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**Airway management during in-hospital cardiac arrest (IHCA) in adults: UK national survey and interview study with anaesthetic and intensive care trainees**

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<td>Date Submitted by the Author:</td>
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| Keywords: | airway management, cardiac arrest, supraglottic airway, tracheal intubation, in-hospital cardiac arrest |

**Abstract:**

Background: The optimal airway management strategy for in-hospital cardiac arrest (IHCA) is unknown.  

Methods: An online survey and telephone interviews with anaesthetic and intensive care trainee doctors identified by the United Kingdom (UK) Research and Audit Federation of Trainees. Questions explored IHCA frequency, grade and specialty of those attending, proportion of patients receiving advanced airway management, airway strategies immediately available, and views on a randomised trial of airway management strategies during IHCA.  

Results: Completed surveys were received from 128 hospital sites (76% response rate). Adult IHCA were attended by anaesthesia staff at 40 sites (31%), intensive care staff at 37 sites (29%), and a combination of specialties at 51 sites (40%). The majority (123/128, 96%) of
respondents reported immediate access to both tracheal intubation (TI) and supraglottic airways (SGAs). A bag-mask technique was used ‘very frequently’ or ‘frequently’ during IHCA by 111/128 (87%) of respondents, followed by SGAs (101/128, 79%) and TI (69/128, 54%). The majority (60/100, 60%) of respondents estimated that ≤30% of IHCA patients undergo TI, while 34 (34%) estimated this to be between 31-70%. Most respondents (102/128, 80%) would be ‘likely’ or ‘very likely’ to recruit future patients to a trial of alternative airway management strategies during IHCA. Interview data identified several barriers and facilitators to conducting research on airway management in IHCA.

Conclusion: There is variation in airway management strategies for adult IHCA across the UK. Most respondents would be willing to take part in a randomised trial of airway management during IHCA.
Title: Airway management during in-hospital cardiac arrest (IHCA) in adults: UK national survey and interview study with anaesthetic and intensive care trainees

Laura Goodwin¹, Katie Samuel², Behnaz Schofield¹, Sarah Voss¹, Stephen J. Brett³, Keith Couper⁴,⁵, Doug Gould⁶, David Harrison⁶, Ranjit Lall⁶, Jerry P. Nolan⁴,⁷, Gavin D. Perkins⁴,⁵, Jasmeet Soar², Matthew Thomas⁸ & Jonathan Benger¹,⁸, in collaboration with the Research and Audit Federation of Trainees (RAFT) network.

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Running title: National survey of UK airway management for IHCA

Declaration of Conflicting Interests
The authors declare that there is no conflict of interest.

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Keywords for indexing
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Keywords: Airway management, airway devices, cardiac arrest, intensive care, in-hospital cardiac arrest, supraglottic airway, tracheal intubation
Introduction

In-hospital cardiac arrest (IHCA) is an important health problem; current survival to hospital discharge is approximately 24% for all IHCA patients,¹ but may be closer to 10% for those requiring advanced airway management in the United Kingdom (UK) population (Couper K, personal communication, 2020). Airway management is an integral part of cardiac arrest management, and may affect patient outcome.² There is limited evidence on the optimal approach to airway management during adult IHCA,² however an observational study from the United States documented an association between the use of tracheal intubation (TI) during IHCA and decreased survival to hospital discharge.³

While TI has been considered the definitive technique for advanced airway management,⁴ recent randomised controlled trials (RCTs) in out-of-hospital cardiac arrest (OHCA) suggest there may be advantages to using supraglottic airway (SGA) devices instead of TI.⁵,⁶

Differences in the skills and experience of the healthcare professionals responsible for airway management⁷ and clinical differences between IHCA and OHCA patients make it unclear whether these advantages are transferable to the in-hospital setting.⁴,⁸-¹¹ However, there are theoretical advantages to using a SGA over TI during IHCA: SGAs are generally quicker and easier to insert,¹² may reduce the frequency and duration of pauses in chest compression,¹³ and can be inserted safely by a wider range of hospital staff.¹²

The International Liaison Committee on Resuscitation (ILCOR) has called for high quality research to determine the best approach to airway management during IHCA.¹⁴ However, questions remain about the feasibility of conducting a trial in this area because it is unclear what proportion of IHCA calls require advanced airway management, whether there is equipoise regarding airway management.
management strategies, and whether a trial of advanced airway management strategies during IHCA would be feasible and acceptable to practitioners.

We conducted a national survey of UK NHS staff responsible for airway management during IHCA, and follow up telephone interviews with a selection of participants.

The aims of this project were:

1. To examine current airway management practice during adult in-hospital cardiac arrest;
2. To explore participants’ attitudes to potential participation in a randomised trial of airway management during IHCA;
3. To explore the feasibility of proposed aspects of trial design, and identify potential barriers and facilitators.

Methods

Approval for data collection from all hospitals was obtained from the University of the West of England, Bristol Faculty of Health and Applied Sciences Research Ethics Committee (HAS.19.10.055, 15.11.2019). Information about the study was provided to all participants before informed consent was obtained. This included a description of the purpose of the study, what would be involved in participation, details of data confidentiality and storage, a privacy notice, and contact information for the study team. Written and verbal consent was obtained for all participants taking part in the interviews. Participants were required to confirm consent electronically before the first survey question was presented.

Eligible participants were anaesthetic and intensive care trainees with responsibility for adult IHCA airway management at their UK hospital site. Potential participants were identified through the
Research and Audit Federation of Trainees (RAFT) – a collaborative UK-wide trainee led research
group comprised of multiple regional trainee research networks.

An online survey (Appendix 1) was designed and piloted by the study team and prepared in Qualtrics
(Provo, Utah). It was then piloted again for usability and technical functionality. One response was
sought per hospital site; RAFT distributed the survey link via email to one eligible trainee at each
hospital site covered by the RAFT UK network (n =168). Trainees completed the survey between
December 2019 and January 2020. The survey comprised 12 questions with a mixture of multiple-
choice answers and free text responses. A maximum of four items were displayed on any one survey
page, and the full survey was distributed over approximately 7 pages. A progress bar was shown at
the top of the page as the respondent was completing the survey. Questions explored: responsibility
for airway management during IHCA (specialty, grade); the availability and use of different airway
management techniques; estimated incidence of IHCA; the proportion of IHCA patients who receive
advanced airway management; whether there was equipoise for the research question; willingness
to participate in research comparing different methods of airway management during IHCA.

Between January and February 2020, a sub-set of trainees (n = 17) were selected using a
representative sampling approach (one participant per geographical trainee regional network), and
invited to take part in a semi-structured telephone interview at a time convenient to them. An
interview topic guide (Appendix 2) was designed to explore barriers and facilitators to the design
and conduct of a randomised trial of airway management during IHCA. Interviews lasted
approximately 10 minutes and were conducted by authors LG, BS and SV and recorded using Skype
for Business.

Data were analysed using a modified ‘following a thread’ approach, beginning with an initial
analysis of each dataset to identify key concepts requiring further exploration.

Quantitative survey data were collated using Qualtrics and exported to Microsoft Excel, where
duplicate and incomplete responses were removed. Data were then analysed and presented using
simple descriptive statistics. Free-text responses to the online survey were exported to Microsoft Excel and coded into categories for analysis.

Two researchers independently listened to the audio recordings from the telephone interviews, made notes on emerging concepts, and recorded verbatim quotes in a Microsoft Word document. Concepts and quotes were shared between the researchers, and reviewed collaboratively to discuss interpretation of the data.

Concepts from one dataset were then followed across to the other to create a thread of findings which integrated the focus and specificity of the quantitative data with the richness of the qualitative data.

Results

A total of 140 responses to the survey were received, and after exclusion of partial (n = 1) and duplicate (n = 13) responses there were 128 completed surveys: a response rate of 76%. There was representation from all constituent countries of the UK, with a reasonable spread of responses geographically (Figure 1) [insert Figure 1.], apart from the East of England where RAFT is not represented. Survey data can be found in the supplementary materials. Seventeen trainees participated in individual semi-structured telephone interviews.

Current airway management practice during IHCA

In the 128 hospital sites, adult IHCA s were attended by anaesthesia staff at 40 sites (31%), intensive care staff at 37 sites (29%), and a combination of specialties at 51 sites (40%). Other specialties attending adult IHCA s included medical teams and operating department practitioners. The grade of staff with responsibility for advanced airway management at adult IHCA s varied significantly across all hospital sites. This is detailed in table 1.
Table 1: Grade of practitioner with responsibility for airway management during adult IHCA at all participating UK hospital sites

<table>
<thead>
<tr>
<th>Grade of practitioner responsible for airway management during IHCA</th>
<th>Number of hospital sites where this practitioner has responsibility, as a proportion of all responding hospital sites (n = 128)</th>
</tr>
</thead>
<tbody>
<tr>
<td>F2</td>
<td>10 (8%)</td>
</tr>
<tr>
<td>CT1-3 or equivalent</td>
<td>76 (60%)</td>
</tr>
<tr>
<td>CT4-7 or equivalent</td>
<td>82 (64%)</td>
</tr>
<tr>
<td>Non-consultant career-grade doctor or equivalent</td>
<td>29 (23%)</td>
</tr>
<tr>
<td>Consultant or equivalent</td>
<td>10 (8%)</td>
</tr>
<tr>
<td>Critical care practitioner/advanced clinical practitioner</td>
<td>14 (11%)</td>
</tr>
<tr>
<td>Nurse</td>
<td>2 (2%)</td>
</tr>
<tr>
<td>Other</td>
<td>6 (5%)</td>
</tr>
</tbody>
</table>

*At many sites, more than one practitioner may have responsibility for airway management during adult IHCA.

The majority (123/128, 96%) of respondents reported the availability of both TI and SGAs for airway management during IHCA. Of the 126 sites with TI available during IHCA, 30 (24%) reported the availability of videolaryngoscopes. Of the 125 sites with SGA devices available during IHCA, 120 (96%) reported availability of the i-gel, 44 (35%) reported availability of the laryngeal mask airway (LMA), and 7 (6%) reported availability of the laryngeal tube. The majority (81/125, 65%) reported that only one type of SGA device was available during adult IHCA; for 77 (62%) respondents this was the i-gel and for 4 (3%) respondents this was the LMA.

When asked about additional aids during adult IHCA, a skilled assistant was immediately available to 61/128 (48%) respondents, 95 (74%) had an intubating bougie immediately available, colorimetric capnography was available to 38 (30%), and waveform capnography was available to 67 (52%).

Fifteen of the 128 respondents (12%) reported that none of these aids were immediately available during adult IHCA, and free-text answers suggested a disparity of equipment availability between wards; ‘[only] some areas outside ICU do have waveform capnography and videolaryngoscopy. Sometimes I take the [videolaryngoscopy] from ICU to arrests with the transfer bag’.
Respondents also suggested that available equipment was not always suitable for the patient they were attending; one respondent commented ‘our Trust only provides size 4 i-gel on cardiac arrest trolleys’. Others reported that the full range of airway management techniques, including fibreoptic scopes and front of neck access, were ‘available to anaesthesia, but are not available on the standard arrest trolley’.

The use of different airway management techniques was compared by the percentage of respondents using the technique either ‘very frequently’ or ‘frequently’; bag-mask was chosen ‘very frequently’ or ‘frequently’ by 111/128 (87%) of respondents, followed by SGAs (101/128, 79%) and then TI (69/128, 54%). Free-text responses emphasised the importance of patient history, underlying diagnosis and patient co-morbidity in decisions regarding which airway management technique should be used. The ‘perception of whether or not patients would be a candidate for ICU’ was also cited as influencing this decision, along with factors including airway soiling and adequacy of the SGA seal.

When asked to estimate the number of IHCA patients who currently undergo TI prior to achieving a return of spontaneous circulation, or the cessation of resuscitation attempts, the majority (60/100, 60%) estimated this to be 30% or fewer, while 34 (34%) estimated this proportion to be between 31-70%, and 6 (6%) estimated this at more than 70%.

**Taking part in a trial of airway management during IHCA**

Attitudes towards a randomised trial of airway management strategies during IHCA were largely positive; the majority (102/128, 80%) of survey respondents said they would be either ‘likely’ or ‘very likely’ to take part in this type of study. Respondents who said they were ‘unlikely’ (5/128, 4%) or ‘very unlikely’ (2/128, 2%) to take part indicated ethical concerns with randomising patients to one airway management technique or another. There were also concerns about the practicality of
individual patient randomisation, availability of equipment and the need for a definitive airway in
patients who would require ongoing care.

Interview data reflected survey results; 16 of the 17 interviewees reported that they would
participate in a trial of airway management strategies and felt it was an important research question
to address.

_There’s nothing great in the literature on whether or not one’s better at securing the airway
during a cardiac arrest than the other. There’s different skill sets involved [in using each
strategy]. So obviously if an SGA is deemed to be comparable to Ti then that’s probably for
the better._ – Interview 3

Participants also confirmed that there is considerable variation in how airway management decisions
are made, and that having a ‘best practice’ standard would aid this decision-making.

_I think that to get a general answer [on which strategy to use] would certainly be useful. And
I think probably a randomised controlled trial is the best way of doing that, and is going to
give us the best answer._ – Interview 6

However, a minority of participants expressed concerns that a trial might constitute a change in
practice at their hospital. One such concern was that randomisation could place increased burden on
the intensive care unit (ICU), as ‘[the] tube commits people to ICU’. Another participant stated that
they would have to call a second person if they were going to insert a tracheal tube at an IHCA.
These additional requirements led participants to suggest that there would need to be ‘buy-in’ from
ICU and senior members of staff to facilitate a potential trial.

When reflecting on additional barriers and facilitators to the design of a potential trial, participants
suggested that the ability to use clinical judgment where appropriate should be emphasised, in order
to increase the acceptability of a randomised trial design.
The urgency with which resuscitation needs to commence was noted by participants as a potential barrier to randomisation of patients, as the method of randomisation would need to be straightforward and rapid.

*Once you arrive you have got to get involved quite quickly, so it would have to be something you could do very quickly...because as soon as you arrive, someone expects for you to take over the airway* – Interview 4

There was also discussion regarding the timing of randomisation; while some participants suggested that this should happen on the way to an arrest call, others felt it was appropriate to randomise a patient once an arrest had been confirmed.

Some participants proposed that another staff member, such as a resuscitation officer or research nurse, could support recruitment either by randomising patients themselves or by reminding the recruiting doctor to do so.

**Discussion**

We identified considerable diversity in airway management practice for IHCA across the UK; the grade and speciality of the individual responsible for airway management varied significantly across hospital sites. This has implications for airway management during IHCA because the choice of technique may depend on the skill of the provider, and the support available to them. Tracheal intubation may therefore be used more frequently in hospitals where more experienced clinicians are responsible for airway management during IHCA.

Our findings indicate that both TI and SGAs are commonly available to those responsible for airway management during IHCA, and that airway management technique is dependent on operator choice and judgement. While SGAs were indicated as being used slightly more frequently than TI, it is
unclear whether this is due to personal preference, related to practitioners’ individual skill and 
experience, or whether practitioners insert an SGA before moving on to TI in a step-wise approach. A 
stepwise approach to airway management is recommended in current guidelines for both IHCA and 
OHCA. However, during interviews with paramedics who took part in a trial of advanced airway 
management for OHCA, some indicated that they would always use this step-wise approach, while 
others described using their professional judgement and clinical skills to decide which technique to 
use depending on the clinical situation.

Both survey and interview participants suggested it would be feasible and acceptable to conduct a 
randomised trial of airway management during IHCA, and a number of suggestions were made about 
the design of a potential trial. As TI and SGA devices are both readily available and used with similar 
frequency, participants felt there was equipoise in relation to this research question. Randomisation 
would not cause substantial divergence from usual practice and would therefore not be ethically 
controversial. This is important, as previous literature suggests that for research to be successful the 
enrolment of patients into a research study must be simple and integrated into current practice as 
far as possible.

Respondents’ willingness to take part in emergency care research is supported by findings from 
prehospital literature, where practitioners have expressed positive attitudes towards taking part in 
trials, both in general, and specifically of airway management during cardiac arrest. In a follow-up 
study of paramedics who took part in the AIRWAYS-2 trial, both survey respondents and interview 
participants were comfortable with enrolling critically unwell patients into a randomised controlled 
trial using either deferred or a waiver of consent.

There are some limitations to our study. Only one response was sought per hospital site and these 
responses were based on participants’ reports and not externally validated. As such, there is the 
possibility of recall bias. However, all responses were from anaesthetic and intensive care trainees 
with responsibility for airway management during IHCA, who would therefore be best placed to
provide accurate information on this topic. The participants of this study were identified by members of RAFT, which is a research organisation. It is therefore possible that this sample of trainees would be more willing to take part in an RCT than those who are not research active.

To the best of our knowledge, this is the first survey of current airway management strategy for adult IHCA in the UK, with a high response rate and excellent representation of UK geographical training regions. As such, we suggest that the survey findings are a reliable description of current practice in the UK.

In conclusion, our study demonstrates considerable variation in current airway management during IHCA in the UK. The majority of respondents felt that a randomised trial of airway management for IHCA was important and would be willing to take part in such a study.
Acknowledgements


Declaration of Conflicting Interests

The authors declare that there is no conflict of interest.

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References


Figure 1: Map of hospital sites from which responses were received*
*RAFT does not have representation in the East of England or Northern Scotland

251x270mm (96 x 96 DPI)
Appendix one: Survey Questions

Q1) In which hospital site do you work currently?
Please type out the name in full

Q2) In your hospital, which speciality attends adult IHCA calls with the responsibility for airway management?
Tick more than one, if applicable.
   Anaesthesia
   Intensive Care
   Other (please state) ________________________________________________
   Don't know

Q3) In your hospital, which grade of practitioner on the cardiac arrest team usually has responsibility for airway management?
Tick more than one, if applicable.
   F2
   CT1-3 or equivalent
   CT4-7 or equivalent
   Non-consultant career grade doctor or equivalent
   Consultant or equivalent
   Critical care practitioner/advanced clinical practitioner
   Nurse
   Other (please state) ________________________________________________
   Don't know

Q4) When you attend a confirmed adult IHCA, which of the following airway management options are available to you (i.e. both the equipment is readily available, and you have the skills and support to complete the intervention successfully)?
Please indicate all available options.
   Basic airway techniques (bag-mask ventilation with or without oral or nasal airways)
   Supraglottic airway (SGA) (e.g. LMA, i-gel, laryngeal tube)
   Tracheal intubation using direct laryngoscopy
   Tracheal intubation using indirect (video) laryngoscopy
   Other (please state) ________________________________________________
   None of the above

Q5) Which SGA devices are immediately available for use during IHCA in your hospital?
Please indicate all available options.
   LMA
   i-gel
   laryngeal tube

Q6) When you attend a confirmed adult IHCA, which of the following are immediately available to you?
Please indicate all available options.
   Skilled assistant (e.g. ODP, anaesthetic nurse)
   Intubating bougie
   Colorimetric capnography
   Waveform capnography
   None of the above
Q7) In your opinion, what proportion of IHCA patients in your hospital undergo tracheal intubation prior to achieving a return of spontaneous circulation or being pronounced dead?

- <10%
- 10-30%
- 31-50%
- 51-70%
- 71-90%
- >90%
- Don't know

Q8) Please indicate the frequency with which you personally use the following airway management techniques during IHCA:

<table>
<thead>
<tr>
<th>Technique</th>
<th>Very frequently</th>
<th>Frequently</th>
<th>Sometimes</th>
<th>Rarely</th>
<th>Very rarely/Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pocket mask with or without supplemental oxygen</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bag-valve mask</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SGA: LMA</td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>SGA: i-gel</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>SGA: laryngeal tube</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Tracheal intubation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other (please state if applicable)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

Q9) How important do you think it is to do a Randomised Controlled Trial of tracheal intubation during IHCA and its effect on long-term outcomes?

- Very important
- Important
- Neither important or unimportant
- Not very important
- Not at all important
Q10) How likely would you be to participate in a Randomised Controlled Trial of tracheal intubation during IHCA if patient allocation occurred via an app downloaded to your smartphone?
   Very likely
   Likely
   Neither likely nor unlikely
   Unlikely
   Very unlikely

Q11) Please provide a reason for this answer

Q12) Is there anything you would like to add about airway management during IHCA?
Appendix Two: Interview topic guide

1) Explore their experience of in hospital cardiac arrest airways management
   a. How are you personally involved in IHCA?

2) We would like to conduct a randomised controlled trial of airway management strategies for in hospital cardiac arrest. *(Describe the proposed methodology).*
   a. Would you participate in such a study? What makes you say that? Why?
   b. How can we make it more practical for a cardiac arrest scenario?
   c. When would be a good time to press the randomisation button? Can you see this being at the bedside once the cardiac arrest has been confirmed and you have decided to proceed with Advanced Airway Management?
   d. Should we change anything? If so what?
### Checklist for Reporting Results of Internet E-Surveys (CHERRIES)*

<table>
<thead>
<tr>
<th>Item category</th>
<th>Checklist item</th>
<th>Page no.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design</td>
<td>Study design</td>
<td>Pg 4</td>
<td>The target population was anaesthetic and intensive care trainees responsible for adult IHCA airway management in the UK, and were identified through the Research and Audit Federation of Trainees (RAFT); a collaborative UK-wide trainee led research group comprised of multiple regional trainee research networks. One participant was sought per hospital site covered by RAFT.</td>
</tr>
<tr>
<td>Ethics</td>
<td>Ethics approval</td>
<td>Pg 4</td>
<td>This work was classed as a service evaluation, and as such ethics approval was obtained from the University of the West of England, Bristol Faculty of Health and Applied Sciences Research Ethics Committee (HAS.19.10.055, 15.11.2019), to cover data collection from all hospitals.</td>
</tr>
<tr>
<td>Informed consent</td>
<td></td>
<td>Pg 4</td>
<td>Informed consent for the survey was obtained from all those agreeing to complete a survey, with participant information displayed on the welcome page that the survey would take approximately 10 minutes to complete, that all responses were confidential and anonymous, and that data would be stored and analysed on password protected encrypted computers at UWE, accessed only by the study team, and deleted once the study findings are accepted for publication. A Privacy Notice was also available to download, and contact details were displayed for the research team. Consent was indicated when respondents clicked the ‘I consent’ button at the bottom of this page. For interviews, informed consent was obtained through signed consent forms, after participants had been emailed a copy of the participant information sheet and privacy notice. Consent was then re-confirmed verbally at the start of the interview.</td>
</tr>
<tr>
<td>Data protection</td>
<td></td>
<td>Pg 4</td>
<td>No personal information was collected (Random IDs were given to participants in case they wished to withdraw their data). Survey data are stored on a secure server at UWE Bristol and the survey platform ‘Qualtrics’ (approved by UWE Bristol) for data security.</td>
</tr>
<tr>
<td>Development and pre-testing</td>
<td>Development and testing</td>
<td>Pg 4</td>
<td>The survey was designed using input from earlier research and review by the research team (healthcare professionals and researchers). A draft survey was piloted by members of the research team, as well as doctors responsible for airway management, who were included in the final sample.</td>
</tr>
<tr>
<td>Recruitment Process</td>
<td>Open vs closed Survey</td>
<td>Pg 4</td>
<td>This was a closed survey</td>
</tr>
</tbody>
</table>

https://mc.manuscriptcentral.com/inc
<table>
<thead>
<tr>
<th>Contact mode</th>
<th>Pg 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAFT distributed the participant information and survey link via email to one eligible trainee at each hospital site covered by the RAFT UK network.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Recruitment process (cont’d)</th>
<th>Advertising the survey</th>
<th>Pg 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>The survey was not advertised; as above, RAFT sent the survey link via email.</td>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Survey administration</th>
<th>Web/email</th>
<th>Pg 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>This was a web-based survey, hosted by the survey platform ‘Qualtrics’</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Context</th>
<th>Pg 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qualtrics is an online survey platform.</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Mandatory/voluntary</th>
<th>Pg 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voluntary.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Incentives</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survey respondents were offered acknowledgement on a resulting publication from the survey results. If respondents wished to be acknowledged, they were asked to complete a separate survey which asked for their name and email address. This was not linked to the survey results in any way.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time/date</th>
<th>Pg 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses were collected between December 2019 and January 2020.</td>
<td></td>
</tr>
<tr>
<td>Item category</td>
<td>Checklist item</td>
</tr>
<tr>
<td>--------------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>Item randomisation</td>
<td>Appendix 1</td>
</tr>
<tr>
<td>Adaptive questioning</td>
<td>Appendix 1</td>
</tr>
<tr>
<td>Number of items</td>
<td>Appendix 1</td>
</tr>
<tr>
<td>Number of screens</td>
<td>Appendix 1</td>
</tr>
<tr>
<td>Completeness check</td>
<td>Appendix 1</td>
</tr>
<tr>
<td>Review step</td>
<td>Appendix 1</td>
</tr>
<tr>
<td>Response rates</td>
<td>Unique site visitor</td>
</tr>
<tr>
<td></td>
<td>View rate</td>
</tr>
<tr>
<td></td>
<td>Participation rate</td>
</tr>
<tr>
<td>Item category</td>
<td>Checklist item</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>--------------------------------------</td>
</tr>
<tr>
<td></td>
<td>Completion rate</td>
</tr>
<tr>
<td>Preventing multiple entries</td>
<td>Cookies used</td>
</tr>
<tr>
<td>from same individual</td>
<td>IP check</td>
</tr>
<tr>
<td></td>
<td>Log file analysis</td>
</tr>
<tr>
<td>Registration</td>
<td>A login was not used - entry to the survey was via a web link emailed to eligible participants. Duplicate entries were found through the first survey question (a free-text response of which hospital site the respondent was based at). Where duplicate responses were found, the first entry was kept for analysis.</td>
</tr>
<tr>
<td>Analysis</td>
<td>Handling of incomplete questionnaires</td>
</tr>
<tr>
<td></td>
<td>Questionnaires with atypical timestamp</td>
</tr>
<tr>
<td></td>
<td>Statistical correction</td>
</tr>
</tbody>
</table>

Titles and descriptions for supplemental material

Appendix one

Title: Appendix one: Survey questions. Supplemental material for Airway management during in-hospital cardiac arrest (IHCA) in adults: UK national survey and interview study.

Description: Appendix one: Survey questions. Supplemental material, for Airway management during in-hospital cardiac arrest (IHCA) in adults: UK national survey and interview study, by Goodwin L, Samuel K, Schofield B, et al in JICS.

Appendix two

Title: Appendix two: Interview topic guide. Supplemental material for Airway management during in-hospital cardiac arrest (IHCA) in adults: UK national survey and interview study.