

Perioperative care in adults

[G] Evidence review for nutritional screening in preoperative assessment

NICE guideline NG180

Evidence reviews underpinning recommendations 1.3.10 and 1.3.11 in the NICE guideline

August 2020

Final

*This evidence review was developed by
the National Guideline Centre*

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1 Nutritional screening

1.1 Review question: Does nutritional screening in preoperative assessment improve surgical outcome for adults?

1.2 Introduction

Surgery both planned and unplanned propagates a state of metabolic activation commonly referred to as the surgical stress response. The extent of stress response directly links to the scale of the surgery trauma and is characterised by hormonal, haematological, metabolic and immunological changes. To meet these requirements the body has to mobilise its energy reserves to support metabolic activation, tissue repair and patient recovery.

It is well known that patients with low nutritional reserves, including those that are frail with reduced muscle content, may struggle to meet the demands of this increased metabolic stress induced by surgery and as a consequence may have more complications with a prolonged recovery period.

The purpose of the nutritional question for NICE perioperative guidance was to understand if nutritional screening in preoperative assessment could be demonstrated to improve surgical outcomes.

1.3 PICO table

For full details see the review protocol in appendix A.

Table 1: PICO characteristics of review question

Population	Adults 18 years and over having surgery.
Interventions	Nutritional screening in preoperative assessment, for example: <ul style="list-style-type: none"> • Malnutrition University Screening Tool (MUST) scoring • Nutritional Risk Screening 2002 • Mini Nutritional Assessment (MNA) • Albumin levels assessment • BMI (<20, >35) assessment
Comparisons	Standard care (no nutritional screening)
Outcomes	<p>Critical outcomes:</p> <ul style="list-style-type: none"> • health-related quality of life • mortality • patient, family and carer experience of care • adverse events and complications (Clavien-Dindo, postoperative morbidity score (POMS), respiratory complications, infection and sepsis, postoperative cardiac complications) <p>Important outcomes:</p> <ul style="list-style-type: none"> • length of hospital stay • unplanned ICU admission • ICU length of stay (planned and unplanned)
Study design	Randomised controlled trials (RCTs), systematic reviews of RCTs.

1.4 Clinical evidence

1.4.1 Included studies

No relevant clinical studies comparing preoperative nutritional screening with standard care were identified.

1.4.2 Excluded studies

1.5 Economic evidence

1.5.1 Included studies

No health economic studies were included.

1.5.2 Excluded studies

No relevant health economic studies were excluded due to assessment of limited applicability or methodological limitations.

See also the health economic study selection flow chart in Appendix G:.

1.6 Evidence statements

1.6.1 Clinical evidence statements

- No relevant published evidence was identified.

1.6.2 Health economic evidence statements

- No relevant economic evaluations were identified.

1.7 The committee's discussion of the evidence

Please see recommendations 1.3.10 – 1.3.11 in the guideline.

1.7.1 Interpreting the evidence

1.7.1.1 The outcomes that matter most

The committee agreed that patients with low nutritional reserves, including those that are frail with reduced muscle content, may struggle to meet the demands of this increased metabolic stress induced by surgery and as a consequence may have more complications with a prolonged recovery period. The committee considered that critical outcomes for decision making should be health-related quality of life, mortality, patient, family and carer experience of care, adverse events and complications. The committee also considered length of hospital stay, unplanned ICU admission and ICU length of stay to be important outcomes.

No evidence was identified for any of the outcomes.

1.7.1.2 The quality of the evidence

No evidence was identified.

1.7.1.3 Benefits and harms

No clinical evidence was identified.

The committee noted that nutritional assessment aims to identifying people who may be at nutritional risk, and who may benefit from appropriate nutritional intervention. Surgical patients are at risk of malnutrition in the perioperative period for a range of reasons including: inadequate access to nutrition whilst hospitalised, and surgery itself can lead to significant metabolic stress. Nutritional deficiency contributes to reduced physiological resilience which is associated with increased complications and perioperative mortality. Similarly, over-nutrition should be identified in the perioperative period as a significant proportion of patients suffer with obesity which is associated with increased perioperative risk and post-operative complications as well as medical comorbid sequelae of the condition.

1.7.2 Cost effectiveness and resource use

No economic evaluations were identified for this question.

There are no costs associated with nutritional screening as it is conducted during a preoperative assessment and it is standard practice to measure a patient's nutritional status, using a validated screening tool, for example Malnutrition Universal Screening Tool (MUST). It is likely that conducting nutritional screening can result in downstream costs because it can lead to certain interventions before surgery. For example, an adult may be referred to a dietician or receive supplement drinks prior to undergoing surgery. Although these may result in additional costs, the committee acknowledged that assessing an adult's nutritional status and referring them to receive the correct interventions can lead to better surgical outcomes. Therefore, these interventions could reduce complications and reduce length of stay which would result in downstream savings.

The committee made a consensus recommendation to offer preoperative nutritional screening for patients undergoing intermediate, major or complex surgery. The committee acknowledged that the recommendations would not lead to a substantial resource impact as nutritional screening is already undertaken in current practice.

1.7.3 Other factors the committee took into account

The committee noted that nutritional risk assessment is current practice before intermediate, major or complex surgery. The committee highlighted that nutritional assessment linked to improved nutrition prior to surgery has been linked to reduced length of hospital stay and increase patient satisfaction. A deterioration in nutritional state adversely affect outcomes such as infection, multiple organ dysfunction, wound healing and functional recovery. It was outside of the scope of this guideline to comment on how to treat improper preoperative nutrition, but agreed that preoperative assessment was necessary. The committee also noted the common challenge of insufficient time between nutritional assessment and planned surgery to significantly improve any nutritional markers.

The committee referred to guidance given in the NICE guideline on Nutrition Support for the management of poor preoperative nutrition.

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Appendices

Appendix A: Review protocols

Table 2: Review protocol: Nutritional screening in preoperative assessment

ID	Field	Content
0.	PROSPERO registration number	Not registered on PROSPERO
1.	Review title	Does nutritional screening in preoperative assessment improve surgical outcome for adults?
2.	Review question	Does nutritional screening in preoperative assessment improve surgical outcome for adults?
3.	Objective	To determine whether nutritional screening in preoperative assessment improves surgical outcome for adults.
4.	Searches	<ul style="list-style-type: none"> • Cochrane Central Register of Controlled Trials (CENTRAL) • Cochrane Database of Systematic Reviews (CDSR) • MEDLINE • Embase • Epistemonikos <p>The searches may be re-run 6 weeks before the final committee meeting and further studies retrieved for inclusion if relevant.</p> <p>The full search strategies will be published in the final review.</p>
5.	Condition or domain being studied	Perioperative care
6.	Population	<p>Inclusion: Adults 18 years and over having surgery.</p> <p>Exclusion:</p> <ul style="list-style-type: none"> • children and young people aged 17 years and younger • surgery for burns, traumatic brain injury or neurosurgery
7.	Intervention/Exposure/Test	<ul style="list-style-type: none"> • nutritional screening in preoperative assessment (for example Malnutrition University Screening Tool (MUST) scoring; Nutritional Risk Screening 2002; Mini Nutritional Assessment (MNA); Albumin levels; BMI (<20, >35))

8.	Comparator/Reference standard/Confounding factors	<ul style="list-style-type: none"> • standard care (no nutritional screening)
9.	Types of study to be included	<p>Randomised controlled trials (RCTs), systematic reviews of RCTs.</p> <p>Observational studies if no RCT evidence is identified.</p>
10.	Other exclusion criteria	<p>Exclusions:</p> <ul style="list-style-type: none"> • non-English language studies • studies published before 2000
11.	Context	n/a
12.	Primary outcomes (critical outcomes)	<ul style="list-style-type: none"> • health-related quality of life • mortality • patient, family and carer experience of care • adverse events and complications (Clavien-Dindo, postoperative morbidity score (POMS), respiratory complications, infection and sepsis, postoperative cardiac complications) <p>The committee did not agree to on any established minimal clinically important differences, therefore the default MIDs will be used and any difference in mortality will be considered clinically important.</p>
13.	Secondary outcomes (important outcomes)	<ul style="list-style-type: none"> • length of hospital stay • unplanned ICU admission • ICU length of stay (planned and unplanned) <p>The committee did not agree to on any established minimal clinically important differences, therefore the default MIDs will be used and any difference in mortality will be considered clinically important.</p>
14.	Data extraction (selection and coding)	<p>EndNote will be used for reference management, sifting, citations and bibliographies. All references identified by the searches and from other sources will be screened for inclusion. 10% of the abstracts will be reviewed by two reviewers, with any disagreements resolved by discussion or, if necessary, a third independent reviewer. The full text of potentially eligible studies will be retrieved and will be assessed in line with the criteria outlined above.</p> <p>Data extractions performed using EviBase, a platform designed and maintained by the National Guideline Centre (NGC)</p>
15.	Risk of bias (quality) assessment	<p>Risk of bias will be assessed using the appropriate checklist as described in Developing NICE guidelines: the manual.</p> <ul style="list-style-type: none"> • Systematic reviews: Risk of Bias in

		<p>Systematic Reviews (ROBIS)</p> <ul style="list-style-type: none"> • Randomised Controlled Trial: Cochrane RoB (2.0) • Non randomised study, including cohort studies: Cochrane ROBINS-I • Case control study: CASP case control checklist • Controlled before-and-after study or Interrupted time series: Effective Practice and Organisation of Care (EPOC) RoB Tool • Cross sectional study: JBI checklist for cross sectional study • Case series: Institute of Health Economics (IHE) checklist for case series <p>10% of all evidence reviews are quality assured by a senior research fellow. This includes checking:</p> <ul style="list-style-type: none"> • papers were included /excluded appropriately • a sample of the data extractions • correct methods are used to synthesise data • a sample of the risk of bias assessments <p>Disagreements between the review authors over the risk of bias in particular studies will be resolved by discussion, with involvement of a third review author where necessary.</p>
16.	Strategy for data synthesis	<p>Pairwise meta-analyses will be performed using Cochrane Review Manager (RevMan5).</p> <p>GRADEpro will be used to assess the quality of evidence for each outcome, taking into account individual study quality and the meta-analysis results. The 4 main quality elements (risk of bias, indirectness, inconsistency and imprecision) will be appraised for each outcome. Publication bias is tested for when there are more than 5 studies for an outcome.</p> <p>The risk of bias across all available evidence was evaluated for each outcome using an adaptation of the 'Grading of Recommendations Assessment, Development and Evaluation (GRADE) toolbox' developed by the international GRADE working group http://www.gradeworkinggroup.org/</p> <ul style="list-style-type: none"> • Where meta-analysis is not possible, data will be presented and quality assessed individually per outcome. • CERQual will be used to synthesise data from qualitative studies. • WinBUGS will be used for network meta-analysis, if possible given the data identified.

		<ul style="list-style-type: none"> List any other software planned to be used. <p>Heterogeneity between the studies in effect measures will be assessed using the I² statistic and visually inspected. An I² value greater than 50% will be considered indicative of substantial heterogeneity. Sensitivity analyses will be conducted based on pre-specified subgroups using stratified meta-analysis to explore the heterogeneity in effect estimates. If this does not explain the heterogeneity, the results will be presented pooled using random-effects.</p>		
17.	Analysis of sub-groups	<p>Strata:</p> <ul style="list-style-type: none"> cancer surgery non-cancer surgery <p>Subgroups:</p> <ul style="list-style-type: none"> older adults (over 60) surgery grade based on NICE preoperative tests for elective surgery guideline categorisation American Society of Anesthesiologists (ASA) Physical Status grade 		
18.	Type and method of review	<input checked="" type="checkbox"/>	Intervention	
		<input type="checkbox"/>	Diagnostic	
		<input type="checkbox"/>	Prognostic	
		<input type="checkbox"/>	Qualitative	
		<input type="checkbox"/>	Epidemiologic	
		<input type="checkbox"/>	Service Delivery	
		<input type="checkbox"/>	Other (please specify)	
19.	Language	English		
20.	Country	England		
21.	Anticipated or actual start date	[To be added.]		
22.	Anticipated completion date	[To be added.]		
23.	Stage of review at time of this submission	Review stage	Started	Completed
		Preliminary searches	<input type="checkbox"/>	<input type="checkbox"/>
		Piloting of the study selection process	<input type="checkbox"/>	<input type="checkbox"/>
		Formal screening of search results against eligibility criteria	<input type="checkbox"/>	<input type="checkbox"/>
		Data extraction	<input type="checkbox"/>	<input type="checkbox"/>
		Risk of bias (quality)	<input type="checkbox"/>	<input type="checkbox"/>

		assessment		
		Data analysis	<input type="checkbox"/>	<input type="checkbox"/>
24.	Named contact	<p>5a. Named contact National Guideline Centre</p> <p>5b Named contact e-mail perioperativecare@nice.org.uk</p> <p>5e Organisational affiliation of the review National Institute for Health and Care Excellence (NICE) and the National Guideline Centre</p>		
25.	Review team members	<p>From the National Guideline Centre:</p> <p>Ms Kate Ashmore Ms Kate Kelley Ms Sharon Swain Mr Ben Mayer Ms Maria Smyth Mr Vimal Bedia Mr Audrius Stonkus Ms Madelaine Zucker Ms Margaret Constanti Ms Annabelle Davis Ms Lina Gulhane</p>		
26.	Funding sources/sponsor	<p>This systematic review is being completed by the National Guideline Centre which receives funding from NICE.</p>		
27.	Conflicts of interest	<p>All guideline committee members and anyone who has direct input into NICE guidelines (including the evidence review team and expert witnesses) must declare any potential conflicts of interest in line with NICE's code of practice for declaring and dealing with conflicts of interest. Any relevant interests, or changes to interests, will also be declared publicly at the start of each guideline committee meeting. Before each meeting, any potential conflicts of interest will be considered by the guideline committee Chair and a senior member of the development team. Any decisions to exclude a person from all or part of a meeting will be documented. Any changes to a member's declaration of interests will be recorded in the minutes of the meeting. Declarations of interests will be published with the final guideline.</p>		

28.	Collaborators	Development of this systematic review will be overseen by an advisory committee who will use the review to inform the development of evidence-based recommendations in line with section 3 of <u>Developing NICE guidelines: the manual</u> . Members of the guideline committee are available on the NICE website.	
29.	Other registration details	n/a	
30.	Reference/URL for published protocol	n/a	
31.	Dissemination plans	<p>NICE may use a range of different methods to raise awareness of the guideline. These include standard approaches such as:</p> <ul style="list-style-type: none"> • notifying registered stakeholders of publication • publicising the guideline through NICE's newsletter and alerts • issuing a press release or briefing as appropriate, posting news articles on the NICE website, using social media channels, and publicising the guideline within NICE. 	
32.	Keywords	Perioperative care, preoperative, nutrition, screening	
33.	Details of existing review of same topic by same authors	n/a	
34.	Current review status	<input type="checkbox"/>	Ongoing
		<input type="checkbox"/>	Completed but not published
		<input type="checkbox"/>	Completed and published
		<input type="checkbox"/>	Completed, published and being updated
		<input type="checkbox"/>	Discontinued
35..	Additional information	n/a	
36.	Details of final publication	www.nice.org.uk	

Table 3: Health economic review protocol

Review question	All questions – health economic evidence
Objectives	To identify health economic studies relevant to any of the review questions.
Search criteria	<ul style="list-style-type: none"> • Populations, interventions and comparators must be as specified in the clinical review protocol above. • Studies must be of a relevant health economic study design (cost–utility analysis, cost-effectiveness analysis, cost–benefit analysis, cost–consequences analysis, comparative cost analysis). • Studies must not be a letter, editorial or commentary, or a review of health economic evaluations. (Recent reviews will be ordered although not reviewed. The bibliographies will be checked for relevant studies, which will then be ordered.) • Unpublished reports will not be considered unless submitted as part of a call for evidence. • Studies must be in English.
Search strategy	A health economic study search will be undertaken using population-specific terms and a health economic study filter – see appendix B below.
Review strategy	<p>Studies not meeting any of the search criteria above will be excluded. Studies published before 2003, abstract-only studies and studies from non-OECD countries or the USA will also be excluded.</p> <p>Each remaining study will be assessed for applicability and methodological limitations using the NICE economic evaluation checklist which can be found in appendix H of Developing NICE guidelines: the manual (2014).¹⁵</p> <p>Inclusion and exclusion criteria</p> <ul style="list-style-type: none"> • If a study is rated as both ‘Directly applicable’ and with ‘Minor limitations’ then it will be included in the guideline. A health economic evidence table will be completed and it will be included in the health economic evidence profile. • If a study is rated as either ‘Not applicable’ or with ‘Very serious limitations’ then it will usually be excluded from the guideline. If it is excluded then a health economic evidence table will not be completed and it will not be included in the health economic evidence profile. • If a study is rated as ‘Partially applicable’, with ‘Potentially serious limitations’ or both then there is discretion over whether it should be included. <p>Where there is discretion</p> <p>The health economist will make a decision based on the relative applicability and quality of the available evidence for that question, in discussion with the guideline committee if required. The ultimate aim is to include health economic studies that are helpful for decision-making in the context of the guideline and the current NHS setting. If several studies are considered of sufficiently high applicability and methodological quality that they could all be included, then the health economist, in discussion with the committee if required, may decide to include only the most applicable studies and to selectively exclude the remaining studies. All studies excluded on the basis of applicability or methodological limitations will be listed with explanation in the excluded health economic studies appendix below.</p> <p>The health economist will be guided by the following hierarchies.</p> <p><i>Setting:</i></p> <ul style="list-style-type: none"> • UK NHS (most applicable). • OECD countries with predominantly public health insurance systems (for example, France, Germany, Sweden). • OECD countries with predominantly private health insurance systems (for example, Switzerland).

- Studies set in non-OECD countries or in the USA will be excluded before being assessed for applicability and methodological limitations.

Health economic study type:

- Cost–utility analysis (most applicable).
- Other type of full economic evaluation (cost–benefit analysis, cost-effectiveness analysis, cost–consequences analysis).
- Comparative cost analysis.
- Non-comparative cost analyses including cost-of-illness studies will be excluded before being assessed for applicability and methodological limitations.

Year of analysis:

- The more recent the study, the more applicable it will be.
- Studies published in 2003 or later but that depend on unit costs and resource data entirely or predominantly from before 2003 will be rated as ‘Not applicable’.
- Studies published before 2003 will be excluded before being assessed for applicability and methodological limitations.

Quality and relevance of effectiveness data used in the health economic analysis:

- The more closely the clinical effectiveness data used in the health economic analysis match with the outcomes of the studies included in the clinical review the more useful the analysis will be for decision-making in the guideline. For example, economic evaluations based on observational studies will be excluded, when the clinical review is only looking for RCTs,

Appendix B: Literature search strategies

The literature searches for this review are detailed below and complied with the methodology outlined in Developing NICE guidelines: the manual 2014, updated 2018.¹⁵

For more detailed information, please see the Methodology Review.

B.1 Clinical search literature search strategy

Searches were constructed using a PICO framework where population (P) terms were combined with Intervention (I) and in some cases Comparison (C) terms. Outcomes (O) are rarely used in search strategies for interventions as these concepts may not be well described in title, abstract or indexes and therefore difficult to retrieve. Search filters were applied to the search where appropriate.

Table 4: Database date parameters and filters used

Database	Dates searched	Search filter used
Medline (OVID)	1946 – 30 May 2019	Exclusions Randomised controlled trials Systematic review studies
Embase (OVID)	1974 – 30 May 2019	Exclusions Randomised controlled trials Systematic review studies
The Cochrane Library (Wiley)	Cochrane Reviews to 2019 Issue 5 of 12 CENTRAL to 2019 Issue 5 of 12 DARE, and NHSEED to 2015 Issue 2 of 4 HTA to 2016 Issue 4 of 4	None
Epistemonikos (Epistemonikos Foundation)	Inception - 10 May 2019	Systematic review studies

Medline (Ovid) search terms

1.	exp Preoperative Care/ or Preoperative Period/
2.	(pre-operat* or preoperat* or pre-surg* or presurg*).ti,ab.
3.	((before or prior or advance or pre or prepar*) adj3 (surg* or operat* or anaesthes* or anesthes*)).ti,ab.
4.	or/1-3
5.	limit 4 to English language
6.	(exp child/ or exp pediatrics/ or exp infant/) not (exp adolescent/ or exp adult/ or exp middle age/ or exp aged/)
7.	5 not 6
8.	letter/
9.	editorial/
10.	news/
11.	exp historical article/
12.	Anecdotes as Topic/
13.	comment/
14.	case report/
15.	(letter or comment*).ti.

16.	or/8-15
17.	randomized controlled trial/ or random*.ti,ab.
18.	16 not 17
19.	animals/ not humans/
20.	exp Animals, Laboratory/
21.	exp Animal Experimentation/
22.	exp Models, Animal/
23.	exp Rodentia/
24.	(rat or rats or mouse or mice).ti.
25.	or/18-24
26.	7 not 25
27.	nutrition assessment/
28.	Nutritional Status/
29.	Serum Albumin/
30.	body mass index/
31.	((nutrition* or malnutrition* or malnourish* or undernourish* or under nourish* or undernutrition*) adj5 (screen* or assess* or status or exam* or index* or indices or survey* or questionnaire* or marker* or tool*)).ti,ab.
32.	(albumin* or prealbumin*).ti,ab.
33.	((body mass index or Quetelet*or BMI) adj6 (screen* or assess* or status or exam*)).ti,ab.
34.	Decision Support Techniques/
35.	((score* or scoring or stratif*) adj3 (system* or schem* or tool*)).ti,ab.
36.	or/27-35
37.	26 and 36
38.	randomized controlled trial.pt.
39.	controlled clinical trial.pt.
40.	randomi#ed.ab.
41.	placebo.ab.
42.	randomly.ab.
43.	clinical trials as topic.sh.
44.	trial.ti.
45.	or/38-44
46.	Meta-Analysis/
47.	Meta-Analysis as Topic/
48.	(meta analy* or metanaly* or metaanaly* or meta regression).ti,ab.
49.	((systematic* or evidence*) adj3 (review* or overview*)).ti,ab.
50.	(reference list* or bibliograph* or hand search* or manual search* or relevant journals).ab.
51.	(search strategy or search criteria or systematic search or study selection or data extraction).ab.
52.	(search* adj4 literature).ab.
53.	(medline or pubmed or cochrane or embase or psychlit or psyclit or psychinfo or psycinfo or cinahl or science citation index or bids or cancerlit).ab.
54.	cochrane.jw.
55.	((multiple treatment* or indirect or mixed) adj2 comparison*).ti,ab.
56.	or/46-55

57.	37 and (45 or 56)
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Embase (Ovid) search terms

1.	*preoperative care/ or *preoperative period/
2.	(pre-operat* or preoperat* or pre-surg* or presurg*).ti,ab.
3.	((before or prior or advance or pre or prepar*) adj3 (surg* or operat* or anaesthes* or anesthes*)).ti,ab.
4.	or/1-3
5.	limit 4 to English language
6.	(exp child/ or exp pediatrics/ or exp infant/) not (exp adolescent/ or exp adult/ or exp middle age/ or exp aged/)
7.	5 not 6
8.	letter.pt. or letter/
9.	note.pt.
10.	editorial.pt.
11.	case report/ or case study/
12.	(letter or comment*).ti.
13.	or/8-12
14.	randomized controlled trial/ or random*.ti,ab.
15.	13 not 14
16.	animal/ not human/
17.	nonhuman/
18.	exp Animal Experiment/
19.	exp Experimental Animal/
20.	animal model/
21.	exp Rodent/
22.	(rat or rats or mouse or mice).ti.
23.	or/15-22
24.	7 not 23
25.	nutritional assessment/
26.	nutritional status/
27.	serum albumin/
28.	*body mass/
29.	((nutrition* or malnutrition* or malnourish* or undernourish* or under nourish* or undernutrition*) adj5 (screen* or assess* or status or exam* or index* or indices or survey* or questionnaire* or marker* or tool*)).ti,ab.
30.	(albumin* or prealbumin*).ti,ab.
31.	((body mass index or Quetelet* or BMI) adj6 (screen* or assess* or status or exam*)).ti,ab.
32.	decision support system/
33.	((score* or scoring or stratif*) adj3 (system* or schem* or tool*)).ti,ab.
34.	or/25-33
35.	24 and 34
36.	random*.ti,ab.
37.	factorial*.ti,ab.
38.	(crossover* or cross over*).ti,ab.
39.	((doubl* or singl*) adj blind*).ti,ab.

40.	(assign* or allocat* or volunteer* or placebo*).ti,ab.
41.	crossover procedure/
42.	single blind procedure/
43.	randomized controlled trial/
44.	double blind procedure/
45.	or/36-44
46.	systematic review/
47.	Meta-Analysis/
48.	(meta analy* or metanaly* or metaanaly* or meta regression).ti,ab.
49.	((systematic* or evidence*) adj3 (review* or overview*)).ti,ab.
50.	(reference list* or bibliograph* or hand search* or manual search* or relevant journals).ab.
51.	(search strategy or search criteria or systematic search or study selection or data extraction).ab.
52.	(search* adj4 literature).ab.
53.	(medline or pubmed or cochrane or embase or psychlit or psyclit or psychinfo or psycinfo or cinahl or science citation index or bids or cancerlit).ab.
54.	cochrane.jw.
55.	((multiple treatment* or indirect or mixed) adj2 comparison*).ti,ab.
56.	or/46-55
57.	35 and (45 or 56)

Cochrane Library (Wiley) search terms

#1.	MeSH descriptor: [Preoperative Care] this term only
#2.	MeSH descriptor: [Preoperative Period] this term only
#3.	MeSH descriptor: [Perioperative Nursing] this term only
#4.	(pre-operative* or preoperative* or preop* or pre-op* or pre-surg* or presurg*):ti,ab
#5.	(before or prior or advance) near/3 (surg* or operat* or anaesthes* or anesthes*):ti,ab
#6.	(or #1-#5)
#7.	MeSH descriptor: [Nutrition Assessment] this term only
#8.	MeSH descriptor: [Nutritional Status] this term only
#9.	MeSH descriptor: [Serum Albumin] this term only
#10.	MeSH descriptor: [Body Mass Index] this term only
#11.	((nutrition* or malnutrition* or malnourish* or undernourish* or under nourish* or undernutrition*) near/5 (screen* or assess* or status or exam* or index* or indices or survey* or questionnaire* or marker* or tool*)):ti,ab
#12.	(albumin* or prealbumin*):ti,ab
#13.	((body mass index or Quetelet*or BMI) near/6 (screen* or assess* or status or exam*)):ti,ab
#14.	MeSH descriptor: [Decision Support Techniques] this term only
#15.	((score* or scoring or stratif*) near/3 (system* or schem* or tool*)):ti,ab
#16.	(or #7-#15)
#17.	#6 and #16

Epistemonikos (Epistemonikos Foundation) search terms

1.	(advanced_title_en:((pre-operative* OR preoperative* OR preop* OR pre-op* OR pre-surg* OR presurg*) AND (nutrition* OR malnutrition* OR malnourish* OR undernourish* OR under nourish* OR undernutrition* OR MNA OR MUST)) OR advanced_abstract_en:((pre-operative* OR preoperative* OR preop* OR pre-op* OR pre-surg* OR presurg*) AND (nutrition* OR malnutrition* OR malnourish* OR undernourish* OR under nourish* OR undernutrition* OR MNA OR MUST))) [Filters: classification=systematic-review, protocol=no]
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B.2 Health Economics literature search strategy

Health economic evidence was identified by conducting a broad search relating to the perioperative care population in NHS Economic Evaluation Database (NHS EED – this ceased to be updated after March 2015) and the Health Technology Assessment database (HTA) with no date restrictions. NHS EED and HTA databases are hosted by the Centre for Research and Dissemination (CRD). Additional health economics searches were run on Medline and Embase.

Table 5: Database date parameters and filters used

Database	Dates searched	Search filter used
Medline	2014 – 30 May 2019	Exclusions Health economics studies
Embase	2014 – 30 May 2019	Exclusions Health economics studies
Centre for Research and Dissemination (CRD)	HTA - Inception – 02 May 2019 NHSEED - Inception to 02 May 2019	None

Medline (Ovid) search terms

1.	exp Preoperative Care/ or exp Perioperative Care/ or exp Perioperative Period/ or exp Perioperative Nursing/
2.	((pre-operative* or preoperative* or preop* or pre-op* or pre-surg* or presurg*) adj3 (care* or caring or treat* or nurs* or monitor* or recover* or medicine)).ti,ab.
3.	((perioperative* or peri-operative* or intraoperative* or intra-operative* or intrasurg* or intra-surg* or peroperat* or per-operat*) adj3 (care* or caring or treat* or nurs* or monitor* or recover* or medicine)).ti,ab.
4.	((postoperative* or postop* or post-op* or post-surg* or postsurg*) adj3 (care* or caring or treat* or nurs* or monitor* or recover* or medicine)).ti,ab.
5.	((care* or caring or treat* or nurs* or recover* or monitor*) adj3 (before or prior or advance or during or after) adj3 (surg* or operat* or anaesthes* or anesthes*)).ti,ab.
6.	1 or 2 or 3 or 4 or 5
7.	(intraoperative* or intra-operative* or intrasurg* or intra-surg* or peroperat* or per-operat* or perioperat* or peri-operat*).ti,ab.
8.	((during or duration) adj3 (surg* or operat* or anaesthes* or anesthes*)).ti,ab.
9.	7 or 8
10.	postoperative care/ or exp Postoperative Period/ or exp Perioperative nursing/
11.	(postop* or post-op* or post-surg* or postsurg* or perioperat* or peri-operat*).ti,ab.
12.	(after adj3 (surg* or operat* or anaesthes* or anesthes*)).ti,ab.
13.	(post adj3 (operat* or anaesthes* or anesthes*)).ti,ab.
14.	10 or 11 or 12 or 13

15.	exp Preoperative Care/ or Preoperative Period/
16.	(pre-operat* or preoperat* or pre-surg* or presurg*).ti,ab.
17.	((before or prior or advance or pre or prepar*) adj3 (surg* or operat* or anaesthes* or anesthes*)).ti,ab.
18.	15 or 16 or 17
19.	6 or 9 or 14 or 18
20.	letter/
21.	editorial/
22.	news/
23.	exp historical article/
24.	Anecdotes as Topic/
25.	comment/
26.	case report/
27.	(letter or comment*).ti.
28.	or/20-27
29.	randomized controlled trial/ or random*.ti,ab.
30.	28 not 29
31.	animals/ not humans/
32.	exp Animals, Laboratory/
33.	exp Animal Experimentation/
34.	exp Models, Animal/
35.	exp Rodentia/
36.	(rat or rats or mouse or mice).ti.
37.	or/30-36
38.	19 not 37
39.	limit 38 to English language
40.	(exp child/ or exp pediatrics/ or exp infant/) not (exp adolescent/ or exp adult/ or exp middle age/ or exp aged/)
41.	39 not 40
42.	economics/
43.	value of life/
44.	exp "costs and cost analysis"/
45.	exp Economics, Hospital/
46.	exp Economics, medical/
47.	Economics, nursing/
48.	economics, pharmaceutical/
49.	exp "Fees and Charges"/
50.	exp budgets/
51.	budget*.ti,ab.
52.	cost*.ti.
53.	(economic* or pharmaco?economic*).ti.
54.	(price* or pricing*).ti,ab.
55.	(cost* adj2 (effectiv* or utilit* or benefit* or minimi* or unit* or estimat* or variable*)).ab.
56.	(financ* or fee or fees).ti,ab.
57.	(value adj2 (money or monetary)).ti,ab.
58.	or/42-57

59.	41 and 58
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Embase (Ovid) search terms

1.	*preoperative period/ or *intraoperative period/ or *postoperative period/ or *perioperative nursing/ or *surgical patient/
2.	((pre-operative* or preoperative* or preop* or pre-op* or pre-surg* or presurg*) adj3 (care* or caring or treat* or nurs* or monitor* or recover* or medicine)).ti,ab.
3.	((perioperative* or peri-operative* or intraoperative* or intra-operative* or intrasurg* or intra-surg* or peroperat* or per-operat*) adj3 (care* or caring or treat* or nurs* or monitor* or recover* or medicine)).ti,ab.
4.	((care* or caring or treat* or nurs* or recover* or monitor*) adj3 (before or prior or advance or during or after) adj3 (surg* or operat* or anaesthes* or anesthes*)).ti,ab.
5.	1 or 2 or 3 or 4
6.	peroperative care/ or exp peroperative care/ or exp perioperative nursing/
7.	(intraoperative* or intra-operative* or intrasurg* or intra-surg* or peroperat* or per-operat* or perioperat* or peri-operat*).ti,ab.
8.	((during or duration) adj3 (surg* or operat* or anaesthes* or anesthes*)).ti,ab.
9.	6 or 7 or 8
10.	postoperative care/ or exp postoperative period/ or perioperative nursing/
11.	(postop* or post-op* or post-surg* or postsurg* or perioperat* or peri-operat*).ti,ab.
12.	(after adj3 (surg* or operat* or anaesthes* or anesthes*)).ti,ab.
13.	(post adj3 (operat* or anaesthes* or anesthes*)).ti,ab.
14.	10 or 11 or 12 or 13
15.	exp preoperative care/ or preoperative period/
16.	(pre-operat* or preoperat* or pre-surg* or presurg*).ti,ab.
17.	((before or prior or advance or pre or prepar*) adj3 (surg* or operat* or anaesthes* or anesthes*)).ti,ab.
18.	15 or 16 or 17
19.	5 or 9 or 14 or 18
20.	letter.pt. or letter/
21.	note.pt.
22.	editorial.pt.
23.	case report/ or case study/
24.	(letter or comment*).ti.
25.	or/20-24
26.	randomized controlled trial/ or random*.ti,ab.
27.	25 not 26
28.	animal/ not human/
29.	nonhuman/
30.	exp Animal Experiment/
31.	exp Experimental Animal/
32.	animal model/
33.	exp Rodent/
34.	(rat or rats or mouse or mice).ti.

35.	or/27-34
36.	19 not 35
37.	limit 36 to English language
38.	(exp child/ or exp pediatrics/) not (exp adult/ or exp adolescent/)
39.	37 not 38
40.	health economics/
41.	exp economic evaluation/
42.	exp health care cost/
43.	exp fee/
44.	budget/
45.	funding/
46.	budget*.ti,ab.
47.	cost*.ti.
48.	(economic* or pharmaco?economic*).ti.
49.	(price* or pricing*).ti,ab.
50.	(cost* adj2 (effectiv* or utilit* or benefit* or minimi* or unit* or estimat* or variable*)).ab.
51.	(financ* or fee or fees).ti,ab.
52.	(value adj2 (money or monetary)).ti,ab.
53.	or/40-52
54.	39 and 53

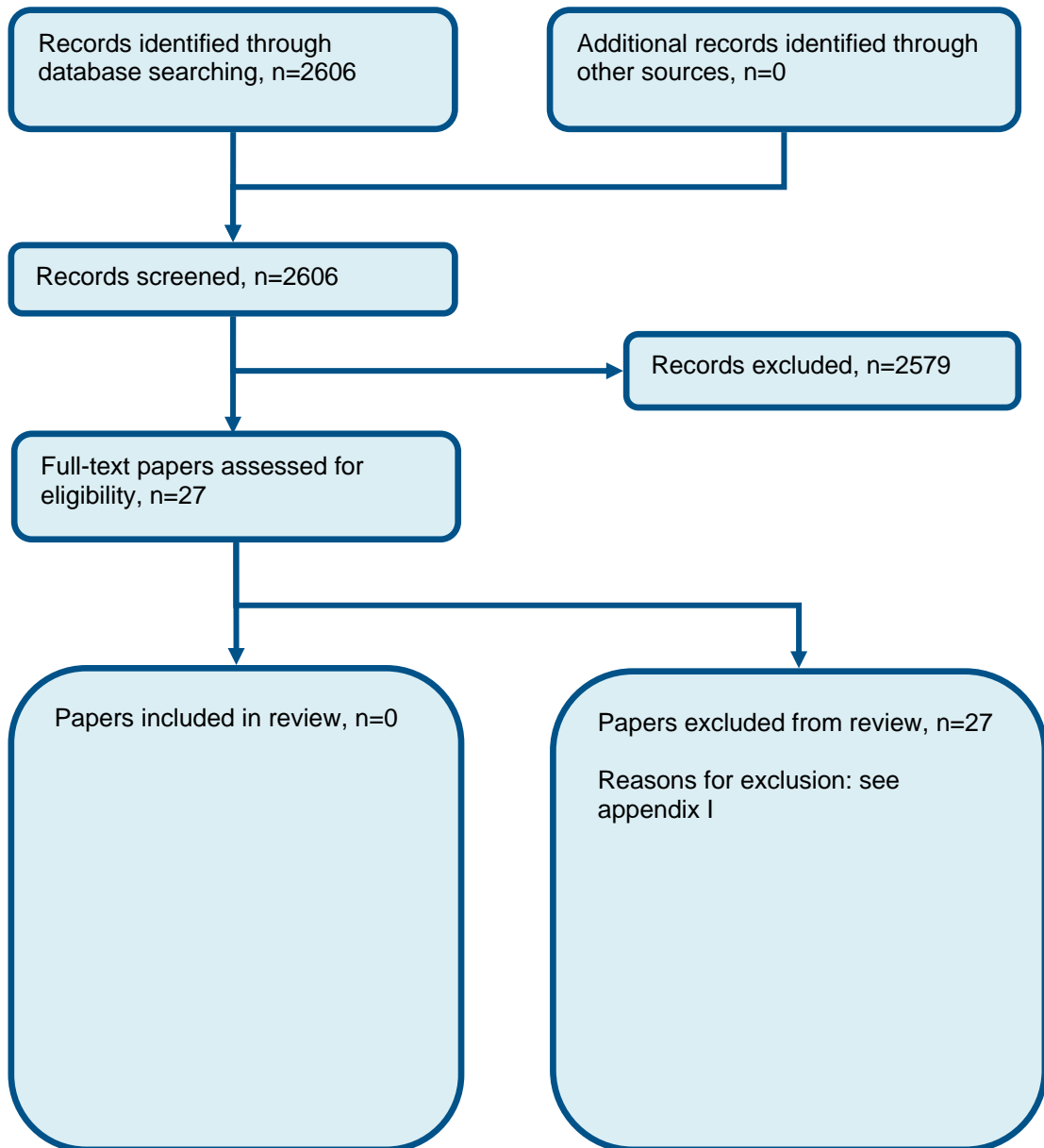
NHS EED and HTA (CRD) search terms

#1.	MeSH DESCRIPTOR Preoperative Care EXPLODE ALL TREES
#2.	MeSH DESCRIPTOR Perioperative Care EXPLODE ALL TREES
#3.	MeSH DESCRIPTOR Perioperative Period EXPLODE ALL TREES
#4.	MeSH DESCRIPTOR Perioperative Nursing EXPLODE ALL TREES
#5.	((perioperative* or peri-operative* or intraoperative* or intra-operative* or intrasurg* or intra-surg* or peroperat* or per-operat*) adj3 (care* or caring or treat* or nurs* or monitor* or recover* or medicine))
#6.	((care* or caring or treat* or nurs* or recover* or monitor*) adj3 (before or prior or advance or during or after) adj3 (surg* or operat* or anaesthes* or anesthes*))
#7.	((pre-operative* or preoperative* or preop* or pre-op* or pre-surg* or presurg*) adj3 (care* or caring or treat* or nurs* or monitor* or recover* or medicine))
#8.	((postoperative* or postop* or post-op* or post-surg* or postsurg*) adj3 (care* or caring or treat* or nurs* or monitor* or recover* or medicine))
#9.	#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8
#10.	(* IN HTA)
#11.	(* IN NHSEED)
#12.	#9 AND #10
#13.	#9 AND #11
#14.	MeSH DESCRIPTOR Intraoperative Care EXPLODE ALL TREES
#15.	#1 OR #2 OR #3 OR #4 OR #14
#16.	((intraoperative* or intra-operative* or intrasurg* or intra-surg* or peroperat* or per-operat* or perioperat* or peri-operat*))
#17.	((during or duration) adj3 (surg* or operat* or anaesthes* or anesthes*))

#18.	((postop* or post-op* or post-surg* or postsurg* or perioperat* or peri-operat*))
#19.	((after adj3 (surg* or operat* or anaesthes* or anesthes*)))
#20.	((post adj3 (operat* or anaesthes* or anesthes*)))
#21.	((pre-operat* or preoperat* or pre-surg* or presurg*))
#22.	((((before or prior or advance or pre or prepar*) adj3 (surg* or operat* or anaesthes* or anesthes*)))
#23.	#15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22
#24.	#10 AND #23
#25.	#11 AND #23
#26.	#12 OR #13 OR #24 OR #25

Appendix C: Clinical evidence selection

Figure 1: Flow chart of clinical study selection for the review of nutritional screening in preoperative assessment



Appendix D: Clinical evidence tables

No studies were identified.

Appendix E: Forest plots

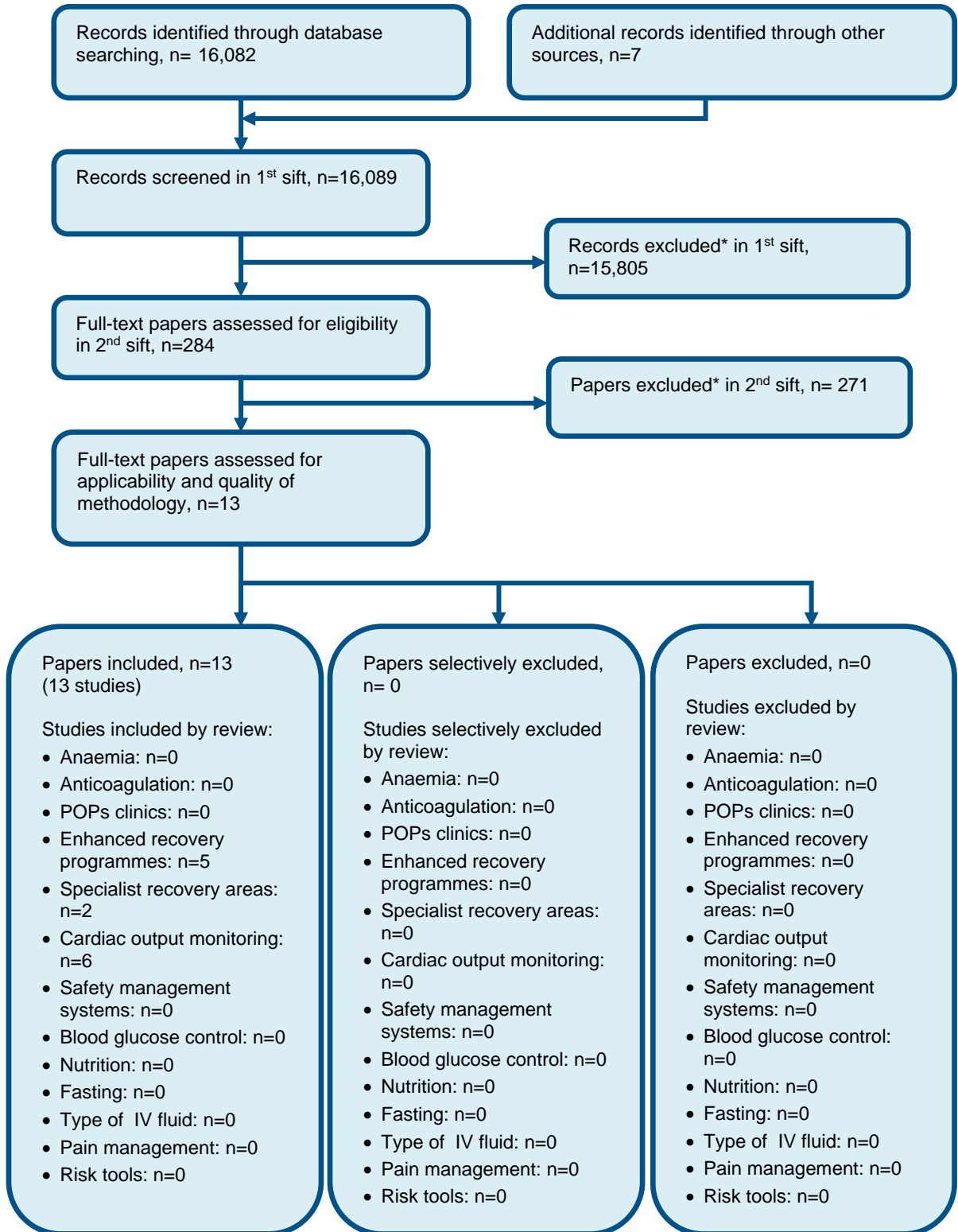
No studies were identified.

Appendix F: GRADE tables

No studies were identified.

Appendix G: Health economic evidence selection

Figure 2: Flow chart of health economic study selection for the guideline



* Non-relevant population, intervention, comparison, design or setting; non-English language

Appendix H: Health economic evidence tables

None.

Appendix I: Excluded studies

I.1 Excluded clinical studies

Table 6: Studies excluded from the clinical review

Reference	Reason for exclusion
Benoit 2016 ¹	Inappropriate comparison
Dubhashi 2012 ²	Inappropriate study design
Dupuis 2017 ³	Inappropriate study design
Fu 2016 ⁴	Inappropriate study design
Ge 2018 ⁵	Inappropriate systematic review: not relevant PICO
Grass 2013 ⁶	Inappropriate Citation only
Grass 2015 ⁷	Inappropriate study design
Gustafsson 2011 ⁸	Inappropriate study design
Hakonsen 2013 ⁹	Inappropriate Study design
Hall 2006 ¹⁰	Inappropriate study design
He 2017 ¹¹	Inappropriate systematic review: not relevant PICO
Kokudo 2016 ¹²	Inappropriate Citation only
Liu 2018 ¹³	Inappropriate systematic review: not relevant PICO
Lomivorotov 2013 ¹⁴	Inappropriate study design
Nct 2018 ¹⁶	Inappropriate Trial registry record
Osipov 2015 ¹⁷	Inappropriate Citation only
Perry 2016 ¹⁸	Inappropriate Citation only
Probst 2015 ¹⁹	Inappropriate Citation only
Pronio 2008 ²⁰	Inappropriate Not in English
Schwartzbaum 1999 ²¹	Inappropriate study design
Smale 1981 ²²	Inappropriate comparison
Sun 2015 ²³	Inappropriate systematic review: not relevant PICO
Tratsyak 2016 ²⁴	Inappropriate Citation only
van Wissen 2016 ²⁵	Inappropriate study design
Wang 2015 ²⁶	Inappropriate intervention
Yoshida 2016 ²⁷	Inappropriate study design
Zhang 2012 ²⁸	Inappropriate study design

I.2 Excluded health economic studies

Published health economic studies that met the inclusion criteria (relevant population, comparators, economic study design, published 2003 or later and not from non-OECD country or USA) but that were excluded following appraisal of applicability and methodological quality are listed below. See the health economic protocol for more details.

Table 7: Studies excluded from the health economic review

Reference	Reason for exclusion
None	