

Elderly's Malnutrition, Processes/health Outcomes in Primary Health Care: A Scoping Review

Adriana Sofia Taveira (✉ adricasofia@gmail.com)

University of Minho

Bárbara Sousa

University of Minho

Patrício Costa

University of Minho

Ana Paula Macedo

University of Minho

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Abstract

Objectives - The aim of this study, as the first review directed at Primary Health Care, is identifying screening/intervention tools/health outcomes that validate malnutrition in the elderly.

Methods - Following PRISMA, searches were conducted in 4 electronic databases on observational, qualitative, quantitative, or mixed studies, written in Portuguese, Spanish or English language, with participants aged 65 years or older.

Results - 483 studies were identified, 16 were considered eligible. The Mini Nutritional Assessment showed the highest criteria of choice, however, health systems do not demonstrate standardized practices in the screening's use. Studies are more oriented towards the relationship's analysis of mortality/morbidity and malnutrition than its effects on the person's quality of life.

Discussion - Malnutrition is one of the modifiable factors and contributes to the frail elderly condition, with serious effects, especially when related to other comorbidities. Yet, several authors argue that Primary Health Care intervention can improve health outcomes.

Introduction

The 21st century is witnessing one of the most relevant social changes to which Portugal is no stranger. According to National Statistical Institute (2017), the Portuguese demographic pyramid reflects a marked population aging (5th highest value and 3rd lowest value of the renewal index at European level). An aging population has a marked propensity for developing multimorbidity states, which project functional disabilities with effects on resource consumption (WHO, 2015). Santana (2000), although the health of the Portuguese population has improved in recent decades, this increase has not been accompanied by policies that reflect the need for elderly health, recognizing that the phenomenon may mirror an increase in the demand for care.

Rodrigues et al. (2018) in their study, confirmed a high prevalence of multimorbidity (78.3%), increasing across age strata (72.8% for 65 - 69 years to 83.4% for ≥ 80 years). The hospitalization was reported by 25.8% of the individuals, concluding that the high prevalence of multimorbidity, associated with unhealthy lifestyles, of which diet stands out, is a predictor of vulnerability in the elderly, requiring dedicated intervention. This fact represents an enormous challenge at the level of the health sector, specifically for Primary Health Care (PHC) (a privileged and first-line access route for the person to the National Health Systems), expecting (given their mission) the implementation and improvement of effective and rapid community intervention strategies that mobilize responses capable of satisfying the specific needs of this population (DGS, 2004).

In Portugal, assumed the dynamics of aging, the Ministry of Health (2004) approved the National Programme for the Health of the Elderly, recommending special attention to the elderly, for the intervention of health professionals in the elderly with malnutrition.

Nutrition is an essential component of health in the elderly population, capable of determining the quality of aging. In this sense, the adequate nutritional status results from the reflection of the balance between food intake and the nutritional needs of the elderly body (Agarwal et al., 2013; Cederholm et al., 2017). The concept of malnutrition refers to a state resulting from a lack of nutrient absorption or intake that leads to changes in body composition (decreased fat-free mass) and body cell mass, with a consequent decrease in physical and mental function, associated with a more reserved clinical prognosis (Rasmussen et al., 2010).

According to the National Programme for the Promotion of Healthy Eating (2020), the population's inadequate eating habits are the fourth modifiable risk factor that most contributed to the loss of healthy life years (11.4% of the total number of deaths), especially malnutrition, particularly in the elderly.

It should be noted that malnutrition in the elderly is a current phenomenon often underdiagnosed and has not received the deserved attention. It is easily assumed as a natural and expected sign of aging, and therefore its early recognition becomes essential for appropriate and timely correction (Visvanathan, 2003). The common and cross-cutting thematic interest promoted by the different authors referenced for systematic reviews, oriented towards malnutrition in the hospitalized/institutionalized elderly is assumed (Bunn et al., 2018; Gorji et al., 2017; Omidvari AH, Vali Y, Murray SM, Wonderling D, 2014; Roediger et al., 2019; Sharma et al., 2020; Silva et al., 2015). In this sense, it is important to recognize the importance of re-conducting a new research study capable of validating the terms of analysis for the context of the potential PHC intervention. The study will be based on a methodology that structures a scoping review and simultaneously substantiates the following objectives:

1. To identify the screening/intervention instruments that validate the phenomenon of malnutrition in the elderly;
2. To identify the health outcomes (morbidity, mortality, functional capacity, and quality of life) associated with under-diagnosis and under-intervention of Family Health Teams (Doctors and Nurses) regarding the phenomenon of malnutrition in the elderly;

Methods

Eligibility criteria

The selected studies complied with the following PICOS strategy. Only studies are written in English, Spanish and Portuguese languages were included. The inclusion criteria were: (Population) adults aged 65 years and over; (Intervention) use of screening/intervention tools in the face of the malnutrition phenomenon; under-diagnosis and the under-intervention of the Family Health Teams in the face of the malnutrition phenomenon; (Outcomes) identification of the phenomenon of malnutrition in the use of screening/intervention instruments; identification of health outcomes (morbidity, mortality, functional capacity and quality of life) associated with under-diagnosis and under-intervention of the Family Health

Teams in the face of the phenomenon of malnutrition; (Study design) observational, qualitative, quantitative or mixed indexed studies; published between 2011-2021.

Information sources and search strategy

In July of 2021, the literature search was carried out by two reviewers (AT, BS) in PubMed, Web of Science, Scopus & EMBASE. The literature was selected from the year 2011 onwards. We chose to define this temporal period from which to develop our research, grounded in the recent years of publication of systematic reviews concerning the topic of malnutrition in the elderly (Gorji et al., 2017; Omidvari AH, Vali Y, Murray SM, Wonderling D, 2014; Roediger et al., 2019; Sharma et al., 2020; Silva et al., 2015; Young et al., 2011). Snowball citations were retrospectively and prospectively screened to ensure literature saturation. The search strategy was adapted to the specificities of each database and was the same for all. An example strategy for Web of Science is as follows: (malnutrition) OR (undernutrition) AND TOPIC: (elderly) OR (elderly) OR (geriatric population) AND TOPIC: (screening tools) OR (treatments) OR (assessment) AND TOPIC: (primary health care) OR (family doctor) OR (family nurse) AND TOPIC: (morbidity) OR (mortality) OR (functional capacity) OR (global functions) OR (quality of life) NOT (child*) OR (adolesce*) OR (adolescent*).

Study selection

Studies founded by database analysis were exported to the Rayyan Management Software. Reviewers (AT, AM) selected the eligible studies for this review. An inclusion/exclusion algorithm was created to facilitate the data screening phases (three in total). In the first data screening phase, duplicates identified by the software were reviewed and removed by (AT, BS). In the second phase, two reviewers (AT, AM) independently identified assessed the titles and abstracts of the studies for inclusion. Each reviewer decided on the inclusion or exclusion of each paper based on the inclusion/exclusion criteria stated above. During the third phase, two reviewers (AT, AM) independently conducted a full review of the papers approved during the second phase data review for inclusion. Possible disagreements were resolved by consensus. The reason for exclusion was identified for all excluded studies and a PRISMA chart was plotted to summarise the study and selection process (Fig.1).

Data extraction

The selected data migrated to Excel document format. Values were placed on data from studies that identify (1) the screening/intervention tools most used by health professionals that validate the phenomenon of malnutrition in the elderly; (2) and/or data from studies that identify health outcomes associated with under-diagnosis and under-intervention by Family Health Teams.

In addition, when possible, data were extracted on: 1) study characteristics (study design, country of origin, year of publication, and sample size); 2) participant characteristics (socioeconomic and educational variables, clinical conditions, living arrangement, mean age, gender, and race); 3) screening instrument used in the diagnosis of malnutrition; 4) elderly's health outcomes (morbidity, mortality,

functional capacity and quality of life); 5) main conclusions. The descriptions of the studies are presented in Tables 1 and 2.

Data synthesis

The included articles were submitted to a qualitative synthesis. The main results were organized into different categories in a discrete and non-overlapping manner. In each category, the results were summarised, highlighting their meaning.

Results

Initially, 483 studies were identified through an electronic database search. After duplicates were removed (n = 54), the titles and abstracts were screened. Completed the entire screening process, 391 studies were excluded. The main reasons for the exclusion of studies were: i) did not consider the research scope (n=335); ii) study contexts were exclusively hospital/nursing homes /inpatient (n=32); iii) followed systematic review and meta-analysis methodology (n = 21); iv) include articles published in languages excluded (n=1); v) opinion's articles (n=1); vi) book chapters (n=1). Of the 38 full-text articles assessed for eligibility, 13 met the inclusion criteria. References of these studies were manually analyzed, resulting in 3 additional studies. In total, 16 studies were identified for this scoping review (Fig.1).

Characteristics of included studies

Country of origin, year of publication, and sample sizes. The last 10 years (between 2011 and 2021) evoke research interest in the topic across a broad geographical context, most notably (18.75%) in Belgium (Geurden et al., 2015; Hegendörfer et al., 2020; Vandewoude et al., 2019) and (12.5%) in the USA (Ahmed et al., 2018; Yang et al., 2011), followed by (0.06%), respectively in Saudi Arabia (Alhamadan et al., 2019), Spain (Galiot et al., 2015), Slovenia (Klemenc-Ketis et al., 2020), India (Krishnamoorthy et al., 2017), Italy (Mastronuzzi et al., 2015), Denmark (Pedersen et al., 2016), Australia (Preston et al., 2018), Mexico (Rodriguez-Tadeo et al., 2012), Netherlands (Schilp et al., 2014), Sweden (Shakersain et al., 2016) and Lithuania (Spirgienė et al., 2018). Sample sizes of the included studies ranged from a minimum of n=57 (Galiot et al., 2015) to, maximum of n=15.121.31 (Ahmed et al., 2018).

Sample characteristics. The sample characteristics of the included studies reveal that the age of the participants ranged between 60 (Klemenc-Ketis et al., 2020; Krishnamoorthy et al., 2017; Shakersain et al., 2016) and 99 years (Klemenc-Ketis et al., 2020). Most of the malnourished elderly were female (Ahmed et al., 2018; Alhamadan et al., 2019; Galiot et al., 2015; Geurden et al., 2015; Hegendörfer et al., 2020; Klemenc-Ketis et al., 2020; Krishnamoorthy et al., 2017; Pedersen et al., 2016; Preston et al., 2018; Rodriguez-Tadeo et al., 2012; Schilp et al., 2014; Shakersain et al., 2016; Spirgienė et al., 2018; Vandewoude et al., 2019; Yang et al., 2011), lived with another person (Alhamadan et al., 2019; Preston et al., 2018; Rodriguez-Tadeo et al., 2012; Spirgienė et al., 2018), and had associated comorbidities (Ahmed et al., 2018; Klemenc-Ketis et al., 2020; Krishnamoorthy et al., 2017; Pedersen et al., 2016; Preston et al., 2018; Rodriguez-Tadeo et al., 2012; Shakersain et al., 2016; Vandewoude et al., 2019; Yang et al., 2011). It

should be noted that given the other terms that we previously established in the analysis of the sample characteristics, only two studies considered the assessment of the socioeconomic level of the participants (Krishnamoorthy et al., 2017; Alhamadan et al., 2019) five studies reveal the educational level (Yang et al., 2011; Rodriguez-Tadeo et al., 2012; Shakersain et al., 2016; Krishnamoorthy et al., 2017; Alhamadan et al., 2019) and two consider the race (Ahmed et al., 2018; Yang et al., 2011).

Design. The research design was mostly (75%) observational, cross-sectional descriptive studies (Ahmed et al., 2018; Alhamadan et al., 2019; Galiot et al., 2015; Hegendörfer et al., 2020; Klemenc-Ketis et al., 2020; Krishnamoorthy et al., 2017; Mastronuzzi et al., 2015; Rodriguez-Tadeo et al., 2012; Shakersain et al., 2016; Spirgienè et al., 2018; Vandewoude et al., 2019; Yang et al., 2011), followed by (18.7%) quantitative studies (Geurden et al., 2015; Pedersen et al., 2016; Schilp et al., 2014), and 0.06% mixed (Preston et al., 2018). The dissemination of the articles was essentially (56.2%) from the health area (Ahmed et al., 2018; Geurden et al., 2015; Hegendörfer et al., 2020; Krishnamoorthy et al., 2017; Preston et al., 2018; Schilp et al., 2014; Spirgienè et al., 2018; Vandewoude et al., 2019; Yang et al., 2011), with 43.8% from the nutrition scope (Alhamadan et al., 2019; Galiot et al., 2015; Klemenc-Ketis et al., 2020; Mastronuzzi et al., 2015; Pedersen et al., 2016; Rodriguez-Tadeo et al., 2012; Shakersain et al., 2016).

Procedures. Fifteen samples of malnourished elderly were obtained based on validated screening instruments (Alhamadan et al., 2019; Galiot et al., 2015; Geurden et al., 2015; Hegendörfer et al., 2020; Klemenc-Ketis et al., 2020; Krishnamoorthy et al., 2017; Mastronuzzi et al., 2015; Pedersen et al., 2016; Preston et al., 2018; Rodriguez-Tadeo et al., 2012; Schilp et al., 2014; Shakersain et al., 2016; Spirgienè et al., 2018; Vandewoude et al., 2019; Yang et al., 2011) and only one study (Ahmed et al., 2018) based on the clinical diagnosis made by the physician, reported in the elderly patient's clinical file.

Measures. Twelve studies used the Mini Nutritional Assessment (MNA) for the diagnosis of malnutrition in the elderly (Alhamadan et al., 2019; Galiot et al., 2015; Hegendörfer et al., 2020; Krishnamoorthy et al., 2017; Mastronuzzi et al., 2015; Pedersen et al., 2016; Preston et al., 2018; Rodriguez-Tadeo et al., 2012; Shakersain et al., 2016; Spirgienè et al., 2018; Vandewoude et al., 2019; Yang et al., 2011). Of highlighting those nine studies used it exclusively for the sample selection (Galiot et al., 2015; Krishnamoorthy et al., 2017; Mastronuzzi et al., 2015; Pedersen et al., 2016; Rodriguez-Tadeo et al., 2012; Shakersain et al., 2016; Spirgienè et al., 2018; Vandewoude et al., 2019; Yang et al., 2011). Hegendörfer et al., (2020) used it combined with pre-albumin levels, and Preston et al. (2018) used it in association with three other screening instruments (namely, Australian Nutritional Screening Initiative – ANSI; Malnutrition Universal Screening Tool – MUST and Malnutrition Screening Tool - MST). Schilp et al. (2014) appealed to Short Nutritional Assessment Questionnaire 65+ (SNAQ 65+). Galiot, Torrado and Cambrodón, (2015) and Klemenc-Ketis et al. (2020) just used MUST. Ahmed et al. (2018) does not consider the screening instrument. The study selected malnourished participants based on the clinical diagnosis in the medical record (ICD-9 and 10).

Elderly's health outcomes. Concerning health outcomes in the elderly at risk of malnutrition, analysis of the articles reveals a greater interest (37.5%) in studying the phenomenon associated with morbidity (Galiot et al., 2015; Klemenc-Ketis et al., 2020; Mastronuzzi et al., 2015; Preston et al., 2018; Rodriguez-Tadeo et al., 2012; Spirigienė et al., 2018), followed by mortality (31.25%) (Ahmed et al., 2018; Hegendörfer et al., 2020; Mastronuzzi et al., 2015; Shakersain et al., 2016; Yang et al., 2011), (25%) activities day living (ADL) (Alhamadan et al., 2019; Pedersen et al., 2016; Rodriguez-Tadeo et al., 2012; Vandewoude et al., 2019), hospitalization (25%) (Hegendörfer et al., 2020; Mastronuzzi et al., 2015; Pedersen et al., 2016; Yang et al., 2011), social risk (18.75%) (Galiot et al., 2015; Preston et al., 2018; Rodriguez-Tadeo et al., 2012), and lastly health costs and functional capacity (12.5%). In terms of the results, the study of Krishnamoorthy et al. (2017) only carried out the characterization of the sample (highlighting the prevalence of malnutrition in the elderly, without its correlation with the variables under analysis). However, we opted for its inclusion considering the relationship between the diagnosis phase and the value of PHC intervention. Only Schilp et al. (2014) have established the relationship between malnutrition and the quality of life.

Table 1 Description of main sample characteristics, study design, and procedures.

Authors (Year)	Sample size (n)	Sample characteristics (mean age, socio-economic and educational variables, clinical conditions, gender, living arrangement, and race)	Design	Procedures (recruitment)
Ahmed et al. (2018)	n=15.121.131 (801.272) malnourished	<p>Malnourished elderly</p> <p>M = 75.4 years</p> <p>Social level= NR</p> <p>Educational level=NR</p> <p>Clinical conditions = 100% diabetes</p> <p>Gender= 57.63% women</p> <p>Living arrangement= NR</p> <p>Race = 74.93% whites</p> <p>Normo-nourished elderly</p> <p>M = 71.3 years</p> <p>Social level= NR</p> <p>Educational level=NR</p> <p>Clinical conditions = 100% diabetes</p> <p>Gender= 52.79% women</p> <p>Living arrangement= NR</p> <p>Race = 79.24% whites</p>	Observational retrospective study	Clinical diagnosis in the medical record (ICD-9 and 10)
Alhamadan et al. (2019)	n= 2045 (427.4) risk/malnourished	<p>Risk/malnourished Elderly</p> <p>M = 66.1 years</p> <p>Social level= 83.7% Not Employed</p>	Cross-sectional descriptive study	MNA & BMI

		<p>Educational level= 27% Intermediate & Secondary</p> <p>Clinical conditions = 63.2% without comorbidities</p> <p>Gender= 55 % women</p> <p>Living arrangement= 79.4% married</p> <p>Race =NR</p>		
Galiot et al. (2015)	n= 57 (14.89) risk/malnourished	<p>Risk/malnourished Elderly</p> <p>Age = range from 75 to 80 years (59.65%)</p> <p>Social level= NR</p> <p>Educational level= NR</p> <p>Clinical conditions = 63.2% without comorbidities</p> <p>Gender= 55 % women</p> <p>Living arrangement= NR</p> <p>Race =NR</p>	Cross-sectional descriptive study	MNA
Geurden et al. (2015)	n= 100 (29) risk/malnourished	<p>Risk/malnourished Elderly</p> <p>M = 76.1 years</p> <p>Social level= NR</p> <p>Educational level= NR</p> <p>Clinical conditions = NR</p> <p>Gender= 86.2 % women</p> <p>Living arrangement= NR</p> <p>Race =NR</p>	Randomized cross sectional study design	MUST
Hegendörfer et al. (2020)	n=567 (69) were at risk of malnutrition based	<p>Malnourished elderly based on MNA</p> <p>M = 85.6 years</p>	Observational prospective cohort study	MNA & prealbumin levels

on MNA and (72)
based on pre-
albumin

Social level= NR
Educational level=NR
Clinical conditions = NR
Gender= 72.1% women
Living arrangement=NR
Race = NR

**Malnourished elderly
based on pre-albumin
levels**

M = 95.9 years
Social level= NR
Educational level=NR
Clinical conditions = NR
Gender= 76.9% women
Living arrangement=NR
Race = NR

Klemenc-Ketis
et al. (2020)

n= 1641
(216) risk
malnourished

**Risk malnourished
Elderly**

Age = 60.4 % (range
from 20 to 99 years)

Social level= NR
Educational level=NR
Clinical conditions
=43.6%
Gender= 68.1% women
Living arrangement=NR
Race =NR

Cross-
sectional
observational
study

MUST

Krishnamoorthy
et al. (2017)

n=279
(50)
risk/malnourished

**Risk/malnourished
Elderly**

Age = range from 60 to
70 years (62%)

Social level= 96%
unemployed

Cross-
sectional
descriptive
study

MNA

Educational level= 88%
no formal education

Clinical conditions = NR

Gender= 76 % women

Living
arrangement= NR

Race =NR

Mastronuzzi et
al. (2015)

n=274
(99)
risk/malnourished

**Risk/malnourished
Elderly**

M = 85 years

Social level= NR

Educational level= NR

Clinical conditions
= 23.3% dementia

Gender= 63.63%
women

Living
arrangement= NR

Race =NR

Cross-
sectional
descriptive
study

MNA

Pedersen et al.
(2016)

n=208 malnourished

Intervention Group

M = 86 years

Social level= NR

Educational level=NR

Clinical conditions
=35% comorbidities

Gender= 59% women

Living
arrangement=64.5% eat
alone

Race = NR

Control Group

M = 86.3 years

Social level= NR

Educational level=NR

Randomized
study

MNA

		<p>Clinical conditions =32% comorbidities</p> <p>Gender= 55% women</p> <p>Living arrangement=63% eat alone</p> <p>Race = NR</p>		
Preston et al. (2018)	<p>n=59</p> <p>(37/59) malnourished based on ANSI</p> <p>(10/59) malnourished based on MNA</p> <p>(9/59) malnourished based on MUST</p> <p>(12/59) malnourished based on MST</p>	<p>Malnourished elderly</p> <p>Age= >=80 years (60%)</p> <p>Social level= NR</p> <p>Educational level=NR</p> <p>Clinical conditions =60% fracture risk</p> <p>Gender= 60% women</p> <p>Living arrangement=70% living with another</p> <p>Race = NR</p>	Mixed Study	MNA, ANSI, MUST & MST
Rodriguez- Tadeo et al. (2012)	<p>n=760</p> <p>(384) risk/malnourished</p>	<p>Elderly</p> <p>Age = range from 70 to 79 years (44.6%)</p> <p>Social level= NR</p> <p>Educational level= 41.8% Primary or lower</p> <p>Clinical conditions = 52.7 % depression</p> <p>Gender= 63.63% women</p> <p>Living arrangement= 47.1% married</p> <p>Race =NR</p>	Observational, descriptive, and cross- sectional study	MNA
Schilp et al. (2014)	n=146 malnourished	<p>Intervention Group</p> <p>M = 80.6 years</p> <p>Social level= NR</p> <p>Educational level=NR</p>	Randomized study	SNAQ 65+

Clinical conditions =NR

Gender= 62.5% women

Living arrangement=43% living alone

Race = NR

Control Group

M = 80.5 years

Social level= NR

Educational level=NR

Clinical conditions =NR

Gender= 66.2% women

Living arrangement=53% living alone

Race = NR

Shakersain et al. (2016)

n=3041
(802)
risk/malnourished

Risk/Malnourished Elderly

Age = 60-69 years

Social level= NR

Educational level=42.6% High School

Clinical conditions =80.1% vascular disease

Gender= 70.9% women

Living arrangement=65.2% living alone

Race = NR

Observational prospective cohort study

MNA

Spirgienė et al. (2018)

n= 169
(82) malnourished

Malnourished Elderly

Age = range from 65 to 75 years (55%)

Social level= NR

Educational level=NR

Cross-sectional descriptive study

MNA

					<p>Clinical conditions =NR</p> <p>Gender= 63.9 % women</p> <p>Living arrangement= 45% living with another person</p> <p>Race =NR</p>
Vandewoude et al. (2019)	n= 3299 (1389) risk/malnourished	Risk/Malnourished Elderly M = 82.7 years Social level= NR Educational level=NR Clinical conditions =20% depression Gender= 69,5% women Living arrangement=NR Race = NR	Observational Cross-sectional study	MNA	
Yang et al. (2011)	n= 198 (124.7) risk/malnourished	Risk/Malnourished Elderly M = 78 years Social level= NR Educational level=48.9% High School Clinical conditions =NR Gender= 84.9% women Living arrangement=22.8% living with another person Race =35.6% African American	Observational prospective cohort study	MNA	

Note. ANSI = Australian Nutritional Screening Initiative; BMI = Body Mass Index; ICD = International Classifications of Diseases; MNA = Mini Nutritional Assessment; MUST = Malnutrition Universal Screening Tool; MST = Malnutrition Screening Tool; NR = Not Reported; SNAQ 65+ = Short Nutritional Assessment Questionnaire 65+

Table 2

Description of elderly's health outcomes (morbidity, mortality, functional capacity, and quality of life), and main conclusions of the eligible studies.

Authors (Year)	Elderly's health outcomes (morbidity, mortality, functional capacity, and quality of life)	Main conclusions
Ahmed et al. (2018)	<p>The risk of death for those with diabetes increased 69% in malnourished versus normal nutrients ($P < 0.0001$). Malnutrition increased the risk of death within reach of the common comorbid conditions, including ischaemic heart disease, chronic obstructive pulmonary disorder, stroke or transient ischemic attack, heart failure, chronic kidney disease, and acute myocardial infarction. In addition, the total annual expenditure for the malnourished beneficiaries were significantly higher than then for the normal-nutrient beneficiaries (\$36 079 vs 20 787) ($P < 0.0001$)</p>	<p>Malnutrition is significant comorbidity affecting the survival and health care costs of the person with diabetes. There is a need to develop and implement evidence-based clinical decision pathways for appropriate screening, assessment, diagnosis, and treatment of malnourished patients, and to prevent malnutrition in normal-nutritious patients with diabetes</p>
Alhamadan et al. (2019)	<p>There was a significant association between nutritional status and ADL. Among those assessed as fully functional, only 15.2% were at risk of malnutrition or malnourishment. Among those rated as moderately functional or severely unfunctional, 55.3% and 73.9% were classified as at risk of malnutrition or malnourished, respectively</p>	<p>Assessing the nutritional status of the elderly identified a high prevalence of undernutrition and obesity. Such assessments should be routine practice in PHC</p>
Galiot et al. (2015)	<p>The risk of malnutrition was positively related to social risk and the number of chronic diseases. 3.6% of participants who had social problems, were at risk of malnutrition and malnutrition (1.8%). People suffering from more than six pathologies, also had a higher nutritional risk</p>	<p>The risk of undernutrition seems to be associated with a more disadvantaged social condition and comorbidities. The development of training programs in nutrition education and the use of simple tools to identify nutritional risk in primary health care could be effective to reduce the prevalence of malnutrition, avoid negative health consequences and improve the quality of care. If a situation of nutritional risk is not detected and treated early, it can</p>

		lead to malnutrition, a serious pathological situation with very negative consequences for the elderly's health, not to mention the social and health costs that this situation entails
Geurden et al., (2015)	Patients at risk of malnutrition were significantly sicker ($P < 0.001$), and reveals more eating problems such as difficulties with chewing or swallowing and loss of appetite ($P < 0.001$)	Belgian nurses providing care at home do not yet fully comply with international nutritional recommendations. Our survey of nurses revealed low awareness, low knowledge capacity, and poor communication between stakeholders. Systematic screening should be further developed and evaluated in this population at risk. Additional training in nutritional nursing care and screening methods for malnutrition is needed
Hegendörfer et al. (2020)	Survival is statistically significantly lower for those with a risk of malnutrition based on either MNA ($P < 0.001$) or pre-albumin ($P = 0.001$). No significantly higher hospitalization is observed for those at risk of malnutrition based on MNA ($P = 0.068$) or pre-albumin ($P = 0.058$)	There is the need for further research on the assessment of nutritional status in community-dwelling, independent very old adults who would benefit from a combination of both anthropometric and/or dietary assessment and biomarkers such as pre-albumin. This is important in light of the growing global population of adults 80 years and older, the impact of malnutrition on their quality of life and risk of adverse outcomes, and the availability of potentially beneficial interventions
Klemenc-Ketis et al. (2020)	There is a significant association of increased risk of malnutrition with age and BMI ($P = 0.022$); several chronic diseases ($P = 0.001$); a misperception of their current health status ($P = 0.001$); feeling lonely ($P < 0.001$); and increased pain intensity ($P = 0.003$)	A screening program in primary health care can help identify people at risk of malnutrition. In addition, appropriate nutritional support is suggested as it can help to reverse or stop the trajectory of malnutrition and the negative outcomes associated with poor nutritional status. It should be noted that by limiting screening for malnutrition only to hospitalized and elderly patients, we are missing a large percentage of the population living at home, especially those who do not attend PHC
Krishnamoorthy et al. (2017)	Not Reported	Nutritional dysfunctions are important health issues to

		<p>be considered among the elderly population. Opportunistic screening may be useful at the PHC level. Strengthening primary health care to address and prevent this health issue through</p> <p>balanced dietary practices can improve their nutritional status, thereby improving their quality of life</p>
Mastronuzzi et al. (2015)	<p>A significantly higher number of major events, including death, were observed in the undernourished group. In (20.4%) of patients were identified as having a high risk of developing major complications in the future. The sensitivity of the MNA test in identifying these patients was 84%. Several major events were registered both in patients at risk of malnutrition and in malnourished ones (bone fractures – 20.5%; hospitalization – 30%; death – 2.8-16%)</p>	<p>The prevalence of malnutrition is high among the elderly in the context of family practice. The MNA allows for better identification of malnourished subjects than the BMI and effectively. The application of a simple, quick, and easy-to-fill screening tool such as the MNA makes it possible to identify better than BMI those older adults who are malnourished or at risk, which is also useful for quantifying the risk of future major events. Malnutrition is often underestimated as nutritional status is not routinely checked and reported in the patient's electronic file. The classification obtained by the MNA makes it possible to stratify patients and obtain information on the risk of complications, at least in older and frail subjects, and indirectly to estimate the burden of care</p>
Pedersen et al. (2016)	<p>Early and integrated nutritional monitoring (Hosp-PHC) of the elderly by health teams in a home setting, prevents and improves the deterioration of activities of daily living and the independence of the individual when associated with malnutrition (in 96% of cases and statically significant $p<0.001$). There is also a reduction in the length of hospital stay</p>	<p>The early identification of the risk of malnutrition can prevent a negative spiral of results for the elderly (functional deterioration, hospital readmissions, death)</p>
Preston et al. (2018)	<p>50% of participants at nutritional risk were at risk of isolation. A large proportion of participants (79.9%) had multiple illnesses with almost 50% more than six prescribed medications. 80% of the nutritional risk group are considered frail.</p> <p>Frailty ($P<0.004$) and prescribed medications ($P<0.042$) reveal a statistically significant relationship with nutritional status</p>	<p>Screening practices with valid and reliable screening tools are imperative to ensure identification and management of older people at risk</p>
Rodriguez-Tadeo et al.	<p>Functional impairment, cognitive impairment, and depression were</p>	<p>PHC plays an important role in early detection, improved quality of life, and better</p>

(2012)	3.0, 1.5, and 2.9 times more likely in the presence of malnutrition or risk of malnutrition. Malnutrition correlates positively with depression, functional impairment to move, and living alone (P <0.001)	prognosis for malnourished individuals
Schilp et al. (2014)	No statistically significant differences were found between introduction of dietary treatment VS usual care in body weight change (mean difference 0.78 kg, 95% CI-0.26e1.82), QALYs (mean difference 0.001, 95% CI -0.04e0.04) and total costs (mean difference V1645, 95% CI -525e3547). The incremental cost-utility ratio (ICUR) for QALYs was not interpretable. The incremental cost-effectiveness ratio (ICER) for body weight gain was 2111. The probability of dietary treatment being cost-effective was 0.78 for a cost-effectiveness ratio of V5000 for body weight and 0.06 for a threshold ratio	Dietary treatment in older, undernourished, community-dwelling individuals was not cost-effective
Shakersain et al. (2016)	The mean age at death of participants with malnutrition and risk of malnutrition was ~ 3 and 1.5 years shorter (CI - 95%, P<0.001) than that of participants with normal nutritional status, respectively, while malnutrition or risk of malnutrition together with abnormal biomarker levels (hemoglobin and albumin) was related to one year shorter survival	Malnutrition and the risk of malnutrition are significantly associated with shorter survival. Poor nutritional status in combination with abnormalities in biomarkers is associated with even shorter survival
Spirgienė et al. (2018)	The risk of/malnutrition was associated with chronic (P < 0.004) and intermittent pain (P < 0.001), chewing difficulties (P < 0.001), swallowing disorders (P < 0.001), dental problems (P < 0.001), and medication use (P < 0.001). The risk of malnutrition and undernutrition was related to depression (P = 0.001) and Alzheimer's disease or other dementia (P < 0.001), but had no statistically significant relationship with cancer (P = 0.120) or diabetes mellitus (P = 0.065)	Educating community elders about healthy nutrition and providing them with specific updated guidelines to follow over the long term contributed to favorable changes. The findings infer that community nurses' efforts to ensure better health outcomes for the elderly, using minimal financial and human resources, appeared to be effective in improving elderly people's nutrition knowledge and practices on nutrition

Vandewoude et al. (2019)	Of all undernourished individuals, 49% were diagnosed by PHC and 13% of the undernourished recognized themselves as such. Mobility (climbing stairs and walking) and ADL dependence (Belgian KATZ score) were impaired in older people with (risk of) malnutrition compared to individuals with normal nutritional status (P< 0.001)	Under-diagnosis of malnutrition is problematic, because the associated loss of mobility and independence may accelerate the transformation of frailty into disability in older people
Yang et al. (2011)	Participants who were malnourished or at risk of malnutrition were more likely to experience sequential under-hospitalization (P = 0.040), emergency room visits (P = 0.047), use of home health aides (P = 0.027), and mortality (P = 0.031)	Malnourished people or at risk of malnutrition, are more likely to use greater amounts of health care resources subsequently and experience mortality. Nutritional interventions aimed at addressing undernutrition in this vulnerable population can improve health outcomes and decrease health service utilization

Note. ADL = Activities Day Living; BMI = Body Mass Index; KATZ = Index Independence Activities Day Living; MNA = Mini Nutritional Assessment; QALYs = Quality Adjusted Life Years

Discussion

The absence of a scoping review on the health processes and outcomes in PHC associated with malnutrition in the elderly is a gap in the literature. In this context, according to Lima (2012), PHC represents a key vector for intervention in promoting healthy eating habits and the prevention of malnutrition. In this respect, a commitment to differentiated intervention assumes a guide by the synergy of efforts of multidisciplinary teams.

To fill this gap, this scoping review was conducted with the following objectives: i) to identify the screening/intervention tools that validate the phenomenon of malnutrition in the elderly; ii) to identify the health outcomes (morbidity, mortality, functional capacity, and quality of life) associated with under-diagnosis and under-intervention of Family Health Teams regarding the phenomenon of malnutrition in the elderly.

The combination of the results founded indicates that health professionals' timely and continuous action, especially PHCs can positively influence the functional outcomes and dietary patterns of older people residing at home (Young et al., 2011).

Reading the articles allows us to state that the effects of malnutrition in the elderly, in terms of associated health outcomes, tend to be severe, especially when related to other comorbidities. Ahmed et al. (2018) concluded that mortality in an elderly person with diabetes and malnutrition increases by 69%, including ischaemic heart disease; chronic obstructive pulmonary disease; stroke, or transient ischaemic stroke; chronic renal failure, and acute myocardial infarction. In addition, the total annual expenditure on

health care for the undernourished individual was significantly higher. However at this point, to Schilp et al. (2014), no statistically significant differences were found between the introduction of dietary treatment VS usual care in total costs.

Shakersain et al. (2016), found that malnutrition and malnutrition risk was significantly associated with all-cause mortality and shortened survival by 3 and 1.5 years respectively. They also found that being elderly, living alone, and institutionalized directly correlated with poor nutritional status. However, the pure effect of malnutrition on mortality may not be perceived. In the present study, the relationship between poor nutritional status and mortality appears to be independent of chronic diseases suggesting that subclinical changes may play a role in the association between poor nutritional status and mortality. But then, Yang et al. (2011), supports the previous analyses by robustly stating by their study that malnutrition in the elderly is assumed to be a risk factor for increased health service utilization and mortality (Hegendörfer et al., 2020; Mastronuzzi et al., 2015; Pedersen et al., 2016). This corroborates Santana's (2000) opinion in recognizing that the phenomenon may reflect an increase in the demand for care.

The risk of malnutrition is identically related to lower physical and cognitive performance, greater functional disability (in terms of autonomy in ADL), and even entails an increased risk of depression and isolation (Alhamadan et al., 2019; Galiot et al., 2015; Geurden et al., 2015; Hegendörfer et al., 2020; Preston et al., 2018; Rodriguez-Tadeo et al., 2012; Spirgienè et al., 2018; Vandewoude et al., 2019). In this connection, Yang et al. (2011), and Mastronuzzi et al. (2015), affirm that malnourished participants were more likely to experience sequential under-hospitalization, emergency room visits, use of home health aides, and mortality. This confirms the idea of Rodrigues et al. (2018), when verifying that the high prevalence of multimorbidity, associated with unhealthy lifestyles, of which diet and its effects stand out, is a predictor of vulnerability, of increased hospitalization in the elderly.

Malnutrition emerges as one of the contributing factors to frailty and loss of quality of life in the elderly. Schilp et al. (2014) assume that the improvement in quality of life occurs after the body weight gain, which confirms the hypothesis of an association between body weight change and quality of life. Their study found that one-fifth of the participants were determined to have nutritional risk, identifying as promoting factors: poverty, poor oral health, medication use ($P=0.042$), and social isolation. Inherent to this perspective, for Preston et al. (2018), frailty itself is statistically significant in increasing their nutritional risk ($P=0.004$), which is why it is possible to argue that the relationship between both is reciprocal and dependent.

Concerning the assessment's process of risk/ malnutrition in the elderly, from the perspective of diagnosis and subsequent health intervention, it was observed that, although different screening instruments are available, the MNA showed a higher criterion of choice and use by researchers, justified by its adequate predictive validity and specificity of analysis concerning the frail elderly population, and is even recommended by the European Society for Enteric and Parental Nutrition (Galiot et al., 2015; Hegendörfer et al., 2020; Krishnamoorthy et al., 2017; Mastronuzzi et al., 2015; Pedersen et al., 2016;

Preston et al., 2018; Shakersain et al., 2016; Spirgienė et al., 2018; Vandewoude et al., 2019; Yang et al., 2011). The results of the distinct studies even highlight the need for early detection and management for nutritional risks regular screening of malnutrition in old age.

It should be noted that, as advocated by Visvanathan (2003), however, across any of the identified tools, health systems do not demonstrate standardized practices in their use and underestimate malnutrition in the elderly (especially in the community setting) (Vandewoude et al., 2019). So for Ahmed et al. (2018), the use of scientifically validated assessment tools is useful in standardizing clinical diagnoses of malnutrition and imperative to ensure identification and early intervention for the elderly at risk (Alhamadan et al., 2019; Galiot et al., 2015; Klemenc-Ketis et al., 2020; Krishnamoorthy et al., 2017; Mastronuzzi et al., 2015; Omidvari AH, Vali Y, Murray SM, Wonderling D, 2014; Preston et al., 2018).

At this level, an important challenge emerges for PHC and their health professionals, they should be encouraged to adopt practices that value the systematic screening and diagnosis of malnutrition, intrinsic to the overall assessment of the older person and always from a perspective of care integration (Hospital - PHC).

This fact seems to be reinforced by the study of Pedersen, Pedersen, and Damsgaard (2016), they found that the early implementation and an integrated nutritional monitoring program by health teams (Hospital-PHC), in the context of home visits, prevents and improves the ADL deterioration (statistically significant condition, $p < 0.001$, observed in 96% of the cases), with an equal reduction in the length of hospital stay.

Early identification of malnutrition's risk can prevent a negative spiral of outcomes for the elderly (functional deterioration, hospital readmissions, and death) (Galiot et al., 2015; Klemenc-Ketis et al., 2020; Pedersen et al., 2016; Shakersain et al., 2016; Yang et al., 2011). However, according to the findings of Schilp et al. (2014), in the development of the first study assessing the cost-effectiveness of dietary treatment in undernourished older people, promoted by PHC in community residential settings, it was found that there was no statistically significant difference in both groups (either in terms of weight gain $p = 0.03$ or in the improvement of their quality of life $p = 0.08$). For the same authors, this fact may be due to the intensity and duration of treatment, which should probably be prolonged (at least one year) and thus influence positively the individual's homeostasis.

Strengths And Limitations

To the best of our knowledge, this is the first scoping review that synthesizes the range of knowledge available on PHC processes and health outcomes associated with malnutrition in older people. This reveals the greatest strength of the current study. The inclusion of peer-reviewed scientific articles published in English, Portuguese and Spanish, with a timeframe that includes the last 10 years of research on the current and growing phenomenon of vulnerability in the elderly, is another possible strength of the scoping review. However, we are aware that it may have limited the analysis by excluding.

Given the interest of the current systematic reviews, it contrasts the need for scientific investment in this area of intervention, the PHC. Efforts were made to capture all relevant articles, assumed by the decision and interest to consult the references of eligible studies; however, articles could be overlooked. The inclusion of studies with different sampling levels reveals another possible strength of scoping review (as it is advisable to present papers that support and reinforce the results, overcoming the limitation of those with a less representative number of participants). However, the same condition may represent a possible associated limitation. Studies with different sampling representativity are included and compared, which may limit the extrapolation of results.

Conclusion

In community settings, in terms of health outcomes analysis on the impact of malnutrition in the elderly, studies are mostly oriented towards its relationship with morbidity/mortality, then effectively to the effect on the cost or the person's quality of life. However, all studies reinforce the severity associated with malnutrition in the irreversible senescence process. The studies also add that, although health professionals evoke in their practice the impact of healthy eating in diagnosis and individual/community prognosis, they have difficulties identifying the issue of risk/ malnutrition in the individual. Professionals need to adopt screening and early intervention practices regarding risk/ malnutrition in the elderly, considering that prompt and correct diagnosis/treatment can improve health outcomes for the person and the system. The current socio-economic situation, aggravated by a pandemic, has led countries, like Portugal, to an unprecedented economic crisis. Associated with this macro context, an increase in the phenomenon of malnutrition is foreseeable, given that people may lose income and see their purchasing power diminish, aspects that will influence the acquisition of foodstuffs. Thus, the possible consequences arising from this new reality should be a call to researchers to invest time in analysis and intervention on the phenomenon of malnutrition in the elderly. Despite the relevant results found, and for futures researches, there are still understudied content areas. Namely, based on an experimental or mixed methodology in the PHC context, the study of the relationship between the effectiveness (cost/benefit) of good practices associated with malnutrition and their expression in results to produce health gains (elderly/system). The scientific process is expected to be able to support the definition of quality interventions/clinical governance that facilitate and promote decision-making in Family Health Teams.

Declarations

Ethical approval and consent to participate: As a scoping review, the study was not submitted to an Ethics Committee. However, the authors approved all included studies and informed consent was obtained.

Consent for publication: Not applicable.

Availability of data and materials: All of the data analysed in this study is included in this published article.

Conflict of interest declaration: The authors declare that there is no conflict of interest.

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Authors' contributions: All authors were involved in this scoping review. AT, AM, and PC designed the study. AT and AM contributed to the development of selection criteria and data extraction. AT, AM and PC carried out the strategy. AT and AM evaluated the studies and data extraction. BS, AM, and PC provided a critical review of the article. AT drafted the manuscript. All authors have read and approved the final version of the manuscript.

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Figures

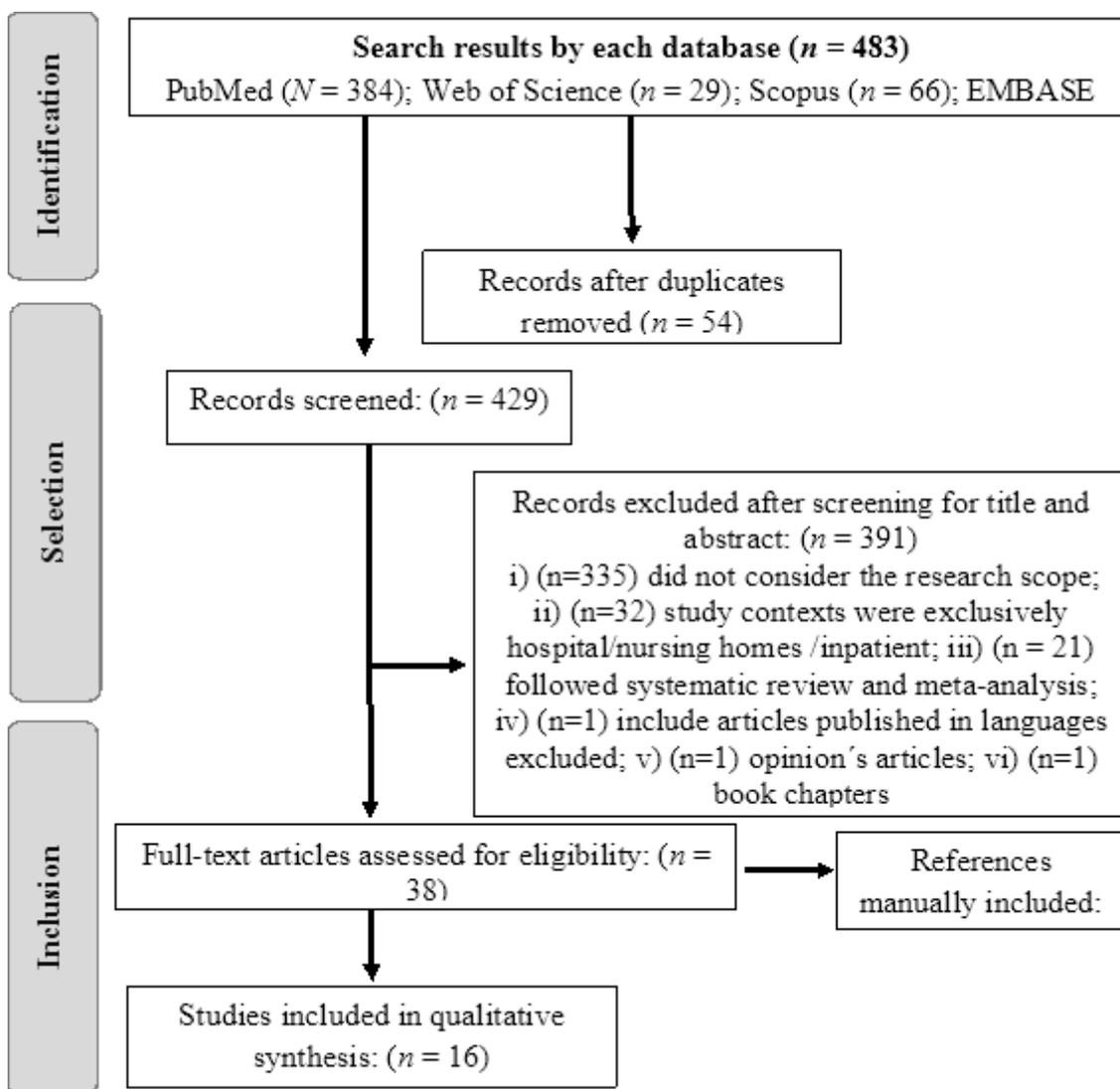


Figure 1

Adaptation of PRISMA flow chart.