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Clinical nutrition in surgical oncology: Young AIOM-AIRO-SICO multidisciplinary national survey on behalf of NutriOnc research group

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Malnutrition is a common condition in cancer patients which is usually associated with functional limitations, as well as increased morbidity and mortality. Based on the support of the young sections of Italian Association of Medical Oncology (AIOM), Italian Association of Radiotherapy and Clinical Oncology (AIRO) and Italian Society of Surgical Oncology (SICO) merged into the NutriOnc Research Group, we performed a multidisciplinary national survey with the aim to define the awareness of nutritional issues among healthcare professionals delivering anticancer care. The questionnaire was organized in four sections, as follows: Knowledge and practices regarding Nutritional Management of cancer patients; Timing of screening and assessment of Nutritional Status; Nutritional Treatment and prescription criteria; Immunonutrition and educational topics. The modules focused on esophagogastric, hepato-bilio-pancreatic and colorectal malignancies. Overall, 215 physicians completed the survey. As regards the management of Nutritional Status of cancer patients, many responders adopted the ERAS program (49.3%), while a consistent number of professionals did not follow a specific validated nutritional care protocol (41.8%), mainly due to lack of educational courses (14.5%) and financial support (15.3%). Nearly all the included institutions had a multidisciplinary team (92%) to finalize the treatment decision-making. Cancer patients routinely underwent nutritional screening according to 57.2% of interviewed physicians. The timing of nutritional assessment was at diagnosis (37.8%), before surgery (25.9%), after surgery (16.7%), before radiochemotherapy (13.5%) and after radiochemotherapy (7%). Most of the responders reported that nutritional status was assessed throughout the duration of cancer treatments (55.6%). An important gap between current delivery and need of nutritional assessment persists. The development of specific and defined care protocols and the adherence to these tools may be the key to improving nutritional support management in clinical practice.

KEYWORDS

clinical nutrition, cancer, malnutrition, nutritional assessment, survey

1. Introduction

In the era of precision medicine, the "one-size-fits-all" approach has been revolutionarily replaced by a patient-centric vision, which aims at minimizing adverse events while enhancing therapeutic impact of new treatments (1). Despite the current period of innovation in oncology, including big data, genomic sequencing, and minimally invasive surgery as part of standard treatment for some cancers, nutritional issues are still serious clinical challenges (2–7).

It has been estimated that up to 80% of cancer patients suffer from malnutrition (8–12), but less than 30% receive nutritional interventions (13). Anyway, the range of reported data is extremely wide due to the lack of fundamental consensus on malnutrition diagnosis (14–16), as well as differences among several types of solid tumors (17, 18). Therefore, based on a consensus process, the Global Leadership Initiative on Malnutrition (GLIM) has recently suggested a shared method, termed the GLIM-process, for diagnosing malnutrition (19). To this address, patients with digestive tract cancers have been found to have one of the highest rates of malnutrition due to its local effects on bowel function from obstruction and malabsorption, and on glandular secretion from dysfunction and atrophy (20–23). Prior studies suggest that the severity of weight loss is significantly associated with advanced cancer (24), but over 40% of patients are malnourished or at risk for malnutrition, even in early disease stages (11).

Malnutrition is correlated with a prolonged hospital stay, increased morbidity and readmission, as well as higher mortality rates (13, 25–27). Furthermore, malnourished cancer patients may experience a reduced tolerance to chemotherapy, lower quality of life, and reduced overall survival (17, 28–31). As a result, clinical nutrition (32), plays an active role in modern cancer surgery hindering all the adverse effects of cancer-associated malnutrition (33). However, the attitude toward this issue varies considerably among oncologists, surgeons, and radiotherapists due to the lack of structured collaboration between healthcare professionals (34, 35).

Despite the European Society for Clinical Nutrition and Metabolism (ESPEN) recently emphasized individualized plans focused on increasing nutritional intake (31), the European Society of Surgical Oncology (ESSO) and its Young Alumni Club (EYSAC) reported in a global survey that surgical units often lack a structured nutritional assessment, postulating a significant impact on the clinical practice by the involvement of nutritionist medical doctors into the multidisciplinary tumor board (36).

We provide, for the first time ever, an intersociety and multidisciplinary national survey, supported by young sections of *Italian Association of Medical Oncology* (AIOM), *Italian Association of Radiotherapy and Clinical Oncology* (AIRO) and *Italian Society of Surgical Oncology* (SICO) merged into the *NutriOnc Research Group* (Figure 1).

Our survey aims at defining the awareness of nutritional issues in oncological setting among anticancer professionals, mainly focused on esophagogastric (EG) hepato-bilio-pancreatic (HPB) and colorectal (CR) cancers. Of note, in EG and HPB tumors, malnutrition is present in up to 70% of patients, and multimodal anticancer treatments are mandatory, laying the groundwork for a more horizontal and crosscutting shared multimodal nutritional interventions.

NRG
NUTRIONC RESEARCH GROUP

FIGURE 1
NutriOnc Research Group. email: nutrionc@gmail.com; LinkedIn: NutriOnc Research Group; Twitter: @NutriOncRG.

2. Methods

2.1. Survey design

In 2020, young sections of AIOM, SICO and AIRO planned common research goals and founded the NutriOnc Research Group, aimed at implementing multidisciplinary strategies to improve patient quality of life. A web-based survey consisting of a total of 15 multiple choice questions was conducted among young (≤40 years) medical oncologists, surgeons and radiotherapists or young trainees who were AIOM, SICO, AIRO members.

The questionnaire was organized in the following sections: 1. Knowledge and practices regarding Nutritional Management of cancer patients, 2. Timing of screening and assessment of Nutritional Status, 3. Nutritional Treatment and prescription criteria, and 4. Immunonutrition (IMN) and Educational topics.

- Section 1: Use of internal protocols and presence of nutritionists/dieticians as part of the multi-disciplinary team: medical nutritionist/physicians with clinical expertise in nutritional assessment, medical oncologist, surgeon, radiotherapist and trained nurse.
- Section 2: Pre-and In-hospital Nutritional Screening and Assessment, who oversees patients' nutritional assessment, when nutritional assessment is conducted, and which questionnaires are administered.
- Section 3: Post-Hospital Nutritional Management, who oversees activating a home therapeutic plan, what kinds of nutritional therapy are planned, what are the main discomforts encountered by patients.
- Section 4: The level of knowledge of IMN or Immunoenhanced nutrition, suggestions for further discussion.

The modules were mainly focused on EG, HPB, and CR cancers.

2.2. Survey dissemination

All young (≤ 40 years) professionals were encouraged to participate by completing modules according to their practice. The questionnaire was distributed online on the AIOM, AIRO and SICO websites in a reserved section and was accessible only through a direct link sent by email on SurveyMonkey®. Overall, the survey could

be accessed online from June 30th, 2021, to July 10th, 2021. Responses were anonymously evaluated and analyzed.

2.3. Statistical analysis

This survey considered the sample of participants who answered the questionnaire, and therefore no sample size was calculated for a specific hypothesis test. Summary statistical measures for continuous and categorical data were used to describe the sample of doctors' characteristics and their answers to each specific item. Results were compared among different societies. Given the descriptive and exploratory intent of the analysis, no attempt to control for multiple tests was pursued.

3. Results

All of the 939 health care professionals representing the target population received the invitation, and 215 (21.5%) participated to the online survey. An overview of participants' demographics and geographic distribution is provided in Table 1.

Among 215 respondents' young health professionals, 101 (47%) were members of SICO, 56 (26%) of AIOM and 45 (21%) of AIRO, while 13 (6%) were not part of any society (Figure 2). The findings regarding the medical specialty were consistent with the results of the membership of SICO, AIOM and AIRO: surgeons (53%) medical oncologist (26.5%), and radiation oncologist (20.4%). Most of the participants were residents (38.1%) and physicians with less and equal to/more than 5 years of medical experience were 67 (31.2%) and 66 (30.7%), respectively.

Concerning the geographical distribution of the responders, 59 were from the Tuscany region, 29 were from Puglia, 20 from Lazio and 17 from Campania (Figure 3). In general, participants were equally distributed between north, center and south-insular Italy.

The physicians dealt with gastrointestinal cancers, and they were focused on CR (61%), EG (24.2%) and HPB (14.8%) cancers. Most of them (34.9%) defined the volume per year of locally advanced CR patients in their own institution as more than 100 patients. Sixty (27.9%) and 48 (22.3%) respondents treated more than 40 HPB and EG l cancer patients per year, respectively. Nearly half of the respondents adopted up-front surgery (42.5%) while 57.5% planned neoadjuvant treatments (radio/chemotherapy).

3.1. Knowledge and practices regarding nutritional management of cancer patients (Table 2; Q1-Q4)

Concerning the management of Nutritional Status of cancer patients, many respondents adopted the Enhanced Recovery After Surgery (ERAS) program (49.3%). Of note, a large number of specialists did not follow a specific validated nutritional care protocol (41.8%) due to a lack of educational courses (14.5%), financial support (15.3%) and understaffing (13%). Only 50.7% of health professionals were aware of specific protocols tailored to diagnose and treat malnutrition in cancer patients undergoing neoadjuvant treatment, because there is a practically lack of medical

TABLE 1 Participants' demographics and institutional volumes [*n* (%)].

	n (%)
Societies	
SICO	101 (47)
AIOM	56 (26)
AIRO	45 (21)
Other	13 (6)
Role of participants	
Residents	82 (38.14)
Consultant 0–5 years	67 (31.16)
Consultant 5–10 years	66 (30.7)
Geographic distribution	
Northwest Italy	34
Liguria	0
Lombardy	22 (10.23)
Piedmont	12 (5.58)
Val d'Aosta	0
Northeast Italy	28
Emilia Romagna	11 (5.12)
Friuli Venezia Giulia	3 (1.4)
Trentino Alto Adige	2 (0.93)
Veneto	12 (5.58)
Central Italy	82
Marche	3 (1.4)
Lazio	20 (9.3)
Tuscany	59 (27.44)
Umbria	0
South Italy	58
Abruzzo	4 (1.86)
Basilicata	1 (0.47)
Calabria	5 (2.23)
Campania	17 (7.91)
Molise	2 (0.93)
Puglia	29 (13.49)
Insular Italy	13
Sardinia	6 (2.79)
Sicily	7 (3.28)
Activities of the unit	
Gastroesophageal	52 (24.19)
Colorectal	131 (60.93)
Hepato-bilio-pancreatic	32 (14.88)
Institutional volumes	
> 100 patients with localized or locally advanced disease treated per year	75 (34.88)
Gastroesophageal cancer	162 (75.35)
> 40	60 (27.91)
20–40	42 (19.53)
< 20	60 (27.91)
Colorectal cancer	189 (87.91)
> 100	75 (34.88)
60–100	64 (29.77)
< 60	50 (23.26)
Hepato-bilio-pancreatic cancer	139 (64.66)
> 40	48 (22.33)
20–40	45 (20.93)
< 20	46 (21.40)

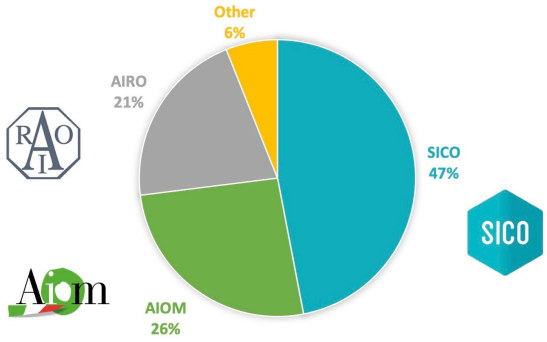

FIGURE 2
Affiliations of participants. Italian Association of Medical Oncology (AIOM), Italian Association of Radiotherapy and Clinical Oncology (AIRO) and Italian Society of Surgical Oncology (SICO).

nutritional specialist in the institutions. Of note, nearly all the Institutions had a multidisciplinary team (92%) to finalize the treatment decision-making. In the absence of dietician, the nutritional assessment of patients performing oncological care was managed by physicians with clinical expertise in nutritional (76.4%).

3.2. Timing of screening and assessment of nutritional status (Table 3; Q5-Q8)

Cancer patients underwent nutritional screening for 57.2% of respondents. In the absence of nutritional staff as described before, the nutritional screening was managed by physicians with clinical expertise in nutritional assessment (35.6%), by surgeons (34.3%), medical/radiation oncologists (36.8%) and by case-manager nurses (6.8%) (Figure 4A). The timing of nutritional assessment was at the first visit (37.8%), before surgery (25.9%), after surgery (16.7%), before radiochemotherapy (RT-CT) (13.5%) and after RT-CT (7%). Most of the respondents reported that nutritional status was assessed throughout the duration of cancer treatments (55.6%) (Figure 4B). Knowledge of nutritional screening tools was reported by 63.3% of physicians. Malnutrition Universal Screening Tool (MUST), Malnutrition Screening Tool (MST), Nutritional Risk Screening 2002 (NRS – 2002), Mini Nutritional Assessment Short-Form (MNA-SF) and Global Leadership Initiative on Malnutrition (GLIM) criteria were known by 56.1, 15, 30.8 and 15.7% of cases. Moreover, 23 (15.7%) respondents were aware of body composition analysis by means of bioimpedance analysis (Bioelectrical Impedance Vector Analysis, BIVA) and 24 (16.4%) of computed tomography (CT) scan of L3 vertebral body as nutritional screening tools (Figure 4C). Nutritional assessment has been performed in the 81.8% of cases reporting abnormal results at nutritional screening. The physicians reported the periodical assessment of the nutritional status of cancer patients during oncological care (60.5%). Concerning the timing, 31.3% conducted the nutritional assessment at diagnosis, 28.1% before surgery, 14.5% after surgery, 20.5% before RT-CT and 8.1% after RT-CT (Figure 4D). Haematochemical indices, such as serum albumin, pre-albumin, creatinine, iron levels, 3-methylhistidine, cholesterol and total lymphocyte (37) (54.4%), food diary (59.3%) and MNA-SF (38.9%) were the main methods adopted by the responders (Figure 4E).

3.3. Nutritional treatment and prescription criteria (Table 4; Q9-Q11)

After discharge from the hospital, the prescription of nutritional support was provided by dieticians (59.5%), medical oncologists (20%), surgeons (15.3%), radiation oncologists (5.12%) (Figure 4F). The respondents were asked about the main issues regarding nutritional support facilities, available in their institutions. Most of them (44.2%) identified the difficulty of finding nutritional products in hospital pharmacies and for patients to have refundability as the main crucial factors. Seventy-seven (35.8%) specialists declared fatigue and loss of appetite as crucial factors concerning nutritional therapy. Similarly, respondents mentioned that nausea (29.3%), malabsorption (24.1%), dysphagia (21.8%), vomiting (18.6%) and mucositis (11.1%) negatively affected the management of nutritional therapy. Additionally, the absence of a dietician/nutritionist in the department (28.3%) as well as the lack of specific rules concerning the prescription criteria of nutritional support (13%) were described as further key issues as factor negatively affecting the optimal nutritional management. In cases of malnutrition (e.g., more than 5% of weight loss in the last 3 months) (38), the physician choices were nutritional counseling (34.8%), oral nutritional supplement (28.8%), enteral nutrition (2.8%), parenteral nutrition (3.3%), and no treatments (0.9%).

3.4. Immunonutrition and educational topics (Table 5; Q12-Q15)

During radiotherapy, 95% of physicians declared that patients needed a supplementary nutrition. Arginine, Omega-3 fatty acids (omega-3 Fas), vitamins/antioxidants, Glutamine, Whey Protein (WP) and RNA were described as essential supplements during radiotherapy by 29.7, 39.5, 49.8, 23.3, 20.9 and 4.7% of respondents, respectively. Fifty-eight (27%) physicians stated that supplementation was not necessary during radiotherapy. Knowledge of IMN was reported by 58.1% of respondents. IMN was prescribed perioperatively (54.5%), before surgery (36.3%) and during neoadjuvant RT-CT (22.3%). One hundred physicians expressed interest in educational courses addressing nutritional issues as a whole. Webinar were mentioned as preferred modality for educational programs (78.1%).

4. Discussion

According to our results based on 215 physicians, almost half of the respondents declared to adopt the ERAS (Enhanced Recovery After Surgery) program (49.3%), while an important number of professionals did not follow a specific validated nutritional care protocol (41.8%) due several reasons, such as lack of educational

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FIGURE 3
Italian map of survey participants: regions with >20 interviewees in dark orange, with 1–19 interviewees in orange, otherwise in white.

courses (14.5%) and financial support (15.3%). In addition, nearly all the included centers had a multidisciplinary team (92%) and the timing of nutritional assessment was at diagnosis (37.8%), before surgery (25.9%), after surgery (16.7%), before radiochemotherapy (RT-CT) (13.5%) and after RT-CT (7%). Moreover, nutritional status was assessed throughout the duration of cancer treatments in 55.6% of cases.

Cancer-related malnutrition is very common among patients affected by solid malignancies, with a high percentage of patients experiencing malnutrition during the course of their disease due to several reasons, including the type of tumor, the disease stage and the type of treatment (e.g., surgery, chemotherapy, concomitant RT-CT, etc.) (39–41). Thus, it is mandatory to identify cancer patients at nutritional risk as a component of a proper, comprehensive care (42). Based on these premises, the delivering of optimal nutritional care is a crucial need for cancer patients. Early detection of nutritional status is essential to initiate nutritional treatment for preserving body composition and avoiding sarcopenia and cachexia, as the toxicity of anticancer therapies depends on body cell mass, and oncological clinical outcomes could be negatively related to malnutrition regardless of therapies (43–46).

In the current survey, we aimed to define the awareness of nutritional issues among young healthcare professionals delivering anticancer care, by providing an intersociety and multidisciplinary national survey supported by young sections of different associations. Despite a notable participation, nutritional screening was carried out at diagnosis by less than 40% of anticancer professionals. This is considered the first step in defining patients at risk of malnutrition or malnourished, followed by a nutritional assessment that may more deeply investigate and schedule the patients to a tailored nutritional support. As previously reported, only 50.7% of responders were aware of specific tools to diagnose timely malnutrition in cancer patients undergoing neoadjuvant treatment. An increasing awareness of nutritional pathway, especially in the surgical community (64.3%), is related to the wide

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TABLE 2 Section 1: Knowledge and practices regarding nutritional management of cancer patients. Questionnaire answer distribution [*n* (%)].

	All (*n*=215)	SICO (*n*=101)	AIOM (*n*=56)	AIRO (*n*=45)
Section 1. Knowledge and practices regarding Nutritional Management of cancer patients				
Q1. Does the centre where you work already have a specific internal protocol for the clinical nutrition of patients? *				
Yes (ERAS)	106 (49.3%)	65 (64.36%)	20 (35.71%)	16 (35.56%)
Yes (others)	22 (10.23%)	6 (5.94%)	9 (16.07%)	7 (15.56%)
NO	90 (41.86%)	31 (30.69%)	27 (48.21%)	24 (53.33%)
Q2. Are there nutritional protocols for the malnourished cancer patient who undergoes neoadjuvant therapy?				
Yes	101(46.97%)	42 (41.59%)	21 (37.5%)	30 (68.67%)
No	77 (35.81%)	41 (40.59%)	20 (35.71%)	12(26.67%)
Only in case of Gastro-Esophageal tumors	23 (10.7%)	9 (8.91%)	11 (19.64%)	2 (4.44%)
Only in case of Colorectal tumors	7 (3.26%)	5 (4.95%)	1 (1.79%)	1 (2.22%)
Only in case of Hepato-bilio-pancreatic tumors	4 (1.86%)	2 (1.98%)	2 (3.57%)	0
Others	3 (1.4%)	2 (1.98%)	1 (1.79%)	0
Q3. Is there a multidisciplinary team in your centre that evaluates cancer patients?				
Yes	198 (92.09%)	89 (88.12%)	52 (92.86%)	45(100%)
No	17 (7.91%)	12 (11.88%)	4 (7.14%)	0
Q4. If there is no nutritionist: do you have a consultant?				
Yes	133 (76.44%)	61 (74.39%)	39 (81.25%)	27 (77.14%)
No	41 (23.56%)	21 (25.61%)	9 (18.75%)	8 (22.86%)

*More than one answer was eligible.

adoption of ERAS protocol (47). Interestingly, no ERAS guidelines consider a specific nutritional protocol for patients scheduled to neoadjuvant treatment, but only perioperatively. Interestingly, this timeframe could represent a "window of opportunity" to define a specific and tailored protocol, to improve treatment compliance, quality of life, and to complete the specific neoadjuvant treatment. Fewer than 60% of the surveyed professionals report that nutritional assessment was carried out continuously throughout the therapeutic care pathway, which calls for its implementation and increased use. The current survey underlines the importance of proper nutritional screening and assessment by health professionals and highlights that an important gap between current delivery and the need for nutritional assessment and care persists. Some strengths and limitations of the current survey should be highlighted. Among the strengths of this study, it is worth noting that this survey included the young sections of three different anticancer Italian associations (AIOM, AIRO, and SICO, merged into the NutriOnc Research Group) and an overall high number of included professionals and Institutions while its limitations include the lack of data on clinical outcomes. Our findings are partially in line with previous experiences suggesting that a remarkable proportion of interviewed professionals does not follow a specific nutritional protocol in the daily clinical practice due to several reasons (e.g., lack of financial support, lack of educational courses, lack of human resources) (48). The value of using different screening tools has practical limitations: parameters should be easy, quick, useful in different populations, and carried out by both dieticians and physicians with clinical expertise in nutritional assessment. Our group would encourage the use of single, shared screening tools, such as MST, to screen all adults for malnutrition in all settings, according to the last position of the Academy of Nutrition and Dietetic (39).

As previously reported, nutritional screening has been performed globally in the 57.2%, in low percentage by a nutritionist, while in high percentage by surgeons, oncologists and radiotherapists or physicians with "an experience in nutritional issue." The nutritional assessment was performed by nurse case managers in only 6.8% of cases. On the one hand, these data suggest the poor inclusion of nutritionist medical specialists in several centers, while these figures should be considered of pivotal importance in this setting. On the other hand, given the lack of financial support and human resources, the disappointing data regarding nurse case managers poses some reflections. In our opinion, this health care figure should be more actively engaged in the nutritional pathway of cancer patients, ranging from the diagnosis to the follow-up of cancer. The central role of nurses has been also suggested by a study published by McHugh and colleagues, since the presence of specialized nurses has an impact in terms of better outcomes, reduced length of hospital stay, less readmissions, and even a decreased mortality rate (49).

At the same time, the current study underlines a higher awareness of nutritional assessment as a fundamental component of cancer patients care in younger health professionals compared with previous multicenter reports, including the study published by Caccialanza and colleagues (34). In this previous Italian experience, the authors observed that nutritional assessment was performed by less than 30% of oncologists at diagnosis, a percentage which is significantly lower compared to that observed in the current survey. According to 42% of oncologists included in this previous Italian study, nutritional assessment was carried out only after patients requested it, and almost 60% of patient affiliates were not aware of

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TABLE 3 Section 2: Timing of screening and assessment of Nutritional Status. Questionnaire answer distribution [*n* (%)].

	All (*n*=215)	SICO (*n*=101)	AIOM (*n*=56)	AIRO (*n*=45)
Section 2. Timing of screening and assessment of Nutritional Status				
Q5. Does your center carry out nutritional screening of patients?				
Yes	123 (57.21%)	53 (52.48%)	30 (53.57%)	33 (73.33%)
No	92 (42.79%)	48 (47.52%)	26 (46.43%)	12 (26.67%)
Q6. Who is responsible for the nutritional screening of patients if there is no nutritionist/dietician?				
A physician with experience in nutritional assessment	57 (35.63%)	21 (28.77%)	19 (39.58%)	13 (40.63%)
Nurse Case Manager	11 (6.88%)	7 (9.59%)	2 (4.17%)	2 (6.25%)
The surgical team	55 (34.38%)	47 (64.38%)	3 (6.25%)	3 (9.38%)
Medical Oncologist/Oncologist Radiotherapist	59 (36.88%)	10 (13.70%)	29 (60.42%)	19 (59.38%)
Q7. Do you know any nutritional screening method? *				
Yes	136 (63.26%)	67 (66.33%)	35 (62.5%)	26 (57.78%)
No	79 (36.74%)	34 (33.67%)	21 (37.5%)	19 (42.22%)
Yes (Malnutrition Universal Screening Tool, MUST)	82 (56.16%)	39 (54.93%)	24 (61.54%)	16 (55.17%)
Yes (Malnutrition Screening Tool, MST)	22 (15.07%)	11(15.49%)	9 (23.08%)	1 (3.45%)
Yes (Nutritional Risk Screening 2002, NRS-2002)	36 (24.66%)	28 (39.44%)	3 (7.69%)	5 (17.24%)
Yes (Mini Nutritional Assessment Short-Form, MNA-SF)	45 (30.82%)	19 (26.76%)	15 (38.46%)	8 (27.59%)
Yes (GLIM criteria)	23 (15.75%)	11 (15.49%)	5 (12.82%)	7 (24.14%)
Yes (instruments: Bioelectrical impedance vector analysis, BIVA)	23 (15.75%)	15 (21.13%)	7 (17.95%)	1 (3.45%)
Yes (instruments: CT at L3 level)	24 (16.44%)	17 (23.94%)	4 (10.26%)	2 (6.90%)
Yes (instruments)	14 (9.59%)	6 (8.45%)	2 (5.13%)	6 (20.69%)
Q8. After having performed the nutritional screening with an abnormal result, is the nutritional assessment carried out? *				
Yes	176 (81.86%)	76 (75.25%)	48 (85.71%)	44 (97.78)
No	39 (18.14%)	25 (24.75%)	8 (14.29%)	1 (2.22%)
Yes (Mini Nutritional Assessment Short-Form, MNA-SF)	65 (38.92%)	27 (37.50%)	22 (45.83%)	13 (32.5%)
Yes (Subject Global Assessments, SGA)	21 (12.57%)	8 (11.11%)	7 (14.28%)	5 (12.5%)
Yes (Score patient-generated Subject Global Assessment, PG-SGA)	24 (14.37%)	6 (8.33%)	5 (10.42%)	11 (27.5%)
Yes (GLIM criteria)	21 (12.57%)	8 (11.11%)	5 (10.42%)	7 (17.5%)
Yes (instruments: Bioelectrical impedance vector analysis, BIVA)	17 (10.18%)	9 (12.50%)	6 (12.5%)	2 (5%)
Yes (instruments: CT at L3 level)	8 (4.79%)	8 (11.11%)	0	0
Yes (instruments: Blood tests/PCR)	91 (54.49%)	47 (65.28%)	24 (50%)	17 (42.5%)
Yes (instruments)	18 (10.78%)	8 (11.11%)	3 (6.25%)	6 (15%)
Yes (Food diary)	99 (59.28%)	42 (58.33%)	24 (50%)	28 (70%)

*More than one answer was eligible.

clinical referrals for home artificial nutrition management. At the same time, for almost all respondents, the nutritional status assessment was considered fundamental in predicting tolerance to anticancer treatment. In another German survey across certified oncologic care institutions, the authors reported that only around 30% of patients received nutritional counseling, regardless of their nutritional status and disease stage, and none of the included centers presented a systematic screening procedure and had paucity of dieticians available (50).

Another point to highlight includes the presence of a multidisciplinary team, which was reported in 92% of the Institutions included in the current survey. This is particularly important since measuring and monitoring metabolic and nutritional status should be reviewed as a defined, standardized part of each multidisciplinary team process, and the presence of specialist oncology dieticians should be encouraged as an essential component of team and involved in all phases of cancer patient management (51, 52). In fact, the high frequency of nutritional issues in each phase of cancer care, ranging

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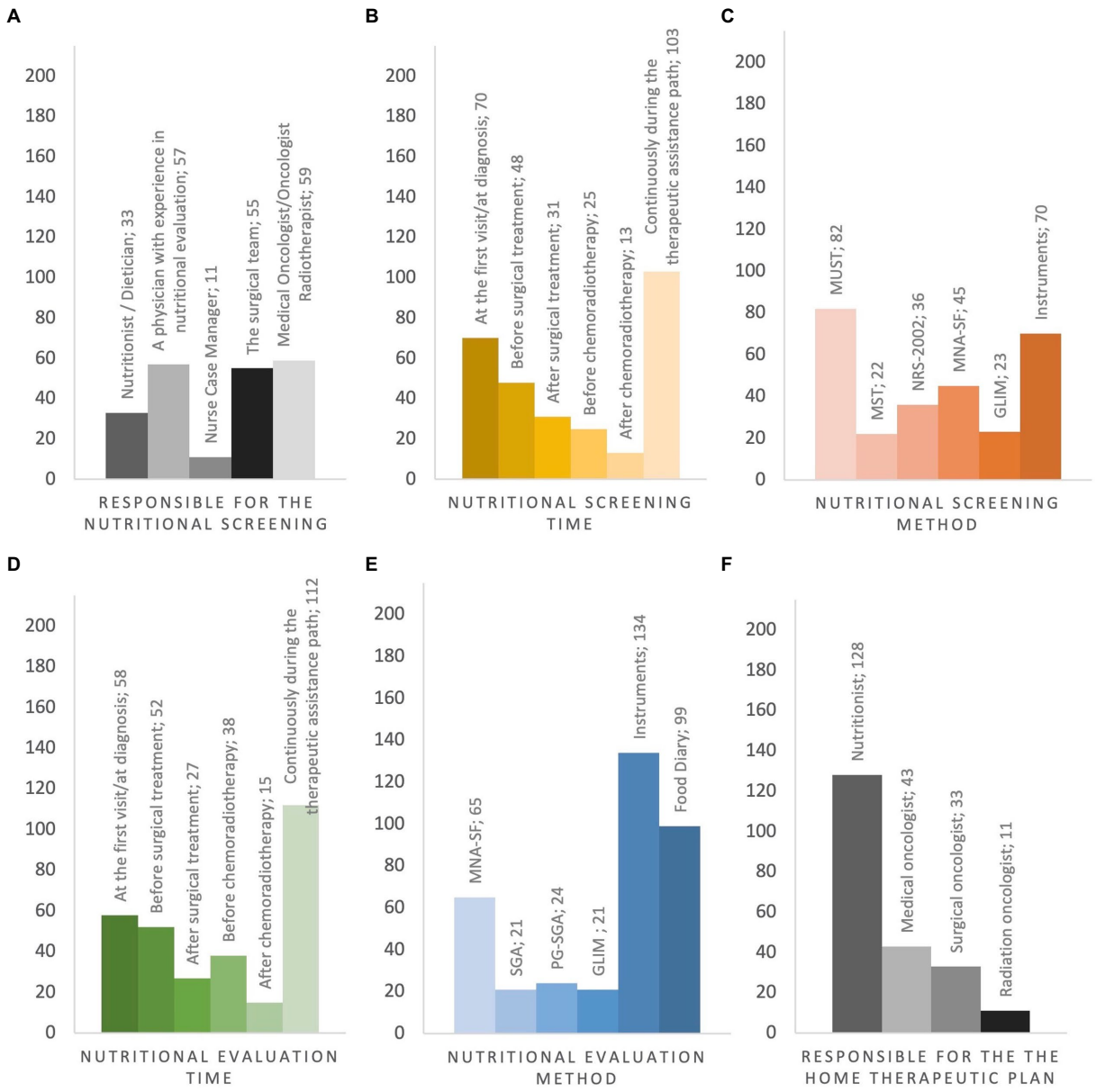

FIGURE 4
Pre-and In-hospital Nutritional Screening and Assessment, Post-Hospital Nutritional Management. **(A)** responsible for the nutritional screening; **(B)** when nutritional screening is performed; **(C)** type of questionnaire administered in nutritional screening; **(D)** when the severity of malnutrition is investigated; **(E)** type of questionnaire administered in nutritional grading assessment; **(F)** who is in charge of activating the home therapeutic plan. MUST Malnutrition Universal Screening Tool, MST Malnutrition Screening Tool, NRS-2002 Nutritional Risk Screening 2002, MNA-SF Mini Nutritional Assessment Short-Form, GLIM Global Leadership Initiative on Malnutrition, SGA Subject Global Assessments, PG-SGA Score patient-generated Subject Global Assessment, Instruments Bioelectrical impedance vector analysis, CT-scan at L3 level, Blood test.

from diagnosis to end of life, makes the integration of nutrition assessment within multidisciplinary teams a key topic.

At the same time, if malnutrition seems to be perceived as a severely limiting factor by both patients and anticancer professionals, adherence to recommendations and guidelines appears low. The development of specific and defined care protocols and the adherence to these shared tools may be one of the keys to improve nutritional support management. Increased awareness of the impact of malnutrition on clinical outcomes is crucial to allow for high-quality nutrition treatments before, during, and following anticancer therapies. In addition, the most commonly used tools are based on the items established in the ERAS protocol being efficient and with adequate specificity and sensitivity, something that should help a wider diffusion of nutritional assessment (25). Of note, through the application of ERAS items protocol IMN has gained more awareness, especially in the perioperative period. However, our survey demonstrated a wide variation among surgeons, oncologist, and radiotherapist in "familiarity" about IMN, while most of the responders consider IMN in a future and common area of interest represented by the impact on clinical outcome in patients undergoing neoadjuvant and surgical treatment and finally cost-effectiveness.

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TABLE 4 Section 3: Nutritional Treatment and prescription criteria. Questionnaire answer distribution [*n* (%)].

	All (*n*=215)	SICO (*n*=101)	AIOM (*n*=56)	AIRO (*n*=45)
Section 3. Nutritional Treatment and prescription criteria				
Q9. If a nutritional support to be administered at patient's home is necessary who is in charge of activating the therapeutic plan?				
Medical oncologist	43 (20%)	19 (18.81%)	20 (35.71%)	2 (4.44%)
Surgical oncologist	33 (15.35%)	25 (24.75%)	1 (1.79%)	2 (4.44%)
Radiation oncologist	11 (5.12%)	0	0	11 (24.44%)
Nutritionist	128 (59.53%)	57 (56.44%)	35 (62.5%)	30 (66.67%)
Q10. In the case of a malnourished patient (e.g., with weight loss>5% in less than 3 months) which kind of nutritional therapy is usually given?				
Nutritional Counseling	75 (34.88%)	23 (22.77%)	31 (55.36%)	18 (40%)
Integration *per os*	62 (28.84%)	34 (33.66%)	13 (23.21%)	9 (20%)
Enteral *via* PEG	6 (2.79%)	3 (2.97%)	0	2 (4.44%)
Associated/mixed (os/parenteral)	63 (29.3%)	33 (32.67%)	12 (21.43%)	15 (33.33%)
Partial/total parenteral	7 (3.26%)	6 (5.94%)	0	1 (2.22%)
Other	2 (0.93%)	2 (1.98%)	0	0
Q11. What are the problems you face during the delivery of nutritional therapy? *				
Supply and/or Refundability of the product	95 (44.19%)	41 (40.59%)	28 (50%)	18 (40%)
Absence of a therapeutic plan in the regional Risk Assessment Document	28 (13.02%)	15 (14.85%)	10 (17.86%)	2 (4.44%)
Absence of a nutritionist in the ward	61 (28.37%)	33 (32.67%)	18 (32.14%)	6 (13.33%)
Mucositis	24 (11.16%)	4 (3.96%)	8 (14.29%)	11 (24.44%)
Asthenia/loss of appetite	77 (35.81%)	31 (30.69%)	20 (35.71%)	21 (46.67%)
Dysphagia	47 (21.86%)	14 (13.86)	11 (19.64%)	20 (44.44%)
Nausea	63 (29.3%)	30 (29.7%)	10 (17.86%)	20 (44.44%)
Vomiting	40 (18.6%)	19 (18.81%)	8 (14.29%)	12 (26.67%)
Malabsorption	52 (24.19%)	28 (27.72%)	11 (19.64%)	12 (26.67%)
Other	15 (6.98%)	9 (8.91%)	4 (7.14%)	2 (4.44%)

*More than one answer was eligible.

As previously stated, if the impact of early nutritional intervention on quality of life and clinical outcomes of cancer patients is widely recognized, some steps forward remain to be taken, and unfortunately, nutritional assessment is frequently neglected. Certainly, healthcare professionals delivering anticancer care have a long way to go to make nutrition care a standardized component of cancer management, but positive signals emanating from this intersociety and multidisciplinary national survey should encourage anticancer professionals to improve systematic nutritional screening and management of oncological patients.

5. Conclusion

To the best of the Authors' knowledge, the current study represents the first survey in literature supported by young sections of three healthcare professionals delivering anticancer care organizations from Italy (AIOM, AIRO, and SICO). Although the results could be affected by a not wide response rate from the target population receiving the invitation, our findings could suggest the persistence of an important gap between current delivery and need of nutritional assessment due to several reasons, and nutritional screening was performed globally in the 57.2% of cases, and in low percentage by a nutritionist. Despite the importance of the assessment of nutritional status in cancer patients is widely recognized by anticancer professionals, some questions remain unanswered, and our results call for an implementation, development, and larger use of specific tools able to perform nutritional assessment in this setting, and to improve nutritional support management in clinical practice.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

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TABLE 5 Section 4: Immunonutrition and Educational topics. Questionnaire answer distribution [*n* (%)].

	All (*n*=215)	SICO (*n*=101)	AIOM (*n*=56)	AIRO (*n*=45)
Section 4. Immunonutrition and Educational topics				
Q12. Do you think there are essential substrates for the nutritional support of patients treated with radiotherapy?				
Yes	95 (44.19%)	40 (39.60%)	25 (44.64%)	21 (46.67%)
No	58 (26.98%)	34 (33.66%)	16 (28.57%)	8 (17.78%)
Q13. Are you familiar with immunonutrition? If YES, can you indicate when it is prescribed? *				
Yes (Perioperative)	72 (54.55%)	54 (60.67%)	10 (41.67%)	3 (27.27%)
Yes (Preoperative)	48 (36.36%)	39 (43.82%)	4 (16.67%)	2 (18.18%)
Yes (in Radio/Chemotherapy)	30 (22.73%)	9 (10.11%)	12 (50%)	8 (72.73%)
No	91 (42.33%)	10 (9.9%)	36 (64.29%)	39 (86.67%)
Q14. Are there any topics related to nutrition in oncology that you would like to investigate? *				
Clinical impact of immunonutrition	139 (64.65%)	54 (53.47%)	42 (75%)	34 (75.56%)
Results of immunonutrition in patients undergoing neoadjuvant treatment	138 (64.19%)	56 (55.45%)	36 (64.29%)	36 (80%)
Surgical outcomes in immunotreated patients	135 (62.79%)	81 (80.2%)	26 (46.43%)	20 (44.44%)
Cost-effectiveness analysis of immunonutrition	93 (43.26%)	48 (47.52%)	23 (41.07%)	17 (37.78%)
Q15. How do you wish to receive information (indicate the methods you prefer)? *				
Specific webinar	168 (78.14%)	84 (83.17%)	46 (81.14%)	28 (62.22%)
Clinical work presentation	78 (36.28%)	42 (41.58%)	14 (25%)	15 (33.33%)
Podcast	30 (13.95%)	15 (14.85%)	6 (10.71%)	7 (15.56%)
Infographic card	40 (18.60%)	20 (19.8%)	7 (12.5%)	7 (15.56%)
Information slide set	79 (36.74%)	28 (27.72%)	30 (53.57%)	17 (37.78%)

*More than one answer was eligible.

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