td>
</tr>
</tbody>
</table>

The longitudinal study, the New Mexico Aging Process Study [12], examines the nutrition and health status of non-institutionalized elderly people, and represents a healthy aging population with almost 50% aged between 75 and 85 years and more than 10% over 85 years of age. An evaluation of nutritional status using the MNA indicated that even in a healthy elderly group about 20% of the elderly people (60 of 347) are borderline and should be assessed for risk of malnutrition, even if albumin levels and BMI were in the normal range. However, their dietary energy intakes tended to be lower, at 1,833 ± 508 kcal/day (n = 265) for the well-nourished and 1,639 ± 527 kcal/day (n = 51) for the at-risk subjects. These differences were not statistically significant (\(p > 0.10\)) [1]. These results suggest that the MNA is able to assess nutritional status in the elderly before severe changes in weight or albumin levels occur.

Protein-energy malnutrition appears to be a strong independent risk factor for 1-year postdischarge mortality [8]. One year after nutritional screening with the MNA, the following mortality was observed (Toulouse, 1991): malnourished (MNA score <17) 48%, at risk of malnutrition (MNA score 17–23.5) 24%, well-nourished (MNA score ⩾24) 0% [16]. Sensitivity (in this case the ability to detect malnutrition) and specificity (the ability to classify the well-nourished correctly) were calculated for the MNA (Toulouse, 1991), using clinical nutritional status as a reference, and showed a sensitivity of 96% and a specificity of 98% [16]. Figures 2–5 show the good correlation between the MNA and nutritional markers (Toulouse, 1991) such as serum transthyretin (prealbumin; correlation coefficient \(r = 0.58; p < 0.0001; n = 147\), serum folate \(r = 0.53; p < 0.0001; n = 140\), vitamin

\[\text{Fig. 2. MNA and serum transthyretin (prealbumin) levels (Toulouse, 1991); n = 147 (each dot represents one subject). Normal values: 0.20–0.40 g/l. MNA threshold values: <17 = malnourished; 17–23.5 = at risk of malnutrition; ⩾24 = well-nourished. Correlation coefficient, } r = 0.58 (p < 0.0001).\]

\[\text{Fig. 3. MNA and serum folate levels (Toulouse, 1991); n = 140 (each dot represents one subject). Normal values: >3 ng/ml (≈ 6.8 nmol/l). MNA threshold values: <17 = malnourished; 17–23.5 = at risk of malnutrition; ⩾24 = well-nourished. Correlation coefficient, } r = 0.53 (p < 0.0001).\]

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![Graph 1: Serum Transhyretin vs. MNA Score]

MNA threshold 17 24

- Serum Transhyretin [g/l]
- 0.45
- 0.40
- 0.35
- 0.40
- 0.35
- 0.30
- 0.25
- 0.20
- 0.15
- 0.10
- 0.05
- 0.00

MNA score

0 5 10 15 20 25 30

![Graph 2: Serum Folic Acid vs. MNA Score]

MNA threshold 17 24

- Serum Folic Acid [ng/l]
- 25
- 20
- 15
- 10
- 5
- 0

MNA score

0 5 10 15 20 25 30

- 6.8 ng/ml
- 3 ng/ml
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![Graph 1: Relationship between MNA score and serum 25 OH-cholecalciferol (ng/ml).]

- **MNA threshold**: 17
- **25 OH-cholecalciferol levels**: 0 to 40 ng/ml

![Graph 2: Relationship between MNA score and dietary energy intake (kJ/day).]

- **MNA threshold**: 17
- **Dietary energy intake**: 0 to 14,000 kJ/day

- **6300 kJ/day**
D (1-hydroxy-cholecalciferol; \( r = 0.53; p < 0.0001; n = 133 \)), and energy intakes (\( r = 0.41; p < 0.0001; n = 151 \)). These results indicate the capacity of the MNA to reflect the nutritional status and the risk of malnutrition.

Examples of the identification of nutritional problems using the MNA are given in Table 2 for different situations: living at home, ambulatory care (general

### Table 2. Prevalence (%) of malnutrition: MNA screening in different situations

<table>
<thead>
<tr>
<th>Location</th>
<th>Well-nourished ≥ 24</th>
<th>At-risk 17–23.5</th>
<th>Malnourished &lt;17</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albuquerque (n = 356/420)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>72</td>
<td>27</td>
<td>1</td>
<td>P. Garry</td>
</tr>
<tr>
<td>Non-Hispanic white</td>
<td>85</td>
<td>15</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Belfast (n = 31)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Free-living, 85–96 years old</td>
<td>44</td>
<td>50</td>
<td>6</td>
<td>I.M. Rea</td>
</tr>
<tr>
<td>Belgium (n = 72/137)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Community</td>
<td>97</td>
<td>3</td>
<td>0</td>
<td>M. Griep</td>
</tr>
<tr>
<td>Retirement homes</td>
<td>58</td>
<td>40</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Toulouse (n = 91)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nursing home</td>
<td>35</td>
<td>48</td>
<td>27</td>
<td>S. Lauque</td>
</tr>
<tr>
<td>Home care</td>
<td>29</td>
<td>53</td>
<td>18</td>
<td>C. Philip-Baudry</td>
</tr>
<tr>
<td>Barcelona (n = 87)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long-term care</td>
<td>47</td>
<td>47</td>
<td>6</td>
<td>A. Salva</td>
</tr>
<tr>
<td>Mendrisio (n = 166)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Admission to hospital</td>
<td>52</td>
<td>33</td>
<td>15</td>
<td>P. Quadri</td>
</tr>
<tr>
<td>St Maurice (n = 200)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General practitioner</td>
<td>88</td>
<td>12</td>
<td>0</td>
<td>M. Coutet</td>
</tr>
<tr>
<td>Nursing home</td>
<td>45</td>
<td>49</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Short-term care</td>
<td>28</td>
<td>62</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Long-term care</td>
<td>4</td>
<td>66</td>
<td>30</td>
<td></td>
</tr>
</tbody>
</table>

**Fig. 4.** MNA and serum vitamin D (25-OH) levels (Toulouse, 1991); \( n = 133 \) (each dot represents one subject). Normal values: 8–100 ng/ml. MNA threshold values: <17 = malnourished; 17–23.5 = at risk of malnutrition; ≥24 = well-nourished. Correlation coefficient, \( r = 0.53 \) (\( p < 0.0001 \)).

**Fig. 5.** MNA and dietary energy intakes (Toulouse, 1991); \( n = 151 \) (each dot represents one subject; men (●) = 50, women (○) = 100). Two thirds of French RDA = 6,300 kJ/day (1,500 kcal/day). MNA threshold values: <17 = malnourished; 17–23.5 = at risk of malnutrition; ≥24 = well-nourished. Correlation coefficient, \( r = 0.41 \) (\( p < 0.0001 \)).
practitioner or home care), retirement homes, nursing homes and hospitals, including short- and long-term care [17]. The prevalence of malnutrition in free-living elderly people was 0–6%; in nursing homes, 2–27%, and in hospital, 10–30%. These studies show that the MNA is good at discriminating undernourished elderly people and, along with the other chapters in this book, strongly support its value in assessing the nutritional status of elderly people under different conditions.

Conclusions

In summary, the MNA was developed and validated for the early detection of protein-energy malnutrition in the elderly in three successive studies [1, 2]. It fulfills the criteria for nutritional evaluation: sensitivity, specificity, cost, and targeting to a specific group (frail elderly people), as proposed by Rush in his recent review on screening in old people [18]. It has now been translated by specialists into more than 15 languages and is freely available. The MNA allows physicians and health professionals to make a rapid and reliable evaluation of the nutritional status of elderly patients, to recognize those at risk of nutritional problems.

References


Discussion

**Dr. Cohendy:** I would like to ask about frail elderly patients. Have you found any relation between the MNA score and the level of hemoglobin, hematocrit or iron?

**Dr. Guigoz:** We didn’t look at iron. There was, however, a relation between MNA score and hemoglobin and hematocrit in the first Toulouse study.

**Dr. Cohendy:** Is this relation sufficiently strong to predict anemia or a problem related to anemia in elderly people?

**Dr. Guigoz:** This should be looked at; we have not done so.

**Dr. Rubenstein:** The fact that people are now looking at nutrition as part of geriatric assessment is really important, but when you described the ongoing use of MNA, most of it seems to be related to research databases or longitudinal population studies. Approximately how many places in the world are now using this assessment as a clinical tool in day-to-day practice? Do you have any feeling for that?

**Dr. Vellas:** I don’t know – most people who use the score probably don’t go to meetings! However, in the Toulouse area we are now seeing more and more patients with MNA scores done by the family practitioner, so it seems to be fairly widespread.

**Dr. Guigoz:** In Geneva, every patient coming to the geriatric hospital has an MNA score.

**Dr. Vellas:** We are also receiving increasing numbers of papers submitted for publication from geriatric hospitals where the MNA is in use.

**Dr. Morley:** In our hospital, both in the outpatients and in subacute care, our fellows have started to use MNA spontaneously, so it is a user-friendly instrument. We did not ask them to do it. They introduced it themselves. This tells us that it is an enjoyable instrument for people who are not used to assessing nutrition, and this is a positive feature.

Although we did not specifically look at the question of the frail obese population, I believe that the MNA probably does pick up malnutrition in obese people who are running into trouble. It seems capable of looking at both ends of the spectrum, and that is one of the positive aspects of the MNA. We must remember that it has high sensitivity, but lower specificity. That’s fine for a screening tool – if you make it too specific, you will miss too many people at risk. The purpose of this tool, which can be used by anyone, is to make sure that people are referred for more sophisticated workup.

I was wondering if you have data from the Toulouse study on hospital admissions and deaths occurring in people who have had MNA. Have you looked to see if the MNA is predictive in that population, or in the New Mexico population?
Dr. Vellas: We do have a correlation between MNA and mortality, but we have not collected retrospective data.

I have a comment relating to Dr. Rubenstein’s question. When medical students come to do geriatric medicine, they like to learn things that they don’t learn in other departments. They can learn how to treat pneumonia or hypertension in most departments. When they come to the geriatric department, they like to learn how to use a tool such as MNA. When students have learned how to use MNA, they will use it more and more.

Dr. Berner: With regard to obesity, the only existing data on obesity as a risk factor come from the Metropolitan Life Tables, where one can see flattening of the J-shaped curve with aging up to a horizontal line above 80. Therefore MNA is very important in obese elderly people where borderline nutritional deficiency may be present but masked by their obesity.

Dr. Rossle: You say that the MNA has been translated into about 20 languages, and has been validated in France and the USA. Would you recommend it for use with people of any ethnic origin? Do you think there are any limitations for the use of this tool?

Dr. Guigoz: I don’t think so. It is validated for elderly people so it should be suitable for any elderly person, though maybe we should check the anthropometric values for different populations. We used the Toulouse population as the standard, but it is possible that other populations may need different anthropometric standards.