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A SELF-COMPLETED NUTRITION SCREENING TOOL FOR COMMUNITY-DWELLING OLDER ADULTS WITH HIGH RELIABILITY: A COMPARISON STUDY

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Abstract: *Objectives:* Malnutrition is common in community-dwelling older adults and is associated with poor outcomes including hospitalization and mortality. Recently, a 6-question short form mini nutritional assessment (SF-MNA) was validated for rapid nutrition screening. Ideally, nutrition screening could be performed by individuals or their caregivers prior to or during an outpatient clinical visit, thus allowing for the ongoing monitoring of nutritional status among older adults. *Design:* We compared the SF-MNA administered by a healthcare professional (HCP) to a 6-item self-administered screening tool (Self-MNA) in 463 community dwelling older adults who gave informed consent. The population was 60% women with a mean age of 76.8±6.8 years. The HCP was blinded to the results of the Self-MNA questionnaire. *Results:* Using the SF-MNA, 27% of subjects were malnourished, 38% were at risk, and 35% had normal nutrition status. The agreement between the Self-MNA and the SF-MNA was 99% (Self-MNA sensitivity 99%, specificity 98%, false negative rate 1%, false positive rate 2%) for identifying Malnourished subjects and 83% (sensitivity 89%, specificity 77%, false negative rate 11%, false positive rate 23%) for identifying At Risk of Malnutrition compared to the MNA-SF administered by a HCP. *Conclusion:* We found that the Self-MNA demonstrates sufficient inter-rater reliability for use in nutrition screening among community-dwelling older adults. Further validation studies and the possible impact of language translation should be pursued.

Key words: Malnutrition, nutrition screening, elderly, older adult.

Introduction

In 2000, there were approximately 35 million Americans aged 65 years or older and 9.3 million aged 80 years or older. By 2030, these numbers are projected to increase to an estimated 71 million and 19.5 million persons, respectively (1). Decreases in food intake by an older adult can have far worse consequences as they are more likely to suffer from multiple medical conditions, causing severe physiologic and body composition changes (1). The demographic epidemiologic shift towards an increasing proportion of the aging population coupled with continuous changes in dietary and nutritional patterns have presented the field of public health with new challenges. In an era of healthcare reform and self-directed care, patients have become more involved in their own health management.

Previous studies have found that malnutrition and being at risk for malnutrition exists in 38% of community older adults worldwide (2), and malnutrition may be present in up to 50% of elderly adults (3). Malnutrition, which is frequently undetected, is the cumulative effect of the often compromised dietary habits of the elderly and the physiological changes associated with aging. It is associated with a significant risk of morbidity and mortality in independently living older adults, as well as in nursing home residents and hospitalized patients (3).

The purpose of nutritional screening is to quickly identify individuals that are malnourished or at risk of malnutrition (4). National and international societies recommend routine nutrition screening to identify malnutrition and the risk of malnutrition (4, 5). The characteristics of an effective nutritional screening tool include: simplicity, utilization of readily available data or data that is easy to obtain, and the inclusion of data relevant to nutritional status. Ideally, an effective screening tool will result in a viable intervention and will also be cost-effective.

Multiple international societies recommend the use of nutrition screening tools to facilitate the identification of malnutrition (4, 5). One of the most common barriers to widespread and regular nutrition screening of the elderly has been the lack of a validated, convenient screening tool that is easily and quickly administered by healthcare professionals (HCPs). For this reason, the Mini Nutritional Assessment (MNA), developed by Guigoz, is a screening tool that can be used to identify geriatric patients (≥65 years) at risk of malnutrition (6, 7). The Mini Nutritional Assessment – Short Form (SF-MNA®), is a 6-question short form of the MNA that can be completed in 5 minutes or less. The MNA has been validated in international studies with a broad range of HCPs in a variety of settings (6, 8). Currently, this instrument is administered by HCPs to determine patients' nutritional status.

We hypothesize that greater gains could be made in the early detection of declining nutritional status if the elderly could assist in the identification of their own nutritional status by completing the self-administered MNA (Self-MNA) themselves, or if it could be completed by a family member or other caregiver. For this reason, we conducted a study to

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determine the inter-rater agreement between the Self-MNA and SF-MNA by comparing the level of agreement in the categorization of nutritional status between both screening tools in a population aged 65 years or older when completed by either the individuals themselves or by their caregiver.

Methods

The Self-MNA was created by modifying the SF-MNA. Through patient interviews, each item of the SF-MNA was tested with individuals aged 65 years or older. Table 1 illustrates the changes in the Self-MNA as compared to the SF-MNA.

Qualifying individuals aged 65 years or older and caregivers were recruited to attend an in-person interview in one of 40 centrally located market research facilities. Subjects and caregivers were recruited using multiple sample sources, including Kantar Health's Lightspeed Consumer Panel, facility databases, and newspaper advertising. HCPs were recruited from Kantar Health's panel of HCPs.

For consumers to be included in our study, they must have been at least 65 years of age and able to speak, read, and write in the English language. For the inclusion of caregivers, they must have been a family member, relative, friend, or professional caregiver of an individual aged 65 years or older who also lived with or visited that individual five or more days a week. Additionally, the caregiver must have been able to make decisions or must have had a strong influence on the elderly person's diet and medical needs. HCPs in our study must have been in practice for two to 30 years as a primary care physician or nurse. He/she must have also spent at least 70% of time with direct patient care and must have treated at least 100 patients per month with at least 60% of the population treated being aged 65 years or older. The HCP was also required to be the individual responsible for handling all patient/caregiver questions related to nutrition.

The study protocol underwent Institutional Review Board (Copernicus Group IRB) approval, and all participants provided written informed consent. Following consent, subjects or their caregivers completed the Self-MNA and remained blinded to the results. Once the form was completed, it was collected and study participants were then interviewed by one of the recruited HCPs who was unknown to the subjects. The HCP then interviewed the subject and subsequently completed the SF-MNA. All HCPs were blinded to the Self-MNA results

Table 1
Comparison of Self-MNA and SF-MNA

SF-MNA	Self MNA
Question 1: Has food intake declined over the past 3 months due to loss of appetite, digestive problems, chewing or swallowing difficulties?	Question 1: Has your food intake declined over the past 3 months?
Question 2: Weight loss during the last 3 months:	Question 2: How much weight have you lost in the past 3 months?
Question 3: Mobility 0 = bed or chair bound 1 = able to get out of bed / chair but does not go out 2 = goes out	Question 3: How would you describe your current mobility? 0 = unable to get out of a bed, a chair, or a wheelchair without the assistance of another person 1 = able to get out of a bed or a chair, but unable to go out of my home 2 = able to leave my home
Question 4: Has suffered psychological stress or acute disease in the past 3 months?	Question 4: Have you been stressed or severely ill in the past 3 months?
Question 5: Neuropsychological problems 0 = severe dementia or depression 1 = mild dementia 2 = no psychological problems	Question 5: Are you currently experiencing dementia and/or prolonged severe sadness? 0 = yes, severe dementia and/or prolonged severe sadness 1 = yes, mild dementia, but no prolonged severe sadness 2 = neither dementia nor prolonged severe sadness
Question 6: 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	Question 6 a: Please refer to the chart (BMI) on the left and follow these instructions: 1. Find your height on the left-hand column of the chart. 2. Go across that row and circle the range that your weight falls into. 3. Look to the bottom of the chart to find what group number (0, 1, 2, or 3) your circled weight range falls into. Question 6b: Measure the circumference of your LEFT calf by following the instructions below: Loop a tape measure all the way around your calf to measure its size. Record the measurement in cm: _____ If less than 31 cm, enter "0" in box to the right. If 31 cm or greater, enter "3" in box to the right.

Figure 1
Self MNA

Self-MNA®

Mini Nutritional Assessment

For Adults 65 years of Age and Older

Last name: First name:

Date: Age:

Complete the screen by filling in the boxes with the appropriate numbers. Total the numbers for the final screening score.

Screening

A Has your food intake declined over the past 3 months? [ENTER ONE NUMBER] *Please enter the most appropriate number (0, 1, or 2) in the box to the right.*	0 = severe decrease in food intake 1 = moderate decrease in food intake 2 = no decrease in food intake	
B How much weight have you lost in the past 3 months? [ENTER ONE NUMBER] *Please enter the most appropriate number (0, 1, 2, or 3) in the box to the right.*	0 = weight loss greater than 3 kg 1 = do not know the amount of weight lost 2 = weight loss between 1 and 3 kg 3 = no weight loss or weight loss less than 1 kg	
C How would you describe your current mobility? [ENTER ONE NUMBER] *Please enter the most appropriate number (0, 1, or 2) in the box to the right.*	0 = unable to get out of a bed, a chair, or a wheelchair without the assistance of another person 1 = able to get out of a bed or a chair, but unable to go out of my home 2 = able to leave my home	
D Have you been stressed or severely ill in the past 3 months? [ENTER ONE NUMBER] *Please enter the most appropriate number (0 or 2) in the box to the right.*	0 = yes 2 = no	
E Are you currently experiencing dementia and/or prolonged severe sadness? [ENTER ONE NUMBER] *Please enter the most appropriate number (0, 1, or 2) in the box to the right.*	0 = yes, severe dementia and/or prolonged severe sadness 1 = yes, mild dementia, but no prolonged severe sadness 2 = neither dementia nor prolonged severe sadness	
Please total all of the numbers you entered in the boxes for questions A-E and write that number here:		

Now, please CHOOSE ONE of the following two questions – F1 or F2 – to answer.

Question F1

Height (cm)	Body Weight (kg)			
147.5	Less than 41.1	41.1 - 45.3	45.4 - 49.6	49.7 or more
150	Less than 42.8	42.8 - 47.2	47.3 - 51.7	51.8 or more
152.5	Less than 44.2	44.2 - 48.7	48.8 - 53.4	53.5 or more
155	Less than 45.6	45.6 - 50.4	50.5 - 55.2	55.3 or more
157.5	Less than 47.1	47.1 - 52.0	52.1 - 57.0	57.1 or more
160	Less than 48.6	48.6 - 53.7	53.8 - 58.8	58.9 or more
162.5	Less than 50.2	50.2 - 55.4	55.5 - 60.6	60.7 or more
165	Less than 51.7	51.7 - 57.1	57.2 - 62.5	62.6 or more
167.5	Less than 53.3	53.3 - 58.8	58.9 - 64.4	64.5 or more
170	Less than 54.9	54.9 - 60.6	60.7 - 66.4	66.5 or more
172.5	Less than 56.5	56.5 - 62.4	62.5 - 68.3	68.4 or more
175	Less than 58.2	58.2 - 64.2	64.3 - 70.3	70.4 or more
177.5	Less than 59.9	59.9 - 66.1	66.2 - 72.4	72.5 or more
180	Less than 61.6	61.6 - 67.9	68.0 - 74.4	74.5 or more
182.5	Less than 63.3	63.3 - 69.8	69.9 - 76.5	76.6 or more
185	Less than 65.0	65.0 - 71.8	71.9 - 78.6	78.7 or more
187.5	Less than 66.8	66.8 - 73.7	73.8 - 80.8	80.9 or more
190	Less than 68.6	68.6 - 75.7	75.8 - 82.9	83.0 or more
192.5	Less than 70.4	70.4 - 77.7	77.8 - 85.1	85.2 or more
Group	**0**	**1**	**2**	**3**

Please refer to the chart on the left and follow these instructions:

1. Find your height on the left-hand column of the chart.
2. Go across that row and circle the range that your weight falls into.
3. Look to the bottom of the chart to find what group number (0, 1, 2, or 3) your circled weight range falls into.

Write the Group Number (0, 1, 2, or 3) here: ☐

Write sum of questions A-E (from page 1) here: ☐

Lastly, calculate the sum of these 2 numbers. This is your SCREENING SCORE: ☐

Question F2

DO NOT ANSWER QUESTION F2 IF QUESTION F1 IS ALREADY COMPLETED.

Measure the circumference of your LEFT calf by following the instructions below:

Loop a tape measure all the way around your calf to measure its size.

Record the measurement in cm: _____

If less than 31 cm, enter "0" in box to the right.

If 31 cm or greater, enter "3" in box to the right.

☐

Write the sum of questions A-E (from page 1) here: ☐

Lastly, calculate the sum of these 2 numbers. This is your SCREENING SCORE: ☐

Screening Score 14 points maximum

12 – 14 points: Normal nutritional status

8 – 11 points: At risk of malnutrition

0 – 7 points: Malnourished

Copy your SCREENING SCORE: ☐

If you score between 0 - 11, please take this form to a healthcare professional for consultation.

Table 2
Sensitivity, Specificity, and Inter-rater Agreement of the Self-MNA

	Self-MNA® (administered by consumer or caregiver) (n=463)	Subject-administered Self-MNA® (n=298)	Caregiver-administered Self-MNA® (n=165)
	CLASSIFIED AS "NORMAL"		
Se (False Negative Rate)	76% (24%)	78% (22%)	71% (29%)
Sp (False Positive Rate)	95% (5%)	96% (4%)	93% (7%)
Accuracy	90%	91%	88%
	CLASSIFIED AS "AT-RISK"		
Se (False Negative Rate)	89% (11%)	91% (9%)	84% (16%)
Sp (False Positive Rate)	77% (23%)	79% (21%)	73% (27%)
Accuracy	83%	85%	80%
	CLASSIFIED AS "MALNOURISHED"		
Se (False Negative Rate)	99% (1%)	99% (1%)	100% (0%)
Sp (False Positive Rate)	98% (2%)	99% (1%)	96% (4%)
Accuracy	99%	99%	99%

completed by the subject or caregiver. At the completion of the HCP interview, the study administrator informed the subject or caregiver of the consumer's nutritional status. If the consumer was identified as "at risk of malnutrition" or "malnourished," they were advised to see their usual HCP. All study participants and HCPs were compensated for their participation.

The inter-rater agreement, sensitivity (Se), specificity (Sp), false negative rate (FNR), and false positive rate (FPR) of the Self-MNA were calculated using the HCP-administered SF-MNA as the gold standard. Although the full MNA has been considered as the gold standard, the SF-MNA has shown a high agreement with the full MNA. Sensitivity was defined as the proportion of individuals correctly classified as having a particular nutritional status (normal, at risk, malnourished). Of note, the false negative rate was defined as 100% - Se. Specificity was defined as the proportion of individuals classified correctly as not having a particular nutritional status (normal, at risk, malnourished). Similarly, the false positive rate was equal to 100% - Sp. Cronbach's alpha was used to determine the coefficient of reliability of the Self-MNA (9). A suggested coefficient of 0.70 is given by Nunnally and Bernstein (1994) as acceptable, however lower thresholds have also been reported as acceptable in the literature (10).

Sample size calculations were based on Fisher's exact test and were performed using Proc Power in SAS® v. 9.1 for Windows (SAS Institute Inc., Cary, NC, USA). It was assumed that we would detect, at the minimum, a 20% difference in the estimated proportion of correctly classified subjects between the Self-MNA and the SF-MNA when the estimate for the percent satisfied in those consumers administered the SF-MNA was 50%. Additionally assuming an alpha-level of 0.05 for statistical significance, it was determined that approximately 206 consumers administered the SF-MNA and 206 consumers administered the Self-MNA were needed to participate.

Results

Our study consisted of 463 subject/caregiver pairs met the inclusion criteria. Of these, 298 subjects were able to complete the Self-MNA, and 165 caregivers completed the Self-MNA on behalf of the subjects. Two hundred seventy six subjects were women (mean age overall was 76.8 ± 6.8 years). The Self-MNA (Figure 1) was completed by 298 consumers aged 65 years or older and 165 caregivers. Additionally, 102 HCPs participated in the study. The SF-MNA, as administered by a HCP, identified 27% of subjects as malnourished, 38% at risk of malnutrition, and 35% with normal nutritional status.

When compared to the SF-MNA, the Self-MNA exhibited 76% and 95% Se and Sp, respectively, in identifying subjects as having "Normal" nutritional status (Table 2). This corresponded to a 24% and 5% FNR and FPR, respectively. The Self-MNA exhibited 89% and 77% Se and Sp, respectively, in identifying subjects as "At Risk" of malnutrition, and 99% and 98% sensitivity and specificity, respectively, in identifying subjects as "Malnourished" (Table 2).

When Se and Sp were examined among consumers or caregivers only (i.e., consumer-administered Self-MNA or caregiver-administered Self-MNA, respectively), the consumer-administered Self-MNA exhibited 78% Se and 96% Sp for classification of "Normal" nutritional status; 91% Se and 79% Sp for classification of being "At Risk"; and 99% Se and Sp for classification of being "Malnourished" (Table 2). The caregiver-administered Self-MNA exhibited 71% Se and 93% Sp for classification of "Normal" nutritional status; 84% Se and 73% Sp for classification of being "At Risk"; and 100% Se and 96% Sp for classification of being "Malnourished" (Table 2).

Inter-rater Agreement

When compared to the SF-MNA, the Self-MNA exhibited 90% agreement in identifying subjects as having "Normal" nutritional status, 83% agreement in identifying subjects as "At Risk" for malnutrition, and 99% agreement in identifying subjects as "Malnourished" (Table 2). The consumer-administered Self-MNA exhibited 91% agreement in identifying subjects as having "Normal" nutritional status, 85% agreement in identifying subjects as "At Risk" for malnutrition, and 99% agreement in identifying subjects as "Malnourished". When compared to the SF-MNA, the caregiver-administered Self-MNA exhibited 88% agreement in identifying subjects as

having "Normal" nutritional status, 80% agreement in identifying subjects as "At Risk" for malnutrition, and 99% agreement in identifying subjects as "Malnourished".

Our measure of internal consistency yielded a reliability coefficient of 0.67 based on 441 subjects with data on BMI, food intake, weight loss, mobility, stress, and neuropsychological problems.

Discussion

This study provides support that the Self-MNA is highly sensitive and specific in the identification of malnutrition. Currently, one in every eight persons in the U.S. is an older adult, which is defined as an individual aged 60 years or older (11). In addition, nearly 80% of this population has at least one chronic health condition and approximately 50% have two or more (12). It has been estimated that five of eight of the most common causes of death among U.S. adults aged 65 or older have a known nutritional risk factor (13, 14). According to the Academy of Nutrition and Dietetics, all Americans aged 60 years and older should receive appropriate nutritional care, should have access to coordinated, comprehensive food and nutrition services, and should receive the benefits of ongoing research to identify the most effective food and nutrition programs, interventions, and therapies (13). Ideally, nutrition screening could be performed by individuals or their caregivers prior to or during an outpatient clinical visit, thus allowing for the ongoing monitoring of nutritional status among older adults. Therefore, nutritional screening tools, like the Self-MNA, are of significant public health importance. The Self-MNA we have designed and presented in this paper was easily administered and provided an efficient method for determining the nutritional status of older adults.

When compared to the SF-MNA, the Self-MNA exhibited good sensitivity and excellent specificity in identifying subjects as having "Normal" nutritional status. The Self-MNA also exhibited high sensitivity and specificity in identifying subjects as "At Risk" of malnutrition, and excellent sensitivity and specificity in identifying subjects as "Malnourished". Additionally we found that the Self-MNA is most sensitive and specific when completed by the elderly person as opposed to the caregiver and HCP. This is similar to the results from the validation studies of the SF-MNA, which were found to have a sensitivity of 89% and a specificity of 82% when compared to the original MNA (15). The high sensitivity of the tool in those classified as "malnourished" illustrates that the Self-MNA is able to detect this status in those who are truly malnourished, indicating the validity of the tool. Indeed, the high sensitivity of the tool means that less cases of malnutrition may go undetected, and ultimately, alleviate or potentially prevent the occurrence of some adverse health outcomes.

Overall, the Self-MNA has a high level of agreement with the SF-MNA. It has also been demonstrated to be equivalent to the SF-MNA with 90% agreement in identifying subjects as having "Normal" nutritional status, 83% agreement in identifying subjects as "At Risk" for malnutrition, and 99% agreement in identifying subjects as "Malnourished". Again, this is similar to the validation of the SF-MNA which was found to accurately classify 79.9% of patients (15).

Nutrition screening is intended to identify the risk of malnutrition, not to provide a comprehensive nutrition assessment and plan of care. As this is a nutrition screening tool, screening should be followed with a full assessment by a healthcare professional. This assessment should include a plan to address malnutrition as well as for follow-up and reassessment. The clinical judgment of the HCP is necessary to formulate a nutrition care plan. This study is limited by the use of the SF-MNA as the "gold standard" comparison to the Self-MNA and therefore has limited generalizability. Nonetheless, the MNA-SF has shown a high agreement with the full MNA, which has been considered as the gold standard. Future studies should focus on further validation and the possible effects of language translation.

Conclusion

This study illustrates that the Self-MNA is an easy to use nutrition screening tool that can efficiently and effectively be utilized by elderly individuals or their caregivers. We found that the Self-MNA demonstrates sufficient inter-rater reliability for use in nutrition screening among community-dwelling older adults.

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