Malnutrition in older adults

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Malnutrition is a highly prevalent condition in older adults, and poses a substantial burden on health, social, and aged-care systems. Older adults are vulnerable to malnutrition due to age-related physiological decline, reduced access to nutritious food, and comorbidity. Clinical guidelines recommend routine screening for malnutrition in all older adults, together with nutritional assessment and individually tailored nutritional support for older adults with a positive screening test. Nutritional support includes offering individualised nutritional advice and counselling; oral nutritional supplements; fortified foods; and enteral or parenteral nutrition as required. However, in clinical practice, the incorporation of nutritional guidelines is inadequate and low-value care is commonplace. This Review discusses the current evidence on identification and treatment of malnutrition in older adults, identifies gaps between evidence and practice in clinical care, and offers practical strategies to translate evidence-based knowledge into improved nutritional care. We also provide an overview of the prevalence, causes, and risk factors of malnutrition in older adults across health-care settings.

Introduction

Malnutrition encompasses both overnutrition (ie, overweight, obesity, and diet-related non-communicable diseases [NCDs]) and undernutrition (ie, underweight, micronutrient deficiencies, wasting, and stunting),[1] and is under the global spotlight as part of the UN Decade of Action on Nutrition (2016–2025).[2] Considerable progress has been made towards the UN Decade of Action's strategic goals for maternal, infant, and young child nutrition, and for diet-related NCDs.[2] However, malnutrition remains rife in older populations globally. Current estimates are that around a quarter of older adults (65 years and older) are malnourished or at risk of malnutrition.[3] This number is expected to rise alongside the rapid increase in the ageing population. The UN projects that between 2019 and 2050, the population of adults who are 65 years and older will double across many regions.[4] If we are to achieve the goal of decreasing malnutrition in older populations, we need a timely, concerted effort to prioritise, prevent, recognise, and appropriately manage malnutrition in this demographic group.[5–7]

This Review will focus on undernutrition in older populations, referring to undernutrition as malnutrition throughout because these two terms are often used interchangeably in the literature.[5] Although malnutrition does not yet have a universal definition, there is currently an active push by the global nutritional community (representing over 40 international clinical nutrition societies) to specifically diagnose malnutrition in older adults as one of three causal subcategories: disease-related malnutrition driven by inflammation, disease-related malnutrition with no perceived inflammation, and malnutrition due to starvation not related to disease (either related to hunger, socioeconomic factors, or psychological factors).[5,8] We use this definition of malnutrition in older adults throughout our Review to distinguish malnutrition in older populations from the broad spectrum of malnutrition across all age groups.

For older adults, adverse health outcomes associated with malnutrition can often be more complex and disproportionally worse than outcomes associated with

overweight or obesity.[9,10] Malnutrition in older adults can lead to weight loss. Functional recovery from this weight loss is unlikely to occur due to the loss of skeletal muscle mass, even with full nutritional support.[11,12] Adverse outcomes of malnutrition include frailty, delirium,

Key messages

- Malnutrition predisposes older adults to an increased risk of adverse clinical outcomes such as frailty, osteoporosis, muscle wastage, and mortality
- Diagnosis of malnutrition in older adults includes three different aetiological subtypes: disease-related malnutrition driven by inflammation, disease-related malnutrition without inflammation, and malnutrition without disease (eg, hunger-related)
- Successful management requires routine screening for malnutrition paired with nutritional assessment, an individualised and comprehensive nutritional care plan, food fortification, education, nutritional counselling, and oral nutritional supplements; dietary restrictions are not recommended
- The availability of management options for older adults with malnutrition varies between regions due to the availability of resources, the priority placed on the nutritional care of older adults, and the nutritional knowledge of health-care professionals
- Multiple gaps exist between evidence-based knowledge and current clinical practice, including positive screening not followed up by nutritional assessment, inappropriate advice given to lose weight, oral nutritional supplements given without any follow-up monitoring, and a scarcity of person-centred care
- To improve rates of evidence-based nutritional practice, solutions include optimisation of nutritional pathways and the incorporation of nutritional guidelines into quality assurance frameworks
- Future nutritional guidelines will require greater attention to feasibility, should be person-centred, and should be paired with active guideline implementation strategies

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	Risk factor for malnutrition	Strength of evidence
Eating problems (low appetite and eating dependency)	Yes	Moderate
Low physical function (ADL, performance, or strength)	Yes	Moderate
Poor self-perceived health	Yes	Moderate
Admission to hospital	Yes	Moderate
Oral health (low number of teeth or pairs of teeth)[49]*	Yes	Low
Loss of interest in life	Yes	Low
Marital status (unmarried, divorced, or separated)[47]	Yes	Low
Lifestyle factors (smoking, alcohol, and low physical activity)	No	Moderate
Psychological factors (distress and anxiety)	No	Low
Socioeconomic factors (access to transport, wellbeing, and loneliness)	No	Low
Polypharmacy and medicine intake	Undetermined	Conflicting evidence
Dysphagia	Undetermined	Conflicting evidence
Cognitive decline	Undetermined	Conflicting evidence
Depression	Undetermined	Conflicting evidence
Constipation	Undetermined	Conflicting evidence

Data are based on evidence from systematic reviews.[10,47,49] The most supportive evidence comes from community-based studies identified by O'Keefe and colleagues,[10] unless otherwise indicated. Strength of evidence is graded as: strong (consistent findings, with >75% of studies showing the same direction of effect in multiple high-quality studies); moderate (consistent findings in multiple low-quality studies); low (findings from one study of low to moderate quality); and conflicting (inconsistent findings across studies regardless of study quality).[10] ADL=activities of daily living. *Oral health was not identified as a risk factor for malnutrition by O'Keefe and colleagues;[10] however, the evidence base linking oral health with the development of malnutrition in older adults has since expanded.[49]

Table 1: Potentially modifiable risk factors for malnutrition in older adults

decreased immunocompetence, muscle wastage, hypothermia, osteoporosis, mood changes, cognitive impairment, lowered quality of life, and premature mortality regardless of the specific cause of death.[9,13–18] Delayed treatment of malnutrition can result in poor wound healing, pressure sores, falls, hospitalisation, and nursing home admission.[12,13,18,19] Many chronic conditions are exacerbated by malnutrition,[9,14] and the condition is also associated with high health-care costs.[6,15,16]

Multiple evidence-based strategies exist and are available for the prevention and management of malnutrition in older adults.[7] However, these strategies are not always appropriately supported in clinical practice,[20] resulting in a wide gap between interventions known to be effective and the care that is applied. In this Review, we summarise current evidence-based clinical practice guidelines for malnutrition in older adults. We highlight important evidence-practice gaps that need to be addressed in high-income countries, and in low-income and middle-income countries (LMICs). We discuss practical strategies to integrate nutritional guidelines into routine care. An overview of the prevalence, causes, risk factors, and screening and assessment methods for malnutrition in older adults is also provided.

How common is malnutrition in older adults?

The prevalence of malnutrition in older adults varies considerably due to variations in both the tool used for its assessment and the population studied. In community-dwelling older adults, the prevalence of malnutrition is 3·1% according to a meta-analysis of prevalence rates using the Mini Nutritional Assessment (MNA), which is the most commonly used nutritional assessment tool in older adults.[21] In addition to malnutrition, risk of malnutrition (and indication of nutritional support need) as assessed by MNA is present in 26·5% of community-dwelling older adults.[21] Malnutrition prevalence increases concomitantly with functional dependency, affecting 8·7% of older adults receiving home-care services, 22·0% of older adults in hospitals, and 28·7% of older adults in long-term care facilities (as assessed by MNA).[21] Prevalence rates tend to be higher in women,[3,22–24] rural populations,[23] populations aged over 80 years,[3] and those affected by chronic illness.[3]

Globally, there are large geographical variations in the prevalence of malnutrition. In community-dwelling older adults, a relatively low prevalence of malnutrition (assessed by MNA) is found in Europe (2·1%)[21] and Asia (4·8%),[21] and higher prevalence rates are found in several LMICs such as Iran (12·2%),[25] India (16·3%),[26] Nepal (24·0%),[22] and Ethiopia (26·6%).[27]

Cause and risk factors

The cause of malnutrition in older adults is complex and not fully elucidated. A decline in food intake due to acute and chronic disease is common in older age groups and can manifest with or without inflammation.[5,7] Disease-related malnutrition due to inflammation is a natural response that occurs in some chronic wasting diseases such as chronic obstructive pulmonary disease, heart failure, and chronic renal failure, where there is a marked disease-related upregulation of chronic inflammatory cytokines.[5] Persistent low-grade inflammation due to proinflammatory cytokines (eg, TNFα, CRP, IL-1b, and IL-6) act on neural centres where they negatively affect appetite, for example by inducing skeletal muscle catabolism, inhibiting gastric emptying, and hindering the action of appetite-controlling hormones.[28,29] Cancer cachexia represents one extreme of this spectrum.[5]

Disease-related malnutrition without inflammation in older adults can result from conditions that cause challenges with eating and swallowing such as stroke, Parkinson's disease, and dementia.[5] The term anorexia of ageing refers to the age-related weight loss that occurs in older adults due to inadequate appetite and food intake,[7,29,30] and can be caused by non-inflammatory

physiological changes.[5] These physiological changes involve lowered sensory function (ie, taste, smell, and vision), dysphagia, skeletal muscle mass loss, increased fat mass, endocrine changes (eg, decreased acylated ghrelin produced by the stomach and impaired insulin action), and an accumulation of appetite-inhibiting hormones such as CCK, GLP-1, and leptin.[28,30,31,]

Malnutrition without disease (non-disease-related malnutrition) can be classified as either hunger-related due to low food availability, which especially occurs during pandemics or climatic events such as droughts or bushfires, or due to socioeconomic or psychological situations,[5] such as financial hardship,[24] social isolation,[32,33] marginalisation,[22] food behaviours,[34,35] cultural factors,[34] low food literacy,[36] and food insecurity.[24,32]

Food insecurity

In LMICs, food insecurity is a major contributor to malnutrition, with many older adults unable to safely access adequate and healthy foods due to low financial resources and high cost of living.[24,32,33,37] Studies from India[33] and sub-Saharan Africa[37] have reported that vulnerable categories of older people include those who are 80 years and older; those with lower socioeconomic position; and those who are unmarried, divorced, or separated. Food insecurity is exacerbated in regions where rapid urbanisation is occurring because older adults either move to the city with their families or remain alone in rural areas without family support systems.[38] High-income countries such as Greece and Portugal also report food insecurity in over two-thirds of older populations due to low economic resources.[39,40] Furthermore, in high-income countries, household food insecurity is elevated in disadvantaged populations, such as Indigenous populations in Canada.[38] There is also worrying evidence that older adults residing in regions with deteriorating security situations face high food insecurity.[41]

The COVID-19 pandemic intensified food insecurity globally, with panic buying and food hoarding leading to price hikes and food shortages.[42,43] Older populations, particularly those with comorbidities or without social support systems, often could not access food supplies that were in shortage.[42,44,45] Fortunately, several countries have placed food security as a top priority as a response to the COVID-19 pandemic, with older adults included in food equity frameworks.[46] However, to achieve practical changes for older populations, much more needs to be done to prevent malnutrition.

Modifiable risk factors

Awareness of risk factors for malnutrition in older adults is a crucial step towards designing targeted prevention strategies. In the past 10 years, the number of known risk factors for malnutrition has increased dramatically, yet most evidence still comes from the community setting.[10,47–49] Risk factors with the most consistent evidence for malnutrition in older adults include low physical

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Panel 1: Dietary intake to prevent malnutrition in older populations

The dietary requirements of older adults differ from those of younger populations, and close attention to energy intake and protein-energy intake is crucial. An older adult might require more protein intake than a younger adult to maintain lean body mass and physiological functioning[7] due to declines in their capacity to utilise protein. Furthermore, older adults have a higher anabolic threshold of protein intake required per meal than younger adults.[53] The recommended daily intake of protein to prevent malnutrition in older adults is at least 1 g of protein per kg of bodyweight per day, according to guidelines published by the European Society for Clinical Nutrition and Metabolism, which is also known as ESPEN.[7,18] The European Food Safety Authority recommends a protein intake of 0·83 g/kg per day, highlighting that there is an unknown likelihood of adverse effects if protein intake is very high in older adults.[54] Other nutritional guidelines recommend a protein intake range of 0·8 to 1·2 g/kg per day for this demographic group.[53,55] Additional protein intake is required for older adults in times of illness, infection, and for adequate recovery from exercise.[7,18,53] Older adults require 1·2 to 1·5 g/kg per day in times of chronic or acute illness,[53] and up to 2·0 g/kg per day if they are severely ill.[53] Daily energy intake to prevent malnutrition in older adults is recommended as more than 30 kcal/kg, although there is a large variation between older populations as to the exact minimum requirement.[7,18]

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function, low appetite, eating dependency, poor self-perceived health, and a previous hospital stay (table 1).[10,47] Other important modifiable risk factors include marital status[47] and poor oral health.[49,50] The lifestyle factors of smoking, low physical activity, and alcohol consumption are not risk factors for malnutrition in older adults according to current systematic review evidence.[10]

In 2019, the European Malnutrition in the Elderly project developed a model of Determinants of Malnutrition in Aged Persons that considers all risk factors across all settings.[51] This informative tiered model was developed on the basis of evidence from systematic reviews,[10,47,52] and includes three central mechanisms by which malnutrition develops (ie, low nutrient intake, high requirements, and reduced nutrient bioavailability), encompassed by direct risk factors such as nausea and vomiting, or malabsorption, which need to be immediately addressed, and indirect influences including medications.[51] Dietary intake to prevent malnutrition in older populations is shown in panel 1.[53–55]

Hospital-acquired and nursing-home-acquired malnutrition

Hospital-acquired malnutrition is common in older adults.[56] Factors that contribute to hospital-acquired malnutrition include interruptions to mealtimes,[57] long

	Components and classification	Recommended setting	Comments*
Screening tools			
Seniors in the Community: Risk Evaluation for Eating and Nutrition, version II[71]	14 questionnaire items: weight (three-part question including weight change and perception of weight); skips meals; limits foods; appetite; intake of fruit and vegetables; intake of meat, eggs, fish, poultry, or meat alternatives; dairy intake; fluid intake; swallowing difficulty; chewing difficulty; uses meal replacements; eats alone; meal preparation (two questions); and getting groceries; maximum score was 64 (low nutrition risk [score >53], medium nutrition risk [score 50–53], or high nutrition risk and need for nutritional intervention [score <50])	Community	Good validity in community-dwelling older populations, including criterion validity; not yet validated in older populations across other settings[68]
Malnutrition Screening Tool[72]	Two items: unintentional weight loss and how much weight was lost; and eating poorly due to decreased appetite; maximum score 5 (at risk of malnutrition [score ≥2] or not at risk of malnutrition [score <2])	Hospital	Good validity in older patients being treated in hospital; shows only fair validity in both residential care and rehabilitation settings; not yet validated in community-dwelling older populations[68]
Malnutrition Universal Screening Tool[82]	Three items: weight loss; acute disease; and BMI (>20kg/m² is 0 points, 18.5–20.0 kg/m² is 1 point, <18.5 kg/m² is 2 points); maximum score 6 (high risk of malnutrition [score ≥2], medium risk of malnutrition [score=1], low risk of malnutrition [score=0])	Hospital	Shows criterion validity in the hospital setting; predictive of mortality in residential care; insufficient validity testing in community-dwelling older populations[68]
Mini Nutritional Assessment–Short Form[73]	Six items: food intake decline; weight loss; mobility; stress and acute disease; neuropsychological problems; and BMI or calf circumference; maximum score 14 (malnourished [score <8], at risk of malnutrition [score 8–11], normal nutritional status [score ≥12])	Hospital	The most common nutritional screening tool used in older populations;[7] however, all validation studies (except for one study) have used the full Mini Nutritional Assessment as the reference standard[68]
Nutritional Form for the elderly[74]†	15 self-assessed items: weight loss; changes in diet; appetite; cooked food intake; portion size; fruit and vegetable intake; food product access; company at meals; activity; oral health; fluid intake; gastrointestinal problems; assistance eating; number of medications; and health state; maximum score 30 (a score of >11 points suggested to indicate malnutrition and higher scores indicate a higher degree of malnutrition)	Rehabilitation	Reported to be as good as clinical dietitian assessment in identifying malnutrition in the rehabilitation setting; however, insufficient criterion validity across other settings[68]
Short Nutritional Assessment Questionnaire (Residential Care)[75]	Four components: unintentional weight loss; self-feeding and drinking; decrease in appetite in the last month; and BMI; scored by a traffic light system (green, amber, and red)	Residential care	Good criterion validity against clinical dietitian assessment in the residential care setting, although shows incorporation bias diagnosis because it relies on screening components such as low BMI; specifically designed for residential care use; not to be confused with the Simplified Nutritional Assessment Questionnaire[68]
Determine Your Nutritional Health Checklist[76]†	Ten self-reported items (each with a score assigned from 0 to 4): illness affecting food intake; number of meals eaten per day; number of alcoholic drinks per day; fruit, vegetable, and dairy intake; chewing difficulties; food affordability; eating alone; taking three or more medications; weight loss or gain in previous 6 months; and meal preparation; maximum score 21 (low nutritional risk [scores ≤2], moderate nutritional risk [scores 3–5], high nutritional risk [scores ≥6])	Community	For community-dwelling older adults; ranks highly on the European Malnutrition in the Elderly scoring system for nutritional screening tools in older adults (equal weighting for validity, parameters, and practicality);[77] however, its criterion validity varies widely between studies, it has poor predictive validity, and it has only been compared with an appropriate reference standard, the Mini Nutritional Assessment, in one study[68]
Nutritional Risk Screening 2002[78]†	Incorporates four pre-screening items: BMI; weight loss; reduced food intake; and critical illness; and if pre-screening is positive, severity of disease, age, and severity of weight loss or BMI are also screened; maximum score 7 (nutritional risk [score ≥3 points], repeat screening weekly [score <3 points])	Hospital	For hospitalised older adults, there is much variation in criterion validity, predominantly because inappropriate reference standards for comparison are used; insufficient validity testing in other settings[68]
Assessment tools			
Mini Nutritional Assessment[79]	Four domains: anthropometry (BMI, calf circumference, and mid-arm circumference); self-reported health; questions regarding diet (including weight loss); and clinical health; maximum score 30.0 (malnourished [score <17.0], risk of malnourishment [score 17.0–23.5], well nourished [score >23.5])	All settings	For community-dwelling older adults: low concurrent validity for diagnosing protein-energy malnutrition and low to moderate quality evidence showing Mini Nutritional Assessment predicts physical dysfunction and death; high-quality diagnostic studies are needed across all settings;[70] this assessment could overdiagnose, therefore pairing with Global Leadership Initiative on Malnutrition criteria could be useful[19]
Subjective Global Assessment[80]	Subjectively considers a wide variety of factors: functional capacity; weight loss history; change in dietary intake; comorbidities and their influence on nutritional intake; gastrointestinal issues lasting more than 2 weeks; and physical features such as muscle wasting, oedema, and amount of subcutaneous fat	All settings	Concurrent validity low for diagnosing protein-energy malnutrition in community-dwelling older adults; a scarcity of diagnostic studies across other settings; predictive validity not yet studied in older populations[70]

(Table 2 continues on next page)

	Components and classification	Recommended setting	Comments*
(Continued from previous page)			
Anthropometric measures			
BMI	BMI <18·5 kg/m² used to objectively define malnutrition (according to WHO), with several variations of this cutoff recommended for older people, due to changes in body composition and stature that occur with ageing[67]	All settings	Commonly used in screening tools, with varying cutoff points; ESPEN guidelines for nutritional screening do not endorse low BMI to detect malnutrition due to its tendency to underdiagnose, given the increasing rate of obesity worldwide[8,81]
Weight loss	Different cutoff points are suggested: weight loss of >5% of bodyweight is included in the Nutritional Risk Screening 2002; unintentional weight loss in the past 3–6 months is included in the Malnutrition Universal Screening Tool; the Mini Nutritional Assessment Short-Form includes weight loss during the past 3 months	All settings	Weight loss is a dynamic parameter of malnutrition or catabolism, or both[29,30]
Circumference measures (calf circumference, mid-arm circumference)	Calf circumference is the widest girth of the calf and mid-arm circumference is the midpoint circumference of upper arm, midway between the acromion process and the elbow's lateral epicondyle	All settings	Calf and mid-arm circumferences are relatively simple to measure in busy clinical practice and have population-specific cutoffs; both calf circumference and mid-arm circumference predict adverse clinical outcomes; calf circumference is more correlated with malnutrition than mid-arm circumference[67]

Although the Mini Nutritional Assessment Short-Form is not highly recommended by Power and colleagues,[68] we have included it in this table due to it being the most common screening tool for malnutrition in older adults. ESPEN=European Society for Clinical Nutrition and Metabolism. *The validity of screening tools for specific health-care settings is based on research by Power and colleagues;[68] the validity of assessment tools is based on the meta-analysis of Marshall and colleagues.[70] †Promising tools for use in older populations.

Table 2: Selected nutrition screening and assessment tools validated for use in older adults

length of hospital stay (longer than 14 days),[56] the neglect of nutritional needs in older adults,[57–60] fasting due to medical procedures,[57] meal dissatisfaction,[57] and illness or treatment effects.[57] Residents of nursing homes are also at high risk for malnutrition.[48,61] Attributed risk factors to nursing-home-acquired malnutrition include low workforce capacity and capability (eg, insufficient recognition and monitoring of malnutrition by staff and inadequate staffing for mealtime assistance),[58,60,62,63] the quality and appropriateness of food services,[63] immobility,[61,64,65] poor meal intake,[61,65] dysphagia,[65] and severe cognitive impairment.[61] However, the quality of studies in both hospitals and nursing homes is generally low, and the evidence from longitudinal studies is scarce. Large-scale, multicentre studies of risk factors in hospital and nursing home settings are therefore needed.

Screening, assessment, and diagnosis

Multiple nutritional guidelines recommend routine screening for malnutrition in older adults across all health-care settings, regardless of an individual's weight.[7,18,66] Screening involves the identification of individuals who are malnourished (or at risk of malnutrition) and would benefit from further nutritional assessment and potential intervention.[28] Malnutrition screening tools are easy to administer, acceptable to both health-care professionals and patients, and can identify treatable malnutrition.[5,28,67] Screening tools typically contain anthropometric measurement (such as BMI, calf circumference, or mid-arm circumference) in combination with brief questions regarding weight loss, changes in appetite, and food intake.[28,67]

Screening for malnutrition is typically paired with nutritional assessment. Specifically, a positive screening test for malnutrition is followed by a detailed nutritional assessment to confirm diagnosis, gauge the severity of malnutrition, identify any potential causes and problems, and inform the development of a nutritional implementation plan.[7,28,66,67] A nutritional assessment is generally undertaken by a dietitian or clinician with nutritional training and considers an array of factors, such as anthropometric measures, biochemical markers, clinical methods, dietary evaluation methods (eg, detailed food consumption records and dietary intake monitoring to estimate the amount of food eaten), lifestyle factors, functional capacity (eg, handgrip strength and gait speed), body composition measurement, and hydration.[7,28,67]

Despite the many benefits derived from nutritional screening and assessment, a remaining challenge is the absence of a gold standard for malnutrition diagnosis. Consequently, there are a plethora of tools for detecting, assessing, and triaging treatment for malnutrition. An ideal tool for identifying malnutrition needs to be valid for the specific setting that it is applied in.[68] Yet, the majority of screening and assessment tools applied in older populations have not been sufficiently tested for reliability and validity.[67–70] This problem was highlighted by the 2018 European Malnutrition in the Elderly project's review of 48 malnutrition screening tools used in older populations, which revealed that many validation studies had major design flaws, showed low sensitivity or specificity, or both, and that a quarter of screening tools were not validated for use in older adults.[68] Ultimately, the performance of nutritional screening and assessment tools needs to be linked with both adverse health outcomes and patient response to treatment.[28] Table 2[71–82]

Panel 2: Gaps between guidelines and practice in the management of older adults with malnutrition

Recommendation one: All older persons should be routinely screened for malnutrition to identify (risk of) malnutrition using a validated tool

Gap between guidelines and practice: Screening is not routinely performed, and there is confusion as to which health professional should perform screening

High-income countries

- A 2020 qualitative study of primary care of 60 patients in London and Hertfordshire, UK, reported that an older patient's weight is poorly recorded in medical records, making case finding difficult; general practitioners report it is difficult to identify malnutrition at first encounter unless obvious visually due to high workloads and limited time to devote to screening[11]
- A 2015 Dutch qualitative study of primary care reported that general practitioners do not consider it their professional group's responsibility to monitor malnutrition in older adults, although home-care nurses and nurse practitioners suggest that general practitioners should be involved with monitoring[87]
- A 2018 Australian study of 172 patients being treated in a Geriatric Evaluation and Management Unit reported that although nutritional screening was attempted for all patients, 34% of nutritional screening by MNA-SF was incomplete due to omission of the calf circumference or BMI measurement[88]
- A 2021 review of 14 studies validating the GLIM criteria in older populations reported that some studies missed the mandatory screening process[84]
- A 2019 mixed-methods synthesis identified that barriers to nutritional screening in primary care (notably patient reluctance to be screened and loneliness) were rarely addressed[86]

Low-income and middle-income countries

- A 2021 audit of nutritional care in Indian intensive care units using data from the nutritionDay study (a third of patients aged 65 and older) reported low adherence to the use of validated nutritional screening and assessment tools[20]
- A 2018 survey of nutritional practices in 41 hospitals in Lebanon showed that only 7·4% of hospitals used a nutritional screening tool, regardless of hospital size or location[89]
- Qualitative research from 2022 on 58 hospitals in Lebanon reported that barriers to malnutrition screening included staff shortages, a deficiency of nutritional knowledge by nurses, and a scarcity of tools (including weighing scales)[92]

Recommendation two: A positive malnutrition screening should be followed by systematic assessment

Gap between guidelines and practice: Positive screening does not lead to assessment in busy clinical settings, and this assessment may not use validated definitions

- A 2020 international survey of nutritional assessment in clinical practice across 14 EU countries reported that, although all 40 geriatricians surveyed included nutritional assessment as part of comprehensive geriatric assessment, clinical assessment was rarely based on validated nutritional assessment tools[91]
- In the Netherlands, qualitative research in 2020 across the health-care spectrum reported that doctors and dietitians did not always follow up results of nutritional screening performed by nurses, leading to no action being taken for older adults with malnutrition[90]
- A 2019 Australian study of 172 patients found that less than half of those screened as malnourished by MNA–SF (49%) were followed up with a dietitian consultation[88]

Recommendation three: Serum albumin is highly influenced by inflammation in older adults, and is not recommended as a biomarker for malnutrition in older adults

Gap between guidelines and practice: Serum albumin is still used as a biomarker for malnutrition in older adults

- A 2020 international study found that serum albumin was still used as a biomarker for malnutrition in older adults in 60% of EU national guidelines, and by over half of geriatricians surveyed[91]
- A 2022 systematic review of malnutrition in older adults living in Thailand reported that serum albumin is still commonly used to assess malnutrition (reported in six studies)[36]

Recommendation four: Nutritional care should be individualised and comprehensive

Gap between guidelines and practice: Individualised and comprehensive care is often not provided to older adults

- In Norway, a 2020 hospital-based and home-care-based study involving in-depth interviews with 23 health-care professionals working in geriatric and acute care reported staff shortages and organisational culture that prevented nurses from implementing individualised nutritional care for older patients[59]
- A 2020 Norwegian qualitative study on the transition between hospital and home-care services identified that nutritional care for older adults, most of whom had malnutrition, was not individualised in either the hospital or by home-care services[93]
- A 2020 Italian survey of 511 nurses across both hospital and home-care settings found knowledge of malnutrition specific to older populations was inadequate, as assessed by the Knowledge of Malnutrition-Geriatric questionnaire[58]
- In Italy, a 2021 survey of nurses in surgical and medical wards across 10 hospitals reported that only 20·2% of nurses had a positive attitude towards nutritional care of older pateints[60]

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- A 2016 Iranian qualitative study in the acute care setting reported that although nurses had positive attitudes towards the nutritional care of older adults, they faced many barriers when providing this care, including time shortages, insufficient recognition by management, and an unsupportive hospital food service[94]

Recommendation five: Nutritional care should be part of a multimodal and multidisciplinary team approach
Gap between guidelines and practice: Nutritional care is often delivered by only one health professional, dietitian support is often requested too late to be fully effective, and health-care professionals do not always communicate regarding nutritional care

- A 2015 primary care-based Dutch qualitative study of nutrition and care professionals regarding nutritional awareness, monitoring, and treatment in community-dwelling older adults reported that the role of each health professional was not clear, with dietitians often called in too late for optimal intervention effectiveness[87]
- A 2020 systematic review of 21 studies on current practices in dietetics revealed that other health-care professionals do not think involving dietitians is worth the effort[95]
- A 2020 qualitative Dutch study of all health-care settings revealed that health-care professionals did not work collaboratively as a team for the nutritional care of older adults with malnutrition, and older adults and their carers regularly felt ignored by health-care professionals regarding their nutritional care[90]
- A 2020 systematic review of qualitative research identified that general practitioners did not have the multidisciplinary support needed (ie, nurse and dietitian support) to optimally identify and manage older adults with malnutrition[96]
- A US hospital-based study of 242 patients with malnutrition identified that 13% of patients had gaps in nutritional care, and delayed orders and interventions, due to poor communication between dietitians and doctors[97]
- A 2022 Lebanon-based qualitive study of nutritional practices in 58 hospitals reported insufficient interprofessional collaboration and communication, and a shortage of dietitians, with 41% of hospitals having no dietitian[92]

Recommendation six: Older adults with (risk of) malnutrition should receive nutritional information, education, and counselling
Gap between guidelines and practice: Health-care professionals have insufficient time and nutrition-related training to provide this education to older adults

- A 2021 Irish qualitative study of primary care found that non-dietetic health-care professionals reported that they did not have confidence in their ability to identify malnutrition in older adults and believed their knowledge of malnutrition to be inadequate to communicate properly with patients[98]
- A 2020 UK study found that older primary care patients with frailty are rarely given information to promote healthy eating[11]
- Primary care research from the Netherlands from 2015 reported that general practitioners have insufficient time and nutrition-related training to provide nutritional education to older patients[87]
- Hospital-based research from Delaware, USA, found that 47·4% of patients with malnutrition received dietary advice on discharge that did not address malnutrition, and those that did receive advice were simply given a low-quality flyer[99]

Recommendation seven: Dietary restrictions should generally be avoided, and weight-reducing diets should only be considered in combination with physical exercise for older adults with obesity with weight-related health problems
Gap between guidelines and practice: The educational message for older adults has been dominated by the obesity narrative

- A 2020 UK qualitative study of primary care and community health-care professionals revealed a strong emphasis on obesity and weight loss for older patients, which stems from cardiovascular disease and diabetes prevention strategies, together with limited information given to patients encouraging healthy eating[11]
- A 2019 US study of 76 malnourished patients being treated in hospital reported that 44·8% of patients received inappropriate discharge instructions to limit caloric intake[99]
- Research from New York, USA, from 2019 investigated gaps in care in 242 patients with malnutrition with a mean age of 67 years, and found 16·1% of patients were given an inappropriate overly restrictive diet and 35% had a gap in nutritional care due to an extended time period fasting before medical procedures and tests (ie, patients were given a nothing-by-mouth instruction)[97]

Recommendation eight: Oral nutritional supplements should be offered to all older patients with (risk of) malnutrition when food fortification or dietary counselling are insufficient, including during their stay in hospital and at discharge, and oral nutritional supplements should be continued and reviewed for at least 1 month after discharge from hospital
Gap between guidelines and practice: The prescription of oral nutritional supplements is often inappropriate, and adherence to nutritional treatment is low in the community due to gaps in communication between hospitals and communities

- A 2018 Israeli study reported that 3 months after they were discharged from hospital, many older adults showed low

(Panel 2 continues on next page)

adherence to oral nutritional supplements unless prescribed directly by a general practicioner[100]
- A qualitative study of 60 primary health and community health professionals from London and Hertfordshire, UK, identified that prescriptions of oral nutritional supplements for older adults with frailty were commonly initiated in the hospital setting without any provision for review, leading to unnecessary ongoing use and high costs in the community; and oral nutritional supplements were often prescribed before advice on food modification, sometimes due to patient request or insufficient knowledge of health-care professionals[11]
- An Irish qualitative study of 13 community-dwelling older adults with a current or previous prescription of oral nutritional supplements identified a large communication gap between hospitals and community-based health-care professionals, with many older adults prescribed these supplements without discharge follow-up; and confusion regarding proper use of oral nutritional supplements was common[101]
- A 2019 hospital-based study from Delaware, USA, of 76 patients with a mean age of 65 years, reported that although 88·2% of patients with malnutrition received instructions to consume oral nutritional supplements (based on electronic medical records), only 7·0% received documented instructions regarding oral nutritional supplements after discharge from hospital[99]
- A study of hospital chart reviews of 242 patients with a mean age of 67 years from New York, USA, identified that 71·6% of patients with malnutrition did not receive oral nutritional supplements on discharge[97]
- Hospital-based research of 58 hospitals in Lebanon from 2022 reported that oral nutritional supplements were not easily accessible or available due to financial barriers[92]

Recommendation nine: Oral nutrition can be supported by food modification
Gap between guidelines and practice: Food modification or fortification is often not done in the hospital setting
- A 2019 USA-based study found that only 14·8% of patients with malnutrition being treated in hospital were given diets with appropriate texture on discharge, and texture modification was not always performed[97]
- In the nursing home setting, qualitative research from 2016 from Vienna, Austria, reported that the top-most determinant affecting nutritional therapy was a food service without an age-appropriate texture[63]

Recommendation ten: Supportive interventions should be offered for all individuals with (risk of) malnutrition residing in nursing homes or receiving home-care services, including offering mealtime assistance, and provision of a home-like dining environment
Gap between guidelines and practice: Supportive interventions are not commonplace, despite being best practice
- Qualitative research from Swedish nursing homes from 2018 found that nurses did not provide individualised nutritional care to older adults due to time shortages, its low priority compared with other nursing tasks, and underestimation of an older person's ability and preferences to be involved in their own nutritional care[62]

All studies included in this panel focused on older populations (65 years and older), or had an average age of participants older than 65 years. For low-income and middle-income countries, older age was defined as adults who were 60 years and older. Gaps are based on nutritional guidelines specific to older adults by ESPEN.[7] ESPEN=European Society for Clinical Nutrition and Metabolism. GLIM=Global Leadership Initiative on Malnutrition. MNA–SF=Mini Nutritional Assessment–Short Form.

outlines various nutritional screening and assessment tools validated in older populations, including the health-care setting that these tools are validated for.

The diagnosis of malnutrition must be distinguished from its concomitant diagnoses of sarcopenia, frailty, and cachexia.[28,83] Indeed, there is considerable overlap of symptoms and diagnostic criteria for these related conditions, including weight loss, low handgrip strength, slow gait speed, and low muscle mass. An emerging solution for a gold standard diagnosis for malnutrition (specifically for disease-related malnutrition) is the recently developed Global Leadership Initiative on Malnutrition (GLIM).[19,66] A diagnosis of malnutrition using GLIM is given when at least one of two pre-defined causal criteria and at least one of three phenotypical criteria are present, once the person has been screened for being at nutitional risk. The three phenotypical criteria are reduced muscle mass assessed using validated body composition measurement, unintentional weight loss, and low BMI. Low BMI is defined as less

than 22·0 kg/m² for the general population who are 70 years or older, and less than 18·5 kg/m² for those younger than 70 years.[19,66] The two causal criteria are low food intake or food assimilation and inflammation or disease burden. The GLIM diagnostic framework is currently being validated for older populations across a variety of settings and clinical conditions.[66,84,85]

Gaps between evidence and practice in nutritional screening, assessment, and diagnosis

Despite the unanimous recommendation by clinical practice guidelines that all older people should be routinely screened for (risk of) malnutrition using a validated screening tool, in practice several barriers prevent this routine screening from occurring (panel 2).[86–101] In the primary care setting, the high workload of general practitioners limits time available for screening, with malnutrition only identified if the patient has obvious visual signs of malnutrition.[11] Patient barriers to malnutrition screening are rarely addressed,[86] and there is

uncertainty regarding which health-care professional should perform screening.[87] Case finding for malnutrition is also difficult because an older person's weight is often poorly recorded in medical records.[11] In hospital and nursing home settings, health-care professionals have little time for, and little knowledge and awareness of the importance of, malnutrition screening in older adults.[58,60,62,63] Malnutrition screening tools are sometimes left incomplete due to difficulties with body composition measurement.[84,88] Hospitals in LMICs also report a low adherence to the use of validated malnutrition screening and assessment tools.[20,89]

Although it is recommended that all older adults with positive malnutrition screening be followed up with nutritional assessment, intervention, and monitoring, this does not regularly occur in clinical practice. Across health-care settings, studies from Australia[88] and the Netherlands[90] have reported that a positive malnutrition screen was often not followed up, leading to no action being taken for older adults with malnutrition. Furthermore, a survey of European geriatricians revealed that clinical assessment of malnutrition was rarely done using validated nutritional assessment tools.[91] A further concern is that coding for malnutrition diagnosis is frequently not added to an individual's medical records in the hospital setting,[6,102] which could hinder appropriate nutritional intervention and miss hospital reimbursement for its large associated costs.[102]

Use of serum albumin as a biomarker to identify malnutrition in older adults should be discouraged.[91] Serum albumin concentrations are highly influenced by systemic inflammation and hydration status in older adults, and its use to detect malnutrition is extremely unreliable and are not recommended in this population group.[7] However, serum albumin is still misguidedly reported in 60% of EU national guidelines for older adults,[91] and remains in common use in clinical practice, for example in both Thailand[36] and Europe.[91]

Management

Adherence to evidence-based guidelines by clinicians and other health-care professionals is essential to guide clinical decision making, reduce gaps between evidence and practice, and provide appropriate care for each patient. A summary of evidence-based clinical recommendations for the management of malnutrition in older adults is shown in table 3. This table is based on the 2019 European Society for Clinical Nutrition and Metabolism (ESPEN)'s *Guideline on Clinical Nutrition and Hydration in Geriatrics*,[7] which provides the purported first evidence-based clinical practice guidelines in nutritional care of older adults with malnutrition.

However, approximately half of these ESPEN guidelines are consensus-based, primarily due to the absence of a substantial evidence base.[7,69] Indeed, the anecdotal experience of clinical experts is frequently used to develop many nutritional guidelines.[7] Furthermore, there

is increasing awareness that evidence-based knowledge for managing malnutrition in older adults is not regularly translated into clinical practice. Subsequently, there are large treatment gaps between the guidelines and current clinical practice. Such gaps are problematic because patients cannot access cost-effective, appropriate care.

In this section, we provide an overview of the guidelines for older adults with malnutrition (table 3) and cast a spotlight on gaps that exist globally between these guidelines and clinical practice. Panel 2 provides examples of studies from across the world that illustrate these gaps in primary care, hospital, and nursing home settings for older adults with malnutrition. Although studies from LMICs feature in this panel, nutritional studies involving older adults in LMICs are comparatively rare.

	Effectiveness
Screening and assessment	
Routinely screen for (risk of) malnutrition in all older adults using a validated tool	Good practice point
Conduct nutritional assessment for all individuals who screened positive, followed by intervention, monitoring, and intervention modification	Good practice point
Use of serum albumin as a biomarker for malnutrition in older adults is discouraged*	Good practice point
General recommendations	
Offer individualised and comprehensive nutritional care	Effective (strong evidence)
Provide nutritional intervention as part of a multimodal and multidisciplinary team intervention	Effective (medium evidence)
Provide education and nutritional counselling	Effective (medium evidence)
Avoid dietary restrictions	Good practice point
Identify and address potential causes of malnutrition	Good practice point
Oral nutritional supplements	
Offer oral nutritional supplements (400 kcal/day including 30 g or more of protein per day) to all older adults with (risk of) malnutrition, including during their stay in hospital and at discharge	Effective (strong evidence)
Offer oral nutritional supplements when dietary counselling and food fortification are insufficient to improve dietary intake or to reach nutritional goals	Good practice point
Advise to continue oral nutritional supplements for at least 1 month (after discharge from hospital), and provide regular assessment of compliance, efficacy, and expected benefit	Good practice point
Food modification	
Provide fortified food	Effective (medium evidence)
Provide additional snacks, finger food, texture-modified food, and enriched foods	Good practice point
Supportive interventions	
Offer mealtime assistance for those with eating dependency (for residential aged care)	Effective (strong evidence)
Food intake should be supported by a home-like, pleasant dining environment (for residential aged care)	Effective (strong evidence)
Offer meal delivery services with energy-dense meals or additional meals (for home care)	Effective (medium evidence)
Offer shared mealtimes	Good practice point

Recommendations derived from ESPEN guidelines of nutrition and hydration in geriatrics.[7,18] Recommendations were scored as having strong evidence (one or more high-quality randomised controlled trials), as having medium evidence (high-quality cohort or case-control studies), or as being good practice points (with >90% expert consensus). ESPEN=European Society for Clinical Nutrition and Metabolism. *Recommendation from European Academy of Medicine for Ageing[91]

Table 3: **Selected key recommendations for the management of older adults with malnutrition**

Individualised and comprehensive nutritional care

Successful management of malnutrition in older adults according to ESPEN guidelines involves the provision of an individualised and comprehensive nutritional care plan aimed to increase energy intake, especially protein-energy intake, and preserve physical function.[5,7] This plan should incorporate the preferences and priorities of patients, address any medical conditions, and manage psychosocial and environmental factors that could influence the delivery of optimal nutritional care.[7,103,104] Nutritional support can include education, nutritional counselling, fortified food, oral nutritional supplements, and enteral or parenteral nutrition as medically needed.[105,106]

Based on systematic review evidence, comprehensive individualised nutritional support does increase energy and protein-energy intake for hospitalised older adults with malnutrition, but the effect on clinical outcomes, including physical function, is modest.[105] Similarly, for hospitalised older adults with nutritional risk, nutritional support leads to weight gain and reductions in serious adverse events including mortality; however, the evidence for this is substandard.[106]

A further concern is that in current clinical practice, individualised and comprehensive nutritional care is out of reach for many older adults with malnutrition. Hospital-based research from Norway,[59] Italy,[58,60] and Iran[94] has highlighted that nurses were unable to provide individualised and comprehensive nutritional care for older patients due to staff shortages, inadequate training, and insufficient support from other health-care professionals. Furthermore, studies from Norway[93] and Sweden[62] show that individualised nutritional care was not provided in hospitals,[93] home-care services,[93] or nursing homes.[62]

Multimodal and multidisciplinary nutritional support

Guidelines recommend that nutritional intervention be delivered as part of a multimodal and multidisciplinary team.[7] The benefits of multidisciplinary team support were highlighted in a meta-analysis published in 2018 and include a probable positive effect on both quality of life and mortality in older adults with malnutrition.[107] However, the supporting evidence for the benefits of involving a multidisciplinary team is based on a small number of studies only.[107] Moreover, in clinical practice, a multidisciplinary team is not consistently used. Across all health-care settings, health-care professionals often do not work collaboratively as a team for the nutritional care of older adults with malnutrition,[90] which can result in suboptimal nutritional care.[97] Furthermore, nutritional support is regularly delivered by only one health-care professional (eg, a general practitioner in the primary care setting),[87] with limited multidisciplinary support.[96] A barrier to multidisciplinary nutritional support is that many health-care professionals believe that dietitian involvement is of little value,[95] with dietitian support frequently requested too late to be effective.[87]

Nutritional information, education, and counselling

Older adults with (risk of) malnutrition are recommended to receive nutritional information and education aimed at improving nutritional awareness.[7] Nutritional counselling by qualified dietitians is also advised as front-line therapy, and involves more in-depth teaching of nutritional concepts than with nutritional education.[7] Systematic review evidence, however, shows that the supporting evidence base for nutritional education and dietary advice is low, and contains methodological flaws.[108,109] Moreover, in current health-care practice, nutritional education and counselling are not regularly performed due to insufficient time and nutritional training of health-care professionals.[11,87,98]

Dietary restrictions

Clinical practice guidelines[7] and a substantial body of research highlight that weight loss can be inappropriate for older adults, because weight loss in older adults leads to a disproportionate loss of muscle mass.[11] For older adults with overweight or obesity, if weight reduction is medically necessary due to weight-related health issues, exercise should be combined with dietary intervention.[7] However, studies from the UK[11] and USA[99] have found that older adults with malnutrition are often inappropriately advised to lose weight, which stems from strategies to prevent cardiovascular disease and diabetes in younger and middle-aged adults (aged <65 years).[11] In addition, a US hospital-based study reported that many patients with malnutrition spent too long fasting (ie, they received a nothing-by-mouth instruction) before medical procedures and tests.[97]

Oral nutritional supplements

Oral nutritional supplements are usually liquid in form and contain macronutrients and micronutrients that are given either to replace, or in addition to, normal oral food intake for those with specific medical conditions.[106] In the hospital setting, guidelines recommend that oral nutritional supplements should be provided for older adults with (risk of) malnutrition at 400 kcal per day, including at least 30 g of protein per day both during the patient's stay in hospital and also after discharge from hospital if medically required.[7] Advantages of oral nutritional supplements compared with usual care have been reported in both trials and systematic reviews, and include gains in bodyweight, dietary intake improvements, and reductions in complications (eg, infectious complications and post-operative complications).[7,109] Oral nutritional supplements should be offered to all older adults with malnutrition (or risk of malnutrition for those with chronic illness) when food fortification and dietary counselling do not help to achieve dietary goals. However, the use of oral nutritional supplements should be in conjunction with these options, rather

than used solely.[7] It is important to involve older adults in decisions regarding their oral nutritional supplement preferences (eg, flavours). The benefits of oral nutritional supplement intake could be delayed; therefore, oral nutritional supplements should be continued for at least 1 month (eg, after hospital discharge) and monitored regularly for compliance and expected benefit (including cost-effectiveness[110]).[7]

However, despite guideline support for oral nutritional supplements, in current clinical practice the prescription of these supplements is regularly inappropriate. Supplementation without considering underlying issues or in the absence of a deficiency is unlikely to be beneficial, and could even be detrimental. There is also low adherence to oral nutritional supplements in the community. For example, research from Israel reported that adherence to oral nutritional supplements after discharge from hospital was low in older adults unless they were prescribed directly by a general practitioner.[100] Furthermore, research from both England[11] and Ireland[101] identified that oral nutritional supplement use was not followed up after hospital discharge, leading to unnecessary long-term use,[11] high associated costs,[11] and confusion for older adults regarding proper oral nutritional supplement use.[101] Oral nutritional supplement use was additionally reported to be prescribed in the hospital setting before any advice on food medication was given, either due to patient request or due to insufficient nutritional knowledge of health-care professionals.[11] In the USA, results of hospital-based studies suggest that patients with malnutrition commonly do not receive either oral nutritional supplements or instructions for these supplements on discharge.[97,99] Of additional concern is that in LMICs, oral nutritional supplements are in scarce supply in hospital settings due to insufficient funding of nutritional care.[92]

Food fortification to support oral nutrition

Food fortification (ie, dietary enrichment) involves the addition of energy and protein-energy to food and beverages for the purpose of increasing energy and protein intake.[111] To fortify food, either specific nutrient preparations (eg, protein powder) or naturally occurring foods that are high in energy or protein (eg, butter, eggs, cream, and oil) can be used.[7] Nutritional guidelines recommend food fortification for older adults with malnutrition, although systematic reviews on the topic highlight the small evidence base and overall low quality of studies.[112–115] In practice, however, food for older adults is regularly left unfortified by food services in both hospitals[97] and nursing homes.[63] Research from the USA additionally reported that many hospitalised patients with malnutrition were given diets with inappropriate texture on discharge, and texture modification was not always performed during hospitalisation.[97]

Supportive interventions for residential aged care and home care

Guidelines recommend supportive interventions for older adults with malnutrition. In residential aged care (ie, nursing homes), a home-like dining environment should be made available, and mealtime assistance for individuals with eating dependency should be provided.[7] For home-care settings, meal delivery services (with energy-dense meals combined with additional meals) are recommended, and can help increase energy and nutrient intake.[7] Shared mealtimes could also benefit those with malnutrition.[7] However, there are several barriers to implementing these recommendations in nursing homes. For example, in Swedish nursing homes, many nurses face time shortages and underestimate an older person's ability and preferences to be involved in their own nutritional care.[62]

Recommendations with consensus support

The importance of augmenting nutritional interventions with exercise to improve and maintain physical function in malnourished older adults is supported by strong expert consensus in clinical guidelines.[7] However, the evidence base remains insufficient. For example, a 2018 meta-analysis of older adults with nutritional vulnerability (ie, malnutrition, risk of malnutrition, frailty, sarcopenia, or cachexia) reported that although exercise combined with oral nutritional supplements led to increased muscle strength, there were no differences in nutritional status, morbidity, or physical performance between those who exercised and those who only had nutritional support.[116]

Other nutritional recommendations with strong expert consensus but with insufficient evidential support include the advice for health-care professionals to identify and address potential causes of malnutrition and the provision of additional snacks, finger food, enriched food, or texture-modified food.[7] Caution is required regarding texture-modified food because it is less nutrient-dense and more diluted due to the added fluid component.

Hospital-based recommendations

In addition to the provision of oral nutritional supplements in the hospital setting, adequate hydration of patients is crucial.[117] Guidelines recommend that if an older patient appears unwell and measured serum or plasma osmolarity is greater than 300 mOsm/kg, then subcutaneous or intravenous fluids should be provided in conjunction with encouraging oral fluid intake.[7] Further details of treatment for disease-related malnutrition in the hospital setting is provided in a 2021 *Lancet* Review by Philipp Schuetz and colleagues,[28] including a discussion on refeeding syndrome, enteral and parenteral nutrition, and ethical considerations for individuals receiving palliative care. After hospital discharge, nutritional plans should be followed up by a

dietitian or expert clinician, although there is currently no evidence-based recommendation underpinning this suggestion.[104]

Emerging topics

New and promising strategies for treating and preventing malnutrition in older adults warrant further research and involve the incorporation of added micronutrients, anti-inflammatory nutrients, and fibre to augment the traditional high-protein or high-energy approach. Such strategies include the Mediterranean dietary pattern, microbiome-enhancing dietary patterns, omega-3 fatty acid supplementation, plant-based protein, fibre products, probiotics, and personalised medicine informed by biomarkers.[118–120] Regarding medications to treat malnutrition in older adults, there are many appetite stimulants available, but to date none have been approved for use in older adults.

Management of malnutrition for older adults affected by COVID-19

Nutritional management for older adults affected by COVID-19 is another important emerging topic. COVID-19 disproportionally affects older adults, and those with malnutrition have an elevated mortality risk, especially if comorbidities are also present.[121] The management of malnutrition in patients with COVID-19 currently follows general nutritional recommendations with further expert advice.[121] This includes routine nutritional screening and assessment for all older patients, providing oral nutritional supplements of at least 400 kcal per day including at least 30 g protein per day for at least 1 month, ensuring sufficient vitamin and mineral supplementation for patients with malnutrition, and specific recommendations for parenteral and enteral feeding for patients being treated in an intensive care unit.[121]

Effective and promising solutions to address evidence-practice gaps

To improve the uptake of evidence-based nutritional knowledge into clinical practice, guidelines need to be accompanied by active implementation strategies informed by local contextual factors (barriers and facilitators) influencing the delivery of care.[2] Implementation strategies should also be underpinned by research aimed at altering long-term behaviour, because it is difficult to modify the eating patterns of older adults.[11] There are several examples of effective and promising guideline implementation activities to manage malnutrition in older adults. In Austria, simply making guidelines for malnutrition formally available to hospital-based health-care professionals led to improved treatment rates for patients with malnutrition.[122] In Bogotá, Colombia, implementation of a quality improvement programme focused on nutrition for community-dwelling older adults (involving nutritional screening, education, oral nutritional supplements, dietary counselling, and follow-up) improved

patient nutritional status.[123] Across Canada, consensus-based Nutrition Care Pathways have been successfully developed and implemented for older adults with malnutrition across a variety of health-care settings;[124,125] for example, the hospital-based More-2-Eat programme.[124]

Incorporating nutritional guidelines into quality assurance frameworks in care protocols linked to funding could further facilitate the translation of evidence into practice—for instance, nutritional recommendations can be converted into quality indicators that can be used by health-care services or policy makers as minimum standards when auditing the quality of nutritional care provided. In the USA, the Malnutrition Quality Improvement Initiative was specifically designed for hospitals to achieve quality indicator parameters for older patients with malnutrition, and involves a dual approach: four electronic quality measures (screening, assessment, nutritional care plan, and diagnosis) and a quality improvement toolkit based on best practice guidelines from the American Society for Parenteral and Enteral Nutrition and the Academy of Nutrition and Dietetics.[6] The Malnutrition Quality Improvement Initiative has shown much success at cost-effectively improving patient outcomes across US hospitals.[6]

Improving the quality of nutritional guidelines for older adults

To improve the quality of the next generation of nutritional guidelines for older adults, several strategies are needed. First and indisputably, there is a pressing need for large, high-quality clinical trials and systematic reviews on nutritional interventions.[69] Currently, the absence of such evidence is hindering the development of evidence-based nutritional recommendations, particularly specific to older adults residing in the community or in residential care.[69] Second, we need evidence-based guidelines that account for the harms and benefits of nutritional interventions, including concerns regarding interactions between oral nutritional supplements and prescribed medications.[126] Third, we need to ensure the perspective of older adults is incorporated into nutritional recommendations, and that clinical trials informing these recommendations use person-centred outcomes. Fourth, we need guidelines that are user friendly and address barriers to adherence by clinicians and health-care professionals.[86] Finally, national guidelines need to be updated with the latest evidence, for example by matching ESPEN guidelines.[7,91]

Conclusion and future perspectives

Priorities in clinical practice over the next 5–10 years include establishing an international standard for diagnosing malnutrition; strengthening the quality of evidence informing nutritional interventions; and ensuring all older adults receive cost-effective, appropriate nutritional care. A major hurdle to overcome is that the identification of malnutrition and nutritional assistance of older adults are frequently dismissed when other care

needs are present.[59,60] Improved knowledge of nutritional care for older adults is also essential to improve the quality of care provided, and there are calls for the topic to be compulsory in nursing training and medical training. Currently, only half of medical schools in European countries incorporate the topic of malnutrition in older adults into their curriculum.[127]

A raised profile of malnutrition in older populations is urgently needed among public health policy makers. Malnutrition needs to be included in public health messages that are currently dominated by the obesity narrative, particularly because several risk factors for malnutrition are amenable to intervention.[10,35] To expand the rates of malnutrition screening in community-dwelling older adults, national policies and resourcing are needed, which can include case finding through electronic medical record alerts.[128] Furthermore, stronger work is needed in the community setting to improve awareness of older people's nutritional needs, including environmental and psychological factors affecting the nutritional status in older adults. These factors are rarely included in diagnosis and assessment, and in treatment plans, but are essential for improving clinical practice.[10,35]

Technological advancements will have a large role in the identification and management of malnutrition in older adults in the future. Mobile and wireless technologies are showing promise at encouraging older adults to enrich their dietary intake.[129] Likewise, telehealth is emerging as a feasible, potentially cost-effective solution to boost diet-related health.[130]

In conclusion, malnutrition prevalence rates are high for older adults, particularly in hospitals and in care settings. The repercussions of weight loss in this age group are high, and there is an urgent need to improve evidence-based nutritional practice.

Search strategy and selection criteria

To identify publications for our Review, we searched PubMed using the subheadings "malnutrition" OR "protein-energy malnutrition" OR "weight loss" AND "aged" combined with the specific search terms "nutrition assessment", "mass screening", "prognosis", "etiology", "causality", "diagnosis", "risk factors", "epidemiology", "prevention", "pathology, clinical", "diet therapy", "food, fortified", "dietary supplements", "drug therapy", "functional decline", "complications", and "mortality." We also used the search term "developing countries" to identify articles from low-income and middle-income countries. We chose publications that were the most relevant to our Review. We included evidence-based guideline publications, systematic reviews, meta-analyses, and peer-reviewed studies published in the previous 5 years. Highly regarded publications that were published more than 5 years before we did the literature search were also included. Only articles published in English were selected. Additional publications were identified from the reference lists of articles, conference proceedings, Google Scholar, and by manual searches of nutritional journals. We included articles focused on older populations (adults who were 65 years and older) or trials with an average age of participants of over 65 years. For low-income and middle-income countries, we defined older populations as adults who were 60 years and older to identify relevant studies. All searches were conducted between Jan 10, 2022, and Sept 21, 2022, for articles published up to Sept 21, 2022.

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