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Chapter

Perspective Chapter: Early Diagnosis of Malnutrition

Tomiyo Nakamura and Hiroshi Imamura

Abstract

Low body mass index (BMI) and unintentional weight loss are the criteria used in many nutritional screening tools (NSTs) to identify the nutritional status of patients and the elderly. However, in hospitals, nursing homes, and communities, weight is often unmeasured. Therefore, we researched the current situation of inadequate nutritional screening due to a lack of weight measurements and what should be done to improve this situation. We conducted a narrative review of peer-reviewed research on nutritional screening, NSTs, missing NST parameters, regular weight measurements, awareness of malnutrition among physicians and others, and nutrition support based on PubMed and J-stage. The NSTs included mostly weight or weight-based parameters (BMI and weight loss). Our findings suggest that, since patients and the elderly do not weigh themselves regularly, they are unaware of their weight loss and do not receive proper nutritional care. The results also show that physicians do not often recognize nutritional problems that require nutritional intervention and do not order nutritional intervention by dietitians. Moreover, patients and community residents at risk of malnutrition do not recognize anorexia and weight loss as nutritional problems. Multidisciplinary and collaborative nutritional interventions are needed to reduce the risk of malnutrition in patients and the elderly.

Keywords: malnutrition, weight loss, nutrition screening, nutritional intervention, weight measurement

1. Introduction

Malnutrition in patients and the elderly decreases the activities of daily living and the quality of life, and it contributes to infections and delayed healing due to reduced immunity, which affects patient prognosis and survival [1]. Therefore, it is important to identify malnutrition at an early stage and provide appropriate nutritional care.

A variety of nutritional screening tools (NSTs) have been developed to identify malnutrition in patients and the elderly, and many tools and their diagnostic accuracies have been reported [2–6]. The parameters of NSTs are generally categorized into anthropometric, biochemical, clinical, dietary assessment, psychological, social, and physical parameters [7]. Most NSTs include anthropometric measurements, especially weight and weight-based parameters (body mass index [BMI] and weight loss).

The Global Leadership Initiative on Malnutrition (GLIM), developed in June 2018 with the participation of four societies in Europe, the United States, Asia, and...
South America, suggests the evaluation of the possibility of malnutrition by assessing phenotypic and etiologic criteria if a validated screening tool determines a patient is at risk [8]. The phenotypic criteria are (1) unintentional weight loss, (2) low BMI, and (3) reduced muscle mass, and the etiologic criteria are (1) reduced food intake or assimilation and (2) inflammation or disease burden. If any of these phenotypic or etiologic criteria are met, a diagnosis of malnutrition is established, and the severity is proposed according to phenotypic metrics. Thus, low BMI and weight loss are not only NSTs, they are also essential components of the GLIM criteria and are equal or more important nutritional parameters compared with other measures of nutrition. Therefore, if the weight of patients and elderly people are not measured and low BMI and unintentional weight loss are not assessed, there is a possibility that truly undernourished patients will not be identified.

Low BMI and unintentional weight loss are the criteria used in many NSTs to identify the nutritional status of patients and the elderly. Unintentional weight loss, a characteristic of malnutrition, is associated with a loss of skeletal muscle mass and increases the risk of sarcopenia, which is characterized by a loss of both muscle mass and muscle strength and function [9]. For this reason, it is important to identify unintentional weight loss.

However, in hospitals, nursing homes, and communities, bodyweight, which is required for evaluating nutritional parameters such as low BMI and unintentional weight loss, is often not measured [10–12]. This has led to the inadequate nutritional screening of patients and the elderly and has caused cases of malnutrition to be overlooked. Therefore, we researched the current situation of inadequate nutritional screening due to the lack of weight measurements to identify strategies to improve this situation.

We conducted a narrative review of peer-reviewed research on nutritional screening, missing NST parameters, regular weight measurements, awareness of malnutrition among physicians and others, and nutrition support from 2010 to 2021 using PubMed and J-stage [13]. Regarding NSTs, the major ones are listed, without any limitations on date.

2. Major validated nutritional screening tools

This section reviews the parameters for assessing the nutritional status of major validated NSTs. Nutritional screening is the first step in nutrition management. A validated NST should be used to identify patients and older adults at nutritional risk, perform a nutritional assessment, and initiate an appropriate intervention for nutrition support.

A systematic review of NSTs for the hospital setting identified 32 different NSTs, most of which were reported to include low BMI and weight loss [14]. Another systematic review reported that 16 NST parameters were categorized as anthropometric, biochemical, clinical, dietary assessment, psychological, social, and physical parameters [7]. In the NSTs, 93% included physical measurements, especially weight or weight-based parameters (BMI and weight loss), and only 12% included biochemical parameters [7]. The commonly NSTs used are described below [2–6].

1. Malnutrition Screening Tool (MST)

   The MST is a simple tool designed by Ferguson et al. which inquires only about weight loss and appetite loss [2].
2. Malnutrition Universal Screening Tool (MUST)

MUST is an NST developed by the British Society of Venous and Enteral Nutrition [3]. The total score of four items (BMI, weight loss, acute illness, and inadequate nutritional intake) is used to determine low, medium, or high risk.


NRS2002 is an NST developed by the European Society for Clinical Nutrition and Metabolism in 2002, and it is mainly used in acute care [4]. It consists of an initial screening consisting of four items: BMI, weight loss, decreased dietary intake, and the presence of severe disease, and a final screening consisting of nutritional impairment, disease severity, and age-related scores.

4. Mini Nutritional Assessment Short-Form (MNA-SF)

The Mini Nutritional Assessment (MNA) was developed to evaluate certain subgroups, especially the elderly, before overt changes in weight or albumin occur [5]. The MNA-SF was later designed to provide a simpler and more practical screening tool [6]. It consists of six items. Each indicator is scored from 0 to 2 or 3, and the total score is used to determine whether the patient has a normal nutritional status, is at risk of malnutrition, or is malnourished.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>MUST</th>
<th>NRS2002</th>
<th>MNA-SF</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI (kg/m²)</td>
<td>0: ≥20</td>
<td>1: 18.5–20.5</td>
<td>3: ≥23</td>
</tr>
<tr>
<td></td>
<td>1: 18.5–20</td>
<td>2: ≤18.5</td>
<td>2: 21–23</td>
</tr>
<tr>
<td></td>
<td>2: ≤18.5</td>
<td></td>
<td>1: 19–21</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0: ≤19</td>
<td></td>
</tr>
<tr>
<td>Weight loss (in the past 1–6 months)</td>
<td>0: ≤5%</td>
<td>1: ≥5% in 3 months</td>
<td>(During the last 3 months) 3: no weight loss</td>
</tr>
<tr>
<td></td>
<td>1: 5–10%</td>
<td>2: ≥5% in 2 months</td>
<td>2: 1–3 kg</td>
</tr>
<tr>
<td></td>
<td>2: ≥10%</td>
<td>3: ≥5% in 1 month</td>
<td>1: does not know</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0: ≥3 kg</td>
</tr>
<tr>
<td>Food intake</td>
<td>2: acutely ill +</td>
<td>0: 0–25%</td>
<td>2: no decrease</td>
</tr>
<tr>
<td></td>
<td>no nutritional intake</td>
<td>1: 25–50%</td>
<td>1: moderate decrease</td>
</tr>
<tr>
<td></td>
<td>for &gt; 5 days</td>
<td>2: 50–75%</td>
<td>0: severe decrease</td>
</tr>
<tr>
<td>Mobility</td>
<td>0: bed or chair bound</td>
<td>1: able to get out of bed/chair but does not go out 2: goes out</td>
<td></td>
</tr>
<tr>
<td>Psychological stress or acute disease</td>
<td>(Within the past 3 months) 2: no</td>
<td>0: yes</td>
<td></td>
</tr>
<tr>
<td>Neuropsychological problems</td>
<td>2: no psychological problems</td>
<td>1: mild dementia 0: severe dementia or depression</td>
<td></td>
</tr>
</tbody>
</table>

BMI, body mass index; MUST, Malnutrition Universal Screening Tool; NRS2002, Nutritional Risk Screening 2002; MNA-SF, Mini Nutritional Assessment Short-Form.

Table 1.
Screening scores for each indicator in the major nutritional screening tools.
Table 1 shows the screening scores for each indicator in the three NSTs. All three NSTs assess weight loss, BMI, and food intake. In these three NSTs, only MNA-SF can be assessed even if weight loss is unknown. The duration and amount of weight loss for the three NSTs are not standardized, but a weight loss of 5% within 3 months may be the standard.

Thus, the parameters of NST include mostly weight or weight-based parameters (BMI and weight loss). This suggests the importance of regular nutritional screening and regular weight measurements for identifying malnutrition.

However, some patients and the elderly are unable to measure their own weight. Therefore, the advantage of the MNA-SF is that it can measure the calf circumference (CC) instead of BMI for elderly people who have difficulty measuring their height and weight [6]. However, Kostka et al. evaluated the usefulness of the MNS-SF in different elderly populations in Poland and concluded that BMI is more useful than CC [15]. For this reason, CC should be used only when BMI cannot be measured, and weight should be measured when possible.

<table>
<thead>
<tr>
<th>Author, Year</th>
<th>NST</th>
<th>Subjects</th>
<th>Missing parameter data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neelemaat F., 2011 [10]</td>
<td>MUST MNA-SF</td>
<td>Netherlands (n = 275)</td>
<td>Missing data 47%</td>
</tr>
<tr>
<td>Ostrowska J., 2021 [18]</td>
<td>MST</td>
<td>(nDay survey) Poland European</td>
<td>Weight loss: missing/unknown 64% (n = 496) 64% (n = 10,862)</td>
</tr>
<tr>
<td>Graeb F., 2021 [11]</td>
<td>MUST</td>
<td>Germany (n = 2,058)</td>
<td>Previous weight or no weight Some residents</td>
</tr>
<tr>
<td>Torbahn G., 2021 [19]</td>
<td>17 variables</td>
<td>European (n = 39,840)</td>
<td>No data for body weight at follow-up 51.3%</td>
</tr>
<tr>
<td>Lahmann N. A., 2016 [12]</td>
<td>MNA-SF MUST</td>
<td>Germany (n = 878)</td>
<td>Weight loss: missing/unknown 48.8% 39.1%</td>
</tr>
<tr>
<td>Nakamura T., 2021 [20]</td>
<td>Japan NST</td>
<td>Japan (n = 103)</td>
<td>Weight loss: missing/unknown 78.6%</td>
</tr>
<tr>
<td>Mikkelsen S., 2021 [21]</td>
<td>(Interviews)</td>
<td>Denmark (n = 30)</td>
<td>Health professionals rarely saw patients with unintended weight loss</td>
</tr>
</tbody>
</table>

BMI, Body Mass Index; MUST, Malnutrition Universal Screening Tool; ESPEN, European Society for Clinical Nutrition and Metabolism; MNA-SF, Mini Nutritional Assessment Short Form; NRS2002, Nutritional Risk Screening 2002; NST, Japan Nutritional Screening Tool; nDay Survey, nutritionDay Survey.

Table 2. Screening scores for each indicator in the major nutrition screening tools.
3. Deficiencies in nutrition screening parameters

This section reviews the proportion of patients and residents assessed by NST-based nutritional screening in hospitals, nursing homes, and the community. Table 2 shows the screening scores for each indicator of the major NSTs.

Neelemaat et al. compared five MSTs for patients in one hospital and found that 47% of the data were missing for MUST and 41% were missing for MNA-SF [10]. They also reported that MUST had low applicability due to the high rate of missing data, while the MNA-SF showed excellent sensitivity but low specificity.

Henriksen et al. attempted to quantify the frequency of malnutrition and the proportion of malnourished patients in two university hospitals in Norway using data from the nDay survey [16]. However, they reported that BMI could be calculated for only two-thirds of the patients because weight and height data were often missing from the patient records.

Ostrowska et al. compared results from all European countries participating in the nDay survey with those from Poland [17]. The results showed that 64% of the data on weight loss within 3 months were missing in both Europe and Poland, and several elements of the nutritional management process in Polish hospitals were inadequate. These results indicate that not all hospital inpatient weight data are available.

Graeb et al. analyzed data from a total of 2058 residents of 19 nursing homes who were hospitalized for more than 3 days in order to determine the causes of their malnutrition risk [11]. The results suggested that the actual prevalence of malnutrition and the risk of malnutrition may still be underestimated, as the last weight measured was a long time ago and some residents did not have access to their weight history prior to hospitalization.

Torbahn et al. investigated predictors of malnutrition in nursing home residents aged 65 years and older who participated in the nDay survey from 2007 to 2018 [19]. They excluded 20,443 (51.3%) of the 39,840 residents with no data on bodyweight at follow-up. This study shows that most nursing homes do not regularly measure the weight of their residents.

Lahmann et al. conducted a multicenter prevalence study of 878 randomly selected clients from 100 randomly selected home care services in Germany in 2012 [12]. They reported that there were many missing values in both NSTs (MNA-SF 48.8%, MUST 39.1%) because many clients did not provide information on weight loss over the past 3–6 months. This finding also emphasizes the need for home care clients to be weighed on a regular basis, so that potential weight loss can be identified early.

Nakamura et al. conducted nutritional screening of the community’s elderly at a daycare facility, but 79% of the participants had no past weight history and their weight loss could not be calculated [20].

Mikkelsen et al. analyzed individual semi-structured interviews of general practitioners and focus group interviews of clinic nurses [21]. They reported that general practices did not routinely identify disease-related malnutrition and rarely saw patients with unintended weight loss.

The results of these studies suggest that many elderly and chronically ill patients in the community do not weigh themselves regularly, are unaware of their weight loss, and do not receive appropriate nutritional care.

Table 3 shows the routine weight measurements in hospitals and nursing homes.
Combating Malnutrition through Sustainable Approaches

Cereda et al. reviewed the data on nutritional care routines collected in the Project: Iatrogenic Malnutrition in Italy (PIMA1) study [22]. The results showed that only 38.2% of the patients had their BMI calculated based on their care in the wards. Nutritional support was prescribed only in 26/191 (13.6%) patients who presented with obvious malnutrition. In addition, only 21.6% of patients had their weight monitored according to a schedule. They concluded that the routine of nutritional care in Italy is still poor and needs to be improved.

Ostrowska et al. compared results from all European countries participating in the nDay survey with those from Poland and found that the patients' weight was recorded on admission (100% vs. 72.9%; p < 0.0001), weekly (20% vs. 41.4%; p < 0.05), and occasionally (0% vs. 9.2%) [18].

Lahmann et al. reported that the rate of routine weight measurement in 100 homecare services in Germany ranged from 33.6% to 57.3% [12]. These findings suggest that not many of the elderly people living in the community are weighed on a regular basis. Reports indicate that 89% of dietitians use weight to solve nutrition problems in malnourished community members, and 87% use BMI as an outcome measure for successful nutritional intervention [23]. Furthermore, regular weight measurements are essential for successful nutritional screening and interventions by dietitians in order to solve the nutritional problems of community residents.

4. Awareness of malnutrition, nutritional screening, or nutrition support

This section reviews the perceptions of healthcare providers, staff, patients, residents, and families toward malnutrition, nutritional screening, and nutrition support. We performed a PubMed search using the keywords malnutrition, nutrition screening, nutrition support, and awareness. The results are shown in Table 4.
Caccialanza et al. noted that there may be a lack of awareness and consideration of nutritional issues among oncologists in Italy, as only 5.7% of the 2375 members participated in the survey [24].

Deftereos et al. conducted a national survey of clinicians with the goal of identifying interdisciplinary clinician practices, perceptions, and perspectives on screening for malnutrition and providing nutritional support for patients undergoing surgery for upper gastrointestinal cancer [25]. The results showed that most participants reported that overall dietary support was available at their healthcare service (98%), but only 41% reported it was available through outpatient services.

Morimoto et al. conducted a web-based questionnaire survey of 500 oncologists [26]. Among the responses, the most common causes of anorexia and weight loss were symptoms due to systemic inflammation caused by cancer (58.8%), and the second most common cause was side effects of anticancer drugs (49.0%). The most common intervention was the prescription of antiemetics (69.7%), and the second most common intervention was teaching patients how to eat recommended foods (49.8%).

Avgerinou et al. conducted a qualitative study using semi-structured interviews to investigate the views of community-dwelling older adults and their caregivers regarding the management of malnutrition [27]. The results showed that older adults at risk of malnutrition rarely recognized lack of appetite or weight loss as a problem.

A web questionnaire survey of cancer patients by Morimoto et al. reported that 38.3% of patients and 46.4% of family members stated they became concerned about weight loss only after a cancer diagnosis [26]. Figure 1 shows the causes of weight loss during cancer treatment based on patients’ perceptions. The patients considered the effects of surgery and the side effects of anticancer drugs as the two most common causes of weight loss.

Table 4.
Awareness of malnutrition, nutritional screening, and nutrition support.
Combating Malnutrition through Sustainable Approaches

Figure 2 presents patients’ concerns about weight loss, and 60% of the patients responded that they were unconcerned. Morimoto et al. reported that 42.1% of the patients reported or consulted their doctors or nurses about their weight loss, while 66.5% of those who did not seek consultation reported that they did not think it was something to be concerned about.

These results indicate that physicians do not recognize nutritional problems that require nutritional intervention and do not order for nutritional intervention by dietitians and that patients and community residents at risk of malnutrition do not recognize anorexia and weight loss as nutritional problems.
5. Nutrition supports for preventing malnutrition

Despite the development of various NSTs and the provision of clinical guidelines recommending regular nutritional screening, malnutrition in patients and the elderly remain unrecognized because regular weight measurements, an integral part of nutritional screening, are not performed. To improve this, various nutrition interventions for staff and community residents have been considered. In this section, these nutrition interventions are presented.

Everink et al. compared the prevalence of malnutrition among nursing home residents in the Netherlands in 2009, 2013, and 2018 [28]. They reported that the prevalence of malnutrition was relatively stable at approximately 16% and that it was unclear whether nursing staff were adequately aware of malnourished (at-risk) residents and the interventions that could be implemented to reduce this occurrence.

Charlton et al. evaluated the adoption of a nutrition care model for older adults designed to improve the detection and management of malnutrition [29]. A systematic review aimed at assessing the effectiveness of nutritional interventions on frailty and frailty-related factors (e.g., malnutrition, sarcopenia, functional capacity) in community-dwelling older adults concluded that multifactorial interventions are more effective than nutritional interventions alone in improving frailty and physical performance [30].

A narrative review that aimed to identify practical conclusions to support the interdisciplinary management of malnutrition in cancer patients suggested that knowledge sharing between oncologists and dietitians can help to successfully address and treat malnutrition in this population [31].

Imamura et al. suggest that postoperative weight loss may affect chemotherapy compliance and may be a risk factor for survival [32]. They reported that patients receiving adjuvant chemotherapy with oral elemental nutritional supplements had increased treatment completion.

Considering these various nutritional interventions, it is necessary to improve the assessment and treatment of malnutrition in patients and the elderly.

6. Limitation

This chapter was a narrative review of peer-reviewed research on nutritional screening, NST, missing NST parameters, regular weight measurements, awareness of malnutrition, and nutrition support. However, only a few studies addressed the missing parameters, missing data, or lack of awareness itself. For this reason, relevant reports were examined one by one in detail, which could have led to a selection bias in the literature retrieved.

7. Conclusion

The findings of this research suggest that patients and the elderly do not weigh themselves regularly, are unaware of their weight loss, and do not receive proper nutritional care. The early diagnosis of malnutrition through routine weighing and nutritional screening and interdisciplinary and collaborative nutritional interventions are necessary to reduce the risk of malnutrition in patients and the elderly.
Conflicts of interest

The authors declare no conflicts of interest.

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References


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