



## Evidence-based Practice Center Systematic Review Protocol

### Project Title: *Malnutrition in Hospitalized Adults*

#### I. Background and Objectives for the Systematic Review

Malnutrition among hospitalized patients remains a serious issue affecting more than 30 percent of hospitalized patients in the United States.<sup>1</sup> According to the American Society for Parenteral and Enteral Nutrition (ASPEN), malnutrition results from a “combination of varying degrees of overnutrition or undernutrition with or without inflammatory activity that leads to a change in body composition and diminished function.”<sup>2</sup> The etiology of malnutrition is heterogeneous, and can result from chronic starvation (e.g., anorexia nervosa); acute or chronic illness (e.g., certain cancers, sarcopenic obesity, major infections); and injury (e.g., burns, head trauma). These conditions are often associated with inadequate intake of protein and other nutrients that can lead to nutritional imbalances, severe weight loss, muscle wasting and loss of subcutaneous fat. Factors such as advanced age, immobilization, and low income can increase the risk of malnutrition.

Malnutrition is associated with high mortality and morbidity, functional decline, prolonged hospital stays, and increased health care costs.<sup>1</sup> Post discharge, malnourished patients are also at risk for more frequent re-admissions. According to an Agency for Healthcare Research and Quality (AHRQ) Healthcare Cost and Utilization Project (HCUP) Statistical Brief, 30-day all cause readmission was nearly 50% higher among patients with malnutrition compared to patients with no associated malnutrition.<sup>3</sup> Patients with protein-calorie malnutrition accounted for the largest number of readmissions among patients with any malnutrition-related index stay.

Early identification and treatment of malnutrition are critical to prevent poor outcomes in hospitalized adult patients. The Joint Commission now requires that hospitals screen for risk of malnutrition as part of the general admission process. However, variations in definitions and tools used to screen and diagnose malnutrition have made it difficult for hospitals to standardize this process.<sup>4,5</sup> Currently, at least 20 different tools exist to assess nutritional risk and determine diagnosis. These tools vary in the factors they examine and in their diagnostic accuracy and clinical utility.

In 2016, a taskforce known as the Global Leadership Institute on Malnutrition (GLIM) convened to develop a universal framework for assessing malnutrition.<sup>6</sup> The GLIM taskforce recommended a two-step approach to identifying malnutrition that involves 1) screening for malnutrition using a valid tool, and 2) performing a formal diagnostic assessment. The taskforce produced consensus-based criteria for the formal assessment that includes both etiologic influences (reduced food intake, hypercatabolic burden of disease) and phenotypic presentations (non-volitional weight loss, low body mass index [BMI], low skeletal muscle mass) of malnutrition. Patients with a diagnosis of malnutrition must have at least one manifestation from each group. A diagnosis of severe malnutrition depends upon criteria for the severity of the phenotypic presentation. The GLIM recommendations have yet to be criterion-validated, but represent the current opinion and best knowledge of experts in the field.<sup>7</sup>

Proper diagnosis of malnutrition is essential to identifying and utilizing appropriate interventions. However, diagnosing malnutrition is challenging in certain populations, such as patients with obesity and/or sarcopenia. While sarcopenic obesity has been described in hospitalized patients, most screening tools do not capture this diagnosis, in part because measurement of muscle mass and function are required.<sup>8,9</sup> Further, some interventions, such as nutritional assessments, visits with registered dietitians, and performing laboratory tests, may be applied across populations. Other interventions, such as initiating parenteral nutrition (PN), may only be appropriate in specific cases. Since interventions relating to treatment of malnutrition have risks (i.e. increased risk of blood-stream infections with prolonged PN, or complications from gastrostomy tube placement), it is important to identify the appropriate context for which such interventions are efficacious, and assess the risk of harms that arise from interventions.

### **Purpose of the Systematic Review**

In fiscal year 2020, Congress requested that AHRQ convene a panel of experts charged with developing quality measures for malnutrition-related hospital readmissions. These measures intend to help assign accountability for the assessment and treatment of malnutrition in hospitalized adults, with an emphasis on the needs of older frail adults. The purpose of this systematic review is to support the efforts of the panel by identifying published literature that will help clearly establish the association between malnutrition and clinical outcomes among hospitalized patients, particularly those who may be at greater risk. This review will also evaluate the effectiveness of screening and/or diagnostic assessment of malnutrition on diagnosis, treatment, and clinical outcomes of hospitalized patients. Ultimately, the findings of this review will aid in the development of quality measures that will reduce malnutrition in hospitalized adults and lead to improvements in clinical outcomes.

## **II. The Key Questions**

The following key questions intend to identify evidence that will aid in the development of quality measures related to malnutrition in hospitalized adult patients. These questions underpin the pathway of care that links patients at risk of malnutrition to clinical outcomes. The analytical framework found on page 5 visually presents this pathway, which depicts movement along several intermediate interventions that begin with screening or diagnostic assessment and ultimately end with clinical outcomes.

**Key Question 1.** What is the association between malnutrition and clinical outcomes among hospitalized patients?

- a. How do outcomes vary depending on measures or tools used to detect malnutrition?
- b. Are patient-related risk factors, such as increased age or certain pre-existing health conditions, associated with poorer clinical outcomes?

**Key Question 2.** What is the effectiveness of screening or diagnostic assessment for malnutrition among hospitalized adults?

- a. In studies that report on clinical outcomes, what is the diagnostic accuracy of screening or diagnostic assessment for malnutrition?
- b. In studies that report on clinical outcomes, what is the effectiveness of screening or diagnostic assessment on measures of nutrition (nutritional stores)?

c. What is the impact of screening or diagnostic assessment on clinical outcomes?

**Key Question 3.** Among patients diagnosed with malnutrition, what is the effectiveness of hospital-initiated interventions used to treat malnutrition on clinical outcomes?

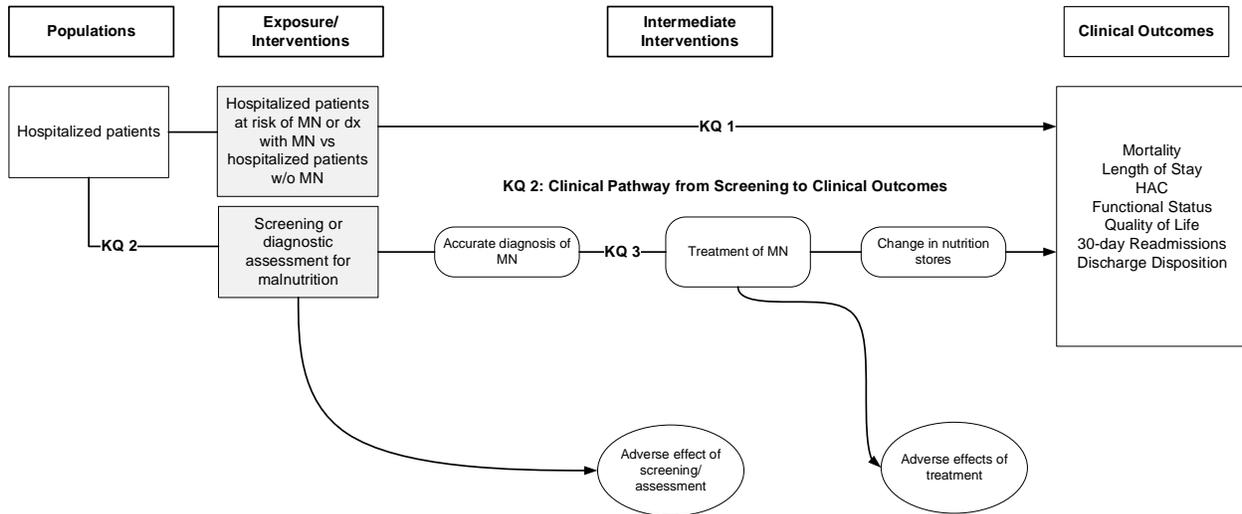
**Table 1. PICOTS (Population, Intervention, Comparator, Outcome, Timing, Setting)**

Category	Definition
<b>Population</b>	<p><b>Key Question 1 and 2:</b> Hospitalized adults aged 18 years or older (see Methods section for exceptions).</p> <p>Key Question 1b subgroups include adults with no risk of malnutrition, adults with risk of malnutrition, and adults with baseline malnutrition. Risk factors of interest to this report include:</p> <ul style="list-style-type: none"> <li>• Older patients (&gt;65 years)</li> <li>• Racial and ethnic minorities</li> <li>• Low income (e.g. Medicaid beneficiaries)</li> <li>• Patients with malignancy</li> <li>• Patients with gastrointestinal disease and subsequent malabsorption, including ulcerative colitis and Crohn’s disease</li> <li>• Patients with chronic liver disease</li> <li>• Patients with stroke</li> <li>• Patients with chronic kidney disease</li> <li>• Patients with dementia</li> <li>• Patients with critical illness</li> <li>• Sepsis/infection</li> </ul> <p><b>Key Question 3:</b> Adults diagnosed with protein-energy malnutrition.</p>
<b>Interventions/ Exposures</b>	<p><b>Key Question 1:</b> Positive screening for nutrition risk and/or diagnosis of malnutrition vs no malnutrition.</p> <p><b>Key Question 2:</b> Malnutrition screening and diagnostic assessment tools (utilized within the U.S., Australia, New Zealand, Canada, and Europe). Examples of tools of interest include:</p> <p><b>Screening</b></p> <ul style="list-style-type: none"> <li>• Malnutrition Screening Tool (MST)</li> <li>• Malnutrition Universal Screening Tool (MUST)</li> <li>• Nutritional Risk Index (NRI)</li> <li>• Nutrition Risk in Critically Ill (NUTRIC) score</li> </ul> <p><b>Diagnostic Assessment</b></p> <ul style="list-style-type: none"> <li>• Subjective Global Assessment (SGA)</li> <li>• Patient Generated Subjective Global Assessment (PS-SGA)</li> <li>• Mini Nutritional Assessment (MNA)</li> <li>• AND (Academy of Nutrition and Dietetics)-ASPEN (American Society for Parenteral and Enteral Nutrition) Malnutrition Consensus Criteria (MCC)</li> <li>• Global Leadership Initiative on Malnutrition (GLIM)</li> </ul> <p><b>Key Question 3:</b> Hospital-initiated malnutrition interventions. Examples of interventions include:</p> <ul style="list-style-type: none"> <li>• Parenteral nutrition</li> <li>• Enteral nutrition</li> <li>• Oral nutrition supplements</li> <li>• Nutrition team consultation, includes dietitian counseling</li> <li>• Pharmacologic interventions</li> </ul>
<b>Comparators</b>	<p><b>Key Question 1:</b> Hospitalized patients without malnutrition, or direct comparisons of different definitions of malnutrition.</p>

Category	Definition
	<p><b>Key Questions 2:</b> Radiographic imaging or SGA will be used as the reference standard.</p> <p><b>Key Question 3:</b> Usual care or another hospital-initiated malnutrition-related intervention.</p>
<b>Outcomes</b>	<p><b><u>Clinical Outcomes (All Key Questions)</u></b></p> <ul style="list-style-type: none"> <li>• Mortality (inpatient and 30-day)</li> <li>• Length of stay</li> <li>• 30-day readmission</li> <li>• Quality of life</li> <li>• Functional status, includes gate speed, Karnofsky Index, handgrip strength, days on ventilator</li> <li>• Activities of daily</li> <li>• Hospital Acquired Condition (HAC)</li> <li>• Wound healing</li> <li>• Discharge disposition</li> </ul> <p><b><u>Intermediate Outcomes (KQ 2)</u></b></p> <p>Diagnostic accuracy outcomes</p> <ul style="list-style-type: none"> <li>• Sensitivity</li> <li>• Specificity</li> <li>• Predictive value</li> <li>• Area under the curve</li> </ul> <p><b><u>Intermediate Outcomes (KQ 2 or KQ 3)</u></b></p> <p>Nutrition Stores: Direct measures of nutrition status (nutrition stores) during and post hospitalization. Examples include:</p> <ul style="list-style-type: none"> <li>• Cross-sectional areas for lumbar skeletal muscle and adipose tissue</li> <li>• Skeletal Muscle Index</li> <li>• Regional or total fat mass and muscle mass assessed using validated gold standard methods, such as body composition measures derived through Computed Tomography (CT) scans, Dual X-ray Absorptiometry (DXA), and Magnetic Resonance Imaging (MRI)</li> </ul>
<b>Timing</b>	Up to 30 days post-discharge
<b>Setting</b>	Acute care hospitalizations

### III. Analytic Framework

Figure 1. Analytic framework for Malnutrition in Hospitalized Adults



### IV. Methods

#### Criteria for Study Inclusion and Exclusion

As suggested in the Agency for Healthcare Research and Quality (AHRQ) EPC Methods Guide for Comparative Effectiveness Reviews, the inclusion criteria are listed below in separate categories pertaining to publication type, study design, patient characteristics, test characteristics, and reported data.<sup>10</sup>

#### Publication Criteria

- 1. Full-length articles.** The article must be published as a full-length, peer-reviewed study. Abstracts and meeting presentations will not be included because they do not include sufficient details about experimental methods to permit an evaluation of study design and conduct; they may also contain only a subset of measured outcomes.<sup>11,12</sup> Additionally, it is not uncommon for abstracts that are published as part of conference proceedings to have inconsistencies when compared with the final study publication or to describe studies that are never published as full articles.<sup>13-16</sup>
- 2. Publication date.** The search date range for studies addressing key question 1 (outcomes of malnutrition) will include systematic reviews published from 2010 to present. For studies assessing key question 2 (the impact of screening and assessment), the search date range will include studies published from 2000 to present.
- 3. Redundancy.** To avoid double-counting patients, when several reports of the same or overlapping groups of patients are available, only outcome data from the report with the largest number of patients will be included. We will make an exception and include data from a smaller study when it reports data on an outcome that was not provided by the largest report or reports longer followup data for an outcome.
- 4. English language.** When a study with an English abstract is published in a foreign language, the abstract will be assessed against the full set of inclusion/exclusion criteria.

If the study appears to fit the inclusion criteria, then we will evaluate whether excluding the study may result in language bias (e.g., if the findings differ from other included studies.) If language bias seems unlikely, the study will be excluded. If a study is selected for inclusion, it will be translated and the data extracted into the evidence tables.

### **Study Design Criteria**

1. For KQ 1, included studies must be systematic reviews of relevant study designs (RCTs, prospective cohort trials, or cross-sectional studies) that use a valid assessment tool to identify patients at risk of malnutrition.
2. For KQ 2, we will include randomized or non-randomized comparative trials, including prospective cohort trials that report on intermediate and clinical outcomes. Retrospective studies will not be considered for inclusion for this key question as these types of study designs are subject to biases that reduce the reliability of the findings.
3. For KQ 3, we will include randomized trials.
4. For all key questions, systematic reviews may also be used as a primary source of data if 3 conditions are met: 1) the review is determined to be at low risk of bias (using Cochrane's ROBIS tool); 2) the included studies would individually meet our inclusion criteria; and 3) our searches did not identify additional, relevant, primary studies that meet our criteria and were not included in the existing review.

### **Patient Criteria**

1. The patient population for key question 1 and 2 will include hospitalized adult patients aged 18 years. Key question 1 will also consider the following subgroups of patients: patients at risk of malnutrition, patients with baseline malnutrition, and patients with no risk of malnutrition. The population for key question 3 will only include patients with a diagnosis of protein-energy malnutrition. Studies enrolling individuals with planned admissions (e.g. undergoing non-emergent elective procedures), patients receiving or who have received hospice services, or pregnant women will not be considered for inclusion in this report.

### **Intervention Criteria**

1. For Key Question 2, studies must report on screening/assessment tools utilized within the U.S., Australia, New Zealand, Canada, and Europe and initiated within the hospital (See list of tools in Table 1).
2. Studies addressing key question 2 or 3 that include an intervention must report on an intervention initiated within the hospital and intended to impact nutritional status (See list of example interventions in Table 1). Studies of interventions that are initiated, managed, or implemented by entities either completely or partially external to the hospital setting; or surgical interventions will be excluded. Examples of excluded interventions include but are not limited to ambulatory clinic follow-up visits, community-based support resources, regulatory policies, and third-party reimbursement programs.

## **Setting Criteria**

1. Only acute care hospitalization settings. Studies of patients in specialty hospitals (e.g., psychiatric, ophthalmologic, orthopedic, cancer, rehabilitation, long-term acute care) will be excluded.

## **Data Criteria**

1. The study must report data pertaining to one of the clinical outcomes of interest (see outcome list in Table 1). Studies reporting only on intermediate outcomes of interest and outcomes exclusive to screening or diagnostic performance will be excluded.

## **Literature Search Strategies for Identification of Relevant Studies to Answer the Key Questions**

Literature searches will be performed by Medical Librarians at the Evidence-based Practice Center (EPC) Information Center, and will follow established systematic review protocols. We will search the following databases using controlled vocabulary and text words: EMBASE, MEDLINE, PubMed, and The Cochrane Library.

The following gray literature sources will be searched using text words: ClinicalTrials.gov, Centers for Disease Control and Prevention (CDC), Medscape, National Academy of Medicine, National Guideline Clearinghouse™ (NGC), the United States Food and Drug Administration (FDA), and the Web sites of relevant organizations (e.g., Agency for Healthcare Research and Quality [AHRQ], American Society for Parenteral and Enteral Nutrition (ASPEN), and Academy of Nutrition and Dietetics (AND)).

Literature screening will be performed in duplicate using the database Distiller SR (Evidence Partners, Ottawa, Ontario, Canada). Literature search results will initially be screened for relevancy. Relevant abstracts will be screened against the inclusion and exclusion criteria in duplicate. Studies that appear to meet the inclusion criteria will be retrieved in full and screened again in duplicate against the inclusion and exclusion criteria. All disagreements will be resolved by consensus discussion between the two original screeners. The literature searches will be updated during the Peer Review process, before finalization of the review.

## **Data Abstraction and Data Management**

Data will be abstracted using Microsoft Word and Excel. All data will be checked for accuracy by a second reviewer. Elements to be abstracted include: general study characteristics (e.g., study design, objective, setting, enrolled number of patients, and length of follow-up); patient characteristics (e.g., age, sex, ethnicity, Medicaid/income status, baseline nutritional status, severity of disease, and comorbidities); type of screening tool used; details of interventions; outcomes data; and risk of bias items. We recognize that well-defined populations are key to measure development, and that granularity about the populations screened in the included trials is important to capture. Thus, in as much as the literature allows, we will abstract data on how studies are defining malnutrition, the proportion of patients who are screened versus not screened, and characteristics about those who are screened versus not screened.

## **Assessment of Methodological Risk of Bias of Individual Studies**

The risk of bias (ROB) of existing SRs will be assessed using the Risk of Bias in Systematic Reviews (ROBIS) tool, individual RCTs will be assessed using the Cochrane Risk of Bias 2 (ROB2) tool, and observational studies will be assessed using the Risk of Bias in Non-

randomized Studies (ROBINS-I) tool. In addition, the ROB of studies assessing the diagnostic accuracy of screening tools (KQ2) will be assessed using the Quality Assessment of Diagnostic Accuracy Studies 2 (QUADAS-2). Studies assessed using any of the above instruments will be rated as “Low,” “High,” or “Unclear” risk of bias.

Risk of bias will be assessed by two independent reviewers, and discrepancies will be addressed through consensus discussion. We will contact authors of original studies if we determine that additional information is needed. If we are unable to reach the study authors or receive a response within 6 weeks, we will assess the study without additional input.

### **Data Synthesis**

For studies reporting on patient-oriented clinical outcomes, we plan to perform meta-analysis when appropriate and possible. Decisions about whether meta-analysis is appropriate will depend on the judged clinical homogeneity of the different study populations, research designs, and outcomes. When meta-analysis is impossible (due to limitations of reported data) or is judged to be inappropriate, the data will be synthesized using a descriptive, narrative review.

We will compute effect sizes and measures of variance using standard methods and will perform random-effects meta-analysis using the Hartung-Knapp method.<sup>17,18</sup> Meta-regression and subgroup analysis will be used to explore possible causes of heterogeneity. Potential covariates include population descriptors (e.g., age, underlying medical condition, malnutrition severity, and low income status).

For Key Question 2, we will assess the impact of confounders on the findings for critical outcomes particularly among studies that consider treatment. If data permit, we will assess the impact through quantitative analysis (e.g., meta-regression, sensitivity analysis). The confounders of interest include age, gender, comorbidities, and illness severity. The following population relevant measures are frequently used within hospital settings to measure severity of illness: Sequential Organ Failure Assessment (SOFA score), Simplified Acute Physiology Score (SAPSII), and Acute Physiology and Chronic Health Evaluation (APACHE). If data do not permit quantitative analysis, we will narratively report and synthesize data on confounders reported in included studies. The methodological quality of studies that do not control for important confounders will be downgraded because not controlling for variables (such as illness severity) can affect the reliability of the findings.

Critical outcomes for all Key Questions are expected to include mortality, length of stay, functional status, activities of daily living, quality of life, readmission, hospital acquired conditions, and discharge disposition as described in the PICOTS framework. For KQ 2, diagnostic accuracy factors (sensitivity and specificity), treatment and change in nutrition stores will be considered as intermediate outcomes. Input from the clinical investigators, Technical Expert Panel (TEP), peer reviewers, and sponsoring agency will also be considered in the identification and final selection of critical outcomes.

### **Grading the Strength of Evidence (SOE) for Major Comparisons and Outcomes**

We will use a formal grading system that conforms with the EPC Methods Guide recommendations on grading the SOE.<sup>10</sup> The primary domains assessed in this system include risk of bias, directness, consistency, precision, and publication bias. Additional domains may be used when appropriate, including dose-response association, strength of association, and the possibility that all plausible confounders would increase the effect size. The output is a rating of

the SOE: high, moderate, low, or insufficient. This rating is made separately for each outcome of each comparison of each KQ. If the evidence is sufficient to permit a conclusion, the rating is deemed high, moderate, or low. A rating of insufficient will be given when the evidence does not permit a conclusion for the outcome of interest for that KQ. Below, we discuss the primary domains and how they will be considered as inputs to the ratings:

**Risk of bias** (see the section Assessment of Methodological Risk of Bias of Individual Studies above). Study limitations concern the degree to which the included studies for a given outcome have a high likelihood of adequate protection against bias (i.e., have good internal validity). If the evidence permits a conclusion, then, all else being equal, a set of studies at low risk of bias yields a higher SOE rating than a set of studies at moderate or high risk of bias.

**Directness.** Directness relates to (a) whether evidence links interventions directly to a health outcome of specific importance for the review, and (b) for comparative studies, whether the comparisons are based on head-to-head studies.

**Consistency.** Consistency is the degree to which included studies find either the same direction or similar magnitude of effect.

**Precision.** Precision is the degree of certainty surrounding an effect estimate with respect to a given outcome, based on the sufficiency of sample size, number of events, and width of confidence intervals relative to a clinically important effect estimate.

**Reporting bias.** Reporting bias will be addressed by examining the funding source of included studies, the direction and magnitude of effects identified in included studies, and noting the presence of abstracts or ClinicalTrials.gov entries describing studies that did not subsequently appear as full-length published articles. If the evidence base includes at least 10 studies that present data for critical outcomes, review of funnel plots may be used to help ascertain publication bias.

**Applicability.** Several *a priori* factors may limit the applicability of findings. Small sample size may be an important limitation in many studies, and addressing this through meta-analysis may be challenging if there is substantial heterogeneity in study design, intervention, and outcome reporting. Additionally, confounding factors such as severity of illness that studies are unable to or fail to control for may impact the relationship between malnutrition and clinical outcomes.

## V. References

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## VI. Definition of Terms

Term	Definition
Malnutrition	For the purpose of this review, malnutrition will be defined as deficient macronutrient stores in the body (decreased lean muscle mass or adiposity) and/or a direct diagnoses of malnutrition through any valid nutrition assessment technique.
Nutrition Screening	Nutrition screening is the administration of a short initial questionnaire, usually by a registered nurse, to determine if the patient would benefit from a more thorough nutrition assessment. Nutrition screening identified patients who may be at risk of malnutrition.
Nutrition Assessment	Nutrition Assessment is the process by which a patient is diagnosed as malnourished. This process usually contains both anthropometric and historical assessment of the patient's nutrition status.
Sensitivity	The ability of a test to correctly identify patients with a disease.
Specificity	The ability of a test to correctly identify people without the disease.
Predictive Value	Positive and negative predictive values (PPV and NPV respectively) are the proportions of positive and negative results in statistics and diagnostic tests that are true positive and true negative results, respectively.

## VII. Summary of Protocol Amendments

If we need to amend this protocol, we will give the date of each amendment, describe the change, and give the rationale in this section. Changes will not be incorporated into the protocol. Example table below:

Date	Section	Original Protocol	Revised Protocol	Rationale
This should be the effective date of the change in protocol	Specify where the change would be found in the protocol	Describe the language of the original protocol.	Describe the change in protocol.	Justify why the change will improve the report. If necessary, describe why the change does not introduce bias. Do not use justification as "because the AE/TOO/TEP/Peer reviewer told us to" but explain what the change hopes to accomplish.

## VIII. Technical Experts

Technical Experts constitute a multi-disciplinary group of clinical, content, and methodological experts who provide input in defining populations, interventions, comparisons, or outcomes and identify particular studies or databases to search. The Technical Expert Panel is selected to provide broad expertise and perspectives specific to the topic under development. Divergent and conflicting opinions are common and perceived as healthy scientific discourse that fosters a thoughtful, relevant systematic review. Therefore, study questions, design, and methodological approaches do not necessarily represent the views of individual technical and content experts. Technical Experts provide information to the EPC to identify literature search strategies and suggest approaches to specific issues as requested by the EPC. Technical Experts do not do

analysis of any kind; neither do they contribute to the writing of the report. They do not review the report, except as given the opportunity to do so through the peer or public review mechanism.

Members of the TEP must disclose any financial conflicts of interest greater than \$5,000 and any other relevant business or professional conflicts of interest. Because of their unique clinical or content expertise, individuals are invited to serve as Technical Experts and those who present with potential conflicts may be retained. The AHRQ TOO and the EPC work to balance, manage, or mitigate any potential conflicts of interest identified.

## **IX. Peer Reviewers**

Peer reviewers are invited to provide written comments on the draft report based on their clinical, content, or methodological expertise. The EPC considers all peer review comments on the draft report in preparing the final report. Peer reviewers do not participate in writing or editing of the final report or other products. The final report does not necessarily represent the views of individual reviewers.

The EPC will complete a disposition of all peer review comments. The disposition of comments for systematic reviews and technical briefs will be published 3 months after publication of the evidence report.

Potential peer reviewers must disclose any financial conflicts of interest greater than \$5,000 and any other relevant business or professional conflicts of interest. Invited peer reviewers with any financial conflict of interest greater than \$5,000 will be disqualified from peer review. Peer reviewers who disclose potential business or professional conflicts of interest can submit comments on draft reports through the public comment mechanism.

## **X. EPC Team Disclosures**

EPC core team members must disclose any financial conflicts of interest greater than \$1,000 and any other relevant business or professional conflicts of interest. Direct financial conflicts of interest that cumulatively total more than \$1,000 will usually disqualify an EPC core team investigator.

## **XI. Role of the Funder**

This project was funded under Contract No. 75Q80120D00002 from the Agency for Healthcare Research and Quality, U.S. Department of Health and Human Services. The AHRQ Task Order Officer reviewed the EPC response to contract deliverables for adherence to contract requirements and quality. The authors of this report are responsible for its content. Statements in the report should not be construed as endorsement by either the Agency for Healthcare Research and Quality or the U.S. Department of Health and Human Services.

## **XII. Registration**

This protocol will be registered in the international prospective register of systematic reviews (PROSPERO).

## Appendix. Sample of Search Strategy

### Information Retrieval Form

Topic	Malnutrition in Hospitalized Patients – KQ1 Systematic Review Search	
Group Code	EPC48	
Requestor	SUhl	
Searcher	RRishar	
Search Date		
Databases searched	Embase Medline	
Database Vendor	Embase.com	
Coverage dates	01/01/2000 – 10/19/2020	
Cost of search		
# of citations identified		
# of citations downloaded		
<b>Set Number</b>	<b>Concept</b>	<b>Search statement</b>
1	Malnutrition	'cachexia'/de OR 'malnutrition'/de OR cachexi* OR malnourish* OR malnutrition OR underfed OR undernourish* OR undernutrition
2	Nutrition risk	(malnutrition OR nutrition*) NEAR/3 risk*
3	Nutrition status	“nutrition* status” OR “nutrition* store*”
4	Hospital setting	'aged hospital patient'/de OR 'hospital patient'/de OR hospitalis* OR hospitaliz* OR icu OR inpatient* OR 'intensive care unit' OR ((hospital* NEAR/2 patient*):ab,ti)
5	Combine	(#1 OR #2 OR #3) AND #4
6	KQ1 - Systematic Reviews	#5 AND ([cochrane review]/lim OR [systematic review]/lim OR [meta analysis]/lim OR cochrane OR 'meta analysis' OR 'meta analyses' OR metaanalysis OR metaanalyses OR search* OR systematic:ti)
7	KQ2 – Screening	'screening'/exp OR screen* OR “Malnutrition Screening Tool” OR MST OR “Malnutrition Universal Screening Tool” OR MUST OR “Nutritional Risk Index” OR NRI OR “Nutrition Risk in Critically Ill” OR NUTRIC

8	KQ2 – Diagnostic Assessment	'diagnostic assessment' OR 'subjective global assessment' OR sga OR 'patient generated subjective global assessment' OR 'ps-sga' OR 'mini nutritional assessment' OR mna OR 'and-aspen mcc' OR 'global leadership initiative on malnutrition' OR glim OR 'malnutrition consensus criteria' OR (('academy of nutrition and dietetics' OR 'and') AND ('american society for parenteral and enteral nutrition' OR aspen OR 'a.s.p.e.n.') AND (consensus OR mcc))
9	KQ2 Combined Screening Methods	#5 AND (#7 OR #8)
10	KQ2 - Systematic reviews	#9 AND ([cochrane review]/lim OR [systematic review]/lim OR [meta analysis]/lim OR cochrane OR 'meta analysis' OR 'meta analyses' OR metaanalysis OR metaanalyses OR search* OR systematic:ti)
11	KQ2 - RCTs	#9 AND ('randomized controlled trial'/de OR 'randomized controlled trial (topic)'/de OR random*:ab,ti OR nct* OR [randomized controlled trial]/lim)
12	KQ2 Non-randomized trials	#9 AND ('cohort analysis' OR 'comparative study'/exp OR 'controlled study'/exp OR 'evaluation study'/de OR 'longitudinal study'/de OR 'major clinical study'/de OR 'prospective study'/de OR 'treatment outcome'/de OR 'between groups':ti,ab OR 'case control*':ti,ab OR cohort*:ti,ab OR compar*:ti,ab OR 'control group*':ti,ab OR 'controlled study':ti,ab OR 'controlled trial':ti,ab OR 'double blind':ti,ab OR 'double blinded':ti,ab OR longitudinal:ti,ab OR 'matched controls':ti,ab OR nonrandomiz*:ti,ab OR prospective:ti,ab OR random*:ti,ab OR versus:ti OR vs:ti)
13	KQ2 Combined set	#10 OR #11 OR #12
14	KQ3 – Hospital initiated malnutrition interventions	#5 AND ('dietary supplement'/exp OR 'drug therapy'/exp OR 'enteric feeding'/exp OR 'parenteral nutrition'/exp OR “drug therap*” OR “nutrition team*” OR ((enteric OR enteral OR parenteral) NEAR/2 (feed* OR nutrition* OR nutrient* OR therap*)) OR “Oral nutrition supplement*” OR pharmacotherap* OR ((diet* OR dietitian* OR nutrition*) NEAR/3 (counsel* OR therap*)))
15	RCTs	#14 AND ('randomized controlled trial'/de OR 'randomized controlled trial (topic)'/de OR random*:ab,ti OR nct* OR [randomized controlled trial]/lim)

16	Systematic Reviews	#14 AND ([cochrane review]/lim OR [systematic review]/lim OR [meta analysis]/lim OR cochrane OR 'meta analysis' OR 'meta analyses' OR metaanalysis OR metaanalyses OR search* OR systematic:ti)
17	KQ3 Combined Set	#15 OR #16
18	KQs 1, 2, 3 Combined	#6 OR #13 OR #17
19	Remove out of scope age groups	#18 NOT (adolescen*:ti OR babies:ti OR baby:ti OR child*:ti OR fetal:ti OR foetal:ti OR infan*:ti OR neonat*:ti OR newborn*:ti OR nicu:ti OR nurser*:ti OR paediatric*:ti OR pediatric*:ti OR pubesc* OR pubert*:ti OR 'school age*:ti OR teen*:ti OR toddler*:ti OR young*:ti OR youth*:ti OR [embryo]/lim OR [fetus]/lim OR [newborn]/lim OR [infant]/lim OR [child]/lim OR [preschool]/lim OR [school]/lim OR [adolescent]/lim)
20	Remove Unwanted Publication Types	#19 NOT (abstract:nc OR annual:nc OR 'book'/exp OR 'case study'/exp OR conference:nc OR 'conference abstract':it OR 'conference paper'/exp OR 'conference paper':it OR 'conference proceeding':pt OR 'conference review':it OR congress:nc OR 'editorial'/exp OR editorial:it OR 'erratum'/exp OR letter:it OR 'note'/exp OR note:it OR meeting:nc OR sessions:nc OR 'short survey'/exp OR symposium:nc OR [conference abstract]/lim OR [conference paper]/lim OR [conference review]/lim OR [editorial]/lim OR [letter]/lim OR [note]/lim OR [short survey]/lim OR comment:ti OR book:pt OR 'case report'/de OR 'case report':ti OR 'a case':ti OR 'a patient':ti OR 'year old':ti,ab)
21	Pub Date	#20 AND [2000-2020]/py
Downloaded filenames:		
Save search name:		