National Institute for Health and Care Excellence

Final

Perioperative care in adults

[D] Evidence review for preoperative optimisation clinics in older adults

NICE guideline NG180

Evidence review underpinning recommendation 1.3.3 in the NICE guideline

August 2020

Final

This evidence review was developed by the National Guideline Centre

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1 Preoperative optimisation

1.1 Review question: What is the clinical and cost effectiveness of preoperative optimisation clinics for older people?

1.2 Introduction

Large numbers of elective surgical procedures are conducted across the United Kingdom each year. The majority of patients undergoing these procedures have some form of preoperative assessment, however, there is variation in the way that this is delivered across the country. The traditional approach of admitting the patient the night before surgery for assessment is now infrequent. Instead, patients are assessed weeks in advance of surgery, in preoperative assessment clinics, usually staffed by dedicated teams of nurses and supported by anaesthetists, with occasional involvement of other allied health professionals. However, the focus in these clinics remains on ensuring the patient is 'fit for surgery', rather than taking the opportunity to optimise the patient, ensure shared decision making and develop an individualised perioperative plan. Recognition of deficits in these routine pathways of care has led to the development of new models of care; Enhanced Recovery after Surgery (ERAS) and 'Perioperative medicine for Older Patients undergoing Surgery' (POPS). ERAS employs a standardised approach to preoperative, intraoperative and postoperative care, whilst POPS delivers care throughout the surgical pathway underpinned by comprehensive geriatric assessment and optimisation methodology.

In this section, the value of these 'enhanced' preoperative optimisation services, in terms of quality of care and cost, is examined.

1.3 PICO table

For full details see the review protocol in appendix A.

Table 1: PICO characteristics of review question

Population	Older people aged 60 years and over having surgery.
Intervention	Preoperative optimisation clinics (including proactive care of older people going to have surgery (POPS) clinics)
Comparison	Standard preoperative assessment
Outcomes	Critical outcomes: • health-related quality of life • mortality • patient, family and carer experience of care • adverse events and complications (Clavien-Dindo, postoperative morbidity score (POMS)) • length of hospital stay (total pre and postoperative) Important outcomes: • unplanned intensive care unit admission • length of stay in intensive care unit • hospital readmission
Study design	Randomised controlled trials (RCTs), systematic reviews of RCTs. Observational studies if no RCT evidence is identified.

1.4 Clinical evidence

1.4.1 Included studies

Three randomised controlled trials were included in the review;[20, 26, 28] these are summarised in Table 2 below. Evidence from these studies is summarised in the clinical evidence summary below (Table 3).

See also the study selection flow chart in appendix C, study evidence tables in appendix D, forest plots in appendix E and GRADE tables in appendix F.

1.4.2 Excluded studies

See the excluded studies list in appendix I.

1.4.3 Summary of clinical studies included in the evidence review

Table 2: Summary of studies included in the evidence review

Study	Intervention and comparison	Population	Outcomes	Comments
Macpherson 1994[20]	**Outpatient appointment:** Received appointment at the Medical Preoperative Evaluation Clinic, seen within 3 weeks of scheduled admission for surgery. Preoperative laboratory and radiology screening obtained at visit, standard set of preoperative tests ordered. Patients who required medical interventions of special testing before surgery could be seen for additional appointments. Patients in whom internal medicine follow-up was believed to be necessary while an inpatient were seen by the general medical consultation service. n=176 **Usual care**: Admitted as scheduled. Internal medicine evaluation could be requested by the surgeon through the hospitals general medical consultation service. The same standards for preoperative testing were used for this group.	Veterans aged <50 years who were referred from a surgeon for internal medicine evaluation before scheduled surgery. Mean age (SD): 65.5 (6.7) USA	• Length of hospital stay • Patient experience of care	Pre-op assessment with post-op follow-up Length of stay data extracted for those who underwent surgery. 24% did not undergo surgery (43 in the intervention group, 42 in the usual care group). Twice as many people in the usual care arm had surgery cancelled after admission (intervention n=10, usual care n=22)

Study	Intervention and comparison	Population	Outcomes	Comments
	n=179			
Ommundsen 2018[26]	**Comprehensive geriatric assessment:** Preoperative GA followed by a tailored intervention based on the results of the GA, performed by a medical doctor specialising in geriatric medicine. A full somatic work-up and blood tests for haematology, renal and liver function were also performed. Thereafter, a tailored intervention based on the results of the GA was performed to optimise comorbidities. n=57 **Usual care:** Care as usual. n=65	People older than 65 years who fulfilled predefined criteria for frailty and were scheduled for resection of adenocarcinoma in the colon and/or rectum. Mean age (SD): 78.5 (7.6) Norway	• Mortality • Complications • Length of hospital stay • Readmission	
Partridge 2017[28]	**Comprehensive geriatric assessment:** Patients were assessed and optimised. Comprehensive geriatric assessment delivered by a multidisciplinary team (geriatrician, clinical nurse specialist, social worker, occupational therapist) according to individual patient need. The intervention was documented in an individualised care plan	Patients aged at least 65 years scheduled for elective endovascular/open aortic aneurysm repair or lower-limb arterial bypass surgery. Mean age (SD): 75.5 (6.5) UK	• Length of hospital stay • Readmission	

Study	Intervention and comparison	Population	Outcomes	Comments
	available to all healthcare professionals on the electronic patient record. This care plan provided advice regarding the prevention and management of anticipated postoperative complications. n=104 **Usual care:** A nurse-led preoperative assessment clinic where an appraisal of anaesthetic and medical issues was conducted. This process tended to focus on the binary labelling of 'fit' or 'unfit' for anaesthesia/surgery, and was not designed to optimize patients' fitness. If issues that might affect surgery were identified, a more detailed specialist medical or anaesthetic evaluation was requested, or patients were referred back to their general practitioner. n=105			

See appendix D for full evidence tables.

1.4.4 Quality assessment of clinical studies included in the evidence review

Table 3: Clinical evidence summary: Preoperative optimisation clinic compared to usual care for surgery in older people

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with Usual care	Risk difference with Preoperative optimisation clinic (95% CI)
Mortality (30 day)	116 (1 study) 30 days	⨁⨁⨀⨀ LOW[a] due to imprecision	RR 0.79 (0.14 to 4.57)	Moderate	
				54 per 1000	11 fewer per 1000 (from 46 fewer to 193 more)
Mortality (3 months)	116 (1 study) 3 months	⨁⨁⨀⨀ LOW[a] due to imprecision	RR 0.89 (0.21 to 3.81)	Moderate	
				64 per 1000	7 fewer per 1000 (from 51 fewer to 180 more)
Complications (Clavien-Dindo Grade I; higher grades=more severe)	116 (1 study) 1 months	⨁⨁⨀⨀ LOW[a] due to imprecision	RR 0.59 (0.19 to 1.86)	Moderate	
				127 per 1000	52 fewer per 1000 (from 103 fewer to 109 more)
Complications (Clavien-Dindo Grade II; higher grades=more severe)	116 (1 study) 1 months	⨁⨁⨁⨀ MODERATE[a] due to imprecision	RR 0.66 (0.44 to 0.99)	Moderate	
				571 per 1000	194 fewer per 1000 (from 6 fewer to 320 fewer)
Complications (Clavien-Dindo Grade III; higher grades=more severe)	116 (1 study) 1 months	⨁⨁⨁⨀ MODERATE[a] due to imprecision	RR 2.38 (0.76 to 7.46)	Moderate	
				64 per 1000	88 more per 1000 (from 15 fewer to 413 more)
Complications (Clavien-Dindo Grade IV; higher grades=more severe)	116 (1 study) 1 months	⨁⨁⨀⨀ LOW[a] due to imprecision	RR 1.78 (0.53 to 5.99)	Moderate	
				64 per 1000	50 more per 1000 (from 30 fewer to 319 more)
Complications (Clavien-Dindo Grade V: higher grades=more severe)	116 (1 study) 1 months	⨁⨁⨀⨀ LOW[a] due to imprecision	RR 0.79 (0.14 to	Moderate	
				48 per 1000	10 fewer per 1000 (from 41 fewer to 171 more)

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with Usual care	Risk difference with Preoperative optimisation clinic (95% CI)
			4.57)		
Length of stay (total)	270 (1 study)	⨁⨁⨁⨁ HIGH		The mean length of stay (total) in the control groups was 7 days	The mean length of stay (total) in the intervention groups was 0.1 higher (1.7 lower to 1.9 higher)
Length of stay (pre-op)	270 (1 study)	⨁⨁⨀⨀ MODERATE[a] due to imprecision		The mean length of stay (pre-op) in the control groups was 3 days	The mean length of stay (pre-op) in the intervention groups was 1.1 lower (1.7 to 0.5 lower)
Length of stay (post-op)	270 (1 study)	⨁⨁⨁⨁ HIGH		The mean length of stay (post-op) in the control groups was 3.9 days	The mean length of stay (post-op) in the intervention groups was 0.9 higher (0.63 lower to 2.43 higher)
30-day readmission	292 (2 studies) 1 months	⨁⨁⨁⨀ MODERATE[a] due to imprecision	RR 1.82 (0.98 to 3.38)	Moderate	
				87 per 1000	71 more per 1000 (from 2 fewer to 207 more)

(a) Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs.
(b) Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias.

Table 4: Clinical evidence summary: Evidence not suitable for GRADE analysis

Study	Outcome	Intervention results	Intervention group (n)	Comparison results	Comparison group (n)	Risk of bias
Ommundsen 2018[26]	Length of stay	Median: 8 days	53	Median: 8 days	63	Low
		Length of stay between intervention vs control was not statistically significant, p=0.63				
Partridge 2017[28]	Length of stay	Geometric mean:	91	Geometric mean:	85	Low

Study	Outcome	Intervention results	Intervention group (n)	Comparison results	Comparison group (n)	Risk of bias
		3.32 days		5.53 days		
		Length of stay between intervention vs control was statistically significant, p<0.001				
Macpherson 1994[20]	Patient satisfaction	No significant difference in satisfaction with care was discovered between groups.				High

See appendix F for full GRADE tables.

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:.

1.5.3 Unit costs

Relevant unit costs are provided below to aid consideration of cost effectiveness.

Table 5 shows the staff members required for implementing a preoperative optimisation clinic and the cost associated with them.

Table 5: Staff costs

Staff	Cost per hour of patient contact[(a)]	Source
Geriatrician	£186[(a)]	PSSRU 2018[9], (based on salary of medical consultant)
Nurse specialist	£119[(b)]	PSSRU 2018[9], (based on salary of band 6 nurse specialist)
Occupational therapist specialist	£67[(c)]	PSSRU 2018[9], (based on salary of band 6 occupational therapist specialist)

(a) These costs include the ratio of direct to indirect time with patients from the PSSRU; 1.33 for medical consultants; 2.44 for nurse specialists and 1.37 for occupational therapists. All costs include qualification costs.

1.6 Evidence statements

1.6.1 Clinical evidence statements

No evidence was found for health related quality of life; patient, family and carer experience of care; unplanned intensive care unit admission and length of stay in intensive care unit.

Preoperative optimisation clinics versus usual care

Mortality
One study demonstrated a clinically important benefit with preoperative optimisation clinic for mortality at 30 days compared to usual care (1 study, n=116, low quality evidence).

One study showed a clinically important benefit with preoperative optimisation clinic for mortality at 3 months compared to usual care (1 study, n=116, low quality evidence).

Complications

One study showed a clinically important harm with preoperative optimisation clinic, with fewer clavien-dindo grade I and II complications, but more grade III and IV complications compared to usual care (1 study, n=116, low/moderate quality evidence).

One study showed no difference in length of stay between preoperative optimisation clinic and usual care (1 study, n=270, high quality evidence).

Readmissions

Two studies found a clinically important harm of pre-operative optimisation clinics in 30-day readmission rate compared to usual care (two studies, n=292, moderate quality evidence).

Outcomes not suitable for GRADE analysis

One study found no statistically significant difference in length of stay between preoperative optimisation clinic and usual care (1 study, n=116, low risk of bias).

One study found a statistically significant benefit with pre-operative optimisation clinics in length of stay compared to usual care (1 study, n=176, low risk of bias).

One study found no statistically significant difference in patient satisfaction between preoperative optimisation clinic and usual care (1 study, n=355, low risk of bias).

1.6.2 Health economic evidence statements

- No relevant economic evaluations were identified.

1.7 The committee's discussion of the evidence

1.7.1 Interpreting the evidence

1.7.1.1 The outcomes that matter most

The focus of this review was to assess the efficacy of POP clinics in optimising older people before surgery with an aim to reduce the risk of complications and improve recovery post-surgery. As such, the committee considered critical outcomes for decision making to be health-related quality of life, mortality, patient, family and carer experience of care, adverse events and complications and length of hospital stay. Unplanned intensive care unit admission, length of stay in intensive care unit and hospital readmission were also thought to be important outcomes.

No evidence was identified for health-related quality of life, unplanned intensive care unit admission and length of stay in intensive care unit. A number of studies did not meet the evidence review protocol criteria.

1.7.1.2 The quality of the evidence

The quality of evidence that was suitable for GRADE analysis ranged from low to high. The majority of the evidence was graded at low quality. This was mostly due to outcome reporting bias and imprecision. The low quality and the low quantity of evidence limited the confidence with which the committee could interpret the evidence.

Outcomes which were not suitable for GRADE analysis were considered to be at low and high risk of bias.

1.7.1.3 Benefits and harms

The committee discussed the evidence on the preoperative optimisation clinics for older people undergoing surgery.

The committee discussed evidence from one study showing POP clinics had an improved capacity to reduce both short and longer term mortality compared with usual care. This benefit was considered by the committee to be clinically important. The committee noted though that the number of patients included in the study and the subsequent number of events was too small with the resultant imprecision in the evidence meaning the benefit was not certain enough to draw any strong conclusions.

The committee also reviewed the evidence from one study reporting adverse events and complications with surgery in those seen in a POPs clinic compared to those receiving usual care. The study reported that those receiving preoperative optimisation were less likely to experience the less severe complications (grades I or II), but were at increased risk of experiencing more severe complications (grades III and IV). The number of people experiencing any complication was higher in the group receiving usual care. The variation of effect of preoperative optimisation clinics over complication severities caused a level of uncertainty in the committee's confidence to make a recommendation, but they noted the potential benefit of POP clinics in managing the total number of people experiencing complications.

Evidence from two studies also showed no clinically significant difference in length of hospital stay between those receiving preoperative optimisation and usual care.

Two studies reported 30-day readmission rate, showing a trend towards an increased risk of readmission with preoperative optimisation compared to usual care. The committee agreed that this effect suggested a possible harm or a result of more intense observation with preoperative optimisation clinics.

The committee noted the findings of one study reporting no significant difference in patient satisfaction between those receiving preoperative optimisation and usual care.

The limited amount of evidence and sometimes conflicting outcomes meant the committee were not confident in making a positive recommendation for preoperative optimisation clinics for older people, and decided more research was needed.

1.7.2 Cost effectiveness and resource use

No economic evidence was identified for this question.

A perioperative optimisation clinic involves a preoperative assessment of the patient to identify any health issues that would affect their surgery, and the issues are then corrected by staff in the clinic.

Setting up a perioperative optimisation clinic would require dedicated staff to be available in order to correct the issues being identified. The committee were presented with some examples of staff unit costs as it is likely this intervention would require setting up a new clinic and employing more staff. The main staff members that would be essential for this intervention include a consultant geriatrician, nurse specialist and an occupational therapist specialist. The cost per hour for a consultant geriatrician, nurse specialist and an occupational therapist specialist is £186, £119 and £67, respectively. As preoperative optimisation clinics would be available for adults over 60 years of age, this affects a large population as the number of older people having surgery is significantly increasing. Hospital Episode Statistics revealed that 50% of operations conducted in the NHS during 2016-17 were on adults over 60 years. Taking in to account the cost of setting up the clinic and the large population involved, a recommendation would have a substantial resource impact.

The committee discussed that in current practice when patients have a problem identified in their preoperative assessment, they are usually referred to other services, for example, their GP or another department in the hospital. This can cause delays in them having their surgery and can also be distressing and have a negative impact on their quality of life. Treating the patient and any problems they may present with in the preoperative optimisation clinic would mean that treatment happens sooner and less people have their surgery postponed. This could lead to future downstream savings and an improvement in quality of life.

As the committee felt that there was insufficient clinical evidence to support making a recommendation that would have a substantial resource impact, they made a research recommendation.

1.7.3 Other factors the committee took into account

The committee noted that the aims of pre-optimisation clinics are to reduce the risks associated with surgery, increase quality, decrease unnecessary costs, and ultimately restore the patient to the desired level of functioning. In order to achieve this all three stages of the patient pathway need to be covered (the perioperative period),

The committee acknowledged the potential usefulness of a specialist preoperative optimisation clinic for older people, with immediate access to healthcare professionals such as geriatricians, clinical nurse specialists, pharmacists, social workers, and occupational therapists to promote shared decision making. However, it was raised that this is not currently the case in many health centres across the United Kingdom. Subsequently, implementation of POP clinics nationwide would result in a significant resource impact.

The committee were aware of the Perioperative Quality Improvement Programme which aims to look at perioperative care of patients undergoing major non-cardiac surgery and measure complication rates, failure to rescue and patient reported outcomes. The committee highlighted the importance of hospitals submitting data to the national audit.

References

1. Abdul Rahman S, Baykuziyev T, Kumar N. Peri-operative care of patients with proximal femur fracture. Anaesthesia. 2017; 72(Suppl 4):39

2. Anderson ADG, McNaught CE, MacFie J, Tring I, Barker P, Mitchell CJ. Randomized clinical trial of multimodal optimization and standard perioperative surgical care. British Journal of Surgery. 2003; 90(12):1497-1504

3. Audisio RA. Preoperative evaluation of the older patient with cancer. Journal of Geriatric Oncology. 2016; 7(6):409-412

4. Bagnall NM, Faiz O, Darzi A, Athanasiou T. What is the utility of preoperative frailty assessment for risk stratification in cardiac surgery? Interactive Cardiovascular and Thoracic Surgery. 2013; 17(2):398-402

5. Bai B, Wang KZ, Liu WK, Song JH, Chen JC. Comprehensive treatment for old patients with hip fractures. Chinese Journal of Traumatology. 2003; 6(5):297-301

6. Banerjee AR, Reilly PG, Marshall JN, Nunez D. Is pre-operative patient assessment effective? A prospective trial of 100 patients. Annals of the Royal College of Surgeons of England. 1996; 78(3 Suppl):119-121

7. Berkel AEM, Bongers BC, van Kamp MJS, Kotte H, Weltevreden P, de Jongh FHC et al. The effects of prehabilitation versus usual care to reduce postoperative complications in high-risk patients with colorectal cancer or dysplasia scheduled for elective colorectal resection: Study protocol of a randomized controlled trial. BMC Gastroenterology. 2018; 18 29

8. Chow WB, Rosenthal RA, Merkow RP, Ko CY, Esnaola NF. Optimal preoperative assessment of the geriatric surgical patient: a best practices guideline from the American College of Surgeons National Surgical Quality Improvement Program and the American Geriatrics Society. Journal of the American College of Surgeons. 2012; 215(4):453-466

9. Curtis L, Burns A. Unit costs of health and social care 2018. Canterbury. Personal Social Services Research Unit University of Kent, 2018. Available from: https://kar.kent.ac.uk/70995/

10. Dale W, Hemmerich J, Kamm A, Posner MC, Matthews JB, Rothman R et al. Geriatric assessment improves prediction of surgical outcomes in older adults undergoing pancreaticoduodenectomy: a prospective cohort study. Annals of Surgery. 2014; 259(5):960-5

11. Dibb W, Fawcett J, Whall R. The use of senior nurses in administering a standardised protocol for the pre-operative optimisation of high risk surgical patients. Nursing in Critical Care. 1999; 4(1):14-17

12. Dubhashi SP, Kayal A. Preoperative nutritional assessment in elderly cancer patients undergoing elective surgery: MNA or PG-SGA? Indian Journal of Surgery. 2015; 77(2):232-235

13. Eamer G, Taheri A, Chen SS, Daviduck Q, Chambers T, Shi X et al. Comprehensive geriatric assessment for older people admitted to a surgical service. Cochrane Database of Systematic Reviews 2018, Issue 1. Art. No.: CD012485. DOI: 10.1002/14651858.CD012485.pub2.

14. Feng MA, McMillan DT, Crowell K, Muss H, Nielsen ME, Smith AB. Geriatric assessment in surgical oncology: a systematic review. Journal of Surgical Research. 2015; 193(1):265-572

15. Gupta A. The effectiveness of geriatrician-led comprehensive hip fracture collaborative care in a new acute hip unit based in a general hospital setting in the UK. Journal of the Royal College of Physicians of Edinburgh. 2014; 44(1):20-26

16. Halloway S, Buchholz SW, Wilbur J, Schoeny ME. Prehabilitation interventions for older adults: an integrative review. Western Journal of Nursing Research. 2015; 37(1):103-23

17. Harari D, Hopper A, Dhesi J, Babic-Illman G, Lockwood L, Martin F. Proactive care of older people undergoing surgery ('POPS'): designing, embedding, evaluating and funding a comprehensive geriatric assessment service for older elective surgical patients. Age and Ageing. 2007; 36(2):190-6

18. Huddleston JM, Long KH, Naessens JM, Vanness D, Larson D, Trousdale R et al. Medical and surgical comanagement after elective hip and knee arthroplasty: a randomized, controlled trial. Annals of Internal Medicine. 2004; 141(1):28-38

19. Kim DH, Kim CA, Placide S, Lipsitz LA, Marcantonio ER. Preoperative frailty assessment and outcomes at 6 months or later in older adults undergoing cardiac surgical procedures: A systematic review. Annals of Internal Medicine. 2016; 165(9):650-660

20. Macpherson DS, Lofgren RP. Outpatient internal medicine preoperative evaluation: a randomized clinical trial. Medical Care. 1994; 32(5):498-507

21. McIsaac DI, Huang A, Wong CA, Wijeysundera DN, Bryson GL, van Walraven C. Effect of preoperative geriatric evaluation on outcomes after elective surgery: a population-based study. Journal of the American Geriatrics Society. 2017; 65(12):2665-2672

22. McIsaac DI, Taljaard M, Bryson GL, Beaule PE, Gagne S, Hamilton G et al. Comparative assessment of two frailty instruments for risk-stratification in elderly surgical patients: study protocol for a prospective cohort study. BMC Anesthesiology. 2016; 16:111

23. Murthy BV, Lake SP, Fisher AC. Evaluation of a decision support system to predict preoperative investigations. British Journal of Anaesthesia. 2008; 100(3):315-21

24. National Institute for Health and Care Excellence. Developing NICE guidelines: the manual, updated 2018. London. National Institute for Health and Care Excellence, 2014. Available from: https://www.nice.org.uk/process/pmg20/chapter/introduction-and-overview

25. Nicholson A, Coldwell CH, Lewis SR, Smith AF. Nurse-led versus doctor-led preoperative assessment for elective surgical patients requiring regional or general anaesthesia. Cochrane Database of Systematic Reviews 2013, Issue 11. Art. No.: CD010160. DOI: 10.1002/14651858.CD010160.pub2.

26. Ommundsen N, Wyller TB, Nesbakken A, Bakka AO, Jordhoy MS, Skovlund E et al. Preoperative geriatric assessment and tailored interventions in frail older patients with colorectal cancer: a randomized controlled trial. Colorectal Disease. 2018; 20(1):16-25

27. Partridge JS, Harari D, Martin FC, Dhesi JK. The impact of pre-operative comprehensive geriatric assessment on postoperative outcomes in older patients

undergoing scheduled surgery: a systematic review. Anaesthesia. 2014; 69(Suppl 1):8-16

28. Partridge JS, Harari D, Martin FC, Peacock JL, Bell R, Mohammed A et al. Randomized clinical trial of comprehensive geriatric assessment and optimization in vascular surgery. British Journal of Surgery. 2017; 104(6):679-687

29. Pasetto LM, Lise M, Monfardini S. Preoperative assessment of elderly cancer patients. Critical Reviews in Oncology-Hematology. 2007; 64(1):10-8

30. Pham CT, Gibb CL, Fitridge RA, Karnon JD. Effectiveness of preoperative medical consultations by internal medicine physicians: a systematic review. BMJ Open. 2017; 7(12):e018632

31. Pollard JB, Garnerin P. Outpatient preoperative evaluation clinic can lead to a rapid shift from inpatient to outpatient surgery: a retrospective review of perioperative setting and outcome. Journal of Clinical Anesthesia. 1999; 11(1):39-45

32. Rafique H, Anele C, Worley G, Faiz O. The use of preoperative frailty measures to predict postoperative outcomes in those undergoing colorectal surgery: A systematic review. Colorectal Disease. 2017; 19((Suppl 2)):68

33. Ramesh HS, Pope D, Gennari R, Audisio RA. Optimising surgical management of elderly cancer patients. World Journal of Surgical Oncology. 2005; 3(1):17

34. Swank AM, Joseph BK, Wendy B, Quesada PM, Nyland J, Arthur M et al. Prehabilitation before total knee arthroplasty increases strength and function in older adults with severe osteoarthritis. Journal of Strength and Conditioning Research. 2011; 25(2):318-325

35. Swart E, Vasudeva E, Makhni EC, Macaulay W, Bozic KJ. Dedicated perioperative hip fracture comanagement programs are cost-effective in high-volume centers: An economic analysis. Clinical Orthopaedics and Related Research. 2016; 474(1):222-33

36. Watt JA, Tricco A, Talbot-Hamon C, Grudniewicz A, Sinclair D, Straus S. Preoperative risk factors predict risk of delirium and other postoperative complications among elderly patients undergoing elective surgery: Systematic review. Journal of General Internal Medicine. 2016; 31(Suppl 2):S356-S357

Appendices

Appendix A: Review protocols

Table 6: Review protocol: pre-operative optimisation clinics

ID	Field	Content
0.	PROSPERO registration number	Not registered on PROSPERO
1.	Review title	In older people (>60 years) who will be undergoing surgery, what is the clinical and cost effectiveness of pre-operative optimisation clinics?
2.	Review question	In older people (>60 years) who will be undergoing surgery, what is the clinical and cost effectiveness of pre-operative optimisation clinics?
3.	Objective	To determine the clinical and cost effectiveness of pre-operative optimisation clinics in older people (>60 years) who will be undergoing surgery.
4.	Searches	• Cochrane Central Register of Controlled Trials (CENTRAL) • Cochrane Database of Systematic Reviews (CDSR) • Embase • MEDLINE The searches may be re-run 6 weeks before the final committee meeting and further studies retrieved for inclusion if relevant. The full search strategies will be published in the final review.
5.	Condition or domain being studied	Perioperative care
6.	Population	Inclusion: Older people 60 years and over having surgery. Exclusion: • children and young people aged 17 years and younger • surgery for burns, traumatic brain injury or neurosurgery
7.	Intervention/Exposure/Test	• preoperative optimisation clinics (including proactive care of older people going to have surgery (POPS) clinics)

8.	Comparator/Reference standard/Confounding factors	• standard preoperative assessment
9.	Types of study to be included	Randomised controlled trials (RCTs), systematic reviews of RCTs. Observational studies if no RCT evidence is identified.
10.	Other exclusion criteria	Exclusions: • non-English language studies • cross-over randomised controlled trials • studies published before 2000
11.	Context	Older people may be considered to be at increased risk when undergoing surgery. Preoperative optimisation clinics may have the capacity to limit these risks.
12.	Primary outcomes (critical outcomes)	• health-related quality of life • mortality • patient, family and carer experience of care • adverse events and complications (Clavien-Dindo, postoperative morbidity score (POMS)) • length of hospital stay (total pre and postoperative) The committee did not agree to any established minimal clinically important differences, therefore the default MIDs will be used and any difference in mortality will be considered clinically important.
13.	Secondary outcomes (important outcomes)	• unplanned intensive care unit admission • length of stay in intensive care unit • hospital readmission The committee did not agree to any established minimal clinically important differences, therefore the default MIDs will be used and any difference in mortality will be considered clinically important.
14.	Data extraction (selection and coding)	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. Data extractions performed using EviBase, a platform designed and maintained by the National Guideline Centre (NGC)
15.	Risk of bias (quality) assessment	Risk of bias will be assessed using the

		appropriate checklist as described in Developing NICE guidelines: the manual. • Systematic reviews: Risk of Bias in Systematic Reviews (ROBIS) • 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 10% of all evidence reviews are quality assured by a senior research fellow. This includes checking: • 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 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.
16.	Strategy for data synthesis	Pairwise meta-analyses will be performed using Cochrane Review Manager (RevMan5). 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. 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/ • 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. • List any other software planned to be used. Heterogeneity between the studies in effect measures will be assessed using the I^2 statistic and visually inspected. An I^2 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.			
17.	Analysis of sub-groups	Subgroups: • American Society of Anesthesiologists (ASA) Physical Status grade • surgery grade based on NICE preoperative tests for elective surgery guideline categorisation			
18.	Type and method of review	☒	Intervention		
		☐	Diagnostic		
		☐	Prognostic		
		☐	Qualitative		
		☐	Epidemiologic		
		☐	Service Delivery		
		☐	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		☐	☐
		Piloting of the study selection process		☐	☐
		Formal screening of search results against eligibility criteria		☐	☐
		Data extraction		☐	☐
		Risk of bias (quality) assessment		☐	☐
		Data analysis		☐	☐

24.	Named contact	5a. Named contact National Guideline Centre 5b Named contact e-mail [Guideline email]@nice.org.uk [Developer to check with Guideline Coordinator for email address] 5e Organisational affiliation of the review National Institute for Health and Care Excellence (NICE) and the National Guideline Centre
25.	Review team members	From the National Guideline Centre: 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
26.	Funding sources/sponsor	This systematic review is being completed by the National Guideline Centre which receives funding from NICE.
27.	Conflicts of interest	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.
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 Developing NICE guidelines: the manual. Members of the guideline committee are available on the NICE website: [NICE guideline webpage].	
29.	Other registration details	[Give the name of any organisation where the systematic review title or protocol is registered (such as with The Campbell Collaboration, or The Joanna Briggs Institute) together with any unique identification number assigned. If extracted data will be stored and made available through a repository such as the Systematic Review Data Repository (SRDR), details and a link should be included here. If none, leave blank.]	
30.	Reference/URL for published protocol	[Give the citation and link for the published protocol, if there is one.]	
31.	Dissemination plans	NICE may use a range of different methods to raise awareness of the guideline. These include standard approaches such as: • 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, optimise, POP clinic	
33.	Details of existing review of same topic by same authors	n/a	
34.	Current review status	☐	Ongoing
		☐	Completed but not published
		☐	Completed and published
		☐	Completed, published and being updated
		☐	Discontinued
35..	Additional information	[Provide any other information the review team feel is relevant to the registration of the review.]	
36.	Details of final publication	www.nice.org.uk	

Table 7: 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	• 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	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. 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).[24] **Inclusion and exclusion criteria** • 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. **Where there is discretion** 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. The health economist will be guided by the following hierarchies. *Setting:* • 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.[24]

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 8: 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

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.	Geriatric Assessment/
28.	Health Services for the Aged/
29.	Geriatrics/
30.	(gemu or gemus).ti,ab.
31.	(frail* or sarcopeni* or elder* or senior* or gerontolog* or geriatric* or veteran* or (old* adj (people or person* or resident* or adult* or patient* or age*))).ti,ab.
32.	(Nurses Improving Care for Healthsystem Elders or modified Hospital Elder Life Program or mHELP or hospitali?ed elder life program*).ti,ab.
33.	(geriatrician* or anaesthetist* or anesthetist*).ti,ab.
34.	((optimis* or optimiz*) adj3 (clinic* or surg*)).ti,ab.
35.	or/27-34
36.	26 and 35
37.	randomized controlled trial.pt.
38.	controlled clinical trial.pt.
39.	randomi#ed.ab.
40.	placebo.ab.
41.	randomly.ab.
42.	clinical trials as topic.sh.
43.	trial.ti.
44.	or/37-43
45.	Meta-Analysis/
46.	Meta-Analysis as Topic/
47.	(meta analy* or metanaly* or metaanaly* or meta regression).ti,ab.
48.	((systematic* or evidence*) adj2 (review* or overview*)).ti,ab.
49.	(reference list* or bibliograph* or hand search* or manual search* or relevant journals).ab.
50.	(search strategy or search criteria or systematic search or study selection or data extraction).ab.
51.	(search* adj4 literature).ab.
52.	(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.
53.	cochrane.jw.
54.	((multiple treatment* or indirect or mixed) adj2 comparison*).ti,ab.
55.	or/45-54
56.	36 and (44 or 55)

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.	geriatric assessment/
26.	exp elderly care/
27.	exp geriatrics/
28.	(gemu or gemus).ti,ab.
29.	(frail* or sarcopeni* or elder* or senior* or gerontolog* or geriatric* or veteran* or (old* adj (people or person* or resident* or adult* or patient* or age*))).ti,ab.
30.	(Nurses Improving Care for Healthsystem Elders or modified Hospital Elder Life Program or mHELP or hospitali?ed elder life program*).ti,ab.
31.	(geriatrician* or anaesthetist* or anesthetist*).ti,ab.
32.	((optimis* or optimiz*) adj3 (clinic* or surg*)).ti,ab.
33.	or/25-32
34.	24 and 33
35.	random*.ti,ab.
36.	factorial*.ti,ab.
37.	(crossover* or cross over*).ti,ab.
38.	((doubl* or singl*) adj blind*).ti,ab.
39.	(assign* or allocat* or volunteer* or placebo*).ti,ab.
40.	crossover procedure/
41.	single blind procedure/
42.	randomized controlled trial/

43.	double blind procedure/
44.	or/35-43
45.	systematic review/
46.	Meta-Analysis/
47.	(meta analy* or metanaly* or metaanaly* or meta regression).ti,ab.
48.	((systematic* or evidence*) adj2 (review* or overview*)).ti,ab.
49.	(reference list* or bibliograph* or hand search* or manual search* or relevant journals).ab.
50.	(search strategy or search criteria or systematic search or study selection or data extraction).ab.
51.	(search* adj4 literature).ab.
52.	(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.
53.	cochrane.jw.
54.	((multiple treatment* or indirect or mixed) adj2 comparison*).ti,ab.
55.	or/45-54
56.	34 and (44 or 55)

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: [Geriatric Assessment] explode all trees
#8.	MeSH descriptor: [Health Services for the Aged] explode all trees
#9.	MeSH descriptor: [Geriatrics] explode all trees
#10.	(gemu or gemus):ti,ab
#11.	(frail* or sarcopeni* or elder* or senior* or gerontolog* or geriatric* or veteran* or (old* near (people or person* or resident* or adult* or patient* or age*))):ti,ab
#12.	(Nurses Improving Care for Healthsystem Elders or modified Hospital Elder Life Program or mHELP or hospitali?ed elder life program*):ti,ab
#13.	(geriatrician* or anaesthetist* or anesthetist*):ti,ab
#14.	((optimis* or optimiz*) near/3 (clinic* or surg*)):ti,ab
#15.	(or #7-#14)
#16.	#6 and #15

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 9: 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

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.

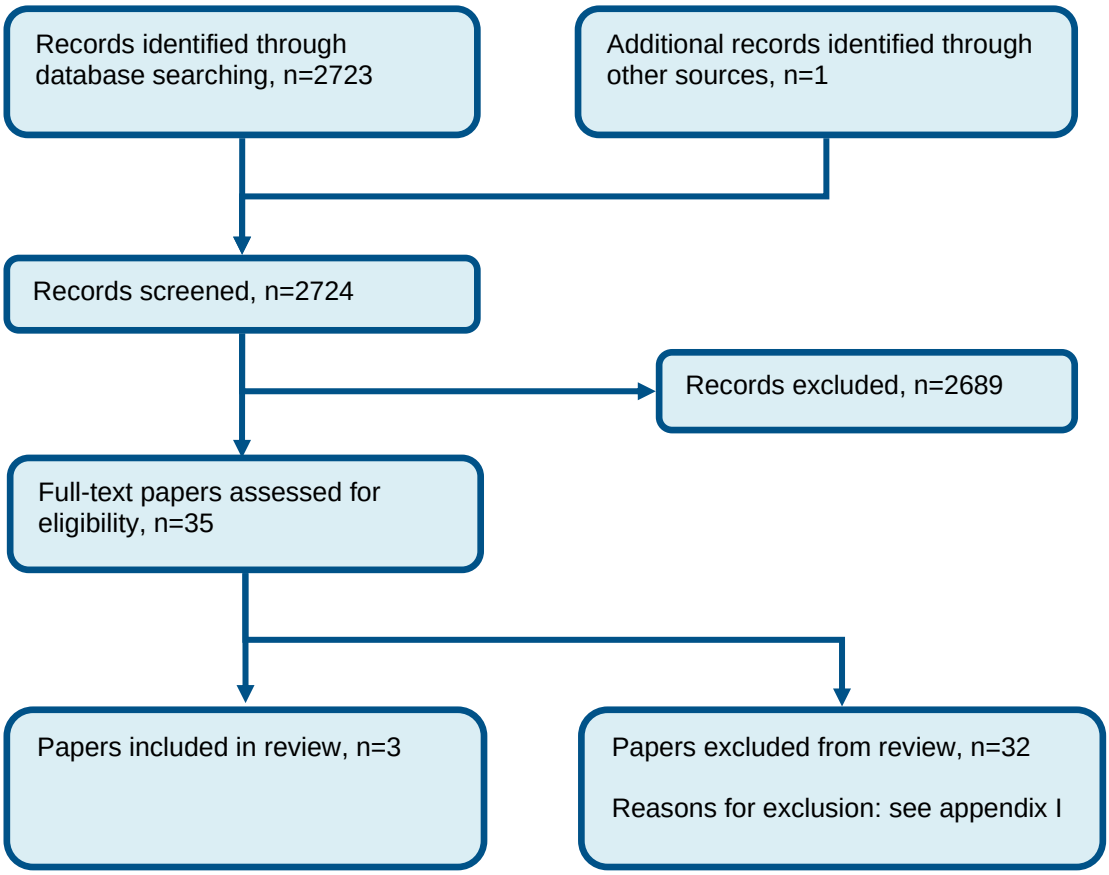
49.	(price* or pricing*).ti,ab.
50.	(cost* adj2 (effectiv* or utilit* or benefit* or minimi* or unit* or estimat* or variable*)).ab.
51.	(financ* or fee or fees).ti,ab.
52.	(value adj2 (money or monetary)).ti,ab.
53.	or/40-52
54.	39 and 53

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 pre-operative optimisation clinics.



Appendix D: Clinical evidence tables

Study	MacPherson 1994[20]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=355)
Countries and setting	Conducted in USA; Setting: Pittsburgh Veterans Affairs Medical Centre,
Line of therapy	Not applicable
Duration of study	Intervention + follow up: 3 weeks
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	Adults aged <50 years who were referred from a surgeon for internal medicine evaluation before scheduled surgery.
Exclusion criteria	Patients who required wheelchair van or ambulance transportation, lived in the extended care facility, were not expected to live more than 30 days, or were cognitively impaired.
Recruitment/selection of patients	Referred from a surgeon for internal medicine evaluation.
Age, gender and ethnicity	Age - Mean (SD): 65.5 (6.7). Gender (M:F): 351/4. Ethnicity: Not reported
Further population details	1. American Society of Anesthesiologists (ASA) Physical Status grade: 2: 33.8%, 3: 59.1%, 4: 7.1%. 2. Surgery grade based on NICE preoperative tests for elective surgery guideline categorisation: Intermediate – Major or complex
Indirectness of population	Serious indirectness: Inclusion criteria aged <50 years
Interventions	(n=176) Intervention 1: Preoperative optimisation clinics - Preoperative optimisation clinics (including proactive care of older people going to have surgery (POPS) clinics). Outpatient appointment: Received appointment at the Medical Preoperative Evaluation Clinic, seen within 3 weeks of scheduled admission for surgery. Preoperative laboratory and radiology screening obtained at visit, standard set of preoperative tests ordered. Patients who required medical interventions of special testing before surgery could be seen for additional appointments. Patients in whom internal medicine follow-up was believed to be necessary while an inpatient were seen by the general medical consultation service. . Duration 3 weeks. Concurrent medication/care: NA. Indirectness: No indirectness

	(n=179) Intervention 2: Usual care - Standard preoperative assessment. Admitted as scheduled. Internal medicine evaluation could be requested by the surgeon through the hospitals general medical consultation service. The same standard for preoperative testing were used for this group.. Duration 3 weeks. Concurrent medication/care: NA. Indirectness: No indirectness
Funding	Funding not stated
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: OUTPATIENT versus INPATIENT Protocol outcome 1: Length of stay - Actual outcome: Length of stay (total) at NA; Group 1: mean 7.1 Days (SD 7.5); n=137, Group 2: mean 7 Days (SD 7.5); n=133 Risk of bias: All domain - Low, Selection - Low, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 42, Reason: Did not require surgery (10), were not admitted but required surgery (33) ; Group 2 Number missing: 43, Reason: Did not require surgery (22), were not admitted but required surgery (20) - Actual outcome: Length of stay (pre-op) at NA; Group 1: mean 1.9 days (SD 2.5); n=133, Group 2: mean 3 days (SD 2.5); n=137 Risk of bias: All domain - Low, Selection - Low, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 42, Reason: Did not require surgery (10), were not admitted but required surgery (33) ; Group 2 Number missing: 43, Reason: Did not require surgery (22), were not admitted but required surgery (20) - Actual outcome: Length of stay (post-op) at NA; Group 1: mean 4.8 days (SD 6.4); n=133, Group 2: mean 3.9 days (SD 6.4); n=137 Risk of bias: All domain - Low, Selection - Low, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 42, Reason: Did not require surgery (10), were not admitted but required surgery (33) ; Group 2 Number missing: 43, Reason: Did not require surgery (22), were not admitted but required surgery (20) Protocol outcome 2: Patient, family and carer experience of care - Actual outcome: Participant satisfaction with care at 2 months; No significant difference in satisfaction with care were discovered. Measured using questionnaire.; Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - High, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 42, Reason: Did not require surgery (10), were not admitted but required surgery (33) ; Group 2 Number missing: 43, Reason: Did not require surgery (22), were not admitted but required surgery (20)	
Protocol outcomes not reported by the study	Quality of life ; Mortality ; Adverse events and complications (Clavien-Dindo, postoperative morbidity score (POMS)) ; Unplanned intensive care unit admission ; Hospital readmission

Study	Ommundsen 2018[26]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=122)
Countries and setting	Conducted in Norway; Setting: Two university hospitals in the Oslo region of Norway.
Line of therapy	Not applicable
Duration of study	Intervention + follow up: 3 weeks
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	People older than 65 years, fulfilled predefined criteria for frailty and were scheduled for resection of adenocarcinoma in the colon and/or rectum.
Exclusion criteria	Emergency surgery or a patient unable to provide written consent.
Recruitment/selection of patients	Consecutively recruited from the preoperative outpatient clinics
Age, gender and ethnicity	Age - Mean (SD): 78.5 (7.6). Gender (M:F): 59/63. Ethnicity: Not reported
Further population details	1. American Society of Anesthesiologists (ASA) Physical Status grade: Not stated / Unclear 2. Surgery grade based on NICE preoperative tests for elective surgery guideline categorisation: Major or complex
Indirectness of population	No indirectness
Interventions	(n=57) Intervention 1: Preoperative optimisation clinics - Preoperative optimisation clinics (including proactive care of older people going to have surgery (POPS) clinics). Underwent a preoperative geriatric assessment (GA) followed by a tailored intervention based on the results of the GA. This was performed during one session, by a medical doctor specialising in geriatric medicine, as soon as possible after the cancer diagnosis was confirmed and surgery was planned. A full somatic work-up and blood tests for haematology, renal and liver function were also performed. Thereafter, a pragmatic tailored intervention based on the results of the GA was performed. Treatment of comorbidities was subsequently optimised.. Duration 3 weeks. Concurrent medication/care: The perioperative phase in both hospitals follows the major principles of the enhanced recovery after surgery (ERAS) model. Indirectness: No indirectness Comments: beta-blockers and anticoagulants were initiated for atrial fibrillation; statins and antiplatelet drugs were initiated for coronary disease; glycaemic control was optimized in diabetes mellitus; medications were adjusted in renal failure; and in patients with COPD we increased antiobstructive medication and referred them to postoperative chest physiotherapy. Patients with malnutrition were advised on increased caloric intake pre- and postoperatively and received prescriptions for nutritional drinks. Blood tests for vitamin D and iron were analysed if

	patients were malnourished, and supplementation prescribed when needed. Inappropriate medication, such as antihypertensive medication in patients with hypotension or nephrotoxic medication in patients with renal failure, was discontinued. (n=65) Intervention 2: Usual care - Standard preoperative assessment. Care as usual. No additional information. Duration 3 weeks. Concurrent medication/care: The perioperative phase in both hospitals follows the major principles of the enhanced recovery after surgery (ERAS) model.. Indirectness: No indirectness
Funding	Academic or government funding (Norwegian Cancer Society)

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: COMPREHENSIVE GERIATRIC ASSESSMENT versus STANDARD PREOPERATIVE ASSESSMENT

Protocol outcome 1: Length of stay
- Actual outcome: Length of stay at 30 days; Median: GA-group, 8 days; Control group, 8 days; p=0.63
Risk of bias: All domain - Low, Selection - Low, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 4, Reason: No cancer (1), next of kin denied participation (1), denied participation pre-intervention (2); Group 2 Number missing: 2, Reason: No cancer (2)

Protocol outcome 2: Hospital readmission
- Actual outcome: Readmission at 30 days; Group 1: 8/53, Group 2: 4/63
Risk of bias: All domain - Low, Selection - Low, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 4, Reason: No cancer (1), next of kin denied participation (1), denied participation pre-intervention (2); Group 2 Number missing: 2, Reason: No cancer (2)

Protocol outcome 3: Mortality
- Actual outcome: Mortality at 30 days; Group 1: 2/53, Group 2: 3/63
Risk of bias: All domain - Low, Selection - Low, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 4, Reason: No cancer (1), next of kin denied participation (1), denied participation pre-intervention (2); Group 2 Number missing: 2, Reason: No cancer (2)
- Actual outcome: Mortality at 3 months; Group 1: 3/53, Group 2: 4/63
Risk of bias: All domain - Low, Selection - Low, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 4, Reason: No cancer (1), next of kin denied participation (1), denied participation pre-intervention (2); Group 2 Number missing: 2, Reason: No cancer (2)

Protocol outcome 4: Adverse events and complications (Clavien-Dindo, postoperative morbidity score (POMS))
- Actual outcome: Clavien-Dindo - Grade I complications at 30 days; Group 1: 4/53, Group 2: 8/63
Risk of bias: All domain - Low, Selection - Low, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover

- Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 4, Reason: No cancer (1), next of kin denied participation (1), denied participation pre-intervention (2); Group 2 Number missing: 2, Reason: No cancer (2) - Actual outcome: Clavien-Dindo - Grade II complications at 30 days; Group 1: 20/53, Group 2: 36/63 Risk of bias: All domain - Low, Selection - Low, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 4, Reason: No cancer (1), next of kin denied participation (1), denied participation pre-intervention (2); Group 2 Number missing: 2, Reason: No cancer (2) - Actual outcome: Clavien-Dindo - Grade III complications at 30 days; Group 1: 8/53, Group 2: 4/63 Risk of bias: All domain - Low, Selection - Low, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 4, Reason: No cancer (1), next of kin denied participation (1), denied participation pre-intervention (2); Group 2 Number missing: 2, Reason: No cancer (2) - Actual outcome: Clavien-Dindo - Grade IV complications at 30 days; Group 1: 6/53, Group 2: 4/63 Risk of bias: All domain - Low, Selection - Low, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 4, Reason: No cancer (1), next of kin denied participation (1), denied participation pre-intervention (2); Group 2 Number missing: 2, Reason: No cancer (2) - Actual outcome: Clavien-Dindo - Grade V complications at 30 days; Group 1: 2/53, Group 2: 3/63 Risk of bias: All domain - Low, Selection - Low, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 4, Reason: No cancer (1), next of kin denied participation (1), denied participation pre-intervention (2); Group 2 Number missing: 2, Reason: No cancer (2)	
Protocol outcomes not reported by the study	Quality of life ; Unplanned intensive care unit admission ; Patient, family and carer experience of care

Study	Partridge 2017[28]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=176)
Countries and setting	Conducted in United Kingdom; Setting: Inner-city teaching hospital with a tertiary referral practice for vascular arterial surgery.
Line of therapy	Not applicable
Duration of study	Intervention + follow up: 30 days
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	Patients aged at least 65 years scheduled for elective endovascular/open aortic aneurysm repair or lower-limb arterial bypass surgery.
Exclusion criteria	Patients admitted directly to the ward from the surgical clinic or emergency department for emergency or very urgent surgery, which precluded the opportunity for outpatient preoperative assessment and optimization.
Recruitment/selection of patients	Patients were approached by a research nurse or fellow in the vascular surgery outpatient clinic once listed for surgery.
Age, gender and ethnicity	Age - Mean (SD): 75.5 (6.5). Gender (M:F): 159:50.
Further population details	1. American Society of Anesthesiologists (ASA) Physical Status grade: Not stated. 2. Surgery grade based on NICE preoperative tests for elective surgery guideline categorisation: Major or complex
Indirectness of population	No indirectness
Interventions	(n=104) Intervention 1: Preoperative optimisation clinics - Preoperative optimisation clinics (including proactive care of older people going to have surgery (POPS) clinics). Patients were assessed and optimized according to peer-reviewed protocols based on current evidence, national and hospital guidelines, and expert opinion. Comprehensive geriatric assessment was delivered by a multidisciplinary team (geriatrician, clinical nurse specialist, social worker, occupational therapist) according to individual patient need. The intervention was documented in an individualised care plan available to all healthcare professionals on the electronic patient record. This care plan provided advice regarding the prevention and management of anticipated postoperative complications, but did not refer to the patient's involvement in the study.. Duration NA. Concurrent medication/care: Postoperative care was delivered by surgical teams who were unaware of the patient's involvement in the study. This routine care involved junior surgical staff and clinical nurse specialists utilizing all electronic clinical documents (including the individualized care plans generated following comprehensive geriatric assessment in the intervention group).

	Indirectness: No indirectness (n=105) Intervention 2: Usual care - Standard preoperative assessment. A nurse-led preoperative assessment clinic where an appraisal of anaesthetic and medical issues was conducted. This process tended to focus on the binary labelling of 'fit' or 'unfit' for anaesthesia/surgery, and was not designed to optimize patients' fitness. If issues that might affect surgery were identified, a more detailed specialist medical or anaesthetic evaluation was requested, or patients were referred back to their general practitioner. Duration NA. Concurrent medication/care: Postoperative care was delivered by surgical teams who were unaware of the patient's involvement in the study. This routine care involved junior surgical staff and clinical nurse specialists utilizing all electronic clinical documents (including the individualized care plans generated following comprehensive geriatric assessment in the intervention group). Indirectness: No indirectness
Funding	Academic or government funding (Study funded by a Research Into Ageing-Age UK-British Geriatrics Society grant and the Guy's and St Thomas' Charity)

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: COMPREHENSIVE GERIATRIC ASSESSMENT AND OPTIMISATION versus STANDARD PREOPERATIVE ASSESSMENT

Protocol outcome 1: Length of stay
- Actual outcome: Length of stay at 30 days; Group 1: geometric mean 3.32 days; n=91, Group 2: mean 5.53 days; n=85, ratio of geometric means (95% CI) 0.60 (0.46, 0.79), $p < 0.001$

Risk of bias: All domain - Low, Selection - Low, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Blinding details: The primary outcome measure was documented in the electronic patient record by hospital administrative staff who were unaware of the study. The length of stay was then recorded by an un-blinded research nurse, but the objective method of collecting the measure eliminated the risk of bias.
; Group 1 Number missing: 18, Reason: Died before surgery (1), decision not to operate following pre-assessment (14), admitted as emergency before scheduled surgery (3).; Group 2 Number missing: 13, Reason: Died before surgery (1), lost to follow-up (3), decision not to operate (6), admitted as emergency before scheduled surgery (3).

Protocol outcome 2: Hospital readmission
- Actual outcome: Unplanned 30-day readmission at 30 days; Group 1: 10/91, Group 2: 15/85

Risk of bias: All domain - Low, Selection - Low, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Blinding details: The primary outcome measure was documented in the electronic patient record by hospital administrative staff who were unaware of the study. The length of stay was then recorded by an un-blinded research nurse, but the objective method of collecting the measure eliminated the risk of bias.
; Group 1 Number missing: 18, Reason: Died before surgery (1), decision not to operate following pre-assessment (14), admitted as emergency before

scheduled surgery (3).; Group 2 Number missing: 13, Reason: Died before surgery (1), lost to follow-up (3), decision not to operate (6), admitted as emergency before scheduled surgery (3).	
Protocol outcomes not reported by the study	Quality of life ; Mortality ; Patient, family and carer experience of care ; Adverse events and complications (Clavien-Dindo, postoperative morbidity score (POMS)) ; Unplanned intensive care unit admission

Appendix E: Forest plots

E.1 Preoperative optimisation clinics versus usual care

Figure 2: Mortality (30 days)

Study or Subgroup	Preop optimisation clinic Events	Total	Usual care Events	Total	Weight	Risk Ratio M-H, Fixed, 95% CI
Ommundsen 2018	2	53	3	63	100.0%	0.79 [0.14, 4.57]
Total (95% CI)		**53**		**63**	**100.0%**	**0.79 [0.14, 4.57]**
Total events	2		3			

Heterogeneity: Not applicable
Test for overall effect: Z = 0.26 (P = 0.79)

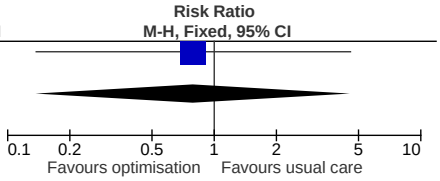


Figure 3: Mortality (3 months)

Study or Subgroup	Preop optimisation clinic Events	Total	Usual care Events	Total	Weight	Risk Ratio M-H, Fixed, 95% CI
Ommundsen 2018	3	53	4	63	100.0%	0.89 [0.21, 3.81]
Total (95% CI)		**53**		**63**	**100.0%**	**0.89 [0.21, 3.81]**
Total events	3		4			

Heterogeneity: Not applicable
Test for overall effect: Z = 0.16 (P = 0.88)

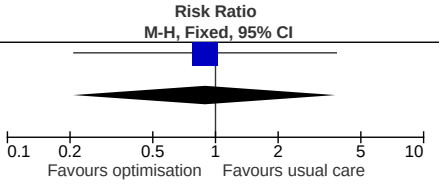


Figure 4: Complications – Clavien-Dindo Grade I

Study or Subgroup	Preop optimisation clinic Events	Total	Usual care Events	Total	Weight	Risk Ratio M-H, Fixed, 95% CI
Ommundsen 2018	4	53	8	63	100.0%	0.59 [0.19, 1.86]
Total (95% CI)		**53**		**63**	**100.0%**	**0.59 [0.19, 1.86]**
Total events	4		8			

Heterogeneity: Not applicable
Test for overall effect: Z = 0.89 (P = 0.37)

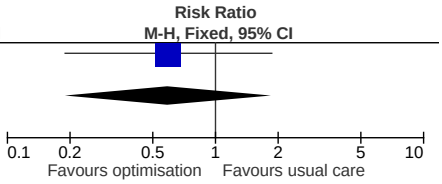


Figure 5: Complications – Clavien-Dindo Grade II

Study or Subgroup	Preop optimisation clinic Events	Total	Usual care Events	Total	Weight	Risk Ratio M-H, Fixed, 95% CI
Ommundsen 2018	20	53	36	63	100.0%	0.66 [0.44, 0.99]
Total (95% CI)		**53**		**63**	**100.0%**	**0.66 [0.44, 0.99]**
Total events	20		36			

Heterogeneity: Not applicable
Test for overall effect: Z = 2.00 (P = 0.05)

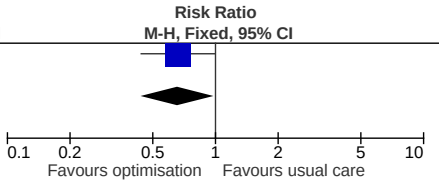


Figure 6: Complications – Clavien-Dindo Grade III

Study or Subgroup	Preop optimisation clinic Events	Total	Usual care Events	Total	Weight	Risk Ratio M-H, Fixed, 95% CI
Ommundsen 2018	8	53	4	63	100.0%	2.38 [0.76, 7.46]
Total (95% CI)		**53**		**63**	**100.0%**	**2.38 [0.76, 7.46]**
Total events	8		4			

Heterogeneity: Not applicable
Test for overall effect: Z = 1.48 (P = 0.14)

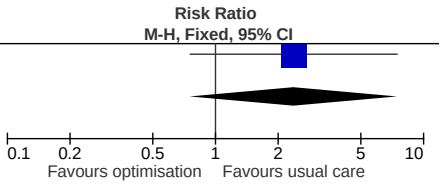


Figure 7: Complications – Clavien-Dindo Grade IV

Study or Subgroup	Preop optimisation clinic Events	Total	Usual care Events	Total	Weight	Risk Ratio M-H, Fixed, 95% CI
Ommundsen 2018	6	53	4	63	100.0%	1.78 [0.53, 5.99]
Total (95% CI)		**53**		**63**	**100.0%**	**1.78 [0.53, 5.99]**
Total events	6		4			

Heterogeneity: Not applicable
Test for overall effect: Z = 0.94 (P = 0.35)

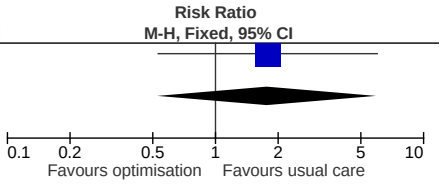


Figure 8: Complications – Clavien-Dindo Grade V

Study or Subgroup	Preop optimisation clinic Events	Total	Usual care Events	Total	Weight	Risk Ratio M-H, Fixed, 95% CI
Ommundsen 2018	2	53	3	63	100.0%	0.79 [0.14, 4.57]
Total (95% CI)		**53**		**63**	**100.0%**	**0.79 [0.14, 4.57]**
Total events	2		3			

Heterogeneity: Not applicable
Test for overall effect: Z = 0.26 (P = 0.79)

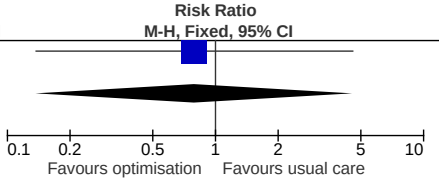


Figure 9: Length of stay (total)

Study or Subgroup	Preop optimisation clinic Mean	SD	Total	Usual care Mean	SD	Total	Weight	Mean Difference IV, Fixed, 95% CI
Macpherson 1994	7.1	7.5445	133	7	7.5445	137	100.0%	0.10 [-1.70, 1.90]
Total (95% CI)			**133**			**137**	**100.0%**	**0.10 [-1.70, 1.90]**

Heterogeneity: Not applicable
Test for overall effect: Z = 0.11 (P = 0.91)

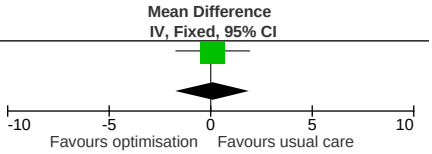


Figure 10: Length of stay (pre-op)

Study or Subgroup	Preop optimisation clinic Mean	SD	Total	Usual care Mean	SD	Total	Weight	Mean Difference IV, Fixed, 95% CI
Macpherson 1994	1.9	2.5148	133	3	2.5148	137	100.0%	-1.10 [-1.70, -0.50]
Total (95% CI)			**133**			**137**	**100.0%**	**-1.10 [-1.70, -0.50]**

Heterogeneity: Not applicable
Test for overall effect: Z = 3.59 (P = 0.0003)

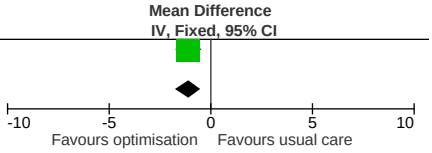


Figure 11: Length of stay (post-op)

Study or Subgroup	Preop optimisation clinic Mean	SD	Total	Usual care Mean	SD	Total	Weight	Mean Difference IV, Fixed, 95% CI
Macpherson 1994	4.8	6.4128	133	3.9	6.4128	137	100.0%	0.90 [-0.63, 2.43]
Total (95% CI)			**133**			**137**	**100.0%**	**0.90 [-0.63, 2.43]**

Heterogeneity: Not applicable
Test for overall effect: Z = 1.15 (P = 0.25)

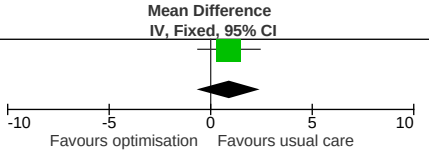
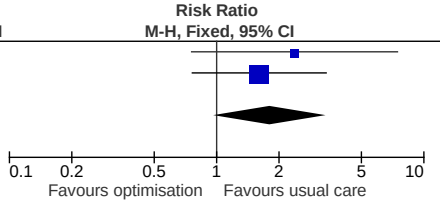


Figure 12: 30-day hospital readmission

Study or Subgroup	Preop optimisation clinic Events	Total	Usual care Events	Total	Weight	Risk Ratio M-H, Fixed, 95% CI
Ommundsen 2018	8	53	4	63	27.5%	2.38 [0.76, 7.46]
Partridge 2017	15	85	10	91	72.5%	1.61 [0.76, 3.38]
Total (95% CI)		**138**		**154**	**100.0%**	**1.82 [0.98, 3.38]**
Total events	23		14			

Heterogeneity: $Chi^2 = 0.32$, df = 1 (P = 0.57); $I^2 = 0\%$
Test for overall effect: Z = 1.89 (P = 0.06)



Appendix F: GRADE tables

Table 10: Clinical evidence profile: Preoperative optimisation clinic vs usual care for surgery in older people

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Preoperative optimisation clinic	Usual care	Relative (95% CI)	Absolute		
Mortality (30 day) (follow-up mean 30 days)												
1	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	very serious[1]	none	2/53 (3.8%)	4.8%	RR 0.79 (0.14 to 4.57)	11 fewer per 1000 (from 46 fewer to 193 more)	⊕⊕OO LOW	CRITICAL
Mortality (3 months) (follow-up mean 3 months)												
1	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	very serious[1]	none	3/53 (5.7%)	6.4%	RR 0.89 (0.21 to 3.81)	7 fewer per 1000 (from 51 fewer to 180 more)	⊕⊕OO LOW	CRITICAL
Complications (Clavien-Dindo Grade I) (follow-up mean 1 months)												
1	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	very serious[1]	none	4/53 (7.5%)	12.7%	RR 0.59 (0.19 to 1.86)	52 fewer per 1000 (from 103 fewer to 109 more)	⊕⊕OO LOW	CRITICAL
Complications (Clavien-Dindo Grade II) (follow-up mean 1 months)												
1	randomised	no serious	no serious	no serious	serious[1]	none	20/53	57.1%	RR 0.66	194 fewer per 1000	⊕⊕⊕O	CRITICAL

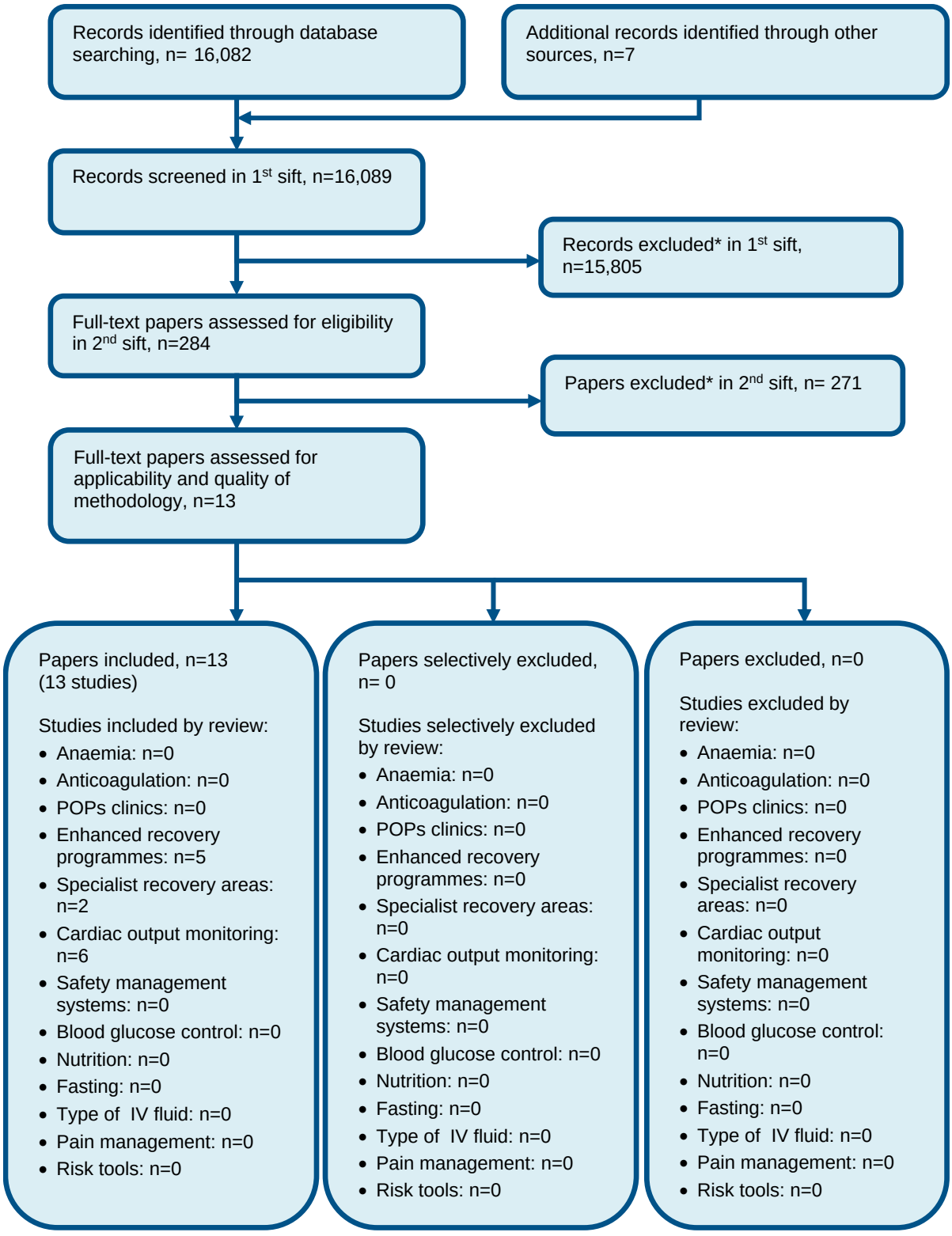
	trials	risk of bias	inconsistency	indirectness			(37.7%)		(0.44 to 0.99)	(from 6 fewer to 320 fewer)	MODERATE	
Complications (Clavien-Dindo Grade III) (follow-up mean 1 months)												
1	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	serious[1]	none	8/53 (15.1%)	6.4%	RR 2.38 (0.76 to 7.46)	88 more per 1000 (from 15 fewer to 413 more)	⊕⊕⊕O MODERATE	CRITICAL
Complications (Clavien-Dindo Grade IV) (follow-up mean 1 months)												
1	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	very serious[1]	none	6/53 (11.3%)	6.4%	RR 1.78 (0.53 to 5.99)	50 more per 1000 (from 30 fewer to 319 more)	⊕⊕OO LOW	CRITICAL
Complications (Clavien-Dindo Grade V) (follow-up mean 1 months)												
1	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	very serious[1]	none	2/53 (3.8%)	4.8%	RR 0.79 (0.14 to 4.57)	10 fewer per 1000 (from 41 fewer to 171 more)	⊕⊕OO LOW	CRITICAL
Length of stay (total) (Better indicated by lower values)												
1	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	no serious imprecision	none			-	MD 0.1 higher (1.7 lower to 1.9 higher)	⊕⊕⊕⊕ HIGH	CRITICAL
Length of stay (pre-op) (Better indicated by lower values)												
1	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	serious[1]	none	133	137	-	MD 1.1 lower (1.7 to 0.5 lower)	⊕⊕⊕O MODERATE	CRITICAL
Length of stay (post-op) (Better indicated by lower values)												

1	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	no serious imprecision	none	133	137	-	MD 0.9 higher (0.63 lower to 2.43 higher)	⊕⊕⊕⊕ HIGH	CRITICAL
30-day readmission (follow-up mean 1 months)												
2	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	serious[1]	none	23/138 (16.7%)	8.7%	RR 1.82 (0.98 to 3.38)	71 more per 1000 (from 2 fewer to 207 more)	⊕⊕⊕O MODERATE	CRITICAL

[1] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs.
[2] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias.
[3] Heterogeneity, I2>50%, not explained by subgroup analysis.
[4] Downgraded by 1 or 2 increments because the majority of the evidence included an indirect or very indirect population respectively

Appendix G: Health economic evidence selection

Figure 13: 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 11: Studies excluded from the clinical review

Reference	Reason for exclusion
Abdul Rahman 2017[1]	Excluded due to inappropriate study design
Anderson 2003[2]	Excluded due to inappropriate intervention
Audisio 2016[3]	Excluded due to inappropriate study design
Bagnall 2013[4]	Excluded due to inappropriate intervention
Bai 2003[5]	Excluded due to no relevant outcomes
Banerjee 1996[6]	Excluded due to inappropriate study design; review population; intervention
Berkel 2018[7]	Excluded due to inappropriate study design
Chow 2012[8]	Excluded due to inappropriate study design
Dale 2014[10]	Excluded due to inappropriate study design; intervention
Dibb 1999[11]	Excluded due to inappropriate study design
Dubhashi 2015[12]	Excluded due to inappropriate study design; review population; intervention
Eamer 2018[13]	Excluded due to inappropriate intervention
Feng 2015[14]	Excluded due to inappropriate intervention
Gupta 2014[15]	Excluded due to inappropriate study design
Halloway 2015[16]	Excluded due to no relevant outcomes
Harari 2007[17]	Excluded due to inappropriate study design
Huddleston 2004[18]	Excluded due to inappropriate intervention
Kim 2016[19]	Excluded due to inappropriate intervention
McIsaac 2016[22]	Excluded due to inappropriate study design
McIsaac 2017[21]	Excluded due to inappropriate study design; intervention
Murthy 2008[23]	Excluded due to inappropriate study design; review population
Nicholson 2013[25]	Excluded due to inappropriate review population
Partridge 2014[27]	Relevant studies included in review
Pasetto 2007[29]	Excluded due to inappropriate study design
Pham 2017[30]	Excluded due to inappropriate review population
Pollard 1999[31]	Excluded due to inappropriate study design; review population
Rafique 2017[32]	Excluded due to inappropriate study design
Ramesh 2005[33]	Excluded due to inappropriate study design
Swank 2011[34]	Excluded due to inappropriate intervention
Swart 2016[35]	Excluded due to inappropriate study design
Watt 2016[36]	Excluded due to 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 12: Studies excluded from the health economic review

Reference	Reason for exclusion
None.	

Appendix J: Research recommendations

J.1 Pre-optimisation clinics

Research question: What is the clinical and cost effectiveness of preoperative optimisation clinics for older people?

Why this is important:

The current evidence for the clinical and cost-effectiveness of POPS (Preoperative Optimisation) clinics is limited, with only a small number of RCTs published. Further high quality evidence is needed to determine the impact of providing proactive optimisation through these clinics to patients over 60 years of age prior to elective surgery.

Criteria for selecting high-priority research recommendations:

PICO question	Population: Older people aged 60 years (including those with multimorbidities) and over having surgery. Intervention(s): Preoperative optimisation clinics (including proactive care of older people going to have surgery (POPS) clinics) Comparison: Standard preoperative assessment Outcome(s): Health-related quality of life, mortality, patient, family and carer experience of care, adverse events and complications (Clavien-Dindo, postoperative morbidity score (POMS)), length of hospital stay (total pre and postoperative), unplanned intensive care unit admission, length of stay in intensive care unit and hospital readmission
Importance to patients or the population	Standard preoperative assessment does not focus significantly on the proactive optimisation of older patients prior to surgery. Currently there is little evidence to guide whether the implementation of POPs clinics more widely would be of benefit to patients, in terms of reduction of post-operative complications and reduction in mortality.
Relevance to NICE guidance	The small number of RCTs available indicate a possible benefit of POPs clinics over standard treatment, however further research is needed to inform future NICE guidelines due to current uncertainty regarding clinical benefit and cost-effectiveness
Relevance to the NHS	Further research in this area will inform NICE recommendations for service delivery and could potentially lead to further POPs clinics being established, with associated financial and logistical considerations.
National priorities	The NHS Long Term Plan (2018) recognises that the NHS needs to be more responsive to the needs of older people living with frailty. Although not specifically focusing on support and specialist services in secondary and tertiary care, POPs clinics may have a role to play in optimising the care of older people, as part of an overall strategy in delivering more effective person-centred care
Current evidence base	There are a small number of RCTs indicating a possible benefit of POP clinics for mortality and overall rate of complications
Equality	Focus is on older people aged over 60 yrs
Study design	A randomised-controlled trial should be undertaken to determine whether POPs clinics are clinically and cost-effective in the management of patients over 60 years of age, prior to elective

	surgery.
Feasibility	No obvious barriers or ethical issues
Other comments	None
Importance	High: the research is essential to inform future updates of key recommendations in the guideline.