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ORIGINAL ARTICLE

Late referral of cancer patients with malnutrition to dietitians: a prospective study of clinical practice

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Abstract

Purpose Malnutrition (MN) in cancer is common but underdiagnosed. Dietitian referrals may not occur until MN is established. We investigated cancer patient characteristics (demographics, nutritional status, and nutrition barriers) on referral to oncology dietitians. We also examined referral practices and prevalence of missed referral opportunities.

Methods This was a naturalistic multi-site study of clinical practice. Data from consecutive referrals were collected in inpatient and outpatient settings. Demographics, nutritional status (weight, body mass index (BMI), weight loss in the preceding 3–6 months, oral intake, nutrition barriers), referral reasons, and use of screening were recorded. Missed opportunities for earlier referral were also noted.

Results Two hundred patients were included (60% male, 51% inpatients). Half had gastrointestinal and hepatobiliary cancers. The majority were on antitumor treatment. Two-thirds had lost ≥ 5% body weight. Forty percent were overweight or obese. Seventy percent had ≥ 2 nutritional barriers. Most common nutrition barriers were anorexia, nausea, and early satiety. Greater weight loss and lower food intake were associated with ≥ 2 barriers. Weight loss was the most common referral reason. Screening was used in 35%. Referrals should have occurred sooner in nearly half (45%, $n = 89$).

Conclusions Cancer patients were referred late to a dietitian, with multiple nutritional barriers. Most referrals were for established weight loss (WL). WL may be masked by pre-existing obesity. Almost half had missed earlier referral opportunities; screening was infrequent. Over one-quarter should have been re-referred sooner. There is a clear need for clinician education. Future research should investigate the optimal timing of dietitian referral and the best nutrition screening tools for use in cancer.

Keywords Cancer · Dietitian · Malnutrition · Referral · Symptoms · Weight loss

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Introduction

Malnutrition (MN) in cancer is common but underdiagnosed [1]. The diverse diagnostic criteria for MN and the overlap with syndromes such as cancer cachexia complicate the definition of malnutrition [2] and reported prevalence varies by cancer site and stage [1]. Nevertheless, it is estimated that up to one-third of cancer outpatients are at nutritional risk [3] and 56% of inpatients with cancer are malnourished [4]. Risk of malnutrition is high, even in patients with localized disease [1], and is evident even before cancer treatment starts [1]. MN is associated with shorter survival [5], increases in length of hospital stay [5, 6], antibiotic use [4, 5] and healthcare costs [6], and poor quality of life [7]. Gastrointestinal (GI) symptoms like altered bowel habit, anorexia, dysgeusia, dysphagia, early satiety, nausea, and xerostomia can negatively impact dietary intake [8] and nutrition. Other nutritional barriers

include fatigue, pain, psychological difficulties [9, 10], lack of nutritional knowledge, and financial constraints [11].

It may be easier to prevent MN than to reverse it [11]. An individualized approach before and during cancer treatment is advocated [12] with intervention before severe MN develops [7]. Barriers to early intervention include lack of consensus about what degree of weight loss (WL) is clinically significant [13], obesity, failure to recognize MN risk, and inadequate screening. The National Institute for Health and Care Excellence (NICE) advocates nutritional support for adults with > 10% WL within the last 3 to 6 months, irrespective of diagnosis [14]. Other clinical guidelines recommend > 5% WL in an unspecified timeframe for diagnosis of undernutrition [15] or > 2% WL in 6 months for diagnosis of cancer cachexia in a person with body mass index (BMI) < 20 kg/m^2 or sarcopenia [16]. MN can be present in cancer regardless of BMI [17]. Many people with cancer are still overweight or obese despite significant prior unintentional WL and/or muscle loss [17]. Prior obesity is independently associated with malnutrition risk [5]; this may be because patients and caregivers are less concerned by WL in an obese person [5]. Moreover, high BMI can make it more difficult for clinicians to recognize MN risk [17] and thus delay intervention.

International guidelines advocate all patients with cancer be evaluated regularly for nutritional risk [7]. It is not possible to complete a full nutritional assessment for every oncology patient, due to resource constraints [18]; thus, screening is recommended to identify people at nutritional risk who need further assessment [18]. Several MN screening tools have been recommended for oncology [7], including the Malnutrition Universal Screening Tool (MUST) [19], the Malnutrition Screening Tool (MST) [20], and the NRS-2002 [21]. However, there is no consensus about which is best [22]. Screening practice is inconsistent across hospitals and clinicians [23].

Dietitians are key professionals in the management of malnutrition [23]. Unfortunately, dietitian referrals are often ad hoc and not part of routine multi-disciplinary care [24]. Between two-thirds [25] and one-third of malnourished patients with cancer [26] received no nutritional support. Failure to refer when dietetic input was necessary has also been reported in specific cancer cohorts—chemotherapy outpatients [27, 28] and oncology/hematology inpatients [6].

Although evidence for nutritional intervention remains weak [29], there is consensus that nutritional intervention should be introduced at a point when the aim is maintenance of or improvement in nutritional status [7]. Anecdotally, cancer patients access nutrition and dietetic services "too late" [9]. To our knowledge, no study to date has used real-world data to study this concern and describe the clinical characteristics (demographics, nutritional status, and barriers) of cancer patients at time of referral to oncology dietitians. We investigated these characteristics and examined referral reasons, use of nutritional screening, and prevalence of missed referral opportunities.

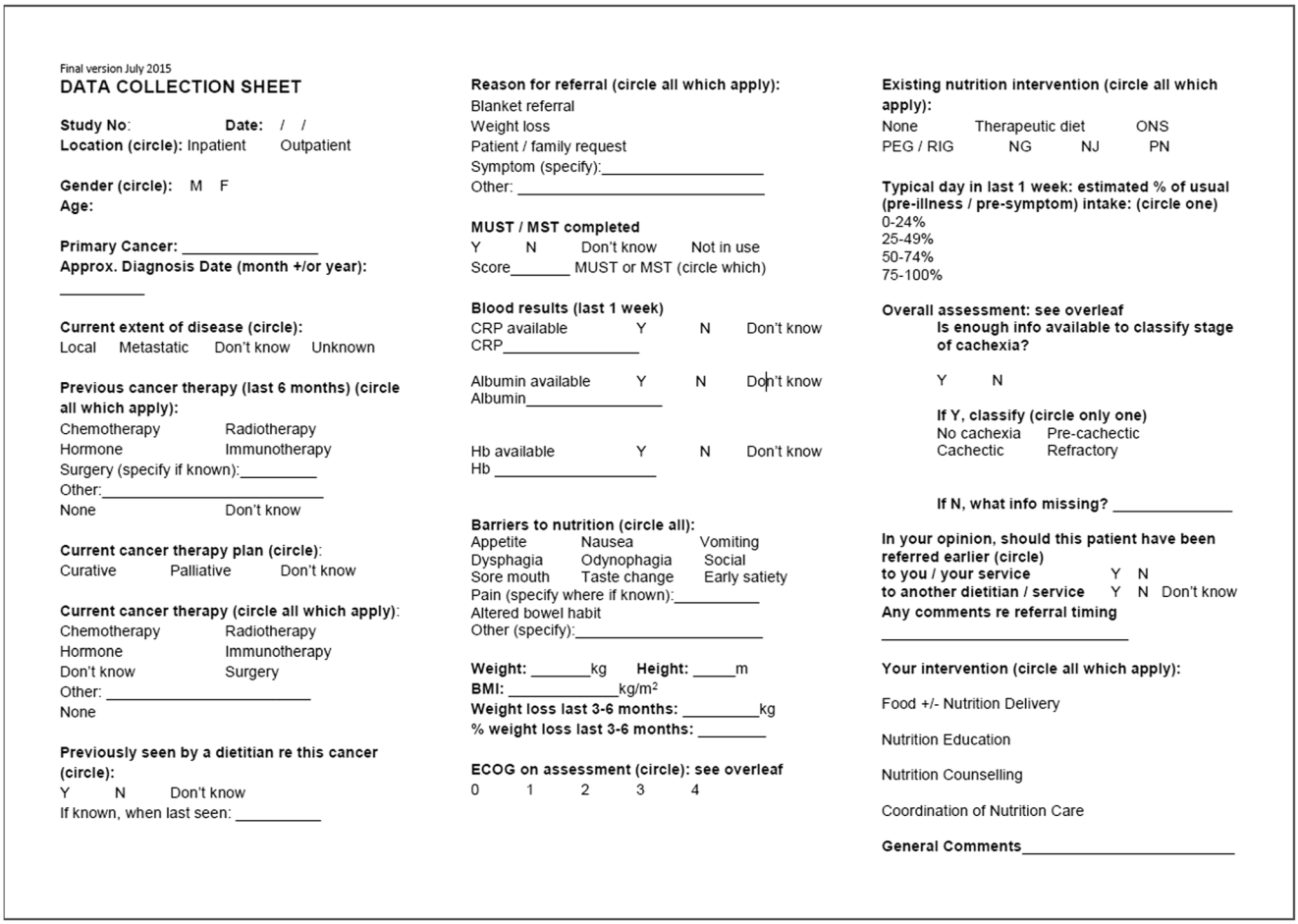
Methods

Data collection

This was a prospective multi-site naturalistic study of clinical practice. All dietitians involved were members of a multidisciplinary research group. Data from consecutive referrals were collected as part of routine first assessment by participating oncology dietitians in five tertiary referral hospitals, including public, private, inpatient, and outpatient settings. All five hospitals have dedicated oncology dietitians and provide a referral-based dietetic service on weekdays. As there is currently no national policy on referral criteria, screening tools, or referral forms, these varied across and within sites. One hospital provides only outpatient radiotherapy services, another is a cancer center with inpatient and outpatient chemotherapy and radiotherapy, and the remaining three hospitals are acute general hospitals with medical and surgical oncology services (all three) and radiotherapy (one hospital). Ethical approval was granted by the research ethics committee at each hospital. Waiver of written consent was approved at three sites (Tallaght University Hospital, St. Vincent's University Hospital, and St. Vincent's Private Hospital). At two sites, written consent was sought (St. Luke's Radiation Oncology Network and the Mater Private Mid-Western Regional Oncology Centre). Patient inclusion criteria were (1) solid tumor diagnosis, (2) ≥ 18 years old, and (3) a new dietitian referral. Lymphoma was included; other hematological malignancies were excluded.

A convenience sample size of 200 patients was agreed empirically in advance by the working group for this exploratory study. A standardized data collection form (Fig. 1) was devised and piloted on 20 patients (included in the final results). Minor adjustments were made, and the final form agreed by consensus. Data were collected in each hospital for four consecutive months between July 2015 and April 2016. Data were recorded during the encounter or immediately afterwards. A coded study number was assigned by the individual dietitian. Weekly teleconferences and monthly face to face meetings took place between researchers to ensure consistency of study processes.

Demographic data (age, gender, primary tumor site, disease extent, past and current treatment, and treatment intent) were recorded from patient healthcare records (paper and/or electronic). Date of cancer diagnosis and Eastern Cooperative Oncology Group Scale of Performance Status (ECOG PS) were noted [30]. Weight in kilograms (kg) was measured with clinic or ward scales. Make and model varied between hospitals; all were purchased and calibrated according to individual hospital policy. Height in centimeters was either measured or patient-reported. Current BMI was calculated (weight [kg]/squared height [meters^2]) and categorized as underweight, normal, overweight, or obese [31]. For analysis purposes,



Final version July 2015

DATA COLLECTION SHEET

Study No: **Date**: / /
Location (circle): Inpatient Outpatient

Gender (circle): M F
Age:

Primary Cancer: _____
Approx. Diagnosis Date (month +/or year):
_____

Current extent of disease (circle):
Local Metastatic Don't know Unknown

Previous cancer therapy (last 6 months) (circle all which apply):
Chemotherapy Radiotherapy
Hormone Immunotherapy
Surgery (specify if known):_____
Other:_____
None Don't know

Current cancer therapy plan (circle):
Curative Palliative Don't know

Current cancer therapy (circle all which apply):
Chemotherapy Radiotherapy
Hormone Immunotherapy
Don't know Surgery
Other: _____
None

Previously seen by a dietitian re this cancer (circle):
Y N Don't know
If known, when last seen: _____

Reason for referral (circle all which apply):
Blanket referral
Weight loss
Patient / family request
Symptom (specify):_____
Other: _____

MUST / MST completed
Y N Don't know Not in use
Score_____ MUST or MST (circle which)

Blood results (last 1 week)
CRP available Y N Don't know
CRP_____

Albumin available Y N Don't know
Albumin_____

Hb available Y N Don't know
Hb _____

Barriers to nutrition (circle all):
Appetite Nausea Vomiting
Dysphagia Odynophagia Social
Sore mouth Taste change Early satiety
Pain (specify where if known):_____
Altered bowel habit
Other (specify):_____

Weight: _____kg **Height:** _____m
BMI: _____kg/m²
Weight loss last 3-6 months: _____kg
% weight loss last 3-6 months: _____

ECOG on assessment (circle): see overleaf
0 1 2 3 4

Existing nutrition intervention (circle all which apply):
None Therapeutic diet ONS
PEG / RIG NG NJ PN

Typical day in last 1 week: estimated % of usual (pre-illness / pre-symptom) intake: (circle one)
0-24%
25-49%
50-74%
75-100%

Overall assessment: see overleaf
Is enough info available to classify stage of cachexia?

Y N

If Y, classify (circle only one)
No cachexia Pre-cachectic
Cachectic Refractory

If N, what info missing? _____

In your opinion, should this patient have been referred earlier (circle)
to you / your service Y N
to another dietitian / service Y N Don't know
Any comments re referral timing
_____

Your intervention (circle all which apply):

Food +/- Nutrition Delivery

Nutrition Education

Nutrition Counselling

Coordination of Nutrition Care

General Comments_____

Fig. 1 Data collection sheet

the underweight and obese categories were conceptualized as "extreme BMI" because three-quarters of the Irish population have normal or overweight BMI [32]. WL (kg) and percentage (%) WL were calculated, based on documented weight from 3 to 6 months preceding the consultation. If no documented prior weight was available, patient-reported prior weight was used. If edema or ascites were present, dry weight was estimated by professional consensus guidelines [33]. Current dietary intake was estimated as a percentage of usual intake (0–25%, 25–50%, 50–75%, ≥75%) [7]. Patient-reported nutrition barriers were recorded, based on the Patient-Generated Subjective Global Assessment (PG-SGA) [8], with minor modifications by group consensus, to allow capture of other symptom and non-symptom barriers, e.g., psychosocial, medical. Barriers recorded were (poor) appetite, nausea, vomiting, dysphagia, odynophagia, social, sore mouth, taste change, early satiety, pain, altered bowel habit, and others (Fig. 1).

Reason for referral (e.g., WL, patient/family request, symptom) and use of any nutritional screening tool by the referrer were noted. Screening was not routine practice across all hospitals in the study, with MUST in use in 3 hospitals (but only in inpatients for 2 of these with no screening in other parts of the hospital), MST in use at 1 hospital, and no screening in another hospital. Malnutrition Universal Screening Tool (MUST) [19] scores were calculated retrospectively for each patient, even if screening had not been used by the referrer. Some patients had been seen previously by a dietitian, either in other hospitals or in the treating hospital. These patients were included only if they had been fully discharged from the original dietitian and were subsequently a new referral to the participating dietitian. Where patients had seen another dietitian previously, this was termed previously assessed (PA). People who had never seen a dietitian since cancer diagnosis were termed never assessed (NA).

We evaluated whether earlier opportunities for referral or re-referral were missed, characterized as "earlier referral needed." There were no set criteria for this; it was a subjective global judgment by the dietitian and was based on the current clinical status of the patient, their reported history of weight loss and nutrition barriers, and known prior contacts with health professionals, for example, prior admission to hospital, since cancer diagnosis and onset of weight loss, with no referral to dietitian. Dietitians also assessed the clinical utility of the 2011 cancer cachexia consensus classification [16]. Full

results of this will be presented elsewhere. Data were collated in a Microsoft Excel spreadsheet (2013, Microsoft Corporation, Redmond, WA) with each entry double-checked for accuracy.

Statistical analysis

Categorical variables were summarized as frequency counts and percentages, continuous variables as median and range. Chi-squared tests compared categorical variables, with Yates' correction for continuity if there were only two categories. Independent *t* tests and Mann-Whitney *U* tests examined group differences between means and medians respectively. Pearson's product-moment correlation coefficient and Spearman's rank-order correlation were used for normal and non-normally distributed data respectively. *P* values < 0.05 (two-tailed) were deemed significant; multiple testing was not accounted for in this hypothesis-generating analysis. Statistical analysis was conducted using Microsoft Excel and SPSS software (Version 20.0, IBM Corporation, Armonk, NY). All percentages are rounded to the nearest whole number throughout.

Results

Data recording forms were complete except location ($n = 1$), treatment intent ($n = 2$), performance status (PS) ($n = 2$), height ($n = 2$), WL amount ($n = 5$), and whether previously assessed by a dietitian ($n = 4$). Demographic data are in Table 1. Median age was 65 years (range 19–93). The population was predominantly male and almost evenly divided between inpatients and outpatients. Half had gastrointestinal (GI) and hepatobiliary cancers. Most (69%) had good PS (ECOG 0–1). About one-third were being treated with curative intent and 50% palliative. Only 9% were not on some form of active therapy. Table 2 summarizes nutritional status. Sixty-six percent had WL $\geq 5\%$. Forty percent were overweight or obese. Most (79%) of those with normal or overweight BMI had lost weight (any weight loss).

The most frequent nutrition barriers were loss of appetite (47%), nausea (34%), and early satiety (27%) (Fig. 2). Seventy percent ($n = 140$) had 2 or more barriers while 90% ($n = 180$) had 1 or more. Both greater WL ($\chi^2 = 23.15$, $p < 0.001$, phi $= -0.36$) and lower food intake (50% usual/normal intake $\chi^2 = 14.58$, $p < 0.001$, phi $= -0.28$) were associated with ≥ 2 barriers. Oral intake decreased (Spearman rho $= -0.49$, $p < 0.00$) and WL increased (Spearman rho $= 0.38$, $p < 0.001$) with more barriers. There was significantly more WL between those with and without anorexia (median 9% vs 5% WL, $U = 3384$, $z = -3.45$, $p = 0.001$, $r = 0.24$), early satiety (median 9% vs 6% WL, $U = 2637$, $z = -3.00$, $p =$

Table 1 Demographic data ($N = 200$)

Variable	
Age (years; median, range)	65 (19–93)
Gender (*N*, %)	
Male	119 (60)
Female	81 (40)
Location (*N*, %)	
Inpatient	102 (51)
Outpatient	97 (48)
Missing data	1 (1)
Diagnosis (*N*, %)	
Upper gastrointestinal	35 (18)
Hepatobiliary	33 (17)
Colorectal	29 (15)
Head and neck	26 (13)
Genitourinary	18 (9)
Breast	18 (9)
Lung	16 (8)
Other	15 (8)
Gynecological	7 (4)
Unknown primary	3 (2)
Extent of disease (*N*, %)	
Local	87 (44)
Metastatic	97 (49)
Unknown	16 (8)
Treatment intent (*N*, %)	
Curative	70 (35)
Palliative	104 (52)
Unknown	26 (13)
Current antitumor treatment (*N*, %)	
Chemotherapy	116 (58)
Radiotherapy	78 (39)
No antitumor treatment	18 (9)
Surgery	15 (8)
Immunotherapy	9 (5)
Hormone	7 (4)
Bisphosphonate	3 (2)
TACE liver metastases	1 (1)
Unknown	3 (2)
ECOG PS (*N*, %)	
0	69 (35)
1	67 (34)
2	37 (19)
3	22 (11)
4	3 (2)
Unknown	2 (1)

TACE, transarterial chemoembolization; *ECOG*, Eastern Cooperative Oncology Group; *PS*, performance status

Unknown: where study dietitian unable to determine disease extent, treatment intent or ECOG, or missing data

Table 2 Nutritional assessment ($N = 200$)

Characteristic	N (%)
BMI (kg/m^2)	
< 18.5 (underweight)	24 (12)
18.5–24.9 (normal)	95 (48)
25–29.9 (overweight)	54 (27)
≥ 30 (obese)	25 (13)
Unknown	2 (1)
Weight loss (%)	
None	44 (23)
< 5	23 (12)
5–9.9	58 (30)
≥ 10	70 (36)
Unknown	5 (3)
Estimated % daily intake	
0–24	19 (10)
25–49	42 (21)
50–74	69 (35)
75–100	70 (35)
MUST score	
≥ 2	94 (49)
< 2	99 (51)
Unknown	7 (4)

BMI, body mass index; *MUST*, Malnutrition Universal Screening Tool

Unknown: where study dietitian unable to determine or missing data

0.003, $r = 0.22$), and nausea (median 9% WL vs 5% WL, $U = 2988$, $z = -3.35$, $p = 0.001$, $r = 0.24$).

The most common reasons for dietitian referral were WL (52%), poor appetite (27%), automatic referral in a treatment-specific pathway (24%), dysphagia (8%), and nausea/vomiting (5%). Three percent of referrers specified patient or family request. Seventy-seven people were PA and 119 NA (Fig. 3). Median time from diagnosis to referral was 61 days (range 4–8078) for NA and 313 (range 9–6622) for PA ($z = 4.945$, $p < 0.001$). Median time since last dietitian visit was 71 days (range 0–2244). Inpatient status, metastatic disease, and palliative treatment intent were significantly more common in the PA group. Age and gender were similar between PA and NA. Formal nutritional screening was used by the referrer in 69 (35%): MUST in 57 people at four hospitals, MST in 12 people at one hospital.

Figure 3 shows the breakdown of all referrals: prior assessment, whether earlier referral was needed, and the subset of patients who received automatic referral. Dietitian judged referral should have occurred sooner in nearly half of the total population (45%; $n = 89$) (Fig. 3). Most (56%; $n = 67$) of NA needed earlier referral compared with 26% ($n = 20$) of PA ($p < 0.001$). There were more outpatients ($p = 0.042$), greater WL ($p = 0.0015$), and more extreme BMI values ($p = 0.031$) among those judged to need earlier referral. Primary tumor sites, age, gender, time since diagnosis, and treatment intent were similar between those who needed earlier referral and those who did not. Fifty-four percent ($n = 26$) of people referred as part of a treatment-specific pathway (automatic referral) required earlier referral compared with 41% ($n = 63$) of those referred for any other reason; this was not statistically significant ($p = 0.136$).

Discussion

People with cancer were often referred to a dietitian after significant WL had already occurred. In almost half of new referrals, an earlier opportunity to see a dietitian was judged to have been missed. Most also had normal or high BMI, despite prior WL, and had concurrent multiple nutrition barriers. Nutrition barriers were very common and were associated with lower food intake and greater WL.

This was a naturalistic study of clinical practice. The median patient age reflected that of people diagnosed with cancer in Ireland. Males accounted for 60%; 53% of cancers are diagnosed in males [34]. The most common cancers were GI and hepatobiliary. These cancers are commonly associated with WL [6, 9]. Prostate and breast cancers [1] are typically associated with less WL or even weight gain. Clinicians may be less alert to nutritional abnormalities in these groups with correspondingly lower referral rates. Lung cancer, also associated with WL [35], was underrepresented. This could signify failure to refer or reflect hospital sites' patient profiles. Many people with lung cancer are now treated at designated lung cancer centers. Only one participating site was a lung cancer center. Similarly, two of the participating hospitals are specialist treatment centers for pancreatic cancer, which may have affected the case mix.

Most had already lost weight (over half had already lost ≥ 5% of their body weight in the preceding 3 to 6 months). While some WL may precede diagnosis, the median time to first referral of over 2 months suggests a potential missed earlier referral opportunity. Given that the majority were on active antitumor treatment, this suggests a lack of appreciation of nutrition as an essential component of supportive care.

Of those with a normal BMI, almost one-third had previously been overweight or obese. Almost all with a normal or overweight BMI had lost weight. These results support a small study in chemotherapy outpatients, where most without dietetic referral had a normal or high BMI [28]. In a society where as many people are overweight as have a normal BMI [32], someone may have to be visibly underweight or obese to prompt clinical concern. Forty-four percent were overweight or obese by BMI, like other studies in mixed cancer cohorts [17, 36]. There is a high prevalence of MN risk (50%) in overweight and obese people with cancer [17]. Inflammation associated with

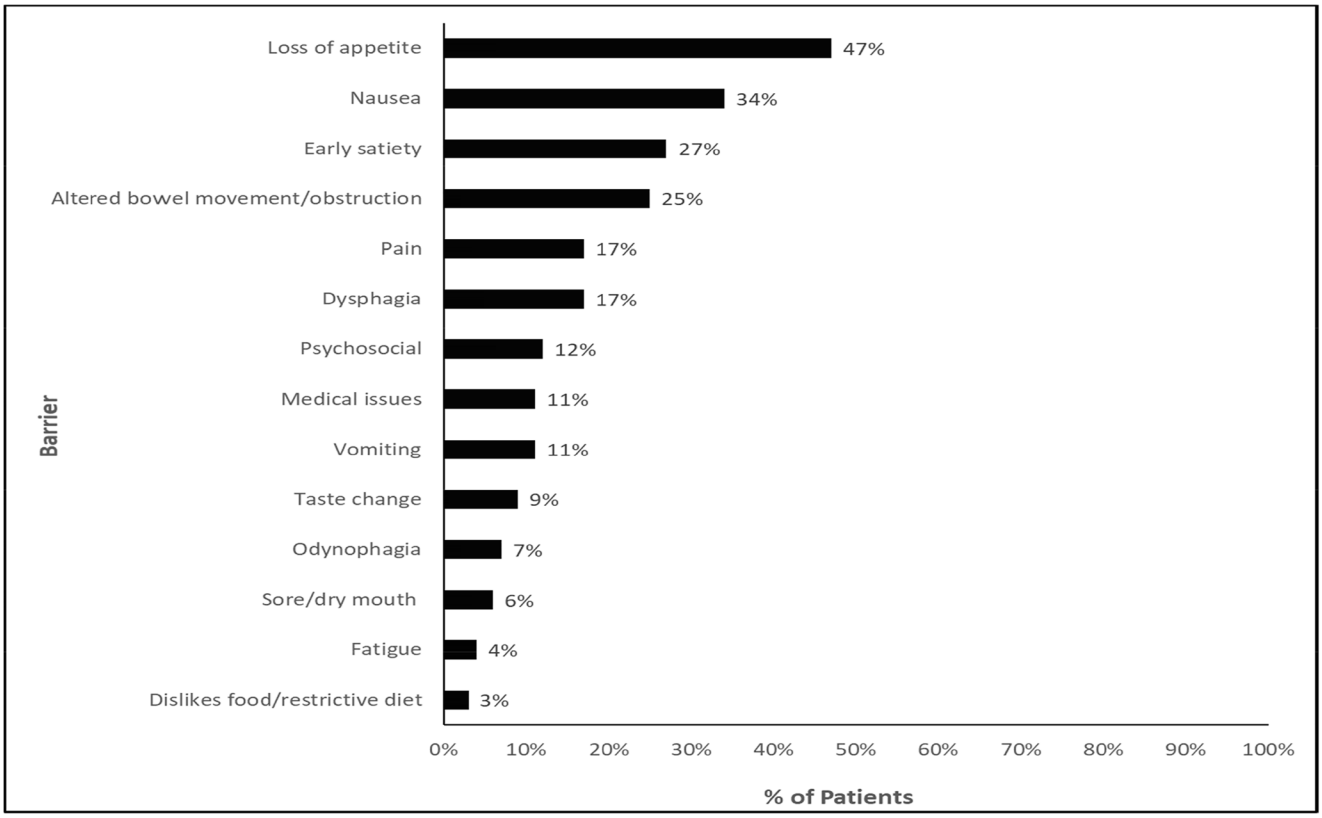


Fig. 2 Prevalence of nutrition barriers ($N = 200$)

obesity contributes to MN [37]. Excess body fat can conceal muscle loss (sarcopenia) [9]; sarcopenic obesity is an independent predictor of poor survival in cancer [36].

Ninety percent had at least one nutrition barrier. The top three nutrition barriers (anorexia, nausea, and early satiety) were similar regardless of whether or not someone had previously seen a dietitian. This suggests consistent problems across the cancer trajectory, which warrant ongoing attention. Over one-quarter, for example, reported early satiety. Non-GI and psychosocial barriers to nutrition were also prevalent. The number of nutrition barriers was significantly associated with both reduced food intake and greater WL. Our findings support a recent review which highlighted the major contribution of reduced intake to WL in cancer [10].

Over half of those who had never seen a dietitian before should have been referred sooner, in the opinion of the oncology dietitian. These findings support previous studies in chemotherapy (35%; [28]) and site-specific (40%; [27]) groups. Another study [6] found 67% of oncology and hematology inpatients had no nutritional support despite being at risk. Even among people who were previously assessed by a dietitian, we found over one-quarter should have been re-referred more quickly. This implies repeated failures to refer in a timely manner to a dietitian.

Late referrals were common, despite a significant minority who were on an automatic referral protocol. This was typically where referral occurred at the start of radiotherapy rather than at diagnosis. Opportunities to see a dietitian, and a window for nutritional intervention, may have been missed in other hospitals or in primary care.

Referrals were largely reactive. Most were for established WL (rather than MN risk). Only one-quarter were referred for anorexia, which suggests poor recognition of this important nutrition barrier. Consistent with other studies [35, 38], anorexia was common and was associated with higher degrees of WL in our cohort. Anorexia, together with early satiety, is associated with poor quality of life [38]. Presence of anorexia predicts survival in advanced cancer [39] but anorexia is also a key feature of the pre-cachexia stage of cancer cachexia [16]; thus, it is important to identify it at all stages of cancer treatment.'

Nutrition is a major concern for people with cancer [7] yet patient or family request accounted for only a small minority of referrals. If people are not provided with good information, they may look elsewhere, e.g., online where information is often inaccurate [40].

Nutritional screening was only used in one-third despite established international best practice guidelines [7]. Even when screening was used, issues remain. MUST is considered a simple tool [19]. Nonetheless, we noted that it was sometimes calculated incorrectly by referrers in our study. It has been proposed that screening tools should focus less on BMI

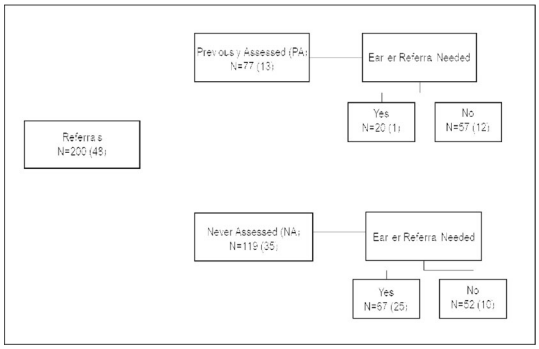


Fig. 3 Assessment and referral status

and that the use of BMI in a screening tool may even hinder the detection of MN [22]. Current screening tools do not address abnormalities of body composition, such as sarcopenia, and a recent study demonstrated that none of the tools studied (MUST, MST, and Nutritional Risk Index (NRI)) were sensitive and specific in the detection of such abnormalities in chemotherapy patients [22]. The authors found that the NRI was most strongly predictive of survival in this cohort [22]. Symptom and non-symptom nutrition barriers were both prevalent and clinically important in our study, yet are not included in most standard nutritional screening tools, including the NRI. The abridged or short-form PG-SGA does address symptoms, as well as food intake and weight loss parameters [18], and has been proposed as a screening tool for chemotherapy outpatients [18]. Further validation of this tool is needed before it is used clinically for a wider oncology population. Future studies must identify which screening tools are best to identify patients at risk of poor clinical outcomes [22] and who will most benefit from nutritional assessment and intervention.

Outpatients in our study were significantly more likely to have missed earlier referral opportunities, consistent with earlier work [27]. Earlier opportunities might be missed due to inadequate dietitian services, particularly in community settings. However, better funding of nutritional care may have economic benefit. MN is associated with higher healthcare costs [6] and early intervention could allow significant savings. One Australian study estimated that diagnosing all cases of malnutrition in an acute oncology hospital could generate an extra AU$ 400,000 (approx. US$ 285,000) in reimbursements annually [41].

In 1974, Butterworth [42] denounced failings in nutritional care. This included delay of nutrition support until MN is advanced and "diffusion of responsibility." Our findings suggest insufficient progress. MN concerns medical, nursing, and dietetic staff, yet lines of responsibility may be blurred and care gaps result. Clinicians may only notice well-established nutritional issues [9, 28]. Lack of knowledge may contribute. Oncology trainees agree nutritional status is important but lack confidence in their ability to recognize MN [13]. Although nurses could monitor and screen nutritional status, some do not have the time or knowledge [11]. The ESPEN (European Society for Clinical Nutrition and Metabolism) [7] proposed clear separation of level 1 (non-nutrition expert healthcare professionals) and level 2 (nutrition professionals), who screen and assess respectively. Screening must be underpinned by education of healthcare professionals, both in use of screening tools and in documentation of nutritional status [23].

The findings described a cohort of patients referred to oncology dietitians in specialist oncology centers; findings may not be applicable to sites without specialist oncology teams or with limited dietetic services. Busy centers with more robust infrastructure may be better at identification of MN [43]. Reason for referral may have been influenced by site-specific procedures and referral forms. We did not group study participants as malnourished/not malnourished nor did we utilize formal criteria to diagnose malnutrition. We did not set out to describe the prevalence of MN but rather sought to describe the population referred to dietitians and timing of referral. Since the most favorable time to commence nutrition support has not been established [7] and the literature on timing of dietitian referrals is very sparse, the judgment of "should have been referred sooner" was necessarily subjective. However, a pilot study suggested a benefit for dietetic intervention at diagnosis, compared with referral-based intervention, with better quality of life, lower nutritional risk, and possible improved survival in those who received earlier intervention [12]. Another study found a survival benefit in esophageal cancer with nutritional intervention before initiation of chemoradiotherapy [44]. Our study did not collect outcome data and could not assess whether outcomes were different for those who had repeated dietitian consultations. A recent study found that inpatients with cancer who had at least 3 dietitian consultations had significant improvements in energy intake and body weight [45]. A longitudinal study which is specifically designed for the objective would help clarify the impact of an automatic referral protocol on outcomes. Future research should investigate the optimal

timing and duration, referral criteria, and impact of single and repeated dietitian consultation.

The study was conducted in naturalistic clinical practice and included consecutive unselected referrals. It reported practice across five different hospitals, in two different cities, and in both private and public settings. It included people treated with each of the major antitumor modalities, and both inpatients and outpatients. Data were collected as part of routine care and the methodology is reproducible in other settings.

Conclusions

This naturalistic study of clinical practice confirms anecdotal concerns about nutrition in cancer care. People with cancer were referred to a dietitian after significant and established WL. Pre-existing obesity may contribute; almost half were overweight or obese by BMI. In almost half of new referrals, an earlier opportunity to see a dietitian was missed, despite a significant minority on an automatic referral protocol. Failure to re-refer was also seen among people who had previously seen a dietitian. Referrals were reactive rather than proactive. Most had normal or high BMI, despite significant WL, and multiple nutrition barriers. Ninety percent had at least one nutrition barrier. Most common barriers were anorexia, nausea, and early satiety. These three symptoms were associated with greater WL. Weight loss was the most common reason for referral. Nutritional screening was infrequent despite best practice guidelines. Future research should investigate the optimal timing and criteria for dietitian referral, and identify which screening tools are most suitable for an increasingly overweight population and are predictive of important clinical outcomes. There is also a clear need for education for clinicians about MN risk and use of screening tools, to allow prioritization of dietitian referrals to dietitians and best use of resources for patient care.

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Collected data: Geraldine Guiry

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Data availability The authors confirm having full control of primary data and agree that Supportive Care in Cancer may review this data on request.

Compliance with ethical standards

Ethical approval was granted by the research ethics committee at each hospital. Waiver of written consent was approved at three sites (Tallaght University Hospital, St. Vincent's University Hospital, and St. Vincent's Private Hospital). At two sites, written consent was sought (St. Luke's Radiation Oncology Network and the Mater Private Mid-Western Regional Oncology Centre).

Conflict of interest The authors declare that they have no conflict of interest.

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