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Prevalence of malnutrition risk in hospitalized patients: a large nationwide study

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Abstract

Background Malnutrition affects up to 50% of hospitalized patients at admission and is linked to significant adverse outcomes, impacting both patient health and healthcare resources. The aim of this nationwide study was to report the prevalence of malnutrition risk among hospitalized adult patients by Turkish Society of Clinical Enteral and Parenteral Nutrition (KEPAN).

Methods Thirty-three hospitals with nutrition support teams in 29 referral hospitals in 21 different cities were included. The data was collected by web-based NRS-2002 integrated to hospital information system of all participating centers.

Results A total of 191,028 patients (54.6% men) were included. The prevalence of malnutrition risk was found to be 11.6% among all patients and 20.4% in patients older than 65 years (22.8% in 71–80 years and 30.2% in > 80 years). Among clinics, this prevalence was highest in the intensive care units (31.9%), followed by hematology and oncology clinics (25.5%), and neurology clinics (18.7%).

Conclusion There is a considerable risk of malnutrition in hospitalized patients and this risk is more prominent in older patients and in intensive care and oncology clinics.

Keywords Malnutrition risk, Hospitalized patients, Nutrition support teams, NRS-2002

Introduction

Malnutrition is a widespread but often underrecognized issue in hospital settings, affecting patients across various medical disciplines. It arises from multiple factors, including inadequate nutrient intake, impaired nutrient absorption, increased metabolic demands due to acute or chronic illness, and the catabolic effects of systemic inflammation [1]. The consequences of malnutrition are severe and multifaceted, leading to increased susceptibility to infections, impaired immune function, delayed wound healing, progressive muscle loss, prolonged hospital stays, higher rates of rehospitalization, increased healthcare costs, and greater mortality risks. These negative outcomes place a significant burden not only on

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individual patients but also on healthcare systems worldwide [2, 3].

The prevalence of malnutrition in hospitalized patients varies greatly, with reports reaching up to 50%, depending on the screening tools used, patient populations studied, and hospital settings [4, 5, 6]. Despite this high prevalence, malnutrition often remains undiagnosed and untreated. One of the primary challenges in addressing hospital malnutrition is the lack of systematic screening protocols in many healthcare facilities. Without routine assessment, patients at risk of malnutrition may not receive timely nutritional interventions, exacerbating their clinical deterioration. To mitigate these risks, early identification and structured nutritional care must become an integral part of hospital management strategies.

Several screening tools have been developed to identify patients at risk of malnutrition, each with its strengths and limitations. Among them, the Nutritional Risk Screening 2002 (NRS-2002) [7], recommended by the European Society for Clinical Nutrition and Metabolism (ESPEN), is widely used for hospitalized patients [8]. This tool integrates key parameters, including recent weight loss, reduced dietary intake, disease severity, and age-related risk factors, making it a reliable predictor of poor nutritional status. Its structured scoring system allows for quick and effective risk stratification, enabling healthcare professionals to initiate early nutritional support when necessary.

Recognizing the growing need for improved nutritional care, the European Nutrition for Health Alliance (ENHA) launched the Optimal Nutrition Care for All (ONCA) campaign in 2014 [9]. The campaign aims to enhance awareness of disease-related malnutrition and promote the integration of nutritional screening and management into routine clinical practice. Türkiye, as an ONCA participant, has made significant strides in incorporating nutrition care into its healthcare system. However, comprehensive national data on the prevalence of malnutrition risk among hospitalized adults remains limited. To address this gap, the Turkish Society of Clinical Enteral and Parenteral Nutrition (KEPAN) initiated this large-scale nationwide study. The study's objectives were to assess the prevalence of malnutrition risk among hospitalized adults using a standardized screening tool (NRS-2002), identify high-risk patient groups requiring targeted nutritional interventions, and provide evidence to support policy changes that promote mandatory nutrition screening in hospitals.

Methods

Study design

Working meetings, conducted by Turkish Society of Clinical Enteral and Parenteral Nutrition (KEPAN), on the ONCA nutritional screening project of Türkiye was commenced on October 13, 2014 with the participation of the Ministry of Health of Türkiye, Public Hospitals Administration of Türkiye, Public Health Institution of Türkiye, Cancer Department of Türkiye, and Turkish Association of Dietitians. At the beginning of the meetings, 37 hospitals with NSTs (Nutrition Support Teams) from 29 health service areas were identified as the participating centers from each 7 geographical regions of Türkiye. Accordingly, 33 hospitals with these features were determined in 21 provinces of Türkiye (Appendix 1).

On July 28, 2015, the Public Hospitals Administration conducted an educational session for NSTs. Each study center sent a representative team comprising a physician, dietitian, and nurse. This one-day meeting, hosted by the Ministry of Health, covered malnutrition awareness and project implementation details. Also, information about data collection through a web-based registry system was provided. Three months later, evaluation of the data collected in the study centers were started. The centers with low number of data and poor data quality were re-visited and the reasons were investigated.

Written informed consent was obtained from each subject or his/her relative following a detailed explanation of the objectives and protocol of the study which was conducted in accordance with the ethical principles stated in the "Declaration of Helsinki" and approved by the Ankara City Hospital No:1 Clinical Researches Ethics Committee (Reference number/Protocol No: E1/244).

Data collection

The web-based registry system was established based on the NRS-2002 by the web services of the Public Hospitals Administration. Data collection was initiated with the first hospital visit on September 01, 2015 and completed with the last visit on January 15, 2017. Data of the patients regarding demographic features (age and gender), anthropometric features (body weight, height, body mass index [BMI]), and clinical properties (diagnosis, weight loss, and oral intake) were collected (Appendix 2). Patients under the age of 18, pregnant women and those who were hospitalized daily were not included in the study.

Statistical analysis

Statistical analysis was performed using the IBM SPSS Statistics for Windows, Version 25.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were expressed by number and frequencies. Inferential statistics were not used in this study considering the goal was to assess the nationwide prevalence of malnutrition risk rather than to compare individual groups.

Table 1 Patient demographics and clinical characteristics

		(*n* = 191,028)
Age (years), Median (Q1-Q3)		60 (45–71)
Age ≥ 65 years, n (%)		74,802 (39.2)
Gender, n (%)	Women	86,809 (45.4)
	Men	104,219 (54.6)
BMI (kg/m^2), Median (Q1-Q3)		26.29 (23.43–30.05)
BMI Group, n (%)	< 20.50 kg/m^2	15,389 (8.1)
	≥ 20.50 kg/m^2	175,639 (91.9)
Weight loss within last 3 months*, n (%)		25,904 (13.6)
Decreased food intake in the previous week*, n (%)		31,016 (16.2)
Presence of a serious illness*, n (%)		60.013 (31.4)

BMI, Body mass index, *as stated in NRS-2002

Results

A total of 191,028 patients (median [Inter Quartile Range, IQR] age: 60 [45–71] years) were included. Of the study population, 54.6% were men, 39.2% of the patients were older adults (> 65 years) and the median BMI of the patients was 26.29 (IQR 23.43–30.05) kg/m^2 (Table 1).

Majority of the patients were hospitalized in internal medicine (36.0%) and in surgery clinics (35.1%) (Table 2). Malnutrition risk prevalence was highest in the intensive care units (31.9%), followed by hematology and oncology clinics (25.5%), and neurology clinics (18.7%) (Table 2).

Malnutrition risk prevalence (NRS-2002 score ≥ 3) was 11.6% in total (11.3% in women and 11.9% in men) and was higher in older adults (20.4% in ≥ 65 years, 22.8% in > 70 years and 30.2% in > 80 years of age) (Table 3).

Among the 22,195 patients identified as at risk for malnutrition, the distribution of patients based on the NRS-2002 final screening components (impaired nutritional status, severity of disease, and age ≥ 70 years) in different clinical settings were presented in Table 4.

Discussion

This study represents the most comprehensive national malnutrition risk screening among hospitalized patients in Türkiye. By screening 191,028 patients across 33 public referral hospitals in 21 different cities, we identified an overall malnutrition risk prevalence (NRS-2002 score ≥ 3) of 11.6%. As expected, this prevalence was higher in specific patient populations, reaching 20.4% in older adults, 25.5% in hematology and oncology patients, and 31.9% in intensive care unit (ICU) patients.

The highest prevalence of malnutrition risk was observed in ICU patients, where nearly one in three individuals (31.9%) was classified as at risk. This is consistent with previous literature, as critically ill patients frequently experience hypermetabolic and catabolic states due to their underlying disease, inflammation, and prolonged immobilization. However, the use of NRS-2002 in the ICU setting remains controversial. While NRS-2002 is widely used in hospitalized populations, its application in ICU settings is debated. Many critically ill patients are inherently at high nutritional risk due to disease severity alone, potentially leading to overestimated malnutrition prevalence. Some researchers advocate for modified tools such as the mNUTRIC score, which incorporates inflammatory markers and illness severity to improve predictive validity in ICU patients [10]. Future studies should assess whether incorporating such measures into routine screening can enhance accuracy.

Prevalence of malnutrition risk is strongly associated with screening tools utilized and settings of assessments according to literature. Two studies in 2000 and 2003 reported malnutrition rates of 20% and 19% respectively in English hospitalized adults [11, 12]. Similarly, malnutrition was detected every one in five patients in a Dutch multicenter study involving 20,255 patients [13]. Another multicenter study has showed malnutrition risk rate was %24.8 when NRS-2002 was used to screen [14]. A previous study conducted in Türkiye reported a malnutrition risk rate of 38% with NRS-2002 [15].

Limited number of studies from Türkiye has evaluated the prevalence of malnutrition in hospitalized patients in a nationally representative manner. In one of those studies, Korfali et al. evaluated the nutritional risk in the hospitalized patients in 2005 by the participation of 34 hospitals from 19 cities and 29,139 patients [16]. According to their results, 15% of the patients had malnutrition risk on admission to healthcare facilities. Regarding the prevalence of malnutrition in clinical departments, it was highest in the patients hospitalized in ICUs (52.0%), followed by the patients hospitalized in medical oncology (43.4%), hematology (24.0%), and neurology (23.9%) departments. Several other studies from Türkiye have utilized different tools for screening malnutrition. Sungurtekin et al. reported the malnutrition prevalence as 44% by the subjective global assessment (SGA) tool in

Table 2 Prevalence of patients with malnutrition risk in different clinics

	All patients (*n* = 191,028)	Patients with malnutrition risk (*n* = 22,195)
	n (%)	n (%)
Internal Medicine	68,742 (36.0)	4,908 (7.1)
Surgery	66,983 (35.1)	2,093 (3.1)
Hematology and Oncology	12,324 (6.5)	3,148 (25.5)
Neurology	12,539 (6.6)	2,341 (18.7)
Intensive Care Unit	30,440 (15.9)	9,708 (31.9)

Table 3 Malnutrition risk prevalence according to the baseline characteristics

		Total
Age (years), n (%)	≤ 30	997 (5.5)
	31–40	835 (4.6)
	41–50	1,345 (5.2)
	51–60	2,441 (6.6)
	61–70	3,409 (8.5)
	71–80	7,358 (22.8)
	≥ 81	5,810 (30.2)
Age ≥ 65 years, n (%)		15,267 (20.4)
Gender, n (%)	Women	9,763 (11.3)
	Men	12,402 (11.9)
BMI Group, n (%)	< 20.50 kg/m^2	4,968 (32.3)
	≥ 20.50 kg/m^2	17,227 (9.8)
Weight loss within last 3 months*, n (%)		10,770 (41.6)
Decreased food intake in the previous week*, n (%)		12,713 (41.0)
Presence of a serious illness*, n (%)		18,168 (30.3)
Total		22,195 (11.6)

BMI, Body mass index, *as stated in NRS-2002

the patients undergoing major intraabdominal surgery, whereas it was found to be 61% with the Nutritional Risk Index [17]. Another study by Nursal et al. found that malnutrition risk was present in 11% of all admissions similar to our report, when the SGA tool was used, but increased to 15.6% when the criteria of anthropometric measurements and laboratory testing were added to SGA [18]. Bozoglu et al. reported that 25–45% of older patients on admission and 20–50% of older patients in inpatient settings had malnutrition [19]. Finally, in their study, Guler et al. reported that the total malnutrition rate was 30.5% and severe malnutrition rate was 8.9% and that patients with benign diseases had a malnutrition rate of 25.8%, despite patients with malign diseases had a rate of 53.3% [20].

In the present study, 20.4% of the patients over the age of 65, while 22.8% between the ages of 71–80 and 30.2% over the age of 80 was at risk for malnutrition. Older age was one of the risk factors for malnutrition consistent with the literature. In a multicenter cross-sectional study in Korea has showed older adults over the age of 70 had significantly higher malnutrition rate than the younger age group (38.2% vs. 17.2%) [21].

Although this study provides a large-scale assessment of hospital malnutrition risk, several limitations must be acknowledged. Despite encompassing a substantial sample from 33 hospitals across 21 cities, the findings of this study may not comprehensively represent all hospitalized patients in Türkiye. The participating centers were selected based on the presence of established NSTs, which may indicate a higher level of nutritional awareness and screening practices compared to hospitals without NSTs. As a result, the actual prevalence of malnutrition risk in facilities without structured nutrition care could be underestimated. Future studies should aim to include a broader range of hospitals, including smaller facilities and those without structured nutrition teams, to obtain a more nationally representative dataset.

Additionally, certain patient characteristics were not fully captured, including comorbidities, inflammatory markers, and detailed nutritional interventions. The absence of laboratory parameters limits the ability to correlate malnutrition risk with biochemical markers such as albumin, prealbumin, or C-reactive protein, which could provide additional insight into the inflammatory and nutritional status of the patients. Furthermore, longitudinal follow-up data on clinical outcomes (e.g., length of stay, complications, mortality) were not collected, which prevents assessment of how nutritional risk translated into real-world patient outcomes.

Despite these limitations, the present study remains the largest and most comprehensive investigation of malnutrition risk in hospitalized patients in Türkiye, emphasizing the importance of routine screening and targeted interventions to improve patient care. The ONCA campaign aims to implement optimal nutritional care for all in participating countries to improve nutritional care in healthcare facilities. In accordance with ONCA activities, KEPAN conducted a series of projects to increase awareness not only in hospitalized patients but also in primary

Table 4 Distribution of patients with malnutrition risk based on the NRS-2002 final screening components

Patients with malnutrition risk (*n* = 22,195)		**Internal Medicine (*n* = 4,908)**	**Surgery (*n* = 2,093)**	**Hematology and Oncology (*n* = 3,148)**	**Neurology (*n* = 2,341)**	**Intensive Care Unit (*n* = 9,708)**
Impaired Nutritional Status* (n,%)	Absent	321 (6.5)	202 (9.7)	174 (5.5)	640 (27.3)	3688 (38.0)
	Mild	2158 (44.0)	803 (38.4)	1417 (45.1)	1036 (44.3)	2775 (28.6)
	Moderate	1466 (29.9)	661 (31.6)	979 (31.1)	523 (22.3)	1428 (14.7)
	Severe	963 (19.6)	427 (20.4)	575 (18.3)	142 (6.1)	1817 (18.7)
Severity of Disease* (n,%)	Absent	517 (10.5)	254 (12.1)	51 (1.6)	89 (3.8)	272 (2.8)
	Mild	3200 (65.2)	1046 (50.0)	2063 (65.6)	516 (22.0)	2005 (20.7)
	Moderate	927 (18.9)	583 (27.9)	905 (28.8)	1612 (68.9)	1517 (15.6)
	Severe	264 (5.4)	210 (10.0)	126 (4.0)	124 (5.3)	5914 (60.9)
Age ≥ 70 years (n,%)		3476 (70.8)	1036 (49.5)	1622 (51.6)	1661 (71.0)	5673 (58.4)

*See Appendix 2 for the descriptions of categories

care as well. Prior to the ONCA campaign, nutritional risk assessment of hospitalized patients was not mandatory and as an achievement of this project, the health authority recognized the importance of nutrition screening in hospital settings.

The Global Leadership Initiative on Malnutrition (GLIM) has established a standardized framework for diagnosing malnutrition, emphasizing a two-step approach; initial malnutrition risk screening to identify at-risk individuals, and diagnostic assessment incorporating phenotypic and etiologic criteria [22]. According to GLIM, malnutrition risk screening is the essential first step, ensuring that patients at risk undergo further nutritional evaluation and intervention. This highlights the critical role of implementing mandatory malnutrition screening in hospital settings to enable early detection and management of malnutrition, ultimately improving patient outcomes.

Conclusion

The present study found that the overall malnutrition risk prevalence among hospitalized patients in Türkiye was 11.6%, reaching as high as 26% in hematology and oncology patients and 32% in intensive care unit and older patients. These findings highlight the substantial burden of malnutrition risk in hospitalized populations and emphasize the need for routine nutritional screening upon admission to facilitate early intervention and improve patient outcomes.

Abbreviations

KEPAN	Turkish society of clinical enteral and parenteral nutrition
NRS-2002	Nutritional risk screening-2002
ESPEN	European society for clinical nutrition and metabolism
ONCA	Optimal nutrition care for all
ENHA	European nutrition for health alliance
BMI	Body mass index
IQR	Inter quartile range
NSTs	Nutrition support teams
GLIM	Global leadership initiative on malnutrition

Supplementary Information

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Supplementary Material 1

Supplementary Material 2

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Author contributions

Mutlu Doganay, Meltem Gulhan Halil, Mehmet Uyar, Pınar Kocatakan and Osman Abbasoglu equally contributed to the conception and design of the research; Ayse Dikmeer, Sadik Kilicturgay, Kubilay Demirag, Hasan Murat Gunduz and Kutay Demirkan equally contributed to acquisition of data; Ayse Dikmeer Mutlu Doganay and Meltem Gulhan Halil equally contributed to the analysis and interpretation of data; Ayse Dikmeer, Burcu Kelleci Cakir, Mutlu Doganay, Meltem Gulhan Halil, Kutay Demirkan, Osman Abbasoglu contributed to drafting the article or revising it critically; Mutlu Doganay, Burcu Kelleci Cakir, and Meltem Gulhan Halil completed the final approval of the version to be submitted. All authors agree to be fully accountable for ensuring the integrity and accuracy of the work and read and approved the final manuscript.

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Data availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate

Written informed consent was obtained from all participants or their caregivers. The protocol of the study was conducted in accordance with the ethical principles stated in the "Declaration of Helsinki" and approved by the local Ethics Committee (Reference number/Protocol No: E1/244).

Consent for publication

Participants signed informed consent regarding publishing their data.

Competing interests

The authors declare no competing interests.

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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(1):49–64.
2. 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(2):514–27.
3. Riley K, Sulo S, Dabbous F, Partridge J, Kozmic S, Landow W, et al. Reducing hospitalizations and costs: A home health Nutrition-Focused quality improvement program. JPEN J Parenter Enter Nutr. 2020;44(1):58–68.
4. Correia M, Perman MI, Waitzberg DL. Hospital malnutrition in Latin America: A systematic review. Clin Nutr. 2017;36(4):958–67.
5. Kirkland LL, Kashiwagi DT, Brantley S, Scheurer D, Varkey P. Nutrition in the hospitalized patient. J Hosp Med. 2013;8(1):52–8.
6. Ukleja A, Freeman KL, Gilbert K, Kochevar M, Kraft MD, Russell MK, et al. Standards for nutrition support: adult hospitalized patients. Nutr Clin Pract. 2010;25(4):403–14.

7. Kondrup J, Rasmussen HH, Hamberg O, Stanga Z. Nutritional risk screening (NRS 2002): a new method based on an analysis of controlled clinical trials. Clin Nutr. 2003;22(3):321–36.
8. Anthony PS. Nutrition screening tools for hospitalized patients. Nutr Clin Pract. 2008;23(4):373–82.
9. The European Nutrition for Health Alliance (ENHA). The Campaign. Optimal Nutritional Care for All (ONCA) [Available from: https://european-nutrition.org/homepage/campaign/
10. Kumar S, Gattani SC, Baheti AH, Dubey A. Comparison of the performance of APACHE II, SOFA, and mNUTRIC scoring systems in critically ill patients: A 2-year Cross-sectional study. Indian J Crit Care Med. 2020;24(11):1057–61.
11. Edington J, Boorman J, Durrant ER, Perkins A, Giffin CV, James R, et al. Prevalence of malnutrition on admission to four hospitals in England. The malnutrition prevalence group. Clin Nutr. 2000;19(3):191–5.
12. O'Flynn J, Peake H, Hickson M, Foster D, Frost G. The prevalence of malnutrition in hospitals can be reduced: results from three consecutive cross-sectional studies. Clin Nutr. 2005;24(6):1078–88.
13. Meijers JM, Halfens RJ, van Bokhorst-de MA, Dassen T, Schols JM. Malnutrition in Dutch health care: prevalence, prevention, treatment, and quality indicators. Nutrition. 2009;25(5):512–9.
14. Zhang Z, Wan Z, Zhu Y, Zhang L, Zhang L, Wan H. Prevalence of malnutrition comparing NRS2002, MUST, and PG-SGA with the GLIM criteria in adults with cancer: A multi-center study. Nutrition. 2021;83:111072.
15. Balci C, Bolayir B, Eşme M, Arik G, Kuyumcu ME, Yeşil Y, et al. Comparison of the efficacy of the global leadership initiative on malnutrition criteria, subjective global assessment, and nutrition risk screening 2002 in diagnosing malnutrition and predicting 5-Year mortality in patients hospitalized for acute illnesses. JPEN J Parenter Enter Nutr. 2021;45(6):1172–80.
16. Korfali G, Gündoğdu H, Aydintuğ S, Bahar M, Besler T, Moral AR, et al. Nutritional risk of hospitalized patients in Turkey. Clin Nutr. 2009;28(5):533–7.
17. Sungurtekin H, Sungurtekin U, Balci C, Zencir M, Erdem E. The influence of nutritional status on complications after major intraabdominal surgery. J Am Coll Nutr. 2004;23(3):227–32.
18. Nursal TZ, Noyan T, Atalay BG, Köz N, Karakayali H. Simple two-part tool for screening of malnutrition. Nutrition. 2005;21(6):659–65.
19. Bozoğlu E, Ozturk A, Definition. Prevalence and etiological factors of malnutrition. Turkiye Klinikleri J Geriatr-Special Top. 2016;2:7–15.
20. Guler Y, Tireli M. Malnutrition frequency in surgical patients and its effect on morbidity and mortality. Acta Med Alanya. 2018;2(1):35–9.
21. 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(2):e10.
22. Cederholm T, Jensen GL, Correia M, Gonzalez MC, Fukushima R, Higashiguchi T, et al. GLIM criteria for the diagnosis of malnutrition - A consensus report from the global clinical nutrition community. Clin Nutr. 2019;38(1):1–9.

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