

Preoperative tests (update)

Routine preoperative tests for elective surgery

NICE guideline NG45

Appendix C: Clinical review protocols

April 2016

*Developed by the National Guideline Centre,
hosted by the Royal College of Physicians*

Disclaimer

Healthcare professionals are expected to take NICE clinical guidelines fully into account when exercising their clinical judgement. However, the guidance does not override the responsibility of healthcare professionals to make decisions appropriate to the circumstances of each patient, in consultation with the patient and, where appropriate, their guardian or carer.

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Appendix C: Clinical review protocols

C.1 Resting electrocardiography

Table 1: Intervention review protocol: Resting electrocardiography

Component	Description
Review question	What is the clinical- and cost-effectiveness of using resting electrocardiography (ECG) as a preoperative test in improving patient outcomes in adults and young people undergoing non-cardiac elective surgery?
Objectives	The aim of this review is to determine whether using resting ECG as a preoperative test improves post-surgery outcomes in people undergoing non-cardiac surgery.
Population	<p>All adults and young people (ASA grade 1 or above) undergoing non-cardiac surgery</p> <p>Exclusion criteria:</p> <ul style="list-style-type: none"> • People undergoing cardiac surgery (such as valve replacement and coronary artery graft) • People undergoing transplantation • People undergoing emergency surgery <p>Stratified analysis if data available for:</p> <ul style="list-style-type: none"> • Surgery type or surgery grade (if specified) • ASA grade • Selected comorbidities: cardiovascular, respiratory and renal diseases, obesity, diabetes <p>Any studies including initial risk stratification of patients will be included.</p>
Subgroups	<p>The following factors will be considered for subgroup analysis if heterogeneity is present:</p> <ul style="list-style-type: none"> • Cardiovascular, respiratory and renal diseases, obesity, diabetes, high cholesterol, cerebrovascular, peripheral vascular
Intervention	Preoperative resting ECG
Comparator	No preoperative test
Outcomes	<p>Critical:</p> <ul style="list-style-type: none"> • All-cause mortality • Health-related quality of life <p>Important:</p> <ul style="list-style-type: none"> • Complications related to surgery or anaesthesia (for example arrhythmias, myocardial infarction, heart failure, respiratory failure, acute kidney failure, infection) • Length of hospital stay after an operation • Hospital readmission • Adverse events caused by testing • Intensive care unit (ICU) admission • Composite outcomes such as the major adverse cardiovascular events (MACE) that incorporate cardiac deaths and non-fatal cardiac events • Optimisation of medical therapy
Study design	<ul style="list-style-type: none"> • Systematic reviews of RCTs

	<ul style="list-style-type: none"> • RCTs • Non-randomised comparative studies <p>Exclusions:</p> <ul style="list-style-type: none"> • Observational studies • Case series • Case reports • Narrative summaries (including literature reviews) • Animal studies
Population size and directness	No restrictions
Setting	<ul style="list-style-type: none"> • NHS-commissioned secondary and tertiary care
Search Strategy	See Appendix G Update from 2003 guideline
Review Strategy	<p>Appraisal of methodological quality</p> <ul style="list-style-type: none"> • The methodological quality of each study will be assessed using NICE checklists and the quality of the evidence will be assessed by GRADE for each outcome. <p>Synthesis of data</p> <ul style="list-style-type: none"> • Meta-analysis will be conducted where appropriate. • Results will be analysed separately for each type of surgery and then the GDG will revise if results can be extrapolated or amalgamated across different surgeries.

Table 2: Prognostic review protocol: Resting electrocardiography

Component	Description
Review question	Does resting electrocardiography (ECG) predict prognosis (patient outcomes after surgery) in adults and young people undergoing non-cardiac elective surgery?
Objectives	Determine the predictive ability of resting electrocardiography (ECG) as a preoperative test for patient outcomes post-surgery.
Population	<p>All adults and young people (ASA grade 1 or above) undergoing non-cardiac surgery.</p> <p>Exclusion criteria:</p> <ul style="list-style-type: none"> • Patients undergoing cardiac surgery (such as valve replacement and coronary artery graft) • Patients undergoing transplantation • Patients undergoing emergency surgery <p>Stratified analysis if data available for:</p> <ul style="list-style-type: none"> • Surgery type or surgery grade (if specified) • ASA grade • Selected comorbidities: cardiovascular, respiratory and renal diseases, obesity, diabetes <p>Any studies including initial risk stratification of patients will be included.</p>
Prognostic test	Resting electrocardiography
Outcomes (30 days post-surgery)	<p>Critical:</p> <ul style="list-style-type: none"> • All-cause mortality <p>Important:</p>

Component	Description
	<ul style="list-style-type: none"> • Complications relating to surgery or anaesthesia • Length of hospital stay • Hospital readmission • Adverse events caused by testing • Health-related quality of life • ICU admission
Study design	Ideally prospective cohorts
Exclusions	Studies with univariate analyses will be excluded
Key confounders	<ul style="list-style-type: none"> • Age • Comorbidities
The review strategy	<p>Appraisal of methodological quality</p> <ul style="list-style-type: none"> • The methodological quality of each study will be assessed using NICE checklists and the quality of the evidence will be assessed for each outcome. <p>Synthesis of data</p> <ul style="list-style-type: none"> • Meta-analysis will be conducted where appropriate. <p>Results will be analysed separately for each type of surgery and then the GDG will revise if results can be extrapolated or amalgamated across different surgeries.</p>

C.2 Resting echocardiography

Table 3: Review protocol: Resting echocardiography

Component	Description
Review question 6b	What is the usefulness of resting echocardiography as a preoperative test in altering perioperative management for adults and young people with mild to severe comorbidities undergoing major or complex elective surgery?
Objectives	Determine the predictive ability of preoperative resting echocardiography testing as a pre-operative test for improving patient outcomes post-surgery.
Population	<p>Adult patients ASA 2 or above at risk of cardiovascular disease undergoing major or complex non-cardiac related surgery</p> <p>Exclusion criteria:</p> <ul style="list-style-type: none"> • People undergoing cardiac surgery (such as valve replacement and coronary artery graft) • People undergoing transplantation • People undergoing emergency surgery <p>Stratified analysis if data available for:</p> <ul style="list-style-type: none"> • Surgery type or surgery grade (if specified) • ASA grade • Selected comorbidities: cardiovascular, respiratory and renal diseases, obesity, diabetes <p>Any studies including initial risk stratification of patients will be included.</p>
Subgroups	The following factors will be considered for subgroup analysis if heterogeneity is present:

	Comorbidities: cardiovascular diseases, diabetes, obesity, respiratory, renal
Interventions	Resting echocardiography
Comparator	No resting echocardiography
Outcomes	<p>Critical:</p> <ul style="list-style-type: none"> • Change in healthcare management (for example cancellation of surgery or treating ischaemia, valvular disease or heart failure on the basis of the results of the tests) <p>Important:</p> <ul style="list-style-type: none"> • All-cause mortality • Complications related to surgery or anaesthesia • Length of hospital stay after an operation • Hospital readmission • Adverse events caused by testing (time of testing) • Health-related quality of life • Intensive care unit (ICU) admission • Composite outcomes such as the major adverse cardiovascular events (MACE) that incorporate cardiac deaths and non-fatal cardiac events • Optimisation of medical therapy
Study design	<ul style="list-style-type: none"> • Systematic reviews of RCTs • RCTs • Non-randomised comparative studies <p>Exclusions:</p> <ul style="list-style-type: none"> • Cohort studies • Case series • Case reports • Narrative summaries (including literature reviews) • Animal studies
Population size and directness	No restrictions
Setting	NHS-commissioned secondary and tertiary care
Search Strategy	2000 cut-off for papers
Review Strategy	<p>Appraisal of methodological quality</p> <p>The methodological quality of each study will be assessed using NICE checklists and the quality of the evidence will be assessed by GRADE for each outcome.</p> <p>Synthesis of data</p> <p>Meta-analysis will be conducted where appropriate.</p>

C.3 Cardiopulmonary exercise testing (CPET)

Table 4: Intervention review protocol: Cardiopulmonary exercise test (CPET)

Component	Description
Review question	What is the clinical- and cost-effectiveness of using cardiopulmonary exercise test

	(CPET) as a preoperative test in improving patient outcomes in adults and young people with mild to severe comorbidities undergoing major or complex non-cardiac elective surgery?
Objectives	The aim of this review is to determine whether using CPET as a preoperative test improves patient outcomes.
Population	<p>Adult patients classified as ASA grade 2 or above undergoing:</p> <ul style="list-style-type: none"> • Major or complex non-cardiac surgery <p>Exclusion criteria:</p> <ul style="list-style-type: none"> • People with severe COPD (equivalent to NYHA IIIb) • People undergoing cardiac surgery (such as valve replacement and coronary artery graft) • People undergoing transplantation • People undergoing emergency surgery <p>Stratified analysis if data available for:</p> <ul style="list-style-type: none"> • Surgery type or surgery grade (if specified) • ASA grade • Selected comorbidities: cardiovascular, respiratory and renal diseases, obesity, diabetes <p>Any studies including initial risk stratification of patients will be included.</p>
Subgroups	<p>The following factors will be considered for subgroup analysis if heterogeneity is present:</p> <ul style="list-style-type: none"> • Type of ischaemic heart disease (such as chronic stable angina, unstable angina, NSTEMI and STEMI) • Heart failure • Vascular diseases • Surgical procedure • Presence of COPD (mild or moderate) • Older people (as many of them would experience comorbidities)
Intervention	<ul style="list-style-type: none"> • Cardiopulmonary exercise test (CPET)
Comparator	<ul style="list-style-type: none"> • No CPET test/clinical assessment only
Outcomes	<p>Critical:</p> <ul style="list-style-type: none"> • All-cause mortality • Health-related quality of life <p>Important:</p> <ul style="list-style-type: none"> • Complications related to surgery or anaesthesia (for example arrhythmias, myocardial infarction, heart failure, respiratory failure, acute kidney failure, infection) • Length of hospital stay after an operation • Hospital readmission • Adverse events caused by testing • Intensive care unit (ICU) admission
Study design	<ul style="list-style-type: none"> • Systematic reviews of RCTs • RCTs • Non-randomised comparative studies <p>Exclusions:</p>

	<ul style="list-style-type: none"> • Observational studies • Case series • Case reports • Narrative summaries (including literature reviews) • Animal studies
Population size and directness	No restrictions
Setting	<ul style="list-style-type: none"> • NHS-commissioned secondary and tertiary care
Search Strategy	See Appendix G
Review Strategy	<p>Appraisal of methodological quality</p> <ul style="list-style-type: none"> • The methodological quality of each study will be assessed using NICE checklists and the quality of the evidence will be assessed by GRADE for each outcome. <p>Synthesis of data</p> <ul style="list-style-type: none"> • Meta-analysis will be conducted where appropriate. • Results will be analysed separately for each type of surgery and then the GDG will revise if results can be extrapolated or amalgamated across different surgeries.

Table 5: Prognostic review protocol: CPET

Component	Description
Review question	Does cardiopulmonary exercise testing (CPET) predict prognosis (patient outcomes after surgery) in adults and young people with mild to severe comorbidities undergoing major or complex non-cardiac elective surgery?
Objectives	Determine the predictive ability of CPET as a preoperative test for patient outcomes post-surgery
Population	<p>People with mild to severe comorbidities (classified as ASA grade 2 or above) undergoing major or complex non-cardiac elective surgery.</p> <p>Stratified analysis if data available for:</p> <ul style="list-style-type: none"> • Surgery type or surgery grade (if specified) • ASA grade • Selected comorbidities: cardiovascular, respiratory and renal diseases, obesity, diabetes <p>Exclusions:</p> <ul style="list-style-type: none"> • People with severe COPD (unless <10% of study population) • Patients undergoing cardiac surgery (such as valve replacement and coronary artery graft) • People undergoing transplantation surgery • People undergoing emergency surgery <p>Any studies including initial risk stratification of patients will be included.</p>
Prognostic test	<p>Cardiopulmonary exercise test measures, including:</p> <ul style="list-style-type: none"> • VO₂ (oxygen uptake) • Peak VO₂ (highest value during test) • VO₂ max (maximal oxygen uptake) • VCO₂ (carbon dioxide exhaled)

Component	Description
	<ul style="list-style-type: none"> • AT – Anaerobic threshold (exercise capacity) • VE/VO₂ and VE/VCO₂ – ventilatory equivalents
Outcomes (30 days post-surgery)	Critical: <ul style="list-style-type: none"> • All-cause mortality Important: <ul style="list-style-type: none"> • Complications relating to surgery or anaesthesia • Length of hospital stay • Hospital readmission • Adverse events caused by testing • Health-related quality of life • ICU admission
Study design	Ideally prospective cohorts
Exclusions	We will exclude studies with univariate analyses
Key confounders	<ul style="list-style-type: none"> • Age • Comorbidities
The review strategy	Stratified analysis if data available for: <ul style="list-style-type: none"> • Surgery type or surgery grade (if specified) • ASA grade • Selected comorbidities: cardiovascular, respiratory and renal diseases, obesity, diabetes

C.4 Polysomnography

Table 6: Intervention review protocol: Polysomnography

Component	Description
Review question	What is the clinical- and cost-effectiveness of using polysomnography as a preoperative test (to detect obstructive sleep apnoea) in improving patient outcomes in adults and young people with obesity undergoing major or complex elective non-cardiac surgery?
Objectives	The aim of this review is to determine whether using polysomnography as a preoperative test improves outcomes in people with obesity.
Population	All adults and young people with obesity (ASA grade 2 or above) undergoing major or complex elective non-cardiac surgery. Exclusion criteria: <ul style="list-style-type: none"> • Patients with a pre-existing diagnosis of obstructive sleep apnoea • People undergoing cardiac surgery (such as valve replacement and coronary artery graft) • People undergoing transplantation • People undergoing emergency surgery Stratified analysis if data available for: <ul style="list-style-type: none"> • Surgery type or surgery grade (if specified) • ASA grade

	Any studies including initial risk stratification of patients will be included.
Subgroups	<p>The following factors will be considered for subgroup analysis if heterogeneity is present:</p> <ul style="list-style-type: none"> • Comorbidities • BMI • Older age • Male • Hypertension <p>Stratified by surgery procedure</p>
Intervention	Polysomnography
Comparative strategies	No polysomnography
Outcomes	<p>Critical:</p> <ul style="list-style-type: none"> • All-cause mortality <p>Important:</p> <ul style="list-style-type: none"> • Complications related to surgery or anaesthesia • Length of hospital stay after an operation • Hospital readmission • Adverse events caused by testing • Health-related quality of life • Intensive care unit (ICU) admission • Optimisation of therapy • Change in management
Study design	<ul style="list-style-type: none"> • Systematic reviews of RCTs or observational studies • RCTs • Non-randomised comparative studies <p>Exclusions:</p> <ul style="list-style-type: none"> • Observational studies (including case control studies) • Case series • Case reports • Narrative summaries (including literature reviews) • Animal studies
Population size and directness	No restrictions
Setting	<ul style="list-style-type: none"> • NHS-commissioned primary care • Community settings in which NHS care is received
Search Strategy	See Appendix G
Review Strategy	<p>Appraisal of methodological quality</p> <ul style="list-style-type: none"> • The methodological quality of each study will be assessed using NICE checklists and the quality of the evidence will be assessed by GRADE for each outcome. <p>Synthesis of data</p> <ul style="list-style-type: none"> • Meta-analysis will be conducted where appropriate.

Table 7: Prognostic review protocol: Polysomnography

Component	Description
Review question	Does polysomnography predict prognosis (patient outcomes after surgery) in adults and young people with obesity undergoing major or complex elective non-cardiac surgery?
Objectives	The aim of this review is to determine the predictive ability of polysomnography for patient outcomes post-surgery.
Population	<p>All adults and young people with obesity (ASA grade 2 or above) undergoing major or complex elective non-cardiac surgery.</p> <p>Exclusion criteria:</p> <ul style="list-style-type: none"> • Patients with a pre-existing diagnosis of obstructive sleep apnoea • People undergoing cardiac surgery (such as valve replacement and coronary artery graft) • People undergoing transplantation • People undergoing emergency surgery <p>Stratified analysis if data available for:</p> <ul style="list-style-type: none"> • Surgery type or surgery grade (if specified) • ASA grade • Selected comorbidities: cardiovascular, respiratory and renal diseases, obesity <p>Any studies including initial risk stratification of patients will be included.</p>
Prognostic test	Polysomnography
Outcomes (30 days post-surgery)	<p>Critical:</p> <ul style="list-style-type: none"> • All-cause mortality <p>Important:</p> <ul style="list-style-type: none"> • Complications relating to surgery or anaesthesia • Length of hospital stay (post-operation) • Hospital readmission • Adverse events after surgery (wound infection) • Health-related quality of life • ICU admission
Study design	<p>Ideally prospective cohorts but retrospective cohorts will be accepted.</p> <p>Only papers with a multivariate analysis will be included.</p>
Exclusions	<p>Exclusion criteria:</p> <ul style="list-style-type: none"> • Patients with a pre-existing diagnosis of obstructive sleep apnoea • Patients undergoing cardiac surgery (such as valve replacement and coronary artery graft) • Patients undergoing transplantation
How the information will be searched	See Appendix G

Component	Description
Key confounders	<p><i>Minimum set of confounders that should be adjusted for (will vary per outcome)</i></p> <ul style="list-style-type: none"> • Comorbidities • BMI • Older age • Male • Hypertension
The review strategy	<p>Stratified by:</p> <ul style="list-style-type: none"> • Type of surgery

C.5 Health technology assessment update

Table 8: Intervention review protocol: HTA update

Component	Description
Review question 1	<p>What is the usefulness of the following tests in predicting outcome or altering perioperative management for adults and young people undergoing any type of elective surgery:</p> <ul style="list-style-type: none"> • Full blood count (haemoglobin, white blood cell count and platelet count) • Kidney function tests (urea, estimated glomerular filtration rate and electrolyte tests) • Lung function tests (also including blood gas analysis)
Objectives	<p>The aim of this review is to determine whether the use of full blood count, kidney function and lung function as preoperative tests improve post-surgical outcomes.</p>
Population	<p>Adults and young people classified as patients ASA grade 1 or 2 undergoing:</p> <ul style="list-style-type: none"> • Minor or intermediate surgery • Major or complex surgery <p>Stratified analysis if data available for:</p> <ul style="list-style-type: none"> • Surgery type or surgery grade (if specified) • ASA grade • Selected comorbidities: cardiovascular, respiratory and renal diseases, obesity, diabetes <p>Exclusions:</p> <ul style="list-style-type: none"> • People undergoing lung resection surgery • People undergoing cardiac surgery (such as valve replacement and coronary artery graft) • People undergoing transplantation • People undergoing emergency surgery
Subgroups	<p>The following factors will be considered for subgroup analysis if heterogeneity is present:</p> <ul style="list-style-type: none"> • Apparently healthy individuals with no clinical indication for testing FBC, U&Es and PFTs • Patients receiving treatment likely to alter results (for example diuretics) • Older age
Intervention	<p>Routine preoperative testing of:</p> <ul style="list-style-type: none"> • Full blood count (haemoglobin, white blood cell count and platelet count)

	<ul style="list-style-type: none"> • Kidney function tests (urea, estimated glomerular filtration rate and electrolyte tests) • Lung function tests (also including blood gas analysis) <p>A combination of the above tests will be included only if the efficacy of each test is analysed individually, not if the results are given as a composite outcome.</p>
Comparator	No routine preoperative testing
Outcomes (30-day post-surgery)	<ul style="list-style-type: none"> • All-cause mortality • Change in healthcare management (for example cancellation of surgery) • Complications related to surgery or anaesthesia • Length of hospital stay after an operation • Hospital readmission • Adverse events caused by testing (time of testing) • Health-related quality of life • Intensive care unit (ICU) admission
Importance of outcomes	<p>Critical outcomes:</p> <ul style="list-style-type: none"> • All-cause mortality • Complications related to surgery or anaesthesia
Study design	<ul style="list-style-type: none"> • Systematic reviews of RCTs or observational studies • RCTs • Non-randomised comparative studies • Observational studies (including case control studies) <p>Exclusions:</p> <ul style="list-style-type: none"> • Case series • Case reports • Narrative summaries (including literature reviews) • Animal studies
Population size and directness	No restrictions
Setting	<ul style="list-style-type: none"> • NHS-commissioned primary care • Secondary care
Search Strategy	<p>See Appendix G</p> <p>Search after May 2009 for adult patients ASA grade 1 or 2 (with cardiovascular, renal and respiratory diseases) undergoing:</p> <ul style="list-style-type: none"> • minor or intermediate surgery (HTA update) <p>Full searches for adult patients ASA grade 1 or 2 (with obesity, diabetes) undergoing:</p> <ul style="list-style-type: none"> • minor or intermediate surgery • major or complex surgery
Review Strategy	<p>Appraisal of methodological quality</p> <ul style="list-style-type: none"> • The methodological quality of each study will be assessed using NICE checklists and the quality of the evidence will be assessed by GRADE for each outcome. <p>Synthesis of data</p> <ul style="list-style-type: none"> • Meta-analysis will be conducted where appropriate.

Table 9: Prognostic review protocol: HTA update

Component	Description
Review question	Do full blood count (haemoglobin, white blood cell count and platelet count), kidney

Component	Description
	function tests (urea, estimated glomerular filtration rate and electrolyte tests) (U&Es) and lung function tests (also including blood gas analysis) predict prognosis (patient outcomes after surgery) in adults and young people ASA 1–4 undergoing minor, intermediate, major or complex elective non-cardiac surgery?
Objectives	The aim of this review is to determine the predictive ability of full blood count, kidney function tests and lung function tests (also including blood gas analysis) for patient outcomes post-surgery.
Population	<p>Adults and young people classified as patients ASA grade 1 to 4 undergoing:</p> <ul style="list-style-type: none"> • Minor, intermediate, complex or major surgery <p>Stratified analysis if data available for:</p> <ul style="list-style-type: none"> • Surgery type or surgery grade (if specified) • ASA grade • Selected comorbidities: cardiovascular, respiratory and renal diseases, obesity, diabetes. <p>Exclusions:</p> <ul style="list-style-type: none"> • Patients undergoing lung resection surgery • Patients undergoing cardiac surgery • Patients undergoing emergency surgery
Presence / absence of risk factor	<ul style="list-style-type: none"> • Full blood count (haemoglobin, white blood cell count and platelet count) (FBC) • Kidney function tests (urea, estimated glomerular filtration rate and electrolyte tests) (U&Es) • Lung function tests (also including blood gas analysis)
Outcomes (30-day post-surgery)	<p>Critical:</p> <ul style="list-style-type: none"> • All-cause mortality • Change in healthcare management (for example cancellation of surgery) • Complications related to surgery or anaesthesia • Length of hospital stay after an operation • Hospital readmission • Adverse events caused by testing (time of testing) • Health-related quality of life • Intensive care unit (ICU) admission
Study design	Ideally prospective cohorts
Exclusions	We have excluded studies with patients with severe COPD, those undergoing cardiac surgery (such as valve replacement and coronary artery graft), any type of organ transplantation or emergency surgery. Diagnostic studies assessing the diagnostic accuracy of CPET were not included.
Key confounders	<ul style="list-style-type: none"> • Age • Comorbidities
The review strategy	<p>Stratified analysis if data available for:</p> <ul style="list-style-type: none"> • Surgery type or surgery grade (if specified) • ASA grade • Selected comorbidities: cardiovascular, respiratory and renal diseases, obesity, diabetes

C.6 Glycated haemoglobin test

C.6.1 HbA1c in diagnosed diabetes

Table 10: Intervention review protocol: HbA1c in diagnosed diabetes

Component	Description
Review question	What is the clinical- and cost-effectiveness of using HbA1c (glycated haemoglobin) as a preoperative test in improving patient outcomes in adults and young people with diabetes and mild to severe comorbidities undergoing non-cardiac elective surgery?
Objectives	The aim of this review is to determine whether using HbA1c (glycated haemoglobin) as a preoperative test improves outcomes in people with diagnosed diabetes.
Population	<p>Adult patients with diabetes (all types) undergoing non-cardiac related surgery</p> <p>Exclusion criteria:</p> <ul style="list-style-type: none"> • People undergoing cardiac surgery (such as valve replacement and coronary artery graft) • People undergoing transplantation • People undergoing emergency surgery <p>Stratified analysis if data available for:</p> <ul style="list-style-type: none"> • Surgery type or surgery grade (if specified) • ASA grade • Selected comorbidities: cardiovascular, respiratory and renal diseases, obesity <p>Any studies including initial risk stratification of patients will be included.</p>
Subgroups	<p>The following factors will be considered for subgroup analysis if heterogeneity is present:</p> <ul style="list-style-type: none"> • Type of ischaemic heart disease (such as chronic stable angina, unstable angina, NSTEMI and STEMI) • Heart failure • Vascular diseases • Older age (as many older people may experience comorbidities)
Intervention	HbA1c (glycated haemoglobin)
Comparator	<ul style="list-style-type: none"> • No HbA1c (glycated haemoglobin) /clinical assessment only • Random blood glucose
Outcomes	<p>Critical:</p> <ul style="list-style-type: none"> • All-cause mortality • Health-related quality of life <p>Important:</p> <ul style="list-style-type: none"> • Complications related to surgery or anaesthesia (for example arrhythmias, myocardial infarction, heart failure, respiratory failure, acute kidney failure, infection) • Adverse events caused by testing. • Length of hospital stay • Hospital readmission • Intensive care unit (ICU) admission

Study design	<ul style="list-style-type: none"> • Systematic reviews of RCTs • RCTs • Non-randomised comparative studies <p>Exclusions:</p> <ul style="list-style-type: none"> • Observational studies • Case series • Case reports • Narrative summaries (including literature reviews) • Animal studies
Population size and directness	No restrictions
Setting	<ul style="list-style-type: none"> • NHS-commissioned secondary and tertiary care
Search Strategy	See Appendix G
Review Strategy	<p>Appraisal of methodological quality</p> <ul style="list-style-type: none"> • The methodological quality of each study will be assessed using NICE checklists and the quality of the evidence will be assessed by GRADE for each outcome. <p>Synthesis of data</p> <ul style="list-style-type: none"> • Meta-analysis will be conducted where appropriate. • Results will be analysed separately for each type of surgery and then the GDG will revise if results can be extrapolated or amalgamated across different surgeries.

Table 11: Review protocol 2 (prognostic): HbA1c in diagnosed diabetes

Component	Description
Review question	Does HbA1c (glycated haemoglobin) predict prognosis (predicting patient outcomes after surgery) of people with diabetes (all types) and mild to severe comorbidities undergoing major or complex non-cardiac elective surgery?
Objectives	The aim of this review is to determine the predictive ability of tests that detect hyperglycaemia in patients with diabetes on outcomes post-surgery.
Population	<p>Adult patients with diabetes (all types) undergoing non-cardiac related surgery</p> <p>Exclusion criteria:</p> <ul style="list-style-type: none"> • People undergoing cardiac surgery (such as valve replacement and coronary artery graft) • People undergoing transplantation • People undergoing emergency surgery <p>Stratified analysis if data available for:</p> <ul style="list-style-type: none"> • Surgery type or surgery grade (if specified) • ASA grade • Selected comorbidities: cardiovascular, respiratory and renal diseases, obesity <p>Any studies including initial risk stratification of patients will be included.</p>
Prognostic test	Level of glycated haemoglobin (HbA1c)
Outcomes	Critical:

Component	Description
(30 days post-surgery)	<ul style="list-style-type: none"> All-cause mortality <p>Important:</p> <ul style="list-style-type: none"> Complications relating to surgery or anaesthesia Length of hospital stay (post-operation) Hospital readmission Adverse events after surgery (wound infection) Health-related quality of life ICU admission
Study design	Ideally prospective cohorts
Exclusions	<p>Exclude studies with univariate analyses if there are studies with multivariable analysis</p> <p>Exclusions:</p> <ul style="list-style-type: none"> Cardiac surgery (for example valve replacement, coronary artery graft) Transplantation surgery
Key confounders	<p><i>Minimum set of confounders that should be adjusted for (will vary per outcome)</i></p> <ul style="list-style-type: none"> Age BMI Comorbidities (cardiovascular, respiratory and renal diseases, obesity) Patients taking drugs that cause a rapid rise in glucose (such as corticosteroids or antipsychotic drugs (≤ 2 months). HbA1c can be used in patients taking these drugs longer term (> 2 months) who are not clinically unwell Ethnic groups Patients with acute pancreatic damage or who have undergone pancreatic surgery Patients with renal failure Patients with HIV infection
The review strategy	<p>Stratified by:</p> <ul style="list-style-type: none"> Type of surgery
Notes	We will consider studies that have compared random glucose test or HbA1c (first arm) versus urine analysis (second arm) by reporting results only for the first arm.

C.6.2 HbA1c in undiagnosed diabetes

Table 12: Intervention review protocol: HbA1c in undiagnosed diabetes

Component	Description
Review question	What is the clinical- and cost-effectiveness of using HbA1c (glycated haemoglobin) as a preoperative test in improving patient outcomes in adults and young people with mild to severe comorbidities undergoing non-cardiac elective surgery?
Objectives	The aim of this review is to determine whether using HbA1c (glycated haemoglobin) as a preoperative test improves outcomes in people without diagnosed diabetes
Population	<p>Adult patients without diagnosed diabetes (all types) undergoing non-cardiac related surgery</p> <p>Exclusion criteria:</p> <ul style="list-style-type: none"> People with diagnosed diabetes

	<ul style="list-style-type: none"> • People undergoing cardiac surgery (such as valve replacement and coronary artery graft) • People undergoing transplantation • People undergoing emergency surgery <p>Stratified analysis if data available for:</p> <ul style="list-style-type: none"> • Surgery type or surgery grade (if specified) • ASA grade • Selected comorbidities: cardiovascular, respiratory and renal diseases, obesity <p>Any studies including initial risk stratification of patients will be included.</p>
Subgroups	<p>The following factors will be considered for subgroup analysis if heterogeneity is present:</p> <ul style="list-style-type: none"> • Type of ischaemic heart disease (such as chronic stable angina, unstable angina, NSTEMI and STEMI) • Heart failure • Vascular diseases • Older age (as many older people would experience comorbidities)
Intervention	HbA1c (glycated haemoglobin)
Comparator	No HbA1c (glycated haemoglobin) /clinical assessment only
Outcomes	<p>Critical:</p> <ul style="list-style-type: none"> • All-cause mortality • Health-related quality of life <p>Important:</p> <ul style="list-style-type: none"> • Complications related to surgery or anaesthesia (for example arrhythmias, myocardial infarction, heart failure, respiratory failure, acute kidney failure, infection) • Length of hospital stay after an operation • Hospital readmission • Intensive care unit (ICU) admission
Study design	<ul style="list-style-type: none"> • Systematic reviews of RCTs • RCTs • Non-randomised comparative studies <p>Exclusions:</p> <ul style="list-style-type: none"> • Observational studies • Case series • Case reports • Narrative summaries (including literature reviews) • Animal studies
Population size and directness	No restrictions
Setting	<ul style="list-style-type: none"> • NHS-commissioned secondary and tertiary care
Search Strategy	See Appendix G
Review Strategy	<p>Appraisal of methodological quality</p> <ul style="list-style-type: none"> • The methodological quality of each study will be assessed using NICE checklists and

	<p>the quality of the evidence will be assessed by GRADE for each outcome.</p> <p>Synthesis of data</p> <ul style="list-style-type: none"> • Meta-analysis will be conducted where appropriate. • Results will be analysed separately for each type of surgery and then the GDG will revise if results can be extrapolated or amalgamated across different surgeries
Notes	<ul style="list-style-type: none"> • Results may potentially inform cost-effectiveness considerations

Table 13: Review protocol 2 (prognostic): HbA1c in undiagnosed diabetes

Component	Description
Review question	Does HbA1c (glycated haemoglobin) predict prognosis (predicting patient outcomes after surgery) of people with mild to severe comorbidities undergoing major or complex non-cardiac elective surgery?
Objectives	The aim of this review is to determine the predictive ability of tests that detect hyperglycaemia for patient outcomes post-surgery.
Population	<p>Adult patients with diabetes (all types) undergoing non-cardiac related surgery</p> <p>Exclusion criteria:</p> <ul style="list-style-type: none"> • People with diagnosed diabetes • People undergoing cardiac surgery (such as valve replacement and coronary artery graft) • People undergoing transplantation • People undergoing emergency surgery <p>Stratified analysis if data available for:</p> <ul style="list-style-type: none"> • Surgery type or surgery grade (if specified) • ASA grade • Selected comorbidities: cardiovascular, respiratory and renal diseases, obesity <p>Any studies including initial risk stratification of patients will be included.</p>
Prognostic test	Level of glycated haemoglobin (HbA1c)
Outcomes (30 days post-surgery)	<p>Critical:</p> <ul style="list-style-type: none"> • All-cause mortality <p>Important:</p> <ul style="list-style-type: none"> • Complications relating to surgery or anaesthesia • Length of hospital stay (post-operation) • Hospital readmission • Adverse events after surgery (wound infection) • Health-related quality of life • ICU admission
Study design	Ideally prospective cohorts but retrospective cohorts will be accepted
Exclusions	<p>Exclusion criteria:</p> <ul style="list-style-type: none"> • Patients undergoing cardiac surgery (such as valve replacement and coronary artery

Component	Description
	graft) <ul style="list-style-type: none"> • Patients undergoing transplantation • Patients with diabetes
Key confounders	<i>Minimum set of confounders that should be adjusted for (will vary per outcome)</i> <ul style="list-style-type: none"> • Age • Comorbidities (cardiovascular, respiratory and renal diseases, obesity) • Patients taking drugs that cause a rapid rise in glucose (such as corticosteroids or antipsychotic drugs (≤ 2 months). HbA1c can be used in patients taking these drugs longer term (> 2 months) who are not clinically unwell. • Ethnic groups (Asian) • Patients with acute pancreatic damage or who have undergone pancreatic surgery • Patients with renal failure • Patients with HIV infection
The review strategy	Stratified by: <ul style="list-style-type: none"> • Type of surgery
Notes	We will consider studies that have compared random glucose test or HbA1c (first arm) versus urine analysis (second arm) by reporting results only for the first arm.

