The Nutrition Society

CAMBRIDGE UNIVERSITY PRESS

Undernutrition in community-dwelling older adults: prevalence, causes and consequences

Marjolein Visser[1,2]

[1]Department of Health Sciences, Faculty of Science, Vrije Universiteit Amsterdam, Amsterdam, The Netherlands and [2]Amsterdam Public Health Research Institute, Amsterdam, The Netherlands

Abstract

The aim of this paper is to review several key aspects of undernutrition in later life, with a major focus on undernutrition in community-dwelling older adults. The prevalence of undernutrition in community-dwelling older adults is about 8.5%, but higher in vulnerable subgroups such as the oldest old (19.3%), those reporting poor appetite (22.4%), and those receiving home care (15.8%). Frequently reported risk factors for undernutrition in the community include poor appetite, functional limitations and previous hospitalisation. The Determinants of Malnutrition in Aged Persons (DoMAP) model provides a clear framework to structure the different direct and indirect potential determinants of undernutrition in old age. Low BMI as well as involuntary weight loss, both important phenotypic criteria of undernutrition, are associated with early mortality in older adults. Furthermore, undernutrition in community-dwelling older adults is associated with a subsequent increased risk of frailty, falls, functional decline and rehospitalisation. Qualitative studies indicate a poor undernutrition awareness among healthcare professionals working in community care as well as among older adults themselves. The Malnutrition Awareness Scale can be used to objectively measure an older persons' undernutrition awareness. In conclusion, the prevalence of undernutrition among older adults living in the community is substantial and has several negative consequences for health and functioning. Strategies towards greater undernutrition awareness by primary care professionals as well as older adults themselves is therefore necessary.

Introduction

Undernutrition can be defined as 'a state resulting from lack of intake or uptake of nutrition that leads to altered body composition (decreased fat free mass) and body cell mass leading to diminished physical and mental function and impaired clinical outcome from disease'[1]. A commonly used synonym of undernutrition is malnutrition, and these terms are often used interchangeably in the literature. However, where possible, the term undernutrition is preferred, as malnutrition in theory includes both under- and overnutrition. Previously, three main types of undernutrition were defined[2]. These include disease-related undernutrition with inflammation (e.g., cancer cachexia), disease-related undernutrition without inflammation (e.g., non-cachectic undernutrition), and undernutrition without disease (e.g., hunger-related undernutrition).

Since 2019, a global consensus on how to diagnose undernutrition is made available by the Global Leadership Initiative on Malnutrition (GLIM)[3,4]. A two-step approach was advised. First, screening to identify who is likely to be undernourished (often called 'at risk') should take place using a validated screening tool. While a previous study identified 48 screening tools being applied to older adults in the literature, a much smaller number of tools have been developed for and/or are validated in older adults for a specific setting[5]. Thus, care should be taken to select the proper tool for screening purposes. Second, in those considered 'at risk' a full diagnosis should take place by assessing three phenotypic criteria (weight loss, low BMI, and low muscle mass) and two etiologic criteria (reduced food intake or assimilation, and inflammation). When at least one phenotypic and one etiologic criterion is met, the diagnosis undernutrition can be made. Extensive guidelines on how to assess low muscle mass and inflammation have been published more recently by GLIM to further stimulate implementation[4,6,7].

Some criteria of undernutrition overlap with the criteria of other age- and nutrition-related concepts such as frailty and sarcopenia (Figure 1). For example, recent weight loss is one of the Fried criteria for frailty[8], and low muscle mass is one of the criteria of the European[9] and the global definition of sarcopenia[10]. Despite the fact that some characteristics are shared between these concepts, and that undernutrition frequently is present in older adults who are frail and/or sarcopenic, it is important to emphasise that undernutrition is a concept very distinct from frailty and sarcopenia.

The aim of this paper is to review several key aspects of undernutrition in later life, with a major focus on undernutrition in community-dwelling older adults.
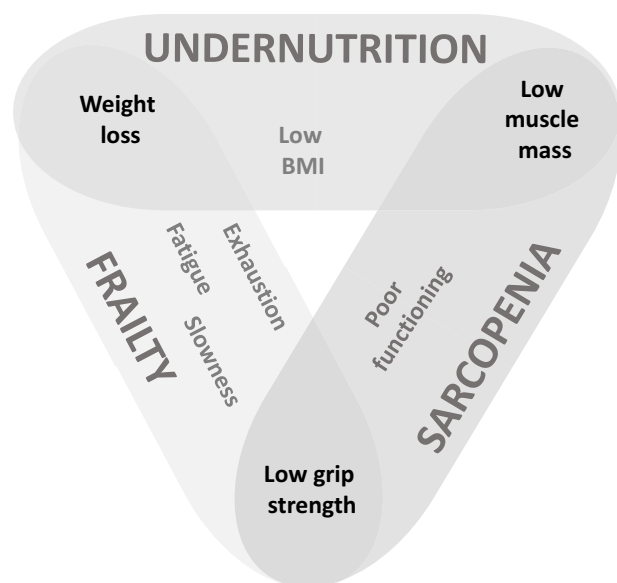
Figure 1. The overlap between undernutrition and other age-related concepts.
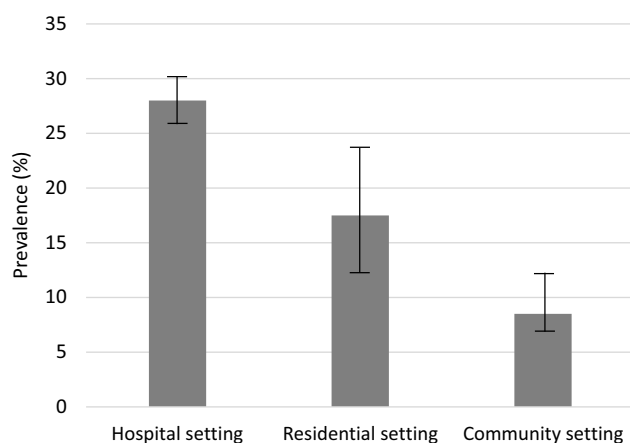

Figure 2. European prevalence of high malnutrition risk in adults aged 65 years and older based on validated screening tools, according to setting. Prevalence is reported as percentage with 95% confidence intervals. Based on Leij-Halfwerk S *et al.* (2019) *Maturitas* **126**, 80–89.

Prevalence of undernutrition

The prevalence of undernutrition in older adults reported in individual studies varies due to differences in the setting (hospital, long-term care or community), sample characteristics (such as age, functioning level, and health status) and method to identify undernutrition (screening tool or diagnosis).

In an extensive review, prevalence data based on 583,972 older adults from 196 studies and 24 European countries were pooled[11]. Studies were only included when a screening tool validated for older adults was used. Overall, the prevalence of being at high risk of undernutrition was 22.6% (95% confidence interval 20.9% to 24.3%). The prevalence was highest in the hospital setting based on 127 studies (Figure 2). Within the hospital setting, the highest prevalence of undernutrition was previously observed in the medical speciality geriatrics[12]. In the residential care setting the prevalence of being at high risk was 17.5% based on 30 studies, while the lowest prevalence, based on 32 studies, was observed among older adults living at home (8.5%)[11].

While the reported prevalence of undernutrition in older adults is generally lowest in the community setting, its prevalence is substantially higher in specific subgroups. A study among 1745 Dutch adults aged 65 years and older (mean age 74 years), showed an overall prevalence of high undernutrition risk of 8.5%[13]. However, the prevalence was higher in those 85 years and older (19.3%), those reporting a poor appetite (22.4%), those reporting mobility limitations (11.5%), those living alone (13.5%), those receiving home care (15.8%), and those with poorer self-reported health (12.2%). Thus, among community-dwelling older adults, subgroups are present that show prevalence rates approaching those of older adults in the hospital setting.

As stated above, the GLIM advices to first screen for undernutrition. When screened positive, a full diagnosis of undernutrition should be performed. In the previously mentioned Dutch prevalence study, and selecting those older adults who had complete data on all required criteria, the prevalence rate was 5.4% based on the screening tool, 7.1% based on GLIM diagnosis, and only 3.1% when a positive screening was followed by a positive GLIM diagnosis[13]. These results importantly suggest that undernutrition cases are being missed when the diagnosis of undernutrition has to be preceded by a positive screening, and that the two-step GLIM approach thus may lead to an underestimation of the problem. This observation, which was made in other studies as well[14], may be dependent on the choice of the malnutrition risk screening tool, and is currently being discussed within the GLIM community[4]. Overall, as different screening and diagnostic tools are being used to assess undernutrition, it remains very important to consider which tools have been used in order to properly interpret and compare prevalence data.

Determinants of undernutrition

Multiple factors are involved in the aetiology of undernutrition, of which some are directly causing undernutrition, while others may indirectly increase the risk of undernutrition. In a systematic review of observational studies investigating determinants of protein-energy malnutrition in older adults, strong evidence was obtained for poor appetite, and moderate evidence for edentulousness, having no diabetes, hospitalisation and poor self-reported health increasing the risk of undernutrition[15]. A meta-analysis of six prospective datasets that were harmonised to identify determinants of incident undernutrition in community-dwelling older adults, older age, not being married, having difficulties walking or climbing stairs, and previous hospitalisation increased the risk of developing undernutrition[16]. In a qualitative study, the causes of undernutrition as reported by older adults themselves were revealed[17]. All participants were screened to be at high risk for undernutrition. Of interest, many participants reported multiple causes of their undernutrition. Causes within the mental, social and food & appetite domain, such as mourning, loneliness, inability to do groceries and poor food quality provided by meal services were mentioned. Other reported causes included aging, surgery and hospitalisation, and forgetfulness.

To structure the potential determinants of undernutrition identified in previous studies, a theoretical framework was developed by Volkert et al.[18]: the DoMAP (Determinants of Malnutrition in Aged Persons) model. The key aspects of this model are summarised in Figure 3. The model indicates three central mechanisms through which undernutrition may develop: reduced nutrient availability, low intake, and high requirements. Certain risk factors may directly lead to one of these central
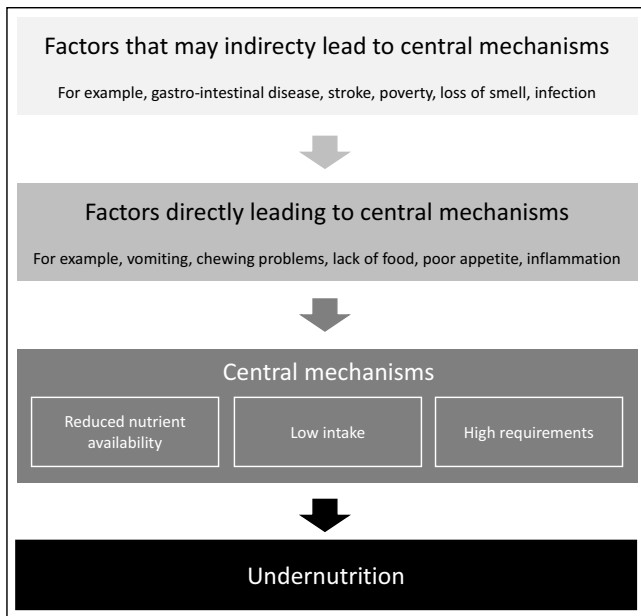
Figure 3. Potential determinants and central mechanisms of the development of undernutrition in older adults. Based on Volkert D *et al.* (2019) *Gerontol Geriatr Med* **5**, 2333721419858438.

mechanisms and could be interpreted as direct causes of undernutrition. Examples are vomiting, chewing problems, lack of food, poor appetite and inflammation. These factors would require immediate attention by healthcare professionals in order to prevent the development of undernutrition or further aggravation of nutritional status. Other factors may not necessarily lead to undernutrition, but may indirectly cause undernutrition through one or more of the direct risk factors. An example is stroke, that may likely induce undernutrition when chewing and swallowing are negatively affected, but will not necessarily always lead to undernutrition.

The DoMAP model clearly highlights the large range of potential causes and mechanisms that underlie the development of undernutrition. The model contains relevant and frequent problems that are often modifiable with appropriate interventions. Thus, the model could support the initiation of preventive measures in clinical practice in order to reduce the risk of developing undernutrition.

Data from a randomised clinical trial conducted in older adults living at home, who were all screened being at high risk of undernutrition, showed that the prevalence of certain risk factors for undernutrition is high. For example, 74–81% reported to have a poor appetite, 69–74% needed support for obtaining groceries, and 73–77% reported an oral health problem[19]. Active screening for undernutrition risk factors and subsequent treatment of those factors that are modifiable may help prevent the aggravation of nutritional status in older adults and the actual development of undernutrition. The potential screening for risk factors of undernutrition (instead of, or in addition to, screening for the presence of undernutrition) as part of the GLIM approach is currently being discussed within the GLIM community[4].

Consequences of undernutrition

Most of the research investigating the consequences of undernutrition has focused on mortality risk. Recent studies report an

increased mortality risk across all settings for those diagnosed with undernutrition using GLIM[4]. A scoping review indicated, based on five cohort studies conducted in community-dwelling older adults, that a positive GLIM diagnosis increased mortality risk 1.6 to 4.4-fold during a follow-up of 2 to14 years[20]. The independent association of two phenotypic GLIM criteria (i.e., low BMI and involuntary weight loss) with mortality in older adults has since long been established[21,22]. However, the independent association between low muscle mass in older community-dwelling adults and mortality seems less clear[23–25]. Prospective studies conducted in community-dwelling older adults, clearly show that a positive screening for undernutrition is associated with other negative clinical outcomes, such as falls[26], rehospitalisation[27], frailty[28], and functional decline[29]. Moreover, malnutrition is also associated with poorer functional recovery and higher mortality risk after a hip fracture[30,31]. Importantly, several studies suggest higher healthcare costs for community-dwelling older adults with undernutrition compared to those without undernutrition, mainly due to a higher use of healthcare resources[32,33].

It should be acknowledged that most of the knowledge on the consequences of undernutrition is based on observational studies, which do not allow drawing any conclusions regarding causality. The presence of undernutrition in older adults is often co-occurs with other health problems such as chronic disease, functional limitations, depression, and cognitive problems, which by themselves are strongly associated with poor clinical outcomes. While intuitively a causal association between undernutrition and clinical outcomes can be expected, as the body needs proper nutrition to remain well-functioning and healthy, experimental studies are necessary to causally link undernutrition to relevant clinical outcomes by testing the impact of nutritional interventions in those who are undernourished.

The EFFORT trial is a landmark study, testing an in-depth, stepwise protocol to treat undernutrition in 2088 patients (mean age 72 y), and showing a greater increase in energy intake and protein intake compared to the usual care group[34]. In the intervention group, 79% reached their energy requirement, while this was only 54% in the control group. The nutritional intervention reduced the risk of any adverse clinical outcome by 21%, which included all-cause mortality, admission to intensive care, non-elective hospital readmission, major complications, and decline in functional status at 30 days. Of interest, only the individual outcomes all-cause mortality and decline in functional status at 30 days were statistically significant reduced. Although this study was conducted in the hospital setting, it clearly highlights the causal impact of reducing or eliminating undernutrition using optimised nutritional care on hard clinical endpoints. Furthermore, a secondary analysis showed that the in-hospital nutritional support was highly cost-effective, mainly due to the reduction in ICU admissions and hospital-associated complications[35].

Unfortunately, a study of similar magnitude conducted among older adults in the community setting has never been performed. Smaller nutritional intervention trials focussed on increasing energy intake and protein intake in undernourished community-dwelling older adults or those at high risk, have shown mixed results. In pooled analyses of individual-participant data from randomised controlled trials conducted in older adults, we earlier observed a clear positive impact of nutrition interventions on energy intake and body weight[36], but not on muscle strength and mortality[34]. Similar results were observed in systematic reviews of nutritional interventions tested in randomised controlled trials in community-dwelling older adults[38,39].
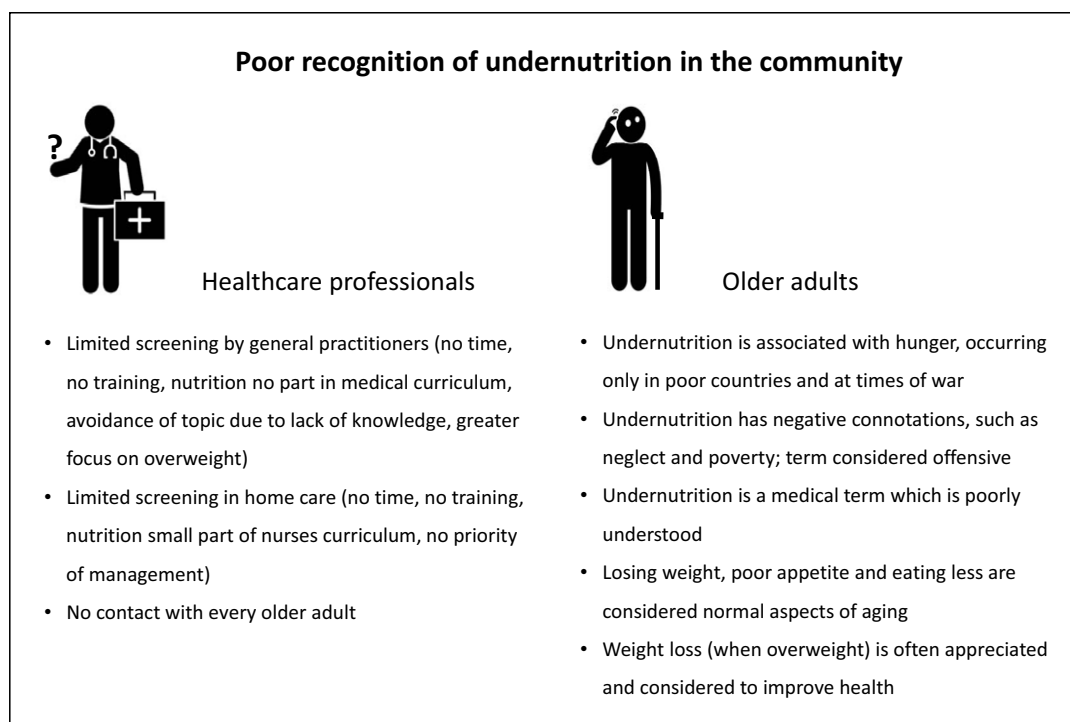
Figure 4. Aspects related to the poor recognition of undernutrition in older adults in the community setting.

Unfortunately, many previous trials conducted in the community setting have methodological shortcomings, including a low sample size, low adherence to the intervention (for example, the actual use of provided oral nutrition supplements), study participants not meeting nutritional requirements, inclusion of participants who were not undernourished at baseline, short follow-up, and the inclusion of outcomes considered less responsive to interventions (such a handgrip strength)[38,40]. These shortcomings likely contribute to an underestimation of the impact of nutritional interventions on relevant clinical outcomes in undernourished older adults, contributing to the mixed conclusions of these studies. Carefully designed and conducted trials, using a core outcome set of relevant and standardised (patient-reported) outcomes[41], are still necessary to answer the key question: what type of nutritional intervention in what setting is effective for which older adult[42]? Although the impact of nutritional treatment on clinical outcomes in community-dwelling older adults who are undernourished remains somewhat unclear, this uncertainty should never justify poor nutritional care in older adults, as proper nutrition and hydration are human rights[43].

Malnutrition awareness in the community setting

While the reported prevalence of high undernutrition risk in older adults is lower in the community setting compared to all other settings, it should be realised that in Europe about 95% of older adults live at home. Thus, most older adults with undernutrition live at home. In an individual-participant data analysis including 15 samples and 5956 older participants across three settings, two criteria for the presence of undernutrition were evaluated: low BMI and previous weight loss, thereby using a harmonised definition of undernutrition[44]. In the community setting samples, undernutrition was mostly (overall, about 69%) identified due to recent weight loss, indicating early malnutrition. In contrast, in the nursing home and institutionalised care setting, undernutrition was mostly identified due to low BMI (overall, about 66%), suggesting the presence of chronic undernutrition. In the home care and day hospital setting, as well as in the acute hospital and rehabilitation setting, the frequency of experiencing both recent weight loss as well as low BMI was highest, suggesting very serious nutritional issues that would require immediate attention. These results suggest that undernutrition in older adults often starts at home, which is supported by observations that older adults admitted to the hospital or nursing home are often already undernourished[45,46].

Since most older adults live at home and undernutrition frequently starts at home, the community setting is a very relevant setting for initiating preventive actions in order to reduce the actual development of undernutrition, as well as for improving the detection of undernutrition at an early stage in order to prevent further decline of nutritional status. Unfortunately, studies show that the recognition of undernutrition in the community and residential setting is low. Routine screening for undernutrition and proper referral to healthcare professionals is often lacking[47–49]. Moreover, older persons themselves are often not aware of their weight loss or are not concerned[50,51].

Figure 4 highlights several aspects contributing to the poor recognition of undernutrition in the community setting. These aspects are based on the results of mainly qualitative studies conducted among healthcare professionals, including general practitioners, dieticians and home care nurses[47–49,52–56], as well as studies among older adults and their informal carers[50,52,57–61]. These results of these studies clearly warrant the need for greater undernutrition awareness in the community setting.

Several potential strategies to increase the recognition of undernutrition in primary and community care as well among older adults are summarised in Figure 5. Embedding specific courses on the topic of undernutrition (in older adults) in the
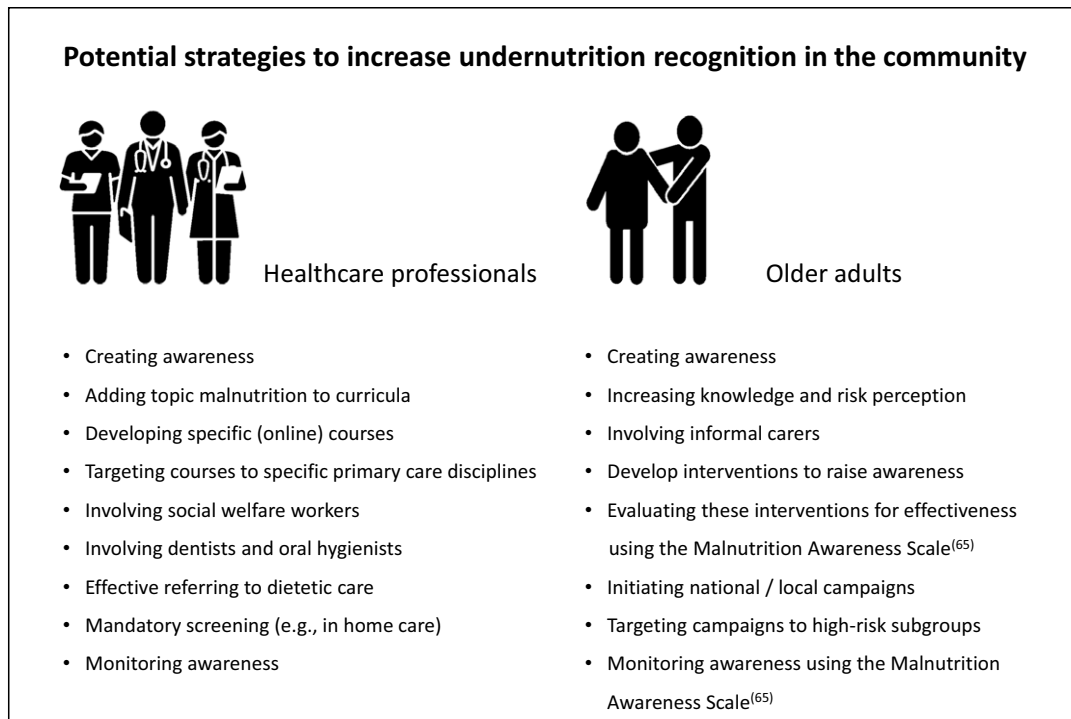
Potential strategies to increase undernutrition recognition in the community

Healthcare professionals

- Creating awareness
- Adding topic malnutrition to curricula
- Developing specific (online) courses
- Targeting courses to specific primary care disciplines
- Involving social welfare workers
- Involving dentists and oral hygienists
- Effective referring to dietetic care
- Mandatory screening (e.g., in home care)
- Monitoring awareness

Older adults

- Creating awareness
- Increasing knowledge and risk perception
- Involving informal carers
- Develop interventions to raise awareness
- Evaluating these interventions for effectiveness using the Malnutrition Awareness Scale[65]
- Initiating national / local campaigns
- Targeting campaigns to high-risk subgroups
- Monitoring awareness using the Malnutrition Awareness Scale[65]

Figure 5. Potential strategies to increase undernutrition recognition in the community.

medical doctors and nurses' curricula, schooling of healthcare professionals through (online) courses, and mandatory screening for undernutrition in specific healthcare settings (such as the formal home care setting) are examples of strategies that could contribute to a greater recognition of undernutrition by healthcare professionals[62–64].

Interventions among community-dwelling older adults are also needed to increase undernutrition awareness. Recently, we developed the Malnutrition Awareness Scale (MAS) to objectively measure undernutrition awareness in older adults[65]. The MAS is specifically developed for community-dwelling older adults and is based on the Integrated-Change model of behavioural change (I-Change model[66]). The MAS assesses the four domains of awareness: knowledge, cues, risk perception and cognizance. The scale contains a total of 22 items (and one priming item) covering these four domains and provides an awareness score between 0 (very low awareness) and 22 (very high awareness). The MAS was shown to be a feasible and reliable tool with good content validity to objectively assess undernutrition awareness in community-dwelling older adults, and is currently being translated and culturally adapted into several other languages. Since previous qualitative research on undernutrition awareness in older adults is limited to specific countries or regions, application of the translated MAS in more diverse regions is important to understand whether undernutrition awareness is culturally specific.

The MAS can be used to identify older adults with poor awareness, to support the development of effective interventions to increase this awareness, and to objectively evaluate the impact of these interventions. The MAS may contribute to much-needed future efforts to increase undernutrition awareness among older adults living in the community, in order to either prevent the development of undernutrition or to recognise undernutrition at an early stage and obtain proper treatment, thereby reducing the negative health and functional consequences of undernutrition.

Conclusions and recommendations

This overview highlights that undernutrition is frequently present among community-dwelling older adults, especially among vulnerable subgroups. A wide range of (modifiable) risk factors can cause or contribute to its development. Undernutrition in community-dwelling older adults has been linked to serious negative health consequences, higher use of healthcare resources and higher healthcare costs. However, undernutrition recognition by primary care professionals and by older adults themselves is generally low.

Strategies are urgently needed to increase undernutrition awareness among healthcare professionals working in primary and community care, for example by embedding courses on the topic of undernutrition in health professionals' curricula. Implementation of the GLIM undernutrition criteria for assessing undernutrition should be supported to enhance uniform diagnosis in clinical care, comparison of prevalence data, and the identification of high-risk subgroups. Greater attention to the presence of factors contributing to the risk of undernutrition, and early treatment of these risk factors in primary and community care, may contribute to the prevention of undernutrition and its negative health consequences. Future research should identify the key modifiable risk factors to be assessed in community-dwelling older adults. Furthermore, future trials are needed to better address what type of nutritional intervention in what setting is effective for which older adult. These trials should include a core outcome set of relevant and standardised (patient-reported) outcomes. Lastly, effective interventions to increase malnutrition awareness need to be developed and implemented in order to empower older adults and their informal care givers to act at an early stage of undernutrition development.

References

1. Sobotka L (Ed.), Basics in clinical nutrition (4th ed.), Galen (2012).
2. Cederholm T, Barazzoni R, Austin P, et al. (2017) ESPEN guidelines on definitions and terminology of clinical nutrition. *Clin Nutr* **36**, 49–64.
3. Cederholm T, Jensen GL, Correia MITD, et al. (2019) GLIM criteria for the diagnosis of malnutrition—A consensus report from the global clinical nutrition community. *Clin Nutr* **38**, 1–9.
4. Jensen GL, Cederholm T, Correia MITD, et al. (2025) GLIM consensus approach to diagnosis of malnutrition: a 5-year update. JPEN J Parenter Enteral Nutr
5. Power L, de van der Schueren MAE, Leij-Halfwerk S, et al. (2019) Development and application of a scoring system to rate malnutrition screening tools used in older adults in community and healthcare settings—A MaNuEL study. *Clin Nutr* **38**, 1807–1819.
6. Barazzoni R, Jensen GL, Correia MITD, et al. (2022) Guidance for assessment of the muscle mass phenotypic criterion for the Global Leadership Initiative on Malnutrition (GLIM) diagnosis of malnutrition. *Clin Nutr* **41**, 1425–1433.
7. Cederholm T, Jensen GL, Ballesteros-Pomar MD, et al. (2024) Guidance for assessment of the inflammation etiologic criterion for the GLIM diagnosis of malnutrition: a modified Delphi approach. *Clin Nutr* **43**, 1025–1032.
8. Fried LP, Tangen CM, Walston J, et al. (2001) Frailty in older adults: evidence for a phenotype. *J Gerontol A Biol Sci Med Sci* **56**, M146–M156.
9. Cruz-Jentoft AJ, Bahat G, Bauer J, et al. (2019) Sarcopenia: revised European consensus on definition and diagnosis. *Age Ageing* **48**, 16–31.
10. Kirk B, Cawthon PM, Arai H, et al. (2024) The conceptual definition of sarcopenia: delphi consensus from the global leadership initiative in sarcopenia (GLIS). *Age Ageing* **53**, afae052.
11. Leij-Halfwerk S, Verwijs MH, van Houdt S, et al. (2019) Prevalence of protein-energy malnutrition risk in European older adults in community, residential and hospital settings, according to 22 malnutrition screening tools validated for use in adults ≥65 years: a systematic review and meta-analysis. *Maturitas* **126**, 80–89.
12. Kruizenga H, van Keeken S, Weijs P, et al. (2016) Undernutrition screening survey in 564,063 patients: patients with a positive undernutrition screening score stay in hospital 1.4 d longer. *Am J Clin Nutr* **103**, 1026–1032.
13. Zügül Y, van Rossum C, Visser M. (2023) Prevalence of undernutrition in community-dwelling older adults in The Netherlands: application of the SNAQ65+ screening tool and GLIM consensus criteria. *Nutrients* **15**, 3917.
14. Van Dronkelaar C, Tieland M, Cederholm T, et al. (2023) Malnutrition screening tools are not sensitive enough to identify older hospital patients with malnutrition. *Nutrients* **15**, 5126.
15. Van der Pols-Vijlbrief R, Wijnhoven HA, Schaap LA, et al. (2014) Determinants of protein-energy malnutrition in community-dwelling older adults: a systematic review of observational studies. *Ageing Res Rev* **18**, 112–131.
16. Streicher M, van Zwienen-Pot J, Bardon L, et al. (2018) Determinants of incident malnutrition in community-dwelling older adults: a MaNuEL multicohort meta-analysis. *J Am Geriatr Soc* **66**, 2335–2343.
17. Van der Pols-Vijlbrief R, Wijnhoven HAH, Visser M. (2017) Perspectives on the causes of undernutrition of community-dwelling older adults: a qualitative study. *J Nutr Health Aging* **21**, 1200–1209.
18. Volkert D, Kiesswetter E, Cederholm T, et al. (2019) Development of a model on determinants of malnutrition in aged persons: a MaNuEL project. *Gerontol Geriatr Med* **5**, 2333721419858438.
19. Van der Pols-Vijlbrief R, Wijnhoven HAH, Bosmans JE, et al. (2017) Targeting the underlying causes of undernutrition. Cost-effectiveness of a multifactorial personalized intervention in community-dwelling older adults: a randomized controlled trial. *Clin Nutr* **36**, 1498–1508.
20. Sánchez-Rodríguez D, De Meester D, Minon L, et al. (2023) Association between malnutrition assessed by the global leadership initiative on malnutrition criteria and mortality in older people: a scoping review. *Int J Environ Res Public Health* **20**, 5320.
21. Global BMI Mortality Collaboration, Di Angelantonio E, Bhupathiraju ShN, et al. (2016) Body-mass index and all-cause mortality: individual-participant-data meta-analysis of 239 prospective studies in four continents. *Lancet* **388**, 776–786.
22. Wijnhoven HA, van Zon SK, Twisk J, et al. (2014) Attribution of causes of weight loss and weight gain to 3-year mortality in older adults: results from the Longitudinal Aging Study Amsterdam. *J Gerontol A Biol Sci Med Sci* **69**, 1236–1243.
23. Newman AB, Kupelian V, Visser M, et al. (2006) Strength, but not muscle mass, is associated with mortality in the health, aging and body composition study cohort. *J Gerontol A Biol Sci Med Sci* **61**, 72–77.
24. Li R, Xia J, Zhang XI, et al. (2018) Associations of muscle mass and strength with all-cause mortality among US older adults. *Med Sci Sports Exerc* **50**, 458–467.
25. Wang Y, Mu D, Wang Y. (2024) Association of low muscle mass with cognitive function and mortality in USA seniors: results from NHANES 1999-2002. *BMC Geriatr* **24**, 420.
26. Eckert C, Gell NM, Wingood M, et al. (2021) Malnutrition risk, rurality, and falls among community-dwelling older adults. *J Nutr Health Aging* **25**, 624–627.
27. Wahyudi ER, Ronoatmodjo S, Setiati S, et al. (2024) The risk of rehospitalization within 30 days of discharge in older adults with malnutrition: a meta-analysis. *Arch Gerontol Geriatr* **118**, 105306.
28. Rodríguez-Mañas L, Rodríguez-Sánchez B, Carnicero JA, et al. (2021) Impact of nutritional status according to GLIM criteria on the risk of incident frailty and mortality in community-dwelling older adults. *Clin Nutr* **40**, 1192–1198.
29. Kiesswetter E, Pohlhausen S, Uhlig K, et al. (2014) Prognostic differences of the Mini Nutritional Assessment short form and long form in relation to 1-year functional decline and mortality in community-dwelling older adults receiving home care. *J Am Geriatr Soc* **62**, 512–517.
30. Inoue T, Misu S, Tanaka T, et al. (2017) Pre-fracture nutritional status is predictive of functional status at discharge during the acute phase with hip fracture patients: a multicenter prospective cohort study. *Clin Nutr* **36**, 1320–1325.
31. Gumieiro DN, Rafacho BP, Gonçalves AF, et al. (2013) Mini nutritional assessment predicts gait status and mortality 6 months after hip fracture. *Br J Nutr* **109**, 1657–1661.
32. Abizanda P, Sinclair A, Barcons N, et al. (2016) Costs of malnutrition in institutionalized and community-dwelling older adults: a systematic review. *J Am Med Dir Assoc* **17**, 17–23.
33. Rodríguez-Sánchez B, Sulo S, et al. (2020) Malnutrition prevalence and burden on healthcare resource use among spanish community-living older adults: results of a longitudinal analysis. *Clinicoecon Outcomes Res* **12**, 355–367.
34. Schuetz P, Fehr R, Baechli V, et al. (2019) Individualised nutritional support in medical inpatients at nutritional risk: a randomised clinical trial. *Lancet* **393**, 2312–2321.
35. Schuetz P, Sulo S, Walzer S, et al. (2020) Economic evaluation of individualized nutritional support in medical inpatients: Secondary analysis of the EFFORT trial. *Clin Nutr* **39**, 3361–3368.
36. Reinders I, Volkert D, de Groot LCPGM, et al. (2019) Effectiveness of nutritional interventions in older adults at risk of malnutrition across different health care settings: pooled analyses of individual participant data from nine randomized controlled trials. *Clin Nutr* **38**, 1797–1806.
37. Van Zwienen-Pot JI, Reinders I, de Groot LCPGM, et al. (2023) Effects of nutritional interventions in older adults with malnutrition or at risk of malnutrition on muscle strength and mortality: results of pooled analyses of individual participant data from nine RCTs. *Nutrients* **15**, 2025.

38. De van der Schueren MA, Wijnhoven HA, Kruizenga HM, *et al.* (2016) A critical appraisal of nutritional intervention studies in malnourished, community dwelling older persons. *Clin Nutr* **35**, 1008–1014.

39. Thomson KH, Rice S, Arisa O, *et al.* (2022) Effectiveness and cost-effectiveness of oral nutritional supplements in frail older people who are malnourished or at risk of malnutrition: a systematic review and meta-analysis. *Lancet Healthy Longev* **3**, e654–e666.

40. Milne AC, Potter J, Vivanti A, *et al.* (2009) Protein and energy supplementation in elderly people at risk from malnutrition. *Cochrane Database of Systematic Rev* **2**, CD003288.

41. Mendonça N, Avgerinou C, Çavdar S, *et al.* (2024) Critical outcomes to be included in the Core Outcome Set for nutritional intervention studies in older adults with malnutrition or at risk of malnutrition: a modified Delphi Study. *Eur J Clin Nutr* **78**, 663–669.

42. Norman K, Haß U, Pirlich M. (2021) Malnutrition in older adults-recent advances and remaining challenges. *Nutrients* **13**, 2764.

43. Beck AM & Volkert D. (2023) Proper nutrition and hydration are human rights: also and especially for older patients. *Eur Geriatr Med* **14**, 407–410.

44. Wolters M, Volkert D, Streicher M, *et al.* (2019) Prevalence of malnutrition using harmonized definitions in older adults from different settings—a MaNuEL study. *Clin Nutr* **38**, 2389–2398.

45. Russell CA & Elia M. (2010) Malnutrition in the UK: where does it begin? *Proc Nutr Soc* **69**, 465–469.

46. Chatindiara I, Allen J, Hettige D, *et al.* (2020) High prevalence of malnutrition and frailty among older adults at admission to residential aged care. *J Prim Health Care* **12**, 305–317.

47. Morley JE. (2012) Undernutrition in older adults. *Fam Pract* **29** (Suppl 1), i89e93.

48. Murphy J, Mayor A, Forde E. (2018) Identifying and treating older patients with malnutrition in primary care: the MUST screening tool. *Br J Gen Pract* **68**, 344e5.

49. Castro PD, Reynolds CME, Kennelly S, *et al.* (2020) General practitioners' views on malnutrition management and oral nutritional supplementation prescription in the community: a qualitative study. *Clin Nutr ESPEN* **36**, 116–127.

50. Avgerinou C, Bhanu C, Walters K, *et al.* (2019) Exploring the views and dietary practices of older people at risk of malnutrition and their carers: a qualitative study. *Nutrients* **11**, 1281.

51. Reynolds CME, Dominguez Castro P, Geraghty AA, *et al.* (2021) 'It takes a village': a qualitative study on malnutrition and oral nutritional supplements with older adults in Ireland. *Eur J Public Health* **31**, 1284–1290.

52. Ziylan C, Haveman-Nies A, van Dongen EJI, *et al.* (2015) Dutch nutrition and care professionals' experiences with undernutrition awareness, monitoring, and treatment among community-dwelling older adults: a qualitative study. *BMC Nutrition* **1**, 38.

53. Craven DL, Pelly FE, Isenring E, *et al.* (2017) Barriers and enablers to malnutrition screening of community-living older adults: a content analysis of survey data by Australian dietitians. *Aust J Prim Health* **23**, 196–201.

54. Harris PS, Payne L, Morrison L, *et al.* (2019) Barriers and facilitators to screening and treating malnutrition in older adults living in the community: a mixed-methods synthesis. *BMC Fam Pract* **20**, 100.

55. Hestevik CH, Molin M, Debesay J, *et al.* (2019) Healthcare professionals' experiences of providing individualized nutritional care for older people in hospital and home care: a qualitative study. *BMC Geriatr* **19**, 317.

56. Geraghty AA, Browne S, Reynolds CME, *et al.* (2021) Malnutrition: a misunderstood diagnosis by primary care health care professionals and community-dwelling older adults in Ireland. *J Acad Nutr Diet* **121**, 2443–2453.

57. Winter JE, McNaughton SA, Nowson CA. (2016) Older adults' attitudes to food and nutrition: a qualitative study. *J Ageing Res Clin Pract* **5**, 114–119.

58. Beelen J, Vasse E, Ziylan C, *et al.* (2017) Undernutrition: who cares? Perspectives of dietitians and older adults on undernutrition. *BMC Nutr* **11**, 24.

59. Chatindiara I, Sheridan N, Kruger M, *et al.* (2020) Eating less the logical thing to do? Vulnerability to malnutrition with advancing age: a qualitative study. *Appetite* **146**, 104502.

60. Payne L, Harris P, Ghio D, *et al.* (2020) Beliefs about inevitable decline among home-living older adults at risk of malnutrition: a qualitative study. *J Hum Nutr Diet* **33**, 841–851.

61. Castro PD, Reynolds CM, Kennelly S, *et al.* (2021) An investigation of community-dwelling older adults' opinions about their nutritional needs and risk of malnutrition; a scoping review. *Clin Nutr* **40**, 2936–2945.

62. Eglseer D, Halfens RJG, Schüssler S, *et al.* (2018) Is the topic of malnutrition in older adults addressed in the European nursing curricula? A MaNuEL study. *Nurse Educ Today* **68**, 13–18.

63. Eglseer D, Visser M, Volkert D, *et al.* (2019) Nutrition education on malnutrition in older adults in European medical schools: need for improvement? *Eur Geriatr Med* **10**, 313–318.

64. Leistra E, van Bokhorst-de van der Schueren MA, Visser M, *et al.* (2014) Systematic screening for undernutrition in hospitals: predictive factors for success. *Clin Nutr* **33**, 495–501.

65. Visser M, Sealy MJ, Leistra E, *et al.* (2024) The Malnutrition Awareness Scale for community-dwelling older adults: Development and psychometric properties. *Clin Nutr* **43**, 446–452.

66. De Vries H (2017) An integrated approach for understanding health behavior; the I-Change model as an example. *Psychol Behav Sci Int* **2**, 555585.