10 NAP7 Individual Anaesthetists' Baseline Survey: preparedness and experiences of perioperative cardiac arrest


Emira Kursumovic


Tim Cook


Sam Martin


Matthew Davies


Lee Varney


Richard Armstrong


Andrew Kane


Jasmeet Soar

Key findings

- A total of 10,746 responses were received from individual anaesthetists and anaesthesia associates: a response rate of 71%.
- Some 90% of anaesthetists were up to date with their training in adult advanced life support.
- A total of 66% of anaesthetists were up to date with their training in paediatric advanced life support.
- More than 10% of anaesthetists have never received formal Resuscitation Council UK (RCUK) or equivalent training in paediatric advanced life support and 2% in adult advanced life support.
- Most anaesthetists (84%) felt confident in leading a cardiac arrest on the operating table, although 70% anaesthetists stated they would benefit from more training in this field.
- Male respondents were overall more confident than female respondents (87% vs 79%).
- Anaesthetists expressed more confidence in managing cardiac arrest than managing debriefs or communication with next of kin afterwards.
- Fewer than 50% of anaesthetists believe that the current guidelines on the management of perioperative arrests are sufficient.
- Approximately half of responding anaesthetists had been involved in the direct or indirect management of at least one cardiac arrest in the previous two years, most in the main theatre complex.
- Of the most recent cardiac arrests responded to by anaesthetists, 7% were in a child.
- The top three causes of perioperative cardiac arrest, as estimated by anaesthetists, were hypovolaemia, hypoxaemia and cardiac ischaemia or failure with haemorrhage fifth.
- The top three suspected or confirmed primary causes of the most recent cardiac arrest attended by respondents were major haemorrhage (20%), anaphylaxis (10%) and cardiac ischaemia (9%).
- In 39% of cases an operating list or shift was paused or stopped following a cardiac arrest and in 31% one or all team members stood down from clinical activity.
- More than 60% of anaesthetists were involved in communication with the patient's family or next of kin following the event.
- Most anaesthetists (87%) were satisfied with how the most recent cardiac arrest was managed.
- Some 38% of anaesthetists involved in a recent event attended or planned to attend a debrief: approximately 60% were 'hot' debriefs, 20% 'cold' debriefs and 20% both.
- Of the anaesthetists involved, 56% received informal wellbeing support from colleagues and 11% received formal wellbeing support.
- An impact on the ability to deliver future patient care was reported by 196 (4.5%) anaesthetists.
- Over their career, 85% of responding anaesthetists had managed a perioperative cardiac arrest as the primary anaesthetist or assisting.

What we already know

In the UK, recommendations regarding preparation and practice for management of a cardiac arrest for adults, children and neonates are directed by the RCUK. Anaesthetists are key members of the resuscitation team and should attend national accredited courses (RCUK 2020a) such as Advanced Life Support (ALS), European Paediatric Advanced Life Support and Advanced Paediatric Life Support. Accredited ALS courses (RCUK or equivalent) are valid for four years unless a clinician is a practicing instructor.

For clinicians working with adult patients, the RCUK recommends that healthcare professionals should receive yearly training updates in adult cardiopulmonary resuscitation (CPR) and defibrillation. The same recommendation applies for those anaesthetists working with children, who are expected to receive yearly training updates in paediatric CPR and defibrillation. The RCoA's *Guidelines for the Provision of Anaesthesia Services* (GPAS) recommend that all anaesthetists should have completed training in adult and paediatric life support that is appropriate for their level of clinical practice (RCoA 2023).

While the RCUK provides guidelines on cardiac arrest management, there are no specific RCUK guidelines for management of cardiac arrest during anaesthesia. The closest are the 'special settings' of the RCUK guidelines for cardiac arrests in the operating room, which encourage checking the airway and capnography waveform, the use of ultrasound to guide resuscitation and the consideration of alternatives to closed chest compressions such as open cardiac compressions and extracorporeal pulmonary resuscitation (eCPR; Deakin 2021). The Association of Anaesthetists' *Quick Reference Handbook* includes a section on cardiac arrest, which is primarily based on the generic RCUK guidelines on management of cardiac arrest (Association of Anaesthetists 2018).

Although not specific to perioperative cardiac arrests, the Association of Anaesthetists has published guidelines on how to manage the aftermath of an intraoperative death, including how to conduct communication with relatives, the review process and the welfare support of anaesthetists (Association of Anaesthetists 2005). These guidelines are in the process of revision at the time of writing.

The aim of the individual anaesthetist's survey was to gain understanding on the training, attitudes, beliefs and current practices surrounding perioperative cardiac arrests including immediate management and the aftermath: debriefing, list management and review processes. Anaesthetists' recent and career experiences and perspectives surrounding the management of perioperative cardiac arrest in the aftermath were also explored.

What we found

Survey methods

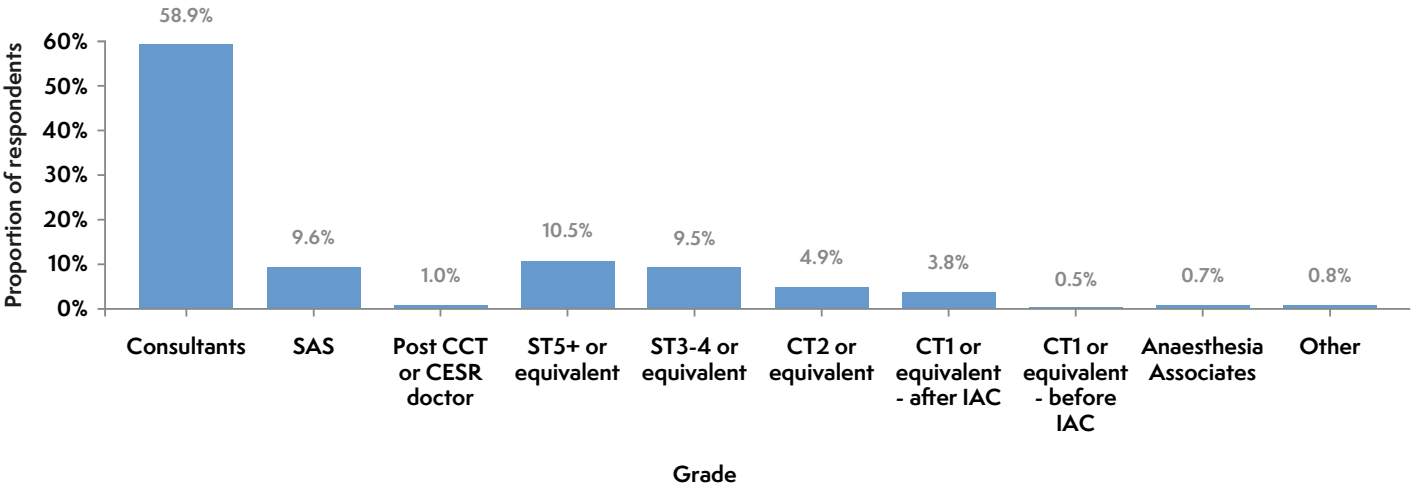
An electronic survey was distributed to UK anaesthetists and anaesthesia associates via the network of Local Coordinators (Chapter 6 Methods) to coincide with the NAP7 launch in June 2021 and responses were accepted for five months. The denominator used for the total number of anaesthetists and anaesthesia associates in the UK was 15,071, based on the RCoA 2020 census (RCoA 2020). We received 10,746 responses, a response rate of 71%. In this chapter, the term 'anaesthetists' is used to describe both medically qualified anaesthetists and anaesthesia associates.

Demographics and workplace characteristics

Questions on demographics and workplace characteristics were answered by 10,009 (93%) anaesthetists. A total of 5,727 (57%) anaesthetists identified themselves as male, 4,085 (41%) female, 12 (0.1%) other, and 185 (2%) preferred not to say. There were 3 (0.03%) individuals younger than 25 years, 2645 (26%) aged 25–35 years, 7126 (71%) aged 36–65 years, 93 (1%) aged over 65 years and 142 (1%) who preferred not to say.

In terms of grade, respondents included 5,896 (59%) consultants, 958 (10%) specialist, associate specialist and specialty (SAS) doctors, 3,007 (30%) anaesthetists in training and non-training positions, 71 (1%) anaesthesia associates and 77 (1%) 'other' (Figure 10.1). The median (IQR [range]) anaesthetic experience

Figure 10.1 The grade of anaesthetists as a proportion (%) of total respondents (*n* = 10,009). CCT, certificate of completion of training; CESR, certificate of eligibility for specialist registration; CT, core trainee; SAS, staff and associate specialist; ST, specialty trainee.



was 13.1 (6.9 –21.8 [0.1 – 50.0] years and the crude sum of experience of all respondents was 147,827 years. Anaesthetists with less than one year's experience accounted for 437 (4%) of respondents (Figure 10.2), which is lower than the 6% reported in the NAP6 report (Kemp 2018). Out-of-hours work, including weekends or nights, was conducted by 9,102 (91%) anaesthetists. Further information on the grade of anaesthetists, median years of anaesthetic experience and out-of-hours working pattern can be found in Appendix 10.1. The country or region of employment reported by 9,917 (92%) anaesthetists is also reported in the appendix.

Anaesthetists' place of work was exclusively in the NHS for 8,298 (83%), exclusively in the independent sector for 65 (1%), and in both sectors for 1,646 (16%).

Specific subspecialty interests reported by responding consultant and SAS anaesthetists are shown in Figure 10.3. The most commonly reported subspecialty areas were obstetrics (1590 individuals; 23%), orthopaedics (1,514; 22%), intensive care medicine (1,458; 21%), regional (1,275; 19%) and trauma (1,193; 17%). A total of 795 (12%) respondents stated 'not applicable' or 'none of the above'.

Figure 10.2 Number of years of anaesthetic experience of respondents

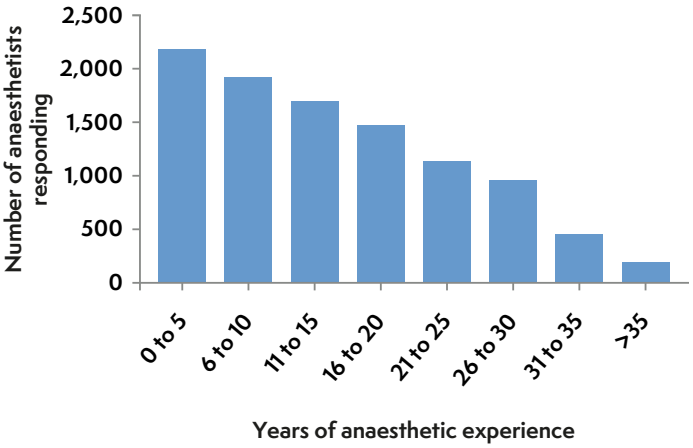
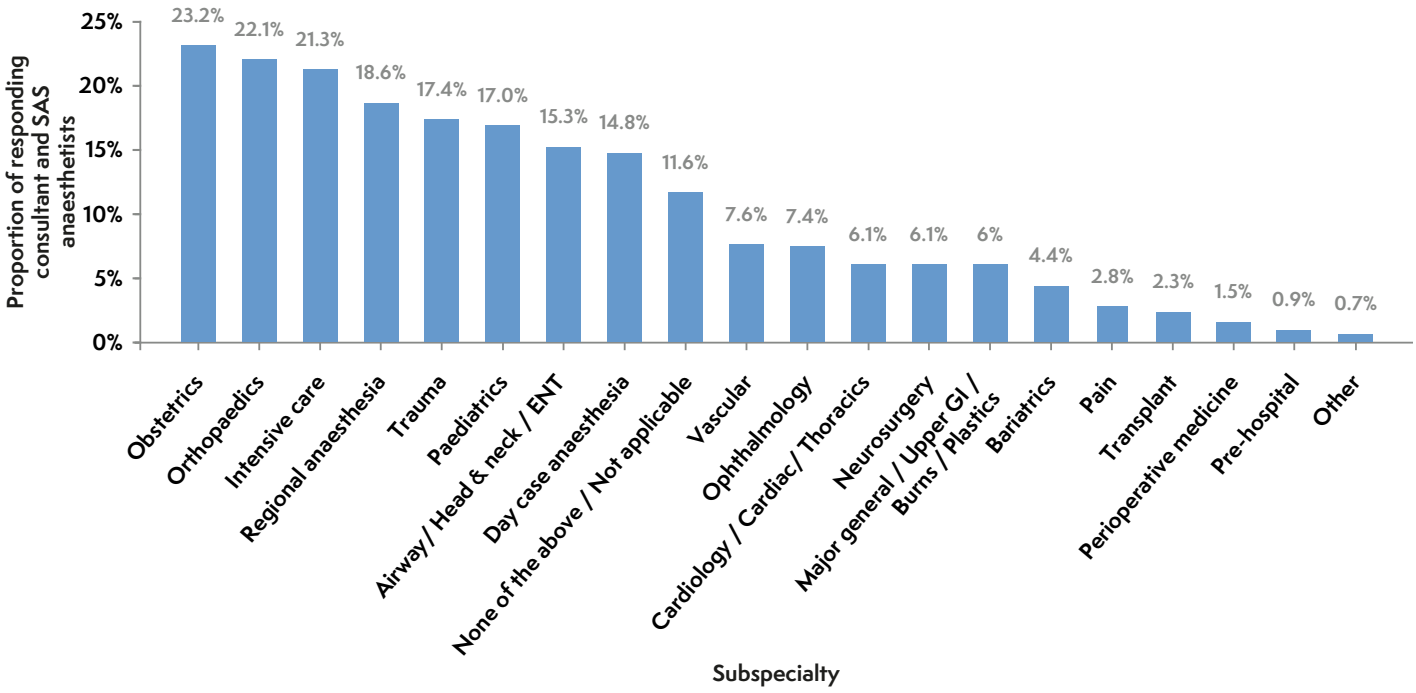


Figure 10.3 Reported subspecialty among consultant and SAS anaesthetists that responded to the NAP7 Baseline Survey (*n* = 6,854)



Knowledge, training and attitudes

All 10,746 (100%) responding anaesthetists answered questions regarding knowledge, training and attitudes to perioperative cardiac arrest.

In terms of resuscitation (CPR and defibrillation) training, 9,646 (90%) anaesthetists were up to date in adult ALS and 7,125 (66%) in paediatric ALS, having received training either in an RCUK or equivalent course within past four years or departmental/ hospital 'hands-on training' within past one to two years (Figure 10.4). Conversely, 799 (7%) and 1,707 (16%) anaesthetist's training in adult and paediatric resuscitation, respectively, was 'out of date' or had never been undertaken. The difference in the total proportion of respondents with most recent up to date training in either RCUK or equivalent or departmental/hospital 'hands-on training' is further described in Appendix 10.1.

In terms of the uptake of nationally accredited formal training courses, instructing, at least yearly, was reported by 1,951 (18%) individuals at adult and 841 (8%) paediatric RCUK or equivalent courses. No formal RCUK or equivalent training had been attained by 218 (2%) anaesthetists for adult ALS and 1,168 (11%) for paediatric ALS.

Overall, up to date training in adult ALS was notably more common than in paediatric ALS. Rates varied little between grades but the finding was consistent (see Appendix 10.1). Among anaesthesia associates few (< 25%) were up to date with and commonly (> 33%) had never been trained in paediatric ALS.

A total of 8,994 (84%) anaesthetists reported that they felt confident (agree and strongly agree) in leading an intraoperative cardiac arrest (Figure 10.5). Although 6,512 (61%) respondents stated that they had received sufficient (agree or strongly agree) training in managing an intraoperative cardiac arrest, 1,776 (17%)

Figure 10.4 Training in adult and paediatric advanced life support among 10,746 anaesthetists. 'In date' ■ = respondents with either RCUK or equivalent course completed within past four years or departmental/hospital 'hands-on training' within past one to two years, or instructs on such courses at least yearly. 'Out of date' ■ = RCUK training completed more than four years ago and departmental/hospital 'hands on training' more than two years ago. 'None' ■ = respondents that have never obtained formal RCUK or equivalent training or departmental/hospital 'hands on training'. 'Other/unknown' ■ = unclear whether respondents were out of date with either RCUK or equivalent course or departmental/hospital 'hands on training' as they reported a mixture of 'can't recall', 'not applicable' and 'none'. 'Not applicable' ■ = not practicing adult or children's anaesthesia.

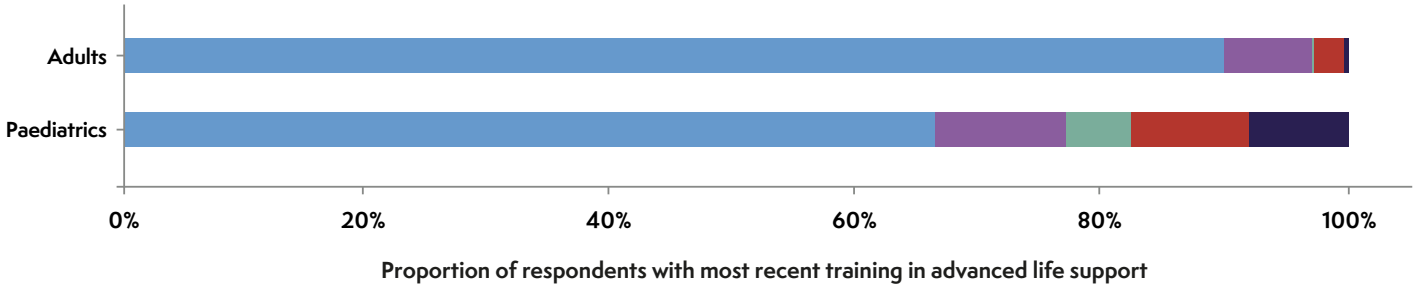
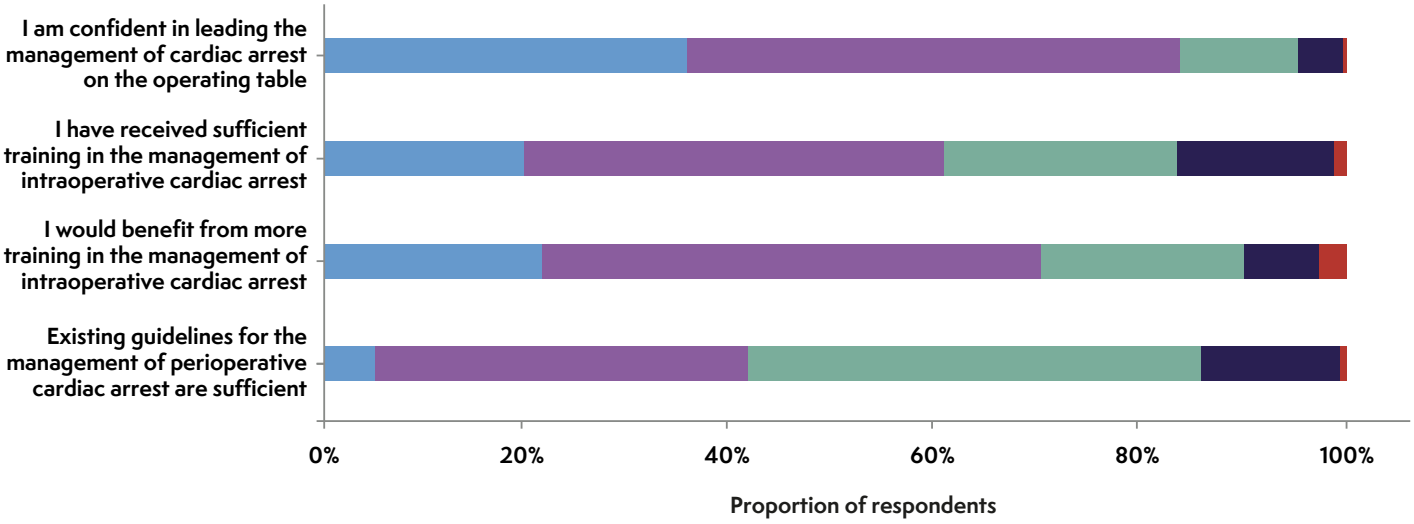


Figure 10.5 Anaesthetists' attitudes to management of perioperative cardiac arrest, including training and guidelines among 10,746 respondents. Strongly Agree ■, Agree ■, Neither agree or disagree ■, Disagree ■, Strongly disagree ■.



disagreed (strongly disagree or disagree) with this statement and 7,551 (70%) anaesthetists stated that they would benefit from more training in this field.

Current guidelines for the management of perioperative cardiac arrests were deemed sufficient (agree or strongly agree) by 4,441 (41%) and insufficient (disagree or strongly disagree) by 1,537 (14%) respondents. Qualitative analysis on the 'free text' comments is provided in Appendix 10.1.

Overall, male respondents were more likely to reply that they felt confident (strongly agree or agree) in managing a perioperative cardiac arrest on the operating table than females (87% vs 79%; Figure 10.6).

Fewer respondents reported feeling confident in the management of the aftermath of a perioperative cardiac arrest, including the debrief process and communication with the family or next of kin, than management of the event itself (Figure 10.7). A total of 5,985 (56%) anaesthetists agreed that they felt confident (agree or strongly agree) in leading a debrief, while 8,138 (76%) reported that they would benefit (agree or strongly agree) from more training in how to conduct a debrief and 7,340 (68%) anaesthetists felt confident (agree or strongly agree) in communicating with the family or next of kin with this process.

Figure 10.6 Anaesthetists' confidence in management of cardiac arrest on the operating table by gender among 9,812 respondents. Male ■, Female ■.

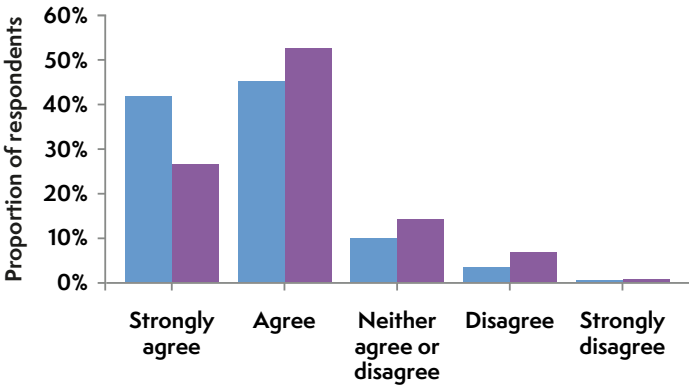


Figure 10.7 Anaesthetists' opinions on debriefing and communication following a perioperative cardiac arrest (*n* = 10,746). Strongly Agree ■, Agree ■, Neither agree or disagree ■, Disagree ■, Strongly disagree ■.

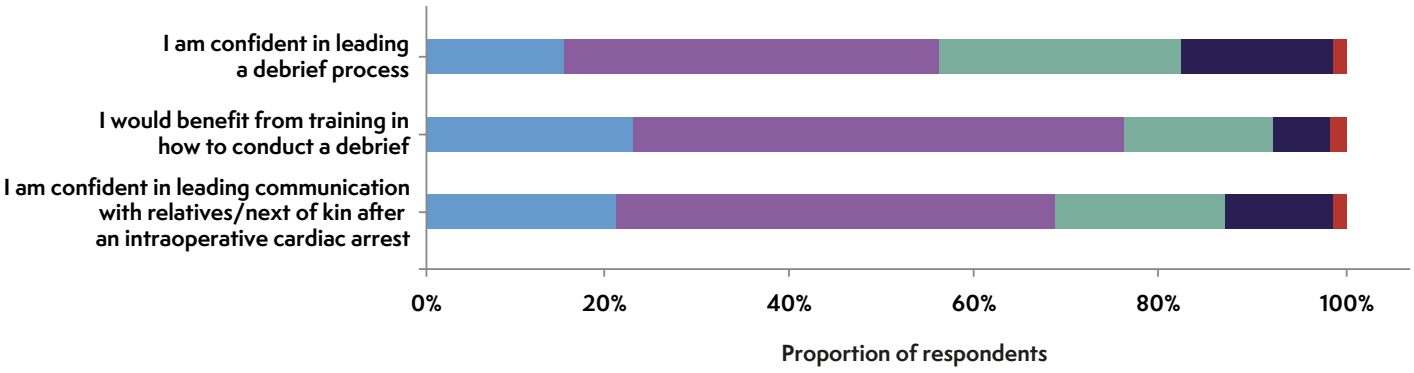
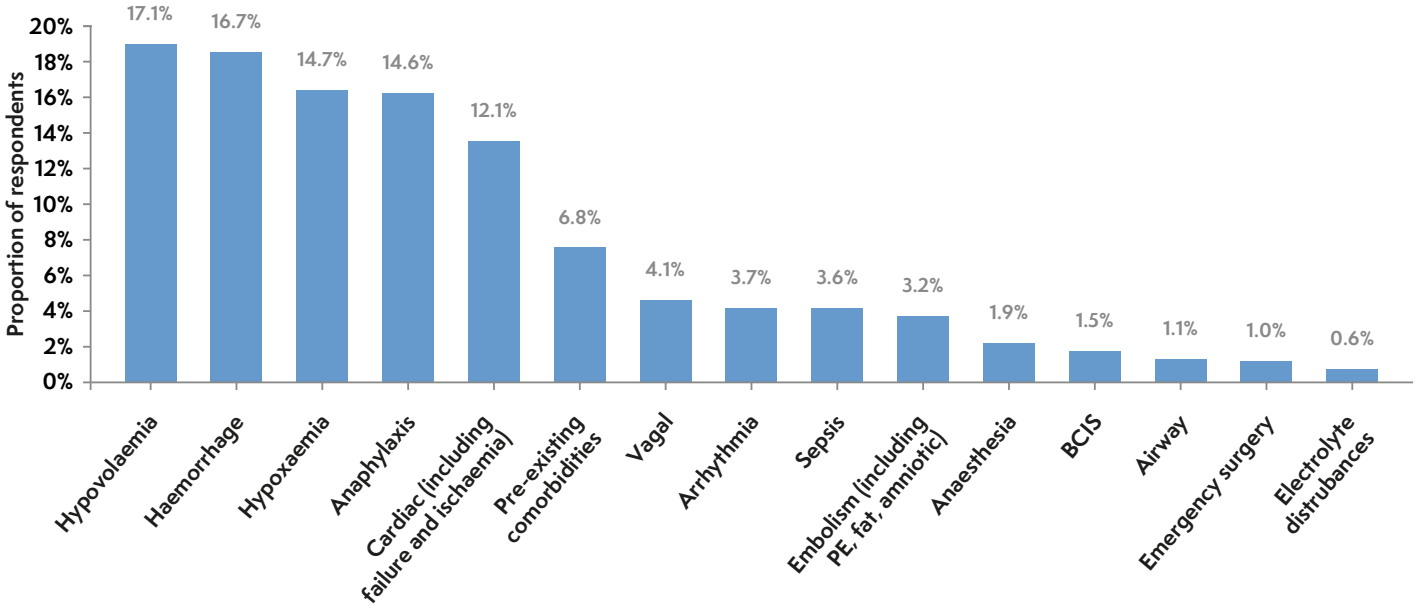


Figure 10.8 Perceived 'most common cause' of perioperative cardiac arrest among 10,746 anaesthetists. BCIS, bone cement implantation syndrome.



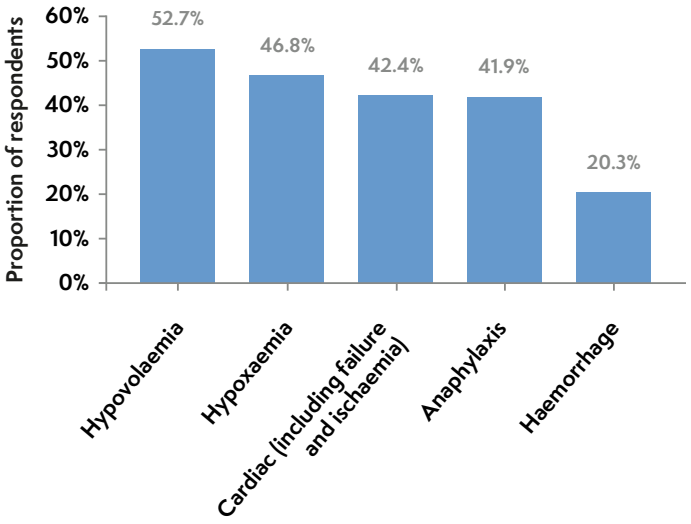
Management of profound hypotension and threshold for initiating chest compressions

The survey inquired about anaesthetists' perspectives on what blood pressure and other clinical triggers they would use to start chest compressions at in a healthy patient scoring ASA 2 and a patient scoring ASA 3 with hypertension during general anaesthesia. The results are described in Chapter 20 Decisions about CPR. In summary, anaesthetists used multiple triggers to initiate chest compressions but among those anaesthetists who chose a blood pressure cut-off (around 80% of respondents); for the 50-year-old patient classified as ASA 2, more than 50% would start CPR when systolic blood pressure fell below 40 mmHg and for the 75-year-old patient at ASA 3, more than 50% would start CPR when systolic blood pressure fell below 50 mmHg.

Perceptions of common causes of cardiac arrest

The top three perceived causes of perioperative cardiac arrest reported by anaesthetists are shown in Figures 10.8–10.9. Figure 10.8 shows the distribution of perceived 'most common cause' and Figure 10.9 the sum of causes included in respondents' 'top three causes'. The top five in all three perceptions were the same, including hypovolaemia, hypoxaemia, cardiac ischaemia or failure, anaphylaxis and haemorrhage.

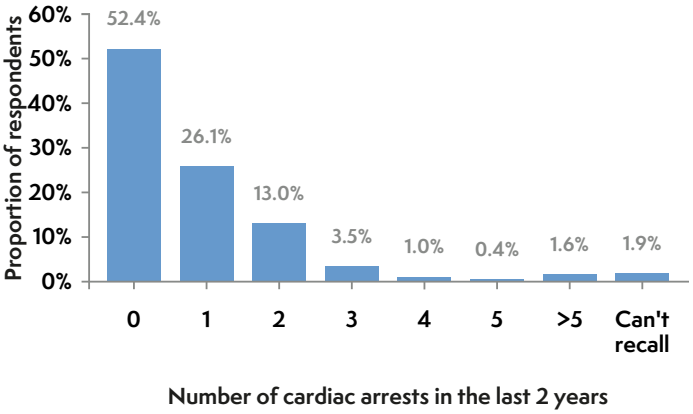
Figure 10.9 Anaesthetists' (*n* = 10,746) perceptions of most common causes of perioperative cardiac arrest: sum of all causes included in respondents 'top 3 causes'



Recent experience and management of perioperative cardiac arrest

A total of 10,508 (98%) of 10,746 respondents answered the question regarding how many cases of perioperative cardiac arrest they recalled managing or being present at to assist in the previous two years; 4,806 (46%) anaesthetists reported involvement in one or more perioperative cardiac arrest in the past two years (Figure 10.10). More than five events were recently experienced by 171 (2%) anaesthetists and only one event by 2,742 (26%) anaesthetists.

Figure 10.10 Anaesthetists' experience of involvement in perioperative cardiac arrests in previous two years (*n* = 10,508)



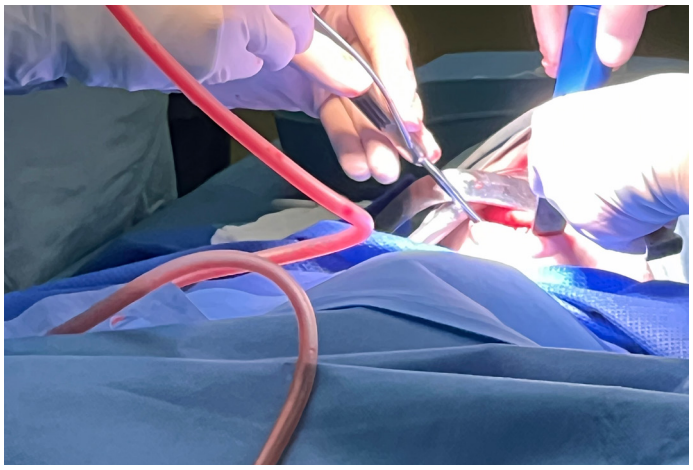


Table 10.1 Patient age among the most recent perioperative cardiac arrest attended by 4,664 anaesthetists

Age of patient (years)	Respondents(%)	
	(*n*)	(%)
0–1	155	3
1–18	166	4
19–65	1817	39
> 65	2353	50
Not known/can't recall	163	3
Prefer not to say	10	0.2

Further questions on the experiences of the most recent perioperative cardiac arrest were initially answered by 4,664 (97%) of the 4,806 eligible respondents and decreased to 4,374 (91%) by the end of this survey section. The location of the cardiac arrest is shown in Figure 10.11, with main theatre suite the most frequent location (3,490; 75% of 4,664 responses), followed by the cardiac catheterisation suite (218; 5%) and obstetric theatres (167; 4%). A cardiac arrest in the obstetric unit (including labour ward) had been attended by 189 (4%) anaesthetists in the previous two years. The age of the patient who had arrested at the last cardiac arrest attended by respondents is shown in Table 10.1.

The type of personal protective equipment (PPE) precautions used by respondents during the management of the most recent perioperative cardiac arrest they had attended and individual perspectives on managing arrests in PPE are reported in Chapter 7 COVID-19.

The most likely suspected or confirmed primary cause of the most recent cardiac arrest attended was answered by 4,639 (97%) of 4806 eligible respondents: these included a cardiovascular cause in 2915 (63%) responses, airway or breathing issues (395, 9%), neurological (157, 3%) and metabolic problems (111, 2%; Figure 10.12). Specific causes are shown in

Figure 10.11 Location of the most recent (previous 2 years) perioperative cardiac arrest attended by 4664 anaesthetists. Locations with less than 50 responses and 'can't recall' responses have not been included.

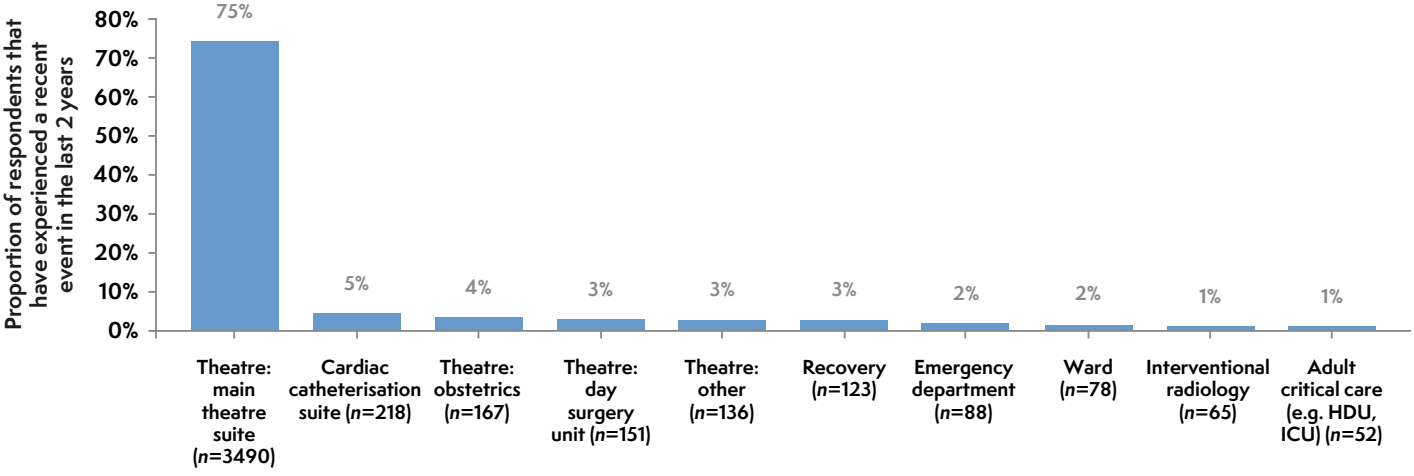


Figure 10.13. The top three suspected or confirmed primary causes of cardiac arrest were major haemorrhage in 927 (20%) cases, anaphylaxis in 474 (10%) and cardiac ischaemia in 397 (9%) cases.

Of the 4,494 responses, 1,341 (30%) respondents reported that the patient did not survive the initial resuscitation attempt. In 76 (6%) of these 1,341 cases, resuscitation efforts were stopped because of the patient's known wishes.

Respondents stated that 1,750 (39%) patients survived to hospital discharge and, in 614 (14%) of cases, the patient was still in hospital or the final outcome was unknown (Figure 10.14).

The responding anaesthetist was present at the start of anaesthesia in 2,695 (60%) of 4,494 most recent cases of perioperative cardiac arrest; 1,725 (64%) were consultants or SAS anaesthetists, 828 (31%) anaesthetists in training and non-training positions and 18 (1%) anaesthesia associates. The numbers of anaesthetists attending each cardiac arrest and their grades are reported in Appendix 10.1 but, generally, numbers of anaesthetists attending the patient increased by approximately 50% during the cardiac arrest.

Specific guidelines to manage the cardiac arrest were used in 2,036 (45%) of the 4494 events, and no guidelines in 1,892 (42%); in 566 (13%) cases, the respondent could not recall.

Figure 10.12 Categories of suspected or confirmed primary cause of perioperative cardiac arrest, among those most recently attended by 4639 anaesthetists. Unclear and 'can't recall' responses have not been included.

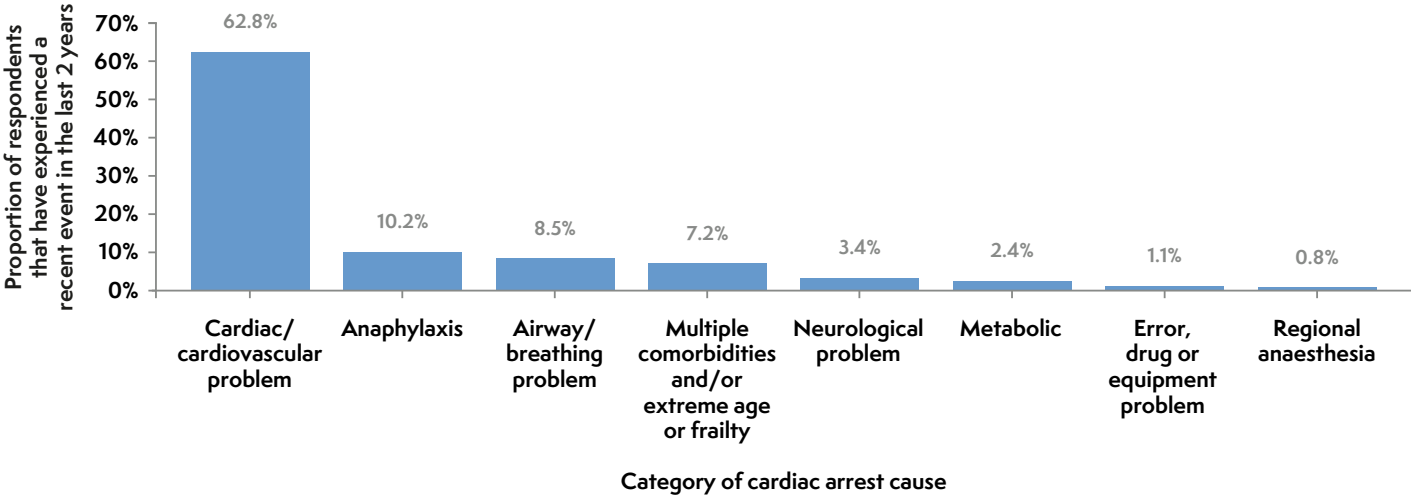


Figure 10.13 Detailed top 20 most common suspected or confirmed primary cause of perioperative cardiac arrest, among those most recently attended by 4639 anaesthetists. Unclear and 'can't recall' responses have not been included.

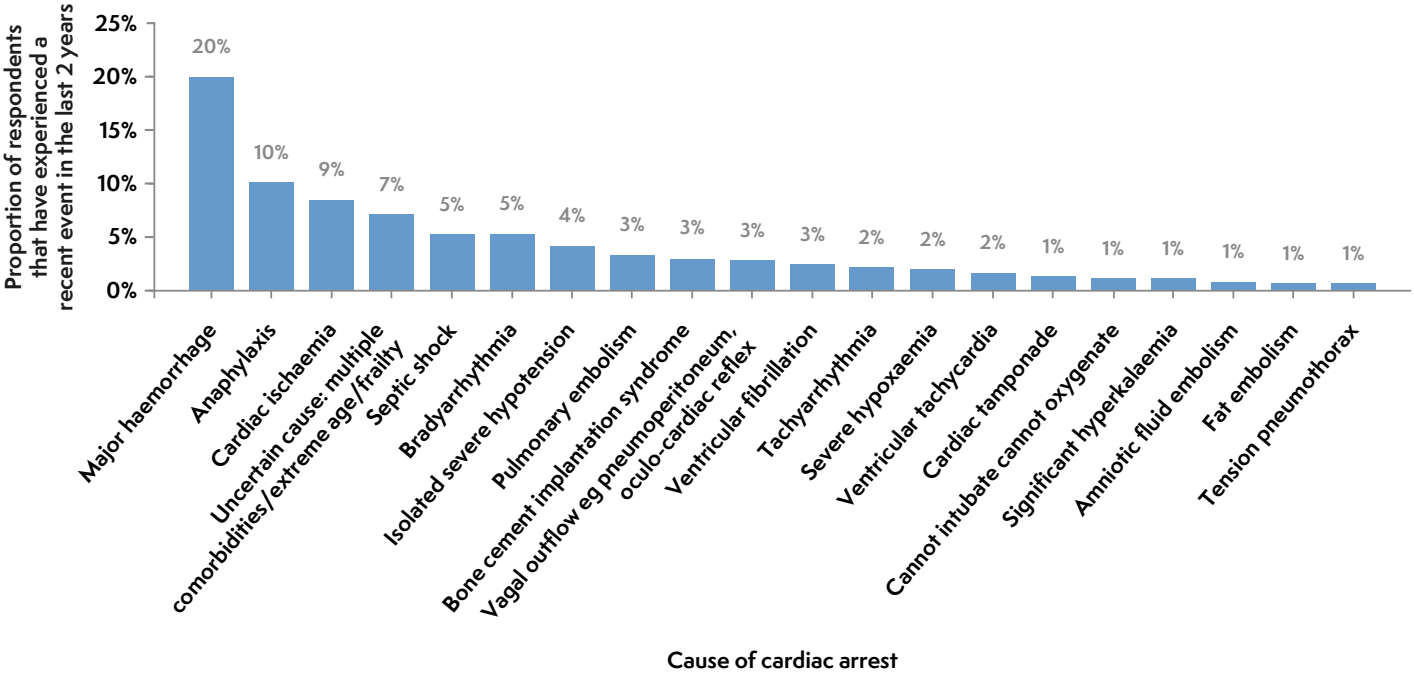
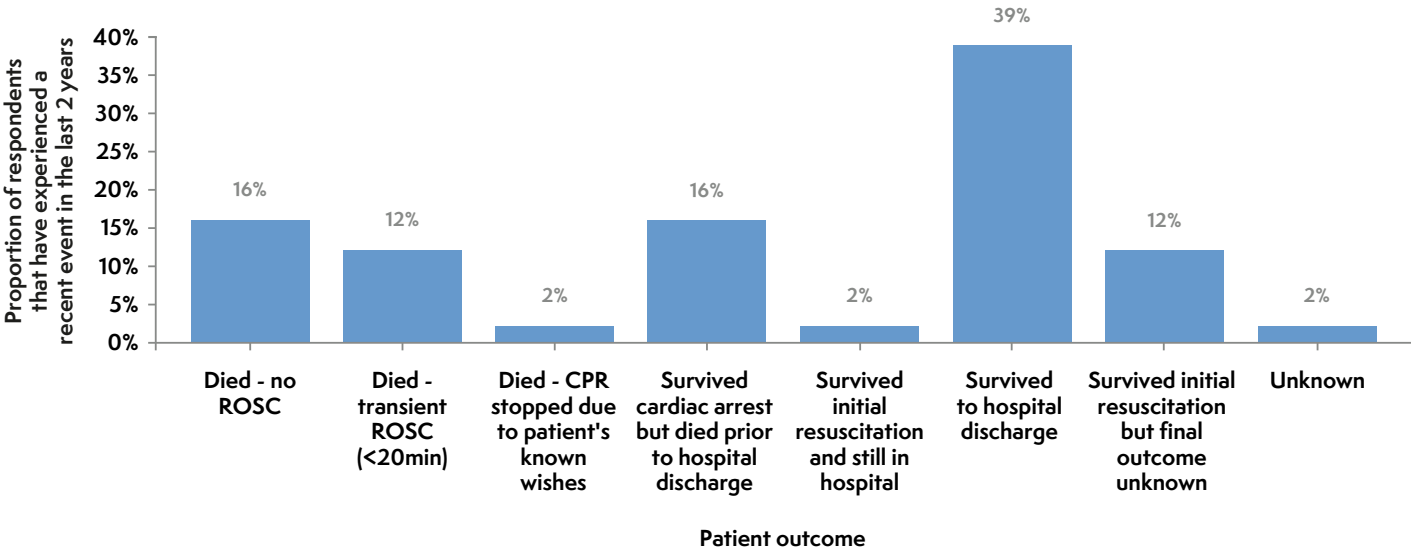


Figure 10.14 Patient outcome reported by 4494 anaesthetists describing their most recent experience of perioperative cardiac arrest



Of 2,015 anaesthetists who reported how they accessed a specific guideline, this was from memory in 65%, using a hard copy of the guideline at the cardiac arrest location in 41% and using an electronic device in 6% (Figure 10.15).

Following the cardiac arrest, of 3,378 cases where an operating list or shift might have been paused or stopped, this occurred in 1,330 (39%) (Table 10.2).

Overall, the quality of the management of the recent cardiac arrest was viewed positively (satisfied or very satisfied) by 3,871 (87%) of 4,436 anaesthetists (Figure 10.16). 'Free text' comments by 1,329 (30%; see Table 10.3 for examples). Of those satisfied by the quality of the management, 964 respondents mentioned the 'positive outcome', 285 described good 'leadership and teamwork', 169 described satisfaction with cardiac arrest 'management procedures' (eg following specific guidelines) and 83 indicated that quick 'recognition of arrest and treatment' was key. Conversely, 54 respondents described events as 'chaotic' and challenging and the outcome not as positive as hoped.

Figure 10.17 shows which personnel communicated with family or next of kin after the cardiac arrest. Of these people, 63% were anaesthetists.

Figure 10.15 Use and access to specific resuscitation guidelines during anaesthetists' most recent experience of perioperative cardiac arrest (*n* = 2,015)

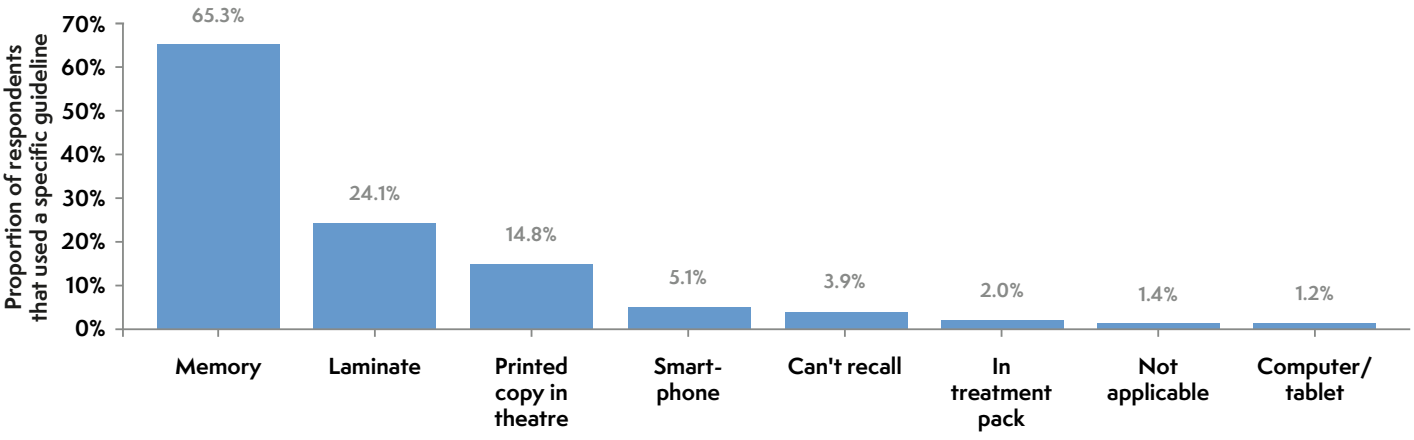


Table 10.2 Theatre list and on-call shift management

Response	Total responses (*n*)	Proportion of respondents (%)
Was theatre list or anaesthetic on-call shift terminated early? (*n* = 3,378)		
No	1663	49
Yes, paused	818	24
Yes, list stopped (includes cancelling remaining patients or transferring to care by a different team)	512	15
No, emergency list (eg CEPOD, trauma, catheterisation laboratory)	150	4
Can't recall	235	7
Did any members of the team stand-down from clinical activity? (*n* = 3,315)		
No one stood down (eg continued with the next case)	1928	58
Yes – some of the team	658	20
Yes – all of the team	201	6
Yes – I stood down	167	5
Can't recall	472	14
How did you or your team stand down? (*n* = 886)		
Took a short break (eg < 1 hour)	287	32
Theatre list terminated early	272	31
Took a sustained break (eg > 1 hour)	248	28
Anaesthetic on-call shift terminated early	68	8
Other	31	3
Can't recall	76	9

Figure 10.16 Satisfaction among 4,436 anaesthetists regarding the 'quality of the management' of the most recent perioperative cardiac arrest they attended in last 2 years. Very satisfied ■, Satisfied ■, Neither satisfied or dissatisfied ■, Dissatisfied ■, Strongly dissatisfied ■.

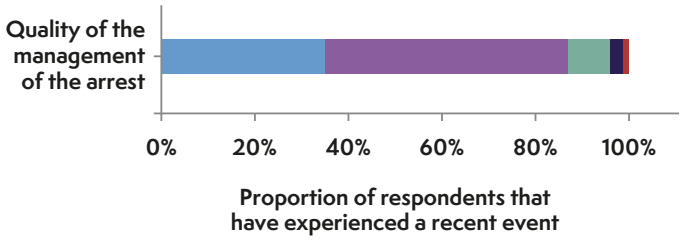


Figure 10.17 Personnel communicating with the patient's relative or next of kin immediately after the most recent perioperative cardiac arrest attended by 3,705 anaesthetists. 'Non-applicable (eg 'no next of kin' and 'can't recall') responses were excluded.

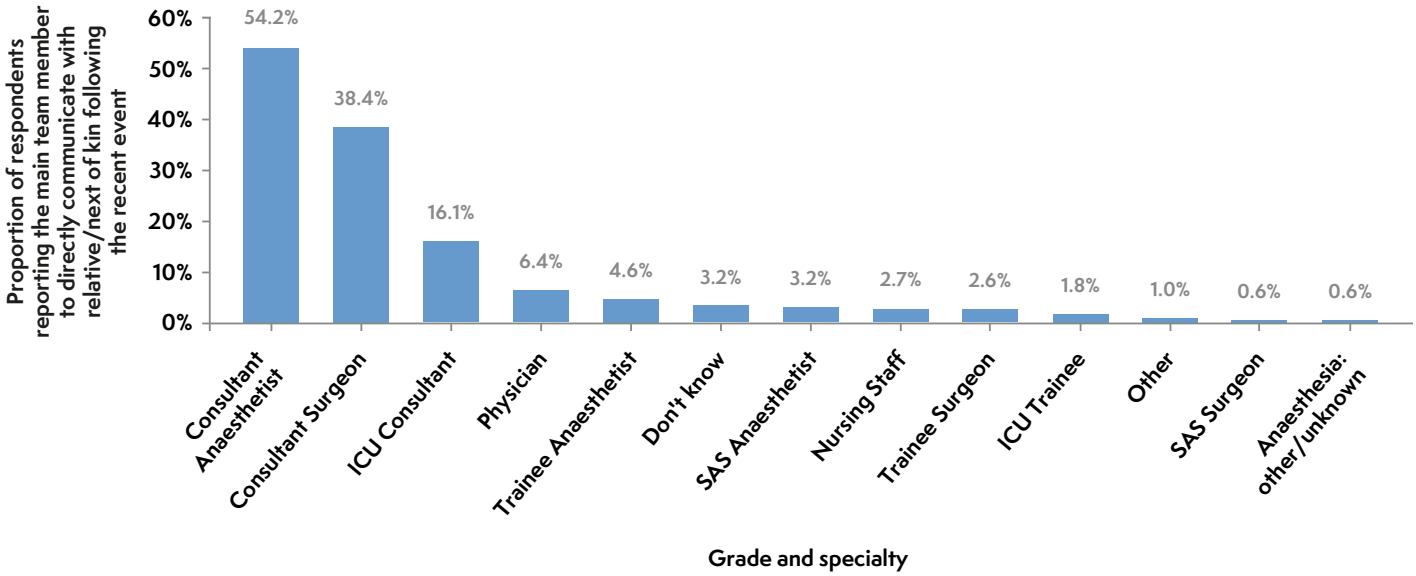


Table 10.3 'Free text' comments and themes from 1,329 anaesthetists regarding the management of their most recently attended perioperative cardiac arrest. CALS, Cardiac advanced life support; ODP, operating department practitioner; PPE, personal protective equipment; ROSC, return of spontaneous circulation.

Themes (number of sentiments)	Examples
Patient outcome (*n* = 1,182): • Positive comments (*n* = 964) • Nuanced/neutral comments (*n* = 55) • Negative comments (*n* = 163)	**Positive examples** 'Successful outcome, no issues, concerns.' 'Good initial outcome. Although very stressful as significant uncertainty over the actual diagnosis.' **Negative examples** 'ROSC was obtained after first cardiac arrest but three-hour delay in transferring patient to intensive care … Patient then had second cardiac arrest and ROSC was not obtained.'
Leadership and teamwork (*n* = 313): • Positive comments (*n* = 285) • Nuanced/neutral comments (*n* = 5) • Negative comments (*n* = 23)	**Positive examples** 'Good teamwork. Got child back very quickly.' 'Theatre team worked very well together. All commented that it had felt like Sim training.' 'Well-managed, not unexpected due to significant major trauma, whole team knew rules and performed well.' 'We received the patient in an incredibly poor state so for that reason I'm annoyed. However, she was managed extremely well. I truly believe that with any other team of people, on any other night, she would have died.' **Negative examples** 'Delay in surgical consultant intervention appeared contributory to the arrest.' 'CALS protocol followed, chest opened and ROSC but not that well led by ICU consultant and problems with blood bank meant took over an hour to obtain blood products in a very coagulopathic patient.' 'No leader, consultant in list in disarray, others helping in slightly uncoordinated fashion, but shocks delivered and outcome good.' 'Consultant refused to recognise patient had arrested, had to overrule him to get ODP to start chest compressions'.
Management procedures (eg guidelines; *n* = 202): • Positive comments (*n* = 169) • Nuanced/neutral comments (*n* = 14) • Negative comments (*n* = 19)	**Positive examples** 'Well managed, major haemorrhage protocol already activated'. 'Good prompt resuscitation of patient. We followed the guidelines to a high standard.' 'Recognition, effective emergency management, appropriate use of pacing'. **Negative examples** 'Management was hampered by difficulty in communication and obtaining equipment due to COVID-19 and PPE.' 'Mandatory to put out hospital cardiac arrest call. Medical team unfamiliar with interventional radiology suite and the procedure being undertaken. Also unfamiliar with anaesthesia and standard processes that were underway.'
Recognition of arrest and treatment (*n* = 90): • Positive comments (*n* = 83) • Nuanced/neutral comments (*n* = 1) • Negative comments (*n* = 6)	**Positive examples** 'Early identification of deteriorating patient and appropriate management, whole arrest team was present before the event.' 'There was a prompt recognition of the cardiac arrest with a high index of suspicion as to the cause throughout.' **Negative examples** 'Consultant refused to recognise patient had arrested, had to overrule him to get ODP to start chest compressions.' 'Not recognised early enough. Poor communication from surgeon who insisted it must be an airway problem.'
Chaos (*n* = 82): • Positive comments (*n* = 19) • Nuanced/neutral comments (*n* = 9) • Negative comments (*n* = 54)	**Positive examples** 'Bleeding abdominal aortic aneurysm. Very difficult case with multiple problems at the same time. We did the best we could!' **Negative examples** 'Too many people giving orders, disorganised.' 'A bit chaotic as a lot of people and equipment in a small room.' 'Chaotic environment with different people trying to lead.' 'Chaotic. Lacked clear leadership. Arrest in lateral position. Slow to turn supine.' 'A lot of people involved, sometimes difficult to see what is being or has been done.'

Debriefing

A total of 1,693 (38%) responding anaesthetists attended a debrief following their most recent perioperative cardiac arrest; 487 (11%) were unable to attend because of personal or work commitments, 78 (2%) were not invited and 45 (1%) decided not to attend (Figure 10.18). Of the anaesthetists that attended a debrief, 58% reported that the debrief occurred immediately ('hot debrief') after the event, 20% after a delayed period ('cold debrief'), 20% both immediately and after a delayed period, and in 1% the debrief occurred as part of the 'end of the list' debrief session. Figure 10.19 shows the various forms of debrief that respondents attended. Informal debriefs were more than four times more common than formal debriefs. Most respondents were positive about how the debrief process was managed after the event, with 79% feeling satisfied or very satisfied (Figure 10.20). Qualitative analysis of the 'free text' comments on the debrief satisfaction is provided in Appendix 10.1. Debriefing is discussed in detail in Chapter 17 Aftermath and learning.

Information on how the most recent cases were reviewed and followed-up at departmental and organisational level, as well as any inquest or legal proceedings, is provided in Figure 10.21 and Table 10.4. More than half of cases were reviewed in a mortality and morbidity meeting and 20% in a clinical governance meeting. Of the 4,374 recent cases, an inquest or equivalent (eg procurator fiscal) occurred or was pending in 374 (9%) cases and legal proceedings in 34 (1%) cases (Table 10.4). A case review was neither carried out nor planned in 449 (10%) recent episodes of perioperative cardiac arrest.

Figure 10.18 Debrief attendance by 4,422 anaesthetists following their most recently attended perioperative cardiac arrest

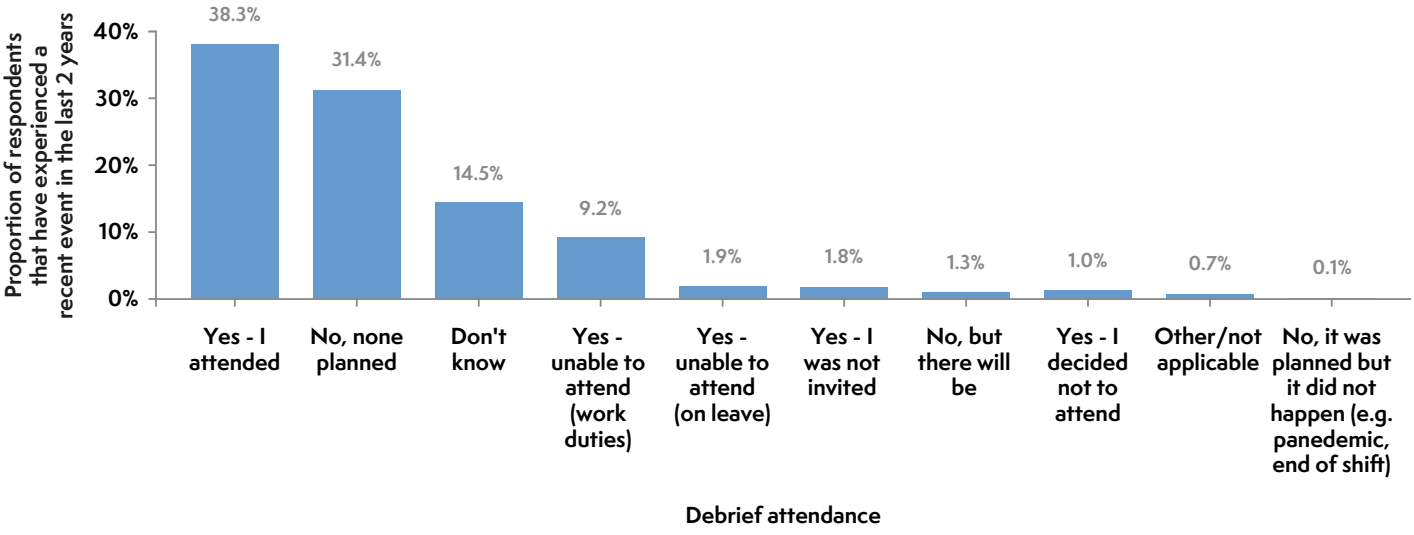


Figure 10.19 Types of debrief experienced by anaesthetists attending a debrief after perioperative cardiac arrest (*n* = 1,563). 'Not applicable' responses have been excluded.

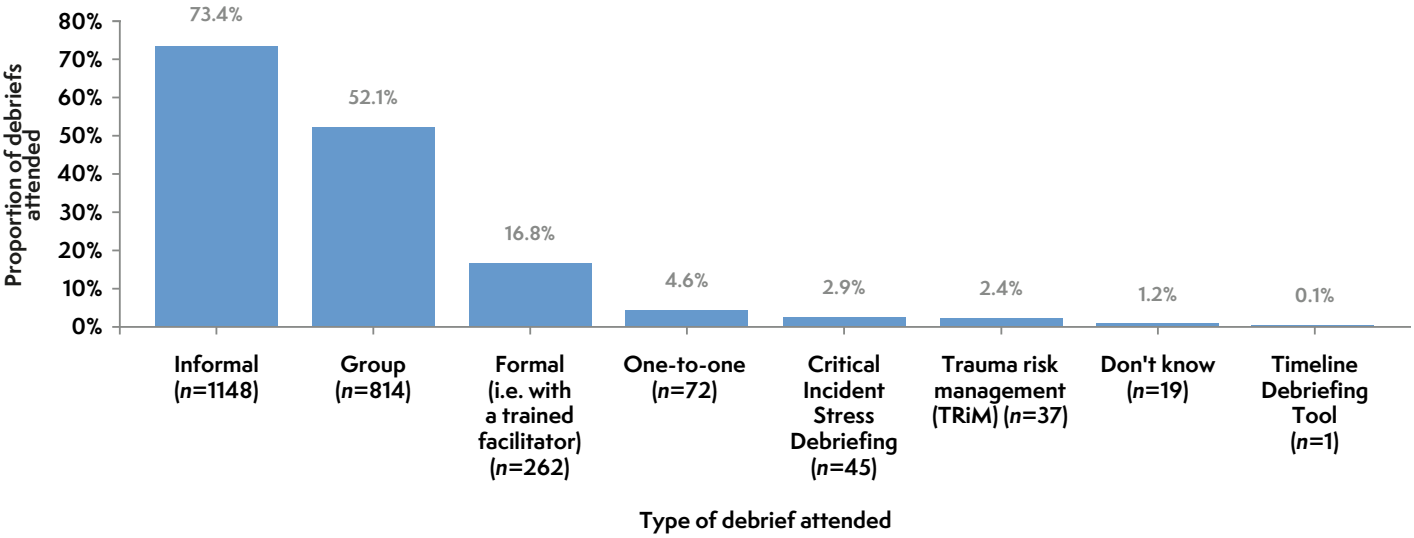


Figure 10.20 Satisfaction with (a) debrief process among 1,568 anaesthetists and (b) follow-up and review process (*n* = 4,374) following their most recently attended perioperative cardiac arrest. Strongly Agree ■, Agree ■, Neither agree or disagree ■, Disagree ■, Strongly disagree ■.

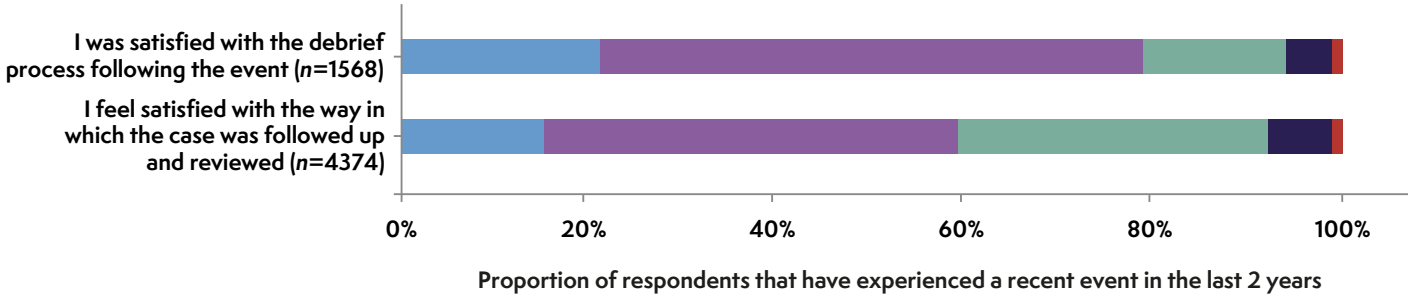


Table 10.4 Extent of external regulatory review of most recently attended perioperative cardiac arrest by 4,374 anaesthetists

Response	Respondents	
	(*n*)	(%)
Inquest or equivalent		
Yes	254	6
Pending	120	3
No/not applicable	2733	62
Prefer not to say	6	0.1
Don't know	1261	29
Legal proceedings		
Yes	34	1
No/not applicable	2930	67
Too early to know	327	7
Prefer not to say	4	0.1
Don't know	1079	25

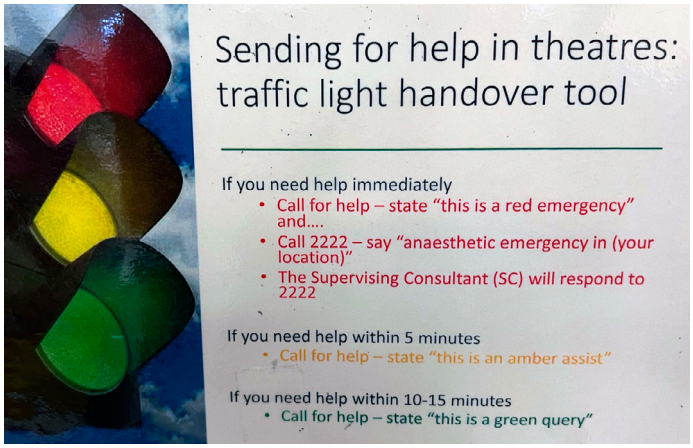
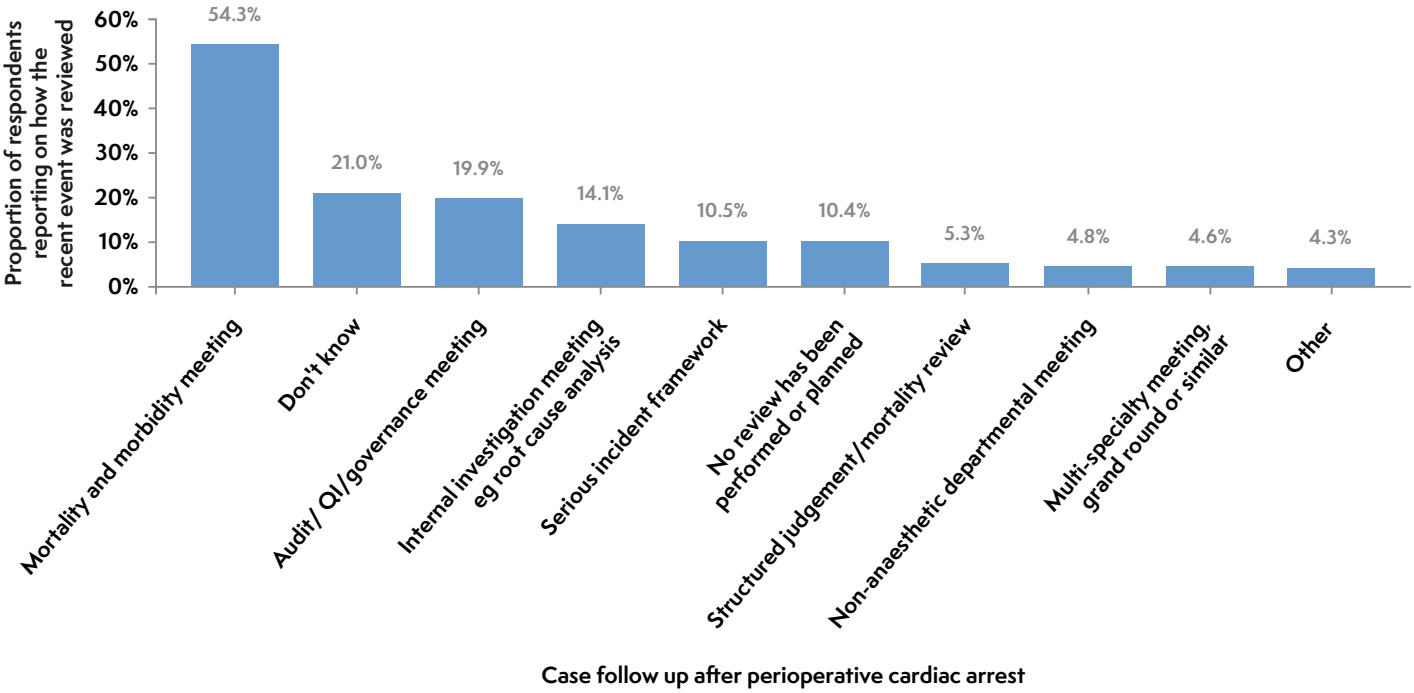


Figure 10.21 Type of case follow-up reported by 4,311 anaesthetists after their most recent experience of perioperative cardiac arrest. 'Not applicable' responses have been excluded.



Impact on anaesthetist's wellbeing

How the most recent experience of perioperative cardiac arrest affected the individual anaesthetist's wellbeing and ability to work effectively is explored in detail in Chapter 17 Aftermath and learning.

Career experience and impact on anaesthetists' wellbeing

In total, 8,654 (85%) of 10,131 responding anaesthetists reported having experienced an episode of perioperative cardiac arrest in their anaesthetic career lifespan. Both the positive and negative effects on personal and professional life are described in Chapter 17 Aftermath and learning.

Discussion

This NAP7 Baseline Survey of anaesthetists and anaesthesia associates may be the largest study to date examining individual perspectives, preparedness and experiences around the management of perioperative cardiac arrest. We received approximately 11,000 responses, representing 71% of UK anaesthetists, which we consider especially notable considering that the survey was conducted 15 months into the COVID-19 pandemic. The high return rate demonstrates the continuing commitment of UK anaesthetists to the NAPs. This was also the first time that a NAP included anaesthesia associates (including anaesthesia associates in training) in the Baseline Survey.

Most anaesthetists have been involved in managing perioperative cardiac arrest: 85% at some point in their career, 45% in the past two years; the number of perioperative cardiac arrests attended in the past two years ranged from one cardiac arrest (26%) to more than five cardiac arrests (2%).

Use of specific guidelines was reported by individual anaesthetists less often in the NAP7 Baseline Survey compared with use observed in the NAP7 case registry (45% vs 70%), although, in both, in the majority of cases guidelines were recalled from memory.

The survey provides a national picture of training in resuscitation in adult and paediatric ALS among anaesthetists. This is important because there is evidence that resuscitation training improves patient outcomes (Lockey 2021). Healthcare professionals are taught technical skills in managing in-hospital cardiac arrest and periarrest arrhythmias but also non-technical skills such as teamworking, communication and situation awareness, with a strong emphasis on the science of human factors (Lockey 2021). Training in adult ALS was high with 90% of anaesthetists having training in date and 94% having, at some point in their career, completed an accredited adult ALS training course. Organisations are encouraged to support individuals to keep up to date with national training courses (RCUK 2023). The RCUK good practice standards state that individuals should receive yearly training updates in CPR and defibrillation within their place of work (RCUK 2023). These standards are often, but not always, being met and organisations are not always providing a platform to meet these requirements. The organisational component of this survey reports that one in four anaesthetic departments does not offer yearly updates in CPR and one in three does not offer yearly updates in defibrillation (Chapter 9 Organisational survey).

In contrast, we identified a gap in paediatric ALS training among UK anaesthetists, with only 66% of anaesthetists being up to date with their training and 76% having, at some point in their career, completed an accredited paediatric ALS training course. Results varied little by grade, except for anaesthesia associates, who were less frequently trained in paediatric resuscitation, probably in keeping with their level of clinical responsibility. The RCoA recommends that all anaesthetists working with children should be trained in resuscitation, appropriate for their level of experience (RCoA 2023) and only 8% of anaesthetists stated that they did not treat children. Of the most recent perioperative cardiac arrests that anaesthetists had attended, around 1 in 30 was an infant and around 1 in 14 a child. Anaesthetists without regular paediatric sessions may also be called on to aid in the resuscitation of children unexpectedly, especially when on call, and elsewhere in this report some concerns are raised regarding the ability to provide the correct expertise when such events occur (Chapter 27 Paediatrics and Chapter 33 Critically-ill children). This gap in paediatric ALS training merits further attention.

Most anaesthetists reported feeling confident in managing a perioperative cardiac arrest on the operating table, with men overall more confident than women. The majority of anaesthetists were content with existing guidance on management of perioperative cardiac arrest, but a majority would welcome more training. The Association of Anaesthetists' *Quick Reference Handbook* provides some specific information, such as to 'turn off' the anaesthetic and to confirm oxygen delivery, but the focus is primarily directed at following the RCUK or the European Resuscitation Council ALS algorithm (Perkins 2021). While there are specific guidelines for managing cardiac arrests in neurosurgical patients (RCUK 2019), in the cardiac catheter suite (Dunning 2022) and for resuscitation of cardiac surgical patients (CALS), these guidelines do not exist for most specialties, nor for perioperative care in general. This is discussed further in Chapter 25 ALS for perioperative cardiac arrest. Of note, anaesthetists were generally less confident in managing the aftermath of a cardiac arrest than the cardiac arrest itself, and this is an area where training might usefully focus.

Individual anaesthetists' overall perceptions of the most 'top three' common causes of perioperative cardiac arrest differed both from those reported in the perioperative cardiac arrests they had most recently attended and in those reported to the NAP7 case registry (Box 10.1).

Box 10.1 Most common causes of perioperative cardiac arrest: perceived by anaesthetists, reported by anaesthetists during most recent event attended and reported to NAP7

Top three causes of cardiac arrest:

- **Perceived** by anaesthetists in Baseline Survey: hypovolaemia, haemorrhage and anaphylaxis
- **Attended** by anaesthetists in Baseline Survey: haemorrhage (20%), anaphylaxis (10%) and cardiac ischaemia (9%)
- **Reported** to NAP7 case registry: major haemorrhage (17%), bradyarrhythmia (9%), and cardiac ischaemia (7%)

See Chapter 13 Cardiac arrest case reports summary.

Anaphylaxis continues to be feared as an anaesthetic emergency. The data from this survey and the NAP7 case registry suggest that anaesthetists overestimate the proportion of perioperative cardiac arrests caused by anaphylaxis and probably overdiagnose it as a cause of perioperative cardiac arrest (Chapter 22 Anaphylaxis). Anaphylaxis accounted for 3% of the 881 cardiac arrests reported to NAP7 and was the eighth most common cause of perioperative cardiac arrest (Chapter 13 Cardiac arrest case reports summary and Chapter 22 Anaphylaxis).

The survey shows that at the time of the cardiac arrest, multiple extra anaesthetic staff attend to assist in the management. During cardiac arrest, the number of anaesthetists present increased by 50% compared with the start of anaesthesia. The most common grade of anaesthetist to attend to assist was a consultant (50%), similar to the NAP7 case review data (69%; Chapter 13 Cardiac arrest case reports summary).

How the aftermath of perioperative cardiac arrests is managed is crucial, as such catastrophic events require compassionate explanation to the patient and their families and can be psychologically impactful for the anaesthetist and the perioperative team. Anaesthetists were frequently involved in communication with families after cardiac arrest but far from all are confident in this aspect of care, nor in leading debriefing. It was not common practice (39%) to stop or pause an operating list or an on-call shift following a recent perioperative cardiac arrest, and even less so for a member of the team to immediately step down from clinical activity. Kelly *et al* recently recommended that it should be presumed that the whole team may have to step down from clinical activity in the aftermath of a serious critical incident (Kelly 2023) and the Association of Anaesthetist's 2005 guideline on managing catastrophic events recommends that after an intraoperative death, a decision should be made by a senior colleague whether the anaesthetist involved should continue with their operating list or on-call duties (Association of Anaesthetists 2005). Finally, it was reported that a debrief process was performed following approximately half of the recent cases of perioperative cardiac arrest. Respondents reported that most (58%) of the debriefs took place immediately following the event, and this is similar to the NAP7 case registry. There is growing evidence that hot debriefs that focus on psychological impact may exacerbate psychological trauma and that organisations should promote a 'team check-in tool' instead (Kelly 2023). These topics are discussed in detail in Chapter 17 Aftermath and learning.

Recommendations

No recommendations.

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Appendix 10.1

Demographics and workplace characteristics

Table 10A.1 Median number of years of anaesthetic experience and out-of-hours working patterns according to grade of anaesthetist (*n* = 10,009). SAS, specialist, associate specialist and specialty.

Grade of anaesthetist	Anaesthetists		Median years of experience	Proportion (%) working weekends or at night
	(*n*)	(%)		
Consultants	5896	59	19.5	90
SAS	958	10	15.5	83
Trainee and non-trainee anaesthetists	3007	30	4.8	97
Other	77	1	7.3	79
Anaesthesia associates	71	1	8.5	47

Figure 10A.1 Country or region of employment of 9917 respondents to NAP7 individual anaesthetists' Baseline Survey

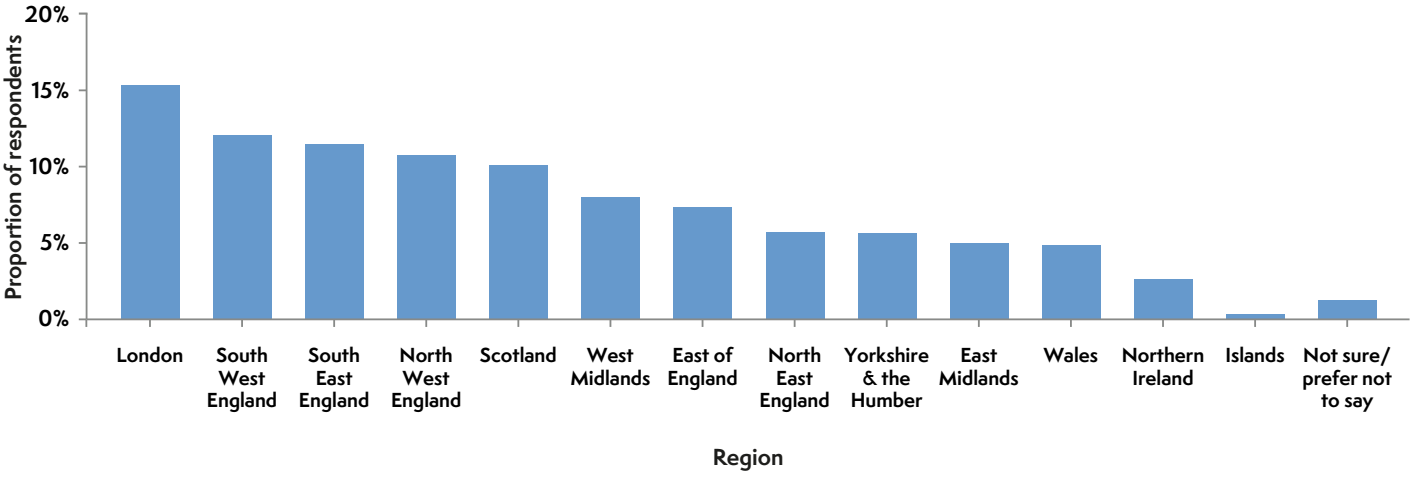


Table 10A.2 Country or region of employment of responding anaesthetists (*n* = 9917)

UK country	Anaesthetists responding (*n*)	Anaesthetists according to RCoA 2020 census (*n*)	Proportion of anaesthetists responding (%)
England	8031	12308	65
Scotland	999	1343	74
Wales	478	923	52
Northern Ireland	256	497	52
Islands	30	Not applicable	
Prefer not to say/not sure	123	Not applicable	

Training in advanced life support

Figure 10A.2 Timing of training in adult advanced life support at an RCUK or equivalent course or as part of departmental/hospital 'hands on training' among 10,746 anaesthetists. 'In date' respondents who have either RCUK or equivalent course completed within past four years or departmental/hospital 'hands-on training' within past one to two years, or instruct on such courses at least yearly. 'Out of date' = respondents that have RCUK training completed more than four years ago and departmental/hospital 'hands on training' more than two years ago. In date ■, Out of date ■, None ■, Can't recall ■, Not applicable ■.

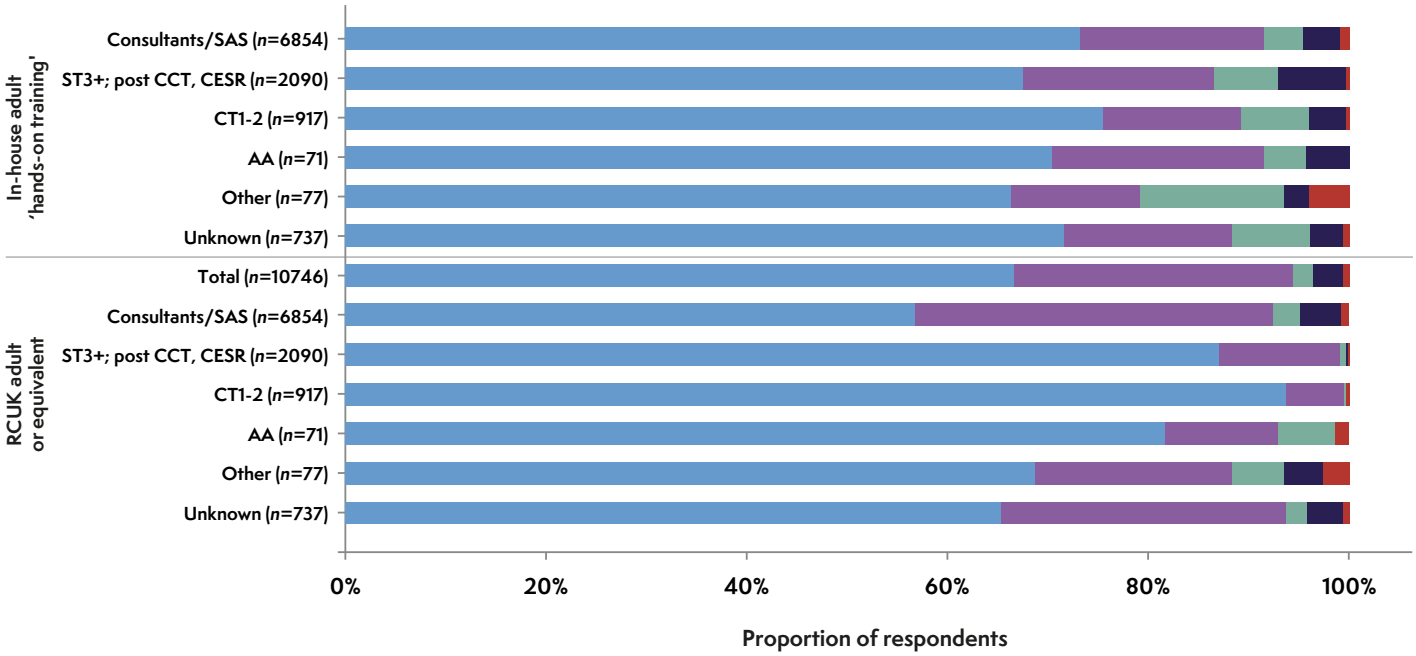
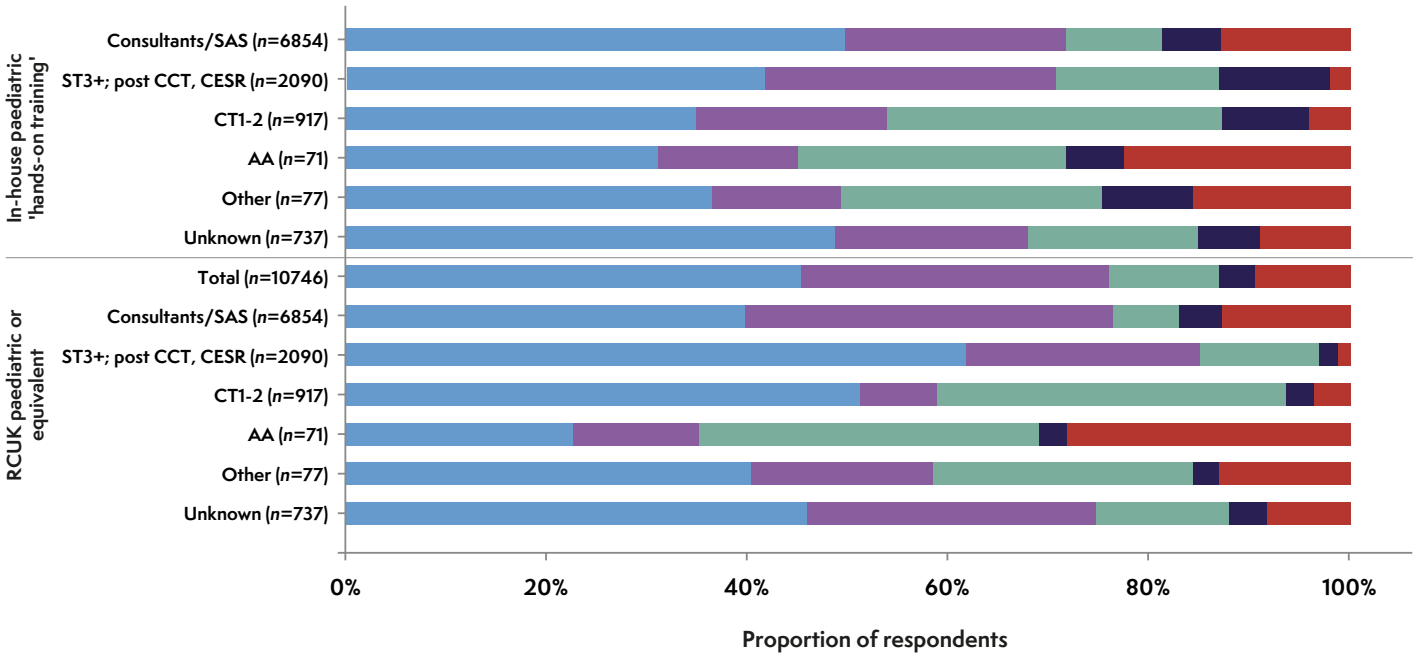


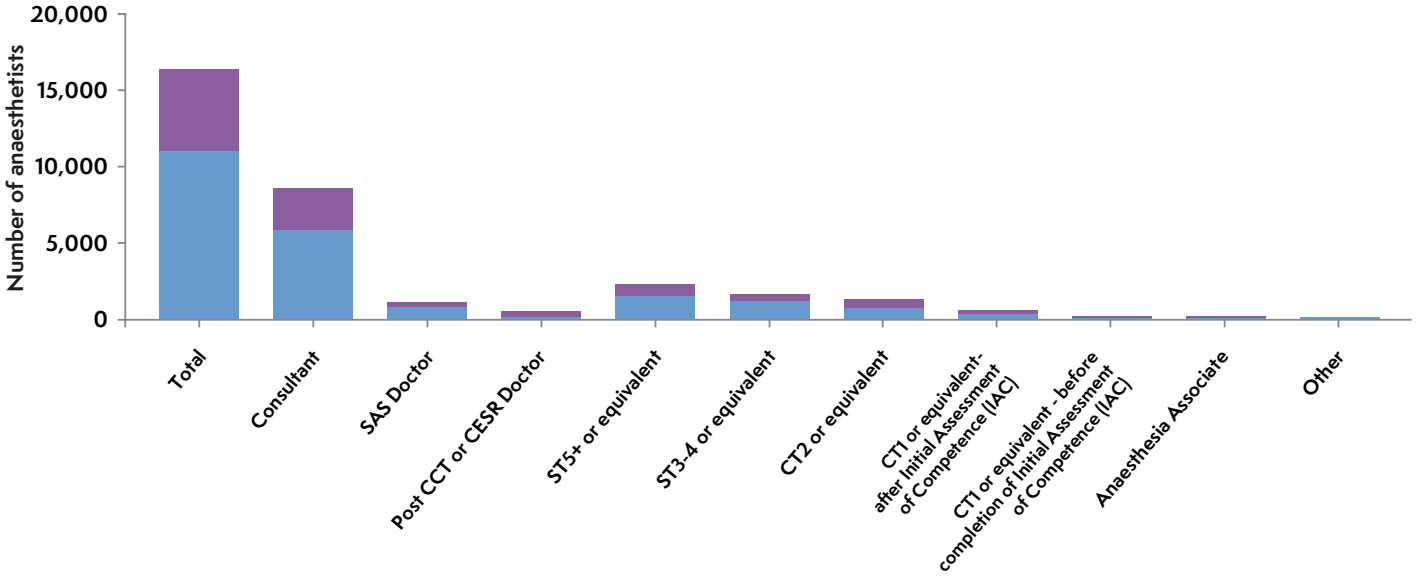
Figure 10A.3 Timing of training in paediatric advanced life support at an RCUK or equivalent course or as part of departmental/hospital 'hands on training' among 10,746 anaesthetists. 'In date' respondents who have either RCUK or equivalent course completed within past four years or departmental/hospital 'hands-on training' within past one to two years, or instruct on such courses at least yearly. 'Out of date' = respondents that have RCUK training completed more than four years ago and departmental/hospital 'hands on training' more than two years ago. In date ■, Out of date ■, None ■, Can't recall ■, Not applicable ■.



Number of anaesthetists present at start of anaesthesia and during cardiac arrest

On average, in addition to the responding anaesthetist, three other personnel were present at the start of anaesthesia. The total number of anaesthetists present at the start of anaesthesia averaged 2.5 per case. During the cardiac arrest, an average of 5.2 anaesthetic personnel attended including an average of 3.6 anaesthetists or anaesthesia associates. The difference in personnel as per different grades of anaesthetist present at the start of anaesthesia and during the cardiac arrest event is shown in Figure 10A.4.

Figure 10A.4 Number of anaesthetists present during the most recent cardiac arrest event and the number of extra anaesthetists who arrived to help with the management of the cardiac arrest (n = 4494). CCT, certificate of completion of training; CESR, certificate of eligibility for specialist registration; CT, core trainee; SAS, staff and associate specialist; ST, specialty trainee. Personnel at start of anaesthesia ■, Extra personnel during cardiac arrest ■.



Qualitative analysis

Table 10A.3 Underlying themes from 'free text' comments (*n* = 2278) on respondents reporting on the question 'Existing guidelines for the management of perioperative cardiac arrest are sufficient'. Comments from one respondent may have created one or more themes. ALS, advanced life support; DNACPR, do not attempt cardiopulmonary resuscitation; QRH, *Quick Reference Handbook*; RCUK, Resuscitation Council UK.

Themes (number of sentiments)	Examples
Awareness of guidelines (*n* = 1002): • Positive comments (*n* = 239) • Nuanced/mixed comments (*n* = 130) • Negative comments (*n* = 633)	**Positive examples** 'AAGBI QRH provides a guide which is more tailored to the perioperative cardiac arrest, compared with ALS.' 'Familiar. Generally easy to follow in high pressures arrest situation.' 'ALS guidelines offer good evidence-based algorithms.' 'We are following national and international guidelines which are created by the most experienced colleagues in the management of cardiac arrest.' 'Training available and guidelines are readily available too.' 'AAGBI quick reference guidelines are pretty good.' **Negative examples** 'I have not recently read these guidelines.' 'I have not delved into them in much detail.' 'Not aware of specific perioperative guidelines.' 'I do not know where to access them or what the existing guidelines are.' 'Are there any?' 'No one seems to know the guidelines. Arrest teams are called by junior team members when not needed.' 'I didn't know there was a guideline!' 'I'm not aware of any formal guidelines for intraoperative arrest specifically.'

Adequate guidelines (*n* = 1219): • Positive comments (*n* = 383) • Nuanced/mixed comments (*n* =2 25) • Negative comments (*n* = 611)	**Positive examples** 'The guidelines provide clear information on the management of perioperative cardiac arrests.' 'Baseline algorithm is sound and guidelines need to be concise enough to act as quick reference and training aid.' 'We have ALS guidelines at hand in the event of perioperative arrest that are clear, concise and easy to follow.' 'The QRH is very thorough and good to have as an app on my phone, plus available in all anaesthetic rooms.' 'Written guidelines and crisis cards are readily available to guide management.' **Negative examples** 'Needs to include more on team roles.' 'As above – RCUK is really focused on non-theatre arrests – see recent editorial on challenging 'no trace wrong place' for example!' 'Need clarity for specific situations including where respect forms are completed and DNACPR instituted.'
Specific scenarios (*n* = 533) • Positive comments (*n* = 58) • Nuanced/mixed comments (*n* = 85) • Negative comments (*n* = 390)	**Positive examples** 'Our scenario based, in theatre training (for consultants, with consultants) is excellent.' 'Plenty of info available for perioperative deterioration, cardiac arrest and management.' **Negative examples** 'Perioperative cardiac arrest differs from other in hospital arrests and needs to be treated as a special situation.' 'Doesn't always take into account different team structure (eg no medics, anaesthetic lead, theatre team).' 'This does not mention about some scenarios like when patient is in prone position or having surgery in head and neck area where table is turned away from anaesthetic machine. It needs some training in terms of ergonomics or logistics.'

Table 10A.4 Underlying themes from 'free text' comments (*n* = 312) on respondents reporting on the question 'I was satisfied with the debrief process following the event'. Comments from one respondent may have created one or more themes. MDT, multidisciplinary team.

Themes (number of sentiments)	Examples
Positive experience (*n* = 194)	'Everyone at the arrest were present. All contributed. Those that had seemed shaken at the event, looked happier after the debrief.' 'Everyone had the chance to speak and analyse the events leading up to the airway loss during tracheostomy insertion.' 'Informal debrief was satisfactory to all, in view of positive outcome. Team all well known to one another and able to talk openly and supportively.'
Nuanced/mixed experience (*n* = 43)	'Informal led by a surgeon not trained in debriefing. Would have benefited from a further cold debrief.' 'Would have been good to do a cold debrief with MDT but difficult due to shift work.'
Negative experience (*n* = 76)	'The whole process was so traumatising. On reflection, I feel we need two types of formal debriefs - hot and cold.' 'Was conducted in the wrong way for a hot debrief and led to a lot of upset and feelings of criticism.' 'It involved anyone involved in the arrest, so difficult for consultant anaesthetists to open up with very junior members of the team there. Also didn't really discuss what went well, what could be improved. No individual debriefing occurred.'