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Clinical Practice

CLINICAL PRACTICE

A national survey of the impact of NAP4 on airway management practice in United Kingdom hospitals: closing the safety gap in anaesthesia, intensive care and the emergency department

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Abstract

Background: The 4th National Audit Project of the Royal College of Anaesthetists' and Difficult Airway Society (NAP4) made recommendations to improve reliability and safety of airway management in hospitals. This survey examines its impact.
Methods: A survey was sent to all UK National Health Service hospitals to examine changes in practice in response to NAP4. We performed a 'gap analysis' to determine whether NAP4 had reduced the 'safety gap' between actual and ideal practice.
Results: The response rate was 62% (192 of 307 hospitals), and 78% answered all questions. Most (97%) respondents reported changes in practice in response to NAP4 but these differed by specialty: 95% in anaesthesia; 80% in intensive care (ICU) and 59% in the emergency department (ED). Approximately 25% reported changes in organizational aspects of airway and human factors teaching. Practice changes led to a median closure of the 'safety gap' in anaesthesia of 39% (IQR 14–66%, range 11–83%), 59% in ICU (IQR 54–73%, range 31–81%) and 48% in ED (IQR 39–53%, range 35–53%).
Conclusions: Publication of NAP4 was followed by changes in practice in the majority of responding departments within two yr. Improvements included improved provision of difficult airway equipment and more widespread routine use of capnography. The biggest change occurred in ICU; the impact on training nursing and junior staff was modest and here, significant safety gaps remain.

Key words: airway; anaesthesia; education; emergency department; intensive care

The 4th National Audit Project of the Royal College of Anaesthetists' and Difficult Airway Society (NAP4) examined major complications of airway management in the UK over a period of one yr and was published in 2011.[1,2] The report made recommendations to improve reliability and safety of airway management in hospitals.[3]

The project's findings and recommendations were disseminated through a national launch, a full report, journal papers, media reports, podcasts, lectures and direct contact with project Local Coordinators in all the UK, National Health Service (NHS) hospitals. These resources were also made freely available online (http://www.nationalauditprojects.org.uk/NAP4_home). Whether, and if so the degree to which NAP4 has led to changes in practice has not been reported. This survey examines the success of dissemination and the impact of the recommendations two yr after the publication of the NAP4 report. The survey also set out to

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Editor's key points

- Guidelines improve and standardize practice.
- The safety gap is the difference between observed practice and an ideal practice.
- NAP4 was a UK practice audit resulting in expert recommendations in airway management.
- This survey identifies improvements and opportunities for further change in airway management.

establish current practices and the gap that exists between current airway management practices and ideal practice.

Methods

The survey did not fulfill current NHS definitions of research, and formal approval by a Regional Ethics Committee was not required.

The survey included 62 questions (appendix 1), investigating whether the department had made changes in practice regarding airway governance and training, airway management before during and after anaesthesia, in the intensive care unit (ICU) and in the emergency department (ED). Survey questions asked about practices before the NAP4 report and changes in practice made as a result of the recommendations made in the NAP4 report. Questions were phrased explicitly, aiming to only identify changes in practice made as a direct consequence of NAP4 and to focus on recommendations relating to departmental or institutional practice (as opposed to national or personal practice).[4]

The survey was conducted in conjunction with the Health Service Research Centre (HSRC) of the National Institute of Academic Anaesthesia at the RCoA. The survey was reviewed by the HSRC executive board before distribution, but was not formally piloted. The HSRC's database was used to identify relevant hospitals and survey recipients. An on-line survey was sent by email to all UK NHS anaesthetic department Departmental Airway Leads.[5] If no response was received the survey was serially sent to the departmental Quality Audit and Research Coordinator (QuARC), Clinical Director and Tutor. The identity of the recipient's hospital was captured to ensure that only one return was received from each hospital. The survey was conducted during 2013 and closed January 2014. Responses were collected independently by HSRC staff who were not further involved in the analysis. The responses were manually checked to ensure that only one response per anaesthetic department was counted, and responses were then de-identified.

Each question in the survey related to a specific recommendation made in the NAP4 report, enquiring about practice before the NAP4 report and changes made as a consequence of the NAP4 report and recommendations. This therefore enabled us to identify the number of departments complying with a particular recommendation before NAP4 and the number changing as a result of NAP4. Based on the assumption that compliance with each NAP4 recommendation improved safety we were able to calculate the following metrics for each recommendation:

Defining A as the percentage compliance with a recommendation before NAP4 and B as the percentage compliance after NAP4.

Previous safety gap=% Safety gap before NAP4=100-A
Current safety gap=% Safety gap after NAP4=100-B
Absolute impact=% change in safety gap=B-A
Relative impact=% closure of the safety Gap=(B-A)/(100-A)×100

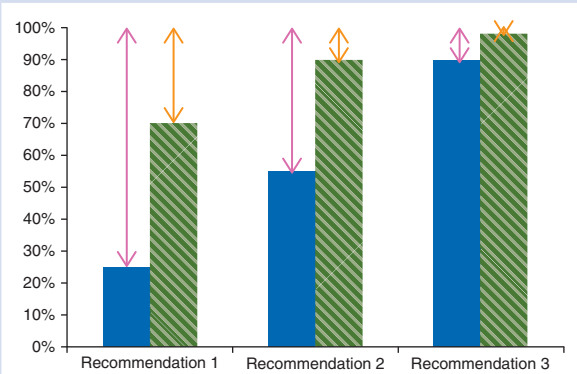

Fig 1 An illustration of closing the safety gap: the 'safety gap' is the difference between practice and 100% compliance with a recommendation. Blue columns represent practice before NAP4 and green columns after NAP4. The difference between the two columns indicates the degree of change. The pink arrow indicates the safety gap before NAP4 and the orange arrow the safety gap after NAP4. The relative lengths of the two arrows indicates the degree to which the safety gap has been closed.

The impact of changes depends on pre-existing practice and the impact of recommendations. This is illustrated in Fig. 1. In Fig. 1 the largest absolute impact was achieved by recommendation one but this is also where the largest remaining safety gap exists. Recommendation two has produced the largest relative impact and for recommendation three there has been a small absolute impact and relative impact but the remaining safety gap is very small.

The survey results were entered into a spreadsheet and descriptive statistics calculated using Microsoft Excel 2010 (Microsoft Cooperation, Redmond, WA, USA). Results are presented as % of respondents.

Results

Surveys were distributed to 307 hospitals assumed to provide surgical services. Some respondents provided data for a group of hospitals: 175 responses were received from 192 hospitals (62% response rate). All 175 respondents replied to questions about organizational aspects and 134–136 answered clinical questions (see appendix).

Respondents were airway leads in 157 (90%) cases. Respondents who were not airway leads were clinical directors 11 (5%), QuARC 2 (1%), Tutor 1 (0.6%) and other consultants with an interest in airway management 5 (3%). All but one respondent (99.4%) were aware of NAP4. The NAP4 results had been presented in 91% of departments. Respondents reported an average 3.1 exposures to results and 98% judged this to be satisfactory.

Changes in overall practice and the role of the airway lead in response to NAP4

Most (97%) respondents reported change in practice in response to NAP4. Respondents were asked to rank the extent of change in their departmental and personal practice. Results are presented in Fig. 2.

Most (95%) respondents reported having a departmental airway lead and 4% planned one; 44% had changed in response to NAP4. Roles of the Departmental Airway Lead included protocol

development (88%), procurement (87%) and multidisciplinary training (89%). In 47% of responding departments the role of the airway lead had changed in response to NAP4. The proportion of departments with representation on hospital procurement committees rose by 5% from 66 to 71% as a result of NAP4.

Slightly fewer than half of respondents (49%) reported a systematic method for ensuring clinicians' competence with new airway equipment – an increase of 14% in response to NAP4.

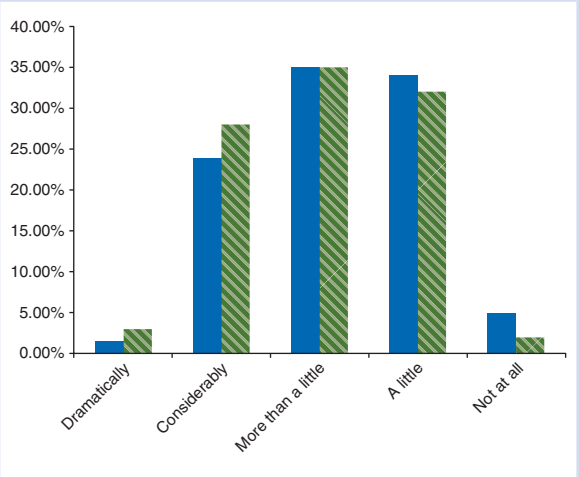

Fig 2 The extent of personal and departmental changes in practice in response to NAP4. Blue columns- personal changes in practice, green columns – departmental changes in practice.

Human factors training increased in response to NAP4, with 61% of respondents including this in departmental airway management training (a 24% increase in response to NAP4) and 65% including multidisciplinary team training for difficult airway management (a 26% change in response to NAP4). Regarding inclusion of airway management planning as part of the World Health Organization's time out before surgery 79% reported these are always or often discussed (a 28% increase in response to NAP4) and 66% of respondents reported that debriefing after difficult airway management occurs more commonly now than before NAP4.

Airway management practices in anaesthesia

We asked questions about 21 recommendations relating to anaesthesia practice.

Most (95%) respondents reported changes in practice in their anaesthetic department. The degree to which the reported safety gap was closed for each area of practice is shown in Fig. 3. Practice before NAP4, the extent of change and the remaining safety gap is shown in Fig. 4.

The greatest absolute changes in practice were in surgical airway training (49% making a change), training for management of cannot intubate cannot ventilate (CICV) situations and extubation guidelines (both, 39% making a change), universal use of capnography for anaesthesia (always 74%; nearly always 26%; sometimes/never 0%) and capnography being available in all recovery areas (both, 36% making a change). The greatest closure of the reported safety gap was in training for management of CICV (83% of gap closed) and the largest remaining gap was the formal pre-assessment of all morbidly obese patients (post-NAP4 gap 71%).

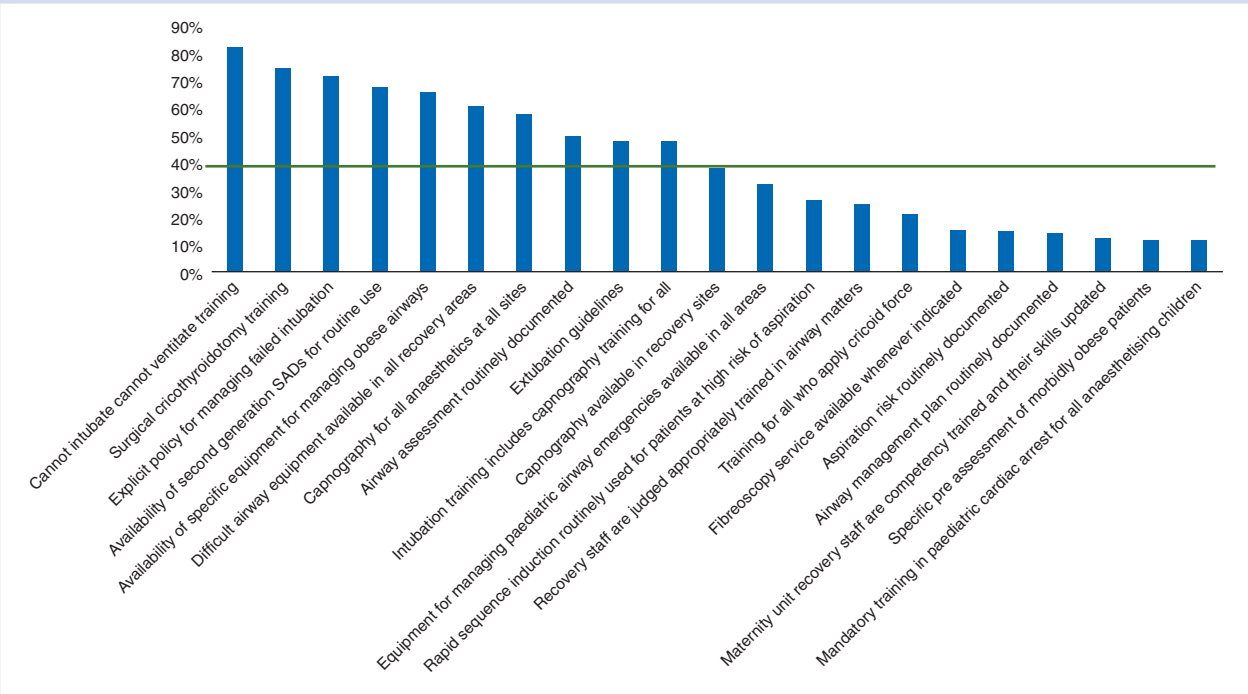

Fig 3 NAP4's impact on closing the 'safety gap' in Anaesthetic practice. The x axis relates to recommendations made in NAP4. The y axis indicates the extent to which the gap between actual and ideal practice has been reduced, as a result of changes in practice because of implementation of NAP4 recommendations. The recommendations are listed in descending order of impact. The green line indicates the median of all the impacts in the graph.

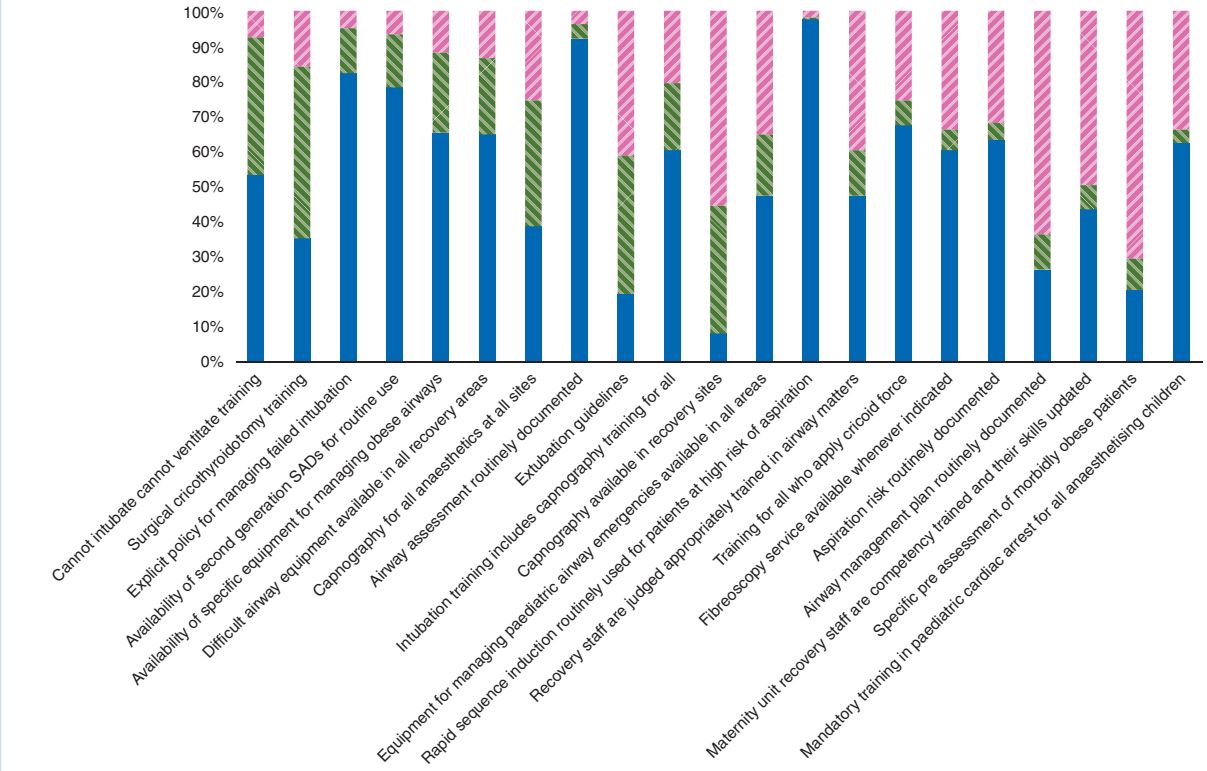

Fig 4 NAP4's impact on the safety gap in Anaesthetic practice. The x axis relates to recommendations made in NAP4. The y axis indicates the percentage of departments complying with the recommendation. The blue bar indicates compliance before NAP4, the green bar the change as a consequence of NAP4 and the pink bar is the remaining gap between practice after NAP4 and ideal practice. The recommendations are listed in descending order of the impact of NAP4 in bridging the gap between actual and ideal practice.

In six areas the gap was closed by more than 60% and in seven areas the gap was closed by less than 25% (Fig. 3). Across the recommendations examined the median safety gap before NAP4 was 40% and after NAP4 26%, with a median 39% (95% CI 14–66%, range 11–83%) closure of the safety gap.

At the time of this survey the NAP4 recommendations with the highest rates of anaesthetic departmental compliance were 1) rapid sequence routinely used for those at risk of aspiration (98% of responding departments), routine documentation of airway assessment (95%) and the adoption of an explicit failed intubation policy (94%). The NAP4 recommendations with the lowest rates of departmental compliance were 1) routine preassessment of all morbidly obese patients (29%), 2) the routine documentation of an airway strategy (36%), and 3) the availability of capnography in all recovery areas (44%).

Intensive care unit practice

We asked questions about 17 recommendations relating to ICU practice. Many (80%) respondents reported changes in practice in their ICU. The degree to which the reported safety gap was closed for each area of practice is shown in Fig. 4. Practice before NAP4, the extent of change, and the remaining safety gap is shown in Supplementary data, Fig. S1.

Two yr after NAP4, in respondents' ICUs, continuous capnography is used for intubation on ICU always or often in 97% (always 79%; often 18%; rarely/never 3%) and for monitoring of patients with tracheal tubes always or often in 89% of units (always 68%; often 21%; rarely 9%; never 2%). A checklist is routinely used before intubation in two thirds of ICUs and more than 90% of units report immediate access to a difficult airway trolley and the existence of a policy for managing difficult intubation. Training of junior and non-medical staff and communication of predicted airway difficulty remain areas of suboptimal practice (Fig. 5).

The greatest absolute changes in practice were in capnography always being used at tracheal intubation in ICU (42% reporting a change in response to NAP4) and for tracheal intubation of the critically ill outside ICU (42% making a change), in the contents of the difficult airway trolley matching those elsewhere in the hospital (38% making a change) and in there being a policy for management of tracheal intubation difficulty on ICU (35% making a change). The greatest closure of the safety gap was in immediate access to a difficult airway trolley on ICU (81% of gap closed) and the largest remaining gap was the proportion of respondents reporting that *all* clinical staff in ICU are trained in interpretation of capnography (post-NAP4 gap 48%).

In six areas the gap was closed by at least 60% and in no areas was the gap closed by less than 25% (Fig. 4). Across the recommendations examined the median safety gap before NAP4 was 45% and after NAP4 18%, with a median 56% (95% CI 54–73%, range 31–81%) closure of the safety gap.

The NAP4 recommendations with the highest rates of ICU departmental compliance were 1) continuous access to senior medical staff for trainee medics (99% of responding departments), 2)

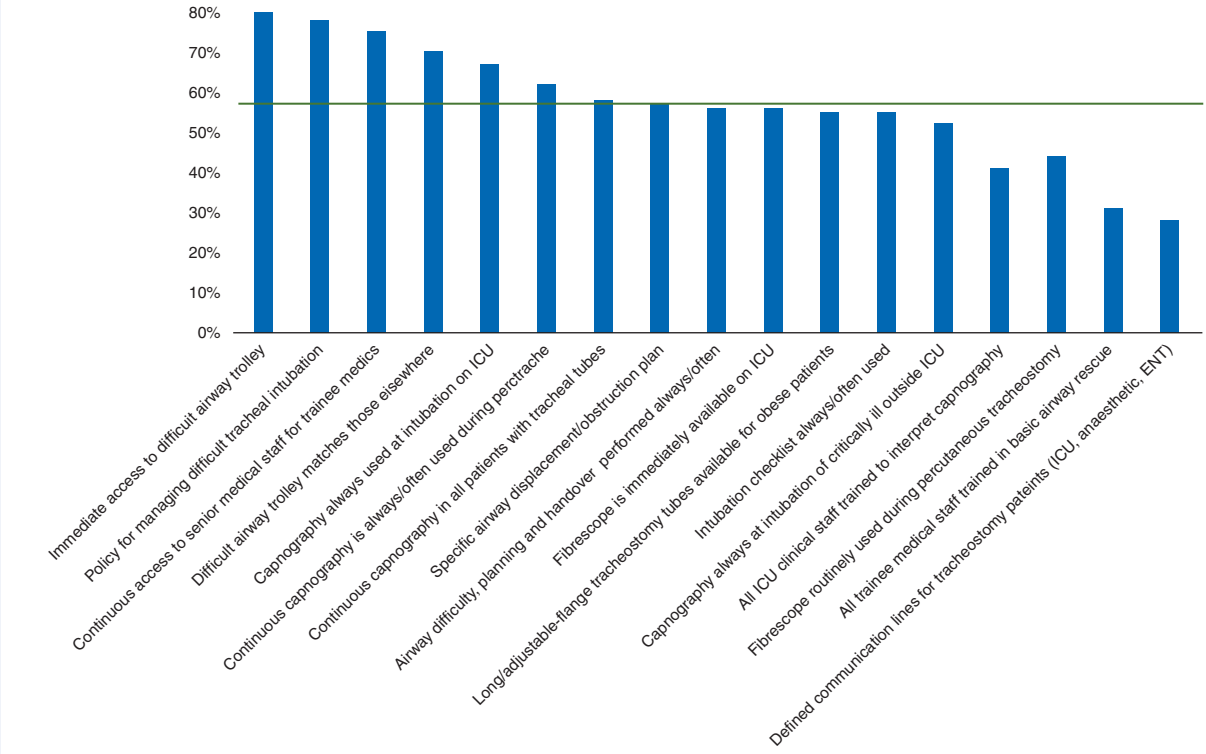

Fig 5 NAP4's impact on the safety gap in Intensive Care practice. The x axis relates to recommendations made in NAP4. The y axis indicates the extent to which the gap between actual and ideal practice has been as a result of changes in practice because of implementation of NAP4 recommendations. The recommendations are listed in descending order of impact. The green line indicates the median of all the impacts in the graph.

immediate access to a difficult airway trolley (93%), and 3) continuous capnography is always/often used during percutaneous tracheostomy (92%). The recommendations with the lowest rates of departmental compliance were 1) all ICU clinical staff trained to interpret capnography (52%), 2) routine use of an intubation checklist (65%), and 3) continuous capnography used in *all* patients with tracheal tubes (68%).

Emergency department practice

We asked questions about six recommendations relating to ED practice. More than half (59%) of the respondents reported changes in practice in their ED. The degree to which the reported safety gap was closed for each area of practice is shown in Fig. 6. Practice before NAP4, the extent of change and the remaining safety gap is shown in Supplementary data, Fig. S2.

After NAP4, capnography was reported to be used for tracheal intubations in the emergency department: always by 72%, often by 22% and rarely by 3%. Respondents reported use of a checklist before tracheal intubation in the ED always or often by 45% and rarely or never by 55%. Trained, skilled assistance for airway management in the ED was reported always or often by 86%: rarely or never by 14%.

The greatest overall changes in practice were in the contents of the difficult airway trolley, matching those elsewhere in the hospital (34% reporting a change in response to NAP4) and in immediate access to a difficult airway trolley (30% making a change). The greatest closure of the safety gap was in immediate access to a difficult airway trolley (53% of gap closed) and the largest remaining gap was in the routine use of a checklist before intubations reported to be always by 20% and often by 25% (post-NAP4 gap 55%).

In no areas was the gap closed by more than 60% or less than 25% (Fig. 6). Across the recommendations examined, the median safety gap before NAP4 was 56% and after NAP4 27%, with a median 48% (95% CI 39–53%, range 35–53%) closure of the safety gap.

The NAP4 recommendations with the highest rates of emergency departmental compliance were 1) robust processes to ensure skilled, senior staff always available (88% of responding departments), 2) trained, skilled airway assistance always present during airway management (84%), and 3) immediate access to a difficult airway trolley (73%). The recommendations with the lowest rates of departmental compliance were 1) use of a checklist before intubation (45%), 2) the difficult airway trolley mimics those elsewhere in the hospital (68%), and 3) capnography used for all intubations (72%).

Discussion

This survey has measured the degree to which departmental level recommendations made in the NAP4 report were implemented nationally in UK NHS hospitals. In doing so the survey has also identified several other useful metrics. Based on the assumption that all recommendations made by NAP4 and measured here were likely to represent safe practice, the survey enables the identification of the 'safety gap' (difference between

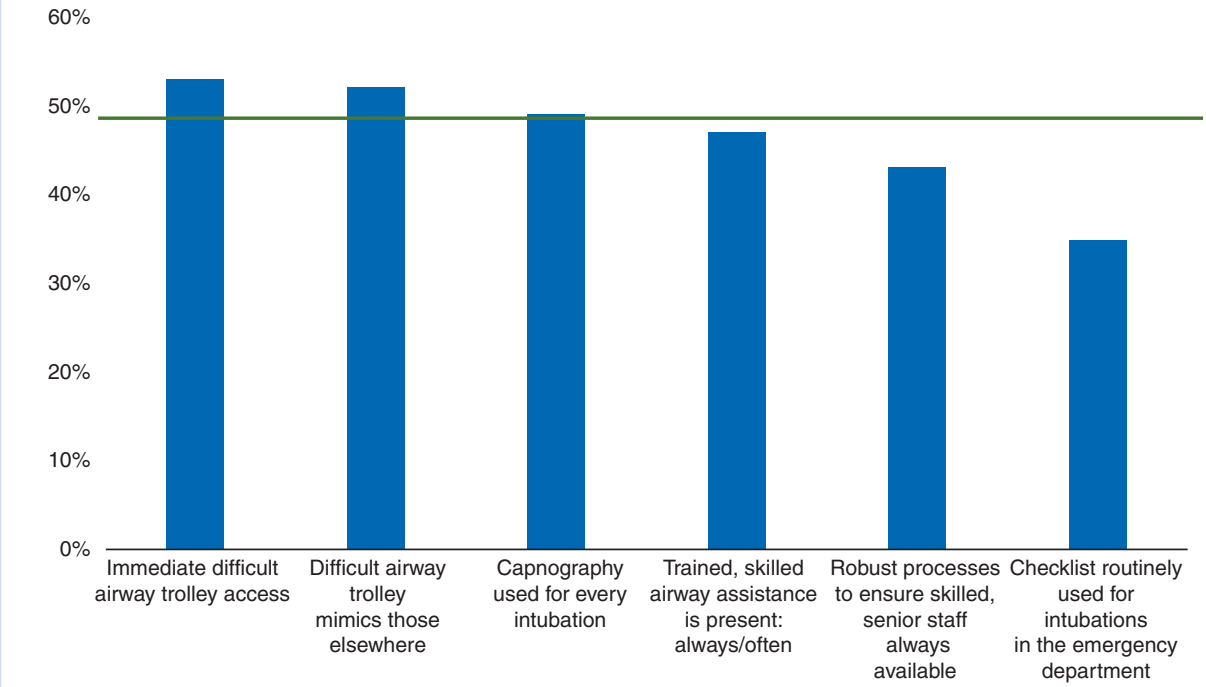

Fig 6 NAP4's impact on the safety gap in Emergency Department practice. The x axis relates to recommendations made in NAP4. The y axis indicates the extent to which the gap between actual and ideal practice has been as a result of changes in practice because of implementation of NAP4 recommendations. The recommendations are listed in descending order of impact. The green line indicates the median of all the impacts in the graph.

actual and ideal practice) both before NAP4 and two yr later. The latter measure enables the identification of the remaining safety gap.

Dissemination appears to have been satisfactory: respondents report more than three exposures to NAP4 each and the project was formally presented to more than 90% of departments. All but 2% of respondents judged this to be satisfactory. We did not examine which aspects of dissemination were most successful, nor which led to most changes in practice where these occurred.

Overall the survey has shown considerable impact of the project. In 2000 Balas and Boren reported that it takes 17 yr for research to lead to significant changes in clinical practice.[6] By this metric the impact of NAP4 has been rapid. While development of information technology is likely to have accelerated the process, it is likely that the full impact of NAP4 is not yet complete. A similar survey performed one yr after the previous NAP – NAP3 which examined major complications of central neuraxial blockade[7] – reported changes in information provided to patients in approximately two thirds of hospitals and changes in care delivery in approximately one quarter of hospitals and by one quarter of individual respondents.[8] In the current survey changes in individual and institutional practice were reported by more than 95% of respondents (Fig. 2).

On one level the safety gap before NAP4 can be considered the 'extent of the problem to be addressed' by NAP4. The proportion of the safety gap closed (Figs 3, 5 and 6) can be considered the 'work done' and the 'safety gap after NAP4' represents the 'work still to do'. Looked at in this way the greatest success has been achieved in ICU. Here the (median) safety gap before NAP4 was the highest of the three areas of practice at 45% and two yr after NAP4 this was reduced to 18% (closing the gap by almost 60%). Of note, ICU was the area of practice where events reported to ICU had the highest incidence, the worst outcome and the highest rates of both poor practice and avoidable deaths.[2,3] In the ED, another area of concern in NAP4, the extent of absolute changes, the extent to which the gap has been closed appears to be lower and the remaining gap higher than in ICU. Conversely anaesthesia was the area of practice in NAP4 with the lowest incidence of events, lowest mortality and highest rates of good practice. Reflecting this, the safety gap before NAP4 was the smallest of the three areas of practice, median 40%, but it was only closed by 40% leaving a residual median 26% gap. It is not clear why NAP4 seems to have had a lesser impact on anaesthesia practice than in ICU. Plausible explanations include: that the recommendations in anaesthesia are harder to achieve; the small number of deaths and cases of poor practice reported to NAP4 act as a relative disincentive; more departments do not agree with the recommendations or see them simply as recommendations rather than standards of care.

There are notable areas where only modest impact has resulted from NAP4 and where a significant proportion of hospitals still do not adhere to good practice. In anaesthesia, routine preassessment of morbidly obese patients remains infrequent and this has changed little since NAP4. Recently published guidance on perioperative management of the obese surgical patient reemphasizes the risks these patients undergo during anaesthesia and surgery.[9] Despite 39% of hospitals changing practice still more than 40% of hospitals have no policy for extubation. The DAS extubation guidelines provide such a framework.[10] Availability of capnography in all recovery units changed in 36% of hospitals but remains unachieved in more than 50% of hospitals.

The updated standards for minimum monitoring of the Association of Anaesthetists of Great Britain and Ireland should provide further impetus to complying with this recommendation.[11] Tracheostomy management was identified by NAP4 as a major concern but two yr after NAP4 more than a quarter of respondents stated that they had no defined communication lines for tracheostomy patients between ICU, anaesthesia and surgical departments. The National Confidential Enquiry into Patient Outcome and Death report 'On the right Trach' made a very similar recommendations.[12] Several recommendations associated with small degrees of change and relatively large remaining gaps relate to training – including of recovery staff, maternity staff and of those performing cricoid force (Fig. 4). In ICU NAP4 has led to major changes in the provision and use of capnography, but further work is required to change this from common to universal practice and to ensure all staff on ICU are able to interpret capnography correctly.[13–15] In the ED, progress has been less dramatic and across all the recommendations explored there remains considerable room for improvement. Further change, if deemed useful, could likely be stimulated by inclusion of the NAP4 recommendations in the College's Guidelines for the Provision of Anaesthetic Services (GPAS) and Anaesthesia Clinical Services Accreditation (ACSA) Standards.

There are several limitations to the survey. First we did not examine the impact of all recommendations made by NAP4. These total 144 and we judged it impractical and counterproductive to explore all these. Some recommendations relate to national or individual practice and this survey focused on those recommendations which we anticipated leading to change at a departmental or institutional level.[9] Second, the response rate (62%) is rather lower than we hoped for. The survey was announced in relevant publications,[4] was emailed serially to named individuals in Anaesthetic Departments, with responsibility for this area of practice and several reminders were sent. All respondents replied regarding organizational changes, whilst 78% responded to the clinical questions. Third, we are not able to validate the respondents' responses, as is the case in any survey. It is possible the respondents have over-estimated the changes made in their hospital and also that non-respondents may have made fewer changes to practice than respondents. It is also possible that respondents may have understated changes and this perhaps affects the ED returns most, as changes may have been made by the ED staff without knowledge of the anaesthesia staff. Fourth, and perhaps converse to above, many of the questions we asked were aspirational – for instance we asked whether 'capnography was used for *all anaesthetics in all locations*' and whether '*all staff* on ICU were trained in interpretation of capnography' – therefore it is quite feasible that hospitals have made changes in practice and improved safety but not reached these stringent targets. This would tend to underestimate the impact of NAP4 on safe practices. Fifth, the survey was completed in 2014 and practices may have changed in either direction since then, under a number of influences. However the main aim of the survey was to identify changes in practice attributable to NAP4 two yr after its publication. Finally, the survey only explores hospital practices as reported by a consultant with an interest in the topic – it does not collect performance at a patient level and cannot measure whether NAP4 has led to a reduction in unsafe practice for individual patients, or reduced the incidence of major airway complications in the UK.

In the two yr after publication, NAP4 led to major changes across broad areas of anaesthetic, ICU and ED airway practice in respondents' hospitals. Its impact appears to have been largest in ICU but also substantial in anaesthesia and the ED. It has reduced the 'safety gap' between actual and ideal practice in broad areas of practice. The survey has identified not only the impact of NAP4 but also shows those areas of practice where significant gaps remain, which require further action to improve airway safety in UK hospitals. These include the screening of morbidly obese patients before anaesthesia, the provision of capnography in anaesthetic recovery units and in some ICUs, staff training in recovery and ICUs, and routine use of an intubation checklist both in ICUs and in the ED.

Author's contributions

Study design/planning: T.M.C., N.W., C.F.
Study conduct: T.M.C., N.W., C.F.
Data analysis: T.M.C., N.W., C.F.
Writing paper: T.M.C.
Revising paper: all authors

Supplementary material

Supplementary material is available at *British Journal of Anaesthesia* online.

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Declaration of interest

T.M.C.'s department has received free or at cost airway equipment for evaluation or research. He has attended an industry-sponsored advisory board on capnography and sedation. To preserve independence, he received no payment for attending nor expenses. He is airway advisor to the Royal College of Anaesthetists. He is an associate editor of the *British Journal of Anaesthesia*.

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References

1. Cook TM, Woodall N, Frerk C. Major complications of airway management in the UK: results of the 4th National Audit Project of the Royal College of Anaesthetists and the Difficult Airway Society. Part 1 Anaesthesia. *Br J Anaesth* 2011; **106**: 617–31
2. Cook TM, Woodall N, Harper J, Benger J. Major complications of airway management in the UK: results of the 4th National Audit Project of the Royal College of Anaesthetists' and the Difficult Airway Society. Part 2 Intensive Care and Emergency Department. *Br J Anaesth* 2011; **106**: 632–42
3. *Fourth National Audit Project of the Royal College of Anaesthetists and Difficult Airway Society*. Major Complications of Airway management in the United Kingdom. Report and Findings. Editors Cook TM, Woodall N, Frerk C. March 2011. Royal College of Anaesthetists, London. Available from http://www.rcoa.ac.uk/document-store/nap4-full-report (accessed 1 July 2016)
4. Woodall N, Frerk C, Cook TM. Can we make airway management (even) safer? Lessons from National audit. *Anaesthesia* 2011; **66**(Supp 2): 27–33

5. Cook TM, Woodall N, Frerk C, *et al*. The College Department Airway Lead and NAP4 follow-up surveys: an announcement. *Bull Royal Coll Anaesth* 2012; **76**: 37–8 (reproduced in the Difficult Airway Society Newsletter November 2012 pp 6–7)
6. Balas EA, Boren SA. Managing clinical knowledge for health care improvement. In: Bemmel J, McCray AT, eds *Yearbook of Medical Informatics 2000. Patient Centred Systems*. Stuffgart, Germany. Schattauer Verlagsgesellschaft mbH, 2000; 65–70
7. Cook TM, Counsell D, Wildsmith JAW. On behalf of the Royal College of Anaesthetists' Third National Audit Project. Major complications of central neuraxial block: report on the 3rd National Audit Project of the Royal College of Anaesthetists'. *Br J Anaesth* 2009; **102**: 179–90
8. Cook TM, Payne S, Anns J. One year on from NAP3: dissemination and clinical changes after the Third National Audit Project of the Royal College of Anaesthetists'. *Br J Anaesth* 2011; **107**: 978–82
9. Association of Anaesthetists of Great Britain and Ireland. Perioperative management of the obese surgical patients 2015. *Anaesthesia* 2015; **70**: 859–76
10. Difficult Airway Society Extubation Guidelines Group. Popat M, Mitchell V, *et al*. Difficult Airway Society Guidelines for the management of tracheal extubation. *Anaesthesia* 2012; **67**: 318–40
11. Checketts MR, Alladi R, Ferguson K, *et al*. Recommendations for standards of monitoring during anaesthesia and recovery 2015. *Anaesthesia* 2016; **71**: 85–93
12. On the Right Trach? A review of the care received by patients who underwent a tracheostomy: National Confidential Enquiry into Patient Outcome and Death June 2014 National Confidential Enquiry into Patient Outcome and Death, London. ISBN 978-0-9926184-1-4
13. Whitaker DK. Time for capnography - everywhere. *Anaesthesia* 2011; **66**: 544–9
14. Higgs A, Cook TM, McGrath BA. Airway management in the critically ill: the same, but different. *Br J Anaesth* Advance Access published on May 4, 2016, doi:10.1093/bja/aew055
15. Cook TM. Capnography for airway monitoring during sedation (and elsewhere) – the winds of change? *Anaesthesia* 2016; **71**: 363–8

Appendix: Post NAP4 National Survey of Airway Management

All questions from question 6 were answered by yes/no and a further question 'Did this change in response to the recommendations of NAP4?' was also answered yes/no. (number of responses)

Department organization

1. Are you aware of the 4th National Audit Project: Major Complications of Airway Management in the UK (also known as NAP4)? (175)
2. Are you aware of the results of NAP4? (175)
3. How did you become aware of the results of NAP4? (175)
   (i) Presentation in your hospital
   (ii) Presentation at a local meeting
   (iii) Presentation at a national meeting
   (iv) Powerpoint presentation on RCoA website
   (v) Read the report online
   (vi) Read the report on paper
   (vii) Read original paper(s) in BJA
   (viii) National press
   (ix) Videocast(s) on College website
   (x) Podbean or You-Tube podcasts
   (xi) I am not aware of NAP4 recommendations
4. Was this process of dissemination satisfactory? (175)
5. Can you suggest a better way (or important additional ways) to disseminate the information? (175)
6. Have the results of NAP4 been presented in your department? (175)
7. Has NAP4 changed your departmental practice? (136)
   not at all/ a little/ more than a little/ considerably
8. Has NAP4 changed your personal practice? (136)
   not at all/ a little/ more than a little/ considerably
9. Does your department have a nominated departmental airway lead? (136)
10. If your department has a nominated Airway Lead, does this role include (136)
    (a) Development or adoption of airway management protocols in all areas of the organisation
    (b) Ensuring the purchase of suitable airway equipment
    (c) Ensuring multidisciplinary training in airway management
11. Does your anaesthetic department have representation on your hospital's procurement committee? (135)
12. Is there a systematic method for ensuring clinicians' competence with newly introduced airway equipment? (136)
13. Is Human Factors training included in airway management training? (136)
14. Are there opportunities for multidisciplinary teams working with the difficult airway to train together (e.g. within simulated scenarios to practice technical and non-technical skills)? (136)
15. Are guidelines and emergency algorithms immediately available in all clinical areas where airway emergencies may arise? (135)
16. Are airway incidents, including near misses, routinely reported and discussed? (136)
    Always Often Rarely Never
17. Are you confident that airway management plans are discussed as part of WHO check before embarking on anaesthesia? (135)
    Always Often Rarely Never
18. Are you confident that difficult airway cases are debriefed more commonly now than before NAP4? (136)

Anaesthesia

1. Does your anaesthetic department have an explicit policy for management of difficult or failed intubation (e.g. formal adoption of the Difficult Airway Society guidelines as a departmental policy)? (136)
2. Does your anaesthetic department provide a service where the skills and equipment are available to deliver awake fibreoptic intubation whenever necessary? (136)
3. Is it routine practice to document whether each patient has had an airway assessment? (136)
4. Is it routine practice to document whether each patient has had an assessment of aspiration risk? (136)
5. Is it routine practice to document the anaesthetic airway plan/strategy? (136)
6. Is capnography used during all intubations for anaesthesia, irrespective of the location? (136)
7. Does training of all clinical staff who intubate patients include interpretation of capnography? (136)
8. Does your hospital have second generation SADs available for both routine use and rescue airway management (i.e. any of i-gel, ProSeal LMA, Supreme LMA, SLIPA, laryngeal tube suction)?

9. Is rapid sequence induction used routinely for patients at high risk of aspiration? (136)
   Always Often Rarely Never
10. Are those who perform cricoid force trained to perform it? (136)
11. Is specific provision made for anaesthetists to evaluate morbidly obese patients before surgery? (e.g. pre-operative assessment clinics or extra time scheduled in lists) (136)
12. Does your organisation have (and use) airway devices and techniques that meet the specific needs of obese patients? (e.g. ramping, Oxford HELP pillow, second generation SADs, RSI etc) (136)
13. Does your department have specific guidelines for the management of extubation? (e.g. has adopted the DAS extubation guidelines or similar) (136)
14. Is capnography available in recovery areas? (135)
15. Is difficult airway equipment readily accessible in recovery areas? (135)
16. Are you confident that your recovery staff are appropriately trained? (e.g. in recognition of airway obstruction, the timing and correct procedures for airway device removal) (136)
17. Do theatres, ICU and ED areas where children are cared for have advanced airway equipment rapidly available to manage airway difficulty in children? (135)
18. Are those performing advanced airway management for children required to be trained in the management of cardiac arrest in children? (135)
19. Are staff working in the recovery area of a delivery suite (including midwifery staff) competency trained and their skills regularly updated? (133)
20. Is training in management of CICV undertaken? (136)
21. Does training in management of CICV include surgical cricothyroidotomy? (135)

Intensive care and the critically ill patient

1. For patients on ICU identified as at risk of airway difficulty, is it routine to make a structured plan which is communicated at shift changes? (e.g. a difficult airway proforma as published in the NAP4 report) (135)
   Always Often Rarely Never
2. Does your ICU have a policy for management of difficult intubation? (e.g. the DAS guidelines or similar) (135)
3. Is capnography used for intubation of all critically ill patients on ICU? (136)
4. Is capnography used for intubation of all critically ill patients outside ICU? (136)
5. Is continuous capnography used in all ICU patients with tracheal tubes (including tracheostomy) who are intubated and ventilator-dependent (except for specific clinical reasons)? (136)
6. Are all clinical staff who work in ICU trained in the interpretation of capnography to detect airway obstruction or displacement? (136)
7. Is an intubation checklist (e.g. including patient preparation, equipment, drugs, team, back-up plans) used routinely for intubation of critically ill patients? (136)
8. Does your ICU have specific plans for management of inadvertent tracheal tube or tracheostomy displacement or obstruction (such as those published in NAP4 or in www.tracheostomy.org)? (136)
9. Does your ICU have immediate access to a difficult airway trolley? (136)
10. Does your ICU airway trolley have the same (or very similar) content and layout as the one used in that hospital's theatre department? (134)
11. Is a fibrescope immediately available for use on ICU? (136)
12. Are trainee medical staff who are immediately responsible for management of patients on ICU trained in simple emergency airway management? (135)
13. Do trainee medical staff have access to senior medical staff with advanced airway skills at all hours? (136)
    Always Often Rarely Never
14. Is a flexible fibrescope used during percutaneous tracheostomy? (136)
    Always Often Rarely Never
15. Is continuous capnography used during percutaneous tracheostomy? (136)
    Always Often Rarely Never
16. Are extra-long or adjustable-flange tracheostomy tubes available for obese patients who have tracheostomies? (136)
17. Does your hospital have defined lines of communication between the teams that manage airway problems related to tracheostomy (ICU, anaesthetic and ENT clinicians)? (136)

Emergency Department

1. Are robust processes in place to ensure the prompt availability of appropriately skilled, senior staff at any time of day or night for emergency airway management in the ED? (136)
2. Does your ED have immediate access to a difficult airway trolley? (135)
3. Does your ED airway trolley have the same (or very similar) content and layout as the one used in that hospital's theatre department? (134)
4. Is a properly trained and skilled assistant always present for airway management in the emergency department? (135)
   Always Often Rarely Never
5. Is a checklist (e.g. as published in NAP4 identifying patient preparation, equipment, drugs, team, and plan for difficulty) used for all ED intubations? (135)
   Always Often Rarely Never
6. Is capnography used routinely for every ED intubation? (135)
   Always Often Rarely Never

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