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Short Communication

GLIM in nursing homes; practical implications

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SUMMARY

Background: Only very few papers have described malnutrition prevalence rates according to the Global Leadership Initiative on Malnutrition (GLIM) criteria in nursing homes, likely due to practical reasons such as missing data on body composition, dietary intake, or acute disease/inflammation.
Methods: Data was collected in 5 different nursing homes. Food intake measurements took place over 3 days of observations, and intakes below 90% of energy or protein requirements were regarded as insufficient. The GLIM diagnosis was based on body weight loss and/or low BMI in combination with insufficient food intake. Additionally, we also studied the sensitivity of GLIM with the question from the Mini Nutritional Assessment Short Form (MNA-SF) on insufficient food intake ($GLIM_{MNA}$) versus GLIM with measured food intake.
Results: Out of 176 participants, 21.0% were categorized as malnourished according to GLIM. Observations revealed an insufficient food intake in 81.3% (N = 143) of residents; only 39% of those (N = 56) scored positive on the MNA-SF question regarding low food intake. $GLIM_{MNA}$ diagnosed 17.0% of residents as malnourished. Sensitivity of $GLIM_{MNA}$ for GLIM was 62.2%, and specificity 95.0% (kappa = 0.61).
Conclusion: Twenty-one percent of nursing home residents were diagnosed malnourished based on a limited set of GLIM criteria. The MNA question on insufficient food intake missed ~60% of residents with a truly low food intake. Herewith, malnutrition prevalence rates with $GLIM_{MNA}$ decreased to 17%. We advise measuring food intake for studies, and to be aware of too low prevalence rates of GLIM when an estimate of reduced food intake is applied.

1. Introduction

Since the introduction of the Global Leadership Initiative on Malnutrition (GLIM) criteria for malnutrition [1], more than 150 papers have been published on malnutrition prevalence rates, and concurrent and predictive validity of GLIM, mostly in hospitalized patients. So far, only 2 papers have been published in the nursing home setting [2,3], which may be a consequence of difficulties collecting the required parameters in this setting. GLIM requires that at least one out of three phenotypic criteria (significant weight loss, low body mass index (BMI), or low muscle mass) and one out of two etiologic criteria (reduced food intake or its assimilation, or inflammation) are measured and met to enable categorizing malnutrition. However, body composition measurements, registration of food intake, and parameters of inflammation are usually not routinely measured in nursing home residents. Body composition measurements are especially done in study settings. Measuring dietary intake is notoriously laborious and it is unclear whether subjective estimates of dietary intake are accurate. Finally, most nursing home residents suffer cognitive impairment and not acute disease or injury with severe inflammation, and laboratory parameters of inflammation are scarcely determined.

Of the two published papers in the nursing home setting, one does not describe which etiologic GLIM criteria were used to diagnose malnutrition and how this data was obtained [3]. In the other study reduced food intake was estimated by the patient/his caregiver and the presence of acute disease inflammation was retrieved from patients' records, without further specifications [2]. In both studies, all phenotypic criteria were collected as part of (body composition) research.

In this paper, we describe prevalence rates of GLIM in nursing home residents, based on the following criteria: body weight loss, BMI, and measured food intake. More specifically, we also examine whether the question from the Mini Nutritional Assessment short-form (MNA-SF) [4] "Has food intake declined over the past three

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months due to loss of appetite, digestive problems, chewing or swallowing difficulties?" is appropriate to answer the GLIM question on reduced food intake, as this is relevant information for applying GLIM in daily practice.

2. Methods

Data was collected in institutionalized older adults residing in five different nursing homes in the Netherlands as part of a larger study. Residents were included when they gave informed consent, either by themselves or by their proxy, and were aged ≥65 years. Residents were excluded when they were bedbound (and consumed food in their own rooms which hindered discrete observing), received end-of-life care or used parenteral nutrition. More than 70% of participants were admitted to a psychogeriatric ward. Sociodemographic characteristics of the participants were collected for other purposes and will be reported elsewhere. First, we determined malnutrition risk with two different validated screening tools for the nursing home setting, the Short Nutritional Assessment Questionnaire for Residential Care ($SNAQ^{RC}$) [5] and the MNA-SF [4]. Then the diagnosis of malnutrition was made with the GLIM criteria [1]. For GLIM, we used the following criteria: BMI (<20/22 kg/m^2 for residents 65–70 and 70 y or older respectively), history of weight loss (>6 kg in 6 months, or >3 kg in the past month), and actual dietary intake. We also applied GLIM independent of the two screening tools. Dietary intake was obtained by direct observation, considered a gold standard because it is practical and independent of a resident's memory [6]. Nutrition and dietetics students observed the residents on three randomly selected days, preferably including one weekend day to account for possible changes in eating habits during the weekend. For calculation of nutritional intake, a nutritional calculation program (Compl-eat) linked to the Dutch Food Composition Table 2021/7.0 [7] was used. Energy and protein intake were considered insufficient if a resident's mean intake over three days was less than 90% of requirements (according to the WHO equation for energy [8] (with correction factor of 1.3), and a protein intake <1.0 g/kg/day [9,10] respectively.

As described above, body composition measurements were not available aswe were not allowed to perform anthropometrics due to Covid-19 restrictions. Parameters of inflammation were not available from the patient charts, and the general description of reasons for stay (mostly: cognitive impairment) did not allow for specifying diseases associated with high inflammation.

Descriptive statistics were used to describe prevalence rates of malnutrition risk according to $SNAQ^{RC}$, MNA-SF and GLIM. The answer to the MNA-SF question "Has food intake declined over the past three months due to loss of appetite, digestive problems, chewing or swallowing difficulties?" (answered by nurses or assistents) was used to define sensitivity and specificity of $GLIM_{MNA}$ (GLIM with the MNA question on reduced food intake) to GLIM with actual food intake data, and the strength of agreement between $GLIM_{MNA}$ and GLIM was determined with a Cohen's kappa.

The ethics committee of the HAN University of Applied Sciences evaluated the study (ECO 182.03/20) and it was judged not to fall within the remit of the Medical Research Involving Human Subjects Act (WMO).

3. Results

3.1. General characteristics

In total 176 residents with a mean age of 85.0 (SD:7.3), of which 72.7% female, participated in the study. Mean BMI of the study population was 26.0 kg/m^2 (SD:5.0). The majority of the participants (72.2%; N = 127) resided in a psychogeriatric department with cognitive impairment being the main reason for stay (Table 1).

Table 1
Characteristics of the study participants (N = 176).

Characteristics	Mean (SD) or N (%)
Age (years)	85.0 (7.3)
Gender: male/female	N = 48/128 (27.3/72.7%)
BMI (kg/m^2)	26.0 (5.0)
<20 (aged 65–70) or <22 (aged 70+)	N = 33 (18.8%)
20–27.5 (aged 65–70) or 22–27.5 (aged 70+)	N = 85 (48.3%)
>27.5	N = 59 (30.7%)
Recent weight loss	
>3 kg *in the past month*	*N = 14 (8.0%)*
>6 kg *over the last six months*	*N = 14 (8.0%)*
Department: psychogeriatric/somatic/rehabilitation	N = 127/31/18 (72.2/17.6/10.2%)
Estimated energy requirements (kcal/day) according to WHO-equation	1894 (249)
Actual energy intake (kcal/day)	1481 (345)
Actual protein intake (g protein/kg/day)	0.81 (0.26)
Risk of malnutrition	
According to $SNAQ^{RC}$	*N = 95 (54.0%)*
According to MNA-SF	*N = 147 (83.5%)*
Diagnosis of malnutrition according to GLIM	
After screening with $SNAQ^{RC}$	*N = 37 (21.0%)*
After screening with MNA-SF	*N = 36 (20.5%)*
Without prior malnutrition risk screening	*N = 37 (21.0%)*

Legend: WHO = World Health Organisation, $SNAQ^{RC}$ = Short Nutritional Assessment Questionnaire for Residential Care, MNA-SF = Mini Nutritional Assessment short form, GLIM = Global Leadership Initiative on Malnutrition.

3.2. Dietary intake

Mean 3-days energy intake of the study population was 1481 kcal/day (SD:345), while mean estimated energy requirements were 1894 kcal/day (SD:249). Mean protein intake was 0.81 g/kg body weight/day (SD:0.26). One hundred and thirty residents (74%) had an energy intake, and 121 (68.8%) had a protein intake of less than 90% of the requirements. One hundred and eight participants (61.4%) fell below 90% of requirements for both energy and protein.

3.3. Malnutrition risk

According to the $SNAQ^{RC}$ malnutrition screening tool, 54.0% (N = 95) of residents were at (moderate) risk of malnutrition. Consecutively, 21.0% (N = 37) were diagnosed malnourished according to GLIM. For MNA-SF, 83.5% (N = 147) were found to be at (moderate) risk of malnutrition. GLIM malnutrition diagnosis after a positive MNA-SF score was 20.5% (N = 36). When applying GLIM independent of $SNAQ^{RC}$ or MNA-SF results the proportion of residents that met any combination of at least one phenotypic and one etiologic criterion was 21.0% (N = 37); weight loss + food intake below requirements occurred in 13.1% (N = 23), and low BMI + food intake below requirements in 12.5% (N = 22).

Prevalence of a reduced food intake according to objective measurements and the MNA-SF question on low food intake was 81.3% (N = 143) and 31.8% (N = 56) respectively, meaning that ~60% of residents with a truly low food intake were not identified by the MNA-SF question. This resulted in 17.0% (N = 30) of residents diagnosed malnourished according to $GLIM_{MNA}$. Sensitivity of the $GLIM_{MNA}$ for GLIM was 62.2% [95%CI: 44.8–77.5%], and specificity 95.0% [95%CI: 89.9–98.0%] (Table 2). The strength of agreement between $GLIM_{MNA}$ and GLIM was moderate (kappa 0.61 [95%CI: 0.47–0.76]).

Table 2
Agreement between GLIM and $GLIM_{MNA}$.

	GLIM positive	GLIM negative	
$GLIM_{MNA}$ positive	23	7	Positive predictive value: 76.7%
$GLIM_{MNA}$ negative	14	132	Negative predictive value: 90.4%
	Sensitivity: 62.2%	Specificity: 95.0%	Kappa: 0.61

4. Discussion

Applying the GLIM criteria in the nursing home setting faces practical difficulties, as data on body composition, dietary intake, and inflammation are mostly unavailable. In this study, we have shown that dietary intake is an important determinant of malnutrition, with >80% of nursing home residents having a too low energy and/or protein intake. Combined with either involuntary weight loss or a low BMI this resulted in a GLIM diagnosis of malnutrition of 21%, independent of the results of previous malnutrition risk screening with either $SNAQ^{RC}$ or MNA-SF.

The first step in GLIM is malnutrition risk screening with a validated screening tool. The $SNAQ^{RC}$ screening tool identified 95 residents at malnutrition risk, and 37 of these (39.0%) were diagnosed GLIM-positive. For MNA-SF, these numbers were 147 at malnutrition risk and 36 (24.5%) of these GLIM-positive. Remarkably, GLIM diagnosis for both tools was 21.0 and 20.5% respectively, indicating that the chosen tool did not materially influence GLIM results: all $SNAQ^{RC}$ and MNA-SF positive patients were also identified GLIM-positive. Moreover, GLIM diagnosis without prior malnutrition risk screening generated the same results. For practicality, we advise using the $SNAQ^{RC}$ screening tool as a first step in the GLIM process in nursing homes, as 76% of the residents identified at malnutrition risk by the MNA-SF were false positive ones, herewith increasing the workload by necessitating further diagnostic steps. Based on the data of this study, GLIM diagnosis can even be justified without risk screening as a first step in a high-risk group like nursing home residents, as GLIM with and without prior risk screening resulted in identical proportions of residents diagnosed malnourished.

A recent study by Sanz-Paris reported a GLIM malnutrition prevalence of 13.5% in nursing home residents, with a model based on questioning dietary intake [2]. In our study, we showed large differences between measuring dietary intake (insufficient intake N = 143) or questioning dietary intake (insufficient intake N = 56). Herewith, the MNA-SF question on a diminished food intake missed ~60% of the residents with a too low intake. We, therefore, understand the low(er) prevalence rates of malnutrition in the other study.

Another recently published study showed a malnutrition diagnosis in 17% of nursing home residents [3], which is more or less in accordance with our data. It is unclear, however, how the GLIM etiologic criteria were collected in this study.

The phenotypic criteria are equivalently important in defining malnutrition in GLIM. Contrary to expectations in the present era of obesity, 18.8% of the residents in our study scored a BMI below the age-dependent cut-offs. This is thought to reflect slowly progressing malnutrition over a longer period of time, which is characteristic of patients with progressive cognitive decline. Therefore, especially in this population, BMI remains to be an important determinant of malnutrition. Involuntary weight loss occurred in 16.0%, which is in line with earlier studies among nursing home residents [11]. Together with the etiologic criteria, the other 2 studies and ours indicate malnutrition, based on GLIM, in ~15–20% of nursing home residents. Low BMI, involuntary weight loss, and low dietary intake seem to contribute more or less equally to the diagnosis. Although the other studies used body composition measures, and we used actual recordings of dietary intake, the prevalence rates across the studies are quite similar and may give a good indication of malnutrition in nursing homes according to GLIM.

A limitation of this study is that only three out of five GLIM criteria were collected. Although this is described to be acceptable in retrospective studies [12], this still is a borderline approach. The two previous studies have also used a limited set of criteria in the nursing home population [2,3], coming up with approximately the same prevalence rates. For future clinical studies, we advise to include at least anthropometric measures for muscle mass, if more advanced techniques are not unavailable [13]. However, we were unable to do so due to Covid-19 restrictions during our study period. With cognitive impairment being the main reason for stay, most participants did not fulfill the criterion of inflammation.

Our study painfully exposes that estimating dietary intake is not appropriate to obtain an idea of a resident's dietary intake. Compared to observations, considered a gold standard, the MNA-SF question on dietary intake missed ~60% of residents with a too low intake. We acknowledge that detailed recordings of dietary intake are not feasible for all nursing home residents. Yet, with a positive predictive value of 76.7%, it might be worth considering starting a food diary for residents who scored positively on the MNA-SF dietary intake question. In study settings, dietary records should be kept for all study participants.

In conclusion: practical reasons will often hinder collecting all GLIM criteria in the nursing home setting. This study and two previous ones are methodologically acceptable examples of a limited approach of GLIM in the nursing home setting, but the limitations should be recognized. The three studies showed that malnutrition prevalence rates in the nursing home setting are between 15 and 20%, based on different combinations of GLIM criteria. Small differences are likely explained by the use of different GLIM parameters across studies. This study particularly highlights the importance of recording dietary intake for study purposes, as questioning intake was shown to be inaccurate.

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Author contributions

Conceptualization: MdvdS, AN, MM. Data collection: GS, AN. Analyses: JB, GS, AN. Report: MdvdS, JB, GS, AN, MM.

Conflicts of interest

The authors declare no conflict of interest.

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