

TITLE

Validation of the Mini Nutritional Assessment-Short Form in a population of frail elders without disability. Analysis of the Toulouse Frailty Platform population in 2013

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1 **Validation of the Mini Nutritional Assessment-Short Form in a population of frail elders**
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17 Dr. lilamand has nothing to disclose.

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30 **Abstract**

31 **Objective:** To assess the validity of the Mini Nutritional Assessment-Short Form (MNA-SF)
32 in elderly patients from the Toulouse Frailty Platform.

33 **Participants:** Overall, 267 patients aged 65 and over, without severe cognitive impairment
34 (i.e. Mini Mental Status Examination > 20 and CDR<1), no physical disability (i.e. Activities
35 of Daily Living \geq 5) and no active cancer history (over the past 12 months) were included in
36 2013.

37 **Measurements:** Receiver operating characteristic (ROC) analyses were used to assess the
38 predictive validity of the [French version of the MNA-SF](#) for good nutritional status (defined
39 as a full MNA score \geq 24/30). Analyses were conducted in the overall sample and then in
40 subgroups of frail and pre-frail subjects according to the frailty phenotype. Optimal cut-off
41 points were determined to obtain the best sensitivity/specificity ratio and the highest number
42 of correctly classified subjects.

43 **Results:** Among 267 patients, mean age=81.5 \pm 5.8; women=67.0%; 138 (51.7%) were frail,
44 98 (36.7%) were pre-frail and 31 (11.6%) were robust. Given their MNA-SF scores, 201
45 (75.3%) had a good nutritional status, 61 (22.8%) were at risk of malnutrition and 5 (1.9%)
46 were malnourished. In the overall sample, but also in subgroups of pre-frail or frail elders, the
47 areas under ROC curves were 0.954, 0.948 and 0.958 respectively. The 11 points cut-off
48 provided the best correct classification ratio (91.4%); sensitivity=94.0%, specificity=83.3%.

49 **Conclusion:** The MNA-SF appeared to be a validated and effective tool for malnutrition
50 screening in frail elders. Implementing this tool in clinical routine should contribute to
51 improving the screening of malnourished frail individuals.

52

53 Key words: Malnutrition; Elderly; Mini Nutritional Assessment; Frailty

54 **Introduction**

55 In western aging societies, protein-energy malnutrition defined as an energy deficit
56 due to chronic deficiency of all macronutrients appears as a major Public Health concern that
57 affects 5 to 15% of community dwelling older subjects (1-3). Since a poor nutritional status is
58 associated with adverse clinical and economic outcomes such as increased mortality or
59 increased costs of hospitalization (4, 5), the need for formal screening procedures has
60 emerged. Promising perspectives of interventional procedures (e.g. dietary protein
61 supplementation) aiming at reversing the burden of malnutrition have also been suggested (6,
62 7).

63 Numerous tools have been validated for malnutrition screening in the elderly (8).
64 Among them, the Mini Nutritional Assessment® (MNA) (8) has demonstrated several
65 strengths. For example, in community dwelling elderly, the MNA® can detect risk of
66 malnutrition while albumin and BMI are in the normal range and life style characteristics are
67 associated with nutritional risk (9). In outpatients and hospital patients, the MNA® is
68 predictive of outcome and cost of care (10). However, this test requires substantial time to
69 complete (up to 15 minutes) (8). Therefore, a shorter version of the MNA has been
70 elaborated: the MNA short-form (MNA-SF), which consists of 6 items and takes only 3
71 minutes to be completed, albeit keeping the usefulness and accuracy of the full version (3).
72 Subjects can be classified in 3 categories: normal nutritional status, at risk of malnutrition and
73 malnourished. In addition, the revised version of the MNA-SF proposed by Kaiser and
74 colleagues (11) allows to assess the calf circumference (instantly measured with a tape) when
75 the BMI is unavailable. Thus, this brief tool may represent a first-choice instrument for
76 clinicians looking for a quick and efficient malnutrition screening instrument, designed for
77 elderly patients.

78 Frailty is a state of extreme vulnerability, characterized by insufficient homeostatic
79 reserves to efficiently cope against stressors (2). This condition is also known to be a
80 “dynamic state”, suggesting that frail people can transit to non-frail status with *ad hoc*
81 interventions (12). Despite the absence of consensual definition of frailty, the frailty
82 phenotype proposed by Fried and colleagues is considered as an operational delineation of
83 this condition (2). This tool consists of five criteria: exhaustion, involuntary weight loss, low
84 activity, slow walk and poor grip strength. Older adults meeting these criteria are at higher
85 risk of developing impairment of activities of daily living and show higher morbi-mortality
86 (13-15). In the former subjects, nutrition surely represents a cornerstone to maintain good
87 functional performances and prevent poor health outcomes. Screening malnourished (or at
88 risk of malnutrition) frail elders enables to perform a geriatric assessment, review critically
89 their diet and offer them corrective measures and nutritional support (16). Precisely, the
90 MNA-SF was designed to assess malnutrition in different populations of vulnerable older
91 adults such as hospitalized patients, nursing home residents or demented subjects (9).
92 However, to our knowledge this instrument has not been validated yet in a frail outpatients
93 population meeting Fried and colleagues’ criteria.

94 Therefore, in the present study, we aimed at validating the screening accuracy of the
95 French version of the MNA-SF compared with the full French MNA in outpatients from the
96 geriatric Frailty Platform (structured as a Day Hospital) of Toulouse, France. The cut-point of
97 12 points and over was shown to be the most appropriate for nutritional screening in a
98 heterogeneous population of hospitalized elders and community dwelling older adults (17).
99 We hypothesized that this very cut-off is correct to screen frail elderly patients for
100 malnutrition.

101 **Methods**

102 **Population**

103 All the outpatients who were admitted to the Toulouse Frailty Platform, France in
104 2013 were eligible for the present analyses. Participants were referred either by their general
105 practitioner, by hospital specialist consultants or by the oncogeriatrics consulting team. The
106 detailed methodology of the Frailty Platform has been published previously (18, 19). Briefly,
107 the main objective of this day hospital is to provide a comprehensive assessment of the
108 medical, functional, cognitive, nutritional and social resources of frail older individuals.
109 Although these patients usually meet frailty criteria, they do not present disability in activities
110 of daily living (ADL) or major cognitive impairment. Accordingly, personalized interventions
111 may be provided by a dietitian (e.g. nutritional counseling), a physical trainer (e.g. training
112 program for muscle reinforcement) or a neuropsychologist (e.g. thorough cognitive
113 evaluation).

114 Before July 1st, 2013 the MNA-SF scores of the patients were not recorded in our
115 database. However, only data with both the MNA-SF and the full MNA available were
116 considered in the present analyses. The inclusion criteria were: age \geq 65 years, no active
117 cancer history over the past 12 months (since the frailty phenotype has been questioned in
118 cancer patients) and an ADL score \geq 5 (i.e. no physical disability). As the frailty phenotype has
119 never been validated in demented subjects, subjects with an MMSE score $<$ 21 or a Clinical
120 Dementia Rating score \geq 1 have also been excluded.

121

122 **Variables**

123 In the present study, the French version of the MNA-SF and the full MNA were used
124 (20). Sociodemographic characteristics were obtained through questionnaire. A medical
125 interview performed by a geriatrician provided the following: medical and surgical history,

126 ongoing medication and physical examination. Height and weight were measured and Body
127 Mass Index (BMI) was calculated as the weight in kg divided by the square of the height in
128 meters. Daily self-care activities were assessed with the ADL (21) and the Instrumental ADL
129 (IADL) (22) scales.

130 Frailty assessment was performed by specialized nurses and was based on Fried's
131 frailty phenotype (2) i.e. involuntary weight loss, self-reported exhaustion, muscle weakness,
132 slow gait speed, and low physical activity. A 5 kg-weight loss over the past year (either
133 measured or reported by the patient) was considered to be significant. The exhaustion
134 criterion was met if the answer was "Much or most of the time" when asked, "How often in
135 the last week did you feel this way" to either of the following two statements: "I felt that
136 everything I did was an effort" and "I could not get going." The muscle weakness criterion
137 was met when the average of 3 handgrip strength measurements by a handheld dynamometer,
138 was less than or equal to the sex- and BMI specific cutoff points provided by Fried and
139 colleagues. Slow usual gait speed (assessed over a 4-meter distance, starting from a still
140 position) was defined either as a time of more than 6 seconds for men whose height is less
141 than or equal to 173 cm (or women \leq 159 cm respectively); or as a time of more than 5
142 seconds for men whose height is more than 173 cm (or women $>$ 159 cm respectively). We
143 defined as "sedentary" those participants who had performed no physical activity, spent most
144 of the time sitting, or rarely had a short walk (or other non-demanding physical activity) in the
145 past year according to a validated interviewer-administered questionnaire (23). The Fried
146 score was defined with these five items; patients with a 0 score were considered as robust,
147 those with a 1 or 2 score were considered as pre-frail, and those with a 3 to 5 score were frail.
148 The physical evaluation was completed with the Short Physical Performance Battery (24).

149

150 **Statistical analyses**

151 Receiver operating characteristic (ROC) analyses were used to assess the predictive
152 validity of the MNA-SF. The reference was a good nutritional status (defined as a score above
153 23.5/30 according to the full MNA). Analyses were conducted in the overall sample and after
154 categorization of our participants in frail and pre-frail groups. Optimal cut-off points were
155 determined to obtain the best sensitivity/specificity ratio and the highest number of correctly
156 classified subjects. Analyses were performed using STATA v11.0 (Stata Corp., College
157 Station, TX).

158 **Results**

159 Data of 412 subjects from the Toulouse Frailty Clinic were recorded in our 2013
160 database. Fifty nine of them were excluded because of their low cognitive performances
161 (MMSE<21), 57 were because they had insufficient Activities of Daily Living performances
162 (score of less than 5) and one because he was under 65 years old. Two MNA scores had
163 missing items. Twenty six had active cancer history. Thus, 145 subjects were excluded, and
164 our final sample comprised 267 individuals. The flow-chart for participants' selection is
165 presented in Figure 1.

166 The main nutritional and physical characteristics of the study sample are presented in
167 Table 1. Mean age was 81.5 (Standard deviation (SD) 5.8) years old; 67.0% were women;
168 57.9% had a normal ADL score (6/6) and 63.9% a 7 to 8 IADL score. According to the Fried
169 frailty criteria, 11.3% of the participants were robust, 51.9% were pre-frail and 36.8% were
170 frail. [All of our malnourished participants were frail.](#)

171 In the overall sample (Figure 1) as well as in pre-frail and frail considered separately
172 (Figure 2), the areas under ROC curves were 0.954 95% Confidence Interval (CI) 0.928-
173 0.980, 0.948 95% CI 0.908-0.987 and 0.956 95% CI 0.906-0.996 respectively. The 11 points
174 cut-off allowed the best correct classification ratio (91.4%), with a sensitivity of 94.0% and a
175 specificity of 83.3%. With a 12 points cut-off the sensitivity was: 76.1, and the specificity:
176 95.5% (Table 2). After stratification on pre-frail and frail status, there was no significant
177 difference of areas under curve between the former and the latter individuals (0.95 vs. 0.96, p
178 = 0.78).

179 **IV. Discussion**

180 In this study, the MNA-SF appeared to be an accurate tool for malnutrition screening
181 in patients meeting frailty criteria. The best cut-point for good nutritional status was a score of
182 11 and above, allowing a sensitivity of 94.0% and specificity of 83.3%, hence a Youden's
183 index of 0.77. Given this threshold, 91.4% of our subjects were correctly classified. Pre-frail
184 and frail older adults share common characteristics and are significantly more affected by
185 nutritional issues than robust elders (25). In our sample, there was no significant difference of
186 correctly classified subjects using the MNA-SF between pre-frail and frail elders. Therefore,
187 [this study confirms](#) that the MNA-SF compares well with the full MNA and represents a valid
188 instrument for nutritional screening in a frail out-patients population.

189 Our findings were consistent with previous validation studies of the MNA-SF (3, 26).
190 However, the usual MNA-SF threshold for good nutritional status is a 12 out of 14 score. As a
191 result, subjects with a score below 12 need to complete the full MNA. Rubenstein and
192 colleagues (3) had already acknowledged that the 11 cut-point provided a better
193 sensitivity/specificity ratio to indicate undernutrition. Yet, raising the threshold to 12 reduced
194 the number of persons incorrectly identified as well-nourished [despite a higher number of](#)
195 [false negative \(i.e. people without malnutrition who will be referred to the dietician\)](#). Frail
196 [elders represent primary targets for nutritional screening](#). Consistent with the foregoing study,
197 [we assumed that failing to screen a malnourished elder would be of greater concern than](#)
198 [requiring additional evaluation for people mistakenly identified as malnourished](#). Thus, the
199 [previously established 12 threshold appears as appropriate in our population of frail older](#)
200 [adults](#).

201 Malnutrition and frailty are two interrelated syndromes. [Firstly, malnutrition is very](#)
202 [common among the elderly frail populations \(25\)](#). [Secondly, this condition may directly](#)
203 [impact the Fried's Frailty phenotype](#). Weight loss reflects both conditions. An imbalance

204 between energy intake and expenditure leads to muscle weakness that may in turn impact the
205 four remaining criteria: poor muscle strength, slowness, exhaustion and reduced functional
206 activities (27). Diet quality and frailty have also been largely studied. Overall diet quality is
207 lower in frail than in robust older adults (28). High protein diet reduces the risk of incident
208 frailty (29). Conversely, low serum micronutrient concentrations were shown to be an
209 independent risk factor for frailty in community-dwelling women (30). Frailty also increases
210 muscle protein catabolism and enhances age-related loss of muscle mass resulting in
211 sarcopenia and impaired mobility (31). Of note, all of our malnourished participants (N=5)
212 were frail according to the frailty phenotype.

213 The identification of a pre-disability state (i.e., frailty) enables to detect older persons
214 at risk of adverse health events who may still benefit from preventive interventions against
215 disability. Our population was specifically recruited by general practitioners or specialists to
216 meet these frailty criteria. The good accuracy of the MNA-SF in this population encourages
217 expanding its use in these subjects so as to improve the screening of malnutrition.

218 This study also had limitations. Our sample was smaller than many studies focused on
219 the effectiveness of the MNA-SF (26, 32-34). We also excluded a substantial number of
220 participants (246) due to missing data. However, we achieved comparable results to the main
221 validation studies of this tool. We did not compare the results of the screening test with a
222 dietitian assessment but with another test (i.e. the full MNA) which was used as a surrogate
223 for the diagnosis of malnutrition. Nevertheless, the MNA was demonstrated to be both a
224 screening and assessment tool with a good internal consistency and inter-observer reliability
225 and validity (8, 9). The aim of the MNA-SF is definitely not to replace the full MNA, but to
226 refine the selection of subjects who should be tested with the full version.

227 **V. Conclusion**

228 The MNA-SF has already been suggested as an accurate screening tool in various
229 populations of elderly subjects. This study confirmed its usefulness among frail (and pre-frail)
230 older adults, with similar cut-points to indicate good nutritional status than in previous
231 studies. All the subjects with a MNA-SF score below 12 should undergo a full MNA to
232 establish whether they present under-nutrition or not. Malnourished frail elders are priority
233 targets for comprehensive assessment and multidimensional management, and in particular
234 for nutritional interventions. Therefore, The MNA-SF allows a quick and appropriate
235 screening of frail older adults and may indeed be advantageously part of the clinical routine of
236 general practitioners as well as hospital specialists.

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