Title: European Society of Cardiology Quality Indicators for the Cardiovascular Preoperative Assessment and Management of patients considered for non-cardiac surgery. Developed in collaboration with the European Society of Anaesthesiology & Intensive Care

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ABSTRACT (250 words)

Aims

To establish a set of quality indicators (QIs) for the cardiovascular (CV) assessment and management of patients undergoing non-cardiac surgery.

Methods and results

The Quality Indicator Committee of the European Society of Cardiology (ESC) and European Society of Anaesthesiology & Intensive Care (ESAIC) in collaboration with Task Force members of the 2022 ESC Guidelines on CV assessment and management of patients undergoing non-cardiac surgery followed the ESC methodology for QI development. This included 1) identification, by constructing a conceptual framework of care, of domains of the CV assessment and management of patients with risk factors or established cardiovascular disease (CVD) who are considered for or undergoing non-cardiac surgery, 2) development of candidate QIs following a systematic literature review, 3) selection of the final set of QIs

using a modified Delphi method, 4) evaluation of the feasibility of the developed QIs. In total, eight main and nine secondary QIs were selected across six domains: 1) Structural framework (written policy), 2) Patient education and quality of life (CV risk discussion), 3) Peri-operative risk assessment (indication for diagnostic tests), 4) Peri-operative risk mitigation (use of hospital therapies), 5) Follow-up (post-discharge assessment) and 6) Outcomes (major CV events).

Conclusion

We present the 2022 ESC/ESAIC QIs for the CV assessment and management of patients with risk factors or established CVD who are considered for or are undergoing non-cardiac surgery. These indicators are supported by evidence from the literature, underpinned by expert consensus and align with 2022 ESC Guidelines on CV assessment and management of patients undergoing non-cardiac surgery.

KEYWORDS: Guidelines. Non-cardiac surgery. Pre-operative cardiac risk assessment. Pre-operative cardiac testing. Pre-operative coronary artery revascularization. Perioperative cardiac management. Anaesthesiology. Post-operative cardiac surveillance. Quality Indicators. Clinical Practice Guidelines.

INTRODUCTION

It is estimated that 7% to 11% of non-cardiac surgeries (NCS) are associated with complications, of which almost a half is due to cardiovascular disease (CVD).[1, 2] Over the coming years, increasing numbers of NCS are projected for an older[3, 4] and higher-risk population – with the potential for increased early mortality and life-threatening complications, such as the development of heart failure (HF) or acute-coronary syndromes.[5] Moreover, observational studies have described variation in the assessment and management of CVD in the peri-operative period for patients undergoing NCS. As such, there is a need for

tools that may standardize CVD care for patients undergoing NCS.[6]

Quality indicators (QIs) are used to evaluate the implementation of guideline-recommended interventions, improve processes of care and capture patient outcomes.[7] In parallel with the development of its Clinical Practice Guidelines, the European Society of Cardiology (ESC) has established suites of QIs for a number of CVD conditions.[8-12] To date there are no QIs that evaluate the quality of CVD care during the peri-operative period for patients undergoing NCS. Therefore, in collaboration with the Task Force of the 2022 ESC Guidelines on cardiovascular (CV) assessment and management of patients undergoing non-cardiac surgery and the European Society of Anaesthesiology & Intensive Care (ESAIC), the Working Group for NCS QIs was established to develop a set of QIs for the assessment and management of CVD in adult patients undergoing NCS. The ESC anticipates that QIs will improve the implementation of guideline recommendations and therefore reduce the 'evidence-practice gap' for patients undergoing NCS.

METHODS

We followed the ESC methodology for the development of QIs for the quantification of CV care and outcomes.[7] In brief, this involves 1) the identification of the key domains of the perioperative assessment and management of CVD for patients undergoing NCS by constructing a conceptual framework of care delivery, 2) the development of candidate QIs by conducting a systematic review of the literature, 3) the selection of the final set of QIs using a modified Delphi method, and 4) the evaluation of the feasibility of the developed QIs.[7] The ESC QIs include main and secondary indicators. The main indicators are those that have higher validity and feasibility as scored by the Working Group members and thus may be used for measurement across regions and over time. Both the main and secondary QIs may be used for local quality improvement activities.[7, 13]

Members of the Working Group

The Working Group comprised Task Force members of the 2022 ESC Guidelines on CV assessment and management of patients undergoing non-cardiac surgery, ESC/ESAIC representatives, a patient representative, and international experts in peri-operative CV care, as well as members of the ESC Quality Indicator Committee. The selection of candidates is based on clinical expertise, knowledge in the development of quality indicators for CV care and outcomes and in the elaboration of ESC guidelines. In collaboration with the chairs of the 2022 ESC Guidelines on CV assessment and management of patients undergoing non-cardiac surgery, the ESC established a QI committee whose members first worked in a smaller group for the conduct of the systematic review and the definition of the QI. Then the potential list of candidates was shared in a wider team of expert clinician (cardiologists and anesthesiologists) and patient representatives defined as the working group.[7] A series of virtual meetings were convened between the members of the Working Group from September 2021 until June 2022.

Target population and domains of care

The initial phase of the development process involved the identification of the 'target population' and the key domains of care. The 'target population' for whom the QIs are intended was defined as patients with established or high risk for CVD, and the key domains of care were established accordingly by constructing a conceptual illustration of the care pathway for this group of patients.[7] The target population included intermediate-risk patients defined as patients aged 65 years or older or those with risk factors for CVD, and high-risk patients defined as patients with known CVD. High-risk NCS was defined as general abdominal or intraperitoneal surgery, neurosurgery, suprainguinal and peripheral arterial surgery, thoracic surgery and transplant surgery. Definitions were developed for each of the QIs. This included a numerator, which is the group of patients for whom the QI is delivered

and a denominator, which is the group of patients eligible for the measurement.[7] Structural QIs are designed as binary measurements evaluating the availability of services in healthcare centres or units providing non-cardiac surgery.

Systematic review

Search strategy

We conducted a systematic review of the published literature in accordance with the Preferred Reporting Items for Systematic Review and Meta-analyses statement.[14] We searched two online bibliographic databases; MEDLINE and Embase via OVID (Wolters Kluwer, Alphen an den Rijn, Netherlands). The initial search strategy was developed in MEDLINE using keywords and medical subject headings (MeSH) terms, such as "Adrenergic beta-Antagonists", Anticoagulants", "Biomarkers", "Cardiovascular Agents", "Cardiovascular Diseases", "Diagnostic Imaging", "Drug Therapy", "Evidence-Based Medicine", "Humans", "Hydroxymethylglutaryl-CoA Reductase Inhibitors", "Intraoperative Complications", "Laparoscopy", "Myocardial Revascularization", "Perioperative Care", "Postoperative Complications", "Preoperative Care" and "Risk Assessment" (for full list see Appendix Table A1). Further potential articles were identified using citation-searching and hand-searching of the references of identified articles. We only included the primary publication of randomized controlled trials and included the main publications of major trials from which our search obtained only sub-studies. We excluded systematic reviews, meta-analyses, editorials, letters and conference proceedings. The search was restricted to English language reports and publication dates between 01 January 2014 and 08 October 2021. The search was restricted to the period after 2014 because this year corresponds to the publication of the previous 2014 ESC Guidelines on non-cardiac surgery: CV assessment and management, thus ensuring current validity and applicability.[15]

Eligibility criteria

We included articles fulfilling the following criteria: (1) the study population was adults (aged ≥18 years) with established or with risk factors for CVD considered for or undergoing non-cardiac surgery, (2) the study defined an intervention (structural or process aspect of risk assessment or preventive care) for which at least one outcome measure was reported, (3) the outcome measures were hard endpoints (e.g. mortality, re-admission) or patient reported outcomes (e.g. quality of life), (4) the study provided definitions for the intervention and outcome measure(s) evaluated and (5) the study was a peer-reviewed randomized controlled trial or comparative clinical effectiveness study. No restriction was placed on sample sizes, but studies which reported surrogate outcomes (e.g. biomarkers) as the main endpoints were excluded.

Study selection

EndNote X9 (Clarivate Analytics, London, UK) was used for reference management and for duplicate removal. Each retrieved study was independent evaluated by three reviewers (SA, BG and BB) against prespecified inclusion criteria. Disagreements were resolved through discussions and full text review of the article.

Quality assessment and data extraction

Studies that met the eligibility criteria were included in the initial phase of the review. The broad inclusion was important to ensure that a list of candidate QIs was representative of a wide range of pre-operative care. For each included study both the intervention studied and the outcome measure(s) that were evaluated were extracted. The variables were then classified according to their domain of care and to the type of the measurement (structural,

process, or outcome).[7, 13] Definitions of the data items extracted were also obtained when provided in the studies.

Clinical Practice Guidelines and existing QIs

We reviewed Clinical Practice Guidelines for preoperative CV management and the assessment of the patient considered for or undergoing non cardiac surgery.[15] Class I and III recommendations were then judged against the ESC selection criteria for QIs (Appendix Table A2). Existing QIs and relevant 'performance measures' to NCS were also considered as candidate QIs using the same ESC QI selection criteria.

Data synthesis

Modified Delphi process

The modified Delphi approach was used to evaluate the candidate QIs derived from the literature review.[7] The Working Group members were made aware of the ESC criteria for QI development (Appendix Table A2) to standardize the voting process, and each candidate QI was ranked by each panelist on a 9-point ordinal scale for both validity and feasibility using an online questionnaire.[7, 13] In total, two rounds of voting were conducted, with a number of teleconferences after each round to discuss the results of the vote and address any concerns, questions or ambiguities.

Voting

The 9-point ordinal scale used for voting implied that ratings of 1 to 3 meant that the QI is not valid/feasible; ratings of 4 to 6 meant that the QI is of an uncertain validity/feasible; and ratings of 7 to 9 meant that the QI is valid/feasible. For each candidate QI, the median and the mean deviation from the median were calculated to evaluate the central tendency and the

dispersion of the votes. Indicators, with median scores ≥7 for validity, ≥4 for feasibility, and with minimal dispersion, were included in the final set of QIs.[7, 13] The candidate QIs that met the inclusion criteria in the first voting round were defined as main QIs, whilst those that met the inclusion criteria after the second round of voting were defined as secondary indicators.

RESULTS

Domains of care

The Working Group identified six domains of care for the assessment and management of CVD peri-operatively for patients undergoing NCS. These domains aim to capture the continuum of care delivery irrespective of the healthcare institution at which the performance measurement is taking place.[16] The domains are: 1) Structural framework, 2) Patient education and quality of life, 3) Peri-operative risk assessment, 4) Peri-operative risk mitigation, 5) Follow-up, and 6) Outcomes (Figure 1).

Systematic review results

The literature search retrieved 1972 articles, of which 86 met the inclusion criteria (Figure 2). In total, 74 candidate QIs were extracted and subsequently included in the first Delphi round.

Modified Delphi results

Following the first round of voting, 51/74 (69%) candidate QIs were excluded. Of the remaining QIs, 8/23 (35%) met the inclusion threshold and thus were included as main QIs. The remaining 15/23 (65%) were deemed inconclusive and carried to the second voting round, after which 9/15 (60%) were included in the second Delphi round as secondary QIs.

Quality Indicators

Domain 1: Structural framework

This domain evaluates the characteristics of the centres that provide peri-operative care for patients with established or high risk for CVD undergoing NCS. The QIs developed in this domain may provide guidance to the allocations of resources which are needed for the delivery of optimal care. One main and no secondary QIs were selected. The main QIs captures the availability of written policies for preoperative preparation, including all of the following: fasting, investigations, blood typing, thromboprophylaxis, peri-operative diabetes management and allergies (**Main 1.1**) for patients undergoing NCS (Table 1).

Domain 2: Patient education and quality of life

Shared decision-making is an essential component of CV risk assessment for patients undergoing NCS. However, the capture of such a measure may be challenging from routine medical records. Thus, a secondary QI that evaluates the discussion with the patient about potential CV risks prior to the NCS is selected (**Secondary 2.1**) (Table 1).

Domain 3: Peri-operative risk assessment

The evaluation of CV risks preoperatively is the cornerstone of the assessment and management of patients undergoing NCS, particularly high-risk surgeries. The assessment of CV risk can help identify those with suboptimal risk factor control who may require treatment optimization or additional testing for stratification (**Main 3.1)**.

The recording of the pre-operative measurement of vital signs (blood pressure and heart) and cardiac physical examination within two hours of surgery is a QI for all patients undergoing non cardiac surgery (**Main 3.2**). In intermediate- and high-risk patients undergoing high-risk

NCS, the documentation of troponin pre-operatively and at 24 or 48 hours after surgery help detect subclinical cardiac injury **(Main 3.3**). For intermediate- and high-risk patients undergoing all types of NCS, full blood count and renal function (**Main 3.4),** as well as coagulation profile (prothrombin time, platelet count) (**Secondary 3.1**) should be checked preoperatively (Table 1). Additional preoperative parameters have been validated in intermediate- and high-risk patients including their functional status using 2-flight of stairs or the Duke Activity Status Index (**Secondary 3.2**), a frailty assessment with a validated tool in patients aged 70 years or older (**Secondary 3.3**), a preoperative ECG (**Secondary 3.4**) and echocardiography within 3 months of surgery in high-risk patients with ongoing symptoms of HF (**Secondary 3.5**).

Domain 4: Peri-operative risk mitigation

Several preventive measures have a role in reducing the perioperative CV risks in high or very high-risk patients undergoing NCS. These measures include the prescription of venous thromboembolism (VTE) prophylaxis prior to high risk orthopedic or abdominal surgery (hip, knee, vertebral column, traumatism, cancer, inflammatory digestive disease, bariatric surgery, or others) (**Main 4.1**), in-hospital cardiac evaluation for patients with perioperative myocardial infarction/injury after NCS (**Main 4.2**) and the continuation of long-term anticoagulation therapy peri-operatively (**Secondary 4.1**) (Table 1).

Domain 5: Follow-up

Incident peri-operative atrial fibrillation occurs frequently in patients undergoing NCS. Stroke risk assessment (using the CHA_2DS_2-VASc score) is mandatory in patients with AF to identify optimal stroke prevention strategy (most commonly oral anticoagulation) (**Secondary 5.1**).

Domain 6: Outcomes

Clinical outcomes following NCS are useful measures of the quality of care delivered. The Working Group selected the recording of in-hospital death, myocardial infarction, stroke, arterial or venous thrombo-embolic events as a main QI (**Main 6.1**), and the documentation of unplanned coronary/peripheral revascularization as a secondary QI (**Secondary 6.1**).

DISCUSSION

This document presents a set of eight main and nine secondary QIs for patients undergoing NCS. These QIs have been developed using a standardized methodology and collaboratively between the Quality Indicator Committee of the ESC, members of the Task Force of the 2022 ESC Guidelines on CV assessment and management of patients undergoing non-cardiac surgery, the ESC Patient Forum and domain experts.[7, 13] The QIs presented in this document align with recommendations of the 2022 ESC Guidelines on non-cardiac surgery CV assessment and management and integrate with other ESC QIs.[8, 10, 12] By developing QIs for patients undergoing NCS who may be at high risk for CV complications peri-operatively, it is hoped that national and international efforts may be initiated to implement these QIs to standardize CVD assessment and management for this group of patients and reduce variation in practice.

During the process of selecting the QIs for patients undergoing NCS, we had more extensive discussions for some of the indicators. The inclusion of HF in the outcome definition was discussed by the group but not retained. This was to avoid duplication of indicators across the ESC guidelines; the ESC Quality Indicators for HF provide information about structural, process and outcome measures for individuals with HF.[8] Also, there was consensus that a standardized definition of HF during hospitalization could be difficult to interpret and implement because HF is usually present prior to the time of surgery. The decision not to

include HF in the outcome as QI does not imply that strategies to prevent and treat HF during hospitalization are not relevant.

The working group proposed that in intermediate- and high-risk patients undergoing high-risk NCS, the documentation of troponin pre-operatively and at 24 or 48 hours after surgery could help detect subclinical cardiac injury. Whilst this QI may help improve stratification of CV risk as well as therapy adaptation, we acknowledge that the documentation of this QI could be a major change to current practice, and potentially not be implementable in every setting. The working group was also careful to be in alignment with the wording used in the 2022 ESC Guidelines on non-cardiac surgery CV assessment and management. The continuous evaluation and reporting of structural, processes and outcomes of healthcare is increasingly mandated by professional societies, regulators and patients.[7, 17] In recent years, QIs for CVD provided a means to benchmark performance, improve the implementation of evidence-based practice and assess the effectiveness of quality improvement initiatives.[13] The ESC QIs have a role in identifying variation in CVD care quality and outcomes across regions and overtime. For patients undergoing NCS, there is a lack of internationally endorsed QIs that promote standardized practice that aligns with Clinical Practice Guidelines.

Whilst previous efforts have sought to develop indicators of care quality during the peri-operative period,[18-20] these have been wide-ranging with little focus on NCS and/or associated CV complications around the time of surgery. Furthermore, there is heterogeneity in clinical practice and evidence for both under and over use of investigations. Thus, there remains a need to standardize the assessment and management of CVD and identify groups of patients for whom non-invasive cardiac testing is appropriate.[21] The 2022 ESC/ESAIC QIs for the CV assessment and management of patients undergoing NCS define key domains of care for this

group of patients and recommend specific QIs for particular subsets of patients and types of NCS.

The provision of a suite of QIs specifically designed for patients undergoing NCS may serve as a catalyst to establish regional, national, or international registries to capture real-world patient data for particular types of high-risk NCS or patient groups. The implementation of evidence-based practice needs first the assessment of potential gaps in the process of care using well-established QIs.[22] This first step is particularly important to design further interventions to overcome barriers. The knowledge-to-action cycle is a well-suited framework to illustrate the perpetual link between scientific knowledge, identification of problems, planned actions to fix it and continuing evaluation of outcomes and system sustainability.[23]

Although our work has several strengths, we acknowledge its limitations. First, we recognize that some barriers could exist for a healthcare setting to implement all the proposed QIs given the wide range of areas. Therefore, the Working Group decided not to use a composite QI because such an indicator may disadvantage centres that offer specific services or smaller hospital services, particularity in the absence of evidence about combined interventions in this clinical area. Also, the Working Group emphasized that efforts are needed to achieve performances through the integration of coordinated systems with enough granularities in the data, such as electronic healthcare records, clinical registries and quality improvement projects.[24] Second, the selection of the final set of QIs was underpinned by expert opinions. However, the procedure of formulation of candidate QIs was based on a systematic review of the literature and the final selection of main and secondary QIs was done after a modified Delphi method involving a range of experts including anaesthetists, surgeons, guideline Task Force members and a patient representative. The ESC threshold criteria for validity and

feasibility was applied to the results of the independent voting. Only indicators with a predefined high median score and minimal dispersion were selected in the final set of QIs. Third, the developed QIs will require updates and revisions according to the emergence of new evidence and the feasibility of measurements needs to be evaluated continuously through registries or systems for data collection. Fourth, although were worked with a patient representative, future iterations should be more inclusive of a wider multidisciplinary membership.

Conclusion

This document defines the 2022 ESC QIs for the NCS which have been developed in collaboration by the members of the Task Force of the 2022 ESC/ESAIC non-Cardiac Surgery: CV assessment and management, the ESC Patient Forum and the Quality Indicator Committee. In total, eight main and nine secondary QIs have been defined across six key domains of NCS. The proposed set of indicators may facilitate the implementation of guidelines recommendations in practice and provide a means to gather information about the quality of care in patients undergoing NCS.

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Conflict of interest

CM has received research support from the Swiss National Science Foundation, the Swiss Heart Foundation, the University Hospital Basel, the University of Basel, Abbott, AstraZeneca, Beckman Coulter, . Brahms, Idorsia, Novartis, Ortho Clinical Diagnostics, Quidel, Roche, . Siemens, Singulex, Sphingotec, and has received speaker honoraria and/or consulting honoraria from Amgen, AstraZeneca, Boehringer Ingelheim, Bristol-Myers

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A Data availability statement

No new data were generated or analyzed in support of this research.

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Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart of systematic review.

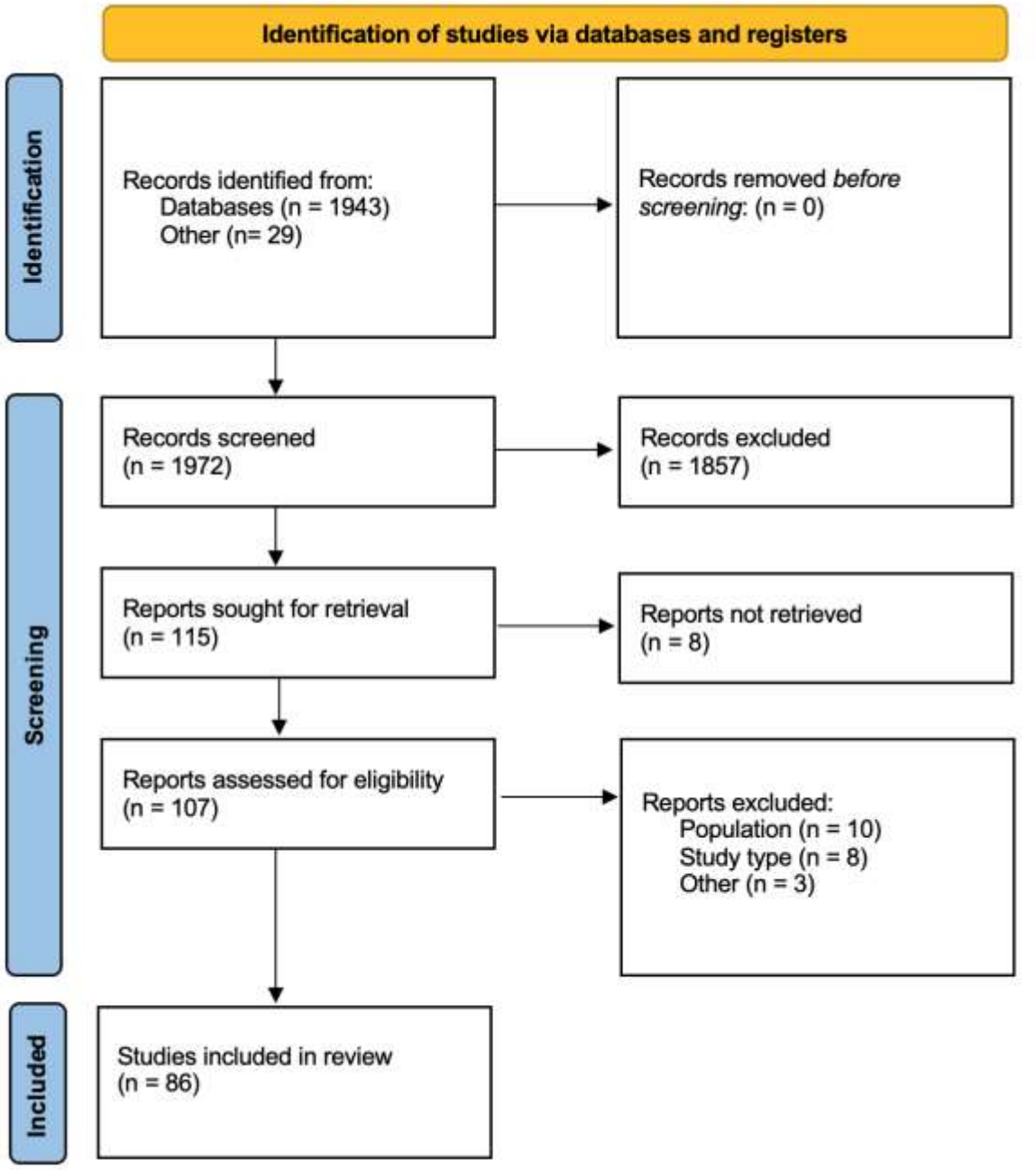
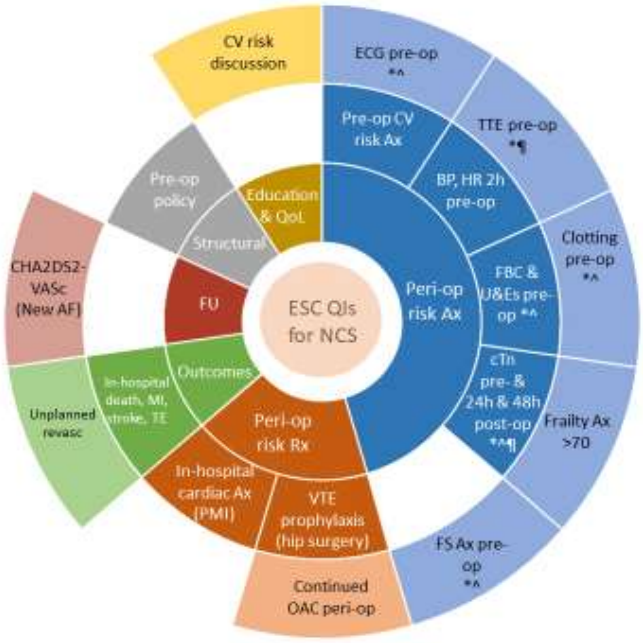


Figure 2. 2022 ESC/EAS Quality Indicators for non-cardiac surgery: cardiovascular assessment and management



Each colour represents of on the selected domains for quality indicators (QIs): (1) Structural framework (grey), (2) Patient education and quality of life (yellow), (3) Peri-operative risk assessment (blue), (4) Peri-operative risk mitigation (orange), (5) Follow-up (brown) and (6) Outcomes. The internal circle defines the previous describes each of QI domains, the middle circle shows the main quality QI and the external circle the secondary QIs attributed for each domain.

Abbreviations: AF= atrial fibrillation, Ax= assessment, BP= blood pressure, cTn= cardiac troponin, CV= cardiovascular, ECG= electrocardiogram, ESC= European Society of Cardiology, FBC= full blood count, FS= functional status, FU= follow up, HR= heart rate, MI= myocardial infarction, NCS= non-cardiac surgery, OAC= oral anti-coagulant, pre-op= pre-operative, peri-op= peri-operative, PMI= peri-operative myocardial infarction, QoL= quality of life, TE= thrombo-embolic events, TTE= transthoracic echocardiogram, VTE= venous thrombo-embolism

**high-risk patients*
^intermediate-risk patients
¶high-risk non-cardiac surgeries

Table 1. 2022 European Society of Cardiology Quality Indicators for the cardiovascular assessment and management on patients undergoing non-cardiac surgery

Non-cardiac surgery Quality Indicators (QIs)	
Main QIs	
Secondary QIs	
Part 2. Main Qis	
Domain 1. Structural framework	
1	Availability of written policies for preoperative preparation, including all the following: fasting, investigations, blood typing, thromboprophylaxis, peri-operative diabetes management and allergies.

Numerator: Centres managing patients undergoing non-cardiac surgery (NCS) with written policies for preoperative preparation, including all the following: fasting, investigations, blood typing, thromboprophylaxis, peri-operative diabetes management and allergies. **Denominator: Number of centres managing patients undergoing NCS**	
Domain 2. Patient education & QoL	
2	Proportion of patients who have a discussion with HCP about the CV risks involved in the surgery pre-operatively
Numerator: Number of patients undergoing NCS who have a documented discussion in the medical recordwith HCP about the CV risks involved in the surgery pre-operatively **Denominator: Number of all patients undergoing NCS**	
Domain 3. Peri-operative risk assessment	
3	Proportion of patients undergoing high-risk NCS who have an assessment of their cardiovascular (CV)
Numerator: Number of patients undergoing high-risk NCS who have an assessment of their CV risk. **Denominator: Number of all patients undergoing NCS.**	
4	Proportion of patients undergoing NCS who have their vital signs (blood pressure and heart rate) and cardiac physical examination checked pre-operatively (within 2h)
Numerator: Number of patients undergoing NCS who have their vital signs (blood pressure and heart rate) and cardiac physical examination checked pre-operatively (within 2h). **Denominator: Number of all patients undergoing NCS.**	
5	Proportion of intermediate- and high-risk patients undergoing high-risk NCS who have their cardiac troponin checked pre-operatively AND at 24h & 48h after surgery
Numerator: Number of intermediate- and high-risk patients undergoing high-risk NCS who have their troponin checked pre-operatively AND at 24h & 48h after surgery. **Denominator: Number of intermediate- and high-risk patients undergoing high-risk NCS.**	
6	Proportion of intermediate- and high-risk patients undergoing NCS who have their full blood count (FBC) and renal function checked pre-operatively
Numerator: Number of intermediate- and high-risk patients undergoing NCS who have their FBC and renal function checked pre-operatively. **Denominator: Number of intermediate- and high-risk patients undergoing NCS.**	
7	Proportion of intermediate- and high-risk patients undergoing NCS who have their coagulation profile (prothrombin time, platelet count) checked pre-operatively
Numerator: Number of intermediate- and high-risk patients undergoing NCS who have their coagulation profile (prothrombin time, platelet count) checked pre-operatively. **Denominator: Number of intermediate- and high-risk patients undergoing NCS.**	

8	Proportion of intermediate- and high-risk patients undergoing NCS who have their functional status evaluated using 2-flight of stairs or DASI pre-operatively
Numerator: Number of intermediate- and high-risk patients undergoing NCS who have their functional status evaluated using 2-flight of stairs or DASI pre-operatively. **Denominator: Number of intermediate- and high-risk patients undergoing NCS.**	
9	Proportion of patients > 70 years of age undergoing NCS who have their frailty assessed pre-operatively using a validated tool
Numerator: Number of patients > 70 years of age undergoing NCS who have their frailty assessed pre-operatively using a validated tool. **Denominator: Number of patients > 70 years of age undergoing NCS.**	
10	Proportion of intermediate- and high-risk patients undergoing NCS who have an ECG pre-operatively
Numerator: Number of intermediate- and high-risk patients undergoing NCS who have an ECG pre-operatively. **Denominator: Number of intermediate- and high-risk patients undergoing NCS.**	
11	Proportion of high-risk patients undergoing non-urgent high-risk NCS who have an echocardiography pre-operatively (within 3mo)
Numerator: Number of high-risk patients undergoing non-urgent high-risk NCS who have an echocardiography pre-operatively (within 3mo). **Denominator: Number of high-risk patients undergoing non-urgent high-risk NCS.**	
Domain 4. Peri-operative risk mitigation	
12	Proportion of patients undergoing high risk orthopedic or abdominal surgery who are prescribed VTE prophylaxis peri-operatively
Numerator: Number of patients undergoing high risk orthopedic or abdominal surgery (hip, knee, vertebral column, traumatism, cancer, inflammatory digestive disease, bariatric surgery, or others) who are prescribed VTE prophylaxis peri-operatively. **Denominator: Number of patients undergoing hip surgery.**	
13	Proportion of patients with perioperative myocardial infarction/injury (PMI) after NCS who undergo cardiac evaluation before hospital discharge
Numerator: Number of patients with PMI after NCS who undergo cardiac evaluation before hospital discharge. **Denominator: Number of patients with PMI after NCS.**	
14	Proportion of patients on anticoagulation who have their anticoagulation therapy continued peri-operatively for low-risk NCS
Numerator: Number of patients on anticoagulation who have their anticoagulation therapy continued peri-operatively for low-risk NCS. **Denominator: Number of patients undergoing low-risk NCS and are on anticoagulation.**	

Domain 5. Follow up	
15	Proportion of patients undergoing NCS with NEW peri-operative AF who have their CHA_2DS_2-VASc score calculated to guide decision-making about anticoagulation
Numerator: Number of patients undergoing NCS with NEW peri-operative AF who have their CHA_2DS_2-VASc score calculated to guide decision-making about anticoagulation **Denominator: Number of patients undergoing NCS with NEW peri-operative AF**	
Domain 6. Outcomes	
16	Proportion of patients who have any of the following CV events during hospitalisation for NCS: - Death - MI - Stroke - Arterial or venous thrombo-embolic event
Numerator: Number of patients undergoing NCS who have any of the following CV events during hospitalisation for NCS: Death, MI, Stroke, Arterial or venous thrombo-embolic event. **Denominator: Number of all patients undergoing NCS.**	
17	Proportion of patients who have unplanned coronary/peripheral revascularisation during hospitalisation for NCS.
Numerator: Number of patients who have unplanned coronary/peripheral revascularisation during hospitalisation for NCS. **Denominator: Number of all patients undergoing NCS.**	

Abbreviations: AF= atrial fibrillation, , CV= cardiovascular, ECG= electrocardiogram, DASI=Duke Activity Status Index, , FBC= full blood count, MI= myocardial infarction, NCS= non-cardiac surgery, PMI= peri-operative myocardial infarction, QoL= quality of life, VTHE= venous thrombo-embolis