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Opinion paper

Malnutrition risk screening: New insights in a new era

Marian A.E. de van der Schueren [a, b, *], Harriët Jager-Wittenaar [c, d, e]

[a] Department of Nutrition, Dietetics and Lifestyle, School of Allied Health, HAN University of Applied Sciences, Nijmegen, the Netherlands
[b] Department of Human Nutrition and Health, Wageningen University and Research, Wageningen, the Netherlands
[c] Research Group Healthy Ageing, Allied Health Care and Nursing, Hanze University of Applied Sciences, Groningen, the Netherlands
[d] Department of Oral and Maxillofacial Surgery, University of Groningen, University Medical Center Groningen, Groningen, the Netherlands
[e] Research Unit Experimental Anatomy, Faculty of Physical Education and Physiotherapy, Department of Physiotherapy and Human Anatomy, Vrije Universiteit Brussel, Brussels, Belgium

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SUMMARY

Twenty years ago, ESPEN published its “Guidelines for nutritional screening 2002”, with the note that these guidelines were based on the evidence available until 2002, and that they needed to be updated and adapted to current state of knowledge in the future.

Twenty years have passed, and tremendous progress has been made in the field of malnutrition risk screening. Many screening tools have been developed and validated for different patient groups and different health care settings. Some countries even have introduced mandatory screening for malnutrition at admission to hospital.

Yet, changes in society and healthcare require a reflection on current practice and policies regarding malnutrition risk screening. In this opinion paper, we share our perspectives on malnutrition risk screening in the twenty-twenties, addressing the changing and varying profile of the malnourished individual, the goals of screening and screening tools (i.e., preventive or reactive), the construct of malnutrition risk (i.e., screening for risk factors or screening for existing malnutrition), and screening alongside a patient’s journey.

1. Introduction

Twenty years ago, ESPEN published its “Guidelines for nutritional screening 2002”, with the note that these guidelines were based on the evidence available until 2002, and that they needed to be updated and adapted to current state of knowledge in the future [1].

Twenty years have passed, and tremendous progress has been made in the field of malnutrition risk screening. Many screening tools have been developed and validated for different patient groups and different health care settings [2–4]. Some countries even have introduced mandatory screening for malnutrition at admission to hospital.

Yet, changes in society and healthcare require a reflection on current practice and policies regarding malnutrition risk screening. Globally, the patient population has become more obese (the prevalence of obesity has tripled since 1975 [5] and the number of hospital admissions with obesity as a primary or secondary diagnosis has increased [6]), and this raises the question whether malnutrition screening tools largely depending on body mass index (BMI) are still appropriate. Furthermore, length of hospital stay has decreased dramatically [7]. This calls for shifting focus from the inpatient to the outpatient setting and community. In addition, demographic changes in society, including ageing, pose challenges on the healthcare system, which calls for prevention of functional decline, and therefore timely treatment or ideally prevention of malnutrition.

These developments have changed the scene for malnutrition risk screening compared to two decades ago. Importantly, the introduction of the Global Leadership Initiative on Malnutrition (GLIM) diagnostic criteria for malnutrition in 2019 [8] requires that malnutrition risk screening is performed as a first selection step before performing the diagnostic steps. This implies that the choice of the screening tool influences the malnutrition diagnosis.

In this opinion paper, we share our perspectives on malnutrition risk screening in the twenty-twenties, addressing the changing and

* Corresponding author. Department of Nutrition, Dietetics and Lifestyle. School of Allied Health, HAN University of Applied Sciences, Nijmegen, the Netherlands
E-mail addresses: marian.devanderschueren@han.nl (M.A.E. de van der Schueren), ha.jager@pl.hanze.nl (H. Jager-Wittenaar).

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varying profile of the malnourished individual, the goals of screening and screening tools (i.e., preventive or reactive), the construct of malnutrition risk (i.e., screening for risk factors or screening for existing malnutrition), and screening alongside a patient's journey.

2. The ongoing problem of malnutrition

Malnutrition is an ongoing problem across the chain of healthcare, i.e., in hospitals, in long-term care, and in the community. Malnutrition is associated with many negative consequences, such as increased morbidity, more side effects or complications of treatment, longer length of hospital stay, increased number of readmissions, increased risk of falling, impaired independency, impaired quality of life, and even increased mortality [9]. As a result, malnutrition contributes to increased health care costs [10–13]. Despite increasing attention to malnutrition risk screening over the past decades, malnutrition prevalence rates across all settings remain high [4]. Moreover, nutritional status often further deteriorates during hospital stay [14].

Multiple factors may explain why the prevalence of malnutrition remains high. Firstly, demographic changes in the population are likely to play a role. Ageing is accompanied by comorbidities, which increases the risk for malnutrition [15]. Secondly, knowledge, skills and awareness among professionals, including clinicians, to identify and manage malnutrition remain insufficient, and nutrition education in medical schools is generally insufficient [16–18]. Moreover, the fact that malnutrition screening is not mandatory in every country and in every setting, implies that malnutrition is still being overlooked and undertreated [19,20]. Thirdly, tackling malnutrition is not yet organized interprofessionally [21,22], meaning that interventions are not meeting goals jointly defined by a team of different professionals. If interventions by different professionals aimed at improving nutritional status or reducing nutritional risk are not aligned, these interventions are likely to lack synergistic effects. Due to these multiple factors, it is expected that malnutrition will remain to be a problem in the next decades. This underlines the importance of ongoing attention for malnutrition risk screening, and to redefine goals of nutritional screening. While nutritional screening is essential for triaging for nutritional interventions, and nutritional screening upon hospital admission has shown to be (cost)effective [23,24], the changing healthcare landscape raises the questions whether effectiveness needs to be further improved, and whether effectiveness needs to be redefined in this context.

3. Malnutrition risk screening

The ESPEN 2002 guidelines for nutritional screening [1] were based on the knowledge that approximately 30% of hospitalized patients were malnourished. In these guidelines, the authors used the term undernutrition, characterized by acute (inflammatory) disease with increased nutritional requirements, evident depletion of both fat mass and fat-free mass, a low BMI, recent involuntary weight loss, and impaired food intake. Matching screening tools were advised, to easily identify patients with these obvious characteristics of disease and depletion. In 2017, the ESPEN guidelines on definitions and terminology of clinical nutrition defined malnutrition risk screening as: “a rapid process performed to identify subjects at nutritional risk, that should be performed using an appropriate validated tool in all subjects that come in contact with healthcare services”. Moreover, it was stated that, depending on the care setting, screening should be performed within the first 24–48 h after first contact and thereafter at regular intervals, and that subjects identified as at risk need to undergo nutritional assessment [25]. However, while the process of screening has been defined, a consensus-based conceptual definition of the construct to be screened, i.e., malnutrition risk, is still lacking.

The manifestation of malnutrition may differ between populations. In acutely ill patients, a rapid loss of fat mass and fat-free mass will occur [26], while in older adults with gradually emerging malnutrition this process is much slower. In all cases, malnutrition is nowadays often masked by overweight, i.e., sarcopenic obesity [27]. As a result, a BMI dropping below cut-off is the exception rather than the rule [28]. Moreover, length of hospital stay has decreased over the past decades. In 2018, the average length of hospital stay was 6.7 days worldwide (and 6.3 days in Europe), in contrast to 8.2 days worldwide in 2000 [7]. Consequently, treatment at the outpatient department, both pre- and post-hospitalization, has become more important. While many countries have made tremendous progress with implementation of (mandatory) malnutrition risk screening, this screening mostly takes place at the first day of admission to hospital. Herewith, an important time frame for identification and timely treatment of malnutrition and its risk factors in the outpatient setting is missed. Moreover, most malnourished patients live at home. In the Netherlands, >2 million older adults live independently, and 117 thousand in institutions [29]. With an estimated malnutrition prevalence rate of 5% in the community and 25% in institutions, this equals >100.000 malnourished older adults living at home and approximately 29.000 in institutions. For those living at home, malnutrition can remain undetected and untreated in the home setting.

4. The principles of screening

The WHO report published in 1968 by Wilson and Jungner set out the principles for screening in general (Box 1) [30].

These principles still hold and also apply to malnutrition risk screening. However, is recognizing the early symptomatic stage of malnutrition adequate enough to tackle the ongoing malnutrition problem? Early symptoms of malnutrition, like limited loss of body

Box 1
Wilson & Jungner principles.

(1) The condition sought should be an important health problem.
(2) There should be an accepted treatment for patients with recognized disease.
(3) Facilities for diagnosis and treatment should be available.
(4) There should be a recognizable latent or early symptomatic stage.
(5) There should be a suitable test or examination.
(6) The test should be acceptable to the population.
(7) The natural history of the condition, including development from latent to declared disease, should be adequately understood.
(8) There should be an agreed policy on whom to treat as patients.
(9) The cost of case-finding (including diagnosis and treatment of patients diagnosed) should be economically balanced in relation to possible expenditure on medical care as a whole.
(10) Case-finding should be a continuing process and not a ‘once and for all’ project.

weight and fat-free mass, indicate that the development of malnutrition is already going on. Malnutrition risk factors can even precede these symptoms and early interventions to treat these risk factors may prevent decline or improve nutritional status. For example, dysphagia, pain, and requiring help doing groceries are three completely different, but well known risk factors for malnutrition, which are treatable by swallowing therapy, nutritional therapy, medication, and household support. We plea to extend screening for symptoms of malnutrition to screening for risk factors of malnutrition, and we will elaborate on this hereafter.

5. Global Leadership Initiative on Malnutrition

With the publication of the GLIM diagnostic criteria for malnutrition, worldwide consensus has been reached on a set of criteria to operationalize malnutrition. This enables comparison of prevalence rates across countries and across healthcare settings at a global level. Different groups of key experts are now working on guidance on applying the GLIM framework and criteria. One paper has been published on validation of the operational criteria within GLIM [31], and another one on guidance on assessment of the muscle mass phenotypic criterion [32]. Another working group is working on guidance on the inflammation criterion, and an implementation working group is developing a guidance paper on strategies for implementation of the GLIM framework in both practice and research. Moreover, different groups worldwide are evaluating the suitability of GLIM criteria for specific populations, e.g., residents of nursing homes, bicultural populations, or patients with neurodegenerative diseases.

Within GLIM, the first step is malnutrition risk screening with a validated screening tool. This will have implications for the results of GLIM outcomes, because only subjects scoring positively on malnutrition risk screening enter into the step of assessment, after which malnutrition is diagnosed according to the GLIM criteria. However, different tools generate different prevalence rates of malnutrition risk. We would like to illustrate this with some examples from our own research groups. In a study in which we compared the SCREENII [33], a screening tool that includes multiple risk factors for malnutrition, with the SNAQ^{65+} [34], a screening tool that mainly includes phenotypic criteria for malnutrition, to assess malnutrition risk in community dwelling older adults, we found a higher prevalence of malnutrition risk with the SCREENII. Of all participants, 69% were at medium or high malnutrition risk according to SCREEN II, while only 14% of the same population was identified as medium or high risk of malnutrition according to SNAQ65+. Agreement between the two tools was poor ($\kappa = 0.053$; $p = 0.132$) [35]. Similar differences between screening tools were found in two studies in the hospital setting. In one study we compared the (self-completed questions) of the Patient-Generated Subjective Global Assessment Short Form (PG-SGA SF), which includes both phenotypic and etiologic criteria and multiple risk factors for malnutrition [36,37] with the Malnutrition Universal Screening Tool (MUST), which mainly includes phenotypic criteria for malnutrition [38]. In this study, the PG-SGA SF identified 42% of the patients as having medium or high risk, whereas the MUST identified only 16% of the same population as medium or high risk [39]. Agreement between the two tools was fair ($\kappa = 0.210$; $p<0.001$). In another study, we compared the PG-SGA SF with the Short Nutritional Assessment Questionnaire (SNAQ) [34], which also mainly includes phenotypic criteria for malnutrition. Also in this study, the PG-SGA SF identified 59% of the patients as having medium or high malnutrition risk, whereas the SNAQ identified only 23% as such [40].

Although neither study continued into diagnosing malnutrition according to GLIM, it is to be expected that different screening tools will lead to different GLIM malnutrition prevalence rates.

In the next paragraph we will discuss differences between screening tools.

6. Screening for 'early stage' or 'late stage' malnutrition?

Table 1 presents an overview of a selection of frequently used and validated malnutrition screening tools. Although they are all known as 'malnutrition screening tools', they assess different constructs. Most of them address the WHO's fourth principle: "there should be a recognizable latent or early symptomatic stage" [30]. Herewith, these tools focus on identifying latent malnutrition. Most of these tools primarily include phenotypic criteria for malnutrition, i.e., weight change, low BMI, as well as etiologic criteria such as disease burden/inflammation, or risk factors like gastrointestinal symptoms, or reduced food/fluid intake. If a screening tool mainly includes phenotypic criteria, and thus expresses evident malnutrition with obvious characteristics of depletion, such a tool merely screens for 'late stage' malnutrition.

However, to enable a more preventive approach to tackle malnutrition, we dare to say that malnutrition screening tools should primarily aim for identification of patients at the earliest possible stage of development of malnutrition, by combining criteria addressing malnutrition risk factors (e.g., nutrition impact symptoms, and factors related to physical or social functioning of patients) with the often used phenotypic and etiologic criteria. Warning signs that a patient is at risk of becoming malnourished (i.e., risk factors) include, amongst others: poor appetite, poor mobility, eating less than normal, insufficient intake of important food groups (such as fruit, vegetables, meat, dairy), eating alone, not being able to buy or prepare food, impaired taste or smell, pain, or fatigue. It is important to note that risk factors may be setting-dependent. For example, risk factors in the community may not be applicable to the acute hospital or nursing home setting.

Only five of the tools presented in Table 1, i.e., DETERMINE, MNA-SF, NUFFE, PG-SGA SF, and SCREENII, address four or more of these risk factors for malnutrition (with a question on appetite being the most common one), next to the often used phenotypic and etiologic criteria. In our opinion, screening for these risk factors, in addition to screening for obvious signs of depletion, adds to the current practice of screening for late stage malnutrition, and offers windows of opportunities for prevention and early interventions, as these risk factors are treatable. For a long period of time, it has been shown that risk factors themselves are predictive for poorer clinical outcomes. Already in 1997, the following items from the DETERMINE checklist were reported to be independently associated with increased mortality: eating meals alone, problems biting or chewing, difficulties with shopping or cooking, and taking more than three medications per day. Importantly, the individual factors had a stronger relation with mortality than the cumulative score [41].

The goal of screening should guide the choice of the most appropriate screening tool. To be able to undertake early or even preventive actions, a tool focusing on risk factors for malnutrition is more appropriate than a tool focusing on presence of malnutrition. Yet, as illustrated in the examples from our own studies, a tool that includes multiple risk factors will identify many more people at malnutrition risk than a tool that focuses on identifying already present malnutrition by including mainly phenotypic criteria.

The tools focusing on malnutrition risk factors will (also) identify generic problems, such as loneliness, financial problems, or impaired mobility (hindering grocery shopping and cooking).

7. Screening, and then?

Obviously, treatment of generic problems needs a multi-domain approach, which may involve not only health professionals

Table 1
Overview of criteria in a selection of current screening tools.

	Phenotypic criteria			Etiologic criteria			Risk factors																		Other
	weight change	low BMI	body composition	food/fluid intake	GI symptoms	disease burden /inflammation (incl. inflammation parameters)	loss of appetite	higher age	mobility/ activity	functional capacity/ muscle function	feeling full	altered taste /smell	inability to eat /needing help with eating	problems with buying or preparing food (including finances)	self-perception of nutritional status	decreased /inadequate intake	mouth problems /problems biting, chewing, swallowing, coughing	eating alone /company at meals	alcohol intake	drugs intake	neuro-spycological problems	health state	pain	fatigue	use of sip feeding and tube feeding
DETERMINE[a]	x			x		x								x		x	x	x	x	x					
GNRI[b]	x				x	x	x																		
MNA-SF[c]	x	x	x	x	x	x	x		x						x		x				x				
MST[d]	x			x			x																		
MUST[e]	x	x		x		x										x									
NRI[f]	x	x				x	x						x												
NRS[g]	x	x		x	x	x	x						x				x								
NRS 2002[h]	x	x		x		x		x								x									
NUFFE[i]	x			x	x	x	x		x				x	x				x		x		x			
PG-SGA SF[j]	x			x	x		x		x		x	x		x		x	x						x	x	x
SCREEN II[k]	x			x			x							x	x	x	x	x							
SNAQ[l]	x						x																		x
SNAQ[RC,m]	x	x					x																		
SNAQ[65+,n]	x		x				x			x			x												
SNAQ[o]							x				x	x													

[a] DETERMINE Your Nutritional Health Nutrition Screening Initiative.
[b] Geriatric Nutrition Risk Index.
[c] Mini Nutritional Assessment Short Form.
[d] Malnutrition Screening Tool.
[e] Malnutrition Universal Screening Tool.
[f] Nutritional Risk Index.
[g] Nutrition Risk Score.
[h] Nutritional Risk Screening 2002.
[i] Nutritional Form For the Elderly.
[j] Patient-Generated Subjective Global Assessment Short Form.
[k] Seniors in the Community: Risk Evaluation for Eating and Nutrition, version II.
[l] Short Nutritional Assessment Questionnaire.
[m] Short Nutritional Assessment Questionnaire for the Residential Care.
[n] Short Nutritional Assessment Questionnaire 65+.
[o] Simplified Nutritional Appetite Questionnaire.

(physicians including general practitioners, dietitians, physiotherapists and (community) nurses), but also welfare professionals, such as social workers. This requires an interprofessional approach in which interventions from the different perspectives are coordinated and aligned, rather than cumulated by relevant disciplines. Collaborative goals need to be set, and interventions from different perspectives need to be integrated, to create potentially synergistic effects [42]. This demands that other disciplines have enough knowledge of nutrition, and the other way around. Interprofessional collaboration is a paradigm shift, that has already started and will take shape over the next years.

In addition, with people moving across healthcare settings, for example from home, to hospital, rehabilitation, and back home again, nutritional care should be organized across the chain of care. Therefore, screening tools would ideally be setting-independent, to allow for comparison and follow-up over time. This becomes even more important in the light of relatively short stays in hospital nowadays. However, it should be noted that suitability of currently available malnutrition screening tools for repeated screening (follow up) will vary, and repeated screening may only be useful if the timeframe which is referred to in the screening questions is equal to or shorter than the interval between the screening moments. Moreover, some screening tools are not suitable for repeated use, e.g., those which consider the start of oral nutritional supplements after further assessment and initiation of treatment as risk of malnutrition (example: SNAQ). The score on these tools will actually worsen once appropriate treatment has started. In addition, not all currently available malnutrition screening tools are suitable for use across the chain of care.

8. In conclusion

The profile of the malnourished patient has changed over the past decades, the healthcare landscape is changing, the population is ageing, and at the same time malnutrition remains to be an ongoing problem. Malnutrition screening aims to identify persons at risk, but the changes referred to here ask that we re-think what malnutrition risk encompasses, and which tools are appropriate to identify 'at-risk' people in the 2020s.

Following up on the success of reaching worldwide consensus on the malnutrition diagnosis (e.g., GLIM), we suggest to also create worldwide consensus on the conceptual definition of malnutrition risk and goals of malnutrition risk screening, as well as to reach consensus on an operationalization the definition of malnutrition risk. The authors are willing to take the lead in such a consensus process, consisting of (multiple) Delphi studies.

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Author contributions

Both authors contributed equally to the conceptualization and writing of this manuscript.

Conflict of Interest

H. Jager-Wittenaar was co-developer of the PG-SGA-based Pt-Global web tool.

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