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Applied nutritional investigation

Does malnutrition influence hospital reimbursement? A call for malnutrition diagnosis and coding

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ABSTRACT

Objectives: The aim of this study was to determine how diagnosing and coding of malnutrition in an internal medicine ward setting influences potential hospital reimbursement.

Methods: Patients admitted to the internal medicine ward of Centro Hospitalar do Médio Ave between April 24 and May 22, 2018 were screened by Nutritional Risk Screening 2002, and patients classified as at "risk for malnutrition" were assessed by the Patient-Generated Subjective Global Assessment (PG-SGA). For each patient, medical coders simulated coding, taking into account the malnutrition diagnosis by PG-SGA, and compared it with the real coding as retrieved from the medical records. For the coding, the Diagnosis-Related Group and Severity of Illness were determined, allowing the calculation of hospitalization cost (HC) according to Portuguese Ministerial Directive number 207/2017. The increase of HC in this subsample was extrapolated to the number of patients admitted during 2018, to obtain the estimated unreported annual HC.

Results: Of the 71% (92/129) participants having malnutrition risk according to Nutritional Risk Screening 2002, 86% were malnourished. Including malnutrition diagnosis in the coding of malnourished patients increased the level of Severity of Illness in 39% of cases and increased HC for this subsample, resulting in €52 000. Extrapolating for the annual HC, total HC reached €1.3 million.

Conclusions: Identifying malnourished patients and including this highly prevalent diagnosis in medical records allows malnutrition coding and consequent increase of HC. This can improve the potential hospital reimbursement, which could contribute to the quality of patient care and economic sustainability of hospitals.

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Introduction

Worldwide, malnutrition affects 20% to 50% of hospitalized patients [1], depending on the population studied and definition used. In Portugal, a cross-sectional study using Nutritional Risk Screening 2002 (NRS 2002) and anthropometric measures for malnutrition assessment revealed that 29% to 47% of the inpatients were at risk of malnutrition, and 6% to 15% were malnourished [2]. Specifically for the Portuguese internal medicine setting, a recent multicenter study found that 73% of patients were malnourished [3]. Malnutrition has negative effects. It deteriorates physical well-being and quality of life and contributes to adverse clinical outcomes, such as increased risk for infections, poor

wound healing, longer length of stay (LOS), increased readmission rates and hospital costs, worsened functional status at discharge, and higher morbidity and mortality rates [1,4–10].

Recognition and identification of malnutrition, including its severity, are essential to start timely intervention and to avoid its consequences. The presence of malnutrition diagnosis in the medical record is also necessary for the correct calculation of hospitalization costs (HC) and for hospitals to obtain the appropriate reimbursement [1,7,8,11–14]. A Canadian prospective study involving medical and surgical patients found that malnutrition at admission increased total costs by 31% to 38%, depending on the severity of malnutrition [10]. According to studies in medical and surgical patients in Australia, Europe, and North America, potential unclaimed hospital reimbursement ranges from approximately €78 000 to €5 000 000 [7,15,16].

There are many types of hospital reimbursement systems [17,18]. In Portugal, this is based on the All Patients Refined Diagnosis-Related Group (APR-DRG) [19,20]. The APR-DRG allows the

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

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operational characterization of the hospital production and grouping patients according to a Diagnosis-Related Group (DRG), risk of mortality (ROM), and severity of illness (SOI). The DRG code and the SOI level determine the relative weight (RW), which is a ponderation coefficient that reflects the expected HC of a standard patient expressed in relative terms according to the baseline price of the average national patient [19,20]. The higher the SOI, the higher the RW and, consequently, the higher the HC [20].

With the coexistence of multiple serious conditions, the complexity of patients may increase, increasing ROM and SOI values [21] and ultimately increasing RW and HC. The HC, adjusted for the Case Mix Index (a global ponderation coefficient that compares one hospital to another in terms of complexity of its casuistry), represents the hospital reimbursement. In fact, a recent Portuguese study found that most Charlson and Elixhauser comorbidities, when coded, significantly influence SOI level [22]. Because malnutrition is a comorbidity, its diagnosis could be important for obtaining the DRG code, because it would lead to a more accurate representation of the patients' actual ROM and SOI level, ensuring the appropriate hospital reimbursement [13].

Although the financial impact of malnutrition has been studied in several medical and surgical disciplines, knowledge is currently lacking on whether malnutrition is sufficiently identified and coded in internal medicine inpatients, and on how this may affect hospital reimbursement. Therefore in this study we aimed to determine how the malnutrition diagnosis influences the potential hospital reimbursement for patients admitted to an internal medicine ward.

Materials and methods

A cross-sectional study was conducted at the internal medicine ward of Centro Hospitalar do Médio Ave (CHMA), Portugal, between April 24 and May 22, 2018. CHMA is a 2-unit regional hospital, located at Vila Nova de Famalicão and Santo Tirso, with a total of 101 internal medicine beds. A consecutive sampling approach was used, allowing the inclusion of patients admitted to the internal medicine ward in the previous 72 h.

Patients under isolation precautions and patients who were discharged before being approached were considered not eligible for inclusion in the study. Each eligible patient was informed about the study procedures, after which they (or their relative/legal representative) were asked to give their written informed consent.

Nutritional screening and assessment

To screen for malnutrition, the researcher completed the NRS 2002 for every participant, in accordance to national guidelines [23]. The NRS 2002 classifies patients by three items: nutritional status (score of 0–3), defined by recent reduction in food intake, weight loss, and body mass index; severity of disease (score of 0–3), classified as absent, mild, moderate, or severe; and addition of an extra point for patients older than 70 y. Patients with a total NRS 2002 score ≥ 3 were considered to be nutritionally at risk [24].

To apply the screening tool, anthropometric measurements (weight or mid upper arm circumference [MUAC]) were performed according to the techniques of the International Standards of Anthropometric Assessment [25]. Patients who could stand on their feet were weighed with a scale (SECA, model 761), wearing light clothes. For patients who were not able to stand on a scale, the self-reported weight on admission was used. Because of the lack of a stadiometer, height was self-reported or retrieved from the national identification card. As suggested by ESPEN, when body weight could not be measured or reported, or if it was unreliable because of accumulation of fluid, MUAC was used [26]. Therefore, a MUAC < 25 cm was considered equivalent to a body mass index < 20.5 kg/m² [26]. MUAC was measured on the right arm; however, in patients whose right arm was injured or had peripheral vascular accesses, MUAC was measured on the left arm.

The Patient-Generated Subjective Global Assessment (PG-SGA) [27,28], translated and culturally adapted for the Portuguese setting [28] and available from the website www.pt-global.org [29], was used for the diagnosis of malnutrition of patients considered nutritionally at risk using NRS 2002. The patient completed the four boxes of the PG-SGA, which is also referred to as the PG-SGA Short Form (SF). Box 1 assesses the patient's weight history, box 2 evaluates the change in food intake, box 3 refers to the presence of nutrition impact symptoms, and box 4 evaluates activities and functioning. If the patient could not complete the PG-SGA SF, the researcher completed the form. The researcher also completed the five worksheets

of the PG-SGA. Worksheet 1 refers to the scoring of weight loss; worksheet 2 addresses conditions that may increase nutritional requirements; worksheet 3 refers to metabolic stress, such as fever and use of corticosteroids; worksheet 4 includes the physical examination (i.e., scoring muscle status, fat stores, and the presence of edema/ascites), and worksheet 5 provides a global rating from the findings in PG-SGA SF plus the physical examination from worksheet 4. Based on worksheet 5, patients were categorized as well nourished (PG-SGA A), moderate/suspected malnutrition (PG-SGA B), or severely malnourished (PG-SGA C) [27,30].

The following data were retrieved from the medical records: sex, age, comorbidities, and type and dose of medication prescribed. In addition, presence of nutrition impact symptoms was retrieved from the medical records if the patient was not able to complete the PG-SGA SF.

Coding of malnutrition and calculation of hospitalization costs

The APR-DRG groups patients into a specific DRG on discharge, based on age, sex, discharge destination, principal and secondary diagnoses, and clinical procedures coded with the *International Classification of Diseases, 10th revision*, Clinical Modification/Procedure Coding System (ICD-10-CM/PCS) [19,20]. With these data and using coding software by certified medical coders, the DRG code, the SOI, and the ROM were obtained for each patient. SOI relates to "the extent of physiological decompensation or organ system loss of function," whereas ROM relates to "the likelihood of dying" [31]. The DRG in conjunction with ROM is applied to evaluate patient mortality, whereas the DRG in conjunction with SOI is used to evaluate resource use [31].

The RW is obtained from the DRG code and the SOI level, and it reflects the expected HC of a standard patient [19,20]. The higher the SOI, the higher the RW and, consequently, the higher the HC [20]. The Case Mix Index (CMI) is a global ponderation coefficient that compares one hospital with another in terms of the complexity of its casuistry. The CMI is defined as "the number of similar patients from each DRG code, pondered by their RWs and the total number of similar patients from the hospital." The national CMI is 1, so the CMI from each health unit will deviate from this reference value according to the proportion of patients grouped in DRG with higher RW compared with the national standard [19]. The HC, adjusted for the CMI, represents the hospital reimbursement.

To study how malnutrition affects SOI and ROM levels, RW, and HC for the patients diagnosed with malnutrition, two simulations of the calculus of DRG code, SOI, and ROM were performed for each malnourished patient from the subsample: one including the malnutrition diagnosis, and the other not including the malnutrition diagnosis.

The codes from ICD-10-CM/PCS used for malnutrition diagnosis were the E46 for the category "PG-SGA B" and the E43 for the category "PG-SGA C" [5]. The RW and HC for the malnourished patients were obtained from Portuguese Ministerial Directive number 207/2017, according to the DRG and SOI values [20]. The difference between the RW and the HC with and without the malnutrition diagnosis was calculated.

Additionally, the number of patients who were admitted to the internal medicine ward during 2018 was obtained. This was used to calculate the unclaimed potential reimbursement for this hospital (per annum) by extrapolating the difference in the total of HC from this subsample to the number of patients in 1 year.

The medical records from all coded patients were accessed to register their LOS, to determine the number of admissions during the previous year, and to identify referral to the clinical nutritionist.

Ethical approval

The study was approved by the Ethics Committee of CHMA on April 20, 2018 (registration no. SGIS/08/2018) and was performed according to the Helsinki Declaration [32].

Statistical analysis

Data were analyzed using IBM SPSS Statistics Version 25.0 for Windows. Results were considered significant when $P < 0.05$. Skewness, kurtosis, and the Kolmogorov-Smirnov test were used to evaluate normality of data. Descriptive analyses were conducted for the sociodemographic and nutritional status characterization of the study sample. Categorical variables were reported as frequencies, and continuous variables were expressed as mean $\pm$ standard deviation for normally distributed data or median and interquartile range (IQR) for nonnormally distributed data or ordinal variables. Differences between well-nourished (PG-SGA A) and malnourished patients (PG-SGA B and C) were compared using χ^2 statistics for sex and number of patients with readmissions during the previous year. Fisher's exact test was used to compare the number of patients referred to the clinical nutritionist. Student's *t* test for independent samples was used to test for differences for normally distributed data (age). Nonnormally distributed data (LOS) were compared using the Mann-Whitney test. Finally, the Wilcoxon test was used to test for differences in ROM and in SOI levels with and without malnutrition diagnosis.

Results

Nutritional status of the participants

The consecutive sampling approach resulted in 188 potential participants. Twenty-one patients under isolation precautions and 12 patients who were discharged before being approached were not included, resulting in 155 patients invited to participate. From the invited patients, 23 did not agree on giving written informed consent, and 3 had missing data, resulting in a total of 129 study participants.

According to NRS 2002, 71% ($n = 92$) of participants were at risk of malnutrition (≥ 3 points). Of these, 86% ($n = 79$) were malnourished: 67% ($n = 53$) had moderate/suspected malnutrition (PG-SGA B) and 33% ($n = 26$) were severely malnourished (PG-SGA C), as depicted in Figure 1.

The nutritional assessment findings using PG-SGA are depicted in Table 1. The highest score was found in box 3, indicating the high prevalence of nutrition impact symptoms in the 2 wk before admission. Median PG-SGA scores were ≥ 9 , indicating that a high percentage of patients are in critical need for improved symptom management and nutrient intervention options.

Characteristics of the participants according to their nutritional status are shown in Table 2. No statistically significant differences were found in sociodemographic characteristics, LOS, readmissions, and the frequency of clinical nutritionist referral between well-nourished and malnourished patients.

Coding of malnutrition and assessment of hospitalization costs

The effect of the inclusion of malnutrition diagnosis in the ROM level is shown in Table 3. ROM level increased ($P < 0.001$) for 15 of the 79 malnourished patients (19%) after the inclusion of malnutrition diagnosis.

SOI level increased ($P < 0.001$) for 31 of the 79 malnourished patients (39%) had their after the inclusion of the malnutrition diagnosis (Table 4).

In malnourished patients without change in SOI level, the difference in the results of RW and HC with and without the inclusion of malnutrition diagnosis was zero. For patients who had their SOI level increased, the results are shown in Table 5.

Fig. 1. Flowchart for the determination of Diagnosis-Related Group code, severity of illness and risk of mortality level, relative weight, and hospitalization cost. HC, hospitalization costs; NRS 2002, Nutritional Risk Screening 2002; PG-SGA, Patient-Generated Subjective Global Assessment; PG-SGA A, well nourished; PG-SGA B, moderate/suspected malnutrition; PG-SGA C, severely malnourished; SOI, Severity of Illness; ROM, risk of mortality; RW, relative weight.

Table 1

Scores of the PG-SGA boxes and worksheets

Boxes/worksheets (score range, points)	Median (IQR)
Box 1: weight (0–5)	2 (1–4)
Box 2: food intake (0–4)	1 (1–4)
Box 3: symptoms*	6 (4–9)
Box 4: activities and function (0–3)	3 (3–3)
Worksheet 1: scoring weight loss (see box 1)	
Worksheet 2: disease and its relation to nutritional requirements (0–7)	1 (1–2)
Worksheet 3: metabolic demand (0–6)	1 (0–3)
Worksheet 4: physical examination (0–3)	2 (1–3)
PG-SGA score	17 (13–22)

IQR, interquartile range; PG-SGA, Patient-Generated Subjective Global Assessment

*Box 3 has no maximum scores because all reported symptoms are scored.

During 2018, the internal medicine ward from CHMA had 3191 hospitalized patients. Therefore by extrapolating the results presented in Table 5 to the annual patient population, the total annual HC for patients admitted to the internal medicine ward during 2018 was €1 297 011.

Discussion

In this study we found that diagnosing malnutrition in internal medical wards largely increases calculated HC and potential hospital reimbursement. In our studied population, the inclusion of malnutrition diagnosis increased ROM and SOI level, resulting in an increased HC of around €52 433. Given that the recognition of malnutrition is poor in CHMA, the increase in HC when malnutrition diagnosis is included in the patient codification corresponds to unclaimed potential reimbursements for the hospital. Therefore this inclusion could mean an annual increase of HC of €1 297 011. Considering that hospital reimbursement is dependent of the HC and CMI, the use of NRS 2002 to identify patients at risk, followed by adequate nutritional assessment, documenting, and coding, increases potential hospital reimbursement.

Our findings are in line with another Portuguese study performed in 469 patients admitted to two public hospitals. This study, with a prevalence of 42% of malnourished patients, found that disease-related malnutrition was responsible for an increase of about 20% of HC [33]. Although worldwide many other types of hospital reimbursement systems exist [17,18], our results can be considered generalizable. In fact, similar studies in other countries and settings [7,11,12,15,16], using other DRG funding systems, found great financial shortfalls to hospitals when malnutrition was not included for coding. An Australian study on medical and surgical patients estimated an unclaimed potential annual reimbursement of more than €5 000 000 [7]. A German study in gastroenterology patients found an annual financial loss of €35 280 as a result of unrecognized malnutrition [15]. An American retrospective audit of patient medical charts also reported a loss of more than €77 000 [16]. Moreover, a Canadian prospective study involving medical and surgical patients found that malnutrition at admission increased total costs by 31% to 38%, depending on the severity of malnutrition [10]. This is in accordance with the concept of reimbursement systems, because adding the malnutrition diagnosis increases the complexity of patients, increasing HC and, consequently, hospital reimbursement.

In the present study, a fair number (12%) of the malnourished patients had an increased ROM level. Although we did not determine mortality rate in the present study, the increased ROM is considered plausible because multiple studies have reported that malnutrition contributes to an increased risk of mortality during hospitalization and after discharge [1,4,8,9]. Malnutrition diagnosis

Table 2
Characterization of patients according to their nutritional status

	Total (n = 129)	Well nourished (n = 50)	Malnourished (n = 79)	P
Male sex, n (%)	73 (56.6%)	28 (56.0%)	45 (57.0%)	0.914
Age (y), mean $\pm$ SD	76.20 $\pm$ 13.57	73.76 $\pm$ 13.99	77.75 $\pm$ 13.15	0.104
LOS (d), median (IQR)	9 (6–17)	8 (6–13)	10 (7–18)	0.073
Readmitted during previous year, n (%)	37 (28.7%)	15 (30.0%)	22 (27.8%)	0.792
Referred to clinical nutritionist, n (%)	13 (10.1%)	3 (6.0%)	10 (12.7%)	0.368

IQR, interquartile range; LOS, length of stay; SD standard deviation.

Table 3
Risk of mortality level with and without the malnutrition diagnosis in malnourished patients (n = 79)

	ROM level with malnutrition (n)				Total
	1	2	3	4	
ROM level without malnutrition (n)	1	5*	4 [†]	0 [†]	9
	2	—	20*	8 [†]	28
	3	—	—	32*	35
	4	—	—	7*	7
Total	5	24	40	10	79

ROM, risk of mortality.

*Number of patients whose ROM level with malnutrition is equal to their ROM level without malnutrition.

[†]Number of patients whose ROM level with malnutrition is higher than their ROM level without malnutrition.

also increased SOI level in 39% of the malnourished patients, leading to an increase in HC, a finding in agreement with previous literature [4,6–8,10]. In the remaining malnourished patients, ROM or SOI level did not increase, which could be explained by the fact that they already were at the maximum ROM or SOI level, or that the inclusion of malnutrition was not sufficient to increase those levels.

This study indicates that the prevalence of both nutritional risk by NRS 2002 and malnutrition by PG-SGA at hospital admission in an internal medicine ward of a regional Portuguese hospital are high. These results are similar to recent findings [3], but higher than older findings [2]. This can be explained by the aging of the population [34], which has been found to be a risk factor for malnutrition [4,8,35,36]. Also, our higher prevalence rates could be explained by differences in methodology, such as the tools used and population studied. The inclusion of a large number of nutrition impact symptoms in the PG-SGA compared with other nutritional assessment tools may contribute to a higher proportion of patients categorized as malnourished. In fact, the highest PG-SGA scores were found in box 3, indicating a high prevalence of nutrition impact symptoms before admission. Furthermore, although our study focuses only on internal medicine patients, most other studies also included surgical patients, who can have different age ranges and comorbidities, with lower rates of malnutrition [37].

This high prevalence of malnutrition and its risk corroborates the need for a systematic malnutrition screening program. Screening for malnutrition has previously been highly recommended [24,26,36,38–41], and it is a required procedure for hospital accreditation [36]. Nutritional screening is already mandatory in countries like the United Kingdom, the United States, the Netherlands, and Denmark [36]. In Portugal, an Order of Minister 6634/2018 was published in *Diário da República* (Official Journal of Portugal) on July 6, 2018 [23], stating that all hospitalized adult patients with an LOS longer than 24 h will have to be screened with NRS 2002 by a multidisciplinary team. When this study was performed, routine screening and assessment for malnutrition had not been implemented in CHMA, and, taking into account the

Table 4
Severity of illness level with and without the malnutrition diagnosis in malnourished patients (n = 79)

	SOI level with malnutrition (n)				Total
	1	2	3	4	
SOI level without malnutrition (n)	1	0	3*	1*	4
	2	—	8 [†]	18*	26
	3	—	—	32 [†]	41
	4	—	—	8 [†]	8
Total	0	11	51	17	79

SOI, Severity of Illness.

*Number of patients whose SOI level with malnutrition is higher than their SOI level without malnutrition.

[†]Number of patients whose SOI level with malnutrition is equal to their SOI level without malnutrition.

number of clinical nutritionist referrals by its physicians, our findings indicate poor recognition of malnutrition. Thus malnutrition remains underrecognized, underdiagnosed, and underdocumented [7,11]. This compromises not only the patient's treatment and, consequently, clinical outcomes but also the scores of ROM and SOI, increasing the unclaimed potential reimbursement as a result of the lack of malnutrition diagnosis in the medical records [7,11,12,42].

However, the implementation of nutritional screening and assessment is considered challenging [11,36]. Studies have recognized insufficient nutrition-related education, time, and monetary resources; lack of support from other staff members; and lack of clearly defined responsibilities among the medical team as the main difficulties to implement screening and assessment tools for malnutrition [11,43,44]. Therefore, when implementing a malnutrition program, an education program and communication among several health care professionals will be required to overcome possible gaps [45].

The results of our study have various implications for clinical practice. Diagnosing and coding malnutrition may help compensating the costs associated with malnutrition by increasing hospital reimbursement. However, this increase in reimbursement may not fully compensate these associated costs, regardless of the country. A German study found that coding malnutrition increased total reimbursement by 8.3% [15], but a subgroup analysis indicated that the direct costs for nutritional interventions were not fully covered by additional coding of malnutrition. Another German

Table 5
Difference in relative weight and hospitalizations costs after the inclusion of malnutrition diagnosis in the malnourished patients with increased SOI level

Difference in RW and HC as a result of increased SOI level	
In RW per patient, mean $\pm$ SD	0.74 $\pm$ 0.45
In HC per patient, mean $\pm$ SD	€1691 $\pm$ 1017
In total HC	€52 433

HC, hospitalization costs; RW, relative weight; SD, standard deviation; SOI, Severity of illness.

study found that the continuous downgrading of diagnosis-related severity resulted in an inability to reimburse the additional cost of malnourished patients [46]. Nevertheless, in an era where every euro counts, we should make an effort to optimize hospital revenue. We have found that one way of doing that is by coding malnutrition. Additionally, it has been reported that nutritional intervention with fortified food [47,48] and nutritional supplementation is cost effective [49–51] by lowering complications and reducing the increased length of stay associated with malnutrition. Therefore, diagnosing, coding, and treating malnutrition has an obvious clinical benefit for malnourished patients and for the hospitals by increasing hospital revenue. Another positive implication for practice is that accurate documentation of nutritional status contributes to the epidemiologic knowledge necessary for the implementation of nationwide measures to tackle malnutrition. The true determination of malnutrition prevalence may justify the need for additional nutritionists in hospital wards. This increased expense would be compensated for by the increased reimbursement set forward by correctly coding malnutrition. Ultimately, this approach would lower adverse clinical outcomes and mortality and improve functional status and quality of life [52]. Future studies should, however, aim to determine the cost of screening, assessing, and treating malnutrition to obtain a more accurate financial picture of this problem.

This study has some limitations worth acknowledging. First, our study is limited to internal medicine patients, which likely underestimates total hospital reimbursement. Second, patients under isolation precautions may be more frail, with more comorbidities and increased probability of being malnourished. Excluding them from our study could have underestimated the prevalence of malnutrition and HC. Third, the relatively small number of patients included may limit extrapolation of the results. Additionally, for the annual extrapolation of the potential unclaimed reimbursement, the seasonality and annual variability of hospital admission was not considered. This could under- or overestimate the results of the unclaimed reimbursement per year because of potential differences in number of admissions [53].

Conclusions

In conclusion, we found that the inclusion of the highly prevalent malnutrition diagnosis in medical records increases calculated HC, increasing the potential hospital reimbursement, which may indirectly contribute to the quality of patient care and to the economic sustainability of hospitals.

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