






















Original Article

The 7th National Audit Project (NAP7) baseline survey of individual anaesthetists: preparedness for and experiences of peri-operative cardiac arrest

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Summary

The Royal College of Anaesthetists' 7th National Audit Project baseline survey assessed knowledge, attitudes, practices and experiences of peri-operative cardiac arrests among UK anaesthetists and Anaesthesia Associates. We received 10,746 responses, representing a 71% response rate. In-date training in adult and paediatric advanced life support was reported by 9646 (90%) and 7125 (66%) anaesthetists, respectively. There were 8994 (84%) respondents who were confident in leading a peri-operative cardiac arrest, with males more confident than females, but only 5985 (56%) were confident in leading a debrief and 7340 (68%) communicating with next of kin. In the previous two years, 4806 (46%) respondents had managed at least one peri-operative cardiac arrest, of which 321 (7%) and 189 (4%) of these events involved a child or an obstetric patient, respectively. Respondents estimated the most common causes of peri-operative cardiac arrest to be hypovolaemia, hypoxaemia and cardiac ischaemia, with haemorrhage coming fifth. However, the most common reported causes for the most recently attended peri-operative cardiac arrest were haemorrhage; (927, 20%); anaphylaxis (474, 10%); and cardiac ischaemia (397, 9%). Operating lists or shifts were paused or stopped after 1330 (39%) cardiac arrests and 1693 (38%) respondents attended a debrief, with 'hot' debriefs most common. Informal wellbeing support was relatively common (2458, 56%) and formal support was uncommon (472, 11%). An impact on future care delivery was reported by 196 (4%) anaesthetists, most commonly a negative psychological impact. Management of a peri-operative cardiac arrest during their career was reported by 8654 (85%) respondents. The overall impact on professional life was more often judged positive (2630, 30%) than negative (1961, 23%), but impact on personal life was more often negative.

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Introduction

The Royal College of Anaesthetists' (RCoA) 7th National Audit Project (NAP7) of peri-operative cardiac arrest conducted two baseline surveys [1]. The first investigated the preparedness of hospitals and anaesthetic departments in managing peri-operative cardiac arrest [2], and the second (described here) explored individual anaesthetists' preparedness and experiences of peri-operative cardiac arrest.

Individual anaesthetist preparedness will depend on their training in, and experience of, peri-operative cardiac arrest. In the UK this is mainly done by attending Resuscitation Council UK (RCUK) life support courses or local training. Anaesthetists in training need to achieve curriculum requirements [3] and it is also recommended that all clinical staff attend annual updates appropriate for their expected clinical roles [4]. Guidelines for the Provision of Anaesthesia Services (GPAS) published by the RCoA recommend that all anaesthetists should have completed training in adult and paediatric life support that is appropriate for their level of clinical practice [5].

While the RCUK provides guidelines on cardiac arrest management, there are no specific guidelines for management of cardiac arrest during anaesthesia. The closest to this is the 'special settings' of the RCUK guidelines for cardiac arrests in the operating theatre [6], whilst the Association of Anaesthetists' Quick Reference Handbook (QRH) includes a section on cardiac arrest, which is primarily based on the generic RCUK guidelines on management of cardiac arrest [7]. The Association of Anaesthetists' 2005 guidelines on managing the aftermath of intra-operative deaths includes recommendations on communication with relatives; debriefing; operating and on-call list management; internal review processes; and welfare support [8]. These guidelines are currently in the process of revision.

A peri-operative cardiac arrest is not only a potentially catastrophic event for the patient and their family but also for the anaesthetist and wider team involved in the resuscitation. The aftermath following catastrophic events may carry an emotional burden for healthcare professionals and have an increased impact on future clinical performance and patient care [9, 10]. Limited research exists on how individual anaesthetists manage such events at the time and in the aftermath including the psychological burden.

The aim of the NAP7 individual anaesthetist's baseline survey was to gain understanding of the training, attitudes, beliefs and current practices surrounding peri-operative cardiac arrest such as debriefing, operating list management and review processes. Anaesthetists' recent

and career experiences and perspectives surrounding the management of peri-operative cardiac arrest in the aftermath were also explored.

Methods

The NAP7 project, including the individual anaesthetists' baseline survey, underwent regulatory approval [1] and was conducted as a clinical service evaluation in keeping with the Health Research Agency's decision tool (online Supporting Information Appendix S2). Survey questions were developed using an internal review process by the NAP7 steering panel and the survey was finalised after a total of six draft testing cycles. Five cycles were conducted among the steering panel and one between a core group of NAP7 panel members and the RCoA Clinical Quality and Research team. Some questions incorporated a branching logic tool with specific follow-up questions based on individual answers (online Supporting Information Appendix S3). After being finalised, the survey was distributed to all UK anaesthetists and Anaesthesia Associates (including trainees) via the NAP7 network of local co-ordinators to coincide with the NAP7 launch in June 2021 [1] using an electronic survey tool (SurveyMonkey®, Momentive, Niskayuna, NY, USA) (online Supporting Information Appendix S4).

In this article, the term 'anaesthetists' describes medically qualified anaesthetists and Anaesthesia Associates. Responses were accepted from 9 June 2021 for approximately five months until closure on 7 November 2021. During this period, response rates were encouraged through several email reminders sent via local co-ordinators, and by advertisement using the National Audit Project (NAP) social media account (@NAPs_RCoA, Twitter Inc (rebranded as X in 2023), San Francisco, CA, USA). All survey questions were mandatory to improve data capture quality (but included 'do not know' options) and the survey included open-ended questions to enable qualitative analysis. Microsoft Excel 2022 (Microsoft Inc., Redmond, WA, USA) was used to export and clean the data and VACMA-public (European Commission and Capia AS, Tromsø, Norway) was used to check for duplicates. Responses judged false or fabricated were removed from final analysis (online Supporting Information Appendix S5).

Quantitative analysis was conducted in Microsoft Excel (Microsoft Inc.). Qualitative data were filtered using Pulsar v2022 (Pulsar TRAC, first-party data tool, Pulsar Platform, London, UK), followed by in-depth analysis using Caplena v2 (Caplena AG, Zurich, Switzerland) and Infranodus v5, 2023 (Nodus Labs, Ways Ltd, Leeds, UK). Themes and sub-

themes were reviewed and revised by an iterative process (by SM and EK).

The denominator used for the total number of anaesthetists and Anaesthesia Associates in the UK to calculate the survey response rate was 15,071 based on the RCoA 2020 census [11]. Each question had a specific survey question response denominator used to calculate response rates. Specific questions that included data field answers as 'not applicable' or 'cannot recall' were not included in the sub-analysis unless stated. Data field responses that were inconsistent with subsequent branching logic answers were removed.

The survey consisted of three main parts (online Supporting Information Appendix S4). Data were first collected on anaesthetists' knowledge, attitudes and training surrounding peri-operative cardiac arrests. Second, we asked in-depth questions about individuals' most recent experience of peri-operative cardiac arrest. The third section collected data on anaesthetists' career experience and any impact on their professional and personal life.

Results

In total, 10,746 responses were received representing a 71% response rate. A progressive decrease in the number of question responses was observed from the start to the end of the survey ranging from 10,746 (100%) to 9917 (92%) (online Supporting Information Appendix S5).

Questions on demographics and workplace characteristics were answered by 10,009 (93%) anaesthetists. A total of 5727 (57%) anaesthetists identified themselves as male, 4085 (41%) female, 12 (< 1%) other and 185 (2%) preferred not to state their gender. There were three (< 1%) individuals aged < 25 y, 2645 (26%) aged 25–35 y, 7126 (71%) aged 36–65 y, 93 (1%) aged > 65 y and 142 (1%) who preferred not to say.

Respondents included 5896 (59%) consultants, 958 (10%) specialists, associate specialist and speciality (SAS) doctors, 3007 (30%) anaesthetists in training and non-training positions, 71 (1%) Anaesthesia Associates and 77 (1%) 'other' (online Supporting Information Appendix S5). Median (IQR [range]) anaesthetic experience was 13 (7–22 [0–50]) y and anaesthetists with less than one year's experience accounted for 437 (4%) of respondents (lower than the 6% reported in NAP6 [12]). Anaesthetists' place of work was exclusively in the NHS for 8298 (83%), exclusively in the independent sector for 65 (1%) and in both sectors for 1646 (16%).

All 10,746 (100%) responding anaesthetists answered questions regarding knowledge, training and attitudes to peri-operative cardiac arrest. In terms of resuscitation

(cardiopulmonary resuscitation and defibrillation) training, 9646 (90%) were 'up to date' in adult advanced life support (ALS) and 7125 (66%) in paediatric ALS, having received training either through an RCUK or equivalent course within the past four years or departmental/hospital 'hands-on training' within the past 1–2 years (Fig. 1). Conversely, 799 (7%) and 1707 (16%) of anaesthetists' training in adult and paediatric resuscitation, respectively, was 'out of date' or had never been undertaken. No formal RCUK or equivalent training had been attained by 218 (2%) for adult ALS and 1168 (11%) for paediatric ALS (online Supporting Information Appendix S5). Overall, up-to-date training in adult ALS was more common than in paediatric ALS across all grades (online Supporting Information Appendix S5). Among Anaesthesia Associates, 16 (23%) were up to date with and 24 (34%) had never been trained in paediatric ALS (RCUK or equivalent course).

A total of 8994 (84%) anaesthetists reported that they felt confident (agree and strongly agree) in leading an intra-operative cardiac arrest (Fig. 2). Although 6512 (61%) reported (agree or strongly agree) that they had received sufficient training in managing an intra-operative cardiac arrest, 1776 (17%) disagreed (strongly disagree or disagree) with this statement and 7551 (70%) stated that they would benefit from more training. Current guidelines for the management of peri-operative cardiac arrest were deemed sufficient (agree or strongly agree) by 4441 (41%) and insufficient (disagree or strongly disagree) by 1537 (14%) respondents. Overall, male (4977, 87%) respondents were more likely to reply that they felt confident (strongly agree or agree) in managing a peri-operative cardiac arrest on the operating table than females (3221, 79%) (online Supporting Information Appendix S5).

Fewer respondents reported feeling confident in the management of the aftermath of a peri-operative cardiac arrest, including the debrief process and communication with the family or next of kin, than management of the event itself (Fig. 2). A total of 5985 (56%) anaesthetists agreed that they felt confident (agree or strongly agree) in leading a debrief, while 8138 (76%) reported that they would benefit (agree or strongly agree) from more training in how to conduct a debrief, and 7340 (68%) felt confident (agree or strongly agree) in communicating with the family or next of kin.

The three most cited 'most common' causes of peri-operative cardiac arrest were hypovolaemia, haemorrhage and hypoxaemia, perceived by 1840 (17%), 1790 (17%) and 1577 (15%) of anaesthetists, respectively (online Supporting Information Appendix S5). However, the sum of respondents' 'top three causes' varied in order. The top five in all three

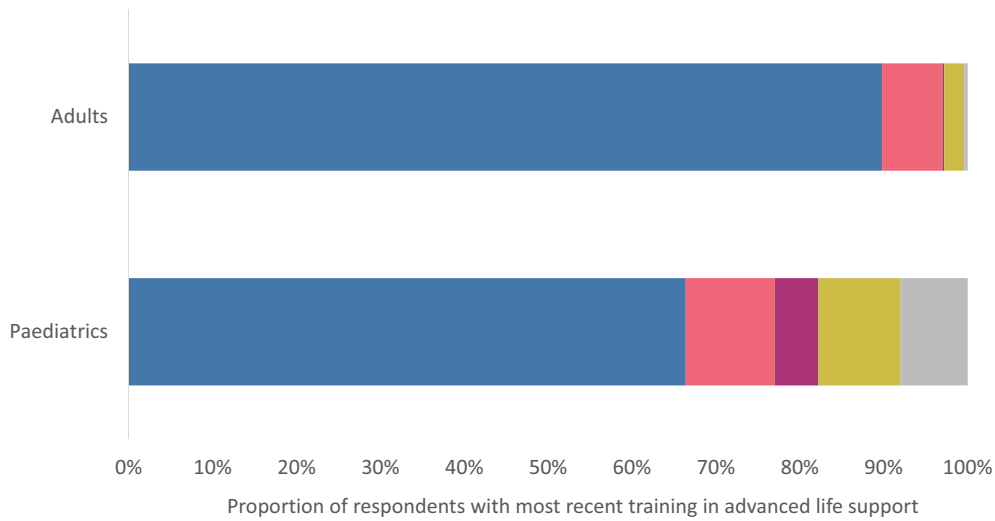


Figure 1 Training in adult and paediatric advanced life support among 10,746 anaesthetists. 'In date' (blue) refers to respondents with either RCUK or equivalent course completed within the past four years or departmental/hospital 'hands-on training' within past 1–2 years or instructs on such courses at least yearly. 'Out of date' (red) refers to RCUK training completed > 4 years ago and departmental/hospital 'hands on training' more than two years ago. 'None' (purple) refers to respondents that have never obtained formal RCUK or equivalent training or departmental/hospital 'hands on training'. 'Other/unknown' (yellow) refers to 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 'cannot recall', 'not applicable' and 'none'. 'Not applicable' (grey) refers to not practising adult or children's anaesthesia. Numerical data available in online Supporting Information Appendix S7 (Table S1).

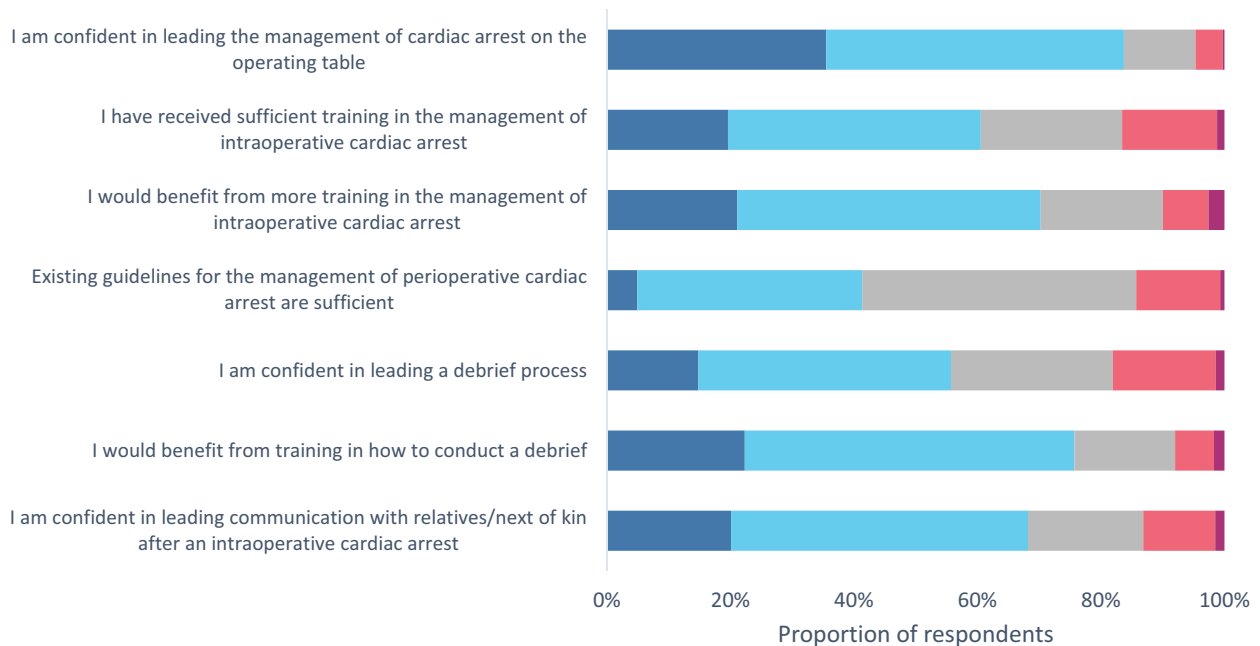


Figure 2 Anaesthetists' attitudes to management of peri-operative cardiac arrest, including training, guidelines and opinions on debriefing and communication following a peri-operative cardiac arrest (n = 10,746). A 5-point Likert scale used: strongly agree (dark blue); agree (light blue); neither agree or disagree (grey); disagree (red); and strongly disagree (purple). Numerical data available in online Supporting Information Appendix S7 (Table S2).

perceptions were the same, including hypovolaemia; hypoxaemia; cardiac ischaemia or failure; anaphylaxis; and haemorrhage (online Supporting Information Appendix S5).

We received 10,508 (98%) responses to a question regarding how many cases of peri-operative cardiac arrest anaesthetists recalled managing or assisting at in the previous two years, with 4806 (46%) reporting involvement in one or more peri-operative cardiac arrest (online Supporting Information Appendix S5). More than five events in the previous two years were reported by 171 (2%) anaesthetists and only one event by 2742 (26%) anaesthetists.

Further questions on the experiences of the most recent peri-operative cardiac arrest were answered by between 4664 (97%) and 4374 (91%) of 4806 eligible respondents. The most likely suspected or confirmed primary cause of the most recent cardiac arrest attended was answered by 4639 (97%) respondents (Table 1). The most common specific causes of cardiac arrest were haemorrhage (927, 20%); anaphylaxis (474, 10%); and cardiac ischaemia (397, 9%) (online Supporting Information Appendix S5). Among 4494 responses, 3079 (69%) patients survived the initial resuscitation event while 2056 (46%) died (Table 1).

The responding anaesthetist was present at the start of anaesthesia in 2695 (60%) of the 4494 most recent cases of peri-operative cardiac arrest: 1725 (64%) were consultant or SAS anaesthetists; 828 (31%) anaesthetists in training and non-training positions; and 18 (1%) Anaesthesia Associates. Generally, the number of anaesthetists attending increased by approximately 50% during the cardiac arrest.

Specific guidelines to manage the cardiac arrest were used in 2036 (45%) events. Most of these were accessed from memory in 1315 (65%) cases or from an electronic device (124, 6%) rather than a hard copy at the cardiac arrest location (821, 41%) (online Supporting Information Appendix S4). Overall, the quality of recent cardiac arrest management was viewed positively (satisfied or very satisfied) by 3871 (87%) of 4436 anaesthetists (see online Supporting Information Appendices S5 and S6).

Following the cardiac arrest, 1330 (39%) operating lists or shifts were paused or stopped where this was practical (Table 2). Of 4422 responding anaesthetists, 1693 (38%) attended a debrief and 1998 (45%) did not (Table 2). Of 1568 anaesthetists that attended a debrief, 911 (58%) reported attending immediately after the event (hot debrief), 318 (20%) after a delayed period (cold debrief), 311 (20%) both immediately and after a

delayed period and in 10 (1%) as part of the 'end of the list' debrief session. Informal debriefs were more than four times more common than formal debriefs (Table 2). Most respondents were positive about how the debrief process was managed after the event with 1236 (79%) feeling satisfied or very satisfied (online Supporting Information Appendices S5 and S6). In 2316 (63%) cases, anaesthetists were involved in the communication process with family or next of kin after the cardiac arrest.

Of 4806 potential respondents, 4374 (91%) responded to questions on wellbeing support and impact on future patient care delivery following their most recent event. Informal support from colleagues was received by 2458 (56%) and 472 (11%) received formal support. Six (< 1%) individuals reported seeking external psychological support (e.g. private therapy). Of those anaesthetists who did not receive informal support, approximately half reported that it was 'not needed' (Fig. 3).

Of the 4374 responding anaesthetists, 196 (4%) reported a direct impact on their ability to deliver future patient care and 3875 (89%) reported no impact. These impacts did not differ by grade of anaesthetist but were more frequently reported by those who had resuscitated a child (19, 6%) or obstetric patient (10, 6%) and in cases of intra-operative death (52, 5%) (online Supporting Information Appendix S5). Of 196 anaesthetists who reported an impact on care delivery, 140 (71%) received informal and 48 (24%) formal support. Of those who did not receive formal support, only around 1 in 5 anaesthetists stated that it was 'not needed' (Fig. 3).

Of 260 sentiments reported, 198 (76%) were negative and 62 (24%) positive (online Supporting Information Appendices S5 and S6). Of these 196 anaesthetists, negative experiences included increased anxiety around work (79, 40%), reduced confidence (72, 37%) and an impact on personal mental health (30, 15%). Conversely, 62 (32%) had a positive experience including improved confidence and their ability to work. Of 10,131 responding anaesthetists, 8654 (85%) had been involved in the management of a peri-operative cardiac arrest at some point in their career, as the primary anaesthetist or assisting.

Negative impacts on professional life were reported by 1961 (23%) anaesthetists and positive impacts by 2630 (30%) (Fig. 4). Negative impacts included work-related anxiety and stress (1489, 76%), loss of professional confidence (1030, 53%), impact on relationship with colleagues (230, 12%) and many other factors (online Supporting Information Appendix S5). Positive impacts of

Table 1 Patient characteristics and cardiac arrest details among the most recent peri-operative cardiac arrest in the past two years. Data are number (proportion).

Location of arrest* (n = 4664)	
Theatre: main theatre suite	3490 (75%)
Cardiac catheterisation suite	218 (5%)
Theatre: obstetrics	167 (4%)
Theatre: day surgery unit	151 (3%)
Theatre: other	136 (3%)
Recovery	123 (3%)
Emergency department	88 (2%)
Ward	78 (2%)
Interventional radiology	65 (1%)
Adult critical care (e.g. HDU, ICU)	52 (1%)
Age of patient (n = 4664); y	
0–1	155 (3%)
1–18	166 (4%)
19–65	1817 (39%)
> 65	2353 (50%)
Not known/cannot recall	163 (3%)
Prefer not to say	10 (< 1%)
Categories of suspected or confirmed primary cause of arrest (n = 4639)	
Cardiac or cardiovascular	2915 (63%)
Anaphylaxis	474 (10%)
Airway or breathing problem	395 (9%)
Uncertain cause – multiple comorbidities and/or extreme age or frailty	333 (7%)
Neurological	157 (3%)
Metabolic	111 (2%)
Error, drug or equipment problem	52 (1%)
Regional anaesthesia	37 (1%)
Cannot recall or unclear	165 (4%)
Patient outcome (n = 4494)	
Survived to hospital discharge	1750 (39%)
Survived cardiac arrest but died before hospital discharge	715 (16%)
Survived initial resuscitation but outcome unknown	518 (12%)
Survived initial resuscitation and still in hospital	96 (2%)
Died – no ROSC	723 (16%)
Died – transient ROSC (< 20 min)	542 (12%)
Died – CPR stopped due to patient's known wishes	76 (2%)
Unknown	74 (2%)

*Locations with < 50 responses and 'cannot recall' responses are not shown.
ROSC, return of spontaneous circulation; CPR, cardiopulmonary resuscitation.

1837 responding anaesthetists included improved educational and reflective processes (837, 46%), clinical experience (353, 19%) and teamwork (332, 18%).

Negative impacts on personal life were reported by 1348 (16%) anaesthetists and positive impacts by 528 (6%) (Fig. 4). Negative impacts included impact on the

relationship with a family member (657, 49%), anxiety and stress (363, 27%) and the need for psychological support (265, 20%) (online Supporting Information Appendix S5). Positive impact themes of 302 responding anaesthetists included improved personal (97, 32%) and professional (77, 25%) development.

Table 2 Operating theatre list/on-call shift management and debrief attendance following most recent peri-operative cardiac arrest. Data are number (proportion).

Was operating theatre list or anaesthetic on-call shift terminated early? (n = 3378)*	
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 (e.g. NCEPOD, trauma, catheterisation laboratory)	150 (4%)
Cannot recall	235 (7%)
Did any members of the team stand-down from clinical activity? (n = 3315)*	
No-one stood down (e.g. 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%)
Cannot recall	472 (14%)
How did you or your team stand down? (n = 886)	
Took a short break (e.g. < 1 h)	287 (32%)
Theatre list terminated early	272 (31%)
Took a sustained break (e.g. > 1 h)	248 (28%)
Anaesthetic on-call shift terminated early	68 (8%)
Other	31 (3%)
Cannot recall	76 (9%)
Debrief attendance (n = 4422)	
Yes – I attended	1693 (38%)
No, none planned	1388 (31%)
Do not know	641 (14%)
Yes – unable to attend (work duties)	405 (9%)
Yes – unable to attend (on leave)	82 (2%)
Yes – I was not invited	78 (2%)
No, but there will be	56 (1%)
Yes – I decided not to attend	45 (1%)
Other/not applicable	31 (1%)
No – it was planned but it did not happen	3 (< 1%)
Types of debrief attended (n = 1563)*	
Informal	1148 (73%)
Group	814 (52%)
Formal (i.e. with a trained facilitator)	262 (17%)
One-to-one	72 (5%)
Critical incident stress debriefing	45 (3%)
Trauma risk management	37 (2%)
Do not know	19 (1%)
Timeline debriefing tool	1 (< 1%)

*Non-applicable answers were not analysed.

NCEPOD, National Confidential Enquiry into Patient Outcome and Death.

Discussion

The NAP7 baseline survey of anaesthetists is the most extensive study examining individual perspectives, preparedness and experiences around managing peri-

operative cardiac arrest. The high return rate is especially notable as the survey was conducted 15 months into the COVID-19 pandemic [13] and demonstrates UK anaesthetists' ongoing commitment to the NAPs. It is also

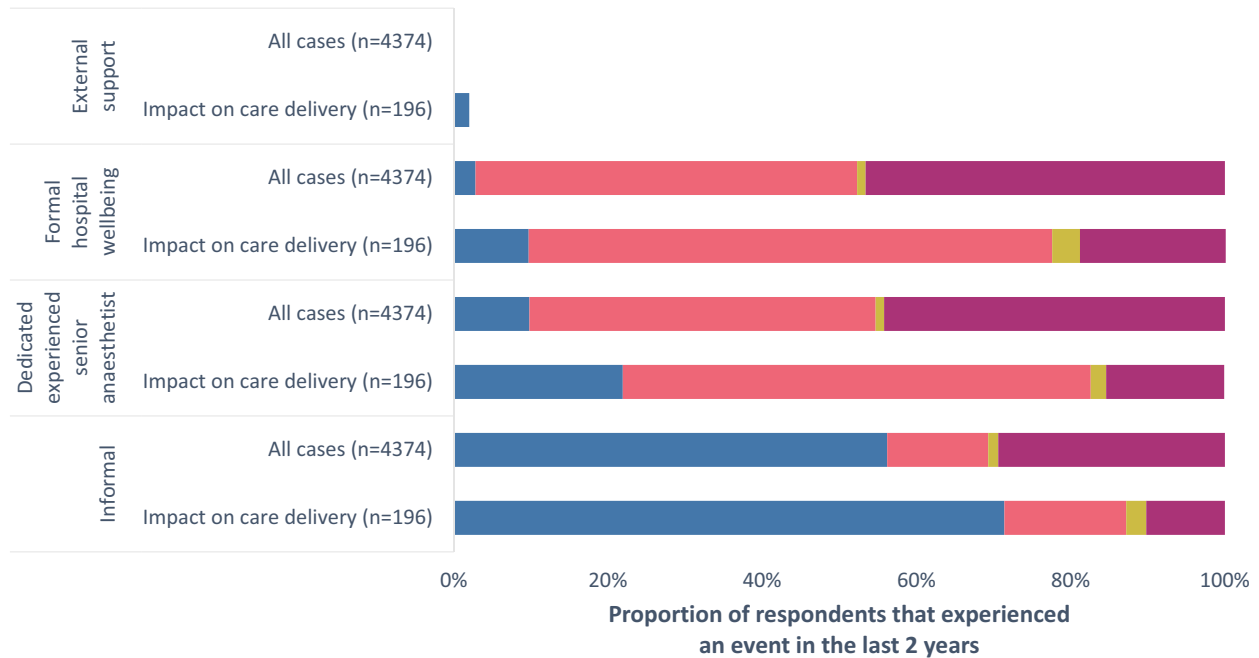


Figure 3 Proportion of anaesthetists receiving informal and formal wellbeing support following their most recent experience of peri-operative cardiac arrest. The different wellbeing support strategies are provided for all the cases (n = 4374) and for those where the anaesthetist reported an impact on their ability to deliver care (n = 196). Responses include 'yes' (blue); 'no' (red); 'prefer not to say' (yellow); and 'not needed' (purple). Numerical data available in online Supporting Information Appendix S7 (Table S3).

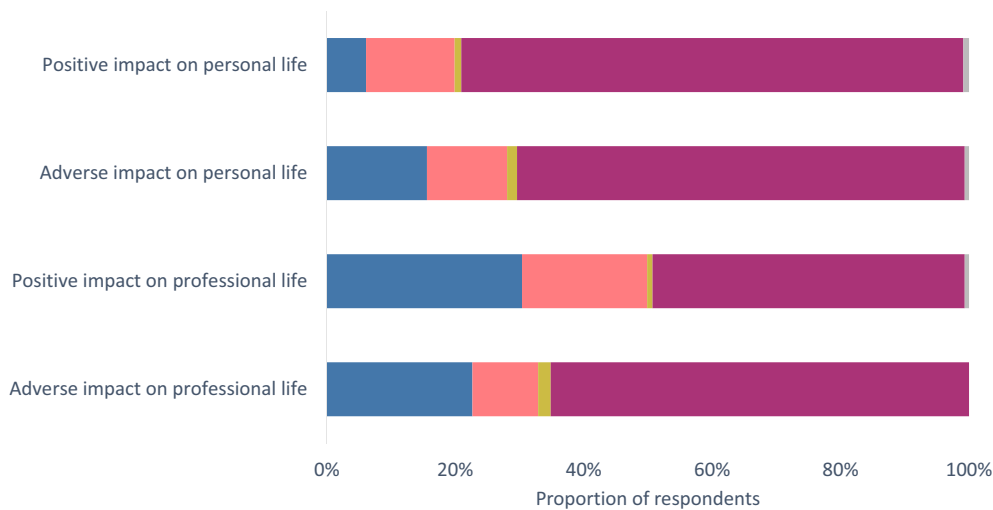


Figure 4 Proportion of anaesthetists reporting positive or adverse impact on personal and professional life following career experiences of peri-operative cardiac arrest (n = 8654). Respondents reported either 'yes' (blue); 'not sure' (red); 'prefer not to say' (yellow); 'no' (purple); or the response was 'unclear' (grey). Numerical data available in online Supporting Information Appendix S7 (Table S4).

the first NAP survey to include Anaesthesia Associates. Together our data provide the experiences of more than 10,000 anaesthetists, their attendance at more than 5000 peri-operative cardiac arrests in the previous two years and at tens of thousands over their careers.

Given the scope and breadth of UK anaesthetic practice, it is unsurprising that most anaesthetists have been involved in managing peri-operative cardiac arrest during their careers. This is reflected in the finding that most anaesthetists reported feeling confident in managing peri-operative

cardiac arrest, with males overall more confident than females. Although most respondents were content with existing guidance on managing peri-operative cardiac arrest, a majority would also welcome more training. An area where training might usefully focus is managing the aftermath of a peri-operative cardiac arrest, where respondents were notably less confident. Effective management of the aftermath of peri-operative cardiac arrest is crucial, as such catastrophic events require compassionate explanation to the patient and their families, and can be psychologically impactful for the anaesthetist and peri-operative team.

The survey provides a valuable national picture of training in resuscitation in adult and paediatric ALS among anaesthetists. The RCUK emphasises the need for organisational support to enable annual training updates in resuscitation for all clinicians [4]. While there were high rates of compliance with annual training in adult resuscitation, only two-thirds of respondents were compliant with yearly training in paediatric resuscitation. These results varied little by grade, except for Anaesthesia Associates who were less frequently trained in paediatric resuscitation, likely in keeping with their level of clinical responsibility. Children with significant acute or chronic medical problems and those requiring complex surgical procedures are often referred to specialist tertiary paediatric centres. However, a substantial proportion of anaesthetic care for children is undertaken in non-specialist centres [14], and only 8% of respondents stated that they did not treat children. Of the most recent peri-operative cardiac arrests that anaesthetists had attended, about 1 in 30 patients were infants, and 1 in 14 were children. Anaesthetists, without regular paediatric sessions, may also be required unexpectedly to aid in the resuscitation of children, especially when on call. This was noted elsewhere in the NAP7 project [2]. This gap in paediatric ALS training merits further attention.

An intra-operative cardiac arrest can be psychologically distressing for an anaesthetist and other staff involved. The survey identified that it was not routine practice to stop or pause an operating list or an on-call shift following a peri-operative cardiac arrest, and even less so for a team member to immediately step down from clinical activity. Recent national guidance 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 [15]. Post-event debriefing is a recognised strategy for managing the aftermath of a critical incident. This has multiple aims, including identifying any safety issues that may have contributed to the incident; highlighting learning points to improve future practice; and safeguarding the

clinician's psychological well-being. A debriefing process followed approximately less than half of the peri-operative cardiac arrests reported in this survey, with 58% occurring immediately following the event. There is growing evidence that a 'hot debrief' that focuses on psychological impact may exacerbate psychological trauma, and that organisations should promote 'operational debriefs' with a 'team check-in tool' instead to normalise events, monitor the team and refer those who require it for formal peer support [15, 16]. This practice appears uncommon currently [2]. Anaesthetists often lead immediate debriefs, but many are not confident in this role, and this may be another area for additional training.

In this project, we have focused on the anaesthetist, but we acknowledge that we are likely to have missed impacts on other care team members. In a survey of American anaesthetists, Gazoni et al. found that following a peri-operative catastrophe, more than 70% experienced anxiety, guilt and reliving of the event, potentially impacting future clinical performance [10]. A systematic review reported that surgeons' involvement in the patient's peri-operative death led to burnout and stress-associated disorders, mainly if death was unexpected [17]. Spencer et al. reported that approximately 10% of those attending in-hospital cardiac arrests screened positive for post-traumatic stress disorder symptoms from this, with those who were more junior being at greatest risk [18].

The impact of managing a peri-operative cardiac arrest on an anaesthetist's professional and personal life is notable. Personal or work-related anxiety or stress in their career as a direct result of a peri-operative cardiac arrest was described by 20% of respondents. Approximately 1 in 4 anaesthetists reported a negative impact on their professional life due to attending peri-operative cardiac arrests. However, this was exceeded by 1 in 3 who judged the impact as professionally positive. Of more concern, 1 in 6 considered the impact on their personal life to be negative, almost three times as many as judged it to have a positive impact.

Events that occurred in children, obstetric patients or led to death were associated with a higher risk of impact. Consistent with previous surveys [10], we found that in a minority of cases, the effect on an anaesthetist may be profound and long-lasting, demonstrating the 'second victim effect' [19]. Notably, the frequency of psychological impact was not altered by anaesthetist seniority, highlighting that the experience level does not mitigate the psychological impact of such events. It is well documented that sustained periods of untreated stress can lead to burnout in healthcare professionals. Recent meta-analyses

have demonstrated that burnout in staff can lead to poorer clinical performance affecting the quality of care and patient safety [20, 21].

Evidence suggests that if healthcare professionals are not adequately supported in the aftermath of catastrophic events, it can harm their well-being and prolong their recovery [10]. Overall, we found that the provision of formal well-being support following a peri-operative cardiac arrest in the UK is low. This is relevant, given the low levels of welfare support reported by Shinde et al. when investigating suicide among anaesthetists in the UK [22].

There are several limitations to this survey. First, the response rates for each question progressively decreased from 100% to 92% of all responding anaesthetists. The overall response rate of 71% of all UK anaesthetists was similar to the response rate for the NAP6 baseline survey [12]. There is a risk of bias in our findings, with the potential of personal experiences influencing the likelihood of responding. Second, we focus solely on anaesthetists, therefore we can offer little insight into the preparation or experiences of other resuscitation team members.

In conclusion, we have presented the largest survey of anaesthetists to date examining individual preparedness, management and experiences of peri-operative cardiac arrest. We have identified areas for quality improvement, particularly in preparation for paediatric resuscitation and managing the aftermath of peri-operative cardiac arrest in the UK.

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Supporting Information

Additional supporting information may be found online via the journal website.

Appendix S1. NAP7 local co-ordinators.

Appendix S2. Ethics and approvals.

Appendix S3. NAP7 baseline survey – question branching logic.

Appendix S4. Baseline survey of all anaesthetists.

Appendix S5. Analyses (quantitative and qualitative).

Appendix S6. Additional qualitative analyses.

Appendix S7. Numerical data from Figs. 1–4.