

## Malnutrition risk and hospitalization in elderly assisted in Primary Care

Risco de desnutrição e internação hospitalar em idosos atendidos na Atenção Básica

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**Abstract** *The aim of this study was to investigate the association of malnutrition risk and single items of the Mini Nutritional Assessment (MNA<sup>®</sup>) with hospitalization in the last 12 months in the elderly assisted in primary care. A cross-sectional study was conducted with the evaluation of 1229 elderly persons assisted in Family Health Strategies in seven cities of South Brazil. Malnutrition risk was evaluated using the MNA<sup>®</sup>, and hospitalization was determined by one question of the Probability of Repeated Admission (PRA) instrument. Most of the elderly were women (61.7%), with a mean age of  $71.7 \pm 7.7$  years. The malnutrition risk rate was 23.3% and hospitalization was 32.9%. The frequency of malnutrition and risk of malnutrition was two times greater among the elderly who were hospitalized (36.8 versus 18.6% -  $P < 0.001$ ). There was a significant association between hospitalization and 11 (64.7%) of the 17 items on the MNA<sup>®</sup> evaluated ( $P < 0.05$ ). Of these, seven items were independently associated with hospitalization by multivariate analysis. We observed an association of malnutrition risk and most of the single MNA<sup>®</sup> items as well, with hospitalization in the elderly assisted in primary care.*

**Key words** *Malnutrition, Nutritional assessment, Elderly, Hospitalization, Primary health care*

**Resumo** *O objetivo deste estudo foi investigar a associação do risco de desnutrição e dos itens isolados da Mini Avaliação Nutricional (MNA<sup>®</sup>) com a ocorrência de internação hospitalar nos últimos 12 meses em idosos atendidos na atenção básica. Trata-se de um estudo transversal no qual foram avaliados 1229 idosos atendidos em Estratégias Saúde da Família de sete municípios da região Sul do Brasil. O risco de desnutrição foi avaliado através da MNA<sup>®</sup> e a ocorrência de hospitalização foi determinada por uma questão do instrumento Probability of Repeated Admission (PRA). Os idosos eram, em sua maioria, mulheres (61,7%), com média de idade de  $71,7 \pm 7,7$  anos. A frequência de risco de desnutrição foi de 23,3% e de hospitalização foi de 32,9%. A frequência de desnutrição e de risco de desnutrição foi duas vezes maior entre os idosos que internaram (36,8% versus 18,6% -  $P < 0,001$ ). Houve associação significativa entre hospitalização e 11 (64,7%) dos 17 itens da MNA<sup>®</sup> avaliados ( $P < 0,05$ ). Destes, sete itens estavam independentemente associados com a ocorrência de hospitalização na análise multivariada. Observou-se associação do risco de desnutrição, bem como da maioria dos itens isolados da MNA<sup>®</sup>, com a ocorrência de internação hospitalar em idosos da atenção básica.*

**Palavras-chave** *Desnutrição, Avaliação nutricional, Idoso, Hospitalização, Atenção primária à saúde*

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## Introduction

Malnutrition is the most important nutritional disturbance observed in the elderly<sup>1</sup>, and it is associated with functional impairment<sup>2</sup>, prolonged hospital stay<sup>3</sup>, institutionalization<sup>4</sup> and mortality<sup>5</sup>.

The Brazilian National Survey on Hospital Nutritional Assessment (IBRANUTRI)<sup>6</sup> revealed that almost half of hospitalized patients in the public network of the country (48,1%) showed some degree of malnutrition, and that malnutrition was related to the main cause of hospitalization, age over 60 years, presence of cancer or infection and prolonged hospital stay.

The detection and identification of malnutrition risk allows early nutritional intervention, preventing malnutrition<sup>7</sup>. However, in countries such as Brazil, in which it is difficult to measure nutritional risk and its impact on public health, it is essential to employ accurate, rapid and easy to use tools at primary care<sup>8</sup>.

The Mini Assessment Nutritional (MNA<sup>®</sup>) is an instrument that is widely used in nutritional assessment and screening of the elderly<sup>7</sup>. The MNA<sup>®</sup> contains specific questions for the elderly population related to nutrition and health, encompassing autonomy, cognition, self-perception of nutritional and health status and anthropometry. It is a tool capable of identifying malnutrition risk, recommended for geriatric routine assessment by the American and European Societies of Enteral and Parenteral Nutrition<sup>9,10</sup> and the Portuguese version has been validated for the Brazilian elderly<sup>11</sup>.

Studies in Brazil, conducted in the context of primary care, which investigate the association between risk of malnutrition and hospitalization, are scarce. Thus, the aim of this study was to investigate the association between malnutrition risk identified by the MNA<sup>®</sup> and hospitalization in the last 12 months in the elderly assisted in Family Health Strategies (FHS). Additionally, we analyzed the association of each item on the MNA<sup>®</sup> with hospitalization.

## Methods

This was a cross-sectional study in which we evaluated elderly individuals (60 years or older) assisted in FHS of seven municipalities of the Conselho Regional de Desenvolvimento do Alto Jacuí-RS (Corede Alto Jacuí), in the period of 2010 to 2012.

In 2010, the Corede Alto Jacuí region included a population of 155,264 inhabitants in

an area of 6905.5 km<sup>2</sup>, comprising 14 municipalities, with Cruz Alta being the pole city. The elderly population of this Corede was estimated at 23,101 (14.87% of the whole population)<sup>12</sup>. To consider 50% of the municipalities of the Corede Alto Jacuí, it was stipulated that seven municipalities would be randomly selected, and these were Cruz Alta and six other municipalities. In each of these municipalities, the sample selected was 10% of the elderly registered and assisted in the last six months in FHS. The exclusion criteria were: (a) unable to provide necessary information (cognitive decline) and (b) residing in a long-term institution.

The elderly were evaluated in their home by a multidisciplinary team composed of nutritionists, physical educators, nurses, physiotherapists and academics trained to carry out the health assessment.

Malnutrition risk was evaluated using the MNA<sup>®</sup>, which is an instrument composed of 18 items (A-R)<sup>7</sup>: (A) decrease in food intake in the past three months; (B) involuntary weight loss during the last three months; (C) mobility; (D) psychological stress or acute disease in the past three months; (E) neuropsychological problems; (F) body mass index (BMI); (G) lives independently; (H) takes more than three prescription drugs per day; (I) pressure sore or skin ulcers; (J) number of full meals per day; (K) consumption markers for protein intake; (L) daily consumption of fruits and vegetables; (M) consumption of fluids per day; (N) mode of feeding; (O) self-view of nutritional status; (P) self-perception of health status; (Q) mid-arm circumference; and (R) calf circumference. Each item is scored from zero to three points, totaling a maximum score of 30 points. The elderly could be classified as “normal nutritional status” (24 to 30 points), “at risk of malnutrition” (17 to 23.5 points) or “malnourished” (<17 points).

The BMI was calculated by dividing the weight in kilograms by the square of the height in meters (weight/height<sup>2</sup>). To measure body weight, Plenna<sup>®</sup> digital scales with maximum capacity of 150 kg was used with subjects standing barefoot and wearing light clothes (Plenna Wave, MEA – 03080, Plenna Especialidades Ltda. São Paulo, SP – Brazil). The height was estimated by the formula that utilizes the knee height<sup>13</sup>. Knee height was measured with the right leg at an angle of ninety degrees with knee and ankle using a flexible and inelastic tape measure, which was positioned at the plantar surface of the foot (heel) and on the head of the patella (kneecap). Circumferences were measured in centimeters with a flexible and

inelastic tape measure on the right side of the body. The mid-arm circumference was measured at the midpoint between the acromion and the olecranon, and the calf circumference was measured as the maximum circumference of the calf muscle, with the calf uncovered<sup>14</sup>.

Hospitalization was determined by the question of the Probability of Repeated Admission (PRA) instrument<sup>15,16</sup>: “In the previous 12 months, have you stayed overnight as a patient in a hospital?”, and the answers were dichotomized in “yes” or “no”.

This study was part of the project titled “Early identification and predictability of grievances in the elderly population assisted in FHS in cities of Corede Alto Jacuí”, approved by the Ethics Committee of University of Cruz Alta. All participants were informed about the objectives and methods of the study and signed an informed consent form.

The data were analyzed using the SPSS Statistics software, version 17.0. Continuous variables with normal distribution were given as mean and standard deviation. Categorical variables were expressed as frequency (absolute and relative)

and compared using the chi-square test with analysis of adjusted residuals. The single MNA<sup>®</sup> items were dichotomized into maximum versus less than maximum score. The question G was not evaluated, since all the elderly interviewed lived in their own home (inclusion criterion of the study). The single MNA<sup>®</sup> items that showed a significant association with hospitalization were included in the adjusted multiple logistic regression model, with the backward selection method (Wald), considering a significance level of  $P < 0.05$  and 95% confidence interval.

## Results

We evaluated 1229 elderly assisted in FHS in the municipalities of Cruz Alta ( $n = 628$ ), Ibirubá ( $n = 292$ ), Selbach ( $n = 77$ ), Colorado ( $n = 73$ ), Quinze de Novembro ( $n = 71$ ), Salto do Jacuí ( $n = 54$ ) and Boa Vista do Incra ( $n = 34$ ).

The characterization of the sample is given in Table 1. Mean age of the sample was  $71.7 \pm 7.7$  years (varying from 60 to 102 years), and the

**Table 1.** Characteristics of the sample and their association with hospitalization in the last 12 months.

Characteristics	N (%)	Hospitalization		P
		No N (%)	Yes N (%)	
Sex				0.042
Female	758 (61.7)	525 (63.7)	233 (57.5)	
Male	471 (38.3)	299 (36.3)	172 (42.5)	
Age				0.023
60–74 years	817 (66.5)	566 (68.7)	251 (62.0)	
≥ 75 years	412 (33.5)	258 (31.3)	154 (38.0)	
Schooling				0.005
None	230 (18.7)	150 (18.2)	80 (19.7)	
< 4 years	827 (67.3)	576 (69.9)	251 (62.0)	
≥ 4 years	172 (14.0)	98 (11.9)	74 (18.3)	
Income*				0.851
None or up to 1 MI	692 (56.3)	466 (56.6)	226 (55.8)	
≥ 2 MI	537 (43.7)	358 (43.4)	179 (44.2)	
Living with whom				0.182
Partner	604 (49.1)	414 (50.2)	190 (46.9)	
Family or others	427 (34.8)	272 (33.0)	155 (38.3)	
Alone	198 (16.1)	138 (16.8)	60 (14.8)	
Nutritional status				< 0.001
Malnutrition	16 (1.3)	3 (0.4)	13 (3.2)	
Risk of malnutrition	286 (23.3)	150 (18.2)	136 (33.6)	
Normal nutritional status	927 (75.4)	671 (81.4)	256 (63.2)	

\* MI: minimum income (Brazilian MI in 2010 = R\$ 510). P: Chi-square test.

majority were women, had less than four years of schooling and equal to or less than the minimum income and lived with a partner.

Malnutrition risk was found in 23.3% of the elderly and 1.3% were malnourished at the time of the interview.

Hospitalization occurring in the last 12 months was reported by 32.9% (n = 405) of the sample. Of those who had been hospitalized, 36.3% (n = 147) were admitted more than once in the period.

The group that reported hospitalization in the last 12 months differed significantly in sex ( $P = 0.042$ ), age ( $P = 0.023$ ), schooling ( $P = 0.005$ ) and nutritional status ( $P < 0.001$ ). An association was observed between hospitalization and males, age 75 years or older, schooling higher than four years, malnutrition and risk of malnutrition.

On analyzing the association between malnutrition risk and hospitalization, we observed that the frequency of malnutrition and risk of malnutrition was twice as high in the elderly hospitalized in the last 12 months compared to those not (36.8 versus 18.6%).

There was a significant association between hospitalization in the last 12 months and 11 of the 17 items on the MNA<sup>®</sup> evaluated (Table 2).

The final model of multivariate analysis showed that seven items on the MNA<sup>®</sup> were independently associated with hospitalization in the last 12 months (Table 3).

## Discussion

In this study, we described the association of malnutrition risk and single items of the MNA<sup>®</sup> with hospitalization in the last 12 months in the elderly assisted in primary care. The results showed that there was an association of malnutrition risk and 11 of the 17 items on the MNA<sup>®</sup> evaluated with hospitalization, and seven of these 11 were independently associated. To the best of our knowledge, this is the first study that was dedicated to investigating this association at primary care.

The prevalence of malnutrition in the elderly varies depending on location and method of

**Table 2.** Distribution of frequencies of MNA<sup>®</sup> items below maximum scores and association with hospitalization in the last 12 months.

MNA <sup>®</sup> item	N (%)	Hospitalization		P
		No N (%)	Yes N (%)	
Moderate or severe decrease in food intake	273 (22.2)	153 (18.6)	120 (29.6)	< 0.001
Weight loss > 1 kg in 3 months or unknown	469 (38.3)	272 (33.0)	197 (48.6)	< 0.001
Impaired mobility	92 (7.5)	45 (5.5)	47 (11.6)	< 0.001
Psychological stress or acute disease	194 (15.8)	107 (13.0)	87 (21.5)	< 0.001
Neuropsychological problems	129 (10.5)	76 (9.2)	53 (13.1)	0.048
Body mass index < 23 kg/m <sup>2</sup>	263 (21.4)	169 (20.5)	94 (23.2)	0.312
> 3 different medications/day	626 (50.9)	377 (45.8)	249 (61.5)	< 0.001
Pressure sores or skin ulcers	99 (8.1)	59 (7.2)	40 (9.9)	0.125
< 3 full meals/day	133 (10.8)	82 (10.0)	51 (12.6)	0.192
< 3 dietary markers for protein intake	344 (28.0)	202 (24.5)	142 (35.1)	< 0.001
< 2 daily portions of fruits or vegetables	161 (13.1)	99 (12.0)	62 (15.3)	0.129
< 5 cups of liquids/day	674 (54.8)	441 (53.5)	233 (57.5)	0.205
Eating dependency	75 (6.1)	31 (3.8)	44 (10.9)	< 0.001
Feels malnourished or is uncertain of nutritional condition	203 (16.5)	101 (12.3)	102 (25.2)	< 0.001
Considers health status not better compared to peers	235 (19.1)	132 (16.0)	103 (25.4)	< 0.001
Mid-arm circumference < 22 cm	43 (3.5)	24 (2.9)	19 (4.7)	0.153
Calf circumference < 31 cm	157 (12.8)	85 (10.3)	72 (17.8)	< 0.001

P: Chi-square test.

**Table 3.** Crude and adjusted odds ratio for the association between MNA<sup>®</sup> items and hospitalization in the last 12 months.

MNA <sup>®</sup> item	Crude OR (95% CI)	Adjusted OR* (95% CI)	P
Weight loss > 1 kg in 3 months or unknown	0.520 (0.41 – 0.66)	1.524 (1.18 – 1.97)	0.001
Psychological stress or acute disease	0.545 (0.40 – 0.74)	1.593 (1.15 – 2.21)	0.005
> 3 different medications/day	0.528 (0.41 – 0.67)	1.682 (1.31 – 2.17)	< 0.001
< 3 dietary markers for protein intake	1.663 (1.28 – 2.15)	1.466 (1.11 – 1.93)	0.006
Eating dependency	0.321 (0.20 – 0.52)	1.853 (1.10 – 3.12)	0.021
Feels malnourished or is uncertain of nutritional condition	0.415 (0.31 – 0.56)	1.670 (1.19 – 2.34)	0.003
Calf circumference <31 cm	0.532 (0.38 – 0.75)	1.526 (1.06 – 2.19)	0.023

OR: Odds ratio; CI: confidence interval; \* Adjusted for other variables in the table by means of logistic multiple regression model. P: logistic multiple regression, backward (Wald) selection method.

assessment. In the community-dwelling elderly, the mean is 4.2%, but can be as high as 23.4% in hospitalized elderly patients. However, the risk of malnutrition is prevalent in the community as well as the hospital environment<sup>17</sup>. The frequency of malnutrition risk in our study (23.3%) was comparable to that reported by Guigoz<sup>18</sup> and Cereda<sup>17</sup> in reviews of studies that used the MNA<sup>®</sup> to evaluate community-dwelling elderly persons (24 and 27.4%, respectively).

Feldblum et al.<sup>19</sup> studied elderly patients up to 48 hours after hospital admission and found that the risk of malnutrition significantly increases risk of hospital admission and length of stay. Moreover, the authors observed that the elderly at risk of malnutrition reported having used more health care services before admission. Amaral et al.<sup>2</sup> also pointed out that malnutrition was common at the time of hospital admission and that the risk of malnutrition appeared to be even more prevalent.

In a study evaluating risk of mortality factors in the elderly patients three months after visiting an emergency department, Gentile et al.<sup>20</sup> indicated malnutrition as the strongest independent risk factor for predicting short-term mortality.

The group of items on the MNA<sup>®</sup> that evaluate dietary habits (“number of full meals the patients eats daily”, “consumption of protein foods”, “consumption of fruits and vegetables”, “daily fluid consumption”, “the reasons for any decline in food intake over the previous 3 months” and “mode of feeding”) was indicated as an independent predictor of mortality in hospitalized elderly<sup>21</sup>. In our study, three of these items were associated with hospitalization (“consumption

of protein foods”, “decreased in food intake”, and “mode of feeding”), where two (“consumption of protein foods” and “mode of feeding”) were independently associated.

Bollwein et al.<sup>22</sup> found an association between 12 items on the MNA<sup>®</sup> and diagnosis of frailty. Among these, eight items were the same as those showing an association with hospitalization in our study (“moderate or severe decrease in food intake in the past three months”, “weight loss of more than 1 kg in the last three months”, “impaired mobility”, “psychological stress or acute disease in the past three months”, “takes more than three prescription drugs per day”, “self-view of malnutrition or uncertain about nutritional condition”, “self-perception of health not as good as others the same age” and “decreased calf circumference”). It should be noted that malnutrition risk is directly associated with frailty in the elderly<sup>22,23</sup> and that this in turn is associated with risk of hospitalization<sup>24</sup>.

In our study, the only anthropometric measure associate with hospitalization was reduced calf circumference. The calf circumference has a positive correlation with nutritional status in the elderly inpatients and indicates loss of muscle mass<sup>25</sup>.

Just as we did not find any association of BMI and mid-arm circumference with hospitalization, Bollwein et al.<sup>22</sup> also did not observe any association of these items with frailty. One explanation for the lack of association between BMI and hospitalization would be the high frequency of BMI  $\geq 23$  kg/m<sup>2</sup> of our sample (mean BMI =  $26.4 \pm 4.8$  kg/m<sup>2</sup>). Additionally, BMI does not appear to be a more reliable indicator of

changes in nutritional status of the elderly, since it does not reflect changes in body composition (fat mass, lean body mass and body water) due to aging<sup>26</sup>. Winter *et al.*<sup>27</sup> observed that even in the community-dwelling older adults who have an annual health assessment, one in six is at risk of malnourishment, of whom one-third have a BMI of 25 kg/m<sup>2</sup> or higher.

On the other hand, mid-arm circumference was found to be associated with risk of mortality in Taiwanese community-dwelling elderly (cut-off point of < 23.5 cm for men and < 22 cm for women)<sup>28</sup>. Ordoñez *et al.*<sup>29</sup> observed that in hospitalized elderly, of the four assessment parameters of nutritional status (subjective global assessment, triceps skinfold thickness, BMI and mid-arm circumference), only mid-arm circumference showed an association with increased mortality. Similar results were reported by Dent *et al.*<sup>30</sup> who noted an association of smaller mid-arm circumference with transfer to higher level of care for hospitalized elderly. One possible explanation for the absence of association between mid-arm circumference and hospitalization in our study could have been the small number of elderly with this altered parameter (3.5%), causing further unreliability of the estimates.

In our study, the number of daily full meals, daily consumption of fruits, vegetables and fluids also were not associated with hospitalization. As these parameters are self-reported and are part of the information on healthy food available in Brazilian basic care (e.g., Ten steps for a healthy diet for elderly persons)<sup>31</sup>, the answers to these items could have been overestimated. Closs *et al.*<sup>32</sup> evaluated the quality of diet of the elderly of South Brazil in a geriatric outpatient clinic of a university hospital, and found that 74.2% of the elderly had a diet that needed modification, where less than 1.1% of the elderly had a varied diet, and that none of those evaluated had a diet considered healthy. Fisberg *et al.*<sup>33</sup> also noted inadequacy in the intake of nutrients by older Brazilians, affirming that the elderly consumed only a third of the recommended daily amounts of fruits and vegetables.

The main limitation of our study was its cross-sectional character, where we could not determine the causality between malnutrition

risk and hospitalization in the last 12 months. It has been demonstrated that nutritional risk is present in the elderly at the time of hospital admission and often precedes the appearance of acute illness that resulted in hospitalization<sup>19,34</sup>. However, it cannot be excluded that hospitalization itself is a risk factor for nutritional decline. Another limitation was the lack of information regarding the hospitalization cause and premorbid profile.

As a positive point, we highlight the importance of studies on the nutritional status of the elderly assisted in primary care, since the physiological and psychosocial changes related to aging can predispose to malnutrition risk<sup>1</sup>, increasing costs and demand for health services. The elderly are more often hospitalized and with longer hospital stays compared to other age groups<sup>35,36</sup>. Between the years 2004 and 2014, the expenditures of the Brazilian Unified Health System (Sistema Único de Saúde - SUS) increased considerably, where the total cost for hospital services grew 61.4% in the age group over 60 years and where the mean cost for hospitalization increased 53.5% in this population<sup>36</sup>. Therefore, the monitoring of life and health conditions of the elderly is essential, especially at primary care, through indicators such as nutritional status<sup>8,31</sup>.

Brazil has strived to meet the changes caused by the increase in elderly population, making efforts to achieve equal access to health services, strengthening SUS with cost-effective strategies, such as the FHS<sup>37</sup>. However, the rapid population aging demands that health services be prepared to evaluate the nutritional risk of this age group<sup>8</sup>. To be clinically useful, the assessment of nutritional status needs to be efficient and to predict adverse outcomes, because they affect the quality of life of the individuals<sup>38</sup>.

In conclusion, the findings of this study demonstrated the association of malnutrition risk, as well as the majority of single MNA<sup>®</sup> items, with hospitalization in the last 12 months in the elderly assisted in FHS, and reinforce the need for more investigations on the use of this tool at primary care as a nutritional screening instrument for identifying the elderly at risk of malnutrition, who could benefit from an early nutritional intervention.

## Collaborations

CB Rosa, SBB Garces, D Hansen, AV Brunelli, J Coser, PDA Bianchi, and MR Krug, participated in the conception of the study and data collection. CB Rosa, SBB Garces and CHA Schwanke contributed in the conception, design and drafting of the article, analysis and interpretation of the results. All authors contributed to the critical review of the article and approved the final version of the manuscript.

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