

The MNA[®] revisited: what does the data tell us?

Chairmen:

Professor Bruno Vellas (Toulouse, France),

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Nestlé Nutrition INSTITUTE			
Mini Nutritional Assessment MNA [®]			
Last name:	First name:	Sex:	
Date:	Age:	Weight, kg:	Height, cm:
Complete the screen by filling in the boxes with the appropriate numbers. Total the numbers for the final screening score.			
Screening			
A Has food intake declined over the past 3 months due to loss of appetite, digestive problems, chewing or swallowing difficulties?			
0 = severe decrease in food intake	1 = moderate decrease in food intake	2 = no decrease in food intake	<input type="checkbox"/>
B Weight loss during the last 3 months			
0 = weight loss greater than 3 kg (6.6 lbs)	1 = does not know	2 = weight loss between 1 and 3 kg (2.2 and 6.6 lbs)	3 = no weight loss
<input type="checkbox"/>			
C Mobility			
0 = bed or chair bound	1 = able to get out of bed / chair but does not go out	2 = goes out	<input type="checkbox"/>
D Has suffered psychological stress or acute disease in the past 3 months?			
0 = yes	2 = no	<input type="checkbox"/>	
E Neuropsychological problems			
0 = severe dementia or depression	1 = mild dementia	2 = no psychological problems	<input type="checkbox"/>
F1 Body Mass Index (BMI) (weight in kg) / (height in m²)			
0 = BMI less than 19	1 = BMI 19 to less than 21	2 = BMI 21 to less than 23	3 = BMI 23 or greater
<input type="checkbox"/>			
IF BMI IS NOT AVAILABLE, REPLACE QUESTION F1 WITH QUESTION F2. DO NOT ANSWER QUESTION F2 IF QUESTION F1 IS ALREADY COMPLETED.			
F2 Calf circumference (CC) in cm			
0 = CC less than 31	3 = CC 31 or greater	<input type="checkbox"/>	
Screening score (max. 14 points) <input type="checkbox"/> <input type="checkbox"/>			
12-14 points: Normal nutritional status			
8-11 points: At risk of malnutrition			
0-7 points: Malnourished			
For a more in-depth assessment, complete the full MNA [®] which is available at www.mna-elderly.com			
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For more information: www.mna-elderly.com			

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The Mini Nutritional Assessment (MNA[®]) was developed in the early 1990s to add a nutrition component to the Comprehensive Geriatric Assessment. It was the result of a joint project of the Nestlé Research Centre, Switzerland, the Centre for Internal Medicine and Clinical Gerontology of Toulouse, France, and the University of New Mexico, USA. Although the MNA[®] has been available for use for over 15 years, it is still not well integrated into clinical practice. To improve utilisation of the MNA[®] and confirm validation, the MNA[®] International Initiative was conducted with data collated from geriatric care settings across the globe. The study results were presented for the first time at this IAGG session, and the new MNA[®]-short form (MNA[®]-SF) was introduced.

Three key features of the new MNA[®]-SF are:

- It is now validated as a stand alone nutrition screening tool;
- Calf circumference (CC) may be used instead of body mass index (BMI); and
- The tool can identify an older person as well nourished, at risk of malnutrition or malnourished.

These features make the MNA[®]-SF a more clinician-friendly tool.



From left: Yves Guigoz; Tommy Cederholm; Bruno Vellas, Larry Rubenstein; Cornel Sieber, Juergen Bauer; and Antonio Salvà

The MNA[®] in research and practice: from birth to present



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Development and validation of the MNA[®]

The development of the Mini Nutritional Assessment (MNA[®]) was a collaborative research programme between the Nestlé Research Centre in Lausanne, Switzerland, the Centre for Internal Medicine and Clinical Gerontology of Toulouse, France, and the Clinical Nutrition Program at the University of New Mexico, USA. One of the original goals of this project was to add a screening tool for malnutrition to complement the existing tools used in

the Comprehensive Geriatric Assessment.

The MNA[®] was first developed in 1991 and published in 1994,¹ and 1996 in Nutrition Reviews.² It is an 18-item questionnaire that incorporates anthropometric measurements, dietary intake, and global- and self-assessment components. The maximum score for the full MNA[®] is 30 points; patients are categorised as normal or well nourished (≥ 24 points), at risk of malnutrition (17–23.5) and undernourished (< 17).

The MNA[®] was validated in three studies involving more than 600 older people.^{1,2} The two principal criteria for validation were clinical status and comprehensive nutritional assessment. Clinical status was evaluated independently by two physicians trained in nutrition based on the subject's clinical record without knowledge of the MNA[®] results. The comprehensive nutrition assessment included assessments of anthropometrics, biochemical markers and dietary intake.

The MNA®-SF

The MNA®-short form (MNA®-SF) – a shortened version of the full MNA® – was subsequently developed to allow a two-step screening process in low-risk populations.⁴ Step 1 uses the MNA®-SF, which consists of six items for a maximum score of 14 points. A screening score ≥ 12 indicates normal nutritional status, and a score < 11 suggests possible undernutrition and necessitates completion of the full MNA® questionnaire (step 2).

The MNA®-SF has been shown to correlate strongly with the total MNA® score.^{3,4} Furthermore, the high sensitivity and specificity of the MNA®-SF compared with the MNA® (Table 1)³⁻⁸ or other nutritional parameters (Table 2)^{3,9-11} indicate that the MNA®-SF is a valid screening tool for malnutrition in the older person.

The full MNA® should be used as a guide for nutritional interventions. It is important that the MNA® is completed at regular intervals for continuous assessment of the patient.

Impact of the MNA® in geriatric research

Numerous articles discussing the MNA® exist in the published literature,

underscoring its value in the medical and geriatric community. The MNA® has become a valuable tool for measuring the nutritional status of subjects in various research settings. Among 211 studies (>81,000 subjects) that reported data on all three levels of nutritional status, malnutrition was least prevalent in community dwelling older persons (3%) and most prevalent in hospitalised (23%) and institutionalised (20%) patients [Guigoz Y, unpublished data]. The risk of malnutrition was even higher across all care settings, including homecare and outpatient (43%), hospitalised (45%), institutionalised (48%) and cognitively impaired (42%) individuals, but comparatively lower in community dwellers (26%).

The ability of the MNA® to discriminate nutritional risk is well documented in clinical studies. The Health and Nutritional Promotion Program for Patients with Dementia (NutriAlz) study showed that the risk of malnutrition (as assessed by MNA®) increased significantly with increasing disability and cognitive impairment ($p \leq 0.0001$).¹² Another study reported increased 3-year mortality rates in geriatric patients with risk for protein-energy malnutrition (according to the MNA®-SF).¹³

Along with the MNA®-SF, the MNA® has now become an integral part of the Comprehensive Geriatric Assessment. It has been translated into many languages and is widely used in a range of geriatric settings in different countries.

**“Along with the MNA®-SF,
the MNA®, has now become
an integral part of the
comprehensive geriatric assessment”**

Conclusions

The MNA® is a reliable two-step screening test to assess the risk of malnutrition in the older person. In the first step, the MNA®-SF serves as a simple valid tool to rapidly screen patients for risk of malnutrition. In the second step, the full MNA® is used to assess nutritional status and facilitate nutritional intervention. The wide use of the MNA® in clinical research reflects its worldwide acceptance as a valid tool for nutritional risk screening and assessment in older people.

References

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Table 1. Sensitivity and specificity of the MNA®-SF compared with MNA®³⁻⁸

	Sensitivity	Specificity	Reference
MNA®	96	98	Rubenstein LZ, et al. 2001
MNA®	86	89	Cohendy R, et al. 2001
MNA® Community	74	95	Borowiak E & Kostka T. 2003
MNA® Institution	64	100	
MNA®	86	94	Kuzuya M, et al. 2005
MNA®	100	95	Charlton KE, et al. 2007
Mean (SD)	84 (13)	95 (4)	

MNA®, Mini Nutritional Assessment

Table 2. Sensitivity and specificity of the MNA®-SF compared with nutritional parameters^{3,9-11}

	Sensitivity	Specificity	Reference
Detailed nutritional assessment	93	38	Visvanathan R, et al. 2004
Malnutrition by nutritionist	100	38	Ranhoff AH, et al. 2005
BMI <23	86	71	
Albumin 3.5 g/dL	44	61	Yamada K, et al. 2008
Prealbumin 30 mg/dL	48	67	
BMI <18.5 kg/m ²	100	81	
Thigh muscle area/ Thigh bone area <10	65	68	
Mean (SD)	79 (26)	59 (18)	

BMI, body mass index; MNA®, Mini Nutritional Assessment

New insights from an internationally pooled database: The MNA[®] International Initiative



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Germany

Aims of the MNA[®] International Initiative

The MNA[®] International Initiative was commenced in 2008 to 2009 to confirm the validation of the MNA[®] using a large international database.

The aims of this project were to:

- Provide information on the prevalence of malnutrition in different settings across the world
- Examine the relationship between the MNA[®] results and external parameters of nutrition and inflammation
- Test the validity of the original MNA[®]-SF
- Develop an alternative MNA[®]-SF for application in individuals where BMI is not available
- Create two cut-offs for the MNA[®]-SF for identical categorisation as provided by the full MNA[®]

Building the database

The international data pool was created by combining raw patient data from numerous studies across care settings and geography. The MNA[®] literature published from 2000 through 2008 was reviewed and studies presenting MNA[®] data plus biochemical, anthropometric and functional parameters as well as dietary assessments from different care settings were selected as possible candidates that could contribute to a combined MNA[®] dataset. The

authors of these studies were asked to participate in the study by sharing their raw data sets.

In total, 24 authors provided 27 datasets that formed the pooled database, comprising 6,257 study participants (>65 years) from around the world. The care settings of the study participants included hospital, nursing home, community and rehabilitation.

Prevalence of malnutrition across settings

According to the MNA[®] categorisation, the overall prevalence of malnutrition was 22.8%, with considerable differences amongst the settings (Figure 1).¹ Patients in the hospital and rehabilitation settings had a higher prevalence of malnutrition than those in nursing home and community settings. However, it should be noted that a large proportion of nursing home residents were at risk of malnutrition. Overall, two thirds of the studied population were either at nutritional risk or malnourished.¹

“Overall, two thirds of the studied population were either at nutritional risk or malnourished”

Prevalence of malnutrition based on external nutritional parameters

The correlations between laboratory data, such as albumin and C-reactive protein (CRP), and MNA[®] categories were tested in the entire database and across different settings. There was a trend of increasing albumin levels as nutritional status improved from the malnourished, at risk and well nourished categories for all patients, with statistically significant differences among the three categories.¹ These differences were more pronounced in the subset of nursing home residents. The CRP levels were also correlated with MNA[®] categories for the full dataset; high values in the malnourished group, lower in the at risk patients and lowest in the well nourished group.¹

“In this large dataset, the original MNA[®]-SF has been re-confirmed to be a validated stand-alone tool”

Testing the original MNA[®]-SF and alternatives

The combined dataset (n=2,032) was used to test the sensitivity and specificity of potential short forms, based on 5,577 possible combinations of six of the 18 items on the full MNA[®].² This extensive analysis showed that the original MNA[®]-SF had the second highest sensitivity and specificity of all the possible versions (Table 3). The original MNA[®]-SF also had a

Figure 1. MNA[®] categories across care settings¹

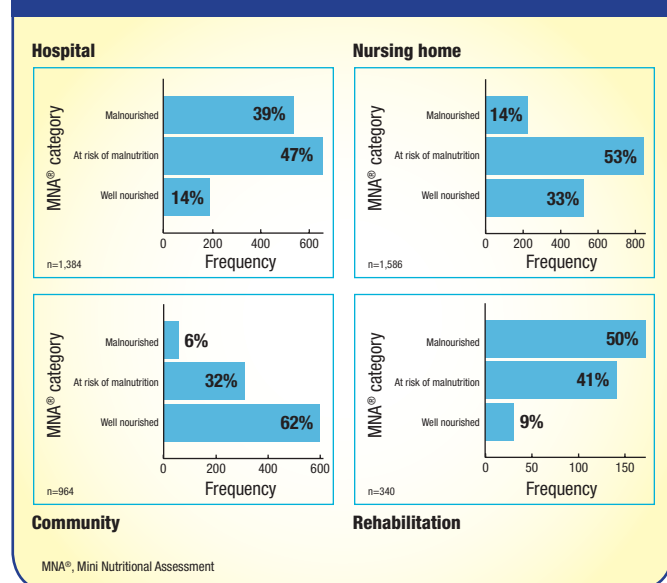


Table 3. The top three short forms ranked for highest sensitivity²

Rank	Items	Sensitivity	Specificity	Correlation with full MNA [®]	Youden-Index
1.	B-C-D-E-F-N	0.90	0.81	0.90	0.71
2.	A-B-C-D-E-F "Original MNA [®] -SF"	0.89	0.82	0.90	0.71
3.	B-C-D-E-F-L	0.89	0.81	0.90	0.70

Youden-Index=sensitivity+specificity-1
MNA[®], Mini Nutrition Assessment

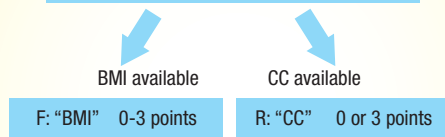
90% correlation with the full MNA. Thus, in this large dataset, the original MNA[®]-SF has been re-confirmed to be a validated stand-alone tool.²

An alternative MNA[®]-SF without BMI

The application of the original MNA[®]-SF has presented problems in certain instances where BMI measurements cannot be easily obtained. In certain geographic regions, weight measurement is uncommon for cultural reasons. In addition, immobility very often complicates weight and height measurements. To improve the applicability of the MNA[®]-SF, CC was introduced as an acceptable alternative to BMI, when BMI was unavailable. Evaluations in the database showed that this MNA[®]-SF variation (with CC instead of BMI) provided high sensitivity (85%) and specificity (84%).³ It is worth noting that BMI remains the preferred measurement, but the new MNA[®]-SF allows use of CC when BMI is not available (Figure 2).

Figure 2. Scoring of the new MNA[®]-SF³

- A: "Appetite loss" 0-2 points
- B: "Weight loss" 0-3 points
- C: "Mobility" 0-2 points
- D: "Acute disease" 0-2 points
- E: "Depression/Dementia" 0-2 points



- 12-14 points Well nourished
- 8-11 points At risk
- 0-7 points Malnourished

BMI, body mass index; CC, calf circumference

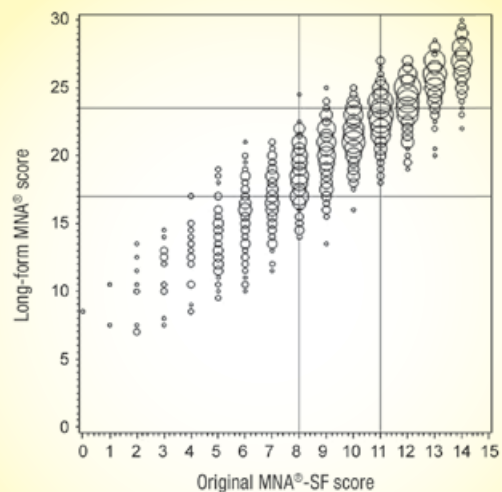
"The new MNA[®]-SF allows use of calf circumference when BMI is not available"

MNA[®]-SF with three result categories

The MNA[®]-SF screens out well nourished older people, but doesn't differentiate between the nutritionally at risk and the malnourished. To identify people who need nutrition intervention, the full MNA[®] must be completed. However, because of manpower, financial and time constraints, the full MNA[®] is often difficult to implement in clinical practice. Therefore, to improve the overall usefulness of the MNA[®]-SF and to make the link to intervention easier, it was determined that the three malnutrition indicator scoring categories (normally nourished, at risk of malnutrition, malnourished) from the full MNA[®] could be incorporated into the new MNA[®]-SF (Figure 2).³ This could easily identify malnourished older persons, who may greatly benefit from nutrition intervention, and the at-risk population.

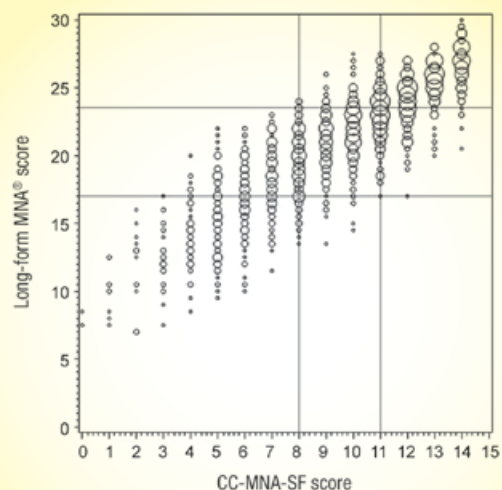
To determine the two cut-off points for nutritional categorisation in the new MNA[®]-SF, a ROC analysis was conducted using the full MNA[®] as

Figure 3. MNA[®]-SF (with BMI) vs full MNA[®]²



Vertical bars represent short-form cut-points; horizontal bars represent long-form cut-points.
MNA[®], Mini Nutritional Assessment; MNA[®]-SF, MNA short form; BMI, body mass index

Figure 4. MNA[®]-SF (with CC) vs full MNA[®]²



Vertical bars represent short-form cut-points; horizontal bars represent long-form cut-points.
MNA[®], Mini Nutritional Assessment; MNA[®]-SF, MNA short form; CC, calf circumference

the reference. The upper cut-off point was optimised for sensitivity and the lower cut-off for specificity. The upper cut-point at 11 had a sensitivity of 89.3% and specificity of 81.8%. The lower cut-point at 8 had a sensitivity of 85.2% and specificity of 94.3%. The three scoring categories obtained in the MNA[®]-SF (using BMI) were then compared with those obtained with the full MNA[®]; the results showed 79.9% correct classifications, and no complete misclassifications by two categories (Figure 3).² The same comparison of the MNA[®]-SF using CC and the full MNA[®] showed 72.9% correct classifications and no complete misclassification by two categories (Figure 4).² Based on this analysis, it was determined that the three categories from the full MNA[®] could be adopted in the new MNA[®]-SF, using either the BMI or CC question.

“The ability of the new MNA[®]-SF to provide identical result categories, which are in high agreement with the full MNA[®], allows for quicker nutrition intervention”

Conclusions

Using the large international database, the MNA[®] has confirmed the high prevalence of malnutrition in older people. The highest prevalence rates of malnutrition have been found in hospitals and rehabilitation units. A strong correlation between the MNA[®] and external nutritional parameters, such as albumin and CRP, further supports the use of the MNA[®] as a valid tool for the screening of malnutrition.

Using the same large database of thousands of subjects, the original MNA[®]-SF has been re-confirmed as a strong, validated, stand-alone tool for nutrition screening. Using CC in the MNA[®]-SF is a valid alternative when BMI is missing. The ability of the new MNA[®]-SF to provide identical result categories, which are in high agreement with the full MNA[®], allows for quicker nutrition intervention.

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Future applications of the MNA[®]



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It is well documented that dietary supplementation can improve nutritional status and reduce mortality and complications in undernourished elderly

patients.¹ However, because of neglect and ignorance, older people do not always receive adequate nutritional care. Therefore, it is important to have valid and feasible tools to provide relevant information on nutritional status in older people. Over the years, a number of nutritional risk assessment tools have emerged: MNA[®]; NRS 2002 (Nutritional Risk Screening 2002); MUST (Malnutrition Universal Screening Tool); SNAQ (Simplified Nutritional Appetite Questionnaire); and SGA (Subjective Global Assessment). Of these, the MNA[®] has been identified as the best screening tool for older people.

Strengths of the MNA[®]-SF

Recently, the short form version of the full MNA[®] (MNA[®]-SF) has been validated as a fast and simple screening tool for identifying subjects who may benefit from nutritional intervention. The new MNA[®]-SF has greater feasibility as it gives the option to substitute CC when BMI is unavailable, such as in bed-ridden subjects and in some cultural contexts where it is not customary to obtain such measurements. Nevertheless, the MNA[®]-SF still targets the older adult population.

The strengths of the MNA[®]-SF are that it:

- predicts poor outcome;
- identifies subjects that may respond to treatment;
- captures the essentials of nutritional status; and
- captures the complexity of ageing.

MNA[®]-SF predicts poor outcome

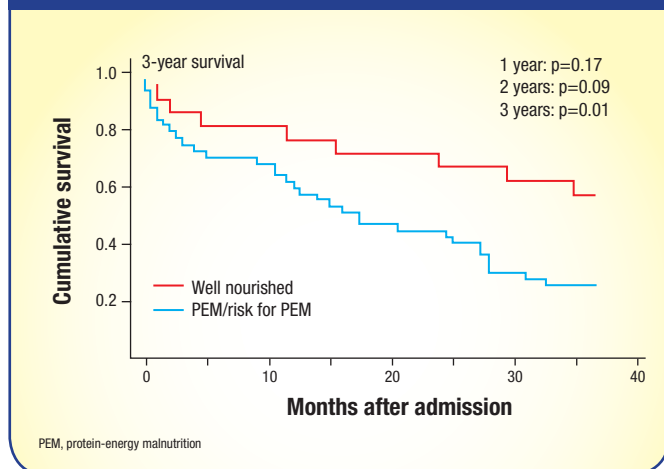
In a prospective follow-up study, the MNA[®]-SF was used to classify 83 consecutive, newly admitted, acute geriatric patients as having protein-energy malnutrition (PEM), being at risk for PEM, or being well nourished (WN).² More than two thirds of the patients were at risk or had PEM on admission. The 3-year mortality rate was significantly higher in PEM patients than WN patients ($p < 0.01$; Figure 5).² These data show that, even in this relatively small sample, the MNA[®]-SF proved useful in identifying malnourished patients at risk for increased mortality.

“The MNA[®]-SF proved useful in identifying malnourished patients at risk for increased mortality”

MNA[®]-SF identifies subjects who respond to treatment

In another study, the combined effects (intervention) of nutritional supplementation and dietary advice were evaluated in patients discharged from a geriatric service.³ Patients identified as at risk of PEM by the MNA[®]-SF were randomly allocated to the intervention or control groups and followed up after 4 months. Among the 54 patients who completed the study, combined nutritional intervention prevented weight loss and improved activities of daily living (ADL) in patients at risk of malnutrition.³

Figure 5. MNA®-SF predicts mortality in geriatric patients²



MNA®-SF captures the essentials of nutritional status

Three of the six variables of the MNA®-SF effectively assess the trajectory of the catabolic process, i.e., weight loss as an indicator of what has happened in the past, BMI or CC indicating the present situation, and appetite assessing what will likely happen in the near future.

MNA®-SF captures the complexity of ageing

The remaining components of the MNA®-SF address age-related variables. For example, disease indicates ongoing catabolism; dementia and depression demonstrate the ability to eat; and immobility portrays the level of sarcopenia.

Clinical applications of the new MNA®-SF

The increased feasibility of the MNA®-SF provides a basis for improved nutritional care, not only in terms of screening, but also in aspects of quality assurance, such as regular audits and national registers.

With respect to quality assurance, there are four important areas in the nutritional care process that need special attention:

- 1. Screening:** The first step in the nutritional care process, with MNA® being the main focus in the older population.
- 2. Care plan:** A documented care plan that includes a calculation of energy needs.
- 3. Meal support and nutritional treatment:** Based on the measures from screening and care plan.
- 4. Transfer of information:** Ensuring that patients' nutritional information records are transferred with them to new care settings.

Discrepancy between nutritional standards and clinical practice

A questionnaire-based survey was conducted among 1,600 physicians, nurses and dietitians in Scandinavian countries to investigate nutritional attitudes and routine in hospital settings. The study found a huge gap

between desirable and actual practice.⁴ For example, more than 80% of the participants felt that nutritional screening should be performed in every situation, but only 20% actually carried out screening in their own practice. Similar discrepancies were found with regard to weighing and making a care plan. The study also showed that ignorance/lack of interest was the biggest obstacle, possibly among hospital managers and authorities.⁴ Therefore, it is important to improve the quality assurance aspect of the care process to increase awareness among hospital management, politicians and decision makers.

“The new MNA®-SF potentially can be a valuable research tool to better understand the link between nutrition and age-related degenerative processes”

MNA®-SF as a quality assurance tool

National quality registers could be one option to improve the quality of care and increase awareness. The Swedish nationwide care preventive register, SeniorAlert, was started in 2008 for subjects >65 years old in acute and community care. This register uses the MNA®-SF for nutritional risk screening. The MNA®-SF could also be an instrument for regular audits.

MNA®-SF as a research tool

The new MNA®-SF has many potential future research applications. Using the pooled international database of retrospective studies, the grading scale of the new MNA®-SF was shown to have good discriminatory ability. It is now important to test this in new prospective studies. Furthermore, the application of the dual option form (BMI or CC version) in the acute and other geriatric settings should also be evaluated. In addition, the MNA®-SF could be used as a denominator for research relating to the degenerative processes of ageing, such as frailty, sarcopenia and sarcopenic obesity.

Conclusions

The MNA®-SF has been established as a valid nutritional risk screening tool for older people. It effectively predicts poor outcomes and identifies subjects who may benefit from nutritional intervention. In addition to improving the overall nutritional care process by improving nutritional screening and quality assurance, the new MNA®-SF potentially can be a valuable research tool to better understand the link between nutrition and age-related degenerative processes.

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Nutrition screening

As **e a s y**
as **m n a**®



The MNA® (Mini Nutritional Assessment) is the most validated screening tool for the elderly. Quick, easy to use and effective, the MNA® was designed to address the nutrition aspects of the Comprehensive Geriatric Assessment.

✓ Most validated tool for the elderly

- Sensitive and reliable
- Recommended by national and international organisations
- Supported by more than 400 published studies

✓ Quick and easy to use

- Screen in less than 4 minutes
- Requires no special training

✓ Identifies nutritional status

- Malnourished vs At risk vs Normally Nourished
- Facilitates early intervention
- Identifies at risk persons before weight loss occurs

The image shows a sample of the Mini Nutritional Assessment (MNA®) form. The form is titled 'Mini Nutritional Assessment MNA®' and includes fields for 'Last name', 'First name', 'Sex', 'Date', 'Age', 'Weight, kg', 'Height, cm', and 'I.D. Number'. It contains several sections of questions, including 'A. Has food intake declined over the past 3 months due to loss of appetite, digestive problems, chewing or swallowing difficulties?', 'B. Weight loss during the last 3 months', 'C. Mobility', 'D. Has suffered psychological stress or acute disease in the past 3 months?', 'E. Neurological/psych problems', and 'F1 Body Mass Index (BMI) (weight in kg / height in m²)'. There is also a section for 'F2 Fall classification (CCI) in last 6 months'. The form includes a 'Scoring score' section with 'F1-14 points', 'F2-11 points', and 'F3-5 points'. At the bottom, there is a 'Nutritional status' section with 'At risk of malnutrition' and 'Malnourished' options. The form also includes a footer with copyright information and a website link: 'www.mna-elderly.com'.

www.mna-elderly.com



www.nestlenutrition-institute.org