Original Article

High Prevalence of Malnutrition and Nutrition Impact Symptoms in Older Patients With Cancer: Results of a Brazilian Multicenter Study

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BACKGROUND: Malnutrition in cancer is an independent factor associated with negative clinical outcomes. The objective of this study was to evaluate the prevalence of malnutrition across different age groups in patients with cancer in Brazil and to identify associations with nutrition impact symptoms (NIS). **METHODS:** In this observational, cross-sectional, multicenter study, the authors evaluated 4783 patients with cancer aged ≥20 years who were admitted to 45 public hospitals in Brazil. Nutritional status, nutritional risk, and NIS were evaluated using the Patient-Generated Subjective Global Assessment. **RESULTS:** More than one-fourth (25.5%) of all participants were aged ≥65 years. In patients aged ≥65 years, the prevalence of moderate/suspected and severe malnutrition was 55%, it was 45.4% in those aged 51 to 64 years, and it was 36.1% in those aged ≤50 years. Among the NIS with a higher risk of occurrence in patients aged ≥65 years were no appetite (odds ratio [OR], 1.90; 95% CI, 1.62-2.22; $P < .05$) and dry mouth (OR, 1.40; 95% CI, 1.1-1.67; $P < .05$). In patients between ages 51 and 64 years, compared with those aged ≤50 years, the NIS with a higher risk of occurrence were no appetite (OR, 1.45; 95% CI, 1.23-1.69; $P < .05$), dry mouth (OR, 1.22; 95% CI, 1.02-1.45; $P < .05$), and problems with swallowing (OR, 1.56; 95% CI, 1.25-1.96; $P < .05$). **CONCLUSIONS:** The prevalence of malnutrition and the occurrence of NIS are high in hospitalized Brazilian patients aged ≥65 years who have cancer. The occurrence of NIS was higher in the population aged >50 years than in those aged ≤50 years. Nutritional screening and assessment should be performed immediately after hospitalization to enable early diagnosis and multidisciplinary or interdisciplinary intervention(s). ***Cancer* 2019;0:1-9**. © *2019 American Cancer Society.*

KEYWORDS: malnutrition, nutrition impact symptoms, nutritional risk, nutritional screening, older adult, Patient-Generated Subjective Global Assessment (PG-SGA).

INTRODUCTION

The world is experiencing a unique and irreversible demographic transition process that will result in an increasingly older adult population.[1] The World Health Organization defines older adults as persons aged ≥65 years in developed countries and aged ≥60 years in developing countries. Moreover, the worldwide proportion of persons aged ≥60 years is growing faster than any other age group: it was 841 million in 2013 and is forecast to reach approximately 2 billion by 2050, when it will represent 21% of the world population.[2] The Brazilian older adult population is also increasing and it is expected that, by 2025, this group will comprise 14% of the Brazilian population.[3]

With aging, changes in body composition occur, resulting in a reduction in lean body mass among older adults. International and Brazilian studies have shown that these changes may alter muscular strength, functionality, and independence in this population.[4-8] In the aging process, senescent cells accumulate over time, and increases in the number of these cells contribute to the late decay of tissues and organs and the emergence of age-related diseases, including cancer.[9-11] Epidemiological studies have shown that more than one-half of the diagnoses of and deaths from cancer occur in individuals aged ≥65 years.[12,13]

Patients with cancer have a high risk of malnutrition.[14-18] It is estimated that the prevalence of malnutrition ranges from 38.7% to 61.2% in adult patients with cancer, depending on the type of cancer and cancer stage. In a previous study, we showed that, in older patients with cancer (aged ≥65 years), the prevalence of malnutrition was as high as that reported in the literature (55%).[18] The main factors involved in the development of malnutrition in these patients are

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metabolic abnormalities and nutrition impact symptoms (NIS), which can be related to the tumor itself or can occur as side effects of anticancer treatment.[19,20] Aging promotes changes in body composition, metabolic and physiological changes, and reduced functional capacity,[21] making older patients with cancer who are undergoing oncological treatment more vulnerable, resulting in increased morbidity and mortality.[22-25]

Currently, the prevalence of malnutrition among older Brazilians with cancer and the prevalence of NIS as risk factors for malnutrition in these patients is unclear. We hypothesized that the prevalence of malnutrition and NIS would be greater in older versus younger adult patients with cancer. Therefore, in the current multicenter study, our objective was to evaluate the prevalence of malnutrition across different age groups among patients with cancer in Brazil and to identify associations with NIS.

MATERIALS AND METHODS

Study Design

The Brazilian Survey of Oncology Nutrition is a hospital-based, multicenter, cross-sectional study of patients with newly diagnosed cancer who were admitted between August and November 2012 to 45 different public hospitals in Brazil.[26]

Patients

Patients who met the following inclusion criteria were considered eligible to participate in the study: adults (age ≥20 years) admitted to hospital with a confirmed diagnosis of cancer. Patients were included after agreeing to participate in the study and signing the informed consent form. Patients who were admitted to intensive care units, in a coma, mentally handicapped, and unable to independently complete the Patient-Generated Subjective Global Assessment (PG-SGA) questionnaire were not included in the study.

The project complied with ethical principles and was approved by the Research Ethics Committee of the National Cancer Institute Jose Alencar Gomes da Silva under registration number 34746/2012.

Assessment of Malnutrition Risk and Malnutrition

Nutritional assessment was performed using the PG-SGA,[27] which was adapted cross-culturally and validated for use in the Brazilian Portuguese setting.[28,29] The PG-SGA was applied during the first 24 hours of hospitalization.

The PG-SGA includes 2 components. The first component, which includes 4 boxes (boxes 1-4) and is also referred to as the PG-SGA Short Form, addresses recent weight history (maximum score, 5), food intake (maximum score, 4), NIS (maximum score, 24), and activities/function capacity (maximum score, 3) and was completed by the patient. The second component was completed by a trained nutritionist and includes 5 worksheets that address: 1) weight loss percentage and score; 2) disease and age and their relation to nutritional requirements; 3) metabolic stress, including fever and the use of corticosteroids; and 4) physical examination, including a loss/deficit of subcutaneous fat, muscle, and the presence of edema or ascites. Upon completion, the patient was classified as being well nourished (stage A), having moderate or suspected malnutrition (stage B), or being severely malnourished (stage C), as guided by Worksheet 5 from the questionnaire. The total PG-SGA numerical score (ie, the sum of all boxes and worksheets)[28-30] provides a score to guide the nutritional interventions as follows:

- A score between 0 and 1 indicates that no intervention is required at this time and re-assessment on a routine and regular basis during treatment;
- A score between 2 and 3 indicates patient and family education by a dietitian, nurse, or other clinician with pharmacologic intervention as indicated by symptom survey and laboratory values, as appropriate;
- A score between 4 and 8 indicates the need for intervention by a dietitian in conjunction with a nurse or physician, as indicated by symptoms; and
- A score ≥9 indicates a critical need for improved symptom management and/or nutrient intervention options.

According to the PG-SGA numerical score, malnutrition risk was categorized as follows: from 0 to 3 points indicates low risk; 4 to 8 points, medium risk; and 9 to 36 points, high risk.[30]

Evaluation of NIS, Body Weight, and Food Intake

Information regarding cancer location, age, and sex was retrieved from the medical records. Cancer location was categorized by 9 groups according to prevalence and nutrition impact (intestine [small intestine, colon, rectum, anus, anal canal], upper digestive cancer [stomach, esophagus, pancreas, and liver], breast, gynecological, head and neck, lung, lymphoma, leukemia, and other). Prostate cancer, thyroid cancer, parathyroid cancer, parotid cancer, cancer of the urinary system, skin cancer, cancer of bone

TABLE 1. Prevalence of Malnutrition in the 5 Regions of Brazil

Region	Total No.[a]	No. of Participants (%)[b]	Well Nourished, Stage A, %	Suspected/Moderate Malnutrition, Stage B, %	Severely Malnourished, Stage C, %	Malnourished, Stage B + C, %
All Areas	N = 35,549	N = 4783 (13.5)	54.7	33.5	11.8	45.3
South-East	17,397	1710 (9.8)	50.9	34.2	14.9	49.1
South	8144	700 (8.6)	52.6	36.7	10.7	47.4
North-East	6739	1.608 (23.9)	61.3	30.3	8.4	38.7
North	957	134 (14.0)	38.8	29.9	31.3	61.2
Central-West	2312	631 (27.3)	54.4	36.6	9.0	45.6

[a]Values indicate the frequency of oncology population hospitalized in Brazil in November 2012.
[b]Values are for the oncology population admitted to the institutions that participated in the study in November 2012.

and connective tissue, cancer in other abdominal locations, cancer of the penis or testes, cancer of the central nervous system, Hodgkin disease, and cancer not specified in the medical record were all categorized as *other*.

Statistical Analysis

The Kolmogorov-Smirnov test was used to test the sample distribution. Descriptive data analysis was performed using central tendency and dispersion measures. Mean and SD values were used for normally distributed variables, median and interquartile range values were used for not normally distributed numerical variables, and frequency (number) and percentage (%) were for categorical data.

The Bonferroni post hoc tests were performed to evaluate power of the sample size to detect differences in the prevalence of malnutrition in hospitalized patients with cancer from all 5 regions of Brazil. With a sample size of at least 525 patients per region, the study has a power of 95% to detect differences in prevalence of malnutrition in hospitalized patients with cancer on the order of 38.7% to 47.4% among large geographic regions, except the North Region (Table 1).

Numerical PG-SGA data are presented as median and interquartile ranges (quartiles 1-3). The association between cancer characteristics, NIS, and the PG–SGA score was evaluated across 3 age groups (ages ≤50, 51-64, and ≥65 years), applying the Kruskal-Wallis test and the Dunn multiple comparisons test.

Categorical data are presented as frequency (number) and percentage (%), and categories were compared using the chi-square test. Binary logistic regression was applied to assess the strength of the association between age (≤50 [reference category], 51-64, and ≥65 years) and the presence of malnutrition and NIS. The Spearman correlation coefficient was used to verify a direct correlation between age (in years) and the total PG–SGA score (in points).

Statistical analysis was performed using the SAS software package, version 6.11 (SAS Institute Inc). The criterion for determining significance was $P < .05$.

RESULTS

In total, 4783 patients with cancer were included in this study, which represents 13.5% of the total number of patients with cancer (n = 35,549) hospitalized in November 2012 at public hospitals in Brazil. Of the patients included in the study, 2504 (52.4%) were women. The mean ± SD age of patients included in the study was 56.7 ± 14.6 years, of which 1606 (33.6%) were aged ≤50 years, 1686 (35.2%) were between ages 51 and 64 years, and 1491 (31.2%) were aged ≥65 years. In the group aged ≥65 years, most were men (57.1%); whereas, in the group aged ≤50 years, most were women (64.1%).

The prevalence of malnutrition (stage B, moderate/suspected malnutrition; stage C, severely malnourished) was 45.3%. The prevalence of malnutrition was greater in patients aged ≥65 years (55%) than in the other age groups (36.1% in those aged ≤50 years and 48.4% in those aged 54-64 years; $P < .001$). Patients who had PG-SGA scores ≥9 (n = 2188; 45.7%) had a higher prevalence of NIS, with no appetite being the most prevalent (58.1%), followed by nausea (38.3%), dry mouth (37.1%), and vomiting (26%).

The prevalence of NIS according to tumor type is provided in Table 2. The prevalence of having no appetite varied from 21.8% to 44.6% and was more prevalent in patients with lung cancer (odds ratio [OR], 2.88; 95% CI, 2.06-4.04; $P < .001$), followed by nausea, which was more prevalent in patients with gynecological cancer (11.6%-27.9%; OR, 2.13; 95% CI, 1.63-2.79; $P < .001$). Patients with upper digestive cancer had higher ORs for vomiting (OR, 3.07; 95% CI, 2.18-4.33; $P < .001$) and dry month (OR, 1.69; 95% CI, 1.25-2.28; $P < .001$). The high prevalence of problems with swallowing was remarkable in

TABLE 2. Prevalence of Nutrition Impact Symptoms According to the Type of Tumor

Nutrition Impact Symptoms	Tumor Type, No. (%)									
	Total, n = 4783	Intestine, n = 760	Gynecological, n = 580	Upper Digestive, n = 375	Head/ Neck, n = 353	Lung, n = 193	Lymphoma, n = 168	Leukemia, n = 168	Other, n = 1512	Breast, n = 674
No appetite	1374 (28.7)	245 (32.2)	203 (35.0)	137 (36.5)	81 (22.9)	86 (44.6)	68 (40.5)	58 (34.5)	349 (23.1)	147 (21.8)
Nausea	949 (19.8)	191 (25.1)	177 (30.5)	114 (30.4)	41 (11.6)	52 (26.9)	38 (22.6)	32 (19.0)	189 (12.5)	115 (17.1)
Vomiting	590 (12.3)	115 (15.1)	118 (20.3)	95 (25.3)	32 (9.1)	36 (18.7)	21 (12.5)	10 (6.0)	96 (6.3)	67 (9.9)
Diarrhea	223 (4.7)	83 (10.9)	30 (5.2)	21 (5.6)	7 (2.0)	9 (4.7)	12 (7.1)	6 (3.6)	33 (2.2)	22 (3.3)
Mouth sores	208 (4.3)	26 (3.4)	16 (2.8)	13 (3.5)	63 (17.8)	5 (2.6)	14 (8.3)	14 (8.3)	34 (2.2)	23 (3.4)
Things taste funny or have no taste	687 (14.4)	146 (19.2)	123 (21.2)	60 (16.0)	27 (7.6)	38 (19.7)	35 (20.8)	26 (15.5)	141 (9.3)	91 (13.5)
Smells bother me	720 (15.1)	165 (21.7)	139 (24.0)	67 (17.9)	23 (6.5)	46 (23.8)	36 (21.4)	32 (19.0)	137 (9.1)	75 (11.1)
Problems swallowing	531 (11.1)	42 (5.5)	39 (6.7)	116 (30.9)	142 (40.2)	37 (19.2)	12 (7.1)	8 (4.8)	98 (6.5)	37 (5.5)
Feel full quickly	722 (15.1)	136 (17.9)	123 (21.2)	94 (25.1)	18 (5.1)	37 (19.2)	32 (19.0)	32 (19.0)	169 (11.2)	81 (12.0)
Dry mouth	975 (20.4)	187 (24.6)	143 (24.7)	102 (27.2)	69 (19.5)	47 (24.4)	44 (26.2)	42 (25.0)	219 (14.5)	122 (18.1)

TABLE 3. Demographic Variables and Location of Cancer According to Age Group in Hospitalized Adult and Older Adult Patients With Cancer

Variable	Total, n = 4783	Age Group			P[a]
		≤50 Years, n = 1606	51-64 Years, n = 1686	≥65 Years, n = 1491	
Sex, %					
Men	51.4	35.9	50.5	57.1	<.0001
Women	48.6	64.1	49.5	42.9	
Cancer site, %					
Head/neck	7.4	5.0	10.1	6.9	<.0001
Upper digestive cancer	7.8	5.2	10.3	7.9	
Intestine	15.9	14.4	17.1	16.0	
Lung	4.0	2.1	5.1	4.9	
Gynecological	12.1	17.1	11.2	7.8	
Breast	14.1	19.8	13.3	8.9	
Lymphoma	3.5	4.7	3.3	2.4	
Leukemia	3.5	5.4	2.3	2.9	
Other	31.6	26.2	27.3	42.3	
PG-SGA categories, no. (%)					
Stage A, well nourished	2618 (54.7)	63.9	54.6	45.0	<.001
Stage B, moderate/suspected malnutrition	1601 (33.5)	27.6	32.9	40.4	
Stage C, severely malnourished	564 (11.8)	8.5	12.5	14.6	
No. of nutrition impact symptoms, %					
>3	20.7	19.9	21.5	20.6	.0002[c,d]
1-3	36.5	33.9	35.3	40.8	
None	42.8	46.2	43.2	38.6	

Abbreviation: PG-SGA, Patient-Generated Subjective Global Assessment.
[a]Categorical data were compared using the chi-square test, and numerical data were compared using a Kruskal-Wallis analysis of variance and the Dunn multiple comparisons test.
[b]$P < .05$ for patients aged ≤50 years versus 51 to 64 years.
[c]$P < .05$ for patients aged ≤50 years versus ≥65 years.
[d]$P < .05$ for patients aged 51 to 64 years versus ≥65 years.

patients who had head and neck cancer at 40.2% (OR, 11.59; 95% CI, 7.81-17.8; $P < .001$).

The distributions of cancer localization, nutritional status, and the presence of NIS across age groups are presented in Table 3. Most patients in the group aged >50 years were women, which explains the high prevalence of breast and gynecological cancers. In patients aged ≥50 years, head and neck, digestive, and upper lung cancers are more prevalent. The presence of >3 symptoms of nutritional impact also was more prevalent

TABLE 4. Nutrition Impact Symptoms and Patient-Generated Subjective Global Assessment Scores According to Age Group[a]

Variable	Total, n = 4783	Age Group			*P*
		≤50 Years, n = 1606	51-64 Years, n = 1686	≥65 Years, n = 1491	
Nutrition impact symptoms, %					
No appetite	28.7	22.2	29.2	35.1	<.001
Nausea	19.8	20.9	20.3	18.2	.14
Vomiting	12.3	12.6	13.4	10.9	.088
Diarrhea	4.7	4.2	4.4	5.4	.23
Mouth sores	4.3	3.6	4.7	4.8	.20
Things taste funny or have no taste	14.4	13.5	15.4	14.2	.31
Smells bother me	15.1	16.0	15.3	13.7	.20
Problems swallowing	11.1	8.6	12.8	11.9	.0003[b,c]
Feel full quickly	15.1	16.9	14.7	13.7	.038[c]
Dry mouth	20.4	17.6	20.6	23.1	.0008[c]
Pain	16.1	16.7	16.9	14.6	.15
Quartiles 1-3	7 (3-15)	6 (2-13)	7 (2-16)	9 (4-17)	<.001
Weight and activity/function, %					
Weight loss, box 1	43.6	39.7	44.3	47.1	.0001[b,c]
Decreased activity/function, box 4	13.2	10.3	14.0	15.4	.0001[b,c]

Abbreviation: box 1, the first box on the Patient-Generated Subjective Global Assessment (PG-SGA) questionnaire; box 4, the fourth on the PG-SGA questionnaire.
[a]Categorical data were compared using the chi-square test, and numerical data were compared using a Kruskal-Wallis analysis of variance and the Dunn multiple comparisons test.
[b]$P < .05$ for patients aged <50 years versus 51 to 64 years.
[c]$P < .05$ for patients aged ≤50 years versus ≥65 years.
[d]$P < .05$ for patients aged 51 to 64 years versus ≥65 years.

(21.5%) in individuals aged 51 to 64 years; whereas, in individuals aged ≥65 years, the presence of 1 to 3 NIS was more prevalent (40.8%; $P < .001$).

Table 4 shows that the prevalence of no appetite (35.1%) and dry mouth (23.1%) was significantly higher in patients aged ≥65 years than in the other 2 age groups. Compared with patients aged ≤50 years, those between ages 51 and 64 years had a significantly higher prevalence of the following NIS: problems swallowing (12.8%), reduced food intake (51.1%), and no appetite (29.2%). Patients aged ≥65 years had significantly higher PG-SGA total scores compared with the other age groups. There was a weak but significant correlation (r) between age and the total PG-SGA numerical score ($r = 0.160$; $P < .0001$) in the total sample (n = 4783).

A higher prevalence of weight loss was reported by older patients compared with less elderly patients at 47.1%, 44.3%, and 39.7% for those aged ≥65 years, between 51 and 64 years, and ≤50 years, respectively ($P < .001$). We also observed that 15.4%, 14%, and 10.3% of individuals aged ≥65 years, between 51 and 64 years, and ≤50 years, respectively, reported a reduction in activity and function.

Patients aged ≥65 years had a significantly higher risk of the occurrence of NIS compared with those aged ≤50 years. These symptoms were: no appetite, problems

TABLE 5. Odds Ratios and Confidence Intervals for Clinical and Nutritional Outcomes in Hospitalized Adults and Older Adult With Cancer

Clinical and Nutritional Outcomes	OR (95% CI)[a]	
	Ages 51-64 vs ≤50 Years	Ages ≥65 vs ≤50 Years
At least 1 nutrition impact symptom	1.13 (0.98-1.30)	1.36 (1.18-1.57)[b]
>3 Nutrition impact symptoms	1.10 (0.93-1.30)	1.04 (0.87-1.24)
No appetite	1.45 (1.23-1.69)[b]	1.90 (1.62-2.22)[b]
Nausea	0.97 (0.82-1.15)	0.84 (0.71-1.01)
Vomiting	1.08 (0.88-1.32)	0.85 (0.68-1.06)
Diarrhea	1.04 (0.74-1.45)	1.30 (0.93-1.81)
Mouth sores	1.31 (0.93-1.85)	1.33 (0.94-1.90)
Things taste funny or have no taste	1.16 (0.96-1.41)	1.06 (0.86-1.29)
Smells bother me	0.95 (0.79-1.14)	0.84 (0.69-1.02)
Problems swallowing	1.56 (1.25-1.96)[b]	1.43 (1.13-1.81)[b]
Feel full quickly	0.85 (0.70-1.02)	0.78 (0.64-0.95)[b]
Dry mouth	1.22 (1.02-1.45)[b]	1.40 (1.18-1.67)[b]
Pain	1.02 (0.85-1.22)	0.85 (0.70-1.03)
Severely malnourished: PG-SGA stage C	1.55 (1.23-1.94)[b]	1.84 (1.47-2.31)[b]
Malnourished: PG-SGA stage B + C	1.47 (1.28-1.69)b	2.16 (1.87-2.50)[b]
Weight and activity/function		
Weight loss	1.21 (1.05-1.39)[b]	1.35 (1.17-1.56)[b]
Decreased activity/function	1.42 (1.15-1.76)[b]	1.58 (1.28-1.96)[b]

Abbreviations: OR, odds ratio; PG-SGA, Patient-Generated Subjective Global Assessment.
[a]Binary logistic regression analysis was conducted with the group aged ≤50 years as the reference.
[b]$P < .05$.

swallowing, and dry mouth. The group aged ≥65 years also had a significantly greater risk of occurrence of severe malnutrition and any degree of malnutrition (stage B and C) (Table 5).

Compared with patients aged ≤50 years, those between ages 51 and 64 years appeared to have a significantly greater risk of the occurrence of the following NIS: problems swallowing, no appetite, and dry mouth. These patients had a higher probability of severe malnutrition, and any degree of malnutrition (stage B and C).

Patient aged ≥65 years and ages 51 to 64 years had a significantly higher risk of weight loss compared with those aged ≤50 years. The same was observed for activity and function, with more limitations in activity and function in older adults and in individuals between ages 51 and 64 years compared with individuals aged ≤50 years (Table 5).

DISCUSSION

To our knowledge, this is the first multicenter study that has assessed the prevalence of malnutrition across different age groups in patients with cancer who were admitted to hospitals in Brazil and has identified associations between age groups and the presence of NIS using the PG-SGA. The results from this study indicate that older hospitalized patients with cancer are at greater risk of being malnourished compared with younger patients with cancer. Interestingly, the prevalence of malnutrition (40.4% moderate/suspected malnutrition and 14.6% severely malnourished) was not only high in the group aged ≥65 years but also was high in the group between ages 51 and 64 years (32.9% moderate/suspected malnutrition and 12.5% severely malnourished). However, in a multicenter, cross-sectional study in Korea, a lower prevalence of malnutrition was found. In that study, with 300 patients recruited in 25 hospitals in Korea, the prevalence of malnutrition was 22%, as assessed by the Subjective Global Assessment. In that study, the prevalence of malnutrition differed between age groups and was significantly higher in older patients (aged ≥70 years) than in the younger age group (38.2% vs 17.2%; $P < .001$).[31]

Furthermore, the current study showed that patients with cancer between ages 51 and 64 years have >3 NIS more often than younger patients. We observed a higher risk for the occurrence of no appetite, problems swallowing, and dry mouth in older patients with cancer compared with those aged ≤50 years. However, in addition to the older patients, the group between ages 51 and 64 years also had a significantly higher probability of the occurrence of the same NIS compared with younger adult patients (aged ≤50 years).

The high prevalence of malnutrition in older, hospitalized adults with cancer found in this study is in line with previous findings. In the current study, the prevalence of malnutrition in the group aged ≥65 years was 55%, of whom 14.6% had severe malnutrition. A study in Brazil with 96 older patients with cancer evaluated by the PG–SGA[32] showed that 29.2% had moderate/suspected malnutrition and 14.6% had severe malnutrition. Among the elderly patients evaluated, 47.9% required critical nutritional intervention. Conversely, another study in patients with cancer that also used the PG-SGA to evaluate nutritional status, in which nearly 50% of the study sample was aged >65 years, showed a higher prevalence of malnutrition than in our study (ie, 65%, of whom 10% were severely malnourished). In that study, 50% of patients had colorectal cancer and the other 50% had mainly lung, gastric, or esophagus cancers.[33] These studies show that both cancer location and patient age are factors that may lead to a higher prevalence of malnutrition and the presence of NIS in this population.

In the current study, no appetite was the most frequent NIS. Although almost one-quarter of patients in the youngest age group (≤50 years) had no appetite, even more than one-third of the oldest age group (≥65 years) had this NIS. Previous findings showed that no appetite is a predicter of weight loss and consequent nutritional risk or malnutrition in adults and older patients.[34] This is in line with findings from 2 recent studies conducted in Japan, which showed that no appetite was the most prevalent symptom in patients with cancer, with a prevalence ranging from 20% to 24.4%.[35,36] However, in 2 other studies conducted in patients with advanced cancer, the prevalence of no appetite varied between 53% and 57%, which is even higher than that found in our study.[37-39]

Nausea was higher in patients with gynecological cancer, and similar findings were reported in a conductive study at Aga Khan University Hospital, Pakistani, where 1 of the most common adverse effects was nausea (33.3%) in patients who received pelvic radiotherapy for gynecological cancer.[40] Conversely, repeated vomiting is 1 of the symptoms used to diagnose upper digestive cancer, because it is considered an alarm symptom.[41] In our study, vomiting also was the most prevalent NIS in patients with upper digestive cancer.

In the current study, problems with swallowing in patients with head and neck cancer was lower than previously reported in the literature. A cross-sectional study

with 95 patients with head and neck cancer who received a combination of surgery, radiotherapy, and chemotherapy reported severe problems with eating or swallowing (50%). In another study in head and neck cancer, patients had been subjected to multiple treatments, either in combination or isolated, and thus had a greater expectation of adverse effects of treatment, including problems with swallowing.[42]

Moreover, the prevalence of dry mouth was significantly higher in older patients compared with those aged ≤50 years. Dry mouth is a common condition in older individuals; it has been associated with increasing age, female sex, and white race,[43,44] and it should be considered in the construction of nutritional therapeutic plans for food-quality adjustments.

The findings from our study have various implications for clinical practice and future research. First, early and systematic assessment, treatment, and monitoring of the various NIS is of utmost importance in all age groups. Having no appetite, which was the most common and prevalent in all age groups in the current study, is likely to result in an insufficient intake of energy and protein, which should be treated with dietary counseling and the use of oral supplements to meet energy and (increased) protein requirements.[45] The timely treatment of patients who have no appetite may prevent weight loss, malnutrition, and other syndromes like sarcopenia and cachexia, which become more prevalent with increasing age.[38,39] Moreover, the high prevalence of both dry mouth and problems swallowing in older adult patients with cancer has implications for the multidisciplinary team. Adapting to the current needs of each patient may require modification of the consistency and content of food and swallowing therapy by a speech therapist.

Second, the high prevalence of NIS observed in all age groups among patients with cancer indicates that, in routine care, it is very important to choose the appropriate tool for the nutritional evaluation of oncological patients to enable the start of a timely and optimal nutritional therapeutic plan. Although various tools have been used to evaluate nutritional status or nutritional risk in patients with cancer, the PG-SGA is not only the most frequently used tool but, together with the Subjective Global Assessment and the Mini-Nutritional Assessment, the PG-SGA is also among the few tools that cover all domains of the construct of malnutrition[46] and is recommended by European Society for Clinical Nutrition and Metabolism.[47] However, of these instruments, the PG–SGA is considered a reference tool in patients with cancer.[30] Moreover, the PG–SGA addresses the highest number of NIS, which can be considered risk factors for malnutrition, such as no appetite, nausea, vomiting, problems swallowing, and other NIS.[18,30,48,49] Identifying the causes of problems with eating (using box 3 on the PG–SGA questionnaire) may facilitate the early prevention or treatment of those impediments, which, in the end, may help prevent malnutrition, or at least prevent the symptoms from getting worse. Therefore, these NIS need to be monitored to avoid unfavorable clinical outcomes in patients of all ages and with the progression of age.[49]

The strengths of the study include the large sample size and that the sample was represented by patients from various regions of Brazil. The limitations of this study are the absence of data on cancer stage, type of treatment, and changes in the prevalence of NIS over time, which is inherent to the cross-sectional study design.

In conclusion, the results of this multicenter study in Brazilian hospitals show that the prevalence of malnutrition is greater in older than in younger adult patients with cancer. Furthermore, patients aged >50 years who have cancer have a higher probability of having NIS of no appetite, dry mouth, and problems swallowing. These results highlight the need for nutritional screening and assessment both for characteristics of malnutrition and for underlying risk factors soon after hospitalization to enable early and multidisciplinary or interdisciplinary interventions.

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CONFLICT OF INTEREST DISCLOSURES

Harriet Jager-Wittenaar was codeveloper of the Patient-Generated Subjective Global Assessment-based Pt-Global app/web tool. The remaining authors made no disclosures.

AUTHOR CONTRIBUTIONS

Nivaldo B. de Pinho: Designed the research (project conception, development of overall research plan, and study oversight), conducted the research, analyzed data, performed statistical analysis, wrote the article, and had primary responsibility for the final content. **Renata B. Martucci:** Designed the research (project conception, development of overall research plan, and study oversight), conducted the research, analyzed data, performed statistical analysis, wrote the article, and had primary responsibility for the final content. **Viviane D. Rodrigues:** Designed the research (project conception, development of overall research plan, and study oversight), conducted the research, analyzed data, performed statistical analysis, wrote the article, and had primary responsibility for the final content. **Cristiane A. D'Almeida:** Designed the research (project conception, development of overall research plan, and study oversight), conducted the research, analyzed data, performed statistical analysis, wrote the article, and had primary responsibility for the final content. **Luiz C. S. Thuler:** Wrote the article and had primary responsibility for the final content. **Claudia Saunders:** Conducted the research, analyzed data, performed statistical analysis, wrote the article, and had primary responsibility for the final content. **Harriet Jager-Wittenaar:** Conducted the research, analyzed data, performed statistical analysis, wrote the article, and had

primary responsibility for the final content. **Wilza A. F. Peres:** Conducted the research, analyzed data, performed statistical analysis, wrote the article, and had primary responsibility for the final content.

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