

Impact of global and subjective mini nutritional assessment (MNA) questions on the evaluation of the nutritional status: The role of gender and age

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ABSTRACT

Undernutrition is a quite common condition in the elderly, often identified using the mini nutritional assessment (MNA) test. The aim of this research was to study the independent value of the global and the subjective MNA questions to predict the undernutrition according to the full MNA score, and to analyze the influence of gender and age on such items. A total of 22,007 Spanish people 65 years of age or older were evaluated using the MNA test. These data were obtained by trained community pharmacists by using receiver Operating Characteristic (ROC) curves. About 4.3% of the studied population were classified as undernourished according to the full MNA test. The subjective subscore (two questions) presented better predictive value than the global one (six questions). Indeed, 99.5% of subjects detected as well nourished using the MNA test were also correctly classified using the two subjective questions. In the present study, it was identified that the two subjective MNA questions can be an efficient tool for a quick screening to rule out non undernourished subjects.

KEYWORDS: MNA in elderly; Undernutrition in elderly; Assessment of undernutrition; Self-perception; Screening of undernutrition

1. INTRODUCTION

Malnutrition in the elderly is a common and relevant problem worldwide (Chen et al., 2007; Martinez et al., 1990; Roubenoff, 2000; Visvanathan, 2003), not only associated to the aging process but also because of the high incidence of chronic diseases, drug prescription, disabilities or underprivileged social circumstances (Martinez et al., 1994; Medhi et al., 2006). The importance of undernutrition in older people is evidenced by longer hospital stays and higher morbidity and mortality rates among undernourished subjects (Kyle et al., 2004; Mowe, 2002; Persson et al., 2002).

In that context, nutritional assessment must be an important part of the comprehensive geriatric surveillance in order to guide healthcare professionals towards appropriate nutritional interventions, which should be closely followed (Vellas et al., 2006).

Therefore, it seems necessary to develop tools which may be able to detect, in a simple, easy and efficient way, nutritional risk situations in such population group, to complete a full nutritional evaluation in those elders that show a possible nutrition-related problem (Chen, 2004).

In both medical practice and clinical research, the MNA is by far the most widely used tool for nutritional screening and assessment of the elderly (Vellas et al., 2006) and it appears as a useful tool to identify old people who need help from the public sector (Beck et al., 2001). Indeed, it is important to get available validated and internationally accepted methods, to be able to obtain results that can be compared between regions and countries. The MNA has been translated into more than 20 languages and validated in many settings (Vellas et al., 2006). The MNA test includes four types of questions: those dealing with anthropometric measurements (4), dietary questionnaire (6), global assessment (6) and subjective questions (2). The MNA total score (maximum 30)

distinguishes between elders with adequate nutritional status, those at risk of undernutrition and those exhibiting undernutrition (Guigoz et al., 1996).

The purpose of the present work was to assess the value of the global (six questions) and subjective (two questions) items to predict the classification of subjects according to the full MNA score, and to study the influence of gender and age on global and subjective MNA items.

2. METHODS

2.1. Subject recruitment

This study was a cross-sectional survey, based on the MNA test (Guigoz et al., 1996). The recruited population encompassed community-dwelling elders all over Spain, recruited by community pharmacists who had direct contact with elders. All the participants were specifically asked if they would be willing to take part in the study. The acceptance to fill in the questionnaires was considered as a personal consent. Only those who accepted were enrolled. Previously, 3,251 community pharmacists were recruited through the Spanish Pharmacists Council to take part in the survey collecting the data. In order to obtain consistent results to be compared among all participants, these community pharmacists received training sessions and a face to face and by videoconference. Besides, an extensive document with the information needed about the survey, the correct way to formulate every question and a decision tree to interpret each answer, were specifically prepared by nutritionists with experience in epidemiological and nutritional questionnaires. After 2 months, 26,484 filled questionnaires were received and after a careful clean up, the final complete sample reached 22,007 volunteers.

2.2. MNA

The MNA test is composed of four subgroups: anthropometric measurements (four questions about weight, height and body circumferences, with a maximum score of eight points), dietary questionnaire (six questions related to number of meals, kind of foods, fluid intake and autonomy of feeding, with a maximum score of nine points), global assessment (six questions according to lifestyle, medication and mobility, with a maximum score of nine points) and subjective assessment (self-perception of health and nutrition, with a maximum score of four points) (Guigoz et al., 1996; Guigoz and Vellas, 1997). The MNA total score distinguishes between elders with adequate nutritional status (score ≥ 24), risk of undernutrition ($17 \leq \text{score} < 24$) and undernutrition (score < 17) as described elsewhere (Guigoz and Vellas, 1999).

2.3. Data collection

Information about height and body weight was self-reported by the participant. In case of doubt, measurement was performed. According to the global assessment part, mobility was recorded in three levels: when the participant was not able to get out of bed or chair, when the participant was able to get out of bed or chair but did not go out home and when he/she was able to go out home. The question regarding psychological stress or acute disease was answered with information reported by the participant or by a relative if it was needed. The item about neuropsychological problems (dementia or depression) was based on the subjective impression of the interviewer. The question about living conditions referred to the normal living of the individual with or without assistance. The intake of drugs (medication) was directly assessed by the pharmacist. It was established that one medication corresponded to one doctors' prescription. Volunteers were also questioned about the presence of pressure sores, defined as bedsores, chair sores or other skin ulcers.

The two questions concerning the subjective assessment referred to a self-perception of the interviewed subject, so, the answer depended upon his/her state of mind and circumstantial events. So, if the interviewer considered the elder was not capable of answering the question, then the carer was asked for opinion. Self-perception of nutritional status question was focused on undernutrition status; so, a person with an overnutrition situation ought to answer “no undernutritional problems”. On the other hand, health status question referred not only to self-perception of physical situation but also of psychological state.

2.4. Statistical analysis

Statistical analyses were performed with the Statistical Package for Social Sciences (SPSS) Inc. Chicago, version 15.0 for Windows XP following criteria as described elsewhere (Martínez-González et al., 2006). Means and standard deviations were used as descriptive statistics. X²-Tests were performed to compare the distribution of frequencies according to gender. To study global and subjective changes with age, we assigned 10 age categories (from 65-66 to ≥85 years) to detect small changes due to the aging process. Stepwise linear multiple-regression analyses were used to study the strength of MNA global and subjective assessment on MNA total score. To look for an efficient tool for undernutrition detection, we investigated the predictive value (PV) of three partial scores: six global questions (from 0 to 9 points), two subjective questions (from 0 to 4 points) and the sum of both parts (from 0 to 13 points), using the full score of the MNA as the gold standard. ROC curves were used to compare the ability of a partial MNA score to predict the presence of undernutrition (according to the full score). The ROC curve tests the ability of a variable to predict an outcome by plotting sensitivity against one minus specificity. From this, the area under the curve (AUC) is an indicator of how well the score of only two MNA questions can predict a positive

test outcome. AUC ranges from 0 to 1, being 0.5 indicative of no predictive power and 1 of perfect power (Gibson, 2005). In addition, the sensitivity, specificity and PVs were calculated to investigate the optimal cut-off point in the partial score of the two subjective MNA questions, to predict the outcome with the full MNA, regarding classification of no undernutrition plus undernutrition risk.

3. RESULTS

The population included a total of 22007 Spanish community dwelling elderly people, 8014 men (36.4%) and 13993 women (63.6%). The mean age of the participants was 75.2 ± 6.8 years (S.D.) with a range from 65 to 100 and the mean MNA total score was 24.9 ± 3.9 . According to the full score of the MNA test, 4.3% of the subjects were classified as undernourished, 25.4% were at risk of undernutrition and 70.3% showed no apparent undernutrition.

As global and subjective assessment are the easiest and shortest questions of the MNA tool, we evaluated the impact of only these questions in detecting an undernutrition situation, using the full MNA as the gold standard. According to global characteristics of the sample, more than 90% of subjects were able to go out home without assistance, being this proportion significantly higher in men than in women (Table 1). However, concerning independence, there were more women living independently than men. A situation of psychological stress or acute disease was found more frequently in women than in men, and the same trend was observed concerning to neuropsychological problems. Gender differences in drug prescription also were statistically significant, with higher pharmacological administration among women. As table 1 shows, there were no gender differences about the presence of pressure sores or skin ulcers, although a marginal p-value was found. The analysis of the self-perception of nutritional and health status, revealed that there were significant differences by gender, being women

who showed a worse self-perception of their nutritional status and men of their health status.

Evolution of global and subjective MNA aspects with age are depicted in Fig. 1 and 2, respectively, where the age from 65 to ≥ 85 years was categorized.

The univariate analysis showed that gender, age, global and subjective assessment were predictors for total MNA score ($p < 0.001$). These variables showed no evidence of collinearity and were simultaneously included in a multiple regression model. The multiple regression analysis including age, gender and global assessment as predictors, was able to explain 58.8% of the variability in the total score. When we repeated the same analysis using the subjective questions instead of the global assessment, these variables predicted 50.1% of the score. The conjoint analysis with a fitted multiple regression model showed that global and subjective variables together accounted for 74.1% of the total MNA score variation ($p < 0.001$).

To study the PV that the six global questions and the two subjective ones had on total MNA result, we grouped elders with adequate nutritional status and those at risk of undernutrition versus elders with an undernutritional situation using the full MNA version (18 questions). The score range of global assessment was from 0 to 9 points and the score range of subjective assessment was from 0 to 4 points, so the ROC curves were plotted (Fig. 3) showing an AUC of 0.924 and 0.938, respectively. Thus, global plus subjective assessment ROC curve was plotted, showing an AUC of 0.967.

Additionally, we studied sensitivity, specificity and predictive values of subjective assessment (Table 2). The point “ < 2.5 ” was, apparently, the best option because it had a very high sensitivity, specificity and negative PV. The sensitivity referred as the proportion of “undernourished” individuals classified correctly using exclusively the two questions of the subjective assessment was found to be 90.2%. The specificity

referred as the proportion of “well nourished” and “at risk” individuals classified correctly by the two questions of the subjective assessment, was found to be 84.5%. The positive PV, i.e., the proportion of subjects correctly classified by the subjective assessment as being in a situation of undernutrition, was found to be 20.8%. Finally, the negative PV defined as the proportion of subjects classified by the two questions of the subjective assessment as being “undernourished”, who were correctly identified, was found to be 99.5%.

4. DISCUSSION

To our knowledge, the high number of subjects enrolled in this study provides apparently the biggest sample in the world to study nutritional status among elderly people, using the MNA test (Vellas et al., 2006).

In this context, recent statistical government report in Spain revealed that 2.3% of people older than 65 years were living in any kind of assistance centre (IMSERSO, 2006), a number near 3.5% in our study, which corroborates that the sample might be representative of Spanish elderly population. Moreover, the study was carried out in a high number of volunteers by face-to-face interviews that were conducted in a similar environment performed by trained pharmacists that gathered the information in an accurate way.

The full MNA includes 18 items grouped in four categories: antropometric, dietetic, global and subjective assessment (Vellas et al., 1999). Global information associated with nutritional status within this cohort, which were provided by data about mobility, acute disease, neuropsychological problems, independence level, medication and skin problems, were generally more prevalent among women than men, as has previously been tested by others (Allaire et al., 1999; Murtagh and Hubert, 2004; Wray and Blaum, 2001). Concerning to subjective assessment, men declared to have a better nutritional

and worse health status self-perception than women. This outcome could have been expected taking into account that women present higher undernutrition prevalence than men (Elia and Stratton, 2005; Kucukerdonmez et al., 2005; Tur et al., 2005) and they live longer than men (Arias, 2006; IMSERSO, 2006).

Concerning to global MNA changes with age, mobility was the item more affected, followed by independent living and drug consumption. Higher self-perception changes were found among older subjects: a quick self-perception worsening of nutritional status and a improvement of health status. That tendency was also found in other surveys (Seculi et al., 2001) which could be explained because in later live subjects who give their opinions are those alive, who have seen their friends or partners died, so they perceive themselves in a good health status.

Furthermore, this work analyzed the impact of global and subjective scores, individually and conjointly, on the MNA score, using a multiple regression analysis and adjusting by gender and age. It was found that each one had an influence of more than 50% on MNA score, but both together revealed that almost 75% of MNA score could be explained by global and subjective assessment questions. Taking into account that subjective assessment consists solely on two questions, we looked for its ability to classify subjects according to their nutritional status. Besides, earlier findings had found that self-perception of health status, one of the two subjective questions, showed most predictive power to identify undernourished subjects according to the full MNA (Christensson et al., 2002). Additionally, other authors had suggested that health status appears to be the most clinically relevant indicator to explain the risk for undernutrition (Griep et al., 2000). But to our knowledge, this is the first study identifying that the two subjective questions in the MNA test are an efficient tool to assess nutritional status in elderly people. The analysis showed that 90.2% of undernourished individuals using MNA test

presented a score of less than 2.5 points using the two subjective questions. On the other hand, 84.5% of non-undernourished subjects using MNA test, presented a score of 2.5 or more. Only 20.8% of subjects whose score was less than 2.5 using the two subjective questions were actually undernourished according to MNA test. However, the present work does not have the objective to detect undernourished elders with only two MNA questions, but to suggest a quick way to rule out a high number of individuals without undernutrition, and then it allows to complete the full MNA test only among those elders that show a possible nutrition-related problem, as it had been proposed by other authors (Chen, 2004). In that context, we found a very high negative PV that indicates that 99.5% of subjects detected as well nourished using 18 questions of the MNA test, were also detected using the two subjective questions. So, subjective assessment, that consists only on two quick and easy-to-answer questions, was able to discard 17,877 subjects (81.2% of the sample) as not presenting an undernutritional situation, with a probability of being right of 99.5% (negative PV). Such finding suggests that it may be not necessary to fulfil more than the two subjective questions to screen as not having undernutrition in a very high percentage of community-dwelling elderly population. It is assumed that in a clinical setting, like a hospital, nursing home, etc., where it is expected an undernutrition prevalence higher than among free-living elderly (Guigoz and Vellas, 1999; Kagansky et al., 2005; Mowe, 2002; Pauly et al., 2007; Thomas et al., 2002), the proportion of discard subjects will be lower. Therefore, more studies are needed to demonstrate it. A potential limitation of this survey is the use of the MNA test as the gold standard, but in support of the validity of the study, it was carried out in a high number of volunteers. In any case, comprehensive geriatric assessment based on MNA has been applied in patients with psychiatric diseases (Riccio et al., 2007) and cognitive impairments (Arellano et al., 2004).

In conclusion, the high sensitivity and specificity of the subjective assessment (self-perception of nutritional and health status) to predict undernutrition, as determined by MNA test, suggested that it could be a good way to save many time in the daily clinical practice.

Conflict of interest statement

The authors declare no conflict of interest concerning the contents of this article.

ACKNOWLEDGEMENTS

We especially thank to every community pharmacist that participated in the survey attending to training sessions and collecting the data, and those who coordinated all the tasks from each provincial Pharmaceutical College and from the Spanish Pharmacists Council. We also thank members of the SUN (Seguimiento Universidad de Navarra) Study Group for their assistance in data processing.

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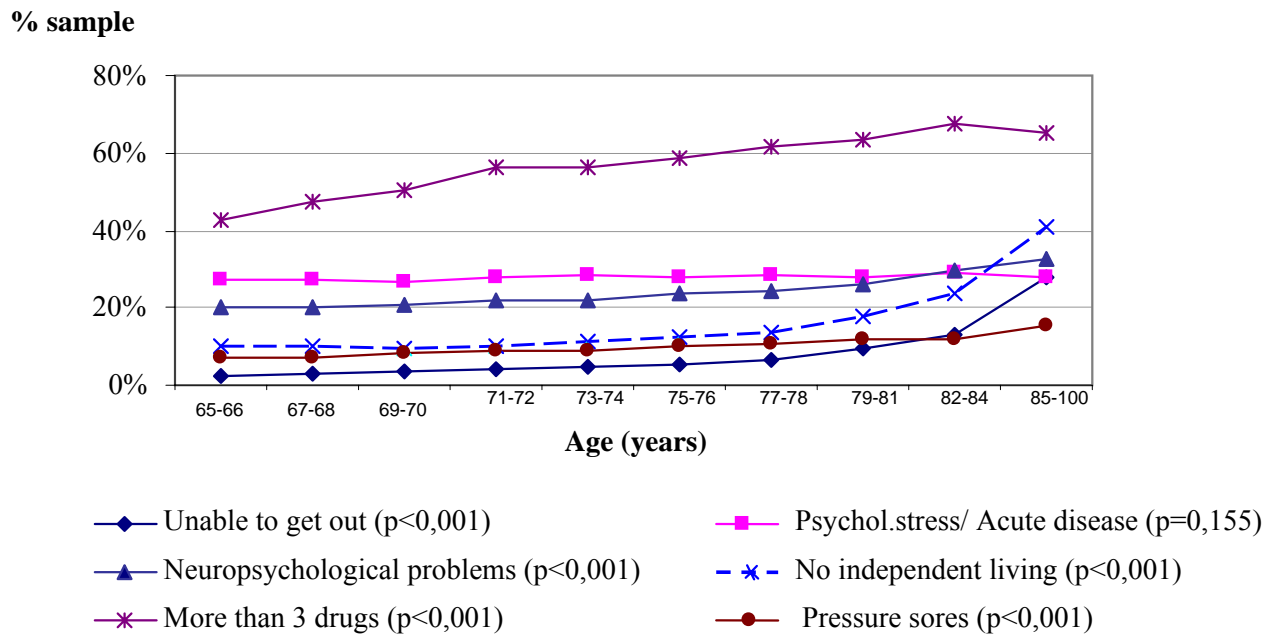
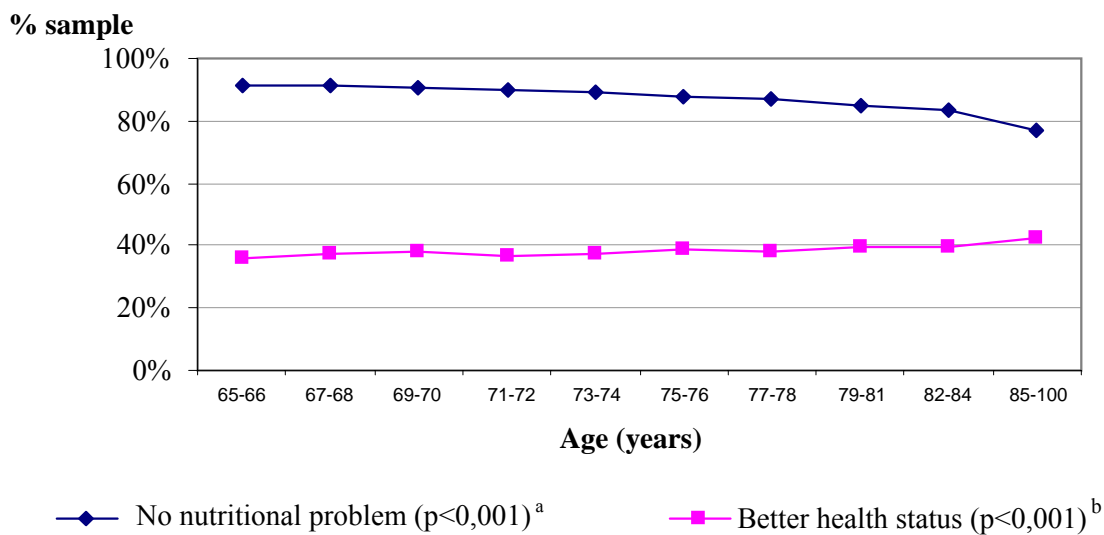
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Table 1: The characteristics of the elderly Spanish population participating in this survey.

	Men	Women	P ^a	Total
Number	8014	13993		22007
DESCRIPTIVE VARIABLES				
Age (years)	75.2 ± 6.6	75.2 ± 6.9	0.874	75.2 ± 6.8 ^b
BMI (kg/m ²)	27.7 ± 4.1	28.1 ± 5.0	<0.001	28.0 ± 4.7 ^b
MNA>23.5 (%)	75.8	67.2	<0.001	70.3
17≤MNA≤23.5 (%)	20.8	28.0		25.4
MNA<17 (%)	3.4	4.8		4.3
GLOBAL ASSESSMENT				
Unable to get out (%)	6.2	8.9	<0.001	7.9
Psychological stress/acute disease (%)	23.5	30.4	<0.001	27.9
Neuropsychological problems (%)	16.3	28.5	<0.001	24.1
No lives independently (%)	16.7	15.4	<0.05	15.9
Takes >3 medications daily (%)	55.0	58.3	<0.001	57.1
Pressure sores or skin ulcers (%)	10.4	9.8	0.087	10.1
SUBJECTIVE ASSESSMENT				
Self-view undernutrition problems (%)	10.1	14.3	<0.001	12.8
Self-view not better health status than other people of the same age (%)	42.0	36.3	<0.001	38.4

^aStudent's *t*-test for continuous variables and χ^2 -test for categorical variables.

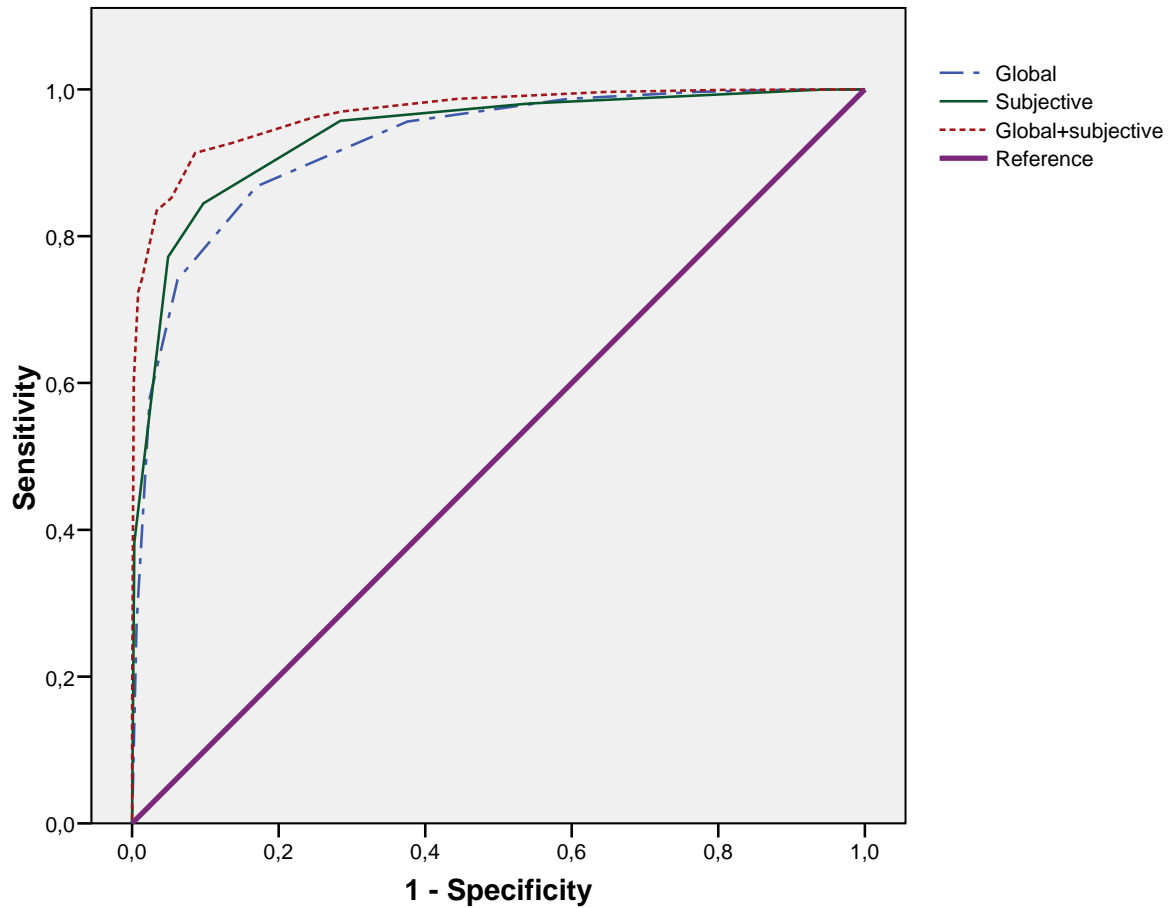
^bMean ± S.D.

Figure 1: Global MNA changes with age.**Figure 2: Subjective MNA changes with age**

^aOriginal question about self-perception of nutritional status, offers three possible answers: self-view as being under-nourished (1), is uncertain of nutritional state (2) and views self as having no nutritional problem (3). For that graphics (1) and (2) were grouped together versus (3).

^bOriginal question about self-perception of health status, offers four possible answers: not as good as other people of the same age (1), does not know (2), as good as other people of the same age (3) and better than other people of the same age (4). For that graphics (1), (2) and (3) were grouped together versus (4).

Figure 3: ROC curves concerning the studied sample (n=22,007) for the MNA global and subjective assessment, individually and together (as compared with the full MNA).



ROC areas under the curve (95% CI) were as follows: global assessment, 0.924 (0.916-0.932); subjective assessment, 0.938 (0.931-0.945); and global + subjective assessment, 0.967 (0.963-0.971), $p < 0.001$.

Table 2: Negative and positive PVs for subjective MNA to detect undernutrition.

Under-nourished	“At risk” + “Well nourished”	Cut-off point for positivity	Sensitivity	95% CI	Specificity	95% CI	+PV	-PV
41	5	<0.5	0.043	0.030-0.056	1.000	1.000-1.000	0.891	0.958
14	1	<1	0.058	0.043-0.073	1.000	1.000-1.000	0.902	0.959
381	399	<1.5	0.458	0.426-0.489	0.981	0.979-0.983	0.518	0.976
246	495	<2	0.716	0.687-0.744	0.957	0.955-0.960	0.431	0.987
178	2,370	<2.5 ^a	0.902	0.884-0.921	0.845	0.840-0.850	0.208	0.995
46	1,537	<3	0.951	0.937-0.964	0.772	0.766-0.777	0.159	0.997
44	8,197	<4	0.997	0.993-1.000	0.382	0.376-0.389	0.068	1.000
3	8,050		1.000	1.000-1.000	0.000	0.000-0.000	0.043	
All								
953	21,054							

^aCut-off point selected for positivity