6 NAP7 Methods


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Key findings

- NAP7 of the Royal College of Anaesthetists examined the incidence, predisposing factors, management or perioperative cardiac arrest.
- NAP7 had three parts: Baseline Surveys, an Activity Survey and a case registry.
- The Baseline Surveys of all anaesthetic departments and anaesthetists in the UK examined respondents' previous perioperative cardiac arrest experience, resuscitation training and local departmental preparedness.
- The Activity Survey recorded anonymised details of all anaesthetic activity in each site over four days, enabling national estimates of annual anaesthetic activity, complexity and complication rates.
- The case reports collected instances of perioperative cardiac arrest in the UK, reported confidentially and anonymously, over one year, starting 16 June 2021, followed by expert review using a structured process.
- The NAP7 definition of perioperative cardiac arrest was the delivery of five or more chest compressions and/or defibrillation in a patient having a procedure under the care of an anaesthetist and 'perioperative' included the period from the World Health Organization (WHO) 'sign-in' checklist or first hands-on contact with the patient and ended either 24 h after the patient handover (eg to the recovery room or intensive care unit) or at hospital discharge if this occurred earlier than 24 h.
- The COVID-19 pandemic delayed the start of NAP7. This delay resulted in changes to the organisation of the project from primarily face-to-face meetings and paper-based data collection to electronic surveys and data entry and secure virtual meetings.
- A total of 328 Local Coordinators were enrolled representing 416 NHS hospitals. From the independent sector, 174 hospitals were enrolled, representing an estimated 39% of independent sector hospitals.
- 72% of NHS hospitals and approximately 4% of independent sector hospitals participated in the Baseline Survey.
- 10,573 anaesthetists (approximately 71% of all UK anaesthetists) and 173 anaesthesia associates participated in the Baseline Survey.
- 24,172 Activity Survey responses were reported from the NHS (85% site participation rate and estimated 95% return rate by site). The independent sector reported approximately 1900 cases, with capture rates unknown.
- 939 cases of perioperative cardiac arrest were reported to NAP7 during one year, starting 16 June 2021. Of these, 881 were included in the final NAP7 registry. Cases were excluded where there was duplication, where the case did not meet inclusion criteria or the report was grossly incomplete or uninterpretable.

Perioperative cardiac arrest is a subject that is important to both patients and clinicians (Mavridou 2013, Burkle 2014). The National Audit Projects of the Royal College of Anaesthetists (RCoA) have an established role in examining clinically important, rare complications of anaesthesia that are incompletely studied (Thomas 2016). There is currently no systematic reporting system for cardiac arrests during anaesthesia in the UK, and the incidence, management and outcomes of perioperative cardiac arrest are unknown (Kane 2021). No major prospective study of perioperative cardiac arrest has previously been performed in the UK.

Previous projects have investigated major anaesthesia-associated complications of neuraxial block (NAP3; Cook 2009), airway management (NAP4; Cook 2011a), accidental awareness during anaesthesia (NAP5; Pandit 2014a, 2014b) and perioperative anaphylaxis (NAP6; Harper 2081a, 2018b). The projects have evolved to include three core components: a *Baseline Survey* assessing anaesthetists' experiences and attitudes on the topic of interest and departmental organisation related to the audit topic; an *Activity Survey* reporting anaesthesia practice, caseload and events relevant to the topic; and a *case report registry* and expert review of the events of interest. The review process includes

quantitative and qualitative analysis leading to consensus recommendations for improving practice based on the project findings (Thomas 2016).

Methods

NAP7 was commissioned by the Health Services Research Centre (HSRC) of the National Institute of Academic Anaesthesia for the Royal College of Anaesthetists (RCoA). It is the seventh in a series of 'national audits' (although they are more correctly described as clinical service evaluations) conducted by the specialty.

The HSRC invited proposals for the topic of NAP7 in 2017, receiving around 80 applications. Following a competitive presentation stage, the HSRC Executive Management Board, representatives of the RCoA and lay members selected the subject of 'perioperative cardiac arrest'.

The NAP7 clinical lead (JS, appointed by competitive interview) and the RCoA Director of National Audit Projects (TC, appointed by the RCoA) co-chaired the steering panel and were supported by the director of the HSRC and RCoA representatives. The RCoA director for the NAPs and NAP7 clinical lead assembled a steering panel for NAP7 to plan and implement the project and provide an expert review of perioperative cardiac arrest cases reported to the registry. The HSRC appointed clinical research fellows (RA, AK, EK) through an open competitive interview process. To establish the steering and review panel, stakeholder organisations, including the RCoA Lay Committee, were identified and invited to nominate their representative to form part of that panel.

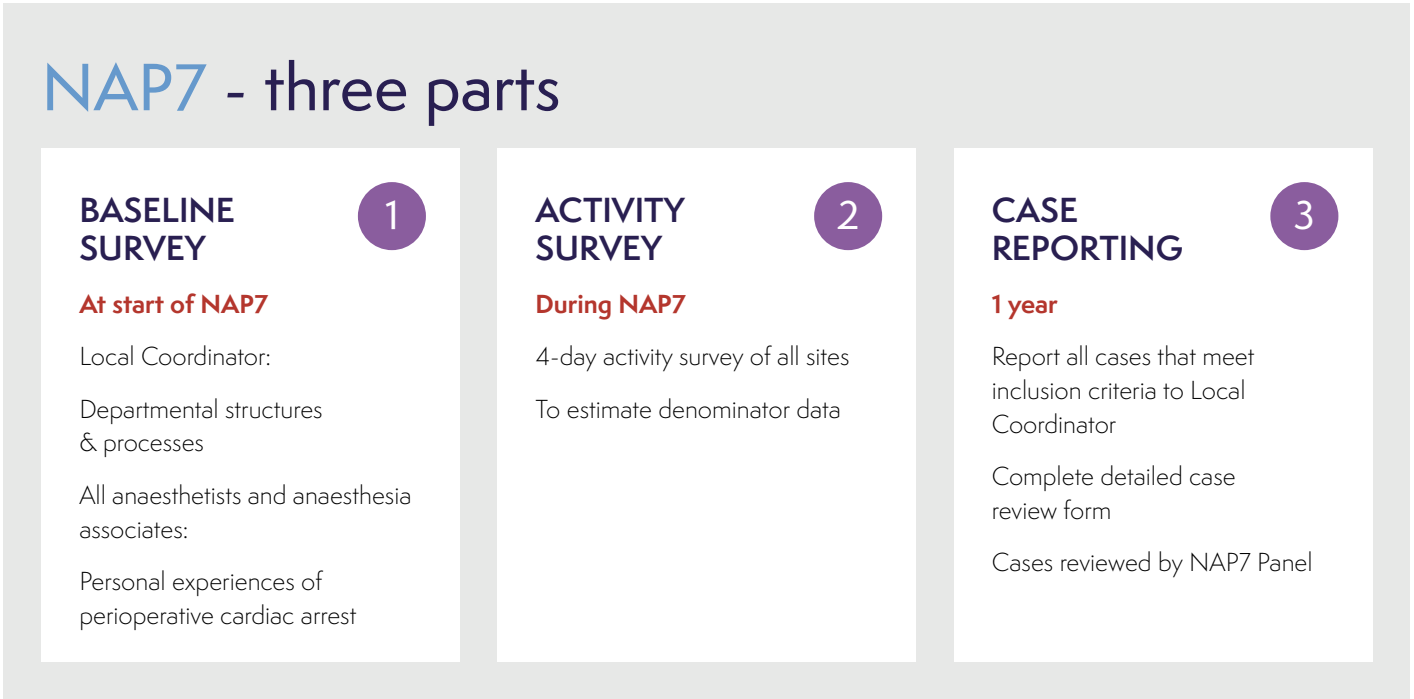
The first meeting of the full NAP7 steering panel was on 26 September 2019 and meetings were held monthly after that.

The project was ready to launch on 13 May 2020; however, the launch was delayed due to the COVID-19 pandemic (see Chapter 7 COVID-19). No full panel meetings were held between March 2020 and July 2021 because of the pandemic. Planning via smaller group meetings continued during this period and the NAP7 Local Coordinator network and infrastructure were used to undertake the Anaesthesia and Critical Care COVID Activity Survey to study the impact of COVID-19 on anaesthesia and critical care services in the UK (Kursumovic 2021; see also Chapter 8 COVID-19 and anaesthetic activity). NAP7 was launched on 16 June 2021 and monthly steering panel meetings restarted in August 2021 to review submitted cases.

Eligibility to contribute to NAP7 included all UK NHS and independent hospital sites undertaking anaesthetics. Sites were contacted in advance of the project start date by the NAP7 coordinator using details held by the RCoA from previous NAP cycles. In each department, a Local Coordinator, usually a consultant or staff grade, associate specialist and specialty (SAS) anaesthetist, was appointed to oversee the project at their site(s). A handbook was produced to facilitate Local Coordinators in this role. The NAP7 coordinator was available by email and phone for queries from Local Coordinators. The NAP7 coordinator did not participate in case reviews to reduce the risk of de-anonymisation. Participating sites and Local Coordinators are listed on the NAP7 website (https://www.nationalauditprojects.org.uk/NAP7-Home). During the project, the NAP7 team updated the frequently asked questions on the website as needed.

There were three parts to the project (Figure 6.1): Baseline Surveys of anaesthetists and departments, an Activity Survey of the anaesthetic caseload in all sites and case reports of perioperative cardiac arrests.

Figure 6.1 NAP7 – three parts



Baseline Surveys

The Baseline Survey had two components:

- A survey of anaesthetists examining knowledge, training and personal experiences of perioperative cardiac arrest (Appendix 6.1). The NAP7 coordinator sent a survey link to Local Coordinators, who forwarded the survey locally to all department members. Anaesthetists informed their Local Coordinators when they had completed their survey to enable the calculation of a response rate. All anaesthetists in the UK, including consultants, SAS grades, anaesthetists in training and anaesthesia associates were invited to participate.
- A survey of departmental organisation concerning perioperative cardiac arrest. Survey questions focused on staff mix, case mix, procedures for summoning emergency help, access to emergency guidelines, resuscitation equipment, including defibrillator availability and governance structure (Appendix 6.2).

The scope of the individual anaesthetist and departmental Baseline Surveys were formulated and agreed upon by the NAP7 steering panel. Both surveys were tested internally within the panel, with multiple iterations leading to final versions. The surveys were distributed before the launch date of the case report registry component of NAP7. They remained open for approximately four and nine months, respectively. The surveys were undertaken using an electronic survey tool (SurveyMonkey®). Data were extracted and cleaned using Microsoft Excel® 2022 (Microsoft Inc., Redmond, WA, USA) and checked for duplicates. Quantitative analysis was performed on Microsoft Excel, and 'big qualitative data analysis' was undertaken after importing and analysing on Pulsar TRAC v2022 (Pulsar, Los Angeles, CA, USA), a first-party data tool, Pulsar Platform; Caplena v.2 (Caplena AG, Zurich, Switzerland), a free text analysis tool; and InfraNodus v5, 2023 (Nodus Labs, Leeds), a discourse and thematic analysis tool.

Activity Survey

The Activity Survey comprised a cross-sectional observational study to collect denominator data about anaesthetic activity, patient characteristics and adverse events during anaesthesia care, building on the previous methodology (Sury 2014, Kemp 2018). The survey enabled the incidence of events occurring during the one-year case reporting phase of the project to be compared against the caseload.

All sites were randomly assigned a continuous four-day data collection period, with an equal chance of starting on any day of the week. Case collection included all cases that started from 00.00 on day 1 until 23.59 on day 4 of the local collection period. Local Coordinators were advised to capture all cases under the care of an anaesthetist during the period, including cases requiring general anaesthesia, regional anaesthesia/analgesia, sedation, local anaesthesia or monitored anaesthesia care (ie care by anaesthetist without administration of anaesthetic drugs). Local Coordinators were reminded to include emergency and trauma theatres, labour ward and obstetric theatres, procedures occurring away from their main site (eg day surgery unit, electroconvulsive therapy unit), interventional pain procedures in operating theatres or pain clinics, diagnostic and interventional radiology, emergency anaesthesia or sedation in the emergency department if administered by an anaesthetist, out of hours work and regional anaesthesia. Any patient returning to theatre for a second procedure was entered as a separate case. Similarly, obstetric patients could be entered separately for each encounter. The following were not included: sedation or anaesthesia solely for critical care or procedures on critical care, newborn resuscitation, inter- or intrahospital transfers.

Question design combined building on previous iterations of the Activity Survey used in previous NAPs and collecting individual case data pertinent to understanding perioperative cardiac arrest. Data fields included patient characteristics, comorbidities, resuscitation status, frailty, anaesthetic technique, monitoring and complications during anaesthesia (Appendix 6.3). Where questions had been asked in previous Activity Surveys, the format of the question was kept, thus enabling trends over time to be assessed. The stakeholder panel tested the Activity Survey internally before final approval, in a similar manner to the Baseline Surveys. Local Coordinators were provided with a link to the survey via SurveyMonkey for distribution at their site, and a QR code on the help sheet provided direct access. Respondents were advised to complete the survey at the end of each case.

An annual caseload was estimated by multiplying the number of cases by a scaling factor, which accounts for scaling the four-day survey to one year and for missed data and uninterpretable forms (Kemp 2018). To exclude erroneous data and data entry mistakes, we examined the data to ensure that the fields were compatible for low-frequency events (Curran 2016, Meade 2012); for example, a 'malignant hyperthermia' report without 'hyperthermia' or metabolic complications is likely to be a mistake. Two reviewers assessed these events and referred discrepancies to a third for overall decision making. Reports were removed if there was judged to be a mistake.

Case reports of perioperative cardiac arrests

The study undertook a case report registry of perioperative cardiac arrest cases. The registry was open for cases occurring between 00.00 on 16 June 2021 and 23.59 on 15 June 2022, and remained open for approximately four months to allow data entry.

To be reported, the NAP7 steering panel has defined a perioperative cardiac arrest as 'five or more chest compressions and/or defibrillation in a patient having a procedure under the care of an anaesthetist' (Figure 6.2 and Table 6.1).

The steering group chose a cut-off of five compressions to exclude cases with a very brief period of chest compression in which cardiac arrest was unlikely to have occurred.

Patients under the care of an anaesthetist include those undergoing general anaesthesia, regional anaesthesia/analgesia, sedation, local anaesthesia or monitored anaesthesia care with an anaesthetist or anaesthesia associate present.

The perioperative period was defined as from either the WHO sign-in or first hands-on contact with a patient to 24 h after the handover of the patient to recovery or another clinician (eg intensive care, ward care) or when the patient leaves the hospital (Figure 6.3).

In addition to these core definitions, there were several special inclusion circumstances based on feedback from stakeholders (Table 6.2). Other exclusions include defibrillation during electrophysiological procedures when this was a planned, normal or expected part of the procedure (eg during VT ablation) and patients with an ASA score of 6 (brain-dead patients being prepared for or undergoing organ donation).

Table 6.1 Extended definition of cardiac arrest

Term	Includes	Excludes
Under the care of an anaesthetist	■ General anaesthesia, regional anaesthesia/analgesia, sedation, local anaesthesia or monitored anaesthesia care with an anaesthetist present ■ Patients who are directly managed by an anaesthesia associate	Sedation or local anaesthesia where an anaesthetist is not present
Chest compressions	There must be at least 5 compressions which may inlude: ■ direct compression of the heart ■ mechanical chest compression ■ extracorporeal cardiopulmonary resuscitation started during cardiac arrest	Four compressions or fewer
Defibrillation	Defibrillation is an unsynchronised DC shock for VF or pVT, including: ■ external or internal defibrillation ■ manual or automated external defibrillation ■ shocks by implanted cardioverter defibrillators for VF/pVT ■ precordial thump	Synchronised DC shock for cardioversion

VF, ventricular fibrillation; pVT, pulseless ventricular tachycardia

Figure 6.2 NAP7 inclusion criteria

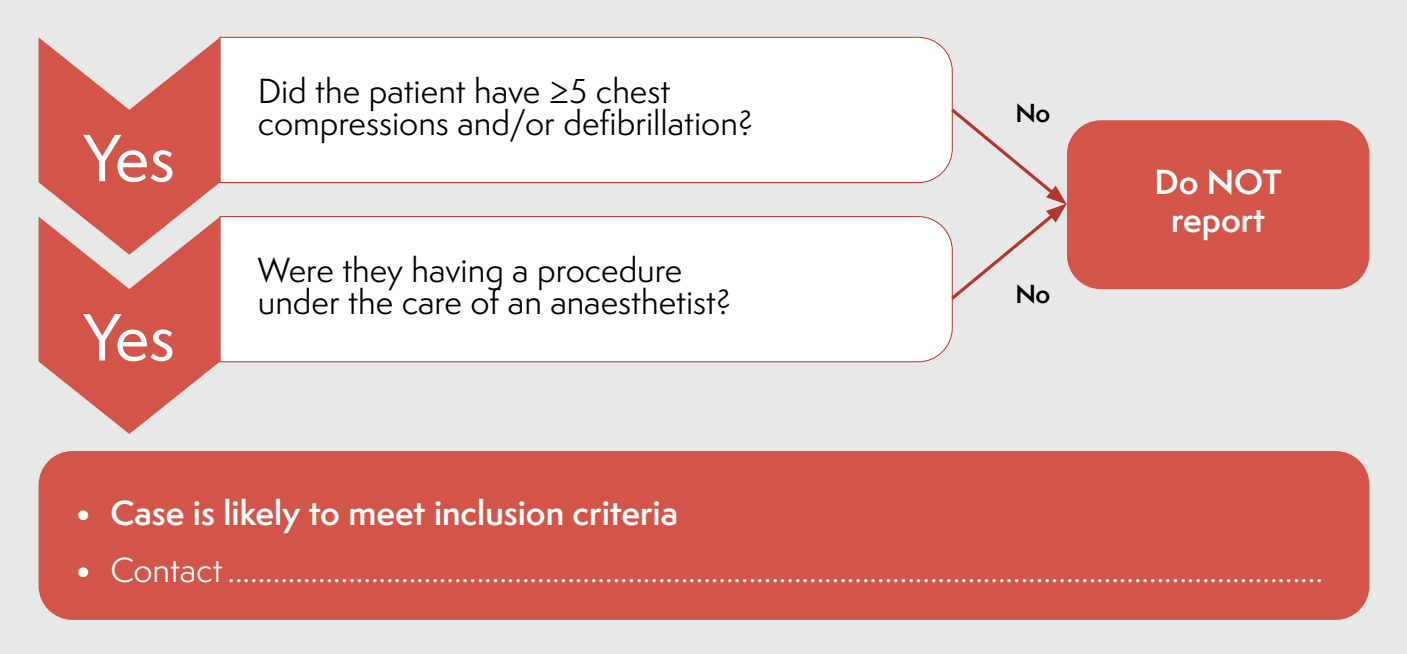
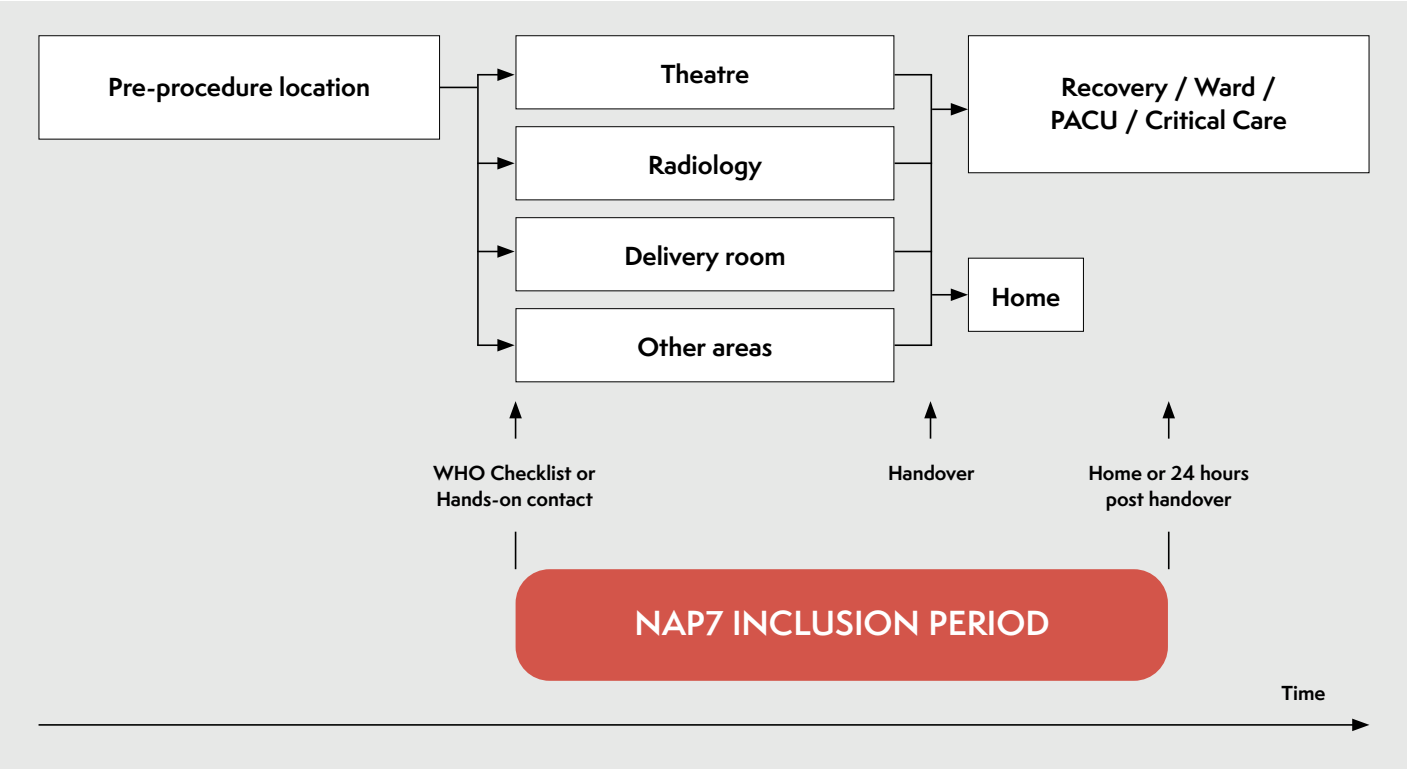


Figure 6.3 NAP7 inclusion period



Case reporting was confidential, and all patient, hospital and clinician details were anonymised at the source by the reporting clinician or the Local Coordinator. When a Local Coordinator or other anaesthetist needed to report a case, they contacted the NAP7 administrator. The reporter confirmed that this was a perioperative cardiac arrest as defined above and that the case occurred during the data collection period. After confirmation that the case met inclusion criteria, the reporter was issued a unique identifier and password to a secure encrypted case submission website. Before accessing the secure webpage, the reporter was required to change their password.

The steering panel designed the structured case report form (Appendix 6.4) to capture the breadth and depth of data needed for each case whilst minimising the risk of patient, clinician or hospital identification. No patient, clinician or hospital data were admissible on the form.

Neither the project team nor the RCoA could identify which Local Coordinator had entered which case(s). The reporting site reminded reporters to check for identifiers before submitting and locking an entry to the registry. Once completed and finalised ('locked'), the submitted form was automatically transferred to the clinical lead to enable analysis.

In cases where it was not clear that a case may or may not have met inclusion criteria, an independent moderator was available for discussion. If there was still doubt, the default was to report the case. The moderator(s) were not on the review panel and had no contact with the review panel throughout the project. They were not permitted to discuss cases with review panel members. This process was vital to maintain confidentiality between reporters, reports and reviewers.

The NAP7 review panel met monthly to review and classify a representative sample of submitted cases using the methodology established in previous NAPs (Cook 2009, Pandit 2014b, Cook 2018). Each case was reviewed by a group of three to five clinical and patient representative panel members, with several groups performing reviews concurrently. The reviews used a structured output form (Appendix 6.5) that guided groups through assessment of anaesthetic care, management during cardiac arrest, post-resuscitation care, case debrief and anaesthetist wellbeing, contributory and causal factors to the event. The severity of harm was assessed according to the National Patient Safety Agency (NPSA 2004) grading.

After the case review in small groups was completed, the review group presented cases and analyses to the whole review panel (typically 12–15 members) at the end of each session to moderate the findings and note points of interest. Key lessons and keywords from each case were recorded. Case reviewers were not permitted to discuss case details outside the review meetings. If a review panel member had any knowledge of a case from direct involvement or indirect means (eg local morbidity and mortality meetings), they were not permitted to highlight this or bring that knowledge to the process as either of these actions would risk de-anonymising the case record.

The review panel referred to published guidelines as indications for current best practices, including, but not limited to, those from the Resuscitation Council UK and the European

Resuscitation Council for adult and paediatric advanced life support (Lott 2021, Nolan 2021, RCUK 2021, Soar 2021, Van de Voorde 2021), the Association of Anaesthetists Quick Reference Handbook (Association of Anaesthetists 2021) and specialist society guidelines (eg Cardiac Advanced Life Support; Dunning 2009), and guidance covering treatment escalation plans and end-of-life care (eg ReSPECT; Pitcher 2017). The panel judged the overall quality of care as 'good', 'poor', 'good and poor' or 'unclear' based on guidelines, the specific circumstances of the case and, ultimately, by panel consensus.

Previous NAPs have reviewed approximately 200 cases. In NAP7, 939 cases were reported. Initially, the panel reviewed all reported cases to establish the review process. Once this process was established, a complementary rapid review process was used to screen for full panel review and to allow learning from all cases to be incorporated into the final report. Rapid review

Table 6.2 Specific inclusion and exclusion criteria

Term	Includes	Excludes
Cardiology and cardiac surgery	■ Anaesthesia for cardiology and cardiac surgical procedures	■ Cardiopulmonary bypass from arterial/aortic cannula insertion to removal ■ Defibrillation during electrophysiological procedures when this is a planned, normal, or expected part of the procedure (eg during VT ablation)

Obstetrics	■ Patients with:
	  ■ obstetric epidural and/or spinal up to 24 h after delivery
	  ■ remifentanil patient-controlled analgesia
		■ Cardiac arrest before the start of anaesthesia care (as defined above) or with no anaesthetic intervention

Paediatrics (age < 18 years)	■ As for adults, with the addition of special inclusion criteria for sick children anaesthetised for resuscitation before retrieval or transfer to another hospital	■ Newborn resuscitation

Critical care	■ Patients on critical care:
	  ■ within 24 h of the end of their procedure/handover to the ICU team
	  ■ having an interventional procedure in another location under the care of an anaesthetist (excludes diagnostic imaging) from first hands-on intervention, including transfer
		■ Sedation or anaesthesia solely for critical care
		■ Procedures performed in the critical care unit (eg percutaneous tracheostomy)
		■ Any intra- or interhospital transfers originating in critical care

eCPR	■ Venoarterial ECMO started during cardiac arrest ■ eCPR start defined as the initiation of extracorporeal flow to the patient after cannulation and circuit connection to cannulae	■ ECMO for any other indication
Pain medicine	■ As per general inclusion criteria (includes procedures in pain clinic)	
Radiology	■ Patients under the care of an anaesthetist for imaging in the radiology department ■ Interventional radiology procedures, as per general inclusion criteria, including stroke thrombectomy/coiling for subarachnoid haemorrhage	■ Patients transferred for diagnostic radiology from critical care
Regional anaesthesia and analgesia	■ Regional blockade performed by an anaesthetist outside the theatre ■ Until 24 h after the procedure	■ Procedures performed on critical care
Emergency department	■ Patients under the care of an anaesthetist who would meet the general criteria for NAP7 inclusion in whom anaesthesia care for an interventional procedure starts in the emergency department	■ Adult patients who are anaesthetised solely for critical care (paediatric patients may be included as per inclusion criteria above) ■ Patients anaesthetised solely for transfer to ICU
Other locations	■ Electroconvulsive therapy suite, even if in a separate building and/or hospital trust	■ Patients in the preassessment clinic ■ Patients undergoing exercise testing ■ Patients who are not in the hospital ■ Patients in the surgical admissions unit, ward or theatre complex before their procedure

ECMO, extracorporeal membrane oxygenation; eCPR, extracorporeal cardiopulmonary resuscitation; ICU, intensive care unit.

cases were assessed by two panel members independently, using a modified review form (Appendix 6.6). Where the case required subspecialty expertise, at least one reviewer had expertise in that area. The review outcome focused on the quality of care and learning points. All rapid reviews were also checked by the NAP7 clinical lead (JS). If panel members recorded that the case should be reviewed by the full panel or identified a new theme or issues, or there was disagreement between panel members in their assessment, the case was submitted for a full panel review. In total, 302 cases had a full panel review and 692 had a rapid review; 58 cases were excluded as being incomplete or uninterpretable, leaving a total of 881 cases (Figures 6.4–6.6).

Figure 6.4 Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow chart of included cases

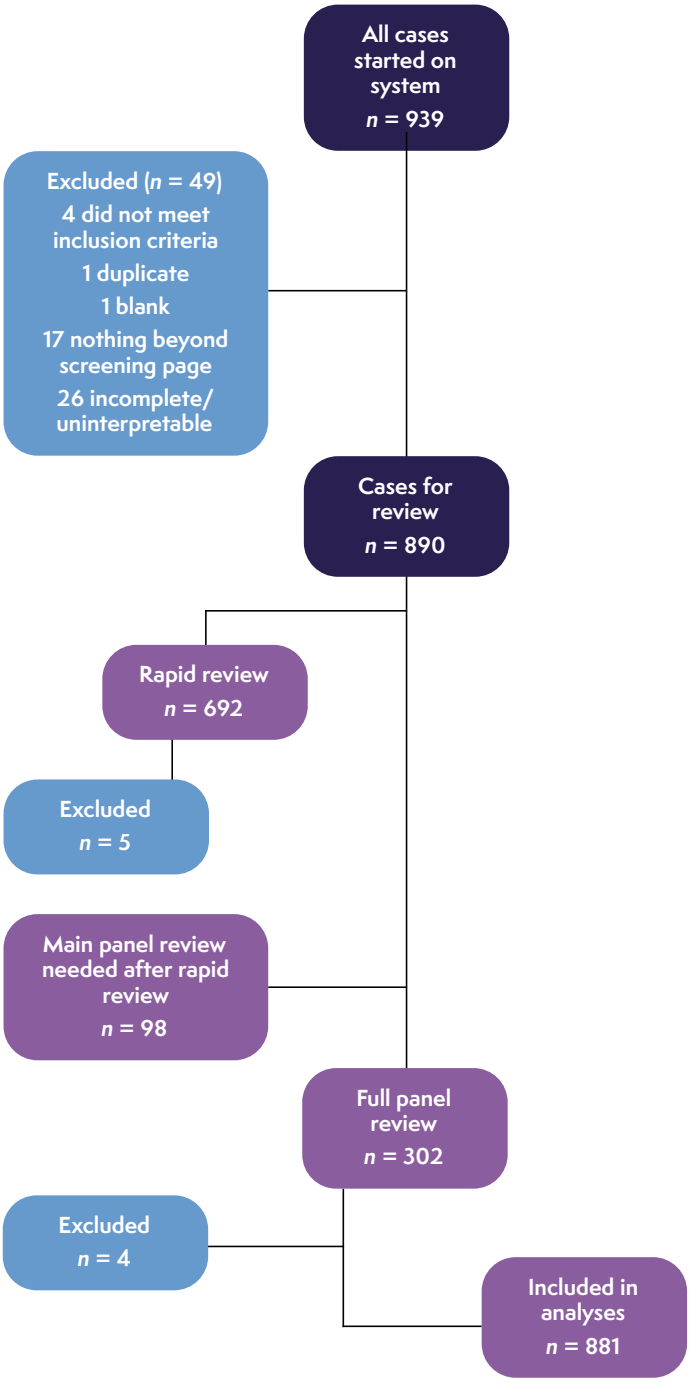
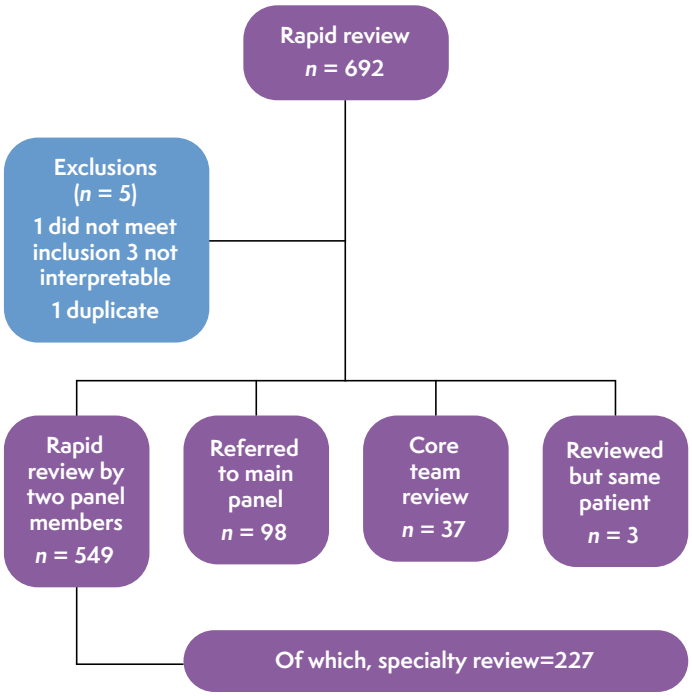
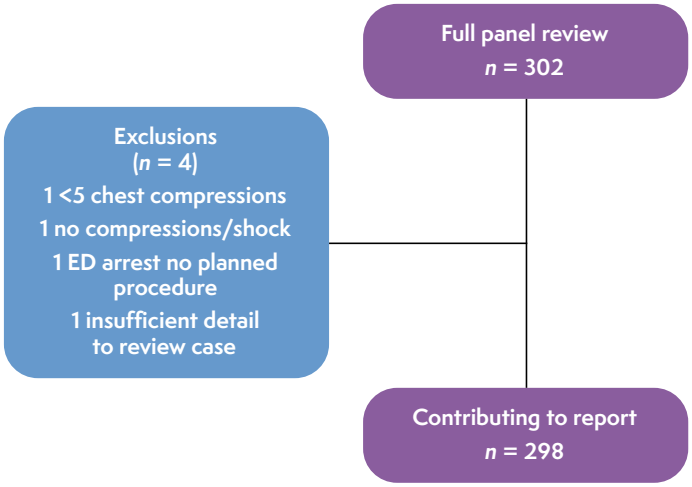


Figure 6.5 Rapid reviews



Descriptive summaries of baseline patient characteristics and clinical variables are presented in the report with continuous variables as percentiles and discrete variables as frequencies and percentages. Categorical data are compared using Chi-squared or Fisher's exact test, as appropriate. The incidence rates of events (eg cardiac arrest) were calculated using numerator data from the registry and denominator data from the Activity Survey. Data analysis was performed using R (R Core Team, Vienna, Austria). Qualitative data analysis was undertaken as described in the Activity Survey section above. Qualitative analysis has identified emerging themes, potential areas for separate analysis and possible recommendations. Keywords were recorded for each case.

Figure 6.6 Full panel reviews



Recommendations

A key output from the NAP7 process is the generation of recommendations derived from the data and agreed upon by the NAP7 panel. During the activity and Baseline Survey data analysis and review of the cases in the registry, panel members discussed how the data might lead to recommendations. At the report writing stage, the authors of each chapter generated potential recommendations.

In round 1, 239 draft recommendations from the collected chapters were presented to panel members via an electronic survey with the options to 'agree', 'agree with modifications', 'disagree' or 'abstain'. These were ranked by 'agree' with or without modifications. Recommendations were edited, combined or re-written based on feedback in the survey.

In round 2, 41 recommendations were presented to the panel. Each member made 20 selections that they felt were the most critical recommendations from the project. Recommendations with the highest votes in this round are presented in Chapter 5 Main Recommendations.

When selecting and ranking recommendations the panel considered:

- The recommendation must come from NAP7 data.
- There should be a problem that the recommendation aims to solve.
- The recommendation should plausibly lead to sustained positive change.
- The risks of the recommendation.
- If the recommendation is already part of existing guidelines – the panel could still make a similar recommendation on issues they considered important.

The following members of the NAP7 panel voted in rounds 1 and 2 of the recommendations process: A. Kane, B. Patel, B. Scholefield, C. Bouch, E. Kursumovic, E. Wain, F. Oglesby, F. Plaat, G. Nickols, G. Kunst, I. Moppett, J. Dorey, J. Cordingley, J. Nolan, J Pappachan, J. Soar, J. Smith, K. Samuel, L. Varney, M. Davies, N. Lucas, R. Armstrong, R. Mouton, S. Agarwal, S. Finney, S. Kendall, T. Cook.

Data protection

For the 12-month case report registry, all data were uploaded via a secure web-based tool using SSL encryption. The NAP7 team at the RCoA controlled access to the tool, with security and confidentiality maintained through a registration process and the use of usernames and passwords. No identifiable patient, clinician or hospital information was recorded or stored; only anonymised data was received and analysed at the RCoA. The RCoA established suitable physical, electronic and managerial procedures to safeguard and secure the information collected online (Appendix 6.7).

Permissions

NAP7 was a clinical service evaluation as there was no intervention, no randomisation of patients and no change to standard patient care or treatment. The project was observational and did not require research ethics committee approval in line with the NHS Health Research Agency and Medical Research Council (NHS HRA 2022) decision tools. In Northern Ireland, the chair of the Privacy Advisory Committee Northern Ireland approved the project. All data were handled under relevant national requirements. The project was approved by the Public Benefit and Privacy Panel for Health and Social Care in Scotland. As part of the requirements to achieve approval, all members of the NAP7 underwent information governance training as specified by these regulatory bodies (Medical Research Council eLearning: 'Research, GDPR and confidentiality – what you really need to know' and completed the e-assessment; (MRC 2022). As for NAPs 3–6, all four chief medical officers of the UK endorsed the NAP7 project (Appendix 6.8).

Discussion

NAP7 is likely to be one of the largest and probably the most comprehensive prospective studies of perioperative cardiac arrest to date (Hur 2017, Fielding-Singh 2020). A strength of the NAP methodology is matching numerator data (from the case review process) and denominator data (from the Activity Survey) to provide incidences of events and calculate risk estimates. Further, the granularity of the data has enabled us to explore how the risks vary with age, sex, ASA physical status, comorbidity status, frailty and more. These data are contextualised in light of the Baseline Surveys, giving insight into how individuals and departments train for cardiac arrest and report their experiences.

Central to the project has been how to define a perioperative cardiac arrest. We have adopted the definition of cardiac arrest as 'chest compressions and/or defibrillation', and our outcome measures are based on the internationally agreed Utstein template (Nolan 2019).

We acknowledge that some cases where a cardiac arrest has occurred, but chest compressions or defibrillation are not performed, will have been excluded (eg patients with 'do not attempt cardiopulmonary resuscitation' recommendations that have been kept active in the perioperative phase). Conversely, we may capture events that may not be full cardiac arrests; for example, low flow states, hypotension/unrecordable blood pressure, or where chest compressions are started to aid circulation as a precaution or in error. Complete cessation of the circulation and pulselessness is only certain in established ventricular fibrillation and asystolic cardiac arrests. In contrast, the inability to feel a pulse may coexist with a low flow state in ventricular tachycardia (VT) – pulseless VT – or pulseless electrical activity. All these situations should be treated with chest compressions and/or defibrillation and are discussed further in Chapter 15 Controversies, Chapter 20 Decisions about CPR and Chapter 25 ALS for perioperative cardiac arrest).

Similarly, we have had to define the perioperative period. The panel has focused the project on examining events happening in the operating theatre and the 24 h following the handover of care. Although cardiac arrest events occurring earlier in the perioperative pathway (eg during cardiopulmonary exercise testing) or more than 24 h after surgery may provide insightful data, the stakeholder panel decided that the period needed to focus on events that are likely to be within our direct care or soon after. The panel decided to include events up to 24 h following care by an anaesthetist, as intraoperative events and management may impact the likelihood of cardiac arrest in this period. The definition of perioperative is largely in line with that used by the National Institute for Health and Care Excellence (NICE 2008).

Conversely, we have special inclusion criteria to capture cardiac arrest events that may not be 'perioperative' but could potentially be high impact following an intervention by an anaesthetist. These include anaesthetising critically unwell children before retrieval or transfer to another hospital for continuing care, regional nerve blocks performed outside the theatre complex and analgesia for labour (including remifentanil patient-controlled analgesia). We have included patients who had a cardiac arrest under the care of an anaesthetist in the emergency department under specific circumstances. These include patients where the team caring for the patient is planning a surgical, interventional radiology or cardiology procedure, but the patient has a cardiac arrest before this is possible. In previous NAPs, the emergency department has been a source of significant learning due to the inherent high-risk nature of the patients and situations presented (Cook 2011b) and there may be similar high-impact learning from NAP7 in this environment.

As with previous NAPs, there is a need to examine a stable healthcare system that is not in fluctuation or crisis. The project was due to launch May 2020 and when the COVID-19 pandemic led to major healthcare disruption, we decided to delay NAP7 by approximately one year. The NAP7 team instituted the Anaesthesia and Critical Care COVID Tracking survey (ACCC-track) to track the impact of COVID-19 on anaesthetic and surgical activity and determine whether starting NAP7 in mid-2021 was feasible (Kursumovic 2021; see also Chapter 8 COVID-19 and anaesthetic activity). Given the results of ACCC-track and accepting that healthcare delivery may not return to normal for a significant time, a pragmatic decision was made to start NAP7 in June 2021. The impact of the pandemic-associated disruption on NAP7 is discussed in Chapter 9 Organisational survey.

We have built on the established methodology of previous NAPs, including multiple, serial, multidisciplinary reviews incorporating patient representation, formal moderation and a structured output. A review of events that have already happened is always unavoidably prone to the limitations of 'looking backwards', which may be exacerbated when the outcome is known (Caplan 1991, Henriksen 2003). Our review processes incorporated structured, quantitative and qualitative, dual review by panel members, with care benchmarked against current guidelines, and make every effort to produce balanced judgements, accepting these known limitations. The standards of care include current guidance in the UK for immediate resuscitation and specific treatments of adverse perioperative events (eg Lott 2021, Soar 2021, Van der Voorde 2021, RCUK 2014). Collection of data at scale across four countries and processes to ensure that reviewers do not know the source of reports adds to the robustness of the methodology.

As with previous NAPs, NAP7 relies on the openness and altruism of anaesthetists in the UK in reporting experiences, data and cases to the project team. In some of these cases, care may not have proceeded as planned and may have impacted patient safety and it is clear that some cases had significant clinician impact (see Chapter 17 Aftermath and learning). This sharing of 'uncomfortable data' is a notable component of the NAPs and reflects the dedication of anaesthetists to learn from patient critical events, whatever the circumstances. While clinicians do not get direct feedback from reporting cases to NAP7, they do so in good faith that they are contributing to a project that may improve healthcare quality and safety. The NAP7 team acknowledges anaesthetists' generosity in supporting NAP7 and previous NAPs.

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Appendices

Appendix 6.1 NAP7 Baseline Survey of all anaesthetists

Appendix 6.2 NAP7 Baseline Survey of all Local Coordinators

Appendix 6.3 NAP7 Activity Survey questions and logic

Appendix 6.4 NAP7 Case review form fields

Appendix 6.5 NAP7 Structured panel review form

Appendix 6.6 NAP7 Rapid review form

Appendix 6.7 NAP7 Data security

Appendix 6.8 NAP7 Permissions

x8 titles to be linked to appendix 6.1 (Seperate File)