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Nutrition screening tools for risk of malnutrition among hospitalized patients

A protocol for systematic review and meta analysis

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Abstract

Background: Malnutrition is a clinical problem with a high prevalence in hospitalized adult patients. Many nutritional screening tools have been developed but there is no consensus on which 1 is more useful. The purpose of this review protocol is to provide an overview of which nutritional screening tool is most valid to identify malnutritional risk in hospitalized adult patients and to analyze the sensitivity and specificity of the different tools.

Methods: The protocol of this systematic review and meta-analysis was registered on the INPLASY website (https://inplasy.com/inplasy-2020-9-0028/) and INPLASY registration number is INPLASY202090028. We will perform a systematic literature search of main databases: PubMed, EMBASE, CINAHL and Web of Science and the Cochrane database. Also, grey literature will be search. Peer-reviewed studies published in English, Portuguese or Spanish language will be selected. Screening of titles, abstract and full text will be assessed for eligibility by 2 independent blinded reviewers and any discrepancies will be resolved via consensus. After screening the studies, a meta-analysis will be conducted, if it is possible.

Results: Results from this systematic review will help health professionals to identify malnutrition in hospitalized patients and to make decisions to prevent or treat it as well as provide new clues to researchers.

Conclusion: Our systematic review will provide aknowledge about the most valid malnutrition risk screening tool in hospitalized adult patients.

Abbreviations: BMI = body mass index, CI = confidence interval, LH = likelihood ratio, NPV = negative predictive value, PPV = positive predictive value.

Keywords: hospitalization, malnutrition, meta-analysis, nutrition assessment, screening, systematic review

1. Introduction

Malnutrition is a condition characterized by a negative balance of energy and/or proteins that leads to altered body composition as a consequence of the decrease in muscle and/or fat mass. Such status leads to diminished physical and mental function and impaired clinical outcomes from disease.[1]

Although a universally accepted definition of malnutrition is still lacking,[2] the European Society for Clinical Nutrition and Metabolism (ESPEN)[3] defined malnutrition by the presence of one of the following criteria:

1. body mass index (BMI) $< 18.5 \, \text{kg/m}^2$;
2. unintentional weight loss and reduced BMI (age dependent cut-offs) or
3. unintentional weight loss and reduced gender dependent fat free mass index.[4]

On the other hand, the American Society for Parenteral and Enteral Nutrition (ASPEN)[5] establishes that at least 2 of the following 6 criteria should be fulfilled to meet the diagnostic criteria of malnutrition: low energy intake, weight loss, loss of muscle mass, loss of subcutaneous fat, fluid accumulation, and diminished hand grip strength.

Malnutrition is a clinical problem of high prevalence, affecting between 30% to 50% of hospitalized patients, depending on age, the screening tool used and the hospital setting.[6–10] Furthermore, malnutrition is associated with increased morbidity and mortality, length of hospital stay

and likelihood of hospital readmission, which in turns raises healthcare costs.[8,11–13]

The risk of malnutrition in hospitals is associated to other diseases, pharmacological treatments and diagnostic and therapeutic interventions.[14] Many studies agree on the efficiency and effectiveness of the prevention of malnutrition by nutritional status screening and assessment during hospital admission, to adequately provide nutrition therapy when it is necessary.[15–17] However, whilst clinical practice guidelines recommend that nutritional screening should be routinely performed at hospital admission together with nutritional assessment, if indicated, the reality is very different, and malnutrition remains highly prevalent among hospital patients.[18]

There is no anthropometric or analytical value alone useful to carry out a diagnosis of malnutrition and there is no international consensus about clinical diagnosis.[2,19] Although a nutritional screening allows for the detection of patients at high risk, such screening is only performed in ~10% to 20% of hospitalized patients, even in hospitals with a clinical nutrition department.[6,11] Furthermore, only half of hospitalized patients undergo laboratory tests, anamnesis or physical examination to evaluate their nutritional status.[20]

Additionally, there is also some confusion in the literature regarding the terminology surrounding malnutrition. For example, nutritional screening (which refers to the identification of malnutritional risk) and nutritional assessment (which aims to establish a nutritional diagnosis to identify malnutrition)[18] are different steps of nutrition care in hospitalized patients.

There are many nutritional screening tools[21] as Nutritional Risk Screening 2002 (NRS-2002),[22] recommended by ESPEN; Malnutrition Universal Screening Tool (MUST),[23] used at community and hospital levels; Mini Nutritional Assessment (MNA),[24] used in patients over 65 years; Short Nutritional Assessment Questionnaire (SNAQ)[25] used, regardless of age, in hospitals, nursing homes and at community level; and Malnutrition Screening Tool (MST)[26] completed by the patient. While numerous nutritional screening tools are in use, their levels of validity, reliability, generalizability and agreement vary.[27] These tools assess different clinical aspects of patients with objective measures (recent weight loss, changes in intake, presence of physical and/or mental illnesses related to a decrease in intake or malabsorption of nutrients) and assign a score that allows classifying patients according to their risk of malnutrition.

Nevertheless, there are screening tools that identify clinical variables similar to the previous ones but that classify the risk of malnutrition according to a subjective final assessment made by the observer, such as the Subjective Global Assessment (SGA),[28] recommended by the ASPEN. This tool, used in all healthcare settings, has been used as a gold standard for the validation of other nutrition screening tools.[26,29]

Despite the availability of these nutritional screening tools, there is no international consensus on which is the most valid tool to use in the hospital setting.[30]

1.1. Research questions

The questions of interest for this systematic review are:

1. Which nutritional screening tool is most valid to identify malnutritional risk in hospitalized adult patients?
2. What are the estimates for sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and likelihood ratios?

1.2. Objectives

The aims of this study are:

1. To provide an overview about which nutritional screening tool is most valid to identify malnutritional risk in hospitalized adult patients.
2. To identify the sensitivity, specificity, PPV, NPV and likelihood ratios of different tools.

2. Methods

2.1. Study protocol and registration

The study protocol has been registered in INPLASY, an International Platform of Registered Systematic Review and Meta-analysis Protocols (https://inplasy.com/inplasy-2020-9-0028/) (Registration No. INPLASY202090028, doi: 10.37766/inplasy2020.9.0028). This protocol is prepared according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocols (PRISMA-P) statements,[31,32] and the systematic review was equally reported according to PRISMA guidelines.[31,33]

2.2. Strategy of literature searches

We will search the following databases: PubMed, EMBASE, CINAHL (via the EBSCO), Web of Science and the Cochrane database. Peer-reviewed studies published in English, Portuguese or Spanish language will be selected. Search terms will include controlled terms from MeSH in PubMed, EMtree in EMBASE and CINAHL headings in CINAHL as well as free text terms. The key search terms that will be combined include "nutrition assessment", "nutritional screening tool", "malnutrition screening", "malnutrition", "adult", and "hospital" (Table 1). Reference lists will also be verified for relevant citations. The search strategy will be performed in cooperation with a research librarian and it is presented in online supplementary additional file.

2.2.1. Additional search strategy (identification of grey literature). Unpublished literature will be identified through the Information System on Gray Literature in Europe (Open Gray), Conference Proceedings of the Web of Science and ProQuest Dissertations and Theses Global. If necessary, the authors will be contacted to obtain a full report of the findings, if available. Data from conference proceedings will not be included in the review due to the limited information available to carry out the methodological quality assessment.

2.3. Eligibility criteria and exclusion criteria
2.3.1. Eligibility criteria. The inclusion criteria will be the following:

1. validation studies of nutritional screening tools developed to identify malnutrition or risk of malnutrition;
2. studies focused on hospitalized adults (18 to 85 years old).

2.3.2. Exclusion criteria. We will exclude studies focused on:

1. residents in nursing homes or long-term facilities care facilities;
2. children and young adults (up to 18-years of age);
3. pregnant women;
4. terminal or palliative patients;
5. patients with eating disorders;

Table 1

Databases search strategy.

PubMed:

("Nutrition Assessment"[Mesh] OR "Nutrition Assessment"[All Fields] OR "nutrition screening"[All Fields] OR "nutritional assessment"[All Fields] OR "nutritional screening"[All Fields] OR "malnutrition screening"[All Fields] OR "screening tool"[All Fields] OR "screening tools"[All Fields] OR "assessment screening tool"[All Fields] OR "assessment screening tools"[All Fields]) AND ("Malnutrition"[Mesh] OR "malnutrition"[All Fields] OR "Protein-Energy Malnutrition"[Mesh] OR "undernutrition"[All Fields] OR "Nutritional Deficiency"[All Fields] OR "Nutritional Deficiencies"[All Fields] OR "Protein Energy Malnutrition"[All Fields]) AND ("Hospitalization"[Mesh] OR "Inpatients" [MesH] OR "Hospitals"[Mesh] OR "hospitalisation"[All Fields] OR "hospitalization"[All Fields] OR "hospitals"[All Fields] OR "hospital"[All Fields] OR "inpatient"[All Fields] OR "inpatients" [All Fields]) AND ("Adult"[Mesh] OR "Adolescent"[Mesh])

EMBASE:

('nutritional assessment'/exp OR 'malnutrition screening tool'/exp OR 'malnutrition screening tool' OR 'nutrition assessment' OR 'nutrition screening' OR 'nutritional assessment' OR 'nutritional screening' OR 'malnutrition screening' OR 'screening tool' OR 'screening tools' OR 'assessment screening tool' OR 'assessment screening tools') AND ('malnutrition'/exp OR 'protein calorie malnutrition'/exp OR 'malnutrition' OR 'protein calorie malnutrition' OR undernutrition OR 'nutrition deficiency' OR 'nutrition deficiencies' OR 'protein energy malnutrition') AND ('hospitalization'/exp OR 'hospital patient'/exp OR 'hospital'/exp OR 'hospitalization' OR 'hospitalisation' OR 'hospital' OR 'hospitals' OR 'hospital patient' OR 'hospital patients' OR 'inpatient' OR 'inpatients') AND ('adolescent'/exp OR 'young adult'/exp OR 'adult'/exp OR 'middle aged'/exp OR 'aged'/exp OR 'very elderly'/exp)

CINAHL:

(MH "Nutrition Assessment+") OR "nutrition screening" OR "nutritional assessment" OR "malnutrition screening" OR "screening tool" OR "assessment screening tool" AND (MH "Malnutrition+") OR (MH "Protein-Energy Malnutrition+") OR undernutrition OR "Nutritional Deficiency" OR "Nutritional Deficiencies" OR "Protein Energy Malnutrition" AND ((MH "Hospitalization+") OR (MH "Inpatients+") OR (MH "Hospitals+") OR hospital OR "Hospital setting" OR "Hospital units" OR inpatient OR inpatients) AND ((MH "Adult+") OR Adults OR "Young Adult" OR (MH "Adolescent+"))

WEB OF SCIENCE:

"Nutrition Assessment" OR "nutrition screening" OR "nutritional assessment" OR "malnutrition screening" OR "screening tool" OR "assessment screening tool" AND Malnutrition OR "Protein-Energy Malnutrition" OR undernutrition OR "Nutritional Deficiency" OR "Nutritional Deficiencies" OR "Protein Energy Malnutrition" AND (Hospitalization OR Inpatients OR Hospitals OR hospital OR "Hospital setting" OR "Hospital units" OR inpatient OR inpatients) AND (Adult OR Adults OR "Young Adult" OR Adolescent)

COCHRANE Database:

[mh "Nutrition Assessment"] OR "nutrition screening" OR "nutritional assessment" OR "malnutrition screening" OR "screening tool" OR "assessment screening tool" AND [mh Malnutrition] OR [mh "Protein-Energy Malnutrition"] OR undernutrition OR "Nutritional Deficiency" OR "Nutritional Deficiencies" OR "Protein Energy Malnutrition" AND ([mh Hospitalization] OR [mh Inpatients] OR [mh Hospitals] OR hospital OR "Hospital setting" OR "Hospital units" OR inpatient OR inpatients) AND ([mh Adult] OR Adults OR "Young Adult" OR [mh Adolescent])

SCOPUS:

INDEXTERMS ("Nutrition Assessment") OR "nutrition screening" OR "nutritional assessment" OR "malnutrition screening" OR "screening tool" OR "assessment screening tool" AND INDEXTERMS ("Malnutrition") OR INDEXTERMS ("Protein-Energy Malnutrition") OR "undernutrition" OR "Nutritional Deficiency" OR "Nutritional Deficiencies" OR "Protein Energy Malnutrition" AND (INDEXTERMS ("Hospitalization") OR INDEXTERMS ("Inpatients") OR INDEXTERMS ("Hospitals") OR "hospital" OR "Hospital setting" OR "Hospital units" OR "inpatient" OR "inpatients") AND (INDEXTERMS ("Adult") OR "Adults" OR "Young Adult" OR INDEXTERMS ("Adolescent"))

ProQuest Dissertations and Theses Global:

Nutrition* assessment OR nutrition* screening tool OR malnutrition* screening (Every country, every university and every language)

OPEN GREY:

"nutrition assessment" OR "nutritional screening tool"

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6. nutrition indexes (NRI, GNRI, etc.) instead of screening tools;
7. reporting in languages other than English, Portuguese or Spanish language.

2.4. Data collection and analyses

2.4.1. Selection of studies.
References of the studies identified by the literature search strategy will be imported into EndNote X9 (Clarivate analytics, Philadelphia, USA) literature management software, and duplicates will be removed. To ensure the quality of the process, 2 blinded reviewers will separately screen the study titles and abstracts for relevance. Should disagreements arise between the reviewers, then the full text of the document will be retrieved. Disagreements will be resolved via consensus; the opinion of a third reviewer will be sought as necessary. After this initial selection, all potentially eligible references will be evaluated to see if they meet the inclusion criteria. The reviewers will contact the authors to obtain full versions of the articles that cannot be obtained in full text. To reduce the risk of bias, a pilot exercise will be carried out to apply the inclusion criteria in a sample of 20 references. A summary of the study screening process will be presented using the PRISMA flow chart (Fig. 1). Excluded studies will be listed in a table with the reasons for their exclusion.

2.4.2. Data extraction and management.
The characteristics of the studies and study data will be managed using Microsoft Excel 2019 (Microsoft Corp, Redmond, WA, www.microsoft.com) and Review Manager software (RevMan version 5.3, Copenhagen, Denmark: The Nordic Cochrane Centre, the Cochrane Collaboration 2014), respectively. Three reviewers (RC, SF and JDP) will separately collect data including eligible studies characteristics (e.g., name of first author, publication year, country, journal title, study design, participants, sample size, study setting, risk assessment tools), outcomes (sensitivity, specificity, and likelihood ratios) and declarations of interests. Where possible, these outcomes will be calculated if they are not already reported within the study. Missing or incomplete data will be obtained by contacting authors of the studies directly.

2.4.3. Quality evaluation.
In order to assess the methodological quality of each included studies, we will use the Quality Assessment of Diagnostic Accuracy Studies (QUADAS-2) checklist as a critical appraisal instrument (http://www.bris.ac.uk/quadas).[34]

Disagreements will be resolved by having a discussion or consultations with another reviewer (MBV).
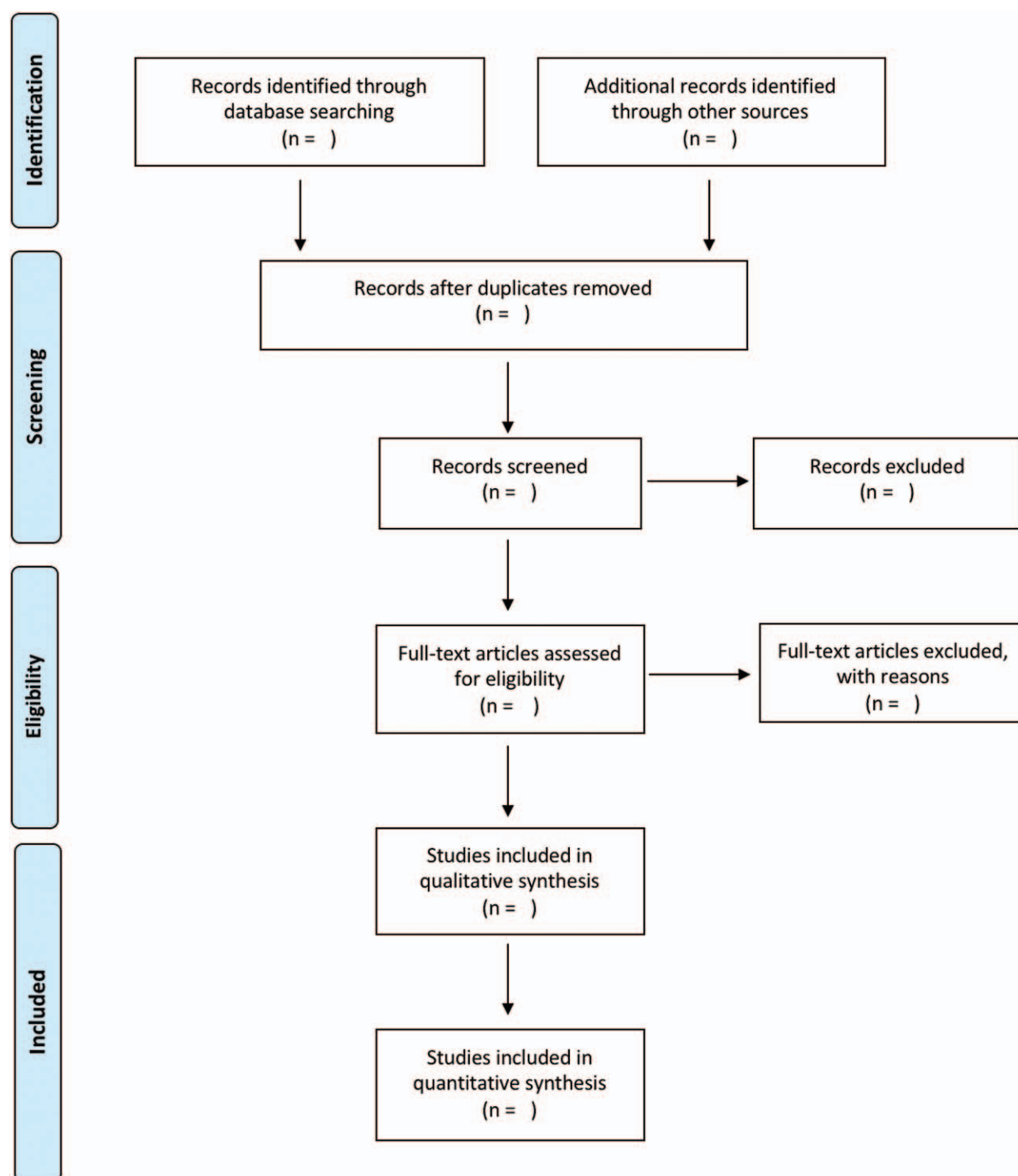
Figure 1. Study screening process: Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow diagram.

A concordance analysis among reviewers will be carried out during the review process and this will be subsequently incorporated into the results using Cohen's kappa coefficient. The following labels will be assigned to the corresponding ranges of kappa: poor (<0.00), slight (0.00–0.20), fair (0.21–0.40), moderate (0.41–0.60), substantial (0.61–0.80) and almost perfect (0.81–1.00).[35]

2.4.4. Data synthesis and meta-analysis. Relevant data checked and agreed by 3 reviewers will be exported from Microsoft Excel to RevMan 5.3 and STATA version 16.1 (Stata, College Station, TX) for quantitative synthesis. A P value $<.05$ will be considered statistically significant for all analyses.

A narrative synthesis of the outcomes will be presented in the final review. Meta-analysis of sensitivity, specify, PPV, NPV and

likelihood ratios (LHs) will be performed for each nutrition screening tool.

2.4.5. Assessment of heterogeneity.
Statistical heterogeneity will be quantified by the Cochranes Q statistic and the inconsistency index (I^2) test.[36] The heterogeneity will be stratified into tree levels: 25% low heterogeneity, 25% to 50% moderate heterogeneity and $> 50\%$ high heterogeneity.[37] We will use fixed-effects model with weighting of the studies if there is no evidence of significant heterogeneity, and will use random-effects model with weighting of the studies when there is heterogeneity between studies.

An assessment of homogeneity in terms of methodology and outcomes will be performed. Should there be high heterogeneity, then only a narrative synthesis will be performed instead, without meta-analysis.

We will use forest plots to graphically represent sensitives, specificities, PPV, NPV and LHs with 95% confidence intervals (CIs) for each nutrition screening tool. We will also conduct sensitivity analysis to assess the influence of each study on the overall effect by removing one of the studies in each round and publication bias across studies will be evaluated using funnel plots and Eggers test.[38]

2.5. Ethical principles and publication

Ethical approval will not be sought as this is a protocol for a systematic review. Patient and public were not involved in this study. The findings of the study will be disseminated through international and national conferences, and in a peer-reviewed journals. The results will also be communicated to patients and patient representatives in suitable language via popular science publications and on institutional websites.

3. Discussion

Nutritional screening should be routinely performed at hospital admission, with the goal of decreasing malnutrition related morbimortality; however, there remains a lack of consensus on which tool is best for determining malnutritional risk on clinical practice.

This systematic review aims to summarise the evidence on the validity of different nutritional screening tools. Results of this systematic review will therefore provide new insights into malnutrition prevention and treatment to promote new clinical practice recommendations and polices. The systematic review may also highlight limitations or gaps in the evidence for future research.

May be interesting to explore results depending on gender, as well as high income and low-income settings. Equally, would be interesting to think about clinician-administered or patient-administered tools.

Author contributions

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Writing – review & editing: Enrique Castro-Sanchez, Sergio Fresneda, Joan De Pedro-Gómez, Aina Yañez.

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