High prevalence of malnutrition in Internal Medicine wards - a multicentre ANUMEDI study

Marinho, Ricardo; Pessoa, Ana; Lopes, Marta; Rosinhas, Joao; Pinho, Joao; Silveira, Joana; Amado, Ana; Silva, Sandra; Oliveira, Bruno M. P. M.; Marinho, Anibal

Published in:
European Journal of Internal Medicine

DOI:
10.1016/j.ejim.2020.02.031

Publication date:
2020

European Journal of Internal Medicine 76 (2020) 82–88

Contents lists available at ScienceDirect

European Journal of Internal Medicine

journal homepage: www.elsevier.com/locate/ejim

Original article

High prevalence of malnutrition in Internal Medicine wards – a multicentre ANUMEDI study

Ricardo Marinho[a,1,*], Ana Pessoa[b,1], Marta Lopes[c], João Rosinhas[d], João Pinho[e], Joana Silveira[f], Ana Amado[g], Sandra Silva[h], Bruno M.P.M. Oliveira[i,j], Aníbal Marinho[k], Harriët Jager-Wittenaar[l,m]

[a] Internal Medicine, Centro Hospitalar Universitário do Porto, Largo do Professor Abel Salazar, 4099-001 Porto, Portugal
[b] Internal Medicine, Centro Hospitalar Médio Ave, Vila Nova de Famalicão, Portugal
[c] Clinical Haematology, Centro Hospitalar Universitário do Porto, Porto, Portugal
[d] Internal Medicine, Unidade Local de Saúde de Matosinhos, Matosinhos, Portugal
[e] Nutrition Unit, Centro Hospitalar Médio Ave, Vila Nova de Famalicão, Portugal
[f] Escola Superior de Biotecnologia, Universidade Católica Portuguesa, Porto, Portugal
[g] EEIG ECOTROPHELIA EUROPE, Avignon, France
[h] Independent Researcher
[i] Faculdade de Ciências de Nutrição e Alimentação da Universidade do Porto, Porto, Portugal
[j] LIAAD - INESC TEC, Porto, Portugal
[k] Intensive Care, Centro Hospitalar do Porto, Porto, Portugal
[l] Research Group Healthy Ageing, Allied Health Care and Nursing, Hanze University of Applied Sciences, Groningen, the Netherlands
[m] Department of Maxillofacial Surgery, University of Groningen, University Medical Center Groningen, Groningen, the Netherlands

ARTICLE INFO

Keywords:
Internal Medicine
Malnutrition
Nutritional assessment
Hospitalization
PG-SGA

ABSTRACT

Background: Disease-related malnutrition is a significant problem in hospitalized patients, with high prevalence rates depending on the studied population. Internal Medicine wards are the backbone of the hospital setting. However, prevalence and determinants of malnutrition in these patients remain unclear. We aimed to determine the prevalence of malnutrition in Internal Medicine wards and to identify and characterize malnourished patients.
Methods: A cross-sectional observational multicentre study was performed in Internal Medicine wards of 24 Portuguese hospitals during 2017. Demographics, hospital admissions during the previous year, type of admission, primary diagnosis, Charlson comorbidity index, and education level were registered. Malnutrition at admission was assessed using Patient-Generated Subjective Global Assessment (PG-SGA). Demographic characteristics were compared between well-nourished and malnourished patients. Logistic regression analysis was used to identify determinants of malnutrition.
Results: 729 participants were included (mean age 74 years, 51% male). Main reason for admission was respiratory disease (32%). Mean Charlson comorbidity index was 5.8 ± 2.8. Prevalence of malnutrition was 73% (56% moderate/suspected malnutrition and 17% severe malnutrition), and 54% had a critical need for multidisciplinary intervention (PG-SGA score ≥ 9). No education (odds ratio [OR] 1.88, 95% confidence interval [CI]: 1.16–3.04), hospital admissions during previous year (OR 1.53, 95%CI: 1.05–2.26), and multiple comorbidities (OR 1.22, 95%CI: 1.14–1.32) significantly increased the odds of being malnourished.
Conclusions: Prevalence of malnutrition in the Internal Medicine population is very high, with the majority of patients having critical need for multidisciplinary intervention. Low education level, admissions during previous year, and multiple comorbidities increase the odds of being malnourished.

Abbreviations: AIDS, acquired immunodeficiency syndrome; ANUMEDI, Avaliação Nutricional em Medicina Interna; APNEP, Associação Portuguesa de Nutrição Entérica e Parentérica; CI, confidence interval; ICD-10, international statistical classification of diseases and related health problems 10th revision; IQR, interquartile range; NRS 2002, nutritional risk screening 2002; OR, odds ratio; PG-SGA, patient-generated subjective global assessment; SD, standard deviation; SGA, subjective global assessment

* Corresponding authors.
E-mail address: u11640@chporto.min-saude.pt (R. Marinho).
[1] Both authors have contributed equally.

https://doi.org/10.1016/j.ejim.2020.02.031
Received 13 January 2020; Received in revised form 17 February 2020; Accepted 29 February 2020
Available online 09 March 2020

1. Introduction

Malnutrition has been described as a state resulting from lack of intake or uptake of nutrition that leads to altered body composition and body cell mass, leading to diminished physical and mental function and impaired clinical outcome from illness [1]. Malnutrition is associated with increased risk of mortality, higher hospitalization costs [2,3], increased length of stay, high readmission rates, and impaired recovery [4].

Worldwide, prevalence of disease-related malnutrition has been reported to be between 20% and 50%, depending on the studied population and the criteria used for the malnutrition diagnosis [5]. In Portugal, the most recent large national study [6] evaluated malnutrition risk using Nutritional Risk Screening 2002 (NRS 2002). In that study, in 1576 patients in medical and surgical wards from six different hospitals, the prevalence of nutritional risk at hospital admission varied between 29% and 47%. However, the study focused on malnutrition risk rather than assessment of malnutrition and was performed in a diverse hospital population.

It has been reported that over 20% of the hospital beds [7] are provided by Internal Medicine wards. However, national and international studies on nutritional status usually focus both on medical and surgical patients [6,8–12]. These studies have shown that age, female sex, multimorbidity, pressure ulcers, cancer, lung disease, and social isolation are associated with malnutrition [9–12]. Additionally, medical patients appear to have higher probability of being malnourished [9,11], since they are generally older and have multiple comorbidities [7,13,14]. However, the prevalence and determinants of malnutrition in patients admitted to Internal Medicine wards remain unclear. Further knowledge on this would allow to proactively identify the most vulnerable patients and optimize their nutritional care in the future. To that end, we aimed to assess the prevalence of malnutrition at admission in Internal Medicine wards, and to identify and characterize malnourished patients.

2. Materials and methods

2.1. Study design and population

The "Avaliação Nutricional em Medicina Interna" (ANUMEDI) study is a cross-sectional multicentre observational study coordinated by the Internal Medicine Study Group of the Portuguese Parenteral and Enteral Nutrition Society (Associação Portuguesa de Nutrição Entérica e Parentérica [APNEP]). Internal Medicine residents from 48 public Portuguese hospitals were asked to join the study through the Portuguese Internal Resident Network from the Portuguese Internal Medicine Society (Sociedade Portuguesa de Medicina Interna). All centres had a local study coordinator and several co-researchers (Internal Medicine residents), who were trained in performing the study measurements during a one-day course. Inter-rater reliability was not assessed, but previous research demonstrated that inter-rater reliability of PG-SGA scores of professionals trained in the use of the PG-SGA was good (intraclass correlation = 0.901; $p < 0.001$) [15]. The study included patients aged ≥18 years old, consecutively admitted to an Internal Medicine ward less than 72 h prior to the day of the study, regardless whether the patient remained admitted or would be discharged on that day. Exclusion criteria were incomplete data and refusal to participate. Data were collected in three different days according to the co-researchers' availability, with an interval of 10–15 days between the measurement days, to allow for the renewal of the admitted patients. In the days of data collection, a member of the scientific committee was available by phone in order to assist the researchers. Data collection started on 1st of February and finished on 31st of December of 2017.

Approval from each Internal Medicine Unit Director and local ethics committee was obtained. Furthermore, the Portuguese Data Protection Authority authorized the collection of the data (authorization number 8479/2016). All participating patients or their legal representatives provided written informed consent before enrolment in the study. Data were handled confidentially and anonymously. Data were entered in an online database, for which each co-researcher had a unique login.

2.2. Procedures

The following data were obtained from the medical records: age, gender, hospital and ward admission date, type of admission, primary diagnosis (according to International Statistical Classification of Diseases and Related Health Problems 10th revision (ICD-10) codes), education level (no education, 4th grade, 9th grade, 12th grade or higher education – defined as a bachelor, master or doctorate degree), place of residence and past admissions in the previous year.

Each patient was evaluated by a co-researcher within 72 h of admission to the ward. Nutritional status was evaluated using the PG-SGA (©FD Ottery 2005, 2006, 2015) [16] that has been previously translated and culturally adapted for the Portuguese setting [17]. The PG-SGA is a multidimensional instrument [18,19] that evaluates the nutritional status and risk factors of patients with chronic illness [20]. This tool was first validated in the oncology setting [21,22], but has also been validated in patients with COPD [23], haemodialysis patients [24], vascular surgery patients [25], and geriatric patients [26], of which the majority represents the Internal Medicine population. Moreover, the PG-SGA covers all domains of the malnutrition definition [19], which is not disease-specific [1]. The PG-SGA includes two components. The first component consists of four boxes regarding weight history, food intake, nutrition impact symptoms, and activities/function, which was completed by the patient or his/her carer. Patients' weight and height were self-reported. The second component includes five worksheets, addressing disease and its relation to nutritional requirements, metabolic stress (i.e., fever and use of corticosteroids), physical examination (i.e., deficit/loss of muscle mass/tone, loss of subcutaneous fat, and oedema or ascites), and a global assessment, which categorized patients as well nourished (Stage A), moderate/suspected malnutrition (Stage B), or severely malnourished (Stage C). Each box and worksheet also produces numerical scores, to identify the required nutritional intervention [20]. If body weight at 1 and 6 months was not known, zero points were given for that item in Box 1 of the PG-SGA. If data were missing for any other item of the PG-SGA, the participant was excluded from the data analysis.

The Charlson comorbidity index score [27] was used to characterize the comorbidity burden of the studied population based on the presence of 19 different scored diagnoses, according to the information described in the patients' clinical records.

2.3. Statistical analysis

Statistical analysis was performed using IBM SPSS Statistics (IBM SPSS Statistics Premium Grad Pack) Version 23.0. Categorical variables were represented as frequencies and percentages. Continuous and ordinal variables were represented as means and standard deviations (SD), or medians with interquartile range (IQR) for variables with skewed distributions. Normal distribution was checked using the Shapiro–Wilk test for skewness and kurtosis.

Categorical variables were compared using the Fisher's exact test or the chi-square test, as appropriate. Differences between the three groups (Stage A, B, and C) were evaluated using an analysis of variance (ANOVA) model, followed by Bonferroni test when findings with the ANOVA model were significant, or by the Kruskal–Wallis analysis of variance and Dunn's multiple-comparison test, when the variables were non-parametric. A Forest Plot graphic was elaborated using chi-square test for each comorbidity represented in the Charlson Index for the odds ratio of being well-nourished (Stage A) against being malnourished (Stage B and C). On the comorbidity AIDS we were unable to perform this test due to the low number of participants having AIDS. All reported p values are two-tailed, with a p value of 0.05 indicating statistical significance.

Univariate and backward multivariate logistic regression analysis were used to identify determinants of malnutrition, as defined by PG-SGA Stage B or C. According to current literature on social and medical risk factors for malnutrition [9–12], the variables included in the regression analyses were: age, residence (own home vs relative's home vs nursing home vs long term facilities vs others), education level (no education vs 4th grade vs 9th grade vs 12th grade vs higher education), admissions in previous year (yes/no), type of admission (admission from emergency department vs admission from other hospital/service vs planned admission), sex, and Charlson comorbidity index score. Subsequently, in each step of the backward multivariate logistic regression, variables with a p-value > 0.1 were removed from the model. Age and individual comorbidities were not included as variables in the multivariate analysis, as they are included in the Charlson Index Score. All reported p values are two-tailed, with a p value of 0.05 indicating statistical significance.

3. Results

3.1. Study population

Of the 48 Portuguese public hospitals invited, 24 participated and 891 patients were included. Of the 162 patients that were excluded, 93 had incomplete data, 66 refused to participate, and 3 were rejected for other reasons. A total of 729 participants were included in the analysis. Characteristics of the study sample are depicted in Table 1. Fifty-one percent of the study subjects were male, with a mean age of 74.2 ± 14.6 years old. Twenty-three percent of the participants had no education, and 55% had only the 4th grade. Mean weight was 70.5 ± 15.7 kg and mean body mass index was 26.3 ± 5.3 kg/m^2. Prior to hospital admission, most of the subjects lived in their own home, followed by a relative's home. Most of the participants were admitted through the emergency department. More than one-third were admitted to a hospital in the previous year, with a median duration of admission of 15 days (interquartile range 7–29 days). The mean Charlson comorbidity index was 5.8 ± 2.8, representing a mortality rate of more than 20% at ten years [27]. The most frequent causes for hospital admission were diseases from the respiratory (32%), circulatory (28%), and genitourinary (11%) system. The most common comorbidities were heart failure (36%), chronic pulmonary disease (22%), and cerebrovascular disease (20%). The distribution of comorbidities according to PG-SGA category is presented in supplementary table S1.

3.2. Malnutrition

Prevalence of malnutrition was 73% (n = 531); 56% (n = 407) of the patients had moderate or suspected malnutrition (Stage B), and 17% (n = 124) were severely malnourished (Stage C). Only 27% of the participants were well nourished (Stage A).

Median PG-SGA score was 10 (IQR 6–15). Fifty-four percent of the participants had a score of ≥9, indicating critical need for improved symptom management and/or nutrient intervention options. The scores obtained in the various boxes and worksheets of PG-SGA are depicted in supplementary table S2. The highest scores were found in Box 3 (i.e., nutrition impact symptoms, symptoms that may limit food intake). Nutrition impact symptoms with highest prevalence were anorexia, fatigue, and dry mouth. Half of the participants had little weight change in the six months prior to hospital admission, but 43% reported weight loss in the previous two weeks. Only 1% of the participants reported to use tube feeding or parenteral nutrition, and none of the participants reported using oral nutritional supplements only. Regarding physical examination, total score showed that 48% of the participants had no overall (muscle, fat and oedema) body deficit, 32% had mild deficit, 16% had moderate deficit, and 5% severe deficit.

3.3. Determinants of malnutrition

As presented in Table 2, malnourished patients were older (Stage A vs B and C, $p < 0.001$; Stage B vs C, $p = 0.007$), had more comorbidities (Stage A vs B and C, $p < 0.001$; Stage B vs C, $p = 0.013$), and had lower level of education (Stage A vs B, $p = 0.021$; Stage A vs C, $p < 0.001$; but not between Stage B and C, $p = 0.106$).

Regarding comorbidities, solid tumour with metastasis (OR = 4.72, 95% CI:1.49–15.53), any tumour without metastasis (OR = 2.41, 95% CI:1.25–4.67), moderate or severe kidney disease (OR = 1.86, 95% CI:1.12–3.08), diabetes without end organ damage (OR = 1.81, 95% CI:1.13–2.89), peptic ulcer (OR = 2.81, 95% CI:1.09–7.26), heart failure (OR = 1.54, 95% CI:1.08–2.19), dementia (OR = 4.39, 95% CI:2.31–8.36), and chronic pulmonary disease (OR = 1.62, 95% CI:1.06–2.47) were associated with malnutrition (Stage B and C), as presented in Fig. 1.

In the univariate regression analysis, male sex and having an education (versus no education) decreased the odds of being malnourished, whereas not living in their own home, admissions during previous year, and multiple comorbidities significantly increased the odds of being malnourished. In the multivariate analysis, having an education decreased the odds of being malnourished, but having multiple comorbidities (OR 1.20, 95% CI: 1.12–1.29) significantly increased the odds of being malnourished (Table 3).

Table 1
Characteristics of the studied participants (n = 729).

Characteristics	
Male sex, n (%)	369 (50.6)
Age (years), mean ± SD	74.2 ± 14.6
Weight (kg), mean ± SD	70.5 ± 15.7
Body mass index (kg/m^2), mean ± SD	26.3 ± 5.3
Education level, n (%)	
No education	170 (23.3)
4th grade	399 (54.7)
9th grade	87 (11.9)
12th grade	37 (5.1)
Higher Education	36 (4.9)
Residence, n (%)	
Home	491 (67.4)
Relative's home	136 (18.7)
Nursing home	77 (9.9)
Long term care facility	10 (1.4)
Others	20 (2.7)
Admission type, n (%)	
Admission from emergency department	636 (87.3)
Admission from other hospital/service	76 (10.4)
Planned admission	17 (2.3)
Admissions during previous year, n (%)	280 (38.4)
Length of stay in the previous year (days), median (IQR)	15 (7–29) days
Primary diagnosis (ICD-10), n (%)	
Diseases of the respiratory system	234 (32.1)
Diseases of the circulatory system	204 (28.0)
Diseases of the genitourinary system	83 (11.4)
Certain infectious and parasitic diseases	39 (5.4)
Diseases of the digestive system	32 (4.4)
Neoplasms	26 (3.6)
Endocrine, nutritional and metabolic diseases	26 (3.6)
Diseases of the blood and blood-forming organs	19 (2.6)
Symptoms, signs and abnormal findings	16 (2.2)
Diseases of the nervous system	14 (1.9)
Diseases of the skin and subcutaneous tissue	14 (1.9)
Diseases of the musculoskeletal system	12 (1.7)
Mental and behavioural disorders	6 (0.8)
Injury, poisoning and others	3 (0.4)
Diseases of the eye and adnexa	1 (0.1)
Charlson comorbidity index, mean ± SD	5.8 ± 2.8

ICD-10: International Statistical Classification of Diseases and Related Health Problems 10th revision; IQR: interquartile range; SD: standard deviation.

Table 2
Demographics and comorbidities per PG-SGA Category.

	PG-SGA Stage A (n = 198)	PG-SGA Stage B (n = 407)	PG-SGA Stage C (n = 124)	p value
Male sex, n (%)	114 (57.6)	188 (46.2)	67 (54)	0.022†
Age (years), mean ± SD	69.69 ± 16.46	75.07 ± 14.16	78.64 ± 10.37	0.001‡
Education level, n (%)				0.001‡
No education	27 (13.6)	99 (24.3)	44 (35.4)	
4th grade	114 (57.6)	225 (55.3)	60 (48.4)	
9th grade	31 (15.7)	45 (11.1)	11 (8.9)	
12th grade	18 (9.1)	14 (3.4)	5 (4)	
Higher education	8 (4)	24 (5.9)	4 (3.2)	
Residence, n (%)				0.001†
Home	160 (80.1)	261 (64.1)	70 (56.5)	
Relative's home	23 (11.6)	86 (21.1)	27 (21.8)	
Nursing home	9 (4.5)	45 (11.1)	18 (14.5)	
Long term care facility	1 (0.5)	6 (1.5)	3 (2.4)	
Others	5 (2.5)	9 (2.2)	6 (4.8)	
Type of admission				0.045†
Admission from emergency department	174 (87.9)	344 (84.9)	116 (93.5)	
Transfer from other hospital/service	18 (9.1)	52 (12.8)	76 (10.5)	
Planned admission	6 (3)	9 (2.2)	2 (1.6)	
Admissions during previous year, n (%)	52 (26.3)	167 (41)	61 (49.2)	0.001†
Charlson comorbidity index, mean ± SD	4.67 ± 2.72	6.07 ± 2.72	6.86 ± 2.61	0.001‡

PG-SGA: Patient-Generated Subjective Global Assessment; SD: standard deviation.
† Kruskal-Wallis analysis of variance.
‡ analysis of variance (A-NOVA) model.

4. Discussion

Our study showed a very high prevalence of malnutrition in patients admitted to the Internal Medicine ward, with one-fifth being severely malnourished. Multiple comorbidities significantly increase the odds of being malnourished, but having an education decreases the odds of being malnourished. Moreover, more than half of this Internal Medicine population has a critical need for improved symptom management and/or nutritional intervention (PG-SGA ≥9 points).

The prevalence of malnutrition in our study, i.e. 73%, is higher than in other studies, which found rates ranging from 22 to 48% [10–12,28–30]. Our higher prevalence rates could be explained by differences in methodology, namely the tools used (Subjective Global Assessment, Mini Nutritional Assessment, and European Society for Clinical Nutrition and Metabolism (ESPEN) Criteria), as well as the population studied. The Subjective Global Assessment (SGA) [31] is a precursor of the PG-SGA. While the SGA also includes weight history, a physical exam, and nutrition impact symptoms, it only includes four (gastrointestinal) symptoms that, to be scored, need to be present for more than 2 weeks. In contrast, the number of nutrition impact symptoms scored in the PG-SGA is much higher, and these nutrition symptoms do not have to be present for two weeks fully to be scored. The inclusion of a larger number of nutrition impact symptoms in the PG-SGA may contribute to a higher proportion of patients being

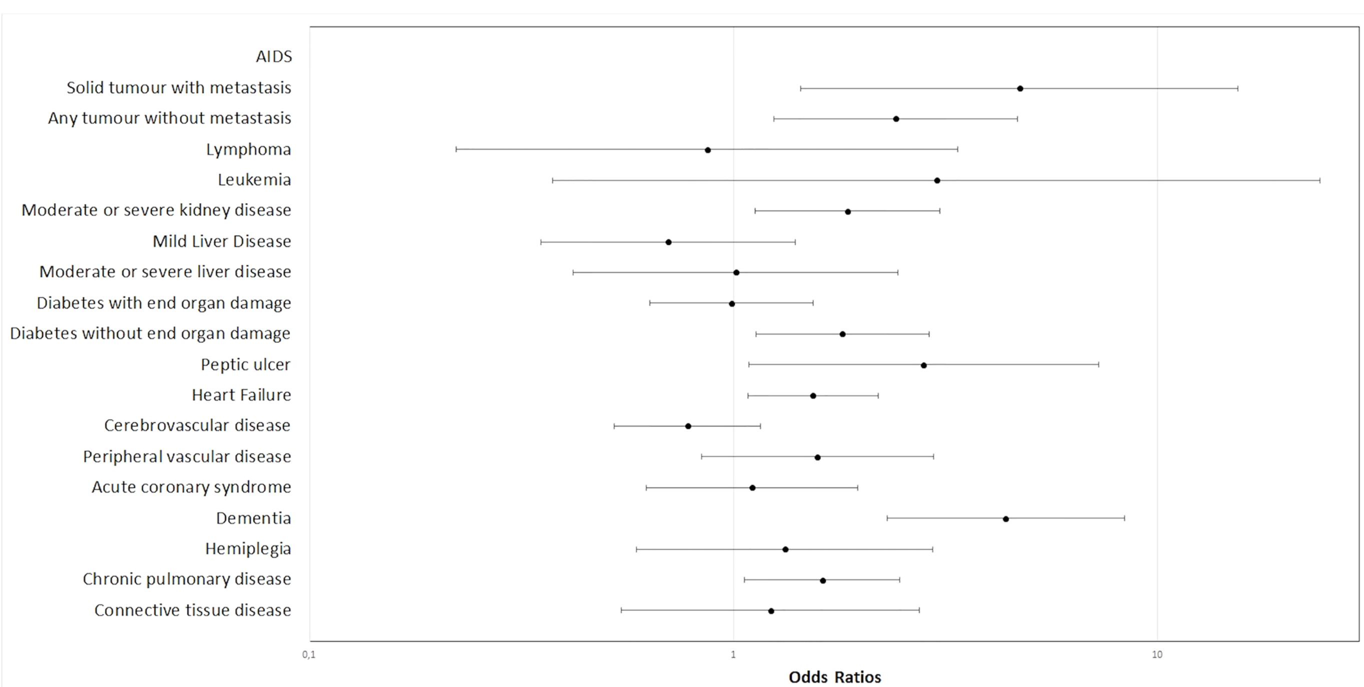

Fig. 1. Odds Ratio of being malnourished (PG-SGA Stage B and C) according to the comorbidities presented in the Charlson Comorbidity index. The comorbidity AIDS (i.e., acquired immunodeficiency syndrome) is represented as 0, due to insufficient prevalence in the study to perform this test.

Table 3
Univariate and multivariate binary logistic regression analyses for malnutrition (PG-SGA Stage B and C).

Variables	Univariate analysis OR	95% CI	p value	Multivariate analysis OR	95% CI	p value
Male sex	0.68	0.49–0.95	0.022	–	–	–
Education level			< 0.001			0.028
No education	1.00			1.00		
4th grade	0.47	0.30–0.75		0.53	0.33–0.86	
9th grade	0.34	0.19–0.62		0.54	0.29–1.02	
12th grade	0.20	0.09–0.43		0.39	0.18–0.89	
Higher education	0.66	0.27–1.60		1.15	0.45–2.97	
Residence			< 0.001			0.057
Home	1.00			1.00		
Relative's home	2.38	1.46–3.86		1.69	1.01–2.815	
Nursing home	3.38	1.64–6.98		2.37	1.12–5.03	
Long term care facility	4.35	0.55–34.64		2.83	0.35–23.30	
Others	1.45	0.52–4.06		1.54	0.54–4.43	
Admissions during previous year	2.11	1.47–3.03	< 0.001	1.43	0.97–2.10	0.075
Type of admission			0.593			–
Transfer from emergency department	1.00			–	–	–
Transfer from other hospital/service	1.22	0.69–2.12		–	–	–
Planned admission	0.693	0.253–1.904		–	–	–
Charlson comorbidity index	1.25	1.17–1.34	< 0.001	1.20	1.12–1.29	< 0.001

Type of admission and sex were excluded during the backward stepwise multivariate regression analysis, due to $p > 0.1$.
CI: confidence interval, OR: odds ratio. Each point increase in the Charlson comorbidity index increases the odds of being malnourished by 1.2.

categorized as malnourished. Furthermore, while our study focuses only on Internal Medicine patients, most other studies also included surgical patients, which can influence age ranges and comorbidities. As reported elsewhere [7,14], medical patients are relatively old, and studies show a higher prevalence of malnutrition in older patients [10–12,32,33]. In fact, studies have suggested that medical patients appear to have higher probability of being malnourished [9,11].

An important finding that helps explain these results is the relationship between comorbidities and malnutrition. Our study demonstrated that patients admitted to the Internal Medicine ward and having multiple comorbidities have high chance of being malnourished. In fact, Internal Medicine patients have numerous comorbidities that impact on their nutritional status [7,14]. In our study, we found that especially neoplastic diseases, kidney disease, diabetes without end organ damage, peptic ulcer, heart failure, dementia and chronic pulmonary disease increased the odds of being malnourished. Previous research also reported that cardiovascular and respiratory diseases, among the most common causes of admission to the Internal Medicine ward [7], also observed in our study, are associated with high prevalence of malnutrition [34]. Patients with heart failure, a severe and common cardiovascular disease, are in a permanent catabolic state due to neurohormonal and immunological changes, increased resting metabolic rate, fat malabsorption, and loss of appetite [34]. Chronic obstructive pulmonary disease patients are also at risk for malnutrition, which seems to be caused by multiple factors, such as tissue hypoxia, ageing, increased resting metabolic rate, chronic inflammation, and certain drugs, resulting in net catabolism [34]. The lower level of education of our studied population, which was associated with malnutrition, may also contribute to the higher chances of being malnourished, which is in line with other results [10].

More than half of the participants had a PG-SGA score that indicates a critical need for improved symptom management and nutritional intervention. The highest score was found in Box 3, addressing the presence of nutrition impact symptoms in the two weeks prior to admission. However, all boxes contributed to this overall result, indicating a need for multidisciplinary intervention not only to support nutritional intake, but also to ameliorate symptoms that may hinder it. Of note, weight loss seemed to be more acute (in the previous 2 weeks versus the previous 3 or 6 months), with 43% of patients reporting eating less than usual in the two weeks before hospital admission. This suggests the presence of acute disease-related malnutrition. In fact, main reasons for decreased eating were anorexia and fatigue, which are frequent symptoms in most diseases.

Since most of the participants were malnourished, higher rates of use of oral nutritional supplements were expected. However, none of the participants used only oral nutritional supplements, and only 1% of the participants reported to use tube feeding or parenteral nutrition. Studies report use of oral nutritional supplements in 4–7% of patients, tube feeding in 6%, and parenteral feeding in 1–2% [12, 33]. However, these studies included surgical populations, in which the frequency of diseases requiring tube feeding and parenteral nutrition is higher. Moreover, the scarce use of medical nutrition upon hospital admission may reflect the lack of nutritional awareness in Portugal, although also reported in other countries and settings [4]. Prior to the start of this study, no national screening policies nor government support of home medical nutrition was implemented. However, ongoing efforts are being made to change this. In 2018, an Order of Minister 6634/2018 was published in Diário da República (Official Journal of Portugal) [35], defining that all hospitalized adult patients with a length of stay > 24 h have to be screened with NRS 2002 by a multidisciplinary team.

The major strength of the current study is the large number of participants, and the good distribution of participating hospitals across different hospital categories and different regions of the country (including the Portuguese islands), showing a good representation of this specific Portuguese population. However, the current study also has some limitations. Firstly, the PG-SGA has not been validated specifically for the Internal Medical ward population yet. However, after being validated in the oncology setting first [21,22], the PG-SGA has already been validated in various other clinical populations, including patients with COPD [23], haemodialysis patients [24], and geriatric patients [26], which represent the majority of our patients. Moreover, the PG-SGA covers all domains of the malnutrition definition [19], which is not disease-specific [1], and therefore we considered appropriate to use the PG-SGA in the current study. Second, weight and height were reported, not measured. In this large multicentre study, measuring current weight was not feasible, due to material constraints across different hospitals and patient mobility issues that would prevent the use of more broadly available measuring devices. However, it has been reported that self-reported height and weight correlated highly with physical measurement of height and weight (Pearson's correlation coefficient > 0.92) [36]. Additionally, PG-SGA data collection on weight history in the past 6 months and past month (Box 1) requires self-report, as previous weight may not be available in the medical records. However, 20% of participants could not estimate their weight, which could have resulted in underestimation of the prevalence of malnutrition. Thirdly, in 34% of the participants, the caregivers completed the patient component of the PG-SGA, for example in highly dependent patients, which might also have resulted in either under- or overestimation of the prevalence of malnutrition.

This study has various implications for clinical practice. The PG-SGA identified nutritional problems that would probably not have been detected by the sole use of screening tools, which generally report body mass index, recent weight loss, dietary intake and acute illness, or other assessment tools, such as SGA. For example, since the PG-SGA also scores multiple nutrition impact symptoms, it may help to detect causes of decreased intake that are amenable to treatment, thus improving nutritional care. Besides, nutrition impact symptoms can serve as proxies for comorbidities, as we saw that multiple comorbidities increase the odds of being malnourished. The high need for multidisciplinary intervention, as indicated by the large proportion (54%) of patients having a PG-SGA score of ≥9 in our population, underlines the need for a more preventive and monitoring strategy to fight malnutrition during hospital admission. However, severe malnutrition cannot be effectively treated only in the hospital setting. Ambulatory screening and follow-up after hospital discharge is also needed. Moreover, the findings of the current study implicate that dietary strategies to prevent or treat malnutrition need to be tailored to the education level of the population. Since a quarter of the population had no education, written and verbal communication should be performed on laymen level.

The findings of this study also have economic implications. Since hospital reimbursement depends on the hospitalization costs and case mix index, the identification of patients at risk followed by nutritional assessment, documenting and coding of malnutrition would increase potential hospital reimbursement [15,37–39], which would help further investment in nutritional care. In fact, the economic situation has been shown to influence the fight against malnutrition, including education and treatment [40]. Future studies should evaluate the cost analysis of coding malnutrition, as such results could also serve as an incentive to screen, evaluate, and treat malnourished patients.

5. Conclusion

Prevalence of malnutrition in patients admitted to Internal Medicine wards is very high, with most patients having a critical need for multidisciplinary intervention. Low education, admissions during previous year, and multiple comorbidities increase the odds of being malnourished. Early adequate nutritional intervention is paramount to properly address our patients' nutritional status. These results call for a more proactive and preventive malnutrition policy, including screening, assessment, and monitoring of malnutrition and its risk factors across the chain of care.

Funding sources

The study was financially supported by APNEP (Portuguese Parenteral and Enteral Nutrition Society).

CRediT authorship contribution statement

Ricardo Marinho: Conceptualization, Methodology, Investigation, Resources, Writing - original draft, Writing - review & editing, Funding acquisition. **Ana Pessoa:** Conceptualization, Methodology, Investigation, Writing - original draft, Writing - review & editing. **Marta Lopes:** Conceptualization, Methodology, Writing - original draft, Writing - review & editing. **João Rosinhas:** Conceptualization, Methodology, Investigation, Writing - review & editing. **João Pinho:** Conceptualization, Methodology, Writing - review & editing. **Joana Silveira:** Conceptualization, Methodology, Writing - review & editing. **Ana Amado:** Conceptualization, Methodology, Writing - review & editing. **Sandra Silva:** Conceptualization, Methodology, Writing - review & editing. **Bruno M.P.M. Oliveira:** Formal analysis, Writing - review & editing. **Aníbal Marinho:** Resources, Writing - review & editing, Supervision, Funding acquisition. **Harriët Jager-Wittenaar:** Conceptualization, Methodology, Writing - review & editing, Supervision.

Declaration of Competing Interest

H. Jager–Wittenaar was co-developer of the PG-SGA-based Pt-Global app/web tool. All other authors have no conflict of interest.

Acknowledgments

The authors would like to thank all the study participants for their contribution in this project, Pedro Marcos for the creation of the online database and Rafaela Abreu for the design of the graphical abstract. The authors are also indebted to all Internal Medicine residents who collaborated in the data collection: Adriana Silva; Alexandra Esteves; Ana Carolina Andrade; Ana Catarina Lucas; Ana Gomes; Ana Isabel Costa; Ana João Carvalho; Ana Silva; Ana Azevedo; Ana Marçal; Ana Pinho; Ana Ponciano; Ana Raquel Ramos; Ana Queirós; Ana Rita Ramos; Ana Gonçalves; Ana Vera Cruz; Andreia Costa; Andreia Lopes; Andreia Marques; Andreia Pinelo ; António Ferreira; Anusca Lopes; Bráulio Gomes; Bruna Nascimento; Carla Nobre; Carlos Anjo; Carmen Pais; Carolina Cadório; Carolina Coelho; Catarina Carvalho; Catarina Castelo Branco; Catarina Machado; Catarina Neto; Catarina Santos; Cátia Canelas; Cátia Pereira; Daniel Oliveira; Daniela Carneiro; Daniela Santos; David Campoamor; David Ferreira; David Garcia; Diana Falcão; Diogo Pedro; Filipa Sousa; Francisca Abecasis; Francisco Coelho; Francisco Gouveia; Helena Gonçalves; Helena Maurício; Helena Moreira; Inês Pintassilgo; Inês Rato; Isabel Caballero; Isabel Eira; Ivone Valadão; Joana Barros; Joana Calvão; Joana Costa; Joana Barros; Joana Milho; Joana Rigor; Joana Serôdio; João Gomes; João Maia; João Oliveira; João Rua; Joel Pinto; Juliana Sá; Luciana Sousa; Luís Santos; Mafalda Pereira; Manuel Barbosa; Márcia Pacheco; Márcia Pinto; Márcia Silva ; Maria Duarte; Maria Pinto; Mariana Alves: Marina Boticário; Mário Bibi; Marta Brás; Marta Gonçalves; Marta Rebocho; Marta Soares Carreira; Mónica Mesquita; Nayive Gomez; Olga Jesus; Paula Ferreira; Paulo Almeida; Pedro Rodrigues; Pedro Tavares; Pedro Verão; Penelope Almeida; Petra Monteiro; Rafaela Araújo; Renato Nogueira; Ricardo Fernandes; Rita Costa; Rita Homem; Rita Martins; Rita Neto; Rita Silva; Rosa Cardoso; Ruben Reis; Rute Martins; Sara Camões; Sara Castelo Branco; Sara Costa; Sara Pinto; Sara Pires; Sara Sarmento; Vânia Rodrigues; Verónica Guiomar.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.ejim.2020.02.031.

References

[1] Cederholm T, Barazzoni R, Austin P, Ballmer P, Biolo G, Bischoff SC, et al. ESPEN guidelines on definitions and terminology of clinical nutrition. Clin Nutr 2017;36:49–64.
[2] Khalatbari-Soltani S, Marques-Vidal P. Impact of nutritional risk screening in hospitalized patients on management, outcome and costs: a retrospective study. Clin Nutr 2016;35:1340–6.
[3] Lim SL, Ong KC, Chan YH, Loke WC, Ferguson M, Daniels L. Malnutrition and its impact on cost of hospitalization, length of stay, readmission and 3-year mortality. Clin Nutr 2012;31:345–50.
[4] Norman K, Pichard C, Lochs H, Pirlich M. Prognostic impact of disease-related malnutrition. Clin Nutr 2008;27:5–15.
[5] Barker LA, Gout BS, Crowe TC. Hospital malnutrition: prevalence, identification and impact on patients and the healthcare system. Int J Environ Res Public Health 2011;8:514–27.
[6] Matos L, Teixeira MA, Henriques A, Tavares MM, Alvares L, Antunes A, et al.

[Nutritional status recording in hospitalized patient notes]. Acta Med Port 2007;20:503–10.
[7] Verma AA, Guo Y, Kwan JL, Lapointe-Shaw L, Rawal S, Tang T, et al. Patient characteristics, resource use and outcomes associated with general internal medicine hospital care: the General Medicine Inpatient Initiative (GEMINI) retrospective cohort study. CMAJ Open 2017;5:E842–e9.
[8] Sauer AC, Goates S, Malone A, Mogensen KM, Gewirtz G, Sulz I, et al. Prevalence of malnutrition risk and the impact of nutrition risk on hospital outcomes: results from nutrition day in the U.S. JPEN J Parenter Enter Nutr 2019;43(7): 918–26.
[9] Bonetti L, Terzoni S, Lusignani M, Negri M, Froldi M, Destrebecq A. Prevalence of malnutrition among older people in medical and surgical wards in hospital and quality of nutritional care: a multicenter, cross-sectional study. J Clin Nurs 2017;26:5082–92.
[10] Pirlich M, Schutz T, Kemps M, Luhman N, Minko N, Lubke HJ, et al. Social risk factors for hospital malnutrition. Nutrition (Burbank, Los Angeles County, Calif) 2005;21:295–300.
[11] Kang MC, Kim JH, Ryu SW, Moon JY, Park JH, Park JK, et al. Prevalence of malnutrition in hospitalized patients: a multicenter cross-sectional study. J. Korean Med. Sci. 2018;33:e10.
[12] Waitzberg DL, Caiaffa WT, Correia MI. Hospital malnutrition: the Brazilian national survey (IBRANUTRI): a study of 4000 patients. Nutrition (Burbank, Los Angeles County, Calif) 2001;17:573–80.
[13] Gomes F, Schuetz P, Bounoure L, Austin P, Ballesteros-Pomar M, Cederholm T, et al. ESPEN guidelines on nutritional support for polymorbid internal medicine patients. Clin Nutr 2018;37:336–53.
[14] Buurman BM, Frenkel WJ, Abu-Hanna A, Parlevliet JL, de Rooij SE. Acute and chronic diseases as part of multimorbidity in acutely hospitalized older patients. Eur. J. Intern. Med. 2016;27:68–75.
[15] Kellett J, Kyle G, Itsiopoulos C, Naunton M, Luff N. Malnutrition: the importance of identification, documentation, and coding in the acute care setting. J Nutr Metab 2016;2016:9026098.
[16] Ottery FD. Definition of standardized nutritional assessment and interventional pathways in oncology. Nutrition (Burbank, Los Angeles County, Calif) 1996;12:S15–9.
[17] Pinho J. Translation, cross-cultural adaptation and validation of the scored patient-generated subjective global assessment (PG-SGA) for the Portuguese setting. Porto, Portugal: Faculty of Nutrition and Food Science of University of Porto; 2015.
[18] Ottery FD. Rethinking nutritional support of the cancer patient: the new field of nutritional oncology. Semin. Oncol. 1994;21:770–8.
[19] Sealy MJ, Nijholt W, Stuiver MM, van der Berg MM, Roodenburg JL, van der Schans CP, et al. Content validity across methods of malnutrition assessment in patients with cancer is limited. J Clin Epidemiol 2016;76:125–36.
[20] Jager-Wittenaar H, Ottery FD. Assessing nutritional status in cancer: role of the patient-generated subjective global assessment. Curr Opin Clin Nutr Metab Care 2017;20:322–9.
[21] Bauer J, Capra S, Ferguson M. Use of the scored patient-generated subjective global assessment (PG-SGA) as a nutrition assessment tool in patients with cancer. Eur J Clin Nutr 2002;56:779–85.
[22] Isenring E, Bauer J, Capra S. The scored patient-generated subjective global assessment (PG-SGA) and its association with quality of life in ambulatory patients receiving radiotherapy. Eur J Clin Nutr 2003;57:305–9.
[23] Bauer J, Egan E, Clavarino A. The scored patient-generated subjective global assessment is an effective nutrition assessment tool in subjects with chronic obstructive pulmonary disease. E Spen Eur E J Clin Nutr Metab 2011;6:e27–30.
[24] Desbrow B, Bauer J, Blum C, Kandasamy A, McDonald A, Montgomery K. Assessment of nutritional status in hemodialysis patients using patient-generated subjective global assessment. J Ren Nutr 2005;15:211–6.
[25] Banning LBD, Ter Beek L, El Moumni M, Visser L, Zeebregts CJ, Jager-Wittenaar H, et al. Vascular surgery patients at risk for malnutrition are at an increased risk of developing postoperative complications. Ann Vasc Surg 2019. S0890-5096(19) 30883-0.
[26] Marshall S, Young A, Bauer J, Isenring E. Malnutrition in geriatric rehabilitation: prevalence, patient outcomes, and criterion validity of the scored patient-generated subjective global assessment and the mini nutritional assessment. J Acad Nutr Diet 2016;116:785–94.
[27] Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. J Chronic Dis 1987;40:373–83.
[28] Naber TH, Schermer T, de Bree A, Nusteling K, Eggink L, Kruimel JW, et al. Prevalence of malnutrition in nonsurgical hospitalized patients and its association with disease complications. Am. J. Clin. Nutr. 1997;66:1232–9.
[29] Gołąbek K, Mandecka A, Chachaj A, Drożdż K, Szuba A, Regulska- Ilow B. Assessment of nutritional status on the basis of the mini nutritional assessment (MNA) questionnaire in patients on the internal medicine ward. Rocz Panstw Zakl Hig 2018;69:281–8.
[30] Rinninella E, Cintoni M, De Lorenzo A, Addolorato G, Vassallo G, Moroni R, et al. Risk, prevalence, and impact of hospital malnutrition in a tertiary care referral university hospital: a cross-sectional study. Intern Emerg Med 2018;13:689–97.
[31] Detsky AS, McLaughlin JR, Baker JP, Johnston N, Whittaker S, Mendelson RA, et al. What is subjective global assessment of nutritional status? JPEN J Parenter Enter Nutr 1987;11:8–13.
[32] Pirlich M, Schutz T, Norman K, Gastell S, Lubke HJ, Bischoff SC, et al. The German hospital malnutrition study. Clin Nutr 2006;25:563–72.
[33] Correia MI, Campos AC. Prevalence of hospital malnutrition in Latin America: the multicenter Elan study. Nutrition (Burbank, Los Angeles County, Calif) 2003;19:823–5.
[34] Anker SD, John M, Pedersen PU, Raguso C, Cicoira M, Dardai E, et al. ESPEN guidelines on enteral nutrition: cardiology and pulmonology. Clin Nutr 2006;25:311–8.
[35] Ministério da Saúde, Secretário de Estado Adjunto e da Saúde. Despacho n.º 6634/ 2018. Diário da República, Série II, nº 1292018-07-06. p. 18713 - 4.
[36] Neermark S, Holst C, Bisgaard T, Bay-Nielsen M, Becker U, Tolstrup JS. Validation and calibration of self-reported height and weight in the Danish health examination survey. Eur J Public Health 2019;29:291–6.
[37] Coelho A, Ferreira I, Alves P, Trigo L, Amaral T. O efeito da codificação da desnutrição no financiamento hospitalar. Nutrícias 2012:18–9.
[38] Amaral TF, Matos LC, Tavares MM, Subtil A, Martins R, Nazare M, et al. The economic impact of disease-related malnutrition at hospital admission. Clin Nutr 2007;26:778–84.
[39] Fernandes A, Pessoa A, Vigário M, Jager-Wittenaar H, Pinho J. Does malnutrition influence hospital reimbursement? A call for malnutrition diagnosis and coding. Nutrition (Burbank, Los Angeles County, Calif). 2019. https://doi.org/10.1016/j.nut.2020.110750. in press.
[40] Klek S, Chourdakis M, Bischoff S, Dubrov S, Forbes A, Galas A, et al. Economy matters to fight against malnutrition: results from a multicenter survey. Clin Nutr 2017;36:162–9.