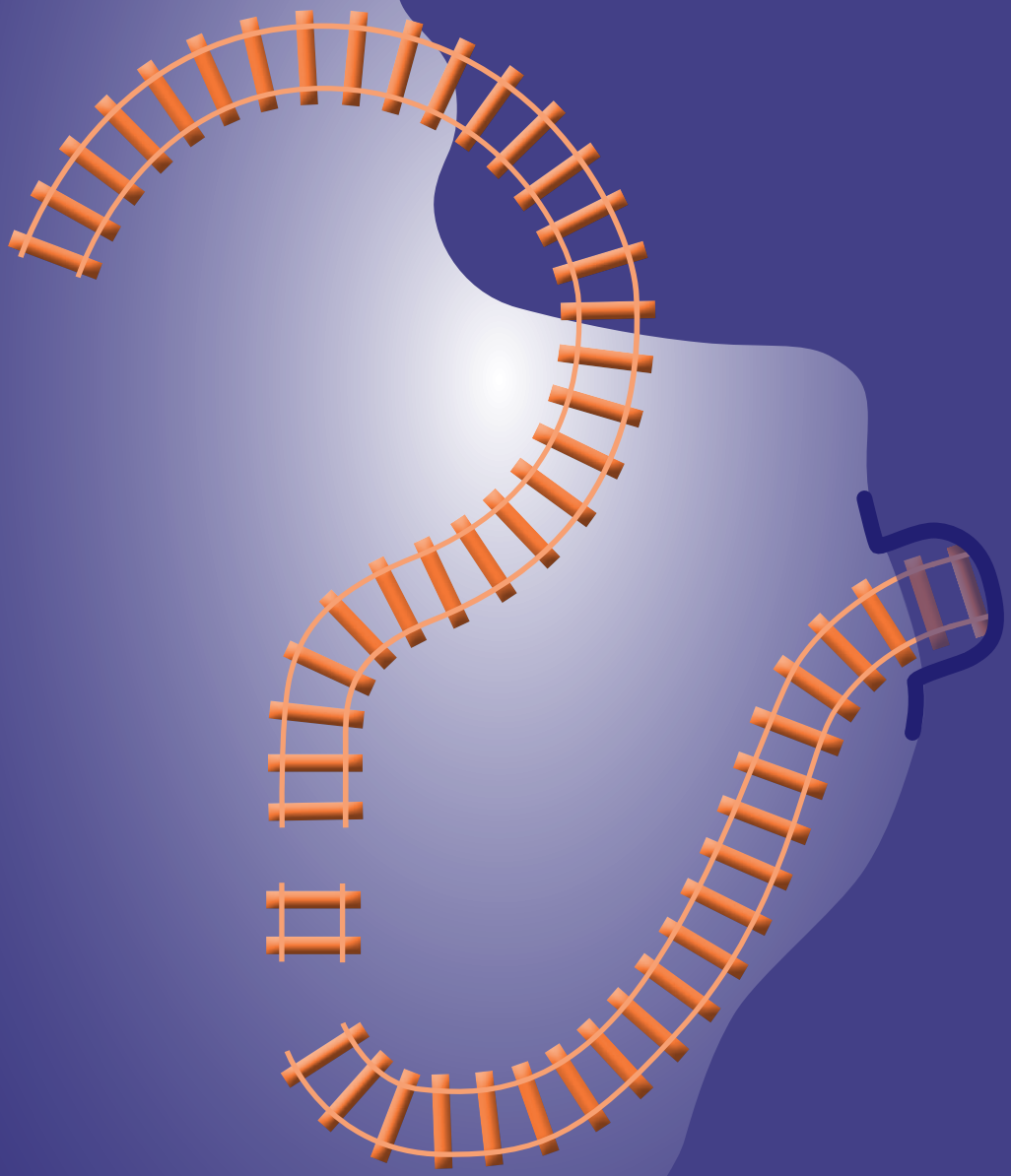
On the Right Trach?

A review of the care received by patients who underwent a tracheostomy



NCEPOD

On the Right Trach?

A review of the care received by patients who underwent a tracheostomy

A report by the National Confidential Enquiry into Patient Outcome and Death (2014)

Compiled by:

K A Wilkinson FRCA FRCPCH
NCEPOD Clinical Co-ordinator (Anaesthetics)
Norfolk and Norwich University Hospitals NHS Foundation Trust

I C Martin LLM FRCS FDSRCS
Former NCEPOD Clinical Co-ordinator (Surgery)
City Hospitals Sunderland NHS Foundation Trust

H Freeth BSc (Hons) MSc RGN MSc – Clinical Researcher

K Kelly BA (Hons), PGC Health Research – Researcher

M Mason PhD – Chief Executive

Study proposed by:
The Association of Anaesthetists of Great Britain and Ireland

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Amanda Thomas, Clinical Specialist Physiotherapist
Anna Perks, Consultant Anaesthetist
Ben Creagh-Brown, Consultant Physician Respiratory and Critical Care Medicine
Carlos Gomez, Consultant Intensive Care and Anaesthesia
Chris Kirwan, Consultant in Critical Care and Renal Medicine
Claudia Russell, Tracheostomy Nurse Consultant
Coral Hulse, Nurse Consultant, Critical Care Outreach
Cyrus Kerawala, Consultant Maxillofacial/ Head and Neck Surgeon
Diane Goff, Speech and Language Therapist
Emma McNeill, Clinical Fellow in ENT
Erica Everitt, Tracheostomy Specialist Practitioner
Gregor McNeill, Consultant in Acute and Critical Care Medicine
Guri Sandhu, Consultant Otolaryngologist
Helen Drewery, Consultant Anaesthetist
Jackie McRae, Specialist Speech and Language Therapist
Jane Hansell, Speech and Language Therapist
Jeremy Sharp, ENT/Head and Neck Consultant Surgeon
Joanna McCormick, Nurse Consultant, Critical Care
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Foreword

There is said to be nothing new under the sun, but tracheostomy takes that proposition to extremes. It may be the only surgical procedure that can be found in both Egyptian records of over 3,500 years BC and the Rig Veda, one of the fundamental texts of Hinduism that also predates the Ramayana by more than a millennium. And it has long been recognised as dangerous: by the 320s BC, when Alexander the Great is supposed to have used his sword to relieve a soldier's upper airway obstruction, Hippocrates had already warned against the procedure, because of the risk of life-threatening haemorrhage from damage to the carotid arteries.

If the value and the dangers of a surgical airway have both been recognised for 2,500 years, it may be surprising that this is the first time there has been a nation-wide study of the quality of care that is delivered to this specific group of patients. This is especially so since in modern times it has moved far beyond being a last ditch expedient to save life. Indeed this study suggests that it is performed about 12,000 times a year in our hospitals. The major change in recent years has been the introduction of percutaneous procedures, now usually performed on the critical care ward, as an alternative to the formal surgical procedure undertaken in the operating theatre. These were introduced in 1985 and made up 70% of our study population.

The dangers that so impressed our forebears, such as obstruction and secondary wound infection have proved manageable in the hands of highly skilled staff who are expressly trained to recognise and manage such complications swiftly. In addition, the staff have to be equipped to handle haemorrhage and accidental decannulation safely and confidently. Whilst the guidance is clear, it is the implementation of good practice across a complex care pathway that NCEPOD has followed in this study. Our Advisors have been able to suggest improvements at every stage.

The acknowledged background to this study is that NHS funds are under explicit pressure as never before. One of the first casualties when services are under pressure, both from the volume of work and the lack of financial resources, is likely to be training. Patients who are at such risk of respiratory compromise that they may need emergency intervention to relieve airway obstruction, depend upon a highly trained team being readily available. The old stability of personnel within the "Firm" is also now unusual: there is a constant turnover of staff in ITU, as there is in HDU and on Level 1 wards. The only way in which hospitals can maintain safe teams is to recognise training as a continuous process, an intrinsic part of the routine work. To find that over a quarter of hospitals managing these patients say that their staff do not receive training in the management of blocked and displaced tubes seems to be a remarkable discovery. I hope that it will be recognised as an organisational red flag because the vital skills in relation to the "ABC" approach to the patient must be universally available wherever the need is a predictable part of the patient's pathway. "A" must come first, whether it is the patients own Airway or an Adjunct to that airway (such as a tracheostomy). In addition when the need can and should be anticipated, there has to be someone there who is trained and who has kept their skills up to date so that they can reliably recognise and change obstructed and displaced tubes.

One useful role for NCEPOD is to provide an amplifier for the professional voices who need to insist to management that training is not an optional extra or a one-off episode. It has to be part of the day to day work of a unit managing these patients. There is no excuse

for ignoring the National Tracheostomy Safety Project – especially since their 2013 Manual can be downloaded as an App for the manager's mobile phone.

Less obvious to the layman may be the need for appropriately trained specialist physiotherapists. Or for speech and language therapists who are trained to perform fibreoptic examination of swallowing. A properly set-up unit aiming to deliver optimal care will also have nutritionists, who are trained to look after the complex needs of these patients and whose contribution is respected by the rest of the team.

It is worrying to find that so many places may be doing badly in so many of these respects.

As usual, it is hard to tell whether these corners are being cut because of the lack of resources in a service striving to respond to the Nicholson Challenge. Training is not cheap, nor is a full range of specialists, but other issues that can readily be resolved within shrinking resources do not seem to be faring much better. Keeping a simple list of those who have been trained to provide these services costs nothing and may save lives. The essence of this problem is that you should not have to look round to find someone who is appropriately trained when a predictable emergency arises. To find that such straightforward advice is being widely ignored in hospitals up and down the country is hard to understand. Most of the time you do not need such a list, because the responding nurse knows perfectly well who to call: but the service has to cater for the new locum or bank nurse who suddenly finds herself/himself on their own.

A service that is going to deliver this sort of airway support safely and reliably as well as responding to the emergencies that will inevitably arise is a bit like a three-legged stool: it must have the right staff, the right equipment and the right systems if it is not going to fall over. And they must all be in place and readily accessible.

Those of us with an interest in risk management were impressed to see the spread of WHO checklists from Operating Theatres to Critical Care Units. The Checklist emphasises the importance of planning, of the methodical approach of pausing to identify who is here and why? What are we going to do and what do we need to check before we do it? Something that happens 12,000 times a year needs to be a routine straightforward process, even though it may be immediately necessary to save the life of a sick and frail person.

This report also casts an interesting light on the problems encountered in moving patients safely on to the next stage in their management. In order for these patients need to be discharged, from both the ITU to the wards and from the wards to the community, appropriate support mechanisms need to be in place. Mostly it works well, but our Advisors did find room for improvement.

The Advisors, who as usual represent the mainstream of professional opinion amongst people who deliver this sort of care, are always asked to identify cases where there is room for improvement under three distinct headings: first in the clinical care delivered to these patients, second in the organisation of that care, and third cases where there was room for improvement in both. Naturally, the third is usually the smallest of the three groups. I think it is telling that in this case the third group is the largest, because it points to the close interdependence of training, the provision of equipment and the organisation of care with the clinical delivery of that care. On these findings, places that are falling down clinically are likely to have sub-optimal organisation as well.

As usual we are indebted to all those who have co-operated to make this report happen. There is the usual team of NCEPOD people who have been built up over decades and who are the basis of all our work, the Local Reporters and Ambassadors who ensure that the mechanics of our studies are possible. We must also acknowledge the commitment of individual doctors who have written reports on their own cases, and the staff and co-ordinators who have written the study.

More than usual I am aware that there is a dedicated group of people who had already recognised the problems and will be waiting anxiously to see what we have found. They come from the Intensive Care Society, the National Tracheostomy Safety Project and the other professional groups who are determined to see that the quality of care received by these 12,000 patients a year improves consistently. The Association of Anaesthetists proposed this study and they also provided many of the expert group who, with representatives of the entire multidisciplinary team, designed a national study that would address the questions that they wanted answered. As usual, we must acknowledge the Advisors, our unpaid volunteers who give up so much of their time to scrutinise the care that their service is delivering.

I am grateful to all of you for the work you have done and for providing the opportunity for NCEPOD to be of service. As usual, we will be providing a toolkit to go with this study, which will enable individual centres to benchmark themselves according to these criteria and to identify where they specifically have room for improvement.

Bertie Leigh
NCEPOD Chair

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Principal recommendations

Tracheostomy insertion should be recorded and coded as an operative procedure. Data collection in all locations should be as robust as that for a theatre environment. This will facilitate better care planning and allow for national and local review and audit. *(Medical Directors and National Coding Systems)*

The diameter and length of the tube used should be appropriate for the size and anatomy of the individual patient, therefore an adequate range of tracheostomy tubes needs to be stocked by units. Operators should be aware of the types of tube available and in particular recognize that adjustable flanged tubes are available with inner tubes. Professionals need to continue to work closely with manufacturers to optimise design and tube options for a non standard population. *(Consultant Operators, Theatre and Critical Care Managers and Professional Health Care Bodies)*

All Trusts should have a protocol and mandatory training for tracheostomy care including guidance on humidification, cuff pressure, monitoring and cleaning of the inner cannula and resuscitation. The clinical practices around tracheostomy care should be the subject of local quality improvement initiatives. Tube data should be more clearly recorded and made available for review at bedside and thereafter facilitated by a 'passport' for each patient, with all data included. *(Medical Directors, Directors of Nursing and Health Care Commissioners)*

In order to facilitate decannulation and discharge planning multidisciplinary care needs to be established as part of routine pathway for ALL tracheostomy patients. Whilst on the critical care unit there should be at least daily review, key additional team members should be involved at an early stage. The team composition should be flexible to properly reflect the patient's needs and provide excellent continuity of care. There are several key team members who one would expect should always participate, e.g. physiotherapy, speech and language therapy, outreach nurses and dietitians. Hospitals need to provide adequate staff to ensure this happens routinely and in a timely manner. *(Clinical Directors and Critical Care Managers)*

Bedside staff who care for tracheostomy patients must be competent in recognizing and managing common airway complications including tube obstruction or displacements and as described by the National Tracheostomy Safety Project algorithms. *(Medical Directors and Directors of Nursing)*

Unplanned and night time critical care discharge is not recommended, particularly in patients with a newly formed tracheostomy and/or patients recently weaned from respiratory support. This reinforces the Intensive Care Society's general recommendation about night time discharges. *(Clinical Directors and Risk Managers)*

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Introduction

Historically tracheostomy has been used to remedy upper airway obstruction, to avoid the laryngeal complications of prolonged tracheal intubation and the continued need for the protection and maintenance of the airway in patients with severe neurological injury. It is also now often planned relatively early in the stay of patients on critical care to improve patient comfort, and facilitate weaning of sedation when there is a need for a longer period of ventilation, and the number of temporary tracheostomies has greatly increased in recent years. The development and refinement of the percutaneous technique, improved equipment and the increasing number of critical care physicians trained to perform the procedure have all enabled a temporary tracheostomy to be placed as a bedside procedure. Alongside these developments there has been initiatives such as the National Tracheostomy Safety Project (NTSP)[1] and guidance on best practice[2] which have provided clearer standards of care for the patient.

From 2005 to 2007 the National Patient Safety Agency (NPSA) collected data submitted from 150 Trusts which showed that 53/1085 (5%) of airway incidents reported related to tracheostomies.[3] Fourteen of the 53 incidents were classed as major or life threatening, and it was recognised by the authors that it was likely that only around 10% of all incidents were reported. The fourth National Anaesthesia Audit Project[4] was specifically set up to examine the frequency and characterise the importance of serious airway related complications, and reported from all age groups and in all hospital locations across the UK over a 12 month period. Many different airway devices were implicated in these events, but in critical care the most serious incidents frequently related to tracheostomy. In half of all airway-related deaths and cases of brain damage in critical care the airway problems were attributed to tracheostomy complications.

UK data published after the NCEPOD study had commenced has shown that there is no improvement in long term outcomes in patients who have a tracheostomy placed at an early or late stage on critical care.[5] Therefore whilst performing a tracheostomy is generally considered a safe procedure with a low complication rate with important benefits such as greater patient comfort, there is still some controversy over the timing and risks of insertion in the critically ill patient. It is important to acknowledge that the alternative (longer term endotracheal intubation) is not itself without complications.

Whilst the basis for national competences for tracheostomy care exist, it is clear that they are not yet fully integrated into mandatory training programmes for all health professionals. The emergence of the Global Tracheostomy Collaborative[6] acknowledges that tracheostomy care is an important priority for many modern health care systems, with a membership which ranges from medical students to Harvard professors. Both this initiative and the NTSP also recognise the very important needs of children as well as the very much larger adult population with tracheostomies, and the importance of professionals working collaboratively to share knowledge and expertise.

In parallel the multidisciplinary team in the hospital caring for any patient with a tracheostomy remains large. Part of the challenge of this report has been to carefully consider all the levels of expertise and to provide a useful summary of what is a very large data set and prioritising the recommendations which have emerged (many of which have been already made by other organisations). Ultimately we have provided six key recommendations which we hope will resonate with all those involved in the care of tracheostomy patients, as well as patients themselves, and on which

action is most likely to result in significant improvements in care.

This study was undertaken to help identify the difficulties in the pathway of care for patients with a tracheostomy and in various hospital settings. The NCEPOD report has also highlighted many of the broader issues which impact upon the care of sick and complex patients. These are not unexpected and include the greater numbers of overweight and obese patients that require critical care, as well as revealing the pressure to admit and discharge relatively complex patients at all times of the day and night.

1 – Method and Data returns

Expert Group

A multidisciplinary group of experts comprising health care professionals from intensive care medicine, anaesthesia, respiratory medicine, critical care nursing, ear, nose and throat surgery, maxillofacial surgery, physiotherapy, speech and language therapy, and a lay representative contributed to the design of the study and reviewed the findings.

Aim

The primary aim of this study was to explore factors surrounding the insertion and subsequent management of tracheostomies in both the critical care unit and ward environments by:

- Exploring (percutaneous and surgical) tracheostomy-related complications following insertion in the operating theatre or the critical care unit
- Exploring remediable factors in the care of adult patients (aged 16 and over) undergoing the insertion of a surgical or percutaneous tracheostomy tube
- Assessing the number and variability of percutaneous tracheostomies performed annually in the critical care unit
- Making recommendations to improve future practice.

Objectives

The expert group identified a number of areas of tracheostomy care to be explored in more detail. These included:

- Insertion of the tracheostomy
  - Indications for the tracheostomy
  - Cautions and contraindications
  - Consent
  - Delays
  - Equipment and monitoring
  - Staffing
  - Anaesthesia
- Environment in which the tracheostomy tube was inserted and cared for
- Routine care
  - Essential equipment
  - Cuff management
  - Humidification
  - Suctioning
  - Inner cannulae
  - Dressings
  - Swallowing
  - Oral care
  - Communication needs
- Changing tracheostomy tubes
- Emergencies, common complications and their management
- Decannulation and long term (30 day) follow up
- Facilities
  - Staff capacity
  - Staff competency
  - Number of patients cared for
  - Training
  - Facilities available
  - Policies and procedures

Hospital participation

Data were collected from all hospitals where the insertion of a tracheostomy tube was undertaken in England, Wales, Northern Ireland, the Channel Islands and the Isle of Man. Data were collected from both the National Health Service (NHS) and the Independent sector where applicable.

Within each hospital, a named contact, referred to as the NCEPOD Local Reporter, acted as a link between NCEPOD and hospital staff, facilitating case identification, dissemination of questionnaires and data collection.

Study population

Patients who underwent a new tracheostomy insertion or a laryngectomy between 25th February – 12th May 2013, were included in the study. Patients were identified at the time of tracheostomy insertion or laryngectomy on the critical care unit or in theatre. Data were collected on both surgical and percutaneous tracheostomies. Where available, the following OPCS codes were used to identify patients.

- E29 – Excision of larynx
  - E29.1 - Total laryngectomy
  - E29.6 - Laryngectomy not elsewhere classified
  - E29.8 - Other specified
  - E29.9 - Unspecified

- E42 – Exteriorisation of trachea
  - E42.1 - Permanent tracheostomy
  - E42.3 - Temporary tracheostomy
  - E42.8 - Other specified
  - E42.9 - Unspecified

Exclusions

Only patients who underwent the creation of a new tracheostomy were included in the study. Therefore patients who were coded with the following OPCS codes were excluded:

- E42.2 - Cricothyroidostomy
- E42.4 - Revision of tracheostomy
- E42.6 - Replacement of tracheostomy
- E42.5 - Closure of tracheostomy
- E42.7 - Removal of tracheostomy tube

Patients aged 15 and younger were not included in the study.

Case identification

Patients were identified at the point of tracheostomy insertion either on the critical care unit or in theatre.

A study contact was set up in the critical care unit and in theatre, and one of their main roles was to identify cases and notify the details of the cases to NCEPOD (either directly or via the Local Reporter).

Once a patient was identified as having undergone a tracheostomy insertion, data were collected up to the point of decannulation on, or discharge from, critical care (with a tracheostomy still in place); decannulation, discharge from or day 30 on a general ward; or death. To assist with this, a study contact was also set up to help collate data from the general wards.

Data were subsequently collected in two ways. Questionnaires were either returned directly to NCEPOD and the case details recorded on the database, or case details were notified to NCEPOD using a data collection spreadsheet, and then these details were uploaded to the study database.

Where data were submitted to NCEPOD via a spreadsheet, this was maintained by the Local Reporter (or other nominated study contact) and was sent to NCEPOD on a regular basis in order to track case load (new insertions and discharge from the critical care unit and the ward). This was followed by a request for the prompt return of questionnaires.

Where the data (spreadsheets and/or questionnaires) were not returned reminders were sent.

Questionnaires

Five questionnaires were developed to collect data for this study:

Organisational questionnaire by hospital
This was sent out at the start of the study to all hospitals to identify wards where patients with tracheostomy tubes could be cared for, and to gather data about the approximate number of tracheostomy insertions undertaken; this was to help determine the sampling period required. This questionnaire collected data around staffing capacity and competency, training and hospital policies and procedures.

Organisation of ward care questionnaire
This questionnaire collected organisational data at a ward level rather than at a hospital level. Questions were asked about the number of tracheostomy patients cared for on a monthly basis, and the equipment and facilities available. Data collection for this questionnaire was undertaken on-line.

Tracheostomy insertion questionnaire
A questionnaire was completed at the time of tracheostomy insertion (Figure 1.1) by the consultant/clinician responsible for the procedure or by the most appropriate person. The same questionnaire was used to gather data for both surgical and percutaneous tracheostomy insertions.

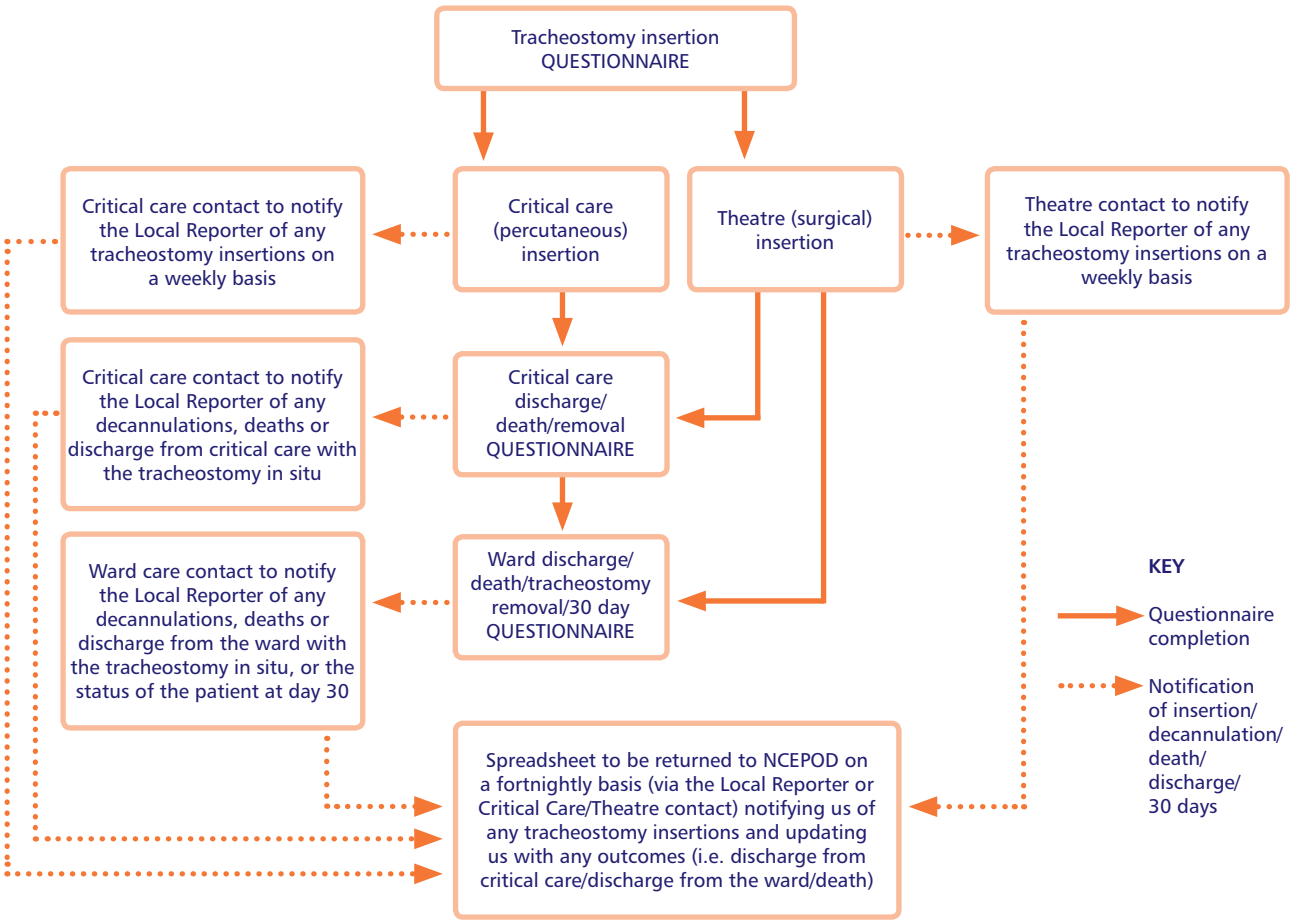

Figure 1.1 Patient pathway for questionnaire completion

Critical care questionnaire

This questionnaire was completed at the time of discharge from the critical care unit to the ward, tracheostomy removal or death, for all patients who were admitted to (or remained on) the critical care unit following their tracheostomy insertion (Figure 1.1). This included patients who had a tracheostomy inserted whilst in the critical care unit and patients who went to the critical care unit following the insertion of a tracheostomy in theatre. As well as collecting clinical data and information about complications, this questionnaire also collected data about the facilities for tracheostomy care in the critical care unit.

Ward questionnaire

This questionnaire was completed for all patients admitted to a ward either from the critical care unit (both surgical and percutaneous) or directly from theatre (Figure 1.1). This was completed at the time of tracheostomy removal, death, discharge from the ward with the tracheostomy in situ, or 30 days post transfer to ward. Again, as well as collecting clinical data and information about complications, this questionnaire collected data about the ward facilities available.

The clinical questionnaires were sent out in packs; each pack contained an insertion, critical care and ward care questionnaire, and also the instructions for completion. Because not all patients had a critical care stay or a general ward stay with a tracheostomy in situ, the completion of all three questionnaires was not required for each patient (Figure 1.1). These study packs were sent out at the beginning of the study based on the number of insertions undertaken annually at each hospital, so they could be completed at the time of tracheostomy insertion.

Case notes

Photocopied case note extracts were requested for two cases per hospital and these were randomly selected by NCEPOD. The requested extracts included:

- Inpatient annotations (main case notes)
- Nursing/speech and language therapy/ physiotherapy notes
- Intensive Care (Level 3)/High Dependency (Level 2) Unit notes
- Anaesthetic records
- Surgical/operation notes
- Observation charts
- Tracheostomy care records
- Ward discharge summaries

Case notes were requested for the time period up to:

- Successful decannulation (either on the critical care unit or a general ward); or
- Death (on the critical care unit or a general ward); or
- Discharge with the tracheostomy in situ from the hospital; or
- Day 30 following admission to a general ward, whichever occurred first.

Advisor group

A multidisciplinary group of Advisors was recruited to undertake peer review of the case notes and associated questionnaires. This group of Advisors comprised clinicians from a number of specialties including critical care medicine, anaesthetics, general medicine, respiratory medicine, oral and maxillofacial surgery, ear, nose and throat (ENT) surgery, plastic surgery, nursing (critical care, critical care outreach, tracheostomy and ENT), physiotherapy and speech and language therapy (SLT). This group also peer reviewed the findings of the larger questionnaire dataset.

Case notes were checked on receipt for completeness. In a majority of cases all of the relevant data were returned, however there were a small number of cases where some of the case notes were missing.

All patient identifiers were removed from the case notes and questionnaires prior to review. Neither the coordinators at NCEPOD, nor the Advisors, had access to patient identifiable information.

After being anonymised, each case was reviewed by at least one Advisor and at regular intervals throughout the meeting the Chair allowed a period of discussion for each Advisor to summarise their case and ask for opinions from other specialties or raise aspects of care for discussion.

Advisors completed a semi-structured electronic assessment, and were encouraged to enter free text commentary at various points. Where the Advisor felt that there was insufficient information available in the case note extracts present in order to make a decision, there was the option to select 'insufficient data'.

The grading system shown in Figure 1.2 was used by the Advisors to grade the overall care each patient received at the time of tracheostomy insertion, during a critical care stay (where applicable), and during a ward stay (where applicable).

Good practice: a standard of care you would expect from yourself, your trainees, and your institution.
Room for improvement: aspects of CLINICAL care that could have been better.
Room for improvement: aspects of ORGANISATIONAL care that could have been better.
Room for improvement: aspects of CLINICAL AND ORGANISATIONAL care that could have been better.
Less than satisfactory: SEVERAL ASPECTS OF CLINICAL AND/OR ORGANISATIONAL care that were well below a standard you would expect from yourself, your trainees and institution.

Figure 1.2 Grading of quality of care

Quality and confidentiality

Each case was given a unique NCEPOD number. The data from all questionnaires received were electronically scanned into a preset database. Prior to any analysis taking place, the data were cleaned to ensure that there were no duplicate records, and that erroneous data had not been entered during scanning. Any fields that contained data that could not be validated were removed.

Data analysis

Following cleaning of the quantitative data, descriptive data summaries were produced.

The qualitative data collected from the Advisors' opinions and free text answers in the clinician questionnaires were coded, where applicable, according to content to allow quantitative analysis. The data were reviewed by NCEPOD Clinical Co-ordinators, a Clinical Researcher, and a Researcher, to identify the nature and frequency of recurring themes.

All data were analysed using Microsoft Access and Excel by the research staff at NCEPOD.

The findings of the report were reviewed by the Expert Group, Advisors, and the NCEPOD Steering Group prior to publication.

Case studies have been used throughout this report to illustrate particular themes.

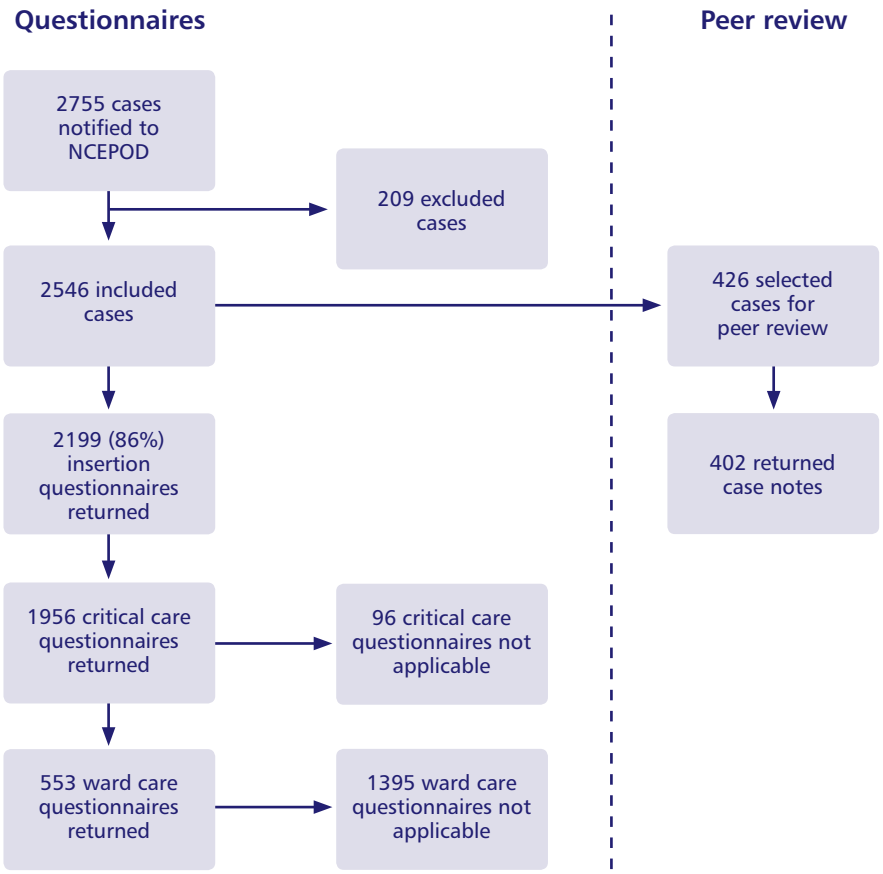

Figure 1.3 Data returns

Data returns

Over the 11 week study period, NCEPOD was notified of 2755 cases of which 209 were subsequently excluded. This gave an overall sample of 2546 included cases. Within this group, 2199 insertion questionnaires were retuned (86.4%). Critical care questionnaires were returned for 1956 patients, and NCEPOD were notified in a further 96 cases that the critical care unit questionnaire was not applicable (the patient did not have a critical care stay). Ward care questionnaires were returned for 553 cases, and NCEPOD were notified in a further 1395 cases that the patient did not have a general ward stay with the tracheostomy in situ and so did not need a questionnaire to be completed (Figure 1.3).

A random sample of case notes was selected for Advisor review. Case notes were limited to two per hospital, giving an overall sample of 426 cases. Of these, 402/426 (94%) sets of case notes were returned.

Study sample denominator by chapter

Within this study the denominator will change for each chapter and occasionally within each chapter. This is because data have been taken from different sources depending on the analysis required. For example, in some cases the data presented will be a total from a question taken from the insertion questionnaire only, whereas some analysis may have required data from the insertion questionnaire and data from the critical care questionnaire.

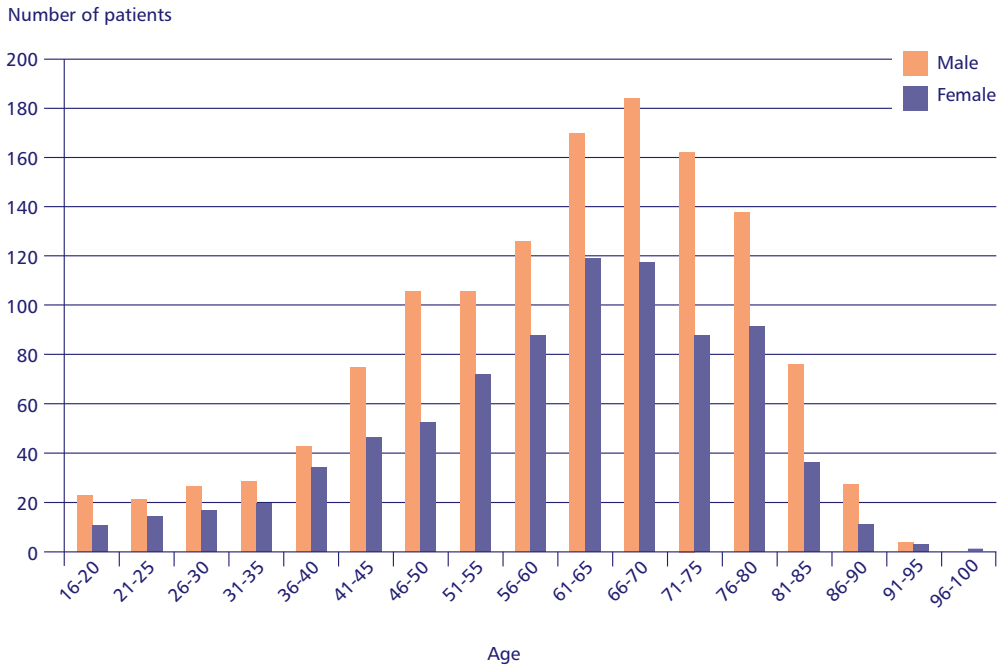

Figure 1.4 Age of patients included in the study

Demographics

Over two thirds of the patients included had their tracheostomy inserted percutaneously and one third surgically (Table 1.1).

Table 1.1 Mode of insertion

	n	%
Percutaneous	1530	69.6
Surgical	669	30.4
Total	**2199**	

Table 1.2 Gender

	n	%
Male	1358	61.9
Female	835	38.1
Subtotal	**2193**	
Not answered	6	
Total	**2199**	

Ages ranged from 16 – 93 and the average age for both male and female patients was 61 years (Figure 1.4) regardless of procedure type.

Of the 2199 cases reported over the study period, 1358 (61.9%) of the sample were male and 835 (38.1%) of the sample were female (Table 1.2). There was very little difference in terms of gender and the mode of tracheostomy insertion with 68% of females and 71% of males undergoing a percutaneous insertion.

A majority of patients were admitted as a result of respiratory disease (703/2139) as their principal diagnosis (Table 1.3).

The greatest difference between gender and age with regard to the principal diagnosis was for trauma; with 8.2% of males being admitted as a result of trauma in comparison to 3.3% of females, and overall more patients aged 16-25 were admitted for trauma.

Table 1.3 Principal diagnosis by gender

	Male		Female		Not answered
	n	%	n	%	n
Respiratory	420	31.7	282	34.9	1
Head & Neck	163	12.3	107	13.2	0
Neurological	158	11.9	106	13.1	1
Cardiac	134	10.1	50	6.2	0
Abdominal Aortic Aneurysm	122	9.2	100	12.4	1
Trauma	109	8.2	27	3.3	0
Sepsis	74	5.6	57	7.0	0
Out of hospital cardiac arrest	42	3.2	9	1.1	0
Abdominal	27	2.0	7	<1	0
Metabolic	25	1.9	25	3.1	0
Renal failure	18	1.4	7	<1	0
Planned operation	16	1.2	12	1.5	0
Urological	12	<1	13	1.6	0
Burns	5	<1	4	<1	0
Vascular	2	<1	3	<1	0
Subtotal	**1327**		**809**		**3**
Not answered	31		26		3
Grand total	**1358**		**835**		**6**

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2 – The organisation of care

For this section data were collected from two sources: at the start of the study, 237 hospitals were identified where the insertion of tracheostomies was undertaken and were sent an organisational questionnaire. Of these, 219 (92%) returned a completed organisational questionnaire (Table 2.1). In addition to this, data were collected on-line at individual ward level. This questionnaire was completed by the ward sister, or a person nominated by them. Questionnaires were returned from 476 wards across 174 hospitals. Of these, 80/476 (17%) were excluded as they were Level 3 units, therefore reducing the denominator to 396 wards from 146 hospitals. Level 2 units were included. The data are presented together and the source indicated as appropriate.

Of the 219 hospitals from which a response was received, in 161 hospitals tracheostomy insertion was undertaken as part of elective practice, 194 as part of emergency practice and in 68 hospitals it was reported that laryngectomies were performed. Table 2.2 displays these data by hospital type.

Table 2.1 Organisational data returns by hospital type

	n	%
District General Hospital (<500 beds)	91	41.6
District General Hospital (≥500 beds)	51	23.3
University Teaching Hospital	58	26.5
Independent Hospital	6	2.7
Single Specialty Hospital	10	4.6
Other	3	1.4
Total	**219**	

There were 50 hospitals where tracheostomy insertion was only undertaken as part of the hospital's emergency practice; which equated to a quarter of all hospitals returning a questionnaire. There were only 68 hospitals where tracheostomy insertion (elective and emergency) and laryngectomies were undertaken.

Table 2.2 Insertion of tracheostomy tube by hospital type

	Elective practice	Emergency practice	Laryngectomies
District General Hospital (<500 beds)	58	77	12
District General Hospital (≥500 beds)	37	49	18
University Teaching Hospital	53	57	35
Independent Hospital	4	3	1
Single Specialty Hospital	8	5	1
Other	1	3	1
Total	**161**	**194**	**68**

Table 2.3 shows the type of ward from which the on-line ward questionnaires were returned. Of those where an answer of 'other' was stated 17/57 stated that their ward was both medical and surgical, and 14/57 were high dependency units.

Table 2.3 Ward type as determined from the on-line ward questionnaire

	n	%
Medical	180	45.5
Surgical	159	40.2
Other	57	14.4
Total	**396**	

The primary function of 47 wards was as a specialist head and neck ward. Just over half of the wards (223/396; 56.3%) included, responded that they were specialist ward – other (Table 2.4). These were wards caring for patients from a particular medical or surgical specialty: a variety of specialties were specified; the most common of these were respiratory wards (58/220; 26%), stroke medicine/neurology (37/220; 17%) and neurosurgery (17/220; 8%). However, 8 of the 220 wards for which a response was given were from specialties that could be recognised as specialist head and neck wards. These were ear, nose and throat (ENT), plastics and maxillofacial surgery.

Table 2.4 Primary function of the ward as determined from the on-line ward questionnaire

	n	%
Specialist head and neck ward	47	11.9
Specialist ward - other	223	56.3
General ward	71	17.9
Other	55	13.9
Total	**396**	

Number of wards

Respondents were asked to specify the number of wards (including the critical care unit) in their hospital where patients with tracheostomies may be cared for. Figure 2.1 demonstrates that in a majority of hospitals patients were most commonly cared for in 2-4 wards (56%; 112/200), however there were a number of hospitals where patients were cared for on 10 or more wards (15/208); these were University Teaching Hospitals (UTH) (11/13) or District General Hospitals (DGH) (<500 beds) (2/13) (Table 2.5).

Table 2.5 Number of wards by type of hospital

	Number of wards													
	1	2	3	4	5	6	7	8	9	10	>10	**Subtotal**	**Not answered**	**Total**
District General Hospital (<500 beds)	6	17	29	11	7	7	6	1	4	1	2	91	0	91
District General Hospital (≥500 beds)	2	10	11	11	3	3	3	3	0	0	0	46	5	51
University Teaching Hospital	0	2	2	7	6	6	4	4	4	6	11	52	6	58
Independent Hospital	4	0	1	0	1	0	0	0	0	0	0	6	0	6
Single Speciality Hospital	1	3	3	1	1	0	0	0	1	0	0	10	0	10
Other	0	2	1	0	0	0	0	0	0	0	0	3	0	3
Total	**13**	**34**	**47**	**30**	**18**	**16**	**13**	**8**	**9**	**7**	**13**	**208**	**11**	**219**

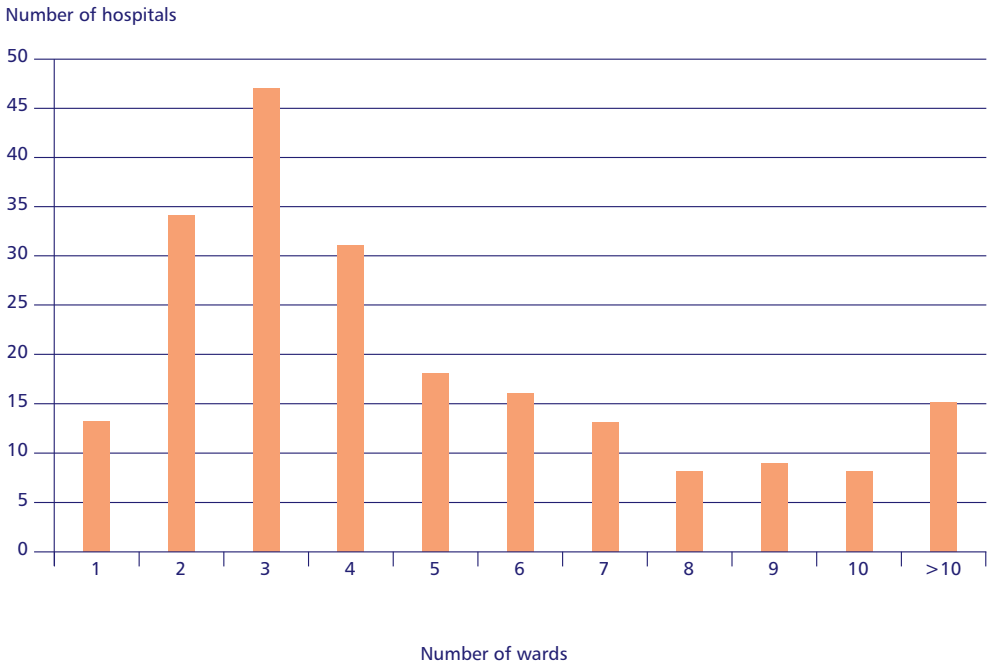

Figure 2.1 Number of wards where patients with tracheostomies may have been cared for *(hospital questionnaire)*

In addition to the hospital organisational questionnaire, data from the on-line ward level questionnaire showed that there were 160 of 220 specialist wards where there might have been expertise or experience to care for patients with tracheostomies (Table 2.6).

There were 38 medical wards and 22 surgical wards of the 220 specialist wards that were specialties that might not have as much experience of tracheostomy care, for example: clinical haematology, diabetic medicine, vascular surgery, and urology.

Table 2.6 Number of wards with expertise/experience with tracheostomies *(on-line questionnaire)*

	Number of wards
Respiratory medicine	58
Stroke medicine/neurology	37
Neurosurgery	17
Cardiothoracic surgery/thoracic surgery/ cardiac surgery	15
Rehabilitation/spinal injuries	14
Ear, nose and throat (ENT)	4
Plastic surgery/burns care	3
Maxillofacial surgery	1

Number of tracheostomies cared for across wards, recorded from the on-line ward level questionnaire

Table 2.7 shows how many patients with tracheostomies were cared for per month on the wards that participated through the on-line ward level questionnaire. Patients who had undergone a surgical tracheostomy were cared for on 315/396 (80%) wards and a percutaneous tracheostomy on 338/396 (85%) wards. Tables 2.7 and 2.8 show that there was a high proportion of wards (including head and neck alone) where fewer than two patients per month were cared for.

The number of tracheostomies undertaken was explored in more detail in relation to the primary function of the ward.

Table 2.7 Surgical and percutaneous tracheostomies cared for per month

	Percutaneous					
Surgical	<2 per month	2-6 per month	>6 per month	**Subtotal**	Unknown	**Total**
<2 per month	203	12	10	**225**	15	**240**
2-6 per month	32	17	1	**50**	3	**53**
>6 per month	13	2	5	**20**	2	**22**
Subtotal	**248**	**31**	**16**	**295**	**20**	**315**
Unknown	4	0	1	**5**	13	**18**
Not applicable	32	3	3	**38**	25	**63**
Total	**284**	**34**	**20**	**338**	**58**	**396**

Table 2.8 Head and neck wards

	Percutaneous					
Surgical	<2 per month	2-6 per month	>6 per month	**Subtotal**	Unknown	**Total**
<2 per month	11	0	0	**11**	0	**11**
2-6 per month	16	3	1	**20**	1	**21**
>6 per month	12	2	0	**14**	1	**15**
Subtotal	**39**	**5**	**1**	**45**	**2**	**47**
Unknown	0	0	1	**1**	0	**0**
Not applicable	0	0	0	**0**	0	**0**
Total	**39**	**5**	**2**	**46**	**1**	**47**

Staffing and equipment

Respondents of the hospital organisational questionnaire were asked whether the hospital had nurses available 24 hours a day 7 days a week who could undertake cuff management, suctioning, the management of blocked/displaced tubes and tube change. Of the 219 responses 212 provided an answer to this question in terms of the number, and types, of wards where patients with a tracheostomy may be cared for. Of these 212 hospitals, details were given on 1014 wards. The following data are presented for the ward type where patients with tracheostomies were most frequently cared for, and also some of the least frequently occurring ward types (Tables 2.9 and 2.10).

Table 2.9 Availability of skills on the most frequently occurring wards where patients may be cared for with a tracheostomy tube in situ *(answers may be multiple)*

		Critical care	Respiratory	General medicine/surgery	ENT/maxillofacial surgery	Neurology/neurosurgery	Cardiothoracic/cardiac surgery	Trauma and orthopaedics	Other
Nurses competent to measure cuff management	Yes	**256**	**95**	**96**	**85**	**59**	**24**	**14**	**45**
	No	4	21	53	6	18	2	6	15
	N/A	1	17	20	2	3	1	3	5
	Not answered	2	4	9	4	1	0	2	5
Nurses competent for suctioning	Yes	261	130	147	92	75	27	21	66
	No	1	3	20	1	4	0	2	0
	Not answered	1	4	11	4	2	0	2	4
Nurses competent for the management of displaced/blocked tubes	Yes	248	96	96	82	53	21	10	39
	No	11	36	68	10	26	6	13	27
	Not answered	4	5	14	5	2	0	2	4
Nurses competent for tube changes	Yes	165	33	27	56	14	16	5	11
	No	94	100	140	36	65	11	18	52
	Not answered	4	4	11	5	2	0	2	5
Total		**263**	**137**	**178**	**97**	**81**	**27**	**25**	**80**

Table 2.10 Availability of skills on the least frequent wards where patients may be cared for with a tracheostomy tube in situ *(answers may be multiple)*

		Gastroenterology	Upper gastrointestinal surgery	Vascular surgery	Haematology	Urology	Hepatobiliary and pancreatic surgery	Diabetic medicine	Breast surgery	Rheumatology	Gynaecology
Nurses competent to measure cuff management	Yes	4	2	2	3	2	3	1	1	0	2
	No	1	3	1	1	1	0	1	1	2	0
	N/A	1	0	1	0	0	0	0	0	0	0
	Not answered	0	0	1	0	0	0	1	0	0	0
Nurses competent for suctioning	Yes	5	2	3	4	3	3	2	2	2	2
	No	1	3	1	0	0	0	0	0	0	0
	Not answered	0	0	1	0	0	0	1	0	0	0
Nurses competent for the management of displaced/blocked tubes	Yes	5	1	1	3	1	3	0	1	1	2
	No	1	4	3	1	2	0	2	1	1	0
	Not answered	0	0	1	0	0	0	1	0	0	0
Nurses competent for tube changes	Yes	1	1	1	2	1	2	0	2	1	2
	No	5	4	3	2	2	1	2	0	1	0
	Not answered	0	0	1	0	0	0	1	0	0	0
Total		**6**	**5**	**5**	**4**	**3**	**3**	**3**	**2**	**2**	**2**

What is clear from Tables 2.9 and 2.10 is that overall there were many wards where cuff management was 'not applicable' and for which it seems unlikely that this will be purely because uncuffed tubes were always used. The availability of skills needed to cope with blocked and displaced tubes is relatively poor in many ward areas outside of the critical care unit and there is great variation by the ward specialty.

Availability of equipment reported by the on-line ward-level questionnaire

Cuff pressure measurement

The National Tracheostomy Safety Project (NTSP)[1] list standards and key performance indicators, which could be used for monitoring compliance to a tracheostomy policy; within this they state that an adequate supply of all necessary equipment should be available on the receiving ward. The availability of equipment to measure cuff pressure on the ward was assessed. Only just over half, (233/396, 59%) of wards from which an on-line ward level questionnaire was received had the equipment to measure cuff pressure on the ward. It was found that the availability of equipment to measure cuff pressure was more frequent in wards where a greater number of patients with tracheostomies were cared for. Table 2.11 shows that, based on proportion, specialist head and neck wards had more equipment available to measure cuff pressure (41/47).

Table 2.11 Availability of equipment to measure cuff pressure

	Yes	No	Total
Specialist head and neck ward	41	6	47
Specialist ward - other	137	86	223
General ward	30	41	71
Other	25	30	55
Total	**233**	**163**	**396**

Where the equipment was available the frequency of cuff pressure measurements was requested (Table 2.12). In the majority of cases, pressure was measured at least every 12 hours (161/218; 74%). Three respondents declared that it was routine to measure cuff pressure hourly.

Table 2.12 Frequency of cuff pressure measurement

	n	%
Hourly	3	1.4
<4 hourly	50	22.9
<8 hourly	43	19.7
<12 hourly	65	29.8
<24 hourly	20	9.2
Other	37	17.0
Subtotal	**218**	
Unknown	16	
Total	**234**	

Of the 37 that answered 'other', 17 specified that cuff pressure was checked as required.

The NTSP recommends that cuff pressure checks should be documented at least once per shift, or in accordance with local guidelines.[1]

Suction

The NTSP states that equipment for the management of the tracheostomy, including suction, should be kept near the patient at all times.[1] And a number of recommendations suggest the importance of having suction equipment available for tracheostomy patients.[1,2,7] The large majority of wards (393/396; 99.2%) had suction available in all bed areas where patients with tracheostomies were nursed.

Oxygen

The NTSP also stated that the receiving ward should ensure that the patient with a tracheostomy or laryngectomy requiring oxygen must have an oxygen supply, and that the oxygen is prescribed on the patient's prescription chart.[1] All except three wards (393/396; 99.2%) had oxygen available in all bed areas where patients with tracheostomies were nursed.

Equipment checks

371/396; (93.7%) of wards had systems in place for checking and recording equipment function. The NTSP recommends that equipment must be checked and that a means of documenting this must be in place.[1]

A relatively large number of wards (356/396, 90%) checked equipment (suction and oxygen) on at least a daily basis on the ward.

Number of tracheostomies performed annually

The number of tracheostomy insertions that were undertaken on an annual basis was requested for each hospital. For the 187/219 (85.4%) hospitals where an answer was given, this figure ranged between 1-375, with an average of 64 between 1st April 2011 – 31st March 2012.

In half of cases this number was an estimate (54.3%, 101/186), with the actual number undertaken being given in 44.8% of hospitals (82/183). This was broken down further to look at how many were undertaken in the critical care unit and theatre. The number undertaken in the critical care unit ranged between 1 – 275 with an average of 44, and in theatre between 1 – 226 with an average of 25 annually. Again in a majority of cases this number was an estimate. The number of tracheostomy insertions undertaken was unknown or not answered by 32 hospitals.

It was reassuring to see from the data provided that the majority of tracheostomies that were performed during this period were likely to have been captured ((64 per month x 219 hospitals)/52 weeks in a year) x 11 week period of data collection). This total of 2964 is similar to the total reported to NCEPOD. This study has also provided a clearer picture of the total number of tracheostomies performed annually, rather than just using estimates.

Organisation of tracheostomy care

Clinical leads

The organisational questionnaire asked whether a medically trained or non-medically trained clinical lead for tracheostomy care was present in each hospital (Table 2.13).

Where a medically trained clinical lead was present the most common primary specialties were critical/intensive care medicine (31/75), ear, nose and throat (23/75) and anaesthetics (13/75). Where a non-medically trained clinical lead was present their primary specialty was nursing in 89 hospitals, physiotherapy in 25 hospitals, speech and language therapy in 6 hospitals and 'other' in 7 hospitals (answers may be multiple).

Table 2.13 Presence of trained leads for tracheostomy care

	Medically trained		Non-medically trained	
	n	%	n	%
Yes	75	34.4	112	51.1
No	143	65.6	107	48.9
Subtotal	**218**		**219**	
Not answered	1		0	
Total	**219**		**219**	

Critical care

Almost all hospitals (218/219) had a critical care unit. The Intensive Care Society standards,[2] the Royal College of Anaesthetists' National Audit Project (NAP4)[4] and the National Tracheostomy Safety Project[1] state that every critical care unit should have immediate access to a difficult airway trolley. The NTSP and the RCoA also recommend that a fibrescope should be immediately available for use in the critical care unit.

Table 2.14 Availability of a difficult airway trolley IMMEDIATELY within the critical care unit

	n	%
Yes	197	90.8
No	20	9.2
Subtotal	**217**	
Not answered	1	
Total	**218**	

Within this study 20/217 hospitals indicated that immediate access to such a trolley was not available (Table 2.14). Of these, 14/20 were DGHs (<500 beds), 5 UTHs and one was an Independent hospital.

Table 2.15 Available equipment to perform bronchoscopy/ fibreoptic laryngoscopy IMMEDIATELY within the critical care unit

	n	%
Yes	162	77.5
No	47	22.5
Subtotal	**209**	
Not answered	9	
Total	**218**	

Only 162/209 hospitals had the equipment to perform bronchoscopy/fibreoptic laryngoscopy immediately available (Table 2.15). Of the 47 hospitals where there was not equipment available 24/47 were DGHs (<500 beds), 13/47 were DGHs (>500 beds), and 6 were UTHs. It is acknowledged that there is now single use endoscopy equipment which is becoming increasingly available. Although data on the use of these were not collected as part of this study it is hoped their use will improve compliance in the future.

A Critical Care Outreach Team was present in 81.3% (171/178) of hospitals. Of these, 96% (169/176) supported the care of patients in hospital with a tracheostomy; however this service was only available 24 hours a day 7 days a week in 41.1% (71/173) of hospitals. When combined with the data which demonstrated the lack of access of specialty wards with expertise to manage tracheostomies 24 hours per day, this raises questions as to what arrangements are in place in these hospitals to ensure safe management of tracheostomies over the full 24 hour period.

Availability of ward bedside emergency airway equipment

From the on-line data most wards (380/396, 96%) had bedside emergency airway equipment available which was able to move with the patient on the ward (Table 2.16). The NTSP recommended that emergency equipment must remain immediately available at the bedside and accompany the patient if they leave their base location.[1]

Table 2.16 Bedside emergency airway equipment available determined from the on-line ward data

	n	%
Yes	380	96.0
No	16	4.0
Total	**396**	

Table 2.17 Difficult airway trolley immediately available within the unit

	Yes	No	Total
Specialist head and neck ward	34	13	**47**
Specialist ward - other	93	130	**223**
General ward	40	31	**71**
Other	25	30	**55**
Total	**192**	**204**	**396**

Table 2.18 Equipment to perform airway endoscopy

	Yes	No	Total
Specialist head and neck ward	31	16	**47**
Specialist ward - other	18	205	**223**
General ward	16	55	**71**
Other	6	49	**55**
Total	**71**	**325**	**396**

Approximately (192/396, 48.5%) wards had a difficult airway trolley immediately available on the ward. The NTSP also recommend that equipment may be in the form of a dedicated case or box that accompanies the patient, or be stocked on a difficult airway trolley in the critical care unit area. This equipment should include suction.[1] NAP4 recommends that the difficult airway trolley should have the same contents and organisation as the difficult airway trolley used in the theatre suite of the same hospital.[4] Table 2.17 shows that proportionally more wards that had a difficult airway trolley immediately available were specialist head and neck ward (34/47).

Only 17.9% (71/396) of the wards had the equipment available to perform airway endoscopy immediately available. Of these, 71 wards, (just under half, 44%) were from wards where the primary function was specialist head and neck (Table 2.18).

The NTSP state that additional equipment and fibreoptic scopes should be available at all hospitals (including wards) where patients with a tracheostomy are cared for.[1] NICE released guidelines in 2013, which indicated the cost and safety benefit for having these disposable scopes immediately available.[8]

Capnography

NAP4 recommended that capnography must be available at each bed space in critical care and should be continuously used while patients are ventilator dependent.[4]

Completion of a set of supplementary questions was requested, specifically relating to the availability and use of capnography in the critical care unit areas where patients with tracheostomies were cared for. Details were given for 333 critical care areas in total, from 198 hospitals.

Whilst in the majority of critical care areas (286/312; 91.7%), bedside capnography was available for intubation/ tracheostomy insertion at all times, it was noticeable that it was absent in 6.4% of wards (Table 2.19).

Table 2.19 Availability of bedside capnography for intubation/tracheostomy insertion at all times

	n	%
Yes	286	91.7
No	20	6.4
Yes - other	6	1.9
Subtotal	**312**	
Not applicable	4	
Unknown	2	
Not answered	15	
Total	**333**	

Within this sample, continuous capnography was used in 218/305 (71.5%) critical care areas (Table 2.20). Where the answer 'other' was given, it was frequently the case that capnography was used, but only when asked for by medical staff. The use of continuous capnography monitoring ensures that loss of an artificial airway (ET tube or tracheostomy) is identified rapidly. This means that in more than one in four critical care areas, this key safety measure was not consistently in place. This goes against the NAP4 recommendation.

Theatre

There was a theatre available 24 hours a day 7 days a week, staffed to deal with emergency and urgent surgery in 93.8% of hospitals (199/219).

Table 2.20 Continuous bedside capnography used at all times when ventilated

	n	%
Yes - for all beds	218	71.5
Yes - for some beds	23	7.5
Other	11	3.6
No	53	17.4
Subtotal	**305**	
Unknown	1	
NA	12	
Not answered	15	
Total	**333**	

On-site head and neck specialist surgery cover was available 24 hours a day 7 days a week in only 32% (70/219) of hospitals. Of those where it was present, this included a resident trainee clinician in 48/66 hospitals, and a dedicated on-call consultant in 55/63 hospitals. It is appropriate to comment that consultant cover would not have been permanently on-site, but available when needed.

Of the 10 Single Specialty Hospitals (SSH) six had on-site specialist surgical cover available 24 hours a day 7 days a week with the relevant competencies for the care of tracheostomies. Of these 6 also had a resident trainee clinician and dedicated on-call consultants.

Just over half of hospitals (110/217; 50.7%) had an anaesthetist competent in endoscopic intubation on-site 24 hours a day 7 days a week. Of these 90/110 included a resident trainee clinician, and 84/104 included a dedicated on-call consultant, although not on-site at all times.

Table 2.21 Presence of a specialist head and neck ward and theatre

	Specialist head and neck ward		Specialist head and neck theatre	
	n	%	n	%
Yes	76	34.7	88	40.9
No	142	65.3	127	59.1
Subtotal	**218**		**215**	
Not answered	1		4	
Total	**219**		**219**	

Seventy-six hospitals had a specialist head and neck ward, and 88/215 had a theatre (Table 2.21). Of those hospitals where there was a specialist theatre, 79/86 had dedicated specialist head and neck theatre staff and of those 17/77 hospitals had such staff who were available 24 hours a day 7 days a week.

In terms of nursing, 46.3% (100/216) of hospitals had specialist head and neck cancer nurses, and 37.7% (81/215) of hospitals had specialist head and neck nurse practitioners. Seventy-nine hospitals (79/211; 37.4%) had tracheostomy care nurses.

Table 2.22 Type of hospital by specialist head and neck centre

Hospital type	Specialist head and neck centre
District General Hospital (<500 beds)	19
District General Hospital (>500 beds)	23
University Teaching Hospital	42
Independent Hospital	2
Single Specialty Hospital	3
Other	1
Total	**90**

Table 2.23 Number of procedures performed by head and neck specialist centre

Number of insertions performed	n
≤20	10
>20 and ≤50	21
>50 and ≤100	16
>100 and ≤200	22
>200	10
Subtotal	**79**
Unknown	6
Not answered	5
Total	**90**

Throughout the remainder of this chapter, some of the data are broken down and explored in more detail in terms of whether the hospital is categorised as a specialist head and neck centre (Tables 2.22 and 2.23). This is defined as any hospital which had on-site head and neck specialist surgery cover 24 hours a day, 7 days a week and/or a specialist head and neck ward, although not necessarily on-site.

Speech and language therapy (SLT)

Within this study, almost all hospitals had a SLT service (Table 2.24), which agrees with the more recent publication from the Royal College of Speech and Language Therapy[9] which states that "all people with critical care needs who have communication and/or swallowing difficulties due to organic, concomitant or psychogenic disorders, should have access to an early, timely, responsive and appropriately skilled speech and language therapy service".

Table 2.24 Availability of SLT in the hospital

	n	%
Yes	217	99.5
No	1	0.5
Subtotal	**218**	
Not answered	1	
Total	**219**	

Where present 99.1% (214/216) offered an inpatient service to the general wards, and in 95.3% (205/215) of hospitals an inpatient service was offered to the critical care unit. These data were examined in more detail to explore the hospital type where such a service was not offered to the critical care unit (Table 2.25).

Table 2.25 SLT inpatient service offered to the critical care unit

	SLT inpatient service offered to the critical care unit				
	Yes	No	Subtotal	Not answered	Total
District General Hospital (<500 beds)	85	5	90	0	90
District General Hospital (>500 beds)	47	3	50	1	51
University Teaching Hospital	56	2	58	0	58
Independent Hospital	5	0	5	0	5
Single Specialty Hospital	9	0	9	0	9
Other	3	0	3	0	3
Total	**205**	**10**	**215**	**1**	**216**

Table 2.26 Specialist head and neck SLT by type of hospital

	Specialist head and neck SLT				
	Yes	No	Subtotal	Not answered	Total
District General Hospital (<500 beds)	40	45	85	5	90
District General Hospital (>500 beds)	32	19	51	0	51
University Teaching Hospital	42	16	58	0	58
Independent Hospital	2	3	5	0	5
Single Specialty Hospital	5	5	10	0	10
Other	1	2	3	0	3
Total	**122**	**90**	**212**	**5**	**217**

Table 2.27 Specialist head and neck SLT by whether or not laryngectomies were undertaken

	Specialist head and neck SLT				
Laryngectomies undertaken	**Yes**	**No**	**Subtotal**	**Not answered**	**Total**
Yes	61	6	**67**	0	**67**
No	56	84	**140**	5	**145**
Subtotal	**117**	**90**	**207**	**5**	**212**
Not answered	5	0	**5**	0	**5**
Total	**122**	**90**	**212**	**5**	**217**

Table 2.28 Specialist speech and language therapy by number of procedures undertaken

Number of insertions performed	**n**	**%**
≤20	16	14.8
>20 and ≤50	39	36.1
>50 and ≤100	24	22.2
>100 and ≤200	19	17.6
>200	9	9.3
Subtotal	**108**	
Unknown	8	
Not answered	6	
Total	**122**	

Fifty-seven percent of hospitals (122/212) had a specialist head and neck, speech and language therapist. Again, these data were looked at in more detail in terms of the hospital type. Specialist SLT were more likely to be present in UTHs (Table 2.26), and were proportionally more likely to be present in hospitals where laryngectomies were undertaken (Table 2.27).

One of the roles of the SLT is to undertake specialised assessment for swallowing[9]; in this study therapists were able to use fibreoptic endoscopic examination of swallowing in 48.2% (92/191) of hospitals. Again this was broken down by hospital type, and proportionally was more likely to be used in UTHs and DGHs (>500 beds) (Table 2.29).

2.29 Fibreoptic endoscopic examination of swallowing by type of hospital

	Fibreoptic endoscopic examination of swallowing				
	Yes	**No**	**Subtotal**	**Not answered**	**Total**
District General Hospital (<500 beds)	32	44	**76**	**14**	**90**
District General Hospital (>500 beds)	20	25	**45**	**6**	**51**
University Teaching Hospital	34	19	**53**	**5**	**58**
Independent Hospital	1	3	**4**	**1**	**5**
Single Specialty Hospital	4	6	**10**	**0**	**10**
Other	1	2	**3**	0	**3**
Total	**92**	**99**	**191**	**26**	**217**

Physiotherapy

Almost all hospitals (217/218; 99.5%) had a physiotherapy unit; of those hospitals where a unit was present, 56.4% (119/211) had specialist physiotherapists for tracheostomy care (Table 2.30).

Table 2.30 Available specialist physiotherapists for tracheostomy care

	n	%
Yes	119	56.4
No	92	43.6
Subtotal	**211**	
Not answered	6	
Total	**217**	

Table 2.31 Specialist physiotherapists by number of procedures performed

	n	%
≤20	21	19.4
>20 and ≤50	37	34.3
>50 and ≤100	22	20.4
>100 and ≤200	20	18.5
>200	8	7.4
Subtotal	**108**	
Unknown	7	
Not answered	5	
Total	**120**	

Where a physiotherapy service was present, 85.4% (175/205) provided daily physiotherapy input (24 hours a day 7 days a week) for patients with a tracheostomy on a general ward, and 93.3% (196/210) provided input (24 hours a day 7 days a week) for patients with a tracheostomy on the critical care unit.

Seventy-five percent of hospitals (150/199) had a planned escalation policy if physiotherapists had concerns regarding a patient. This was not present in 49/199 hospitals, and was not answered in 18 hospitals.

Multidisciplinary team meetings

Hospitals were asked to indicate whether multidisciplinary team (MDT) meetings were held for tracheostomy patients on the critical care unit and on the general ward (Table 2.32).

Table 2.32 Tracheostomy MDT meetings for patients on the critical care unit and the ward

	MDT for critical care patients		MDT for ward care patients	
	n	%	n	%
Yes	49	22.7	56	26.0
No	167	77.3	159	74.0
Subtotal	**216**		**215**	
Not applicable	1		1	
Not answered	2		3	
Total	**219**		**219**	

Table 2.33 MDT for patients on the critical care unit

	Yes	No	Subtotal	Not answered	Not applicable	Total
Specialist centre	21	66	**87**	2	1	**90**
Non specialist centre	26	100	**126**	0	0	**126**

Table 2.34 MDT for patients on the general ward

	Yes	No	Subtotal	Not answered	Not applicable	Total
Specialist centre	29	59	**88**	1	1	**90**
Non specialist centre	26	98	**124**	2	0	**126**

These data were further analysed in view of whether there was a difference between head and neck specialist hospitals (defined as those where there is on-site head and neck specialist surgery cover 24 hours a day, 7 days a week, and/or the presence of a specialist head and neck ward in the hospital).

There was no real difference between specialist and non specialist centres with regard to the number of patients discussed at an MDT for patients on the critical care unit; however a slightly higher number of patients on a general ward were discussed at MDT at specialist centres in comparison to non specialist centres (Tables 2.33 and 2.34)

Respondents were asked to indicate whether they had access to a voice restoration service within their Trust. In those hospitals where laryngectomies were undertaken (n=68) access to such a service was present in 56 hospitals. This question was not answered by 5 hospitals.

Training

The NTSP[1] recommends "Patients with tracheostomies must be cared for by staff that have been appropriately trained and are currently considered competent in tracheostomy care"; the ICS standards[2] state that in every hospital a list should be kept of practitioners competent in undertaking percutaneous tracheostomy insertion. Within this NCEPOD study, such records were maintained in only 12.3% of hospitals for medical staff and 53.7% of hospitals for nursing staff (Table 2.35).

Table 2.35 Records to ensure up-to-date competence and training

	Yes		No		Subtotal	Not answered	Total
	n	%	n	%	n	n	n
Medical	26	12.3	185	87.7	**211**	8	**219**
Nursing	116	53.7	100	46.3	**216**	3	**219**

Furthermore, in only 63.7% (135/212) of hospitals was there reported to be a stated level of competency expected for staff caring for patients with a tracheostomy.

Table 2.36 Records maintained with head and neck specialist hospital and number of insertions.

Number of insertions performed	Medical	Nursing	Total
≤20	3	4	7
>20 and ≤50	1	10	11
>50 and ≤100	3	11	14
>100 and ≤200	3	13	16
>200	2	6	8
Subtotal	**12**	**44**	**56**
Unknown	0	1	1
Not answered	0	2	2
Total	**12**	**47**	**59**

Table 2.37 Delivery of training programmes in accordance with evidence based guidelines on the management of tracheostomy

	n	%
Yes	181	85.4
No	31	14.6
Subtotal	**212**	
Not answered	7	
Total	**219**	

Training was also raised as an issue in NAP4, and was one of the most common contributory factors in the events reported.[4] The NTSP[1] also recommended that training programmes are delivered in accordance with guidelines on the management of a tracheostomy. Trusts responded that training programmes were delivered in accordance with expert consensus on the management of tracheostomy in 85.4% of hospitals; however what these guidelines were was not defined (Table 2.37). Despite reporting a good level of guidelines in existence to support training programmes further on in this report it will be shown that there is still room for improvement given the serious complications which continue to arise.

Where training was provided, this included training in the practice of changes for the emergency re-establishment of the blocked airway in 86.9% (152/175) hospitals, and training in the practice of difficult tube changes in 52.0% (91/175) hospitals.

Policies and procedures for tracheostomy care

The organisational questionnaire was used to collect data on a variety of hospital policies related to tracheostomy care.

Overall management of tracheostomies

There was an approved policy for the overall management of tracheostomies in 172/217 hospitals (Table 2.38).

Table 2.38 Approved policy for the management of tracheostomies

	n	%
Yes	172	79.3
No	45	20.7
Subtotal	**217**	
Not answered	2	
Total	**219**	

In 151/162 hospitals this policy covered the critical care unit, and in 157/166 hospitals this policy covered the general ward. The NTSP recommends "Trusts must have a local policy in place, which outlines the expected management of patients with a tracheostomy or laryngectomy".[1] The same questions were asked around the management of laryngectomies; only 33/63 hospitals where laryngectomies were undertaken and an answer was given, had such a policy. This policy covered the critical care unit in 24/33 hospitals and the general ward in 30 hospitals where an answer was given.

Table 2.39 Guidelines and protocols

	Yes		No		Subtotal	Not answered
	n	%	n	%	n	n
Changing the tracheostomy tube	161	73.5	58	26.5	**219**	0
Humidification and suction of the newly formed tracheostomy	159	73.6	57	26.4	**216**	3
Cuff monitoring	179	81.7	40	18.3	**219**	0
Guideline for feeding/nutritional support of the patient with a tracheostomy	149	69.0	67	31.0	**216**	3
Inner cannula inspection and cleaning	182	83.9	35	16.1	**217**	2

Guidelines and protocols

A number of questions were asked around specific guidelines and protocols (Table 2.39).

73.5 percent of hospitals had a guideline for changing the tracheostomy tube; in 106/158 this guideline was Trust based and in 36/158 it was ward based. Only 157/214 (73.4%) hospitals had guidelines or protocols around humidification and suction of the newly formed tracheostomy tube.

82 percent (179/219) of hospitals indicated they had a guideline or protocol for cuff monitoring. Where it was present, 81/172 hospitals had specific guidelines for different areas within the hospital. Where a guideline was present hospitals were asked to indicate how frequently the guideline states that cuff monitoring is undertaken on the critical care unit and the general ward (Table 2.40). In a majority of hospitals monitoring was undertaken at least once every shift on both the critical care unit and on the general ward.

With regard to feeding/nutritional support of the patient with a tracheostomy, this was present in 69.0% (149/216) of hospitals.

Hospitals were asked whether a protocol or guideline was present for inner cannula inspection and cleaning; this was present in 182/217 hospitals.

Table 2.40 Frequency of cuff monitoring on the critical care unit and general wards

	Critical care	%	General wards	%
Continuous monitoring	7	4.2	2	1.5
Once every shift	71	43.0	66	50.8
More than once a shift	66	40.0	26	20.0
Multiple answers	6	3.6	1	0.8
Other	15	9.1	35	26.9
Subtotal	**165**		**130**	
Unknown	5		29	
Not answered	9		20	
Total	**179**		**179**	

Table 2.41 Frequency of inner cannula inspection on the critical care unit and general wards

	Critical care		General ward	
	n	%	n	%
Hourly	0	0.0	1	<1
Two hourly	24	14.8	26	17.1
Four hourly	76	46.9	69	45.4
Eight hourly	6	3.7	6	3.9
Once every shift	28	17.3	25	16.4
Other	28	17.3	25	16.4
Subtotal	**162**		**152**	
Unknown	8		19	
Not applicable	1		0	
Not answered	11		14	
Total	**182**		**185**	

In 54/174 hospitals it was indicated that there were specific guidelines for different areas within the Trust. Respondents were asked to indicate how frequently the guideline/protocol suggested the inner cannula should be cleaned and inspected in the critical care unit and on the general ward (Table 2.41).

In a majority of hospitals for both the critical care unit and the general ward the guideline states the inner cannula should be checked on a four hourly basis.

Procedures in relation to tracheostomy care

Previous work has shown that loss of communication causes patient anxiety and difficulties participating in treatment decisions, and communication decisions are often overlooked.[1,9] Therefore, an indication was requested on whether there was a policy and/or procedure for patients with tracheostomy or laryngectomy to be able to communicate effectively; this was present in only 63.9% of hospitals (Table 2.42).

Table 2.42 Procedures relating to tracheostomy care

	Yes		No		Subtotal	Not answered
	n	%	n	%	n	n
Procedure for patients with a tracheostomy or laryngectomy to communicate effectively	138	63.9	78	36.1	**216**	3

Table 2.43 Procedure for checking 'safe swallow'

	Yes		No		Subtotal	Not answered
	n	%	n	%	n	n
Procedure and/or tools for checking 'safe swallow', e.g. a swallow screen	208	95.0	11	5.0	**219**	0

It was reported from the majority of hospitals (95%, 208/219) that there were procedures and/or tools for checking safe swallowing (Table 2.43), and this covered both the critical care unit and the ward in most hospitals (the critical care unit – 98%; 192/196, not applicable/ not answered at 11 hospitals; general ward – 98.5%, 198/201, not answered by 7 hospitals). It is not known what detail the procedures for checking swallowing contained, or who was responsible for undertaking the screen, though the high number of procedures/ tools recorded as available for checking swallow in the organisational questionnaire is not supported by clinical data presented later in the report. No data were requested on whether the 'swallow screens' were tailored to the tracheostomy population so it is not possible to comment on this, although good practice would be that a swallow screen for tracheostomy/the critical care unit patients should be differentiated from those for all other patients.

In terms of policies and procedures a number of questions were asked around the resuscitation of patients with a tracheostomy or a laryngectomy, (Table 2.44).

Simple interventions such as administration of oxygen are sometimes done inappropriately in this group of patients, e.g. the mask may be applied inappropriately to the face of a critically ill tracheostomy patient, instead of the neck. Policies and protocols highlighting such matters aim to reduce such oversight.

Just over half of hospitals (116/215) had a resuscitation policy covering the patient with a tracheostomy but whose upper airway may still be patent; 45.3% had a policy which covered the patient who is totally reliant on breathing through the stoma in the neck.

Only 36.6% of hospitals (77/210) had a protocol for the management of neck-breathers who present as an emergency at their hospital. Further to this hospitals were asked to indicate whether the management of neck breathers was covered in mandatory resuscitation training within the Trust. This was included in only 62/217 hospitals, and was not included in the remaining 150 hospitals. This question was not answered by five hospitals.

Table 2.44 Resuscitation policies and protocols

	Yes		No		Subtotal	Not answered
	n	%	n	%	n	n
Resuscitation policy covering the patient with a tracheostomy but whose upper airway may still be patent	116	54.0	99	46.0	215	4
Resuscitation policy covering the patient who is totally reliant on breathing through the stoma in the neck, i.e. a laryngectomy stoma	97	45.3	117	54.7	214	5
Protocol for the management of neck breathers who present as an emergency	77	36.3	135	63.7	212	7

From the on-line ward level data only (103/396, 26%) of wards had bed head signs to state if the patient had had a tracheostomy.

The NTSP states that essential information can be displayed at the bedside to assist in managing an emergency at which the attending staff may not know the history of the patient. They highlight that the use of bed head signs for tracheostomy patients are extremely useful, especially if the patient is not able to communicate.[1]

When assessing the data by ward function (Table 2.45) there were more bed head signs used on specialist head and neck wards than other types of wards. However less than half (19/47) of specialist head and neck wards used bed head signs.

The NTSP described how it can be difficult to tell the difference at the bedside between a laryngectomy and a surgical tracheostomy, particularly close to major surgery. There are many incident reports of patients following a laryngectomy who are mistakenly given oxygen via the face or who have had attempts at managing their upper airway fail because there is no connection between the upper and lower airway.[1]

In 2010, the National Patient Safety Agency recommended that simple bed head signs discriminating between tracheostomy and laryngectomy are a simple measure that may be expected to reduce harm.[10]

The percentage of wards that had bed head signs for laryngectomy patients, shown in Table 2.46, was low (19%). This could be because not all hospitals carry out laryngectomies. However it is possible that patients could have been transferred to a ward at a different hospital where laryngectomy was not undertaken.

Table 2.45 Use of bed head signs by ward function

	Yes	%	No	%	Total
Specialist head and neck ward	19	40	28	59.6	**47**
Specialist ward	53	24	170	76.2	**223**
General ward	18	25	53	74.6	**71**
Other	13	24	42	76.4	**55**
Total	**103**		**293**		**396**

Table 2.46 Bed head signs for laryngectomy patients

	n	%
Yes	75	18.9
No	321	81.1
Total	**396**	

The on-line ward level questionnaire also captured data on whether bed head emergency management algorithms for tracheostomy were available. Only 37.9% (150/396) of wards were answered yes to this.

More specialist head and neck wards, had bed head emergency algorithms available within the ward, however this was still less than half 22/47 (Table 2.47).

Table 2.47 Bed head emergency management algorithms for tracheostomy available

	Yes	No	Total
Specialist head and neck ward	22	25	47
Specialist ward - other	74	149	223
General ward	31	40	71
Other	23	32	55
Total	**150**	**246**	**396**

There was a clear policy in 350/396 (88%) wards, stating who should be called in an emergency related to an airway in a patient with a tracheostomy (Table 2.48).

Table 2.48 Clear policy on who to call in an emergency related to airway in a patient with a tracheostomy

	Yes	No	Total
Specialist head and neck ward	44	3	**47**
Specialist ward - other	200	23	**223**
General ward	62	9	**71**
Other	44	11	**55**
Total	**350**	**46**	**396**

The most serious communication incidents that were highlighted in the review of reports to the National Patient Safety Agency, occurred when staff could not be contacted in an emergency.[10] The NTSP subsequently recommended the use of bed head signs to detail who to call in an emergency.[1]

Admission straight to a ward

The questionnaire also asked if patients were usually admitted to the ward post operatively from theatre and recovery wards rather than going to the critical care unit. This was the case in 59/396 (15%) of wards. Of these 59 wards which received patients immediately from theatre, more of these were specialist head and neck wards (Table 2.49).

Table 2.49 Usually admitted to the ward immediately post operatively via theatre.

	Yes	No	Total
Specialist head and neck wards	26	21	**47**
Specialist wards - other	15	208	**223**
General ward	11	60	**71**
Other	7	48	**55**
Total	**59**	**337**	**396**

Induction programmes that include the care of tracheostomy emergencies were available in (203/396, 51%) wards. These were more frequent in wards that looked after more patients with a tracheostomy. And were more frequently found on specialist head and neck wards (45/47) (Table 2.50)

Table 2.50 Induction programmes to wards that include care of the tracheostomy emergency

	Yes	No	Total
Specialist head and neck wards	45	2	**47**
Specialist ward - other	105	118	**223**
General ward	27	44	**71**
Other	26	29	**55**
Total	**203**	**193**	**396**

The NTSP outlined the importance of all staff being competent to care for patients with tracheostomies in both routine care and in the emergency situation. This includes designated wards and clinical areas, and also acute services such as acute medical units and emergency departments.[1]

Audit

Problems with tracheostomies have the potential to lead to serious complications for the patient. Regular audit of tracheostomy care is therefore important to identify risks and areas for improvement. As Table 2.51 demonstrates, regular multidisciplinary audit was only undertaken in 46/213 hospitals.

Table 2.51 Regular multidisciplinary audit

	n	%
Yes	46	21.2
No	171	78.8
Subtotal	**217**	
Not answered	2	
Total	**219**	

Where it was undertaken further clarification was requested as to the areas of care that this covered, and the critical care unit was covered more frequently (39/43) than the general ward (26/40).

Table 2.52 MDT by Number of insertions performed and specialist head and neck hospitals

	Yes	No	Subtotal	Not Applicable	Not answered	Total
≤20	10	35	**45**	1	0	**46**
>20 and ≤50	16	48	**64**	0	1	**65**
>50 and ≤100	4	37	**41**	0	0	**41**
>100 and ≤200	7	18	**25**	0	0	**25**
>200	3	7	**10**	0	0	**10**
Subtotal	**40**	**145**	**185**	**1**	**1**	**187**
Unknown	5	17	**22**	0	1	**23**
Not answered	4	5	**9**	0	0	**9**
Total	**49**	**167**	**216**	**1**	**2**	**219**

Table 2.53 MDT by Number of insertions performed and specialist head and neck hospitals

	Yes	No	Subtotal	Not applicable	Not answered	Total
Specialist hospital	21	66	**87**	1	2	**90**
Non specialist hospital	26	100	**126**	0	0	**126**
Subtotal	**47**	**166**	**213**	**1**	**2**	**216**
Not answered	2	1	**3**	0	0	**3**
Total	**49**	**167**	**216**	**1**	**2**	**219**

Discharge planning

Information on the existence of written discharge information being available for patients and carers regarding tracheostomy was requested. Such information was available for patients in 54.4% of hospitals (117/215; not answered by 4 hospitals) and for carers in 50.7% of hospitals, (108/211; not answered by 8 hospitals). Where it was available, further information was requested as to the information this contained, (Table 2.54).

In most cases information was included for patients and carers around discharge to the community, however information around discharge from the critical care unit and discharge from ward to ward was included in just over half of hospitals.

The availability of discharge information was looked at in more detail to explore any differences in the availability of information between specialist (defined as the presence of specialist surgery cover and/or a specialist head and neck ward) and non-specialist hospitals (Table 2.55).

Hospitals were asked whether they had the availability of 24 hours a day 7 days a week contact arrangements for patients who had left hospital with a tracheostomy; this was available in 53.1% (111/209) of hospitals (not answered in 10 hospitals).

Table 2.54 Discharge information for patients and carers where it was available

	Patients		Carers	
	Yes	%	Yes	%
Discharge from critical care	55	51.4	48	46.6
Discharge from ward to ward	53	52.0	48	51.5
Discharge to the community	98	92.5	98	99.0

Table 2.55 Availability of discharge information by specialist and non-specialist centres

	Discharge information for patients					Discharge information for carers				
	Yes	No	**Subtotal**	Not answered	**Total**	Yes	No	**Subtotal**	Not answered	**Total**
Specialist centre	56	32	**88**	2	**90**	53	33	**86**	4	**90**
Non-specialist centre	59	65	**124**	2	**126**	53	69	**122**	4	**126**
Subtotal	**115**	**97**	**212**	**4**	**216**	**106**	**102**	**208**	**8**	**216**
Not answered	2	1	**3**	0	**3**	2	1	**3**	0	**3**
Total	**117**	**98**	**215**	**4**	**219**	**108**	**103**	**211**	**8**	**219**

Key findings

2546 tracheostomies were reported as being inserted across England, Wales, Northern Ireland and the Offshore Islands, during the study period.

The number of tracheostomy insertions undertaken annually could not be provided retrospectively in 32/219 (14.6%) hospitals, and where it could be provided it was estimated in 101/186 (54.3%) cases.

20/217 (9.2%) hospitals did not have immediate access to a difficult airway trolley in the critical care unit.

47/209 (22.5%) of hospitals did not have the equipment to perform bronchoscopy/fibreoptic laryngoscopy IMMEDIATELY available within the critical care unit.

181/212 (85.4%) of hospitals delivered training programmes in accordance with clinical consensus guidelines on the management of tracheostomy insertion.

In 152/175 hospitals (86.9%) training included the re-establishment of a blocked airway.

91/175 (52.0%) hospitals included training on the practice of difficult tube changes.

A protocol to help patients communicate was present in 138/216 (63.9%) hospitals.

116/215 (54%) hospitals had a resuscitation policy covering the patient with a tracheostomy but whose upper airway may still be patent.

97/214 (45.3%) hospitals had a resuscitation policy covering the patient who is totally reliant on breathing through the stoma in the neck.

77/212 (36.3%) hospitals had a protocol for the management of neck breathers who present as an emergency.

Capnography was available in a majority of critical care areas where data were available (286/312; 91.7%), it was used continuously in only 218/305 (71.5%) hospitals.

Regular audit of tracheostomy care was only undertaken in 46/217 (21.2%) hospitals.

Only 63.7% (135/212) of hospitals reported a stated level of competency expected for staff caring for a tracheostomy.

203/295 (68.8%) of hospitals had wards where < 2 patients with either surgical or percutaneous tracheostomy were cared for per month.

Recommendations

1. Tracheostomy insertion should be recorded and coded as an operative procedure. Data collection in all locations should be as robust as that for a theatre environment. This will facilitate better care planning and allow for national and local review and audit. *(Medical Directors and National Coding Systems)*

2. Critical care units need a rapidly available difficult airway trolley/fibreoptic laryngoscopy. This recommendation reinforces the Intensive Care Society and Royal College of Anaesthetists' recommendations. *(Clinical Directors)*

3. Training programmes in blocked/displaced tubes/airways and difficult tube changes should be delivered in accordance with clinical consensus guidelines as stated by the National Tracheostomy Safety Project and the Intensive Care Society. *(Medical Directors and Directors of Nursing)*

4. Capnography must be available at each bed space in critical care and should be continuously used when patients are ventilator dependent. This reinforces the recommendation from NAP4 and others. *(Clinical Directors)*

5. Core competences for the care of tracheostomy patients, including resuscitation, should be set out by all Trusts using existing national resources available. *(Medical Directors and Directors of Nursing)*

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3 - Tracheostomy insertion

There are two main types of tracheostomy insertions, utilising either a percutaneous approach, most commonly undertaken in the critical care unit under general anaesthesia or deep sedation, or an open surgical technique most commonly performed in an operating theatre under general anaesthesia. A number of different types of tracheostomy tube may be used and these are illustrated in Appendix 2.

Whilst there are some common themes which are relevant to both types, there are a number of issues specific to the individual processes and this chapter will concentrate on these, drawing comparisons where appropriate.

Common themes between the two types of insertion

The broad diagnostic groups of the primary underlying conditions as shown in Table 3.1.

Table 3.1 Main diagnostic groups leading to admission

	Percutaneous		Surgical	
	n	%	n	%
Abdominal	192	12.7	31	4.9
Burns	6	0.4	3	<1
Cardiac	138	9.2	46	7.3
Head and neck	24	1.6	246	38.9
Metabolic	37	2.5	13	2.1
Neurological	220	14.6	45	7.1
Out of hospital cardiac arrest	46	3.1	5	<1
Renal failure	19	1.3	6	<1
Respiratory	566	37.6	137	21.6
Sepsis	106	7.0	25	3.9
Trauma	96	6.4	40	6.3
Urological	16	1.1	9	1.4
Planned operation	11	0.7	17	2.7
Vascular (including abdominal aortic aneurysm)	29	1.9	10	1.6
Subtotal	**1506**		**633**	
Not answered	24		36	
Total	**1530**		**669**	

Table 3.2 Main diagnostic groups at the point of decision to perform tracheostomy.

	Percutaneous		Surgical	
	n	%	n	%
Abdominal	1	<1	1	<1
Cardiac	11	<1	4	<1
Head and neck	21	1.4	246	38.9
Neurological	352	23.5	59	9.3
Respiratory	1019	67.9	283	44.8
Sepsis	12	<1	1	<1
Trauma	74	4.9	35	5.5
Vascular (including AAA)	1	<1	0	<1
Mediastinitis	3	<1	0	<1
Burns	6	<1	2	<1
Planned operation	0	<1	1	<1
Subtotal	**1500**		**632**	
Not answered	30		37	
Total	**1530**		**669**	

As can be seen by comparing the main diagnosis at the point of admission (Table 3.1), with the main diagnosis leading to the decision to perform a tracheostomy (Table 3.2), the majority of patients other than those admitted for a head and neck condition or trauma, underwent a trachesostomy because of persistence or deterioration in their respiratory or neurological status.

A large proportion of patients in both groups were assessed as having poor physical status with a high American Society of Anaesthesiology (ASA) score, mainly ASA 3, or 4 (1709/2119; 80.7%) (Figure 3.1).

The majority of patients requiring a tracheostomy were admitted as emergencies as shown in Table 3.3.

It is important to note that the distribution of urgency of admission within the two groups is different, with 89.3% of the percutaneous group having been admitted as emergencies, as opposed to 62.3% of the surgical group (Table 3.4; page 52). This is not surprising as in

Table 3.3 Classification of urgency of admission to hospital

	n	%
Elective	406	18.8
Emergency	1756	81.2
Subtotal	**2162**	
Not answered	37	
Total	**2199**	

199/623 (31.9%) of the surgical cases the procedure was performed as part of a larger planned head and neck surgical procedure.

Admitting specialty

The majority of patients admitted under a surgeon were admitted under general surgery, (169/2106; 8%) or neurosurgery, (163/2106; 7.7%) and the data can be seen in Figure 3.2.

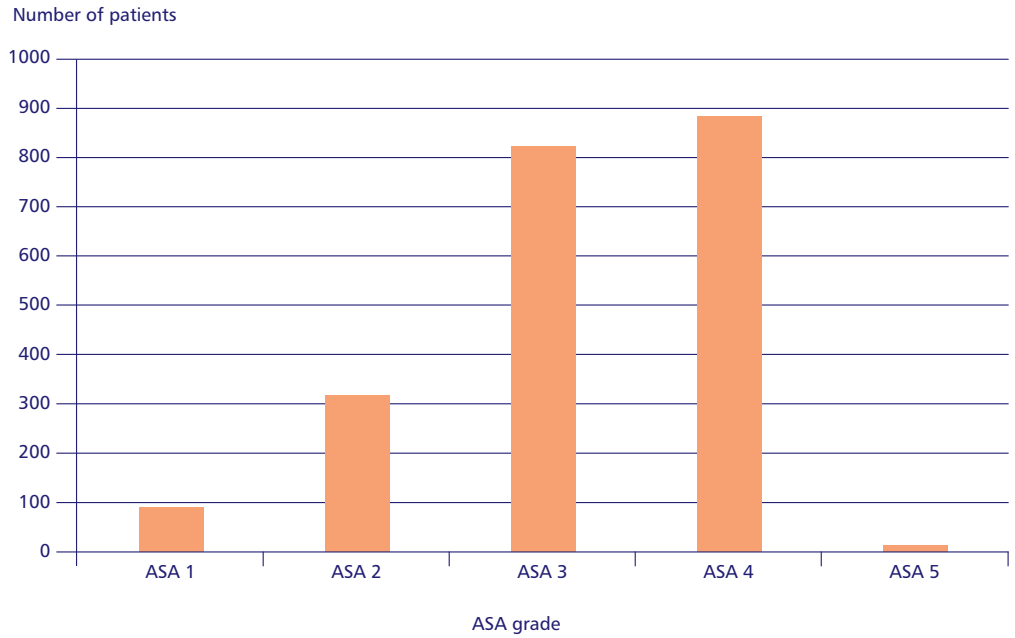

Figure 3.1 ASA status

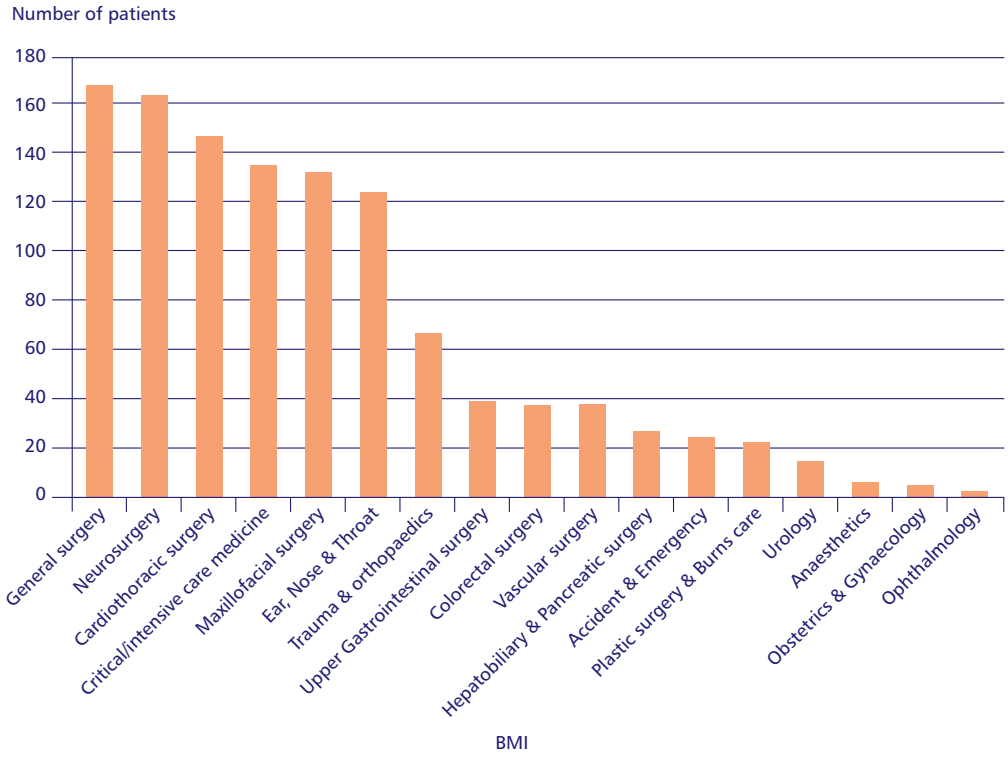

Figure 3.2 Admitting surgical specialties

For patients admitted under a medical specialty, the principal admitting specialties were general medicine (562/2106; 26.7%), respiratory medicine (127/2106; 6%) and cardiology (92/2106; 4.4%) (Figure 3.3).

Approximately half of the patients (1013/2144; 47.2%) were initially admitted to a critical care facility, reflecting the fact that many of these patients were acutely unwell on admission (Figure 3.4).

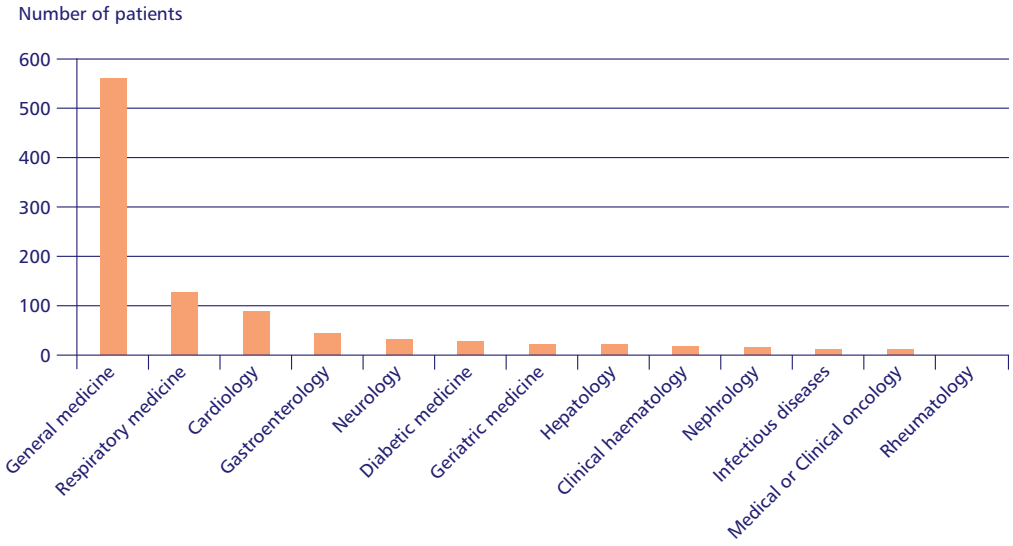

Figure 3.3 Admitting medical specialties

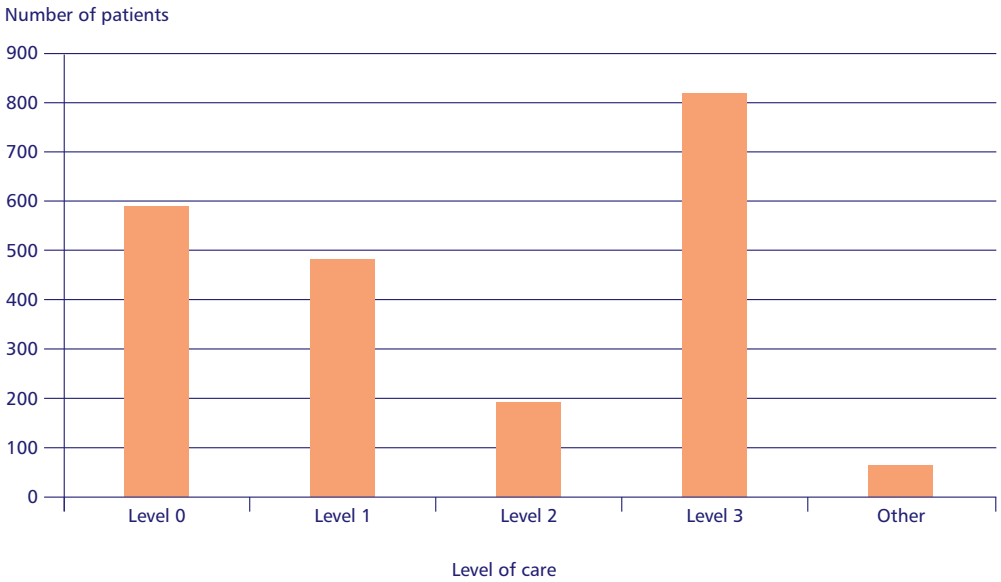

Figure 3.4 Level of care immediately after admission

Immediately prior to tracheostomy insertion, the vast majority of patients were in Level 3 care, (1839/2175; 84.6%) (Figure 3.5).

The indications (which may be multiple) for insertion of tracheostomies in the two groups are shown in Figure 3.6.

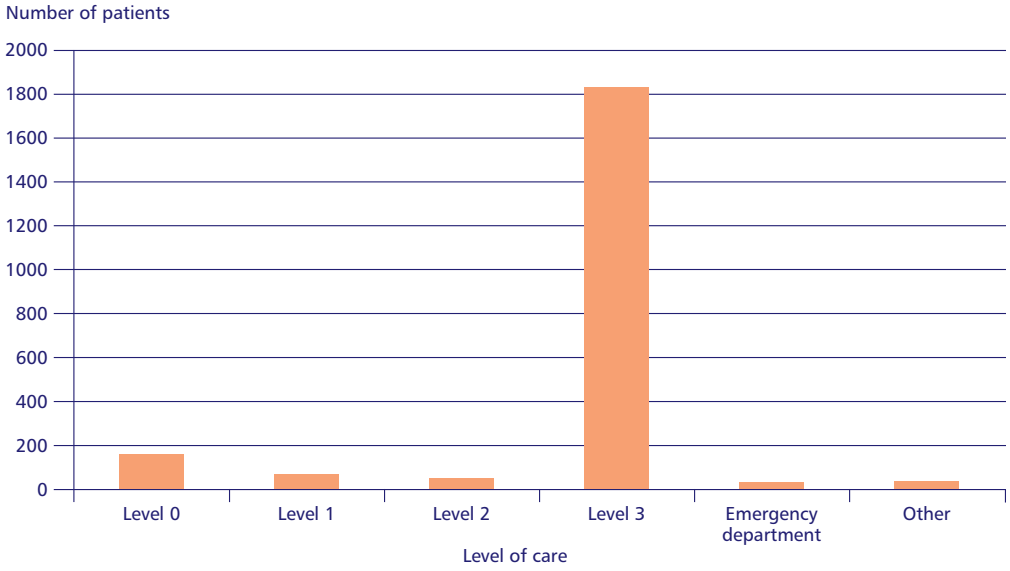

Figure 3.5 Level of care immediately prior to insertion of tracheostomy

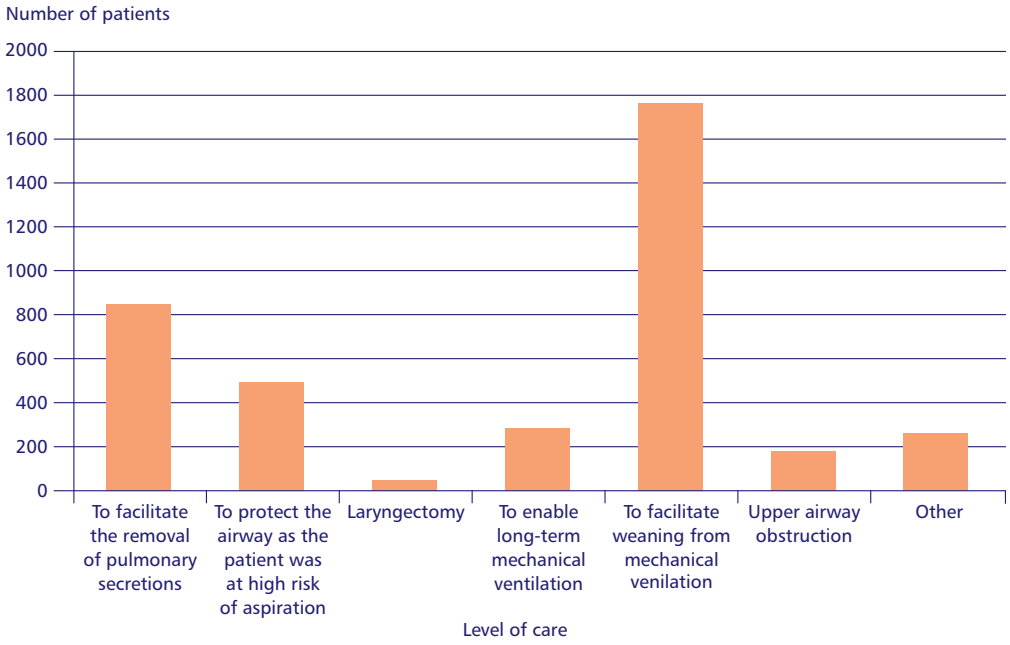

Figure 3.6 Primary indication(s) for insertion of tracheostomy *(Answers may be multiple)*

Table 3.4 Types of insertion technique by urgency of the procedure

	Percutaneous		Surgical	
	n	%	n	%
Elective	162	10.7	244	37.7
Emergency	1353	89.3	403	62.3
Subtotal	**1515**		**647**	
Not answered	15		22	
Total	**1530**		**669**	

When the groups were considered separately, the most common indications for percutaneous insertions were to facilitate weaning, (91.7%; 1399/1525), and or the removal of secretions (46.5%; 709/1525). The picture for the surgically inserted tracheostomies was a little different, with 55%, (360/655) being undertaken to facilitate weaning and 20.6%, (135/655) to facilitate removal of secretions. Only 25/1525 (1.6%) of percutaneous procedures were performed for upper airway obstruction, whereas 147/655 (22.4%) of the surgical procedures were performed because of upper airway obstruction.

Two thirds of patients underwent a tracheostomy as an expedited procedure. Forty-one patients (2%) underwent an immediate life-saving procedure (Table 3.5).

The procedure was performed outside the weekday hours of 08:00 to 18:00 in a total of 127/2085 cases. However, of these only 44/123 (34.9%) cases were classified as either immediate (life- saving) or urgent. By contrast only 11.4% (220/1933) of the tracheostomies performed between 08:00 and 18:00 were classed as immediate or urgent. It is recognized, particularly within the critical care unit environment, that the definition of out of hours, may not reflect the period of time during which a full complement of staff is present and working.

Table 3.5 Urgency of procedure

	n	%
Immediate [Life or limb saving surgery, simultaneous with resuscitation]	41	1.9
Urgent [Acute onset or deterioration of conditions that threaten life, limb or organ survival]	243	11.2
Expedited [Stable patient requiring early intervention for a condition that is not an immediate threat]	1457	67.4
Elective [Surgical procedure planned or booked in advance of routine admission to hospital]	422	19.5
Subtotal	**2163**	
Not answered	36	
Total	**2199**	

Day of insertion

The number of tracheostomies inserted over the weekend was relatively small (221/2195; 10.1%) (Figure 3.7). This suggests that most hospitals did not offer a continuous seven day service.

There was little difference in the percentage of patients undergoing the procedure at weekends between the precutaneous group (9.4%) and the surgical group (11.7%).

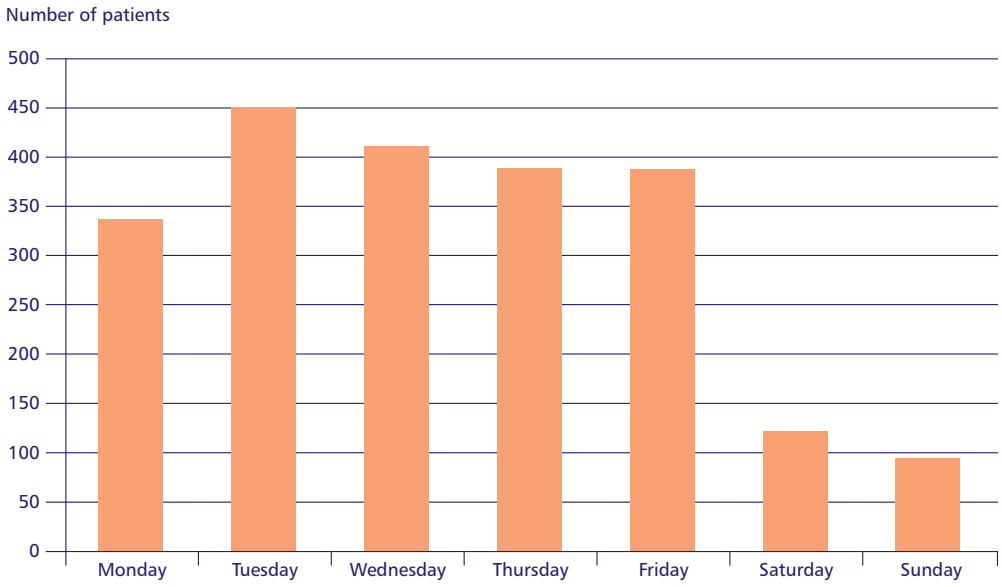

Figure 3.7 Day of insertion

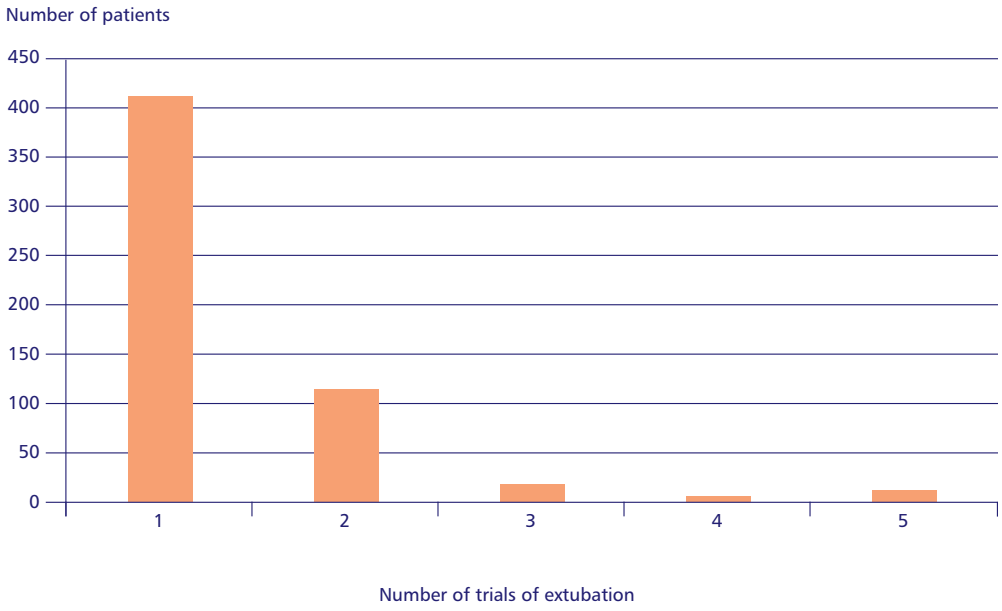

Figure 3.8 Number of trials of extubation prior to tracheostomy

Case study 1

A middle aged patient with liver cirrhosis was admitted with an upper GI bleed and coma due to a subdural haematoma. The patient underwent endotracheal intubation in the emergency department and was admitted to intensive care for ventilatory support. On admission the patient had a low platelet count (56) and an elevated INR (1.5). On reducing sedation, the patient became agitated. The platelet and clotting abnormalities were not corrected. On day four without any systematic attempt at weaning, a percutaneous tracheostomy was performed. On the 2nd post-operative day the patient was stepped down to HDU. Blood clots and blood stained secretions were repeatedly suctioned from the tracheostomy tube. This was thought to be due to local trauma from the tracheostomy tube, and a laryngoscopy was requested from the ENT department, but was not done. Two weeks post-operatively, following a violent episode of coughing which caused local bleeding, the tracheostomy tube was removed by an intensivist and the patient discharged to a general medical ward. A week after decannulation, the patient suffered a major GI bleed. Endotracheal intubation failed, but it was possible to re-intubate through the tracheostomy site, albeit with significant local bleeding. The patient suffered a cardiac arrest, but was successfully resuscitated and taken to theatre, for exploration of the neck and a formal surgical tracheostomy. A bronchoscopy identified bleeding from the right main bronchus. The patient died eight hours later on the intensive care unit.

Advisors questioned whether the tracheostomy had been performed too soon, and without a reasonable systematic attempt to wean the patient. The source of the bleeding from the trachea did not appear to have been adequately investigated, and the tracheostomy tube was removed whilst the patient was continuing to bleed from the tracheo-bronchial tree.

Trials of extubation

Prior to insertion of a tracheostomy a trial of extubation occurred in 565/1890 (29.9%) of patients (excluding those having a tracheostomy as part of a planned head and neck procedure) who received a tracheostomy (Figure 3.8). The percentage of patients having a trial of extubation rose a little to 31.3% (539/1721) where an indication was for removal of secretions and/or to facilitate weaning. In the majority of cases, (410/559; 73.3%) only one attempt at extubation was made.

Indications for insertion

Advisors stated, when reviewing the cases that in the vast majority there was a clear indication for a tracheostomy (Table 3.6).

Table 3.6 There was a clear indication for the tracheostomy

	n	%
Yes	367	97.9
No	8	2.1
Subtotal	**375**	
Insufficient data	18	
Not answered	3	
Total	**396**	

However in 67/300 (22.3%) cases where there was sufficient information to make an assessment, they did not feel that the indication for the tracheostomy had been clearly documented (Table 3.7).

Table 3.7 The indication for tracheostomy was clearly documented

	n	%
Yes	287	81.1
No	67	18.9
Subtotal	**354**	
Insufficient data	32	
Not answered	10	
Total	**396**	

Furthermore of the 291 cases where Advisors had sufficient information to make a judgment, only 183 (62.9%) documented an assessment of airway difficulty (Table 3.8). This assessment is important in order to ensure that an appropriate anaesthetic and operative technique is employed with the appropriate equipment available, and to ensure correct seniority of staff perform the procedure.

Table 3.8 There was an adequately documented assessment of airway difficulty

	n	%
Yes	183	62.9
No	108	37.1
Subtotal	**291**	
Insufficient data	82	
Not answered	23	
Total	**396**	

The failure to adequately document the difficulty of the airway was judged by the Advisors to have caused delay in three cases, critical airway compromise in one case and in two cases was undertaken by an non-consultant when, due to obesity, a consultant should have performed the procedure.

Obesity

Obesity poses greater technical challenges to the insertion of a tracheostomy tube. The distance between the skin surface and the trachea is greater, and patients often have a short neck, so that access is reduced. The equipment and the type of tracheostomy tube used need to be of an appropriate size, both in length and diameter, for the individual patient, standardised tubes may not be satisfactory.

Table 3.9 Classification of BMI where available

	n	%
Underweight	80	4.2
Normal	643	33.7
Overweight	621	32.5
Obese	474	24.8
Morbidly obese	92	4.8
Total	**1910**	

Table 3.10 BMI was recorded or calculated

	n	%
Yes	1910	86.9
No	289	13.1
Total	**2199**	

In 1379 cases a BMI was recorded in the questionnaire (Table 3.9); in 531 cases the BMI was not recorded in the questionnaire but a height and weight were given and the BMI was subsequently calculated (Table 3.10). In 289 patients, the BMI was not recorded and could not be calculated. Therefore, of the 1910 patients for whom the BMI was recorded or calculated, 29.6% of patients were either obese (BMI≥30) or morbidly obese (BMI≥ 40). Recognizing that obese patients are at greater risk of complications, every effort should have been made to obtain weight and height or at the very least make an estimate.

Table 3.11 Potentially difficult neck in the obese and non-obese patients

	The neck was considered potentially difficult							
	Yes		No		**Subtotal**	Unknown	Not answered	**Total**
	n	%	n	%	**n**	n	n	**n**
BMI <30	209	16.2	1080	83.8	**1289**	36	19	**1344**
BMI ≥30	244	44.8	301	55.2	**545**	13	8	**566**
Subtotal	**453**		**1381**		**1834**	**49**	**27**	**1910**
Not answered	85		175		**260**	14	15	**289**
Total	**538**		**1556**		**2094**	**63**	**42**	**2199**

Of the 1289 patients with a BMI less than 30, 209 (16.2%) were judged to have a difficult neck, whereas for those patients with a BMI >30, 244/545 (44.8%) were judged to have had a more difficult neck (Table 3.11).

In 25.7% (538/2094) of all patients their neck was considered to pose difficulties for insertion, but obese patients were clearly more likely to be considered to have a potentially difficult neck.

Advisors did not consider that adequate consideration of the anatomy had been made in 20/288 (6.9%) of cases where it was possible for them to assess this. In 37.1% (108/291) of cases Advisors did not consider that there was adequate documentation of the potential airway difficulty.

Obesity is regarded as a relative contra-indication to percutaneous tracheostomy by many operators, although as more expertise has developed and the techniques and instrumentation have become refined, the indications for percutaneous techniques have been extended and some reports have not identified any difference in the complication rates in obese patients between the two types of procedure.[11] In those patients where BMI could be determined, 178/566 (31.4%) patients with BMI>30 had a surgical procedure as opposed to 388/566 (68.6%) having a percutaneous procedure. Obese patients represented 34.8% (178/512) of the surgical group and 29% (388/1344) of the percutaneous group.

Case study 2

An elderly obese patient (BMI 41) with sepsis and peritonitis secondary to perforated diverticular disease underwent a Hartman's procedure. The patient was transferred to intensive care following surgery. A consultant intensivist performed a percutaneous tracheostomy with a standard length tube 6 days later because the patient failed to wean from the ventilator. The following day, after re-positioning the patient for physiotherapy, the patient de-saturated and suffered a pulseless electrical activity (PEA) cardiac arrest. Blood was suctioned from the tracheostomy tube. Thoracocentesis identified a tension pneumothorax presumed to have arisen from ventilation through a misplaced tube.

Advisors considered that the tube had become displaced because the wrong size had been used, and that there had been inadequate checking of the position of the tube at the time of insertion.

Given that a higher complication rate has been reported in obese patients,[12] and that the majority of serious complications relate to tube obstruction, malposition or dislodgement, the Advisors were concerned that appropriate tubes were not being used in as many patients as they should have been. Adjustable flange tubes with inner tubes are now available and should be used when indicated. In the data presented here, obese patients receiving a percutaneous tracheostomy were less likely to have an adjustable flanged tube inserted (40/359; 11.1%), than the obese patients undergoing a surgical tracheostomy, where 56/151 (37.1%) received an adjustable flanged tube.

Bleeding

There were 252/2115 (11.9%) patients in the study who were known to have a bleeding disorder prior to tracheostomy. In the majority of these patients (183/239; 76.6%), steps were taken in an attempt to correct the abnormality; of these 183 cases, 123 insertions were undertaken percutaneously and 60 surgically (Table 3.12).

Table 3.12 Control of bleeding disorder by mode of tracheostomy insertion

	Mode of insertion		
	Percutaneous	**Surgical**	**Total**
Yes	123	60	**183**
No	40	16	**56**
Subtotal	**163**	**76**	**239**
Unknown	2	2	4
Not answered	5	4	9
Total	**170**	**82**	**252**

Of the 82 surgical patients, four patients had an immediate complication of haemorrhage. This was despite the fact that in all four cases the bleeding disorder had been corrected prior to surgery.

Case study 3

A young patient with leukaemia had previously received chemotherapy and a bone marrow transplant. The patient was admitted with neutropenic sepsis, with a marked thrombocytopenia and generalised oedema. An attempt was made to insert a percutaneous tracheostomy on the intensive care unit, to facilitate weaning, however this was abandoned due to bleeding. The patient was transferred to theatre for an open surgical procedure, which was completed uneventfully, and haemostasis achieved.

Advisors felt that a formal surgical tracheostomy would have been preferable from the outset, following platelet administration.

In the percutaneous group, fourteen patients had an immediate complication of haemorrhage. Within this group the bleeding abnormality had not been corrected prior to the procedure in eight of the 14 patients who experienced a haemorrhage.

Percutaneous Insertion

Timing of insertion

Timing of insertion is controversial. In a recent Cochrane review, the evidence was found to be of poor quality and the potential differences between early and late tracheostomy was felt to require better investigation by means of randomized controlled trials. In particular it was noted that there was no information about any subgroups or individual characteristics which were potentially associated with better outcomes with either early or late tracheostomy.[13] Subsequently, a large multi-centre randomized controlled trial involving patients receiving mechanical ventilation treated in adult critical care departments in the UK; found that tracheostomy

within 4 days of admission to the critical care unit was not associated with an improvement in 30-day mortality.[5] However, early tracheostomy for patients requiring prolonged mechanical ventilation after cardiac surgery was found to be associated with less sedation requirements, better comfort and earlier resumption of autonomy.[14] Early percutaneous tracheostomy has also been associated with a decreased incidence of ventilator associated pneumonia, and an increase in the rate of successful weaning and reduction in length of stay in the critical care unit.[15]

Almost half (45.4%, 675/1486) of the percutaneous tracheostomy tubes were placed within seven days of admission to the critical care unit (Figure 3.9). Fourteen were inserted prior to admission to the critical care unit.

In the majority of cases reviewed by Advisors, where there was sufficient information to make an assessment (333/361; 92.2%), the timing of insertion was judged to be appropriate for the care of those patients. Of the 28 where they did not believe the timing appropriate, Advisors stated that the insertion was premature in eight patients and should have been performed sooner in 11 patients.

From the free text comments it could be seen that Advisors identified cases where their view was that insufficient attempts had been made to wean the patient off ventilation before inserting a tracheostomy. In some instances patients were then moved hastily to a non-critical care environment.

Management of the airway

The majority of percutaneous insertions (95.1%; 1425/1499) were undertaken by consultants or senior specialist trainees in intensive care medicine, (1272/1516; 83.9%) (Figure 3.10). In most cases (1393/1502 (92.7%) a different doctor managed the airway whilst the operator inserted the tracheostomy.

The majority of operators, and practitioners managing the airway were either consultants (777/1496; 51.9%) or senior specialist trainees (380/1496; 25.4%) (Figure 3.11). Staffing deficiencies or delays due to staff availability were very rare, being identified and reported in only 16/1508 cases and 10/341 cases respectively.

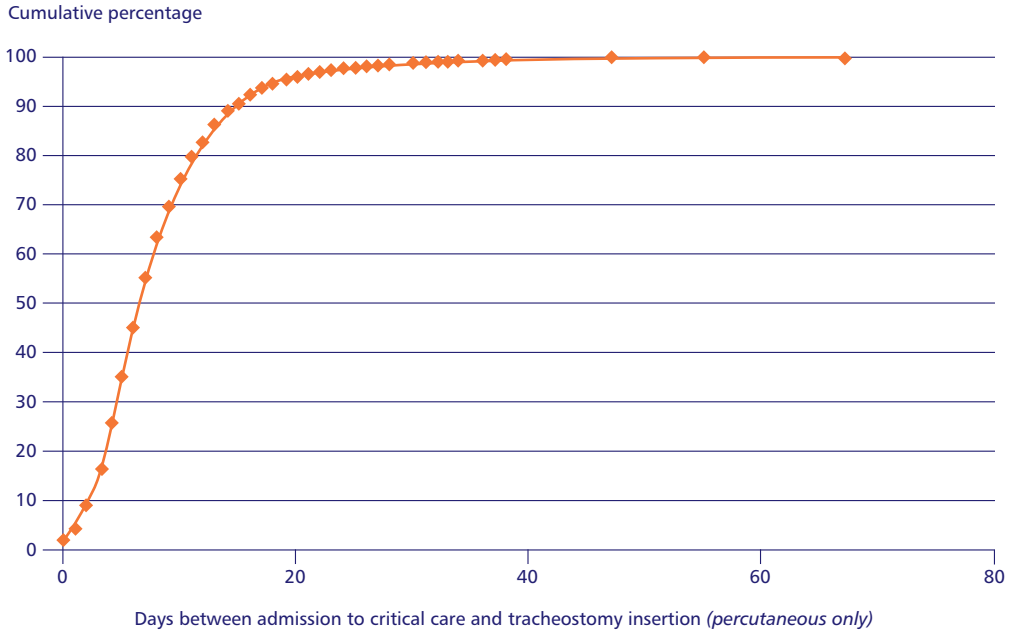

Figure 3.9 Days from the critical care unit admission to insertion

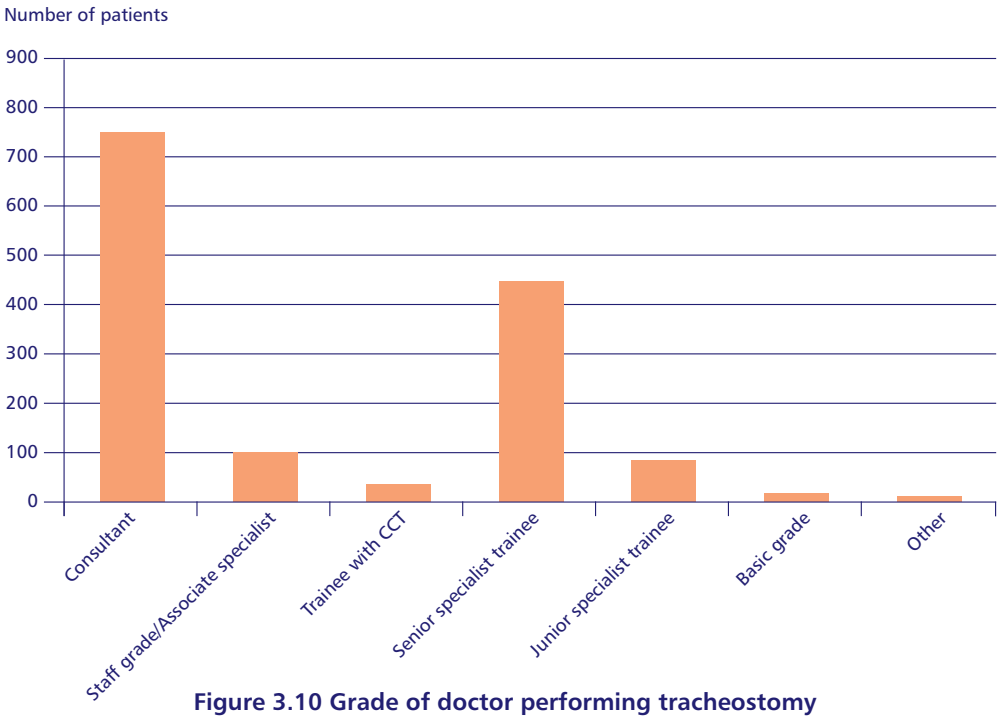

Figure 3.10 Grade of doctor performing tracheostomy

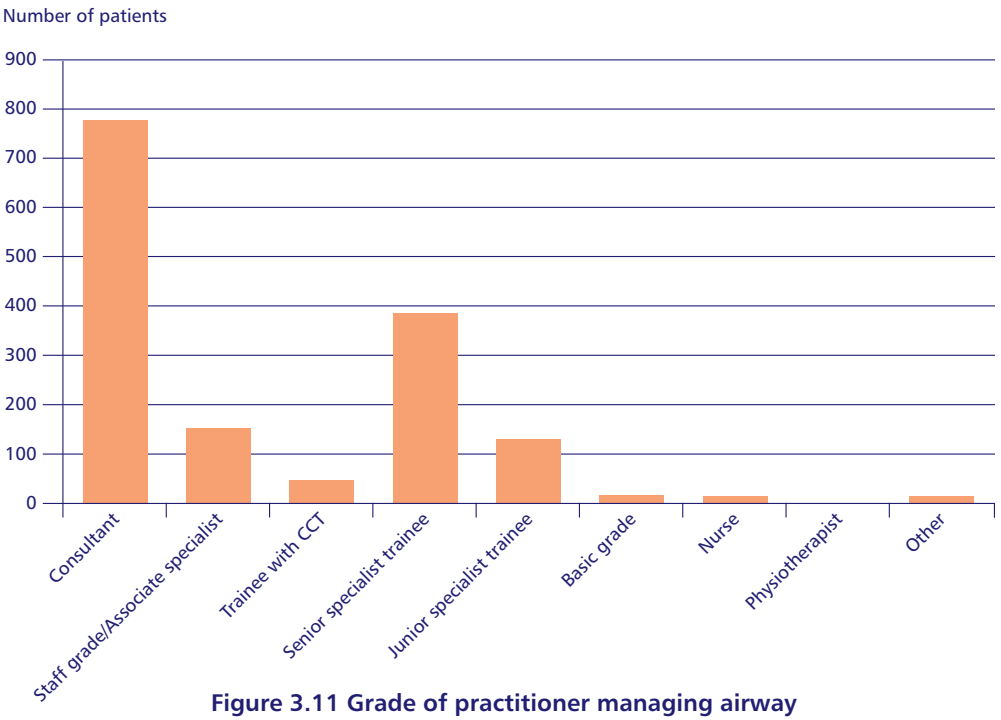

Figure 3.11 Grade of practitioner managing airway

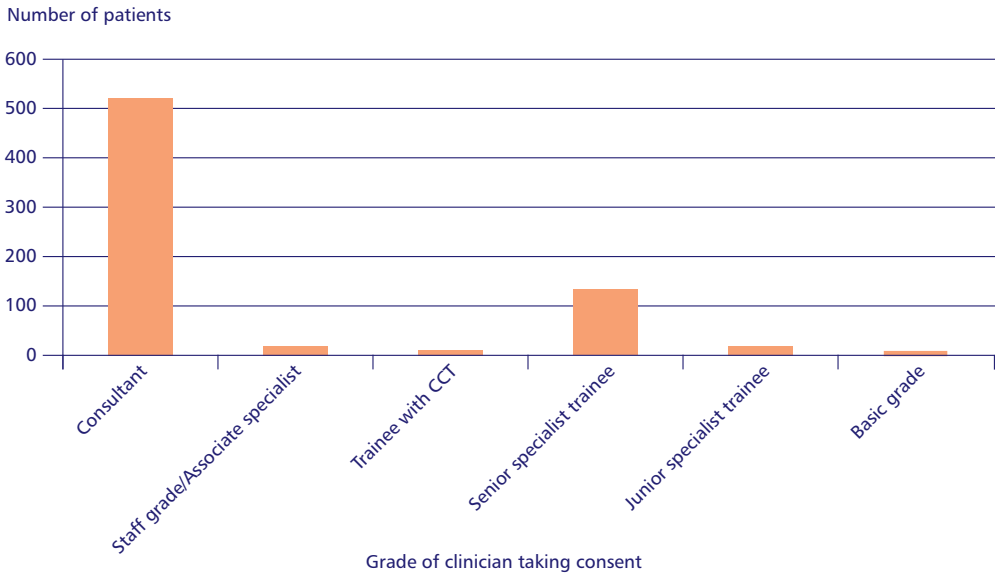

Figure 3.12 Grade of practitioner taking consent

Consent

A consent form was only completed in 728/1491 (48.8%) of those patients receiving a percutaneous tracheostomy. Where consent was obtained, this was usually undertaken by consultants (521/706; 73.8%) or senior trainees (134/706; 19%) (Figure 3.12). The issue of consent in the complex environment of a critical care unit, where many patients lack capacity or require emergency treatment is the subject of considerable debate.[16]

As noted previously, many of the patients receiving a percutaneous tracheostomy were acutely ill, and many were already either anaesthetised, sedated or unconscious prior to insertion of the tracheostomy. It is likely therefore that many of the patients who had no documentary evidence of consent lacked legal capacity as defined under the Mental Capacity Act (MCA) 2005. However, in this situation the General Medical Council (GMC) guidance and MCA would require that appropriate steps are taken by the clinician to assess wherever possible the antecedent wishes of the patient, to take appropriate advice from colleagues and document the steps taken in reaching that decision. In England and Wales the Form 4 consent form is available for recording the process adopted in this situation. Similarly in emergency situations, a practitioner is empowered to provide treatment without patient consent, provided that they act at all times in the best interest of the patient. The GMC would reasonably expect the reasons for undertaking treatment in these circumstances to be documented in the patient's medical record.

In 25 of the 299 cases that could be assessed, Advisors stated that the lack of patient/family information or consent, led to inadequate preparation of the patient for the procedure.

Checklists

Within the surgical operating theatre environment, the use of checklists based upon the World Health Organisation (WHO) checklist have become widespread. The WHO checklist documents the process by which members of the team prepare to undertake a procedure as safely as possible, and subsequently de-brief in order to learn and improve the team functioning and patient care in the future.

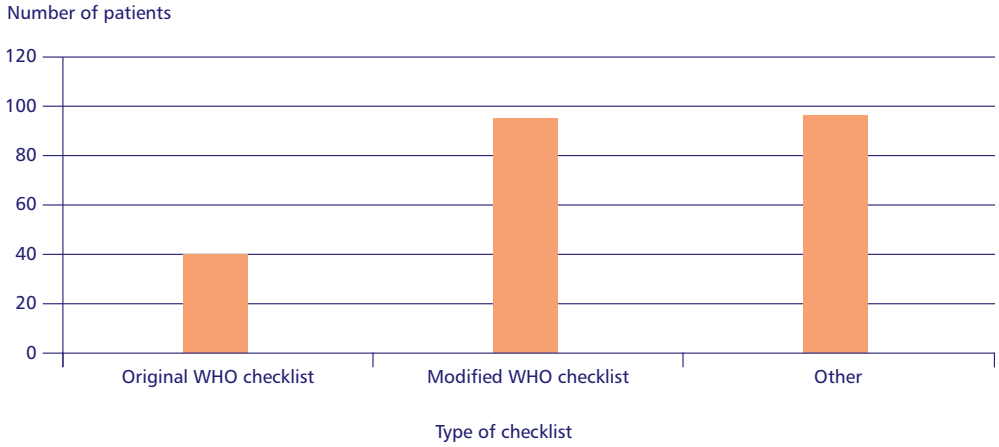

Figure 3.13 Type of checklist used

Where percutaneous tracheostomies were inserted a checklist was used in only 239/1490 (16%) of cases (Figure 3.13).

Very few procedures were performed using the original WHO checklist, however where a checklist was used it was more commonly a modified version (94/230). A percutaneous tracheostomy is a significant surgical procedure and the main difference between this and an open procedure is that in the majority of cases the percutaneous technique is performed outside the theatre environment. Both surgeons and anaesthetists in the UK are very familiar with the WHO checklist process when working in the operating theatre environment, so it is difficult to understand why the same process has not been widely adopted when inserting percutaneous tracheostomy devices in the critical care environment.

Equipment

Deficiencies in equipment were rare (36/1474; 2.4%). The most commonly noted deficiency in equipment, by the clinicians completing the questionnaire, was unavailability of a serviceable bronchoscope (24/32). Advisors identified 22/304 (7.2%) cases where they felt there was a deficiency in the equipment available.

The use of real time ultrasound guidance has been advocated to assist in avoiding damage to vascular structures and to prevent misplacement of the tracheostomy tube. However, in a recent systematic review, the evidence of benefit over traditional landmark-guided techniques was limited[17]. In the current study, ultrasound was used in 484/1471 (32.9%) of patients.

Fibreoptic airway endoscopy was performed in 1270/1502 (84.6%) patients. Of the 1227 cases where information was available, 1124 (91.6%) of the endoscopies were performed by the practitioner managing the airway. The use of airway endoscopy during percutaneous tracheostomy is widely considered to be a considered routine practice in the UK, although this is not uniformly agreed, it is widely regarded as being an important adjunct in certain patients who pose specific difficulties, such as obesity, or otherwise difficult anatomy of the neck.[18] The use of airway endoscopy as an adjunct is recommended by the Intensive Care Society[2], and a survey of practice in 85 intensive care units in the UK found that airway endoscopy was routinely used in 87% of units.[19]

The Intensive Care Society recommends that capnography should be considered as mandatory.[2]

Case study 4

An elderly patient with a BMI of 39 and bilateral pneumonia underwent an attempted percutaneous tracheostomy on the intensive care unit to facilitate ventilation. Bronchoscopy was performed and it was believed that the guidewire was identified within the trachea, however dilation of the tract proved difficult, and when the tube was inserted; no CO_2 was detected on capnography. The procedure was abandoned, and the patient transferred to theatre for an open surgical approach. This proved difficult due to the haematoma and oedema created by the attempted percutaneous tracheostomy, which had created a false passage.

Advisors noted the importance of careful pre-operative assessment, and the value of capnography, even when airway endoscopy is performed.

In the majority of cases (1443/1507; 95.8%), the airway was managed using an endotracheal (ET) tube, immediately prior to tracheostomy (Figure 3.14). In a small number of cases (64/1507) a supraglottic airway device of some sort was used. In 62/1433(4.3%) of cases the airway was considered difficult to re-intubate.

In only six cases did Advisors cite failure to check the equipment as cause of inadequate preparation of the patient. In only four cases the Advisors stated that inadequate preparation, either in terms of consent, preparation of the patient or equipment factors was that due to the urgency of the situation. There were 11/279 (3.9%) cases which were identified by the Advisors as having deficiency of monitoring. In five cases the deficiency identified was a lack of capnography.

Types of tracheostomy tube

The types of tracheostomy tube used are shown in Figure 3.15

The different types of tube are illustrated and described in Appendix 2. Inner tubes permit the lumen to be cleaned to prevent blockage, without removing the outer tracheostomy tube. The adjustable flange permits the length of the tracheostomy tube to be adjusted to suit individual patient anatomy. A sub-glottic port can be incorporated in order to facilitate bronchial toilet

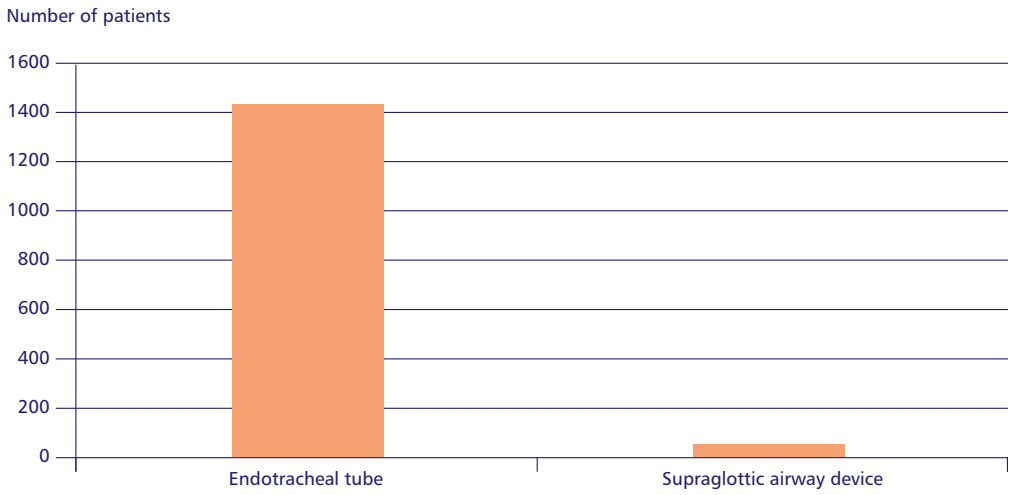

Figure 3.14 Method of airway management immediately prior to tracheostomy

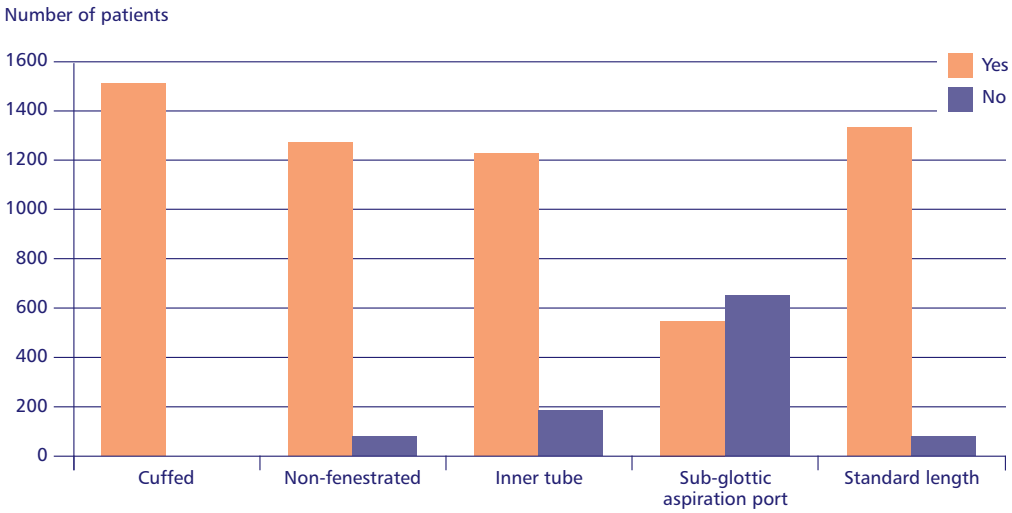

Figure 3.15 Types of tracheostomy tube

and is of particular benefit in reducing the incidence of ventilator associated pneumonias, where prolonged ventilation is required. However the incorporation of a sub-glottic port increases the overall tube diameter and is not available on longer adjustable flange tubes. A fenestration in the tube allows air to flow through the pharynx to facilitate speech, however this can cause trauma to the tracheal wall and lead to granulation tissue. Advisors commented on the number of patients who did not receive an inner tube (190/1407; 13.5%). Perhaps of even greater note was the relatively infrequent use of non-standard length tubes, within the group of obese patients (30/277; 10.8%) and the frequency with which displacement or inadvertent decannulation was observed. Advisors were of the view that the existence of longer tubes with inner tubes was not universally appreciated by operators, and felt that more could be done to publicise their availability.

Case study 5

An elderly patient with, type 2 diabetes, COPD and a high BMI (37)was admitted to critical care with sepsis. A percutaneous tracheostomy was inserted by a consultant intensivist. The tube was secured by both sutures and tapes. Later that night, the patient became de-saturated (SpO_2 40%), and a catheter could not be passed through the tracheostomy tube. The patient was therefore re-intubated with an endotracheal tube and the tracheostomy removed. The following day a surgically assisted percutaneous tracheostomy was placed. Two days later a similar event occurred and again the tracheostomy was occluded and required removal, and re-intubation with an endotracheal tube. A further tracheostomy was performed the following day using a re-inforced tube and the position confirmed by bronchoscopy and check radiograph.

Advisors questioned, whether a tracheostomy was indicated so soon after only one failed attempt at extubation. They did not feel that the correct length and type of tube had been inserted on either the first or second occasions in this patient.

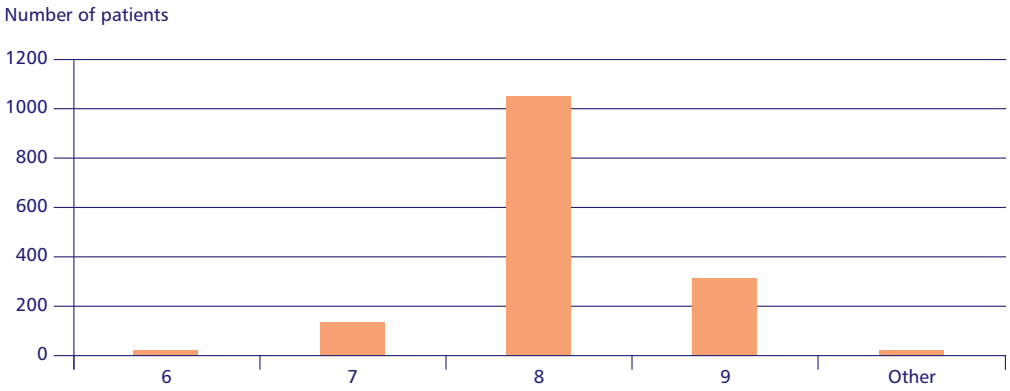

Figure 3.16 Size of tracheostomy tube used

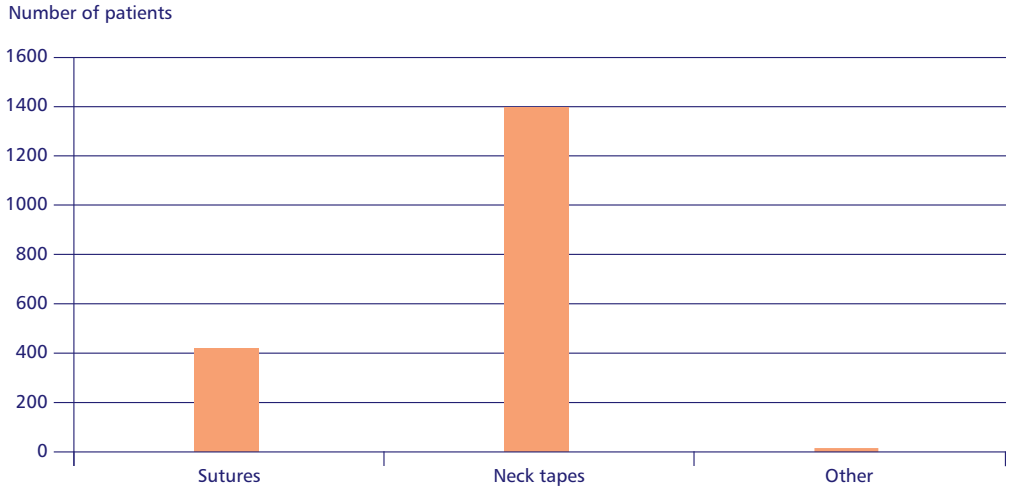

Figure 3.17 How the tracheostomy tube was secured *(Answers may be multiple)*

The majority of patients (1050/1517; 69.2%) received a size 8 cuffed tube (Figure 3.16).

In the percutaneous group the most common mechanism of securing the tube was with neck tapes alone, (1066/1508; 70.7%) in contrast to the surgical group where sutures were usually employed in addition to neck tapes (343/647;53%) (Figure 3.17).

Immediate post insertion management

A chest radiograph was undertaken to confirm the absence of complications caused by insertion and the position of the tube in 1269/1509 (84.1%) of the patients.

Measurement and optimization of cuff pressure is regarded as important in order to prevent mucosal damage which may lead to tracheal stenosis, where prolonged mechanical ventilation requires an inflated cuff. The cuff inflation pressure was measured immediately following insertion in 1011/1379 (73.3%) patients.

Immediate complications

Although immediate complications were uncommon, they still occured in 81/1482 (5.5%) patients. The most common complication was minor haemorrhage (46 cases). Due to the small numbers the breakdown is not presented, however examples of complications are shown in Table 3.13.

Table 3.13 Immediate complications

Haemorrhage - minor	Ventilation
Surgical emphysema	Desaturation
Malplacement of tube	Leaks
Loss of airway	Technical problems
Haemorrhage - severe	Procedure aborts
Tube occlusion	
Pneumothorax	

Surgical (open) insertion

Open surgical insertion was performed in 669/2199 (30.4%) patients. In this surgical group the indications for insertion are shown in Table 3.14, and the main diagnostic groups are shown in Table 3.15.

Table 3.14 Indications for insertion *(Answers may be multiple)*

	Surgical	%
	n	%
To facilitate the removal of pulmonary secretions	135	20.6
To protect the airway as the patient was at high risk of aspiration	89	13.6
Laryngectomy	33	5.0
To enable long term mechanical ventilation	88	13.4
To facilitate weaning from mechanical ventilation	360	55.0
Upper airway obstruction	147	22.4
Other	122	18.6
Subtotal	**655**	
Not answered	14	
Total	**669**	

Table 3.15 Main diagnostic groups undergoing a surgical tracheostomy

	Surgical	%
	n	%
Abdominal	1	0.2
Cardiac	4	0.6
Head and neck	246	38.9
Neurological	59	9.3
Respiratory	283	44.8
Sepsis	1	0.2
Trauma	35	5.5
Vascular (including AAA)	0	0.0
Mediastinitis	0	0.0
Burns	2	0.3
Planned operation	1	0.2
Subtotal	**632**	
Not answered	37	
Total	**669**	

An open surgical tracheostomy was performed as a standalone procedure in 426/641 patients (66.5%). In 199/623 (31.9%) patients the tracheostomy was performed as part of a more extensive planned head and neck operation. These data were explored in more detail in terms of ASA and BMI. Overall there was no difference in ASA between the patients undergoing tracheostomies undertaken as a standalone procedure (not head and neck) and the percutaneous group (Table 3.16).

Patients with a BMI ≥30 were more likely to have had their tracheostomy insertion undertaken as a surgical standalone procedure rather than percutaneously (Table 3.17).

In the majority of patients 486/534 (91%), the tracheostomy was performed as part of a procedure with curative intent, however in 48 patients it was part of a palliative care plan.

Table 3.16 Standalone tracheostomy (not head and neck) by ASA

	Standalone/not head and neck		Percutaneous	
	n	%	n	%
ASA1	11	3.1	56	3.7
ASA2	28	7.8	193	12.9
ASA3	147	41.1	571	38.1
ASA4	171	47.8	676	45.1
ASA5	1	0.3	3	0.2
Subtotal	**358**		**1499**	
Unknown	8		3	
Not answered	25		5	
Total	**391**		**1507**	

Table 3.17 Standalone tracheostomy (not head and neck) by BMI

	Standalone/not head and neck		Percutaneous	
	n	%	n	%
BMI <30	169	58.9	1020	72.1
BMI ≥30	118	41.1	395	27.9
Subtotal	**287**		**1415**	
Not answered	104		132	
Total	**391**		**1547**	

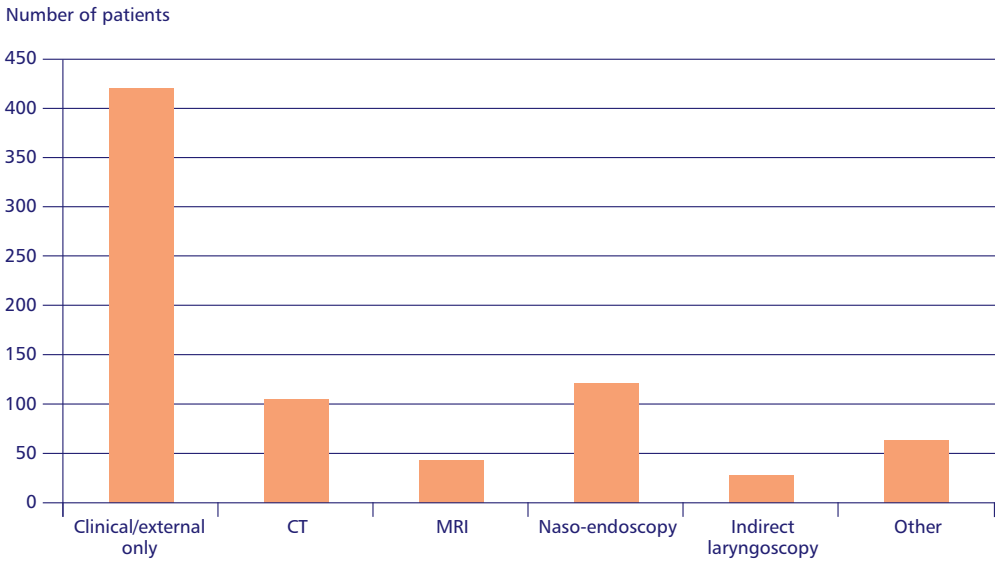

Figure 3.18 Method of pre-operative assessment *(Answers may be multiple)*

Pre-operative assessment

A majority (578/616; 93.8%) of patients had some form of pre-operative airway assessment made, but in most cases this involved external clinical assessment only (314/556; 56.5%) (Figure 3.18). Most patients undergoing a planned head and neck cancer operation would have had a CT scan as part of the routine staging and treatment planning process.

Stridor was noted pre-operatively in 86/596 (14.4%) of patients.

Assessment of difficulty of intubation using either Mallampati score or an alternative was performed in 318/488 (65.2%) patients (Table 3.18). However, some patients were transferred from critical care already intubated and in these Mallampati would not have been appropriate. However overall 154/529 (29.1%) were considered to be difficult to intubate/ re-intubate if necessary.

Table 3.18 Mallampati Scores

	n	%
I	83	28.1
II	96	32.5
III	66	22.4
IV	22	7.5
Other	28	9.5
Subtotal	**295**	
Unknown	15	
Not answered	8	
Total	**318**	

Consent

In contrast to the group of patients undergoing percutaneous tracheostomy, where evidence of consent was completed in less than half of the patients, the majority of patients (611/638 (95.8%) in this group had a consent form completed, despite the fact that 366/642 (57%) patients were comatose or not awake immediately prior to insertion. In two thirds (393/552) of patients, the consent form included risks and benefits. The majority of consent forms were completed by senior staff (490/558; 87.8%) (Figure 3.19). It is good practice to use the Form 4 consent form and document the involvement of carers and colleagues in the decision making process, where a patient lacks capacity.

Airway management and intubation

As previously noted, in this group of patients, 14.4% had stridor, 29.1% were recognized as being potentially difficult to re-intubate and of those patients Mallampati scored, 88/295 (29.8%) were grade III or IV.

The vast majority of patients (565/662) had ET intubation, whilst 46 patients had a simple face mask alone and 5 patients a laryngeal mask as the sole airway immediately prior to tracheostomy (Table 3.19).

Table 3.19 Airway management prior to tracheostomy
(Answers may be multiple)

	n	%
Face mask	62	9.4
Laryngeal mask airway	9	1.4
Endotracheal tube	565	85.3
Cricothyroid puncture	4	<1
Other	22	3.3
Subtotal	**637**	
Unknown	10	
Not answered	22	
Grand total	**669**	

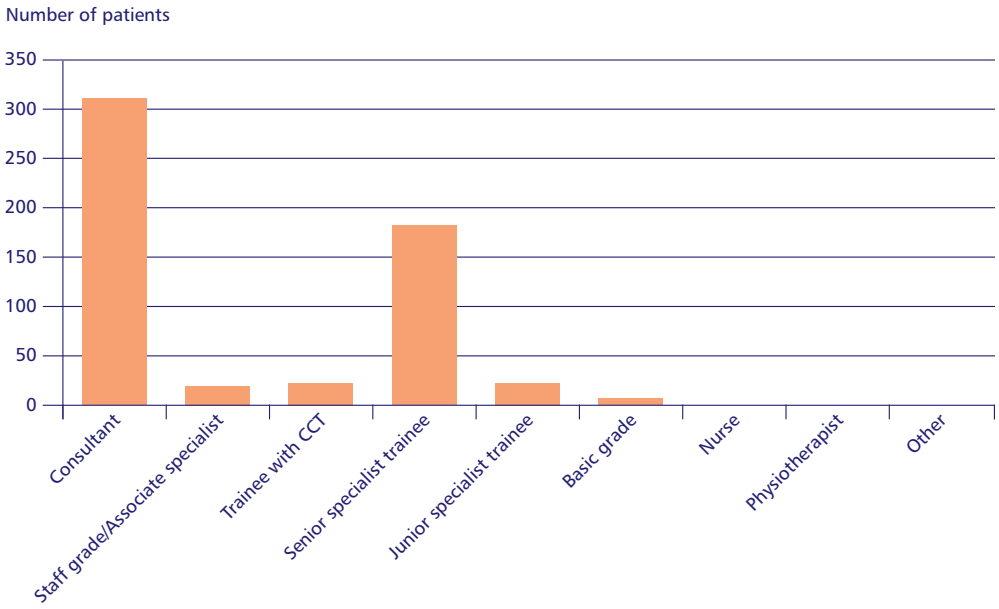

Figure 3.19 Grade of practitioner completing consent

Of the patients who were intubated, 112/563 (19.9%) required additional difficult airway equipment available. In 62/463 patients (13.4%) there were concerns about oxygenation prior to intubation. In 29/472 (6.1%) there was at least one failed attempt at intubation and in 14/472 (3%) of cases the anaesthetist was unable to intubate or ventilate at some point during intubation. In 16/462 (3.5%) cases there were unanticipated complications on induction and in 5/561 patients there was prolonged hypoxia (SaO_2 <90% for >5mins).

The operation

The majority of operations were performed by ENT or oral and maxillofacial surgeons (Table 3.20).

Most open surgical procedures were performed in an operating theatre, and the type of theatre is shown in Table 3.21.

Table 3.20 Specialty of operating surgeon

	n	%
Ear, nose and throat	355	56.7
Maxillofacial/oral surgery	187	29.9
Cardiothoracic surgery (inc cardiac and thoracic)	52	8.3
Plastic surgery/Burns care	11	1.8
General surgery	8	1.3
Vascular surgery	7	1.1
Upper gastrointestinal surgery	3	0.5
Trauma and Orthopaedics	1	0.2
Critical/Intensive care medicine	1	0.2
Subtotal	**626**	
Not answered	43	
Total	**669**	

Table 3.21 Location of operation

	n	%
Critical care	12	1.8
Head and neck specialist theatre	224	33.9
Emergency theatre	262	39.6
General theatre	131	19.8
Other	32	4.8
Subtotal	**661**	
Not answered	8	
Total	**669**	

Table 3.22 most common indication for tracheostomy insertion *(Answers may be multiple)*

	n
To facilitate weaning from mechanical ventilation	42
To facilitate the removal of pulmonary secretions	14
Upper airway obstruction	11
To protect the airway as the patient was at high risk of aspiration	7
To enable long term mechanical ventilation	5
Other	4
Laryngectomy	3
Subtotal	**62**
Not answered	1
Total	**63**

Marked delays were reported by the clinician completing the questionnaire in 63/618 (10.2%) of cases, and in 48/62 cases this was due either to unavailability of a surgeon and/or theatre. Where there was a delay 15/61 patients were admitted on an elective basis and 46/61 on an emergency basis; the urgency of admission was not given in two cases. The indications for surgery were also explored in more detail (Table 3.22); the most common indication for tracheostomy insertion in the group of surgical patients who experienced a delay was to facilitate weaning from mechanical ventilation.

In contrast to the findings in the group of patients receiving percutaneous tracheostomies in the critical care unit environment, the majority of patients (609/624, 97.6%) had either a WHO or modified WHO checklist used.

Staffing

The most senior anaesthetist involved was a consultant in the majority of cases (88.0%; 534/607) and a senior specialist trainee in just under one in ten cases (8.7%; 53/607).

Given the importance of trainees receiving exposure and training in this difficult area of anaesthesia, it is encouraging to note that where the anaesthetic was being administered by a consultant anaesthetist, an anaesthetic trainee was present in 361/467 (77.3%) cases. Of the 96 cases anaesthetised by a trainee where there was sufficient information available to Advisors to make an assessment, all but 5 trainees were believed to have received appropriate supervision.

For open surgical procedures, senior specialist trainees were more frequently the most senior operating surgeon than in the percutaneous group. A consultant was the most senior operator in 297/630 (47.1%) cases and a senior specialist trainee in 260/630 (41.3%) cases.

Where a consultant was operating, trainee presence was high (229/274; 83.6%) (Table 3.23). Where a surgical trainee was performing the procedure, supervision was generally available either from a consultant directly in the operating theatre or on request with the consultant being elsewhere in the hospital.

Table 3.23 Level of trainee supervision

	n	%
Supervised directly by the consultant present	122	44.7
Unsupervised - consultant in hospital	109	39.9
Unsupervised - consultant not in hospital	32	11.7
Other	10	3.7
Subtotal	**273**	
Unknown	8	
Not answered	13	
Total	**294**	

In those cases where Advisors had sufficient information to form an assessment, supervision appeared appropriate in 91/99 cases. However, in the majority of cases they were unable to make an assessment. If a trainee is left unsupervised, or if the consultant is not in the theatre complex, it is essential that careful pre-operative assessment is undertaken, and that the consultant delegates within the competence of the trainee. By its very nature, complications arising during tracheostomy must be addressed immediately if hypoxia or anoxia are to be avoided.

Tracheal incision

Three main types of incision are used to access the tracheal lumen, and can be seen in Appendix 2. A window in which a piece of the tracheal wall is excised and discarded was the most common method employed (56.8%). A vertical incision was used in 13.7% of cases and a Björk flap, (a three sided flap where a trap door is rotated toward the skin surface) was used in 7.7%. Perhaps surprisingly rescue or stay sutures were rarely employed (1.0%) (Table 3.23).

Table 3.24 Type of tracheal incision

	n	%
Vertical incision	80	13.7
Björk flap	45	7.7
Window	332	56.8
Rescue/stay sutures	6	1.0
Other	96	16.4
Multiple answers	26	4.4
Subtotal	**585**	
Unknown	53	
Not answered	31	
Total	**669**	

Given that in the early post-operative period, prior to the establishment of a well-defined surgical tract, location of the tracheal stoma in the event of tube dislodgement, requiring rapid re-insertion, can be difficult, particularly in the obese patient or where there is surgical oedema. A stay or rescue suture inserted into the edge of the incised tracheal lumen can prove invaluable in identifying the lumen and providing traction, to assist in the re-insertion of a misplaced or dislodged tube in the emergency situation. If a vertical incision is employed, horizontal relief incisions at either end of this incision ('I' shape), reduce the chance of the stay sutures cutting out when tension is applied.

Equipment

The majority of patients in this surgical group received a cuffed, non-fenestrated tracheostomy with an inner tube (Figure 3.20). Overall 78.0%, (391/501) of patients received a standard length tube. Of the obese or morbidly obese patients in the group 37.1% (56/151) patients had an adjustable tube in comparison to 14.2% (34/239) patients with a BMI <30.

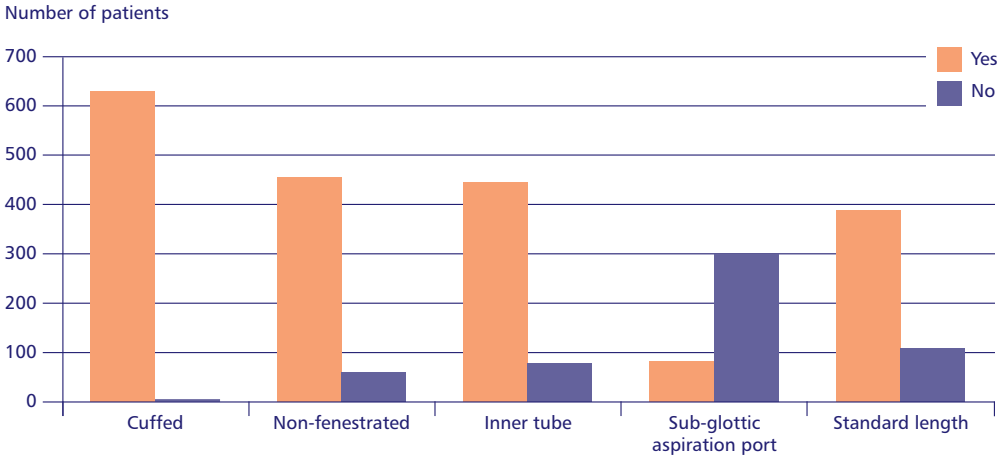

Figure 3.20 Type of tube used

The diameter of tracheostomy tube used was believed to be appropriate in 90.2% (303/336) of cases and of appropriate length in 92.1% (257/279) of cases. This was the same across the percutaneous and surgical groups.

For those patients where an inner cannula was not used, in the majority (45/56) it was unclear from the records available to the Advisors, what the rationale was for not having used an inner cannula. The use of an inner cannula facilitates cleaning and reduces the risk of tube occlusion with debris and secretions.

In contrast to the percutaneous group, the majority of patients in this group had the tube sutures in place, and a substantial number had neck tapes in addition to sutures (Table 3.25).

Table 3.25 Method of securing tube *(Answers may be multiple)*

	n	%
Sutures	602	93
Neck tapes	387	59.8
Other	4	0.6
Subtotal	**647**	
Unknown	6	
Not answered	16	
Total	**669**	

Advisors were unable to identify clear documentation of the method of securing the tube in 126/332 (38%) of cases. It is important that staff on wards are able to clearly identify how the tube has been secured, in order to facilitate aftercare, and to assist if misplacement or unanticipated extubation occurs in the post-operative phase. The use of tapes was more likely to be recorded 155/199 than sutures 106/199, despite the fact that sutures were employed in 93% of cases.

Post-insertion assessment

The Advisors were able to identify documentary evidence of some form of post insertion assessment of position in 272/335 (81.2% of cases). The methods used are shown in Table 3.26.

Table 3.26 Method of post insertion assessment of tube position documented *(Answers may be multiple - Advisors' opinion)*

	Percutaneous	Surgical
Capnography	99	45
Chest X-ray	158	22
Endoscopy	124	13
Subtotal	**206**	**60**
Other	1	0
Not answered	2	3
Total	**209**	**63**

It is likely, that for those patients having a surgical tracheostomy performed under general anaesthesia, that the end tidal CO_2 will have been monitored and checked when the anaesthetic tubing was transferred from the endotracheal tube to the tracheostomy tube. However documentation of this could not be identified in 122/266 cases, where the clinical records were available.

Advisors were similarly asked to identify whether there was documented evidence of post insertion ventilation. Whilst capnography was recorded in 145/222, the findings on chest auscultation was only recorded in 58/222 cases.

Complications of surgical tracheostomy insertions

Immediate (within 4 hours) complications occurred in 33/624 (5.3%) of cases, and Advisors were only able to identify three cases where they felt the complications were avoidable. Due to small numbers the data are not presented but Table 3.27 shows examples of the type of complications occurring. Haemorrhage and misplacement of the tube, were the most common immediate complications.

Table 3.27 Immediate complications following insertion

Haemorrhage - severe
Malplacement of tube
Haemorrhage - minor
Pneumothorax
Surgical emphysema
Tube occlusion
Problems with the cuff
Death
Loss of airway

Table 3.28 Unanticipated intra-operative complications

Unanticipated intra-operative complications	Immediate complications					
	Yes	No	**Subtotal**	Unknown	Not answered	**Total**
Yes	12	20	**32**	1	3	**36**
No	18	543	**561**	6	21	**588**
Subtotal	30	563	**593**	7	24	**624**
Unknown	0	5	**5**	5	1	**11**
Not answered	3	23	**26**	1	7	**34**
Total	**33**	**591**	**624**	**13**	**32**	**669**

Further analysis was undertaken to look at whether there was a relationship between unanticipated intra-operative complications and immediate complications (within 4 hours of admission) (Table 3.28). There were 20 patients who were reported as having an unanticipated intra-operative problem, who were not reported as having an immediate complication. The further detail was examined and in six cases bleeding was reported as an intra-operative complication. Immediately following recovery from the operation the majority of patients were sent to a critical care area, however just over one in ten patients were sent directly to a specialist head and neck ward (Table 3.29 overleaf).

Overall assessment of care at the time of insertion

In 160/353 cases the Advisors assessed the overall care of the patient at the time of the insertion as good. In 51/353 cases care was assessed as room for improvement in clinical care and in 87/353 as room for improvement in organisational care. In 47 cases there it was assessed that there was room for improvement in both clinical and organisational care. Eight cases were assessed as less than satisfactory (Figure 3.21).

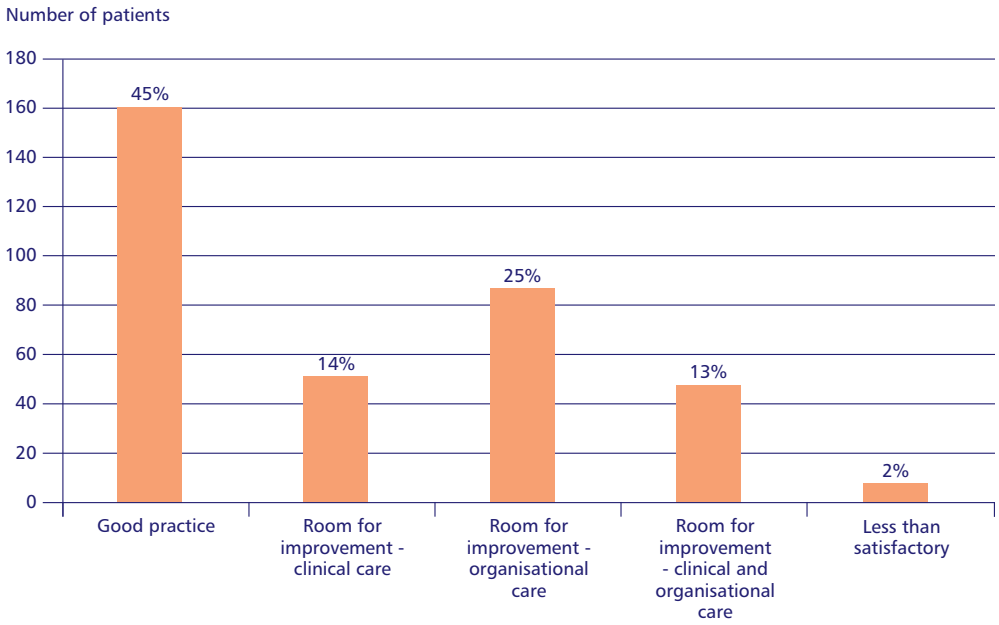

Figure 3.21 Overall assessment of care at the time of insertion

Table 3.29 Immediate place of transfer after insertion

	n	%
Critical care	539	85.8
Specialist head and neck ward	69	11.0
General ward	8	1.3
NA - tracheostomy inserted on critical care	2	<1
NA - patient died during the procedure	1	<1
Other	9	1.4
Subtotal	**628**	
Not answered	41	
Total	**669**	

With regard to room for improvement in clinical care the most common reasons for assigning this grade included issues relating to inner cannula care (25/92), the type of tube selected (25/92), and inadequate monitoring and/or frequency of observations (22/92). In terms of room for improvement in organisational care the most common reasons for assigning this grade included inadequate documentation (121/138) and inadequacies in the consent process (46/138).

The vast majority of patients (85.8%) went to critical care after tracheostomy insertion with a minority going direct to a ward area (12.3%). In the following chapters the pathway of these patients will be outlined.

Key findings

728/1491 (48.8%) patients had consent taken for a percutaneous tracheostomy, compared with 611/638 (95.8%) undergoing a surgical insertion.

239/1490 (16%) patients undergoing a percutaneous tracheostomy had a WHO type (surgical) checklist used.

Adjustable length tracheostomy tubes were used in only 185/1825 (10.1%) of patients. Inner tubes were used in 1661/1931 (86%) of patients.

566/1910 (29.6%) patients included in the study were obese or morbidly obese, but adjustable flanged tubes were only used in 96/510 (18.8%) of patients.

Capnography to assess tube placement was documented in 144/266 (54.1%) of patients.

Post-insertion endoscopy was used in 137/266 (51.5%) of patients.

Recommendations

6. Consent and WHO type (surgical) checklists should be adopted and used prior to tracheostomy insertion, wherever it is performed. *(Medical Directors and Clinical Directors)*

7. The diameter and length of the tube used should be appropriate for the size and anatomy of the individual patient, therefore an adequate range of tracheostomy tubes needs to be stocked by units. Operators should be aware of the types of tube available and in particular recognize that adjustable flanged tubes are available with inner tubes. Professionals need to continue to work closely with manufacturers to optimise design and tube options for a non standard population. *(Consultant Operators, Theatre and Critical Care Managers and Professional Health Care Bodies)*

8. Confirmation of tube placement must be obtained using capnography. This should be readily available and the events documented. *(All Health Care Professionals)*

9. Appropriate positioning of the tube should be made using airway endoscopy. This should be readily available and the events documented. *(All Consultants)*

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4 – Tube care in the patient with a tracheostomy

This chapter will describe the care of the tracheostomy tube at several points in the patient pathway. All had a newly formed tracheal stoma. Many of these patients received all or part of their care in a critical care unit, and some went to a ward with a tracheostomy in place either immediately after surgery or after a stay in the critical care unit. The critical care unit questionnaires were completed at discharge, decannulation or death if a tube was still in place. Ward questionnaires were completed 30 days after ward admission, or earlier than this if the patient underwent decannulation, was discharged or died. Details on the first and second tube changes have been concentrated upon.

Table 4.1 Post operative discharge location

	n	%
Critical care	539	85.8
Specialist head and neck ward	69	11.0
General ward	8	1.3
NA - tracheostomy inserted on critical care	2	<1
NA - patient died during the procedure	1	<1
Other	9	1.4
Subtotal	**628**	
Not answered	41	
Total	**669**	

There were 1956 completed critical care questionnaires of which the majority related to a tracheostomy which had been inserted in the critical care unit. There were 539 patients who had tracheostomy insertion in an operating theatre and were then discharged post operatively to the critical care unit, with 69 patients who went direct to a specialist ward and eight to a general ward after their surgery (Table 4.1).

There are several types of tubes which can be used dependent on patient requirements. Tubes may be changed for a variety of reasons which may be multiple and include a need to provide a more suitable tube length or lumen size for the patient's needs (larger or smaller), to facilitate weaning, the ability to communicate or for more effective clearance of secretions.

Tracheostomy tubes should ideally be changed as a planned procedure. Very early changes are relatively high risk as a tract may have not properly formed and there is a high chance of difficulty in replacing the tube. Other than very early changes, factors which can make tracheostomy tube change more difficult include patient size (e.g. short neck), poor patient co-operation, very thick secretions, pain and hypoxia. Tube changes are more likely to be difficult if they occur in unplanned or emergency circumstances when the patient has already lost their airway. Complications of tube change include formation of a false passage (sometimes resulting in surgical emphysema), barotrauma, haemorrhage and, as a consequence of delay in re-insertion or of other complications, hypoxia.

First tube change in the critical care unit

Of the 1956 critical care discharge questionnaires, data on the first tube change was received for 512 cases (26.2%). In a further 621 this question was not answered (indicating the patient did not undergo a first tube change on the critical care unit), in 11 it was said to be 'unknown' and in 812 'not applicable'. It was assumed for the purpose of analysis that 'not applicable' included patients who were decannulated, died or were discharged before there was an opportunity for the tube to be changed.

Where data were provided there was marked variation in the timing of first tube change with 27% (113/419) of tubes changed for the first time at a point less than 7 days from insertion and 11.7% (49/419) at more than 30 days (Figure 4.1).

Many of the very early changes were unplanned with 24/34 changes at 24 hours or less after insertion being unplanned in the critical care unit. Some units had a policy for performing all first tube changes in the critical care unit before discharge if the tube had been inserted in the unit.

There is a body of opinion that suggests that there may be a difference between the risk of early displacements/changes of surgical versus percutaneously inserted tracheostomies. As the former procedure involves dissection, cutting and stitching of the skin, tissues of the neck and an open incision of the trachea, should the tracheostomy become displaced it may be reasonable to assume that a surgically performed stoma will remain patent after 2-4 days, although this will vary from patient to patient and on the technique used. However a percutaneously performed tracheostomy involves very much less dissection, with the tissues being stretched and dilated. This may mean that if the percutaneous tracheostomy is removed or becomes displaced in the first 7- 10 days it may be significantly more difficult to recannulate.[2] However, all first tube changes, particularly if early or unplanned, have the potential to be high risk and should ideally be performed as a planned procedure in an environment where there is immediate access to emergency intubation facilities.

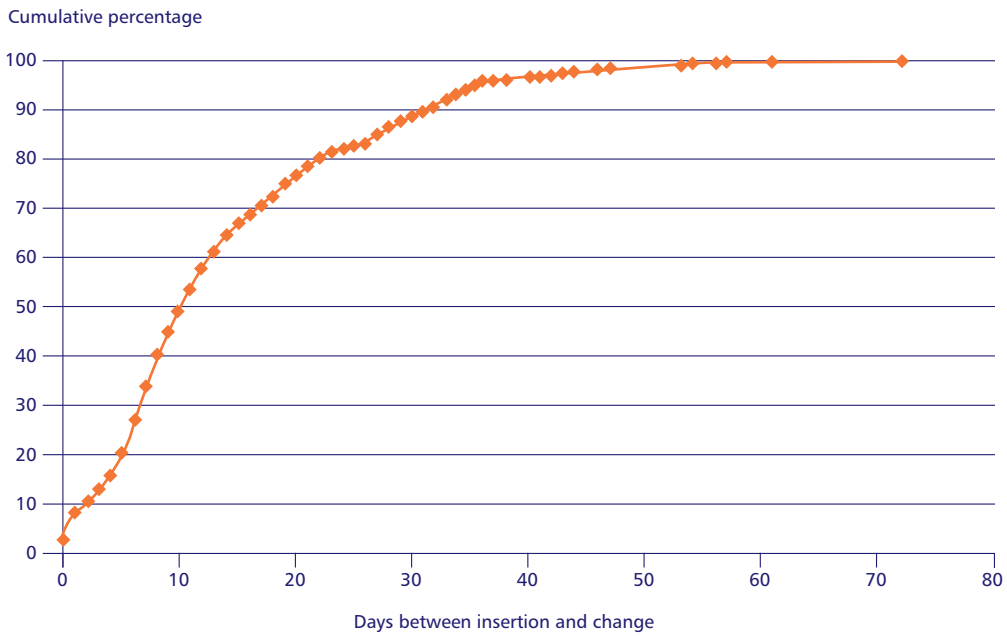

Figure 4.1 First tube change

Table 4.2 Planned vs. unplanned first tube changes in the critical care unit in the first 6 days post insertion

	Type of change				
	Planned	Unplanned	Subtotal	Not answered	Total
Day 0	1	9	10	0	**10**
Day 1	9	15	24	1	**25**
Day 2	2	6	8	2	**10**
Day 3	4	5	9	0	**9**
Day 4	9	3	12	0	**12**
Day 5	11	8	19	0	**19**
Day 6	17	11	28	0	**28**
Total	**53**	**57**	**110**	**3**	**113**

There were 113 first tube changes in the critical care unit in the first 6 days after insertion, and in total 57 of these were unplanned. The nature of the tube change (planned vs. unplanned) was reviewed in more detail. Table 4.2 reveals the extent of very early unplanned changes.

It is recommended that tracheostomy tubes do need to be changed at some stage before 28-30 days after insertion, if an inner cannula is included, or at 12-14 days if a single lumen tube is used.[2] Thereafter if the tube has an inner cannula it may remain in place for up to 28 days with regular cleaning, but in practice will be changed according to the patient's needs and in relation to instructions from the manufacturer.[7] There were a total of 49/419 (11.7%) first tube changes for which data were available on the details of timing when tube changes occurred more than 30 days after insertion. Delaying a tube change for longer than the recommended interval may result in tube encrustation and blockage as well as tracheal damage.

First and second tube changes in the critical care unit occurred predominantly during the standard working week with fewer at weekends (see Figure 4.2).

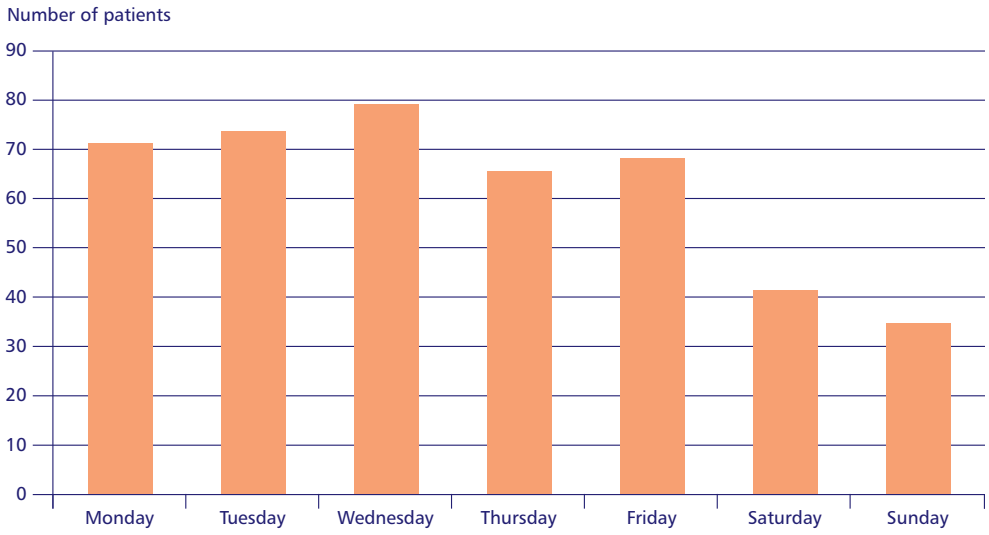

Figure 4.2 Day of week of first tube change in the critical care unit

Table 4.3 Time of day vs. planned or unplanned first tube change critical care unit

Time of change	Type of change					
	Planned	Unplanned	Subtotal	Unknown	Not answered	Total
08:00 - 17:59	241	60	301	2	3	**306**
18:00 - 07:59	18	28	46	0	1	**47**
Subtotal	**259**	**88**	**347**	**2**	**4**	**353**
Not answered	68	18	86	15	58	**159**
Total	**327**	**106**	**433**	**17**	**62**	**512**

Planned first tube changes in the critical care unit were also more likely to occur during normal working hours (08.00-18.00), accepting that many critical care units will have a working day which is considerably longer than this. There were a total of 106 unplanned tube changes, 28 of which occurred between 18.00 and 07.59 (Table 4.3) when there may have been fewer senior staff on site.

Case study 6

An elderly patient underwent emergency laparotomy for perforated duodenum and required prolonged post-operative ventilation. A percutaneous tracheostomy was inserted by a surgeon and an anaesthetist in theatre in a small DGH as the patient was obese and difficulties were anticipated. The patient then suffered two episodes over the next 48 hours in which the tube was accidentally displaced. There was no documentation of how the tube was secured. Two weeks later the patient was successfully decannulated.

Advisors commented upon the potential risks of early accidental decannulation in these circumstances.

The reasons for unplanned tube changes in the critical care unit were reviewed (Table 4.4). As noted many of these related to displaced tubes and a minority to obstructed tubes. Additional reasons for early tube changes may include the need to provide a better tube 'fit' e.g. as a result of inadequate tube length, persistent leak, or alternatively concerns about incipient tube blockage and difficulty with tube toilet.

Table 4.4 Reasons for unplanned tube changes on the critical care unit

	n
Tube blocked	6
Tube displaced	42
Other	61
Subtotal	**109**
Unknown	1
Total	**110**

The 'other' reasons for tube change included problems with the tracheostomy tube cuff leaking or it was decided that the tube was too small. This suggested that a more careful choice of the initial tube size and cuff position may have prevented the need for an unscheduled change. This may also relate to the type of tubes available at present for what is a 'non standard' population.

More generally in the critical care unit, where data were available 33/86 patients who underwent an unplanned tube change had a BMI ≥30 (Table 4.5). This would have posed particular difficulties to the procedure for the clinicians involved.

In those patients who underwent a change before day 7 post insertion, 21/41 had a BMI ≥30, which is a relatively high proportion in comparison to the total percentage of high BMI patients cared for in the critical care unit.

Table 4.5 First unplanned tube change on the critical care unit and BMI

	n
BMI <30	53
BMI ≥30	33
Subtotal	**86**
Not answered	13
Total	**99**

Table 4.6 Accidental decannulation/displacements in regard to type of insertion vs. method of fixation

	Mode of insertion		
	Percutaneous	**Surgical**	**Total**
Sutures	5	18	**23**
Neck tapes	15	15	**30**
Subtotal	**15**	**20**	**35**
Not answered	1	0	**1**
Total	**16**	**20**	**36**

A total of 36 patients who underwent an unplanned tube change in the critical care unit were also reported to have experienced an 'accidental decannulation' in the complications section of this report (Table 4.6). Of these 36, 16 were percutaneous and 20 were surgically inserted. The details of tube fixation in this group were reviewed.

These data suggest that the rate of accidental displacement was higher in the surgical group despite the use of sutures and neck tapes in most cases. The reasons for this are unclear but may relate to a particular group, e.g. high BMI patients having a surgical rather than a percutaneous tracheostomy because of anatomical difficulty. This may then pre-dispose to accidental tube displacement. Where data were available the BMI of patients who had an accidental decannulation was looked at (Table 4.7).

Table 4.7 BMI by type of insertion in cases where there had been accidental decannulations

	Percutaneous	**Surgical**	**Total**
BMI <30	10	9	**19**
BMI ≥30	4	9	**13**
Subtotal	**14**	**18**	**32**
Not answered	2	2	**4**
Total	**16**	**20**	**36**

Whilst numbers are small it would seem from this data that there are relatively more patients with a high BMI who received a surgical tracheostomy and then experienced an accidental decannulation/tube displacement.

First tube change on the ward

Of the 553 ward care questionnaires, data on the first tube change was received for 162 cases (29.3%). In three cases it was unknown as to whether the patient had had a first tube change on the ward, and in 388 cases this question was not answered or was not applicable (again indicating the patient did not undergo a first tube change on the ward).

The date of a first tube change on the ward was provided in 153/162 cases. Where the information was available, 18.3% of these (28/153 cases) occurred within 7 days of insertion.

Numbers are relatively small but more surgically placed tubes were changed during the first 7 days after ward admission (25/83 surgical tubes vs. 2/64 percutaneously placed tubes) (Figure 4.3). This may relate to early downsizing in surgical patients which contained a different case mix some of which were destined for a rapid decannulation e.g. after an elective head and neck procedure.

Time of day for all tube changes was not available, but in comparison to the critical care unit where many more first tube changes occurred (512 in total), there were just 17/161 unplanned changes in the ward (11%). Of these, six occurred at a time outside the normal working day (Table 4.8).

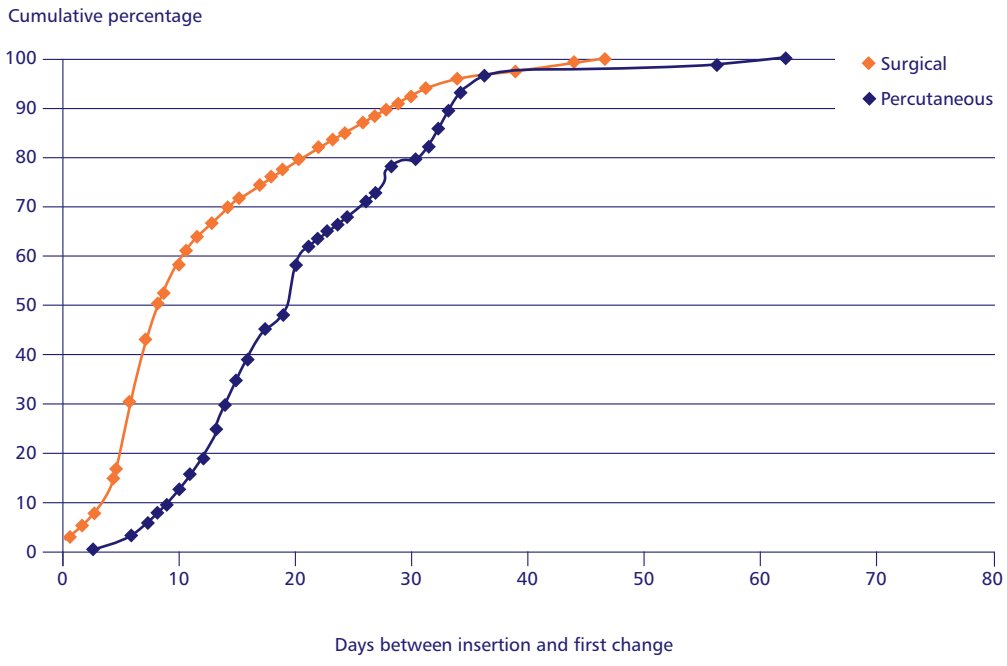

Figure 4.3 Days between insertion and first tube change on the ward

Table 4.8 Planned vs. unplanned first tube changes on ward and time of day

Time	Type				
	Planned	Unplanned	Subtotal	Not answered	Total
08:00 - 17:59	102	7	**109**	1	**110**
18:00 - 07:59	8	6	**14**	0	**14**
Subtotal	**110**	**13**	**123**	**1**	**124**
Not answered	33	4	**37**	1	**38**
Total	**143**	**17**	**160**	**2**	**162**

Of the 17 patients who underwent an unplanned tube change, seven were also reported as experiencing an 'accidental decannulation' in the complications section of this report. Six of the 17 unplanned changes of tubes were inserted percutaneously and nine surgically (in two data was not provided).

Type of tubes used

Figure 4.4 shows the types of tube inserted at the first tube change in the critical care unit. As noted in Chapter 3 (Insertion) and Appendix 2 there are a wide variety of tube choices with a standard cuffed tube with an inner cannula being the most popular.

In 30 cases an inner cannula was not present as part of the replacement tube at first tube change. Advisors commented that whilst there are a few circumstances where it is justifiable for the tube placed at initial tube insertion to not have an inner cannula, this should be a rare choice at first tube change, despite the fact that some adjustable flanged tubes are manufactured without an inner cannula. This is also contrary to guidance from the Intensive Care Society[2] and the National Tracheostomy Safety Project[1] both of which recommend that an inner cannulae should be used routinely to facilitate easy clearance of secretions and prevent total tube occlusion.

Case study 7

A patient was admitted to a small DGH performing less than 30 tracheostomies per year with pneumonia. The patient underwent a tracheostomy insertion and after an early accidental decannulation and tube replacement was rapidly discharged to a ward area after weaning from IPPV. There was very poor documentation and handover to staff in the ward when admission took place in the middle of the night. The patient was disorientated and pulled out both their nasogastric tube and tracheostomy tube soon after the ward admission.

Advisors commented on the poor clinical and organisational aspects of care throughout the patient pathway, but particularly in relation to the planning of the patient's discharge.

Advisors were asked to note whether an inner cannula was inserted at the first tube change where this had taken place. There were 16/77 cases where the new tube did not have an inner cannula, and in four of these there was no clear reason documented as to why this was the case.

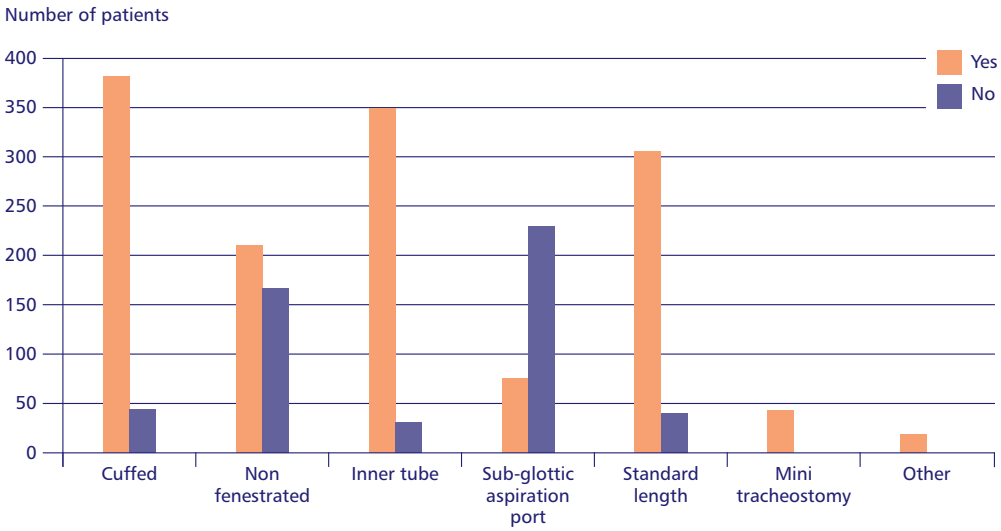

Figure 4.4 Types of tube inserted at first change in the critical care unit

Where data were available 88.3% of tubes were replaced with one of a standard length (Figure 4.4). This was surprising given that so many of the population in this study were noted to be overweight or obese. However, it should be noted that there was considerable variation between manufacturers in what is classed as 'standard length', and Advisors commented that in some patients it was still difficult to find an ideal position and required adjustable length tubes so that the tube 'sits' well to optimise both ventilation and tube suction.

Figure 4.5 shows the characteristics of the tubes chosen in the ward at first tube change, which were broadly similar to those in the critical care unit, but with fewer cuffed tubes. Again there were a few instances where inner cannula was not incorporated and the vast majority of tubes were of standard length.

In those cases peer reviewed by Advisors where the tube was changed it was asked whether they considered that a replacement tube was optimal. In the majority (75) it was but in 12, replacement tubes were felt to be unsuitable in some way.

The fact that the variety of tracheostomy tubes available is extremely large, with a lack of a truly standard length, external diameter and on occasion easy inter-changeable connectors was discussed. This is a particular difficulty when relatively small units wish to provide a small range of tubes with which they feel familiar. It is clear that to date there would appear to be no optimal design and similarly no firm evidence on the ideal method of fixation, which is particularly important in patients with a high BMI.

Case study 8

A middle aged patient developed post operative multi-organ failure after planned bariatric surgery. A percutaneous tracheostomy was performed in the intensive care unit to assist with weaning. At insertion there was no documented capnography and an 8mm standard tube was inserted. The patient required an early tube change within 24 hours due to an immediate cuff leak.

Advisors commented about the need for a very careful plan in such patients in whom insertion, tube positioning and ongoing care is likely to be particularly difficult.

Table 4.9 Type of tube used at first change vs. BMI

	Tube used at first change					
	Standard length	Adjustable flange	**Subtotal**	Unknown	Not answered	**Total**
BMI <30	169	17	**186**	10	80	**276**
BMI ≥30	74	15	**89**	5	37	**131**
Subtotal	**243**	**32**	**275**	**15**	**117**	**407**
Not answered	37	5	**42**	2	23	**67**
Total	**280**	**37**	**317**	**17**	**140**	**474**

Where data were available patients with a BMI of ≥30 were reviewed to see if they had a different type of tube inserted when the tube was changed. In most patients with a high BMI a standard tube was used (Table 4.9), with relatively few (15/89) receiving a tube with an adjustable flange, which would have allowed greater customisation of length to the patient's body shape/size.

Where data were available on BMI it was noted that in all 74 patients with a BMI of ≥30 who underwent a first change on the ward a standard length tube was selected. As with critical care unit first tube changes, an inner cannula was not always part of all tube change, but in total 112/116 (96.6%) of patient's received one and 79/131 ward patients continued to have cuffed tubes after their first tube change.

Second tube change on the critical care unit

In total 95/512 patients underwent a second tube change whilst on the critical care unit.

The interval between first and second tube changes was reviewed, and in a relatively large proportion of this group of patients (51/89) a second tube change was performed at less than 7 days after the first tube one. Whilst overall numbers are small, the fact that the tube was changed so soon implies that either

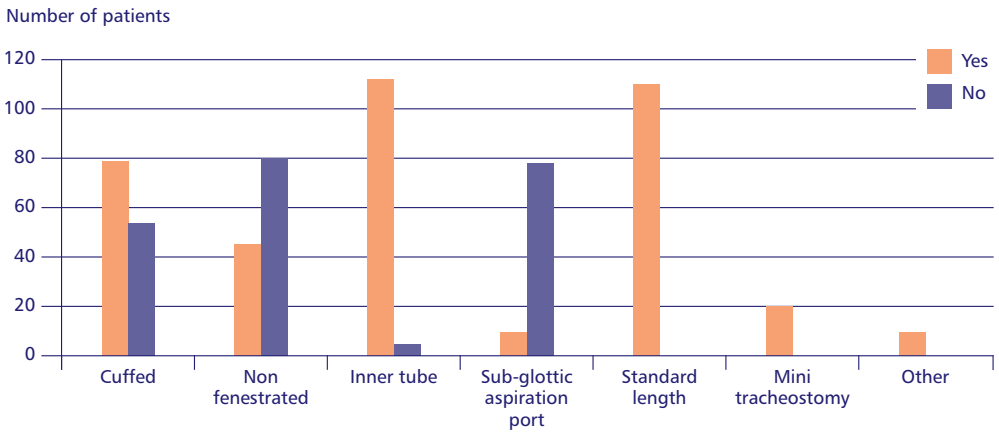

Figure 4.5 Type of tube used to replace original at first tracheostomy tube change *(ward)*

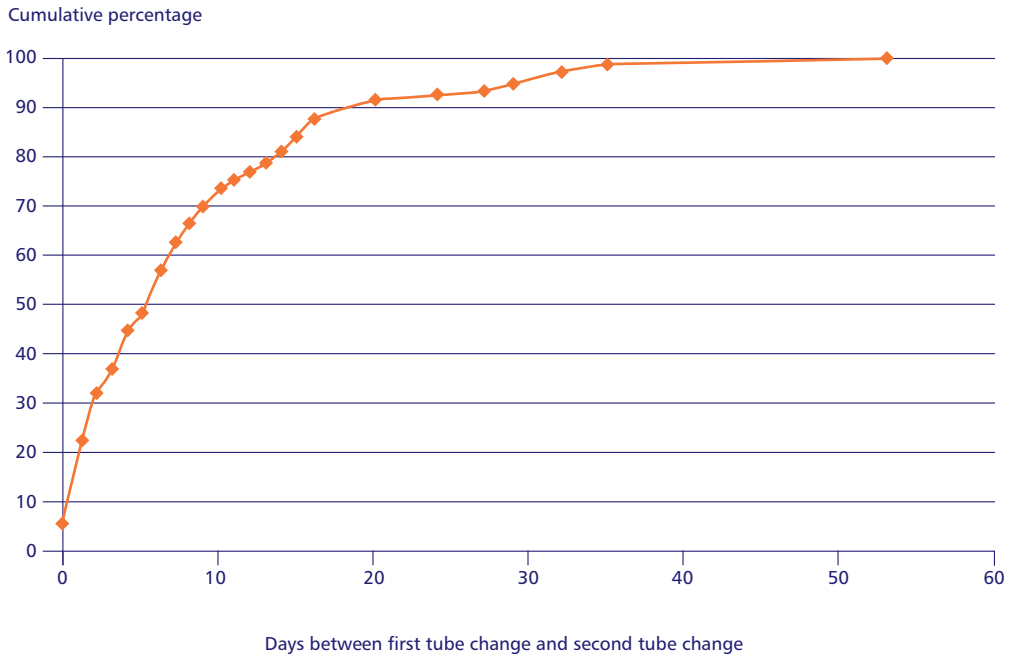

Figure 4.6 Time between first and second tube changes in the critical care unit

there were problems with the first replacement tube in terms of length or internal diameter, or that accidental displacement or blockage occurred. Where data were available it was noted that a total of 59 second tube changes were planned and 31 unplanned. In 5/89 of cases there was more than a 30 day period between first and second tube changes (Figure 4.6).

Humidification and inner cannula care

Compressed air and oxygen used for ventilation in hospitals is both cold and dry. Since a tracheostomy tube bypasses the upper airway which normally provides some ability to heat and humidify inspired gases a replacement mechanism is important, in order to assist with clearance of thick and/or infected secretions. As discussed, the use of an inner cannula is recommended as a standard part of tracheostomy tube design and care and is used alongside good humidification to prevent blockage with secretions. Patency is ensured by regular cleaning.

The methods used to humidify inspired gases in the critical care unit were looked at (Table 4.10).

Table 4.10 Methods used to humidify gases in the tracheostomy patient in the critical care unit

	n	%
Hot water humidification	1103	58.7
Cold water humidification	189	10.1
Heat and moisture exchange	389	20.7
Stoma filter or bib	3	0.2
None	9	0.5
Other	10	0.5
Multiple methods recorded	176	9.4
Subtotal	**1879**	
Unknown	16	
Not answered	61	
Total	**1956**	

The most common method used was hot water humidification which may be seen by many as the 'gold standard'. However, there was no apparent consensus - whilst hot water humidification was used in about two thirds of cases it was not universal, and the next most common method was a heat and moisture exchanger, which though relatively cheap and simple will not provide such a high level of humidification.

Clearance of secretions was a problem in a 128/310 (41.3%) sets of case notes reviewed by the Advisors (Table 4.11).

Table 4.11 Clearance of secretions was a problem in this patient *(Advisors' opinion)*

	n	%
Yes	128	41.3
No	182	58.7
Subtotal	**310**	
Insufficient data	86	
Total	**396**	

There was also felt to be a problem with humidification in 12/245 patients (Table 4.12), but both questions in relation to this and secretion clearance Advisors had insufficient data to make the decision in a relatively large number of cases.

Table 4.12 Adequate humidification (Advisors' opinion)

	n	%
Yes	233	95.1
No	12	4.9
Subtotal	**245**	
Insufficient data	140	
Not answered	10	
Not applicable	1	
Total	**396**	

As mentioned there would seem to be a lack of consensus about the ideal means of providing humidification for patients and whilst there will essentially be a bedside decision made based on patient specific factors, it is notable that there was no apparent minimum standard. However the use of a humidification 'ladder' is recommended within the NTSP[1] with frequent assessments to step the patient up and down between different types of humidification dependent on efficacy of secretion clearance. The NTSP suggested a minimum of 8 hourly suction for patients with tracheostomy.

Table 4.13 Frequency of inner cannula cleaning and inspection

	n	%
No protocol/guideline	109	6.9
Hourly	4	<1
Two hourly	151	9.5
Four hourly	679	42.8
Eight hourly	53	3.3
Once every shift	307	19.3
Patient specific	93	5.9
Other	105	6.6
Multiple answers recorded	86	5.4
Subtotal	**1587**	
Unknown	44	
Not answered	25	
Total	**1656**	

The NTSP also recommended that the inner cannula is taken out and cleaned at least once per 8 hour shift period.[1] Where an inner cannula was used at any stage whilst on critical care, the guidelines for its inspection and cleaning were assessed. In 7% of units there was no guidance, but where guidance was provided the most common response was for a 4 hourly cleaning regimen to be in place (Table 4.13).

In a total of 88% of patients the cannula was cleaned at least once per shift, but again there was considerable diversity which may in part relate to the needs of the individual patient.

Data were collected in the ward questionnaire about whether an inner cannula was used at any stage and about the protocol for inner cannula cleaning. In 96.8% (517/534) of cases an inner cannula had been used, and again 4 hourly cleaning seemed to be the most common option of care (162/450; 36.0%). However it is important to reflect on the fact that at insertion as well as first tube change the use of an inner cannula was by no means universal.

Tube cuff pressure

A cuffed tracheostomy tube is almost always used at least initially on the critical care unit to assist with positive pressure ventilation, until a stoma is better formed with the patient more able to swallow and cough for themselves. Whilst modern tracheostomy tubes have relatively high volume cuffs in which pressure is more evenly distributed, it is important to measure this pressure regularly to ensure it remains within clear limits, avoiding damage to the delicate tracheal lining, and in the longer term high pressure may result in scarring, stenosis and/or tracheomalacia. In the short term an over inflated cuff has particularly detrimental effects on swallowing.

In the majority of patients with a tracheostomy cared for on the critical care unit the tube cuff pressure was monitored (Table 4.14).

Type of tube at discharge

Most patients were discharged from critical care with a cuffed tracheostomy tube still in place (Table 4.15).

In 72.6% (360/496) the cuff was still inflated at discharge. This is a potential safety issue if wards are not equipped or trained to manage cuffed tubes. A cuffed tube can lead to an increased risk of airway obstruction should the tracheostomy tube become blocked, as there is no possibility of ventilation by the native upper airway. It is also important to note that at discharge 508/533 (95.3%) tubes were recorded as having an inner cannula.

Table 4.14 Cuff pressure monitoring in the critical care unit

	n	%
Yes	1727	96.9
No	56	3.1
Subtotal	**1783**	
Unknown	59	
Not applicable - equipment not available	44	
Not applicable - cuffed tube not used	9	
Not answered	61	
Total	**1956**	

Table 4.15 Tube type at discharge from the critical care unit

	n	%
Cuffed	551	95.0
Uncuffed	29	5.0
Subtotal	**580**	
Unknown	3	
Not answered	74	
Total	**657**	

On the ward cuff pressure was monitored in only 75% of patients with a cuffed tube (Table 4.16) and in 28% (130/464) of cases the cuff was kept continuously inflated.

Table 4.16 Cuff pressure was measured on the ward

	n	%
Yes	309	74.6
No	105	25.4
Subtotal	**414**	
Unknown	35	
Not applicable - equipment not available	43	
Not applicable - cuffed tube not used	35	
Not answered	26	
Total	**553**	

Remarkably, equipment to measure cuff pressure was not available on the ward in 100/512 (19.5%) cases. Even when the cuff was continuously inflated pressure equipment was not available to measure pressure in 12.3% of cases (Table 4.17).

Table 4.17 Equipment to measure pressure was available if the cuff was inflated continuously

	n	%
Yes	114	87.7
No	16	12.3
Total	**130**	

It is of concern that pressure was not a part of routine care when cuffed tubes were used and the cuff inflated, particularly when this was continuous. The equipment to measure pressure is relatively inexpensive and simple to use and should be readily available, with appropriate training also being in place.

Cuff pressure - Advisors' opinion

The Advisors were asked if the cuff pressure had been adequately monitored during the patient pathway in both ward and critical care areas. Whilst in about two thirds of cases (151/211; 71.6%) it was felt to be the case, in almost one third it was not, and data was insufficient to make an assessment in a further 178 patients (Table 4.18). The latter may well relate to the recording of cuff pressure at the bedside in either hard copy notes or electronically and the same applies to many other observations about tracheostomy tube care.

Where cuff pressure was not adequately monitored, this was in the critical care unit in 47/56 cases, the ward in 5/56 cases and in both areas in 4/56 cases.

In many aspects of management pertinent to routine tube care it was difficult to find data retrospectively when clinical records were reviewed, which is reflected in the large number of cases where Advisors felt that a decision could not be made. However, there were some outstanding cases where the recording of tube care was easy to find and to review alongside other key pieces of information such as tube size and details about last tube change.

Table 4.18 Cuff pressure was adequately monitored *(Advisors' opinion)*

	n	%
Yes	151	71.6
No	60	28.4
Subtotal	**211**	
Insufficient data	178	
Not applicable	6	
Not answered	1	
Total	**396**	

This is further borne out by the fact that when the Advisors were asked if they felt that cuff pressure was sufficiently well documented, they reported that in less than half the cases (107/214) this was the case. In 107 patients it was not and in a further 148 cases there was insufficient data with which to make a decision (Table 4.19).

Table 4.19 Documentation of cuff pressure was sufficient *(Advisors' opinion)*

	n	%
Yes	107	50.0
No	107	50.0
Subtotal	**214**	
Insufficient data	148	
Not answered	34	
Total	**396**	

Where the documentation was insufficient, this was in the critical care unit in 73/91 cases, 9/91 on the ward and in 9/91 cases there was poor documentation of cuff pressure in both locations.

Routine recording of tube care and observations is important and this information needs to be consulted at the bedside by a large number of professionals. This can be greatly facilitated by comprehensive and well organised records which greatly assisted in patient review.

Whilst most components of the Intensive Care Society[2] recommended bedside equipment list were available, there were some notable exceptions e.g. cricoid hook, artery forceps, tracheostomy wedge and tube holders (Table 4.20).

Table 4.20 Bedside equipment *(Answers may be multiple)*

	n	%
Appropriately sized suction catheters	534	98.7
Operational suction unit with suction tube attached and wide bore sucker	532	98.3
Bedside oxygen	520	96.1
Spare tracheostomy tubes of the same type inserted; one the same size and one smaller	509	94.1
10ml syringe (if cuffed tube)	475	87.8
Non powdered latex free gloves and apron	472	87.2
Tracheal dilators	438	81.0
Tracheostomy tube holder and dressing	379	70.1
Water soluble gel	330	61.0
Rebreathing bag and tubing	318	58.8
Headlight/adequate illumination	251	46.4
Stitch cutter	247	45.7
Catheter mount or connection	240	44.4
Resuscitation equipment	237	43.8
Eye protection	172	31.8
Tracheostomy disconnection wedge	61	11.3
Artery forceps	53	9.8
Cricoid hook	12	2.2
Subtotal	**541**	
Not answered	12	
Total	**553**	

Key findings

27% (113/419) of tubes were changed for the first time in the critical care unit at a point less than 7 days from insertion and 11.7% (49/419) more than 30 days.

21/41 patients with an unplanned tube change before day 7, had a BMI of ≥30.

57/113 (50.4%) patients in the critical care unit who had unplanned tube changes had them in the first 7 days, before a clear tract from skin to trachea had had time to form.

30/379 (7.9%) patients did not have tubes with an inner cannula present as part of the replacement tube at first tube change on critical care.

41.3% (128/310) of patients reviewed by Advisors and where data were available had problems with secretion clearance.

88.3% (302/342) of tubes were replaced with one of a standard length despite many of this population being overweight or obese (a total of 63%).

95% (551/580) of patients were discharged from the critical care unit with a cuffed tracheostomy tube still in place and in 72.6% (360/496) the cuff was still inflated at discharge.

28% (130/464) of tubes on the ward were left continuously inflated and cuff pressure was not measured in 25.4% (105/414) of ward patients.

In just 211/396 (53.3%) of the peer reviewed cases was there information available on cuff pressure available in the case notes.

Recommendations

10. When changing a tracheostomy tube factors that increase the risk of obstruction or loss of airway should be considered. These include tube size/configuration and length. This is particularly important in the obese/high BMI patient. *(All Consultants)*

11. Unplanned tube changes pose additional risks. All unplanned tube changes should be reported locally as critical incidents and investigated to ensure that lessons are learned and reduce the risk of future events. *(All Health Care Professionals and Risk Managers)*

12. Particularly careful consideration should be made at discharge from the critical care unit as to whether a cuffed tube is still indicated, and reasons must be documented. If it is, then there must be equipment and competences available on the ward for cuff pressure measurement. *(Critical Care Consultants and Tracheostomy Leads)*

13. All Trusts should have a protocol and mandatory training for tracheostomy care including guidance on humidification, cuff pressure, monitoring and cleaning of the inner cannula and resuscitation. The clinical practices around tracheostomy care should be the subject of local quality improvement initiatives. Tube data should be more clearly recorded and made available for review at the bedside and thereafter facilitated by a 'passport' for each patient, with all data included. *(Medical Directors, Directors of Nursing and Health Care Commissioners)*

14. All hospitals should adhere to recommendations already made by the National Tracheostomy Safety Project to maintain an essential box of equipment which is sufficiently portable to be moved around with the patient. *(Clinical Directors and Tracheostomy Leads)*

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5 – The multidisciplinary care of tracheostomy patients

The multidisciplinary team

Patients requiring tracheostomies tend to have a longer length of stay due to their underlying disease. Many institutions may have evolved a team approach to provide coordinated care resulting in improved outcome and length of stay. This will comprise leads from the various specialties involved e.g. ear, nose and throat (ENT), head and neck specialists, speech and language therapists (SLT), physiotherapy, dietetics and nursing, from both the ward area and critical care outreach. Some hospitals now have specific tracheostomy nurses that fulfill a liaison role between the different hospital teams and the community. Whilst the team is potentially very large, regular input from key members is important and a flexible approach is required to make sure the correct composition is matched to the patient's ongoing needs. There is evidence that there is a reduced time to decannulation in centres which have provided multidisciplinary team discussion in comparison to their own previous practice.[20]

Clinicians in the hospital were asked about the availability of key members of the multidisciplinary team for the patient on the ward. Physiotherapy and critical care outreach were thought most likely to be consulted early on in the patient's ward stay. Whilst physiotherapy was available to almost all patients, and the team being accessible at all times of day and night in 74.3%, critical care outreach was not available in 96 cases (17.9%), and was only available 24/7 for 217 (40.4%) of ward patients (Table 5.1).

Table 5.1 Availability of disciplines

	Yes 24/7		Yes <24/7		No		**Subtotal**	Unknown	Not answered
	n	**%**	**n**	**%**	**n**	**%**	**n**	**n**	**n**
Physiotherapy	405	74.3	126	23.1	14	2.6	**545**	1	7
Critical care outreach	217	40.4	224	41.7	96	17.9	**537**	4	12

Table 5.2 Time between ward admission and first seeing a physiotherapist

	n	**%**
<12 hours	153	31.6
Between 12 - 24 hours	279	57.6
>24 hours	49	10.1
Other	3	0.6
Subtotal	**484**	
Unknown	24	
NA - Did not see physiotherapist	20	
Not answered	25	
Total	**553**	

Whilst many patients (279; 57.6%) were seen by a physiotherapist on the ward between 12 and 24 hours after admission (Table 5.2), there were 18/214 percutaneously inserted tracheostomy patients and 29/248 surgical cases who waited more than 24 hours to be reviewed. There were also 20 patients who did not see a physiotherapist at any point; 16 of which were surgically inserted. The input of physiotherapists into the routine acute care of the patient with a tracheostomy is extremely important. Particularly in ward based care they are key team members able to provide excellent day to day continuity of care and a level of vigilance to identify both tube and lower respiratory tract problems before they become serious complications.

Table 5.3 Availability of other multidisciplinary team members

	Yes		No		Subtotal	Unknown	Not answered
	n	%	n	%	n	n	n
Speech and language therapy	527	98.1	10	1.9	**537**	5	11
Dietetics	539	99.8	1	<1	**540**	6	7
Head and neck specialist/tracheostomy nurse	304	59	210	40.9	**514**	17	22

79.2% of patients (374/472) saw physiotherapists daily thereafter, and a further 92/472 (19.5%) saw a physiotherapist 2-3 times per week. Clinicians caring for these patients stated that this was inadequate in 19 cases. Other key members of the team were available in the majority of cases (Table 5.3).

Specialist head and neck/tracheostomy nurses were less likely to be part of the team that saw patients outside specialist centres (22/93 cases vs. 263/397 cases). In non head and neck specialist centres, head and neck/ specialist tracheostomy nurses were available in only 23.7% of cases, but in 66.2% of specialist centres. There was also a difference between the two in physiotherapy provision with non head and neck centres having availability 24/7 in 59.4% (63/106) of cases reviewed compared with 77.9% (321/412) in the specialist centre.

Patients were discussed at an MDT meeting in 318/474 (67.1%) cases. Overall 72.6% (180/248) surgical patients were discussed at an MDT on the ward vs. 62.3% (127/204) of patients with a percutaneously placed tracheostomy. This may be explained by the fact that those patients who received a surgical tracheostomy often have them provided as part of a planned head and neck procedure which includes a relatively well defined pathway, in which overview by an MDT is embedded in the process of care. Whilst percutaneous tracheostomies were inserted in a more diverse patient group in terms of underlying diagnosis, the need for supervision of care by an experienced MDT is no less important to ensure ongoing high quality care and decision making and facilitate appropriate discharge.

An MDT was more likely to have occurred in a head and neck centre (Table 5.4).

Table 5.4 Patient was discussed at an MDT post insertion (head and neck specialist vs. non head and neck specialist centres)

	Head and neck specialist hospital		Non head and neck specialist hospital	
	n	%	n	%
Yes	247	68.8	55	58.5
No	112	31.2	39	41.5
Subtotal	**359**		**94**	
Unknown	45		11	
Not answered	11		3	
Total	**415**		**108**	

The outcomes of all patients are discussed in full in chapter 7. However, of the patients not discussed at an MDT 14 patients went on to be discharged with a tracheostomy and yet had not benefited from MDT involvement, but would nevertheless need some level of ongoing care and supervision which may not have been adequately defined or organized (Table 5.5).

Table 5.5 Outcome of patients not discussed at a ward MDT

	n	%
Death	13	8.4
Decannulation	107	69.0
Discharge alive with the tracheostomy in situ	14	8.4
Alive and day 30 after insertion in theatre and transferred straight to ward	4	2.6
Alive and day 30 after leaving critical care	10	6.5
Alive and day 30 after insertion - location of insertion unknown	8	5.2
Subtotal	**155**	
Not answered	1	
Total	**156**	

In those cases where there was a ward based MDT discussion, details were collected about participation of teams members.

Whilst in the majority physiotherapy, dietetics and SLT were included, critical care outreach was much less likely to be represented, with just 93 cases (42.7%) where the outreach team were included (Table 5.6). Whilst the data has shown that only half of the ward cases had a percutaneous tracheostomy, it would seem sensible to suggest that the routine involvement of critical care outreach is an important feature of multidisciplinary care. In some units this liaison role may be in part fulfilled by dedicated tracheostomy care specialist nursing staff. Participation of dietitians was not universal with 41.2% of cases where they were not involved. However given the level of involvement of physiotherapy in the day to day care of tracheostomy patients, perhaps it is most surprising to see that 12% of patients did not benefit from their inclusion in the MDT review.

Table 5.6 Additional clinical teams participating in ward MDT in tracheostomy patients

	Yes		No		**Subtotal**	Unknown	Not available	Not answered
	n	%	n	%	n	n	n	n
Physiotherapy	243	88.0	33	12.0	**276**	11	6	25
Critical care outreach	93	42.7	125	57.3	**218**	12	33	55
Speech and language therapist	253	90.7	26	9.3	**279**	17	3	19
Dietetics	153	58.8	107	41.2	**260**	16	2	40
Head and neck specialist nurse	161	76.7	49	23.3	**210**	9	71	28

Case study 9

An elderly patient with known atrial fibrillation had a large stroke and required ventilation. A percutaneous tracheostomy was performed on day 4 and a cuffed fenestrated tube selected. The patient was discharged and appeared to have had no speech and language therapy input whilst on the intensive care unit (ICU). There was no documented handover note from ICU at discharge. Whilst on the stroke unit the Critical care outreach team organised decannulation after a 4 hour trial. The patient died within 3 days of decannulation, still with a very poor GCS and no clear plan of management, or withdrawal of care statement having been made.

Advisors felt that whilst this patient was likely to have had a poor outcome, they were concerned about the apparent lack of communication between the team members and the patient's family and documentation of a management plan.

Table 5.7 Specialist head and neck MDT participation

	Head and neck specialist hospital					
	Yes	No	**Subtotal**	Unknown	Not applicable	Not answered
Physiotherapy	178	33	**211**	7	5	24
Critical care outreach	63	100	**163**	8	31	45
Speech and language therapy	210	13	**223**	11	1	12
Dietetics	127	87	**214**	11	1	21
Head and neck specialist nurse	147	27	**174**	5	53	15

Table 5.8 Non specialist head and neck MDT participation

	Non head and neck specialist hospital					
	Yes	No	**Subtotal**	Unknown	Not applicable	Not answered
Physiotherapy	52	0	**52**	1	1	1
Critical care outreach	28	18	**46**	1	2	6
Speech and language therapy	38	12	**50**	2	1	2
Dietetics	20	19	**39**	2	0	14
Head and neck specialist nurse	7	22	**29**	2	16	8

As might be expected head and neck specialist/ tracheostomy nurses were also much more likely to be part of the MDT for the patients cared for in a centre with a head and neck facility on-site (Table 5.7). It was found that for 147/174 patients head and neck specialist nurses were part of the MDT for those in head and neck centres vs. just 7/29 in non head and neck centres, where data was provided (Table 5.8).

Communication in the critical care unit

Clinicians caring for patients in the critical care unit with a tracheostomy were asked whether efforts were made to facilitate communication. In the majority of cases this had occurred (Table 5.9).

Table 5.9 Attempts were made to facilitate patient communication

	n	%
Yes	1472	82.5
No	312	17.5
Subtotal	**1784**	
Unknown	116	
Not answered	56	
Total	**1956**	

However it is not known how many patients were unconscious (due to heavy sedation or neurological injury) during their critical care stay, and in these cases communication may well have been particularly difficult and/or impossible. However, even in these circumstances it is extremely important that bedside carers adopt a policy of assuming the patient is aware of conversations and kept informed on management decisions.

In those patients where communication was attempted the following methods were used (Table 5.10).

Pen and paper and employing a speaking valve were the most frequently used tools (Table 5.10). Whilst pen and paper is readily available it may be particularly difficult for the patient to both focus and use fine co-ordination skills to write legibly in this situation. In only 19.9% of patients 'other' methods were used. It is important that creative techniques appropriate to the special needs of the tracheostomy patient are employed, and this is particularly important when the patient has a cuffed and inflated tube and so use of a speaking valve is not possible.[21,22]

Table 5.10 Methods used to facilitate communication
(Answers may be multiple)

	n	%
Pen/paper	792	54.8
Speaking valve	731	50.6
Picture/alphabet chart	555	38.4
Other	288	19.9
Fenestrated tube	152	10.5
Other electronic device	65	4.5
Other insufflation devices	2	0.1
Subtotal	**1444**	
Not answered	28	

Whilst in 1472 patients cared for with a new tracheostomy on the critical care unit attempts were made to facilitate communication, in just 456/1693 (26.9%) cases was the advice of SLT sought. In some cases this may have related to the fact that there was insufficient time to involve SLT e.g. rapid decannulation or discharge. However their input and advice particularly in relation to longer term patients with anticipated swallowing difficulty, or problems with communication and decannulation are a very important part of the MDT approach in critical care as in other locations. Specific competencies for SLT in relation to the care of tracheostomy patients have recently been published.[23]

Ward communication, swallowing and nutrition

It would be expected that patients were referred to both SLT and dietetics at an early stage after admission. Whilst it is usually the case that assessment of swallow is not carried out until the tube cuff is deflated (with patients often nasogastric tube fed in the interim) it would be expected that SLT would be involved in relation also to communication and this may well be necessary at an earlier stage.

Clinicians completing a questionnaire at ward discharge stated that 50.7% (181/357) of patients with a newly formed tracheostomy were referred to SLT within 48 hours following the insertion. 31.7% (113/357) of patients waited longer than 48 hours to be referred and in 72 cases this information was unknown. Following referral, 78.6% (272/346) patients were assessed within 48 hours, and 11.6% (40/346) waited longer than 48 hours for their assessment. Thereafter the clinician completing the ward discharge questionnaires noted that half the patients (53.2%; 185/348) saw a SLT at least 2-3 times per week, but there were 13.2% (46/348) of patients where this was less than weekly and in 60 cases the information was unknown to the clinicians caring for the patient (Table 5.11). In 20/334 (6%) cases the clinicians caring for the patients reported that they felt this was not appropriate to the patient's needs.

The Advisors were asked, in those cases peer reviewed, if they believed that there had been sufficient attention to the communication needs of the patients in both the critical care unit and ward. In 65/295 (22%) cases reviewed where data was available this aspect of care was stated to be a problem. It was most commonly due to lack of SLT input and/or the tube cuff being permanently inflated.

Table 5.11 Frequency of ward patient seeing SLT after initial assessment

	n	%
Daily	62	17.8
2-3 times a week	185	53.2
Weekly	55	15.8
Less often	46	13.2
Subtotal	**348**	
Unknown	60	
Not answered	21	
Total	**429**	

It was also noted from the ward questionnaire data that it was common for patients on the ward to have swallowing difficulties, with 220/425 (51.6%) patients where this was reported (Table 5.12) This was a problem in both patients with surgical and percutaneously placed tracheostomy tubes in about equal numbers.

Table 5.12 Patient had ongoing swallowing difficulties

	Swallowing difficulties							
Type of tracheostomy	Yes		No		**Subtotal**	Unknown	Not answered	**Total**
	n	%	n	%				
Percutaneous	94	54.7	78	45.3	**172**	49	19	**240**
Surgical	115	48.5	122	51.5	**237**	25	23	**285**
Subtotal	**209**		**200**		**409**	**74**	**42**	**525**
Not answered	11		6		**17**	5	7	**29**
Total	**220**		**206**		**426**	**79**	**49**	**554**

Table 5.13 Cuff was continuously inflated vs. swallowing difficulty on ward

	Cuff was continuously inflated							
Swallowing difficulty on ward	Yes		No		**Subtotal**	Unknown	Not answered	**Total**
	n	%	n	%	n	n	n	n
Yes	51	26.0	145	74.0	**196**	5	10	**211**
No	47	28.6	119	71.4	**166**	14	7	**187**
Subtotal	**98**		**264**		**362**	**19**	**17**	**398**
Unknown	21		47		68	2	3	73
Not answered	11		23		34	0	13	47
Total	**130**		**334**		**464**	**21**	**33**	**518**

It was reported in Chapter 4 that there was a high percentage of ward patients who had a cuffed tube in place, and that in some the cuff was continuously inflated. The impact of an inflated cuff on the incidence of swallowing difficulty was assessed (Table 5.13)

Whilst these data do not confirm a clear association between cuff inflation and swallowing difficulty, it is recognised that the presence of a tracheostomy tube restricts laryngeal movement, desensitises the larynx and has a marked effect on the ability to swallow, particularly soon after insertion and there is an increased risk of aspiration. This is a highly complex area and the causative relationship is not completely clear with ongoing dysphagia also being linked to the underlying diagnosis, the degree of critical illness and associated respiratory compromise. Patients require very careful assessment by SLT prior to beginning oral fluids and feeding, with ongoing vigilance by the ward team to prevent complications.

Data from the 220 patients with reported dysphagia were reviewed and their access to SLT services assessed (Table 5.14).

Table 5.14 Point of referral to SLT for patients with dysphagia

	n	**%**
<24 hours	52	31.0
Between 24 - 48 hours	44	26.2
>48 hours	42	25.0
Other	30	17.9
Subtotal	**168**	
Unknown	30	
NA - not referred to SLT	17	
Not answered	5	
Total	**220**	

Whilst about half the patients had an early referral to SLT (within 48 hours), 42/168 patients waited longer to be referred and in 47 patients there was no SLT referral or timing was unknown. Whilst dysphagia in these patients may have resolved this would seem to be rather at odds with organisational data and data provided earlier in this chapter which suggested that SLT is a very readily available service in most centres.

For those referred, the speed at which SLT was able to attend for a first consultation was reviewed.

This indicated that SLT were available to see patients with dysphagia within 48 hours of referral in 82.5% of cases (132/160). However there were also 15 patients where this referral took place at a point greater than 48 hours from assessment. (Data were not available or not provided in two cases). Thereafter 86/159 patients benefited from SLT attention 2-3 times per week, but in 29/159 this was less often and in 9 patients this was either unknown or not answered. In total there were 113/348 patients who experienced a delay of more than 48 hours in either referral or review and 16 patients in whom both was experienced.

In most patients, both in the critical care unit and ward, peer reviewed data demonstrated insufficient attention to the patient's ability to swallow safely was given in about 14.3% patients (Table 5.15). The reason for this in the majority (24/31) of patients was felt to be lack of SLT involvement, and in 8 because their tracheostomy tube cuff was permanently inflated.

Table 5.15 Attention to patient's ability to swallow safely

	n	%
Yes	191	85.7
No	32	14.3
Subtotal	**223**	
Insufficient data	74	
Not applicable	77	
Not answered	22	
Total	**396**	

Given the frequency of swallowing difficulties it is unsurprising that 82.4% (436/529) of patients required ongoing artificial hydration and nutrition using a nasogastric tube or gastrostomy at some point during their stay. Many would have also had complex metabolic needs related to their underlying diagnosis, and some may have had pre-existing poor nutrition. Just over half of ward patients (58.3%; 260/446) were referred to a dietician within 48 hours of the tracheostomy insertion, with 87.1% (366/420) being seen within 48 hours of referral. Thereafter 94.8% (405/427) were seen by a dietitian at least weekly, with 1 in 5 (22.5%; 96/427) seen daily.

Key findings

67.1% (318/474) of ward patients with a tracheostomy were discussed at an MDT meeting.

Composition of the MDT varied and dietetics and critical care outreach were relatively poorly represented (included in 42.7% (93/218) and 58.8% (153/260) of MDTs respectively).

Physiotherapy was not included in 12% (33/276) of patient MDTs.

96/168 57.1%) of patients with a swallowing difficulty had an early referral to Speech and Language Therapy (within 48 hours).

42/168 (25%) patients with a swallowing difficulty waited longer than 48 hours for referral to Speech and Language Therapy.

In cases reviewed by Advisors there were 32/223 patients (14.3%) where it was felt that attention to swallowing difficulty was insufficient, and this related mainly to a lack of Speech and Language Therapy input.

The advice of SLT was sought in only 456/1693 (26.9%) patients with a new tracheostomy on the critical care unit.

Recommendations

15. In order to facilitate decannulation and discharge planning multidisciplinary care needs to be established as part of the routine pathway for ALL tracheostomy patients. Whilst on the critical care unit where there will be at least daily reviews, key additional team members should be involved at an early stage. The team composition should be flexible to properly reflect the patient's needs and provide excellent continuity of care. There are several key team members who one would expect should always participate, e.g. physiotherapy, speech and language therapy, outreach nurses and dietitians. Hospitals need to provide adequate staff to ensure this happens routinely and in a timely manner. *(Clinical Directors and Critical Care Managers)*

16. Involvement of Speech and Language Therapy in critical care needs to be facilitated particularly for more complex patients and to assist clinicians with high quality communication strategies as well as day to day ward care and according to patient needs. *(Clinical Directors and Speech and Language Therapists)*

17. Dysphagia reported in tracheostomy patients warrants ongoing and further study in terms of risk factors, identification and natural history. *(All Professional Health Care Bodies involved with tracheostomy care)*

18. There needs to be improved recognition of the incidence of swallowing difficulty in tracheostomy patients at all points in the care pathway. Early referrals to Speech and Language Therapy with specific competences are recommended. *(All Consultants and Speech and Language Therapists)*

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6 – Complications and adverse events

A wide range of complications, known to occur in patients with a tracheostomy were assessed. Whilst these are well documented elsewhere [4,10,24,25,26], these data are from a recent large UK population of both surgical and percutaneous insertions of tracheostomy. This NCEPOD report comes after important national recommendations and initiatives for care of patients with tracheostomy have been published and widely disseminated.[1,2,4,7,27]

A total of 461/1956 (23.6%) patients experienced a defined complication whilst in the critical care unit after insertion of a tracheostomy (Table 6.1). Many of these complications occurred in the same patients. Not all could be attributed solely to the presence of a tracheostomy (e.g. respiratory infection which was the most common complication). 121/461 patients had 'infection – respiratory' as a sole complication. The narrative of those events where an artificial airway contributed directly to the complication, and particularly those complications of a potentially immediate life threatening nature, were the focus.

Whilst the majority of patients had one reported complication, 134/461 (29.1%) had 2 or more (Table 6.1).

Table 6.1 Number of patients with complications vs. number of complications per patient

	n	%
1	327	70.9
2	98	21.3
3	29	6.3
4	6	1.3
5	1	<1
Total	**461**	

The complications which occurred in critical care must be looked at in the context of the sick patient who requires an artificial airway in order to facilitate ventilation, prevent aspiration and/or bypass airway obstruction. Endotracheal tubes which might be seen as an alternative for some patients also result in a range of serious complications.[4] The insertion of a tracheostomy tube is attended with some of the same complications and is performed in the belief that the benefits (in terms of increased patient comfort and improved ability to wean from ventilation) generally outweigh the risks. The type of complication experienced was assessed (Table 6.2).

Table 6.2 Complications in the critical care unit *(Answers may be multiple referring to the numbers of complications not patients).*

	Complication		Recurrence
	n	%	n
Infection - respiratory	190	9.7	36
Bleeding - minor	92	4.7	13
Accidental decannulation/ displacement	80	4.1	12
Obstruction	45	2.3	7
Pneumothorax	35	1.8	6
Infection - local	34	1.7	5
Dysphagia	26	1.3	10
Bleeding major	25	1.3	6
Surgical emphysema	24	1.2	1
Aspiration	19	1.0	2
Pneumo-mediastinum	8	<1	0
Fistula formation - trache-oesophageal	5	<1	3
Infection - mediastinitis	4	<1	0
Tracheal damage - to tracheal ring/necrosis	2	<1	0

Timing of complications

Patients in this study were followed for their entire critical care stay if their tracheostomy remained in place, which in some was for many weeks or months. Where data were available, slightly more complications (279; 57.3%) occurred in the first 7 days after insertion, than the rest of the time on critical care (208; 42.7%) (Table 6.3).

It would be expected that some complications would be more common in the early days after a tracheostomy insertion (e.g. pneumothorax, surgical emphysema). The analysis was guided to look at those complications which led to the need to replace the tube before an established tract may have formed. Tube displacement or obstruction may be very difficult to deal with in this situation, and, when the larynx is still present, may require that the patient is urgently re-intubated to re-establish a patent airway. The consequences of a blocked or displaced tube may result in a very rapid deterioration in oxygenation to vital organs, particularly in association with respiratory and cardiovascular co-morbidity. Even if managed both quickly and expertly further deterioration is likely. There were 32 cases of accidental decannulation and 19 cases of tube obstruction which were recorded in the first 7 days post insertion.

Table 6.3 Timing of complications in relation to insertion

	Before day 7	Day 7 or after	**Subtotal**	Not answered	**Total**
Surgical emphysema	15	4	**19**	5	**24**
Pneumo-mediastinum	2	3	**5**	3	**8**
Pneumothorax	19	11	**30**	5	**35**
Accidental decannulation/ displacement	32	39	**71**	9	**80**
Obstruction	19	21	**40**	5	**45**
Bleeding - minor	67	14	**81**	11	**92**
Bleeding - major	14	6	**20**	5	**25**
Infection - local	19	10	**29**	5	**34**
Infection - mediastinitis	1	0	**1**	3	**4**
Infection - respiratory	82	75	**157**	33	**190**
Aspiration	4	9	**13**	6	**19**
Fistula formation - trache-oesophageal	1	0	**1**	4	**5**
Tracheal damage - to tracheal ring/necrosis	1	1	**2**	0	**2**
Dysphagia	3	15	**18**	8	**26**

Table 6.4 A known coagulation defect in the case of a major haemorrhage

	n
Yes	6
No	17
Subtotal	**23**
Not answered	1
Total	**24**

Bleeding was also a relatively common complication in the first 7 days after tube placement, with 67/81 cases of minor bleeding and 14/20 cases of major bleeding occurring relatively early. This may have related to pre-existing deranged coagulation in some. There were 6/23 patients who sustained a major haemorrhage in whom there was a known coagulation defect (Table 6.4). In five of these cases it was known that attempted correction of the coagulation disorder had taken place.

There were 50 'other' complications which occurred in the patients on the critical care unit and ranged from cuff leak to vocal cord palsy.

Clinicians provided free text comments about complications not specifically listed in the questionnaire. When examined 13/25 of these 'free field' comments related to cuff problems, mainly leakage of the cuff. As well as immediate problems with oxygenation and ventilation such leaks lead to a greater risk of ventilator associated pneumonia secondary to aspiration.

BMI and complications

Whilst some studies have recognised that patients with a high BMI have a greater incidence of tracheostomy related complications,[4,28] a large meta-analysis on whether obesity had an overall effect on outcome from critical illness did not demonstrate increased mortality'.[29]

Case study 10

A young immuno-compromised patient with severe viral pneumonia deteriorated quickly and was transferred for ECMO from a small DGH due to their very high ventilatory requirements. The patient underwent percutaneous tracheostomy insertion (9mm tube) within hours of being established on VV ECMO and whilst fully anti-coagulated receiving a heparin infusion. Directly after insertion large amounts of blood were aspirated from the tracheostomy tube but this subsequently settled. The patient was successfully weaned from ECMO two weeks later and transferred back to their local intensive care unit with a tracheostomy in place but breathing spontaneously with a mask.

Advisors could not be clear from records why there was an urgency to insert a tracheostomy so soon after transfer and commencing ECMO and when full anti-coagulation was an additional risk factor.

However other studies which relate obesity to critical care survival have shown a greater number of deaths in particular subsets of critically ill patient e.g. those ventilated for more than 48 hours.[10]

The data in Table 6.5 did not reveal that complications overall were more commonly seen in the high BMI group. BMI was not recorded in 240 cases (240/1895; 12.7%).

Case study 11

A relatively young patient with a BMI of 44 and known central hypoventilation syndrome, chronic renal impairment, and cardiac failure was admitted after a respiratory arrest at home. There was a history of increasing shortness of breath for the previous 48 hours and of drowsiness. Both bag/mask ventilation and intubation in the emergency department proved very difficult and the patient sustained a period of cardiac arrest. The patient was transferred sedated and ventilated to the Critical care unit by an anaesthetic registrar, and underwent a percutaneous tracheostomy 5 days later using an 8mm tube with an adjustable flange but no inner tube. After a poor initial neurological recovery the patient was rapidly weaned to CPAP. However the tracheostomy tube was accidentally displaced in the middle of the night with a difficult re-insertion and a period of de-saturation, after which the patient required re-ventilation. This episode was very poorly documented in the medical notes and NCEPOD questionnaires. The following day the patient underwent a further (planned) tracheostomy change using a larger tube after recurrent episodes of de-saturation. Two days later, after no further apparent neurological recovery, a decision was made to withdraw care.

Whilst the accidental tracheostomy tube displacement was not thought to have contributed materially to the overall outcome of this patient, the Advisors were concerned about the choice of tracheostomy tube at first insertion as well as the poor standard of documentation in this case.

Table 6.5 All complications vs. BMI in critical care patients

	BMI<30 (n=1151)	BMI ≥30 (n=504)	BMI not given (n=240)
	n	n	n
Surgical emphysema	8	11	3
Pneumo-mediastinum	3	2	3
Pneumothorax	16	11	5
Accidental decannulation/displacement	45	21	12
Obstruction	29	11	4
Bleeding - minor	55	24	12
Bleeding - major	19	4	2
Infection - local	23	8	3
Infection - mediastinitis	2	2	0
Infection - respiratory	115	41	26
Aspiration	45	3	3
Fistula formation trache-oesophageal	4	0	1
Tracheal damage	1	0	1
Dysphagia	16	6	2

Table 6.6 Major complications in critical care patients with a tracheostomy

	Complication		Consultant present in the first hour		
Complication	**n**	**%**	**Yes**	**No**	**Not answered**
Major bleeding	25	1.3	18	3	4
Pneumothorax	35	1.8	26	1	8
Accidental decannulation/displacement	80	4.1	36	26	18
Obstruction	45	2.3	21	14	10

Major tracheostomy complications in critical care

Major complications were reviewed in more detail (major bleeding, pneumothorax, accidental decannulation/displacement and tube obstruction), and the response in terms of seniority of staff involved (Table 6.6).

Clinicians were asked to identify the number and seniority of medical staff that responded to these emergency situations within the first hour after they had occurred. The data was examined for the four major complications separately.

An artificial airway, particularly in a critically ill patient, will always provide the potential for severe complications. As discussed in Chapter 4, many of these complications arise unpredictably, and lead to very rapid deterioration, particularly in a patient group with serious co-morbidities. Avoidance of critical airway events is important whenever possible, and relies heavily on meticulous attention to detail in terms of tube position and daily bedside care. This must be matched with the competences to recognize and provide early management of tube problems by skilled nurses, physiotherapists and attending medical staff. If airway problems are rapidly resolved then there may be no need to escalate care and to seek urgent consultant support.

Table 6.6 demonstrated that the management of serious tracheostomy complications included a high level of early on-site attention by Critical Care consultants. Whilst this is appropriate, there also needs to be an ongoing focus for training (including simulation) on how to recognize and provide an early and effective response to tracheostomy emergencies.

Case study 12

A middle aged patient who had a high BMI sustained a high cervical fracture after a fall with a high thoracic sensory level due to spinal cord trauma. There were other injuries, to chest and face, and the patient underwent a difficult insertion of surgical tracheostomy. At day 10 after insertion and during day time hours the tube was either blocked or displaced which resulted in a cardiac arrest responding to short period CPR and tube re-insertion. Management was complicated by lack of venous access at this point.

Advisors commented on the speed of onset of severe hypoxia and arrest in this patient which was ultimately very well managed by resident staff. Despite the potential for major harm as a result of this complication the patient was successfully decannulated about one month later.

Complications and adverse events on the ward

As in critical care, the nature and frequency of complications on the ward in those patients with a tracheostomy was reviewed. The study period for individual patients varied according to the particular outcome of tracheostomy care but was always less than 30 days.

A total of 173/553 (31.3%) patients with a tracheostomy were cared for in wards other than the critical care unit and experienced complications. In one third (58/173) of patients there was more than one complication (Table 6.7).

Table 6.7 Number of complications experienced by ward based tracheostomy patients

Number of complications per patient	n	%
1	115	66.5
2	42	24.3
3	11	6.4
4	5	2.9
Subtotal	**173**	

Where data were available it demonstrated that a minority of patients (31) suffered complications on both critical care and ward (Table 6.8).

Table 6.8 Patients who had ward complications also had complications in the critical care unit

Complication on the critical care unit	Complication on the ward		
	Yes	No	Total
Yes	31	55	**86**
No	99	240	**339**
Total	**130**	**295**	**425**

The most common complication reported in the ward as in the critical care unit was respiratory infection (Table 6.9). Difficulty swallowing was more commonly reported in the ward as compared to the critical care unit, and was seen in 1.3% in the critical care unit and 6.3% of patients in the ward. It was noted that whilst swallowing difficulty occurred in more than 40% of ward patients overall, it was only reported as a complication in 6%. This may indicate that it was a short lived problem, but could also signify a level of under reporting of the problem by clinicians completing the questionnaire. It may also denote the genuine difficulty which clinicians have in deciding between what is a temporary problem with swallowing post tracheostomy insertion and the picture is with respect to longer term dysphagia.

Table 6.9 Complications on the ward *(Answers may be multiple)*

	Complication		Recurrence
	n	%	Yes
Infection - respiratory	82	14.8	14
Accidental decannulation/ displacement	35	6.3	3
Dysphagia	35	6.3	7
Bleeding - minor	19	3.4	4
Aspiration	18	3.2	3
Infection - local	17	3.1	1
Surgical emphysema	6	1.1	1
Obstruction	5	<1	1
Bleeding major	4	<1	1
Pneumothorax	3	<1	0
Pneumo-mediastinum	1	<1	0
Infection - mediastinitis	1	<1	0
Fistula formation - trache-oesophageal	1	<1	0

Accidental decannulation was more common in ward areas in comparison to critical care (6.3% vs. 4.1%) and it is perhaps unsurprising that in locations where patients are likely to be relatively active/mobile, and without 1:1 nursing care, that accidental decannulation/ tube displacement is a more frequent complication. It is known that the consequences of such an event can be extremely serious for the patient if expert management is not swiftly available.[10] Therefore ward nurses need also to be competent and confident to deal with these situations and have in place clear action plans.

Major bleeding is potentially an extremely serious complication when it occurs in the ward. Management requires skilled personnel to provide resuscitation as well as airway management, appropriate equipment, good lighting, and often blood transfusion. In this study major bleeding in the ward occurred in a very small number of cases but the early involvement of a consultant and on-site assistance within the first hour was not universal.

Advisor data-major complications

The Advisors were also asked to provide further detail about major complications seen within peer reviewed cases (Table 6.10).

As with questionnaire data, overall major complications were more common in patients whilst in critical care compared with ward care. Critical care cases represented the largest proportion of cases subject to peer review (70%) and on occasion patients remained on critical care for very long periods with a tracheostomy in place. However the period of ward review was a maximum of 30 days. It is self evident that patients requiring critical care are more likely to have a greater acuity of associated cardio-respiratory illness, and are therefore likely to decompensate more rapidly when complications arise.

Table 6.10 Major complications *(Advisors' opinion)*

				Location			
	Complication		Reoccurrence	Critical care	Ward	Both	Not answered
	n	%	n	n	n	n	n
Major bleeding	10	2.5	6	6	1	2	1
Pneumothorax	10	2.5	2	8	1	0	1
Accidental decannulation	29	7.3	5	15	11	1	2
Obstruction of tube	14	3.5	6	11	2	0	1

Table 6.11 The patient suffered serious long term effects from a clinically significant tracheostomy related complication *(Advisors' opinion)*

	n	%
Yes	12	4.1
No	281	95.9
Subtotal	**293**	
Insufficient data	24	
Not answered	79	
Total	**396**	

Advisors were asked to whether they believed the patients they reviewed had suffered a serious complication as a result of a tracheostomy which led to a poor outcome and in 12 cases they stated that such an event had occurred (Table 6.11).

The detail on the reasons for this outcome is presented in Table 6.12.

Table 6.12 Serious long term outcomes from Tracheostomy related complications *(Advisors' opinion) (Answers may be multiple)*

	n
Hypoxic brain damage	3
Myocardial ischaemia	1
Severe local sepsis	3
Other	4
Total	**12**

The detail of the four cases stated by Advisors to have sustained a serious long term outcome due to 'other' causes was reviewed. There appeared to be several reasons for making this decision including severe intrathoracic air leaks and tracheostomy fistula.

Adverse events and outcomes

There were a larger number of episodes of hypoxia some of which led to cardiac arrest in the the critical care unit. NCEPOD had data on a much larger population of patients cared for in these areas (1956 vs. 554). However, as noted previously, it would be the expectation that critical care patients would have a much higher burden of illness, with cardio-respiratory co-morbidity being particularly common.

Hypoxia and adverse outcomes in the critical care unit

The questionnaires of all cases in which it had been indicated that there had been a period of hypoxia secondary to a tracheostomy related complication in Critical Care were reviewed. Several of these were reported by local clinicians to have ultimately had an adverse outcome as a result of a serious airway event.

A detailed examination of available questionnaires of the 35 patients who had suffered a period of hypoxia of more than five minutes duration with oxygen saturations less than or equal to 90% where this related to a tracheostomy or airway related incident was performed. Hypoxic events occurred at all points in the patient pathway from insertion to decannulation.

Hypoxia at tracheostomy insertion in the critical care unit

At tracheostomy insertion there were various reasons cited for the hypoxic event. Examples of events included accidental endotracheal cuff puncture during a percutaneous tracheostomy tube insertion in a patient with very poor lung compliance, failed percutaneous tracheostomy in a patient with a short neck and high BMI (resulting in a planned surgical insertion in theatre), and emergency failed intubation followed by a failed (emergency) percutaneous insertion (resulting in an emergency tracheostomy in theatre) (see Table 3.13).

These difficult airway scenarios further illustrate the problems which sometimes arise during both planned and particularly unplanned tracheostomy insertion/ emergency airway rescue. It is clear that there is a need to adhere initially to basic airway emergency algorithms in these situations with the priority being oxygenation, and that both a range of equipment and advanced competences need then to be readily available to provide a good outcome for the patient.[30]

There were other patients in the critical care unit who sustained a period of hypoxia during their stay which related to a tracheostomy tube complication which followed insertion. Many had a high level of associated co-morbidity and as in the main population around one third had a BMI of more than 30. Eighteen patients had undergone percutaneous insertion, 14 surgical and in one this information was not clearly recorded as an insertion questionnaire was not completed.

The reasons for severe and prolonged hypoxia are summarised as follows:

Blocked tracheostomy tube
A minority of cases occurred very early after insertion and were managed appropriately with emergency re-intubation. There were also cases which occurred in association with major haemorrhage. Some patients sustained a cardiac arrest as a consequence of a blocked tube.

Accidental decannulation
Accidental decannulation/tube displacement occurred due to the patient removing the tube themselves or whilst being moved to provide care e.g. when rolling the patient to prevent pressure areas, or in moving the patient in or out of bed the tube is dislodged. In this study whilst some cases were managed relatively rapidly without apparent long term effects, all resulted in a period of hypoxia and several cases of displaced tube led to cardiac arrest.

Severe haemorrhage
Severe haemorrhage tended to occur relatively early in the first 7 days post tracheostomy insertion, and in a minority was associated with severe hypoxia. Haemorrhage resulted in tube occlusion, and also occurred after accidental decannulation. As well as airway clearance and tube re-insertion, patients also required transfusion and correction of coagulopathy.

Major tube leaks
Tube leaks were a relatively common reason for other complications and in some cases there were serious consequences resulting from inadequate ventilation and oxygenation.

Other causes of severe and prolonged hypoxia include major intra-thoracic air leaks producing pneumothorax, aspiration and difficult tube changes in patients with a pre-existing high oxygen requirement which resulted in more prolonged interruptions in oxygenation/ventilation.

Cardiac arrest in the critical care unit
There were 11/121 cases where clinicians indicated that a cardiac arrest had occurred directly as a result of a complication of the tracheostomy and these patient questionnaires were reviewed. As might be expected the vast majority occurred after a period of hypoxia (see discussion of cases discussed in the previous section).

Patients who sustained a cardiac arrest as a result of a tracheostomy related complication were from mixed diagnostic groups, and many had a high BMI (≥30). All had a very high acuity of associated illness with associated co-morbidities which included severe sepsis. Whilst most had been admitted as emergencies some patients had undergone planned (non head and neck) surgery including cardiac and neurosurgery and had developed severe post operative complications which required prolonged stays in critical care and ventilatory support.

The management of blocked and displaced tubes is a recurrent theme within this study and ultimately it was this complication which was the greatest single cause of hypoxia and cardiac arrest in patients with a tracheostomy leading to serious morbidity and mortality. This is not an unexpected finding and has been highlighted in many previous studies, most recently in the UK in the National Audit of Airway complications conducted by the RCoA and Difficult Airway Society and published in 2011.[4]

A number of questions were asked in the organisational questionnaire around the guidelines, protocols and training around the management of blocked and displaced tubes. The ICS standards[2] state "every hospital must have a procedure for managing patients whose tracheostomy is blocked or displaced. Staff must be aware of this and receive appropriate training to manage the problem". Such an algorithm is reproduced in Appendix 3.

Table 6.13 Procedures for the management of blocked or displaced tubes

	Yes		No		Subtotal	Not answered
	n	%	n	%	n	n
Is there a procedure for the management of patients whose tracheostomy is blocked or displaced?	174	80.6	42	19.4	**216**	3

Within this study, nearly 81% of hospitals reported having a protocol for the management of patients whose tracheostomy is blocked or displaced (Table 6.13). Where such a protocol was in place hospitals were asked to indicate whether this covered critical care and/or the general ward, and in a vast majority of cases it did (critical care –94.5%; 154/163; 11 not answered; general ward – 90.8%; 148/163; 11 not answered). Where a protocol was in place, respondents were asked to indicate whether all staff were made aware of this, and in 88.2% of hospitals (150/170) they were. However, hospitals were also asked to indicate whether all staff received training in the management of blocked and displaced tubes, (Table 6.14). This was not undertaken in 27.9% of hospitals.

Table 6.14 Training in the management of blocked or displaced tubes

	n	%
Yes	124	72.1
No	48	27.9
Subtotal	**172**	
Not answered	2	
Total	**174**	

Ward data (prolonged hypoxia and cardiac arrest)

It was also asked if patients on the ward suffered any evidence of clinical hypoxia during their ward stay and whether this was confirmed by monitoring of oxygen saturation (accepting that, unlike in critical care patients continuous oxygen saturation monitoring will not be generally indicated).

Episodes of prolonged clinical hypoxia were reported in 39/518 patients (7.5%), and were confirmed by monitoring of oxygen saturation in 19/24 cases, (the question was unknown in one case and not answered in 14 cases) (Table 6.15).

Table 6.15 Number of patients who suffered clinical hypoxia whilst on ward

	n	%
Yes	39	7.5
No	479	92.5
Subtotal	**518**	
Unknown	7	
Not answered	28	
Total	**553**	

In 8/38 cases clinical hypoxia was felt to be due to a tracheostomy related complication, and health professionals reported that this resulted in harm in five patients. The factors which led to hypoxia were essentially the same as in critical care with accidental decannulation and tube obstruction being the most common, with one case resulting in cardiac arrest.

Key findings

23.6% (461/1956) of patients had complications whilst in the critical care unit.

31.3% (173/553) of patients had complications whilst on the ward.

The most serious complications in patients during and after tracheostomy insertion in both critical care and the ward, were accidental tube displacement, obstruction, pneumothorax and haemorrhage. Consultant involvement in the management of these complications was high.

Accidental tube decannulation/displacement occurred in 35/553 (6.3%) of patients in the ward and in 80/1956 (4.1%) patients in critical care.

174/216 hospitals (80.6%) had a policy for the management of blocked or displaced tubes.

27.9% (48/172) of hospital sites did not provide staff training in the management of blocked and displaced tubes.

Recommendations

19. Bedside staff who care for tracheostomy patients must be competent in recognizing and managing common airway complications including tube obstruction or displacements and as described by the National Tracheostomy Safety Project algorithms. *(Medical Directors and Directors of Nursing)*

20. Emergency action plans must clearly reflect the escalation policy in order to summon senior staff in the event of a difficult airway event. Equipment including capnography must be always available, checked and utilised in patient care and in training scenarios. This reinforces the recommendation in the NAP4 guidance. *(Clinical Directors)*

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7 – Outcomes of care in tracheostomy patients

The outcome of patients after a new tracheostomy was reviewed, end points included planned decannulation, discharge beyond the hospital from which data had been requested, or death. The pathway after discharge from the critical care unit if this involved a ward stay in the same hospital was up to a maximum of 30 days.

Critical care outcome

Table 7.1 Reasons for the critical care unit discharge questionnaire completion

	n	%
Decannulation	944	48.6
Discharge	657	33.8
Death	340	17.5
Subtotal	**1941**	
Not answered	15	
Total	**1956**	

Table 7.1 represents a summary of the outcome of patients with a new tracheostomy who were decannulated, died or were discharged with a tracheostomy from the critical care unit where data was provided.

Ward outcome

Table 7.2 represents the summary of the outcomes of patients with a new tracheostomy who were decannulated, died or were discharged from a ward at or less than 30 days after being admitted, or that still remained there with a tracheostomy on day 30 where data was provided. These data were divided into surgical and percutaneously inserted tracheostomies. In 26 cases this part of the questionnaire was not completed, and so data were not available.

Table 7.2 Summary of outcomes on the ward

	Type of tracheostomy insertion				
	Surgical	Percutaneous	**Subtotal**	Not answered	**Total**
Death	13	25	**38**	1	**39**
Decannulation	172	146	**318**	16	**334**
Discharge alive with the tracheostomy in situ	50	30	**80**	2	**82**
Alive and day 30 after insertion in theatre and transferred straight to ward	14	1	**15**	0	**15**
Alive and day 30 after leaving the critical care unit	18	28	**46**	2	**48**
Alive and day 30 after insertion - location of insertion unknown	13	10	**23**	5	**28**
Subtotal	**280**	**240**	**520**	**26**	**546**
Not answered	4	0	**4**	3	**7**
Total	**284**	**240**	**524**	**29**	**553**

Decannulation

It was apparent from both the Expert and Advisor groups that hospitals have very different overarching policies and approaches to discharge of patients with a tracheostomy for routine ongoing care in ward areas. Whilst many units appeared to have policies which sought to provide planned decannulation before discharge from the critical care unit, others promoted relatively early discharge to a ward area, with many patients still having a cuffed tracheostomy tube in place. Likewise some hospitals had a limited number of locations outside the critical care unit where patients with a tracheostomy can be cared for, whilst others have many as shown in Chapter 2). It was therefore expected that decannulation would occur in both locations.

Decannulation in the critical care unit

Decannulation in the critical care unit occurred in 944/1941 (48.6%) patients. This was successful in 916 patients (Table 7.3)

Patients were decannulated in the critical care unit throughout the whole week (Figure 7.1)

Table 7.3 Success of decannulation in the critical care unit

	n	%
Yes	916	98.8
No	11	1.2
Subtotal	**927**	
Unknown	3	
Not answered	14	
Total	**944**	

Where data was available it showed that patients tended to be decannulated during the normal working day (Table 7.4).

Table 7.4 Time of decannulation

	n	%
08:00 - 17:59	730	94.1
18:00 - 17:59	46	5.9
Subtotal	**776**	
Unknown	143	
Not answered	25	
Total	**944**	

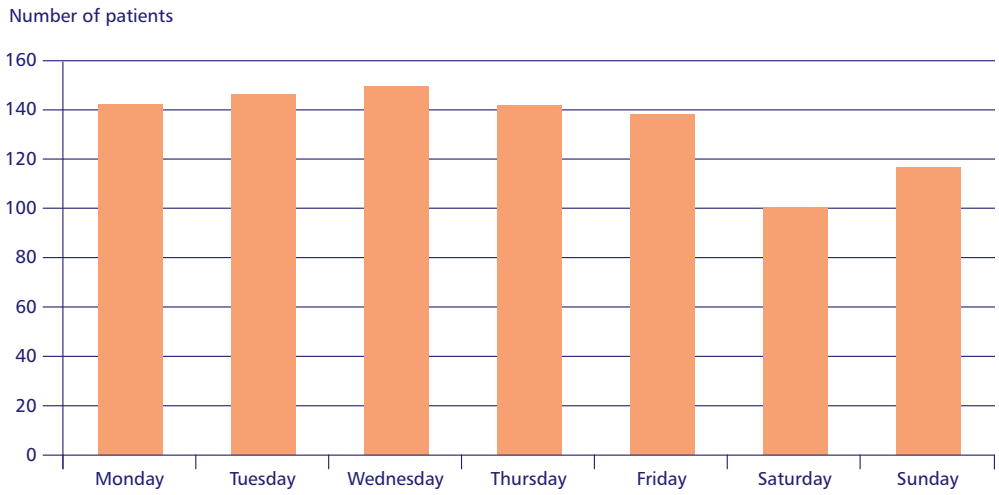

Figure 7.1 Day of week of decannulation

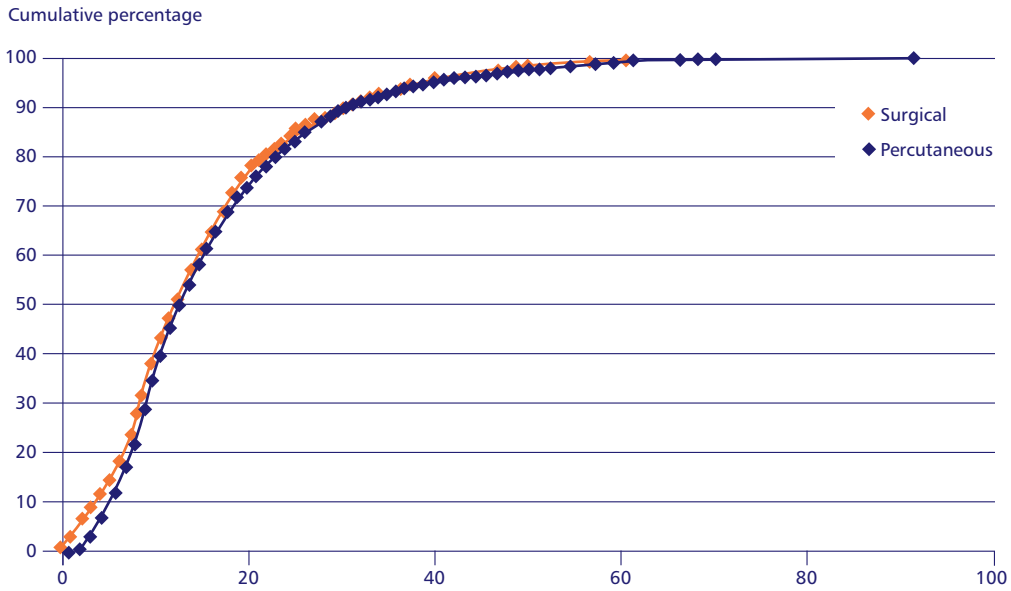

Figure 7.2 Days between insertion and decannulation in critical care

Timing of decannulation in relation to insertion was assessed (Figure 7.2).

Given the possible need for re-insertion and the fact that a tracheostomy tract may be poorly established before approximately day 7, it would be expected that planned decannulation may be relatively high risk before this point in time. 17.7% (161/910) of patients underwent decannulation in under 7 days in the critical care unit.

There was very little difference between the number of early decannulations in patients with surgical and percutaneously inserted tracheostomy (18.7% vs. 17.6% at less than 7 days from insertion). The fact that so many underwent early decannulation may reflect decisions to place a tracheostomy in patients who would have perhaps weaned successfully to extubation if an endotracheal tube had remained.

From Chapter 3 it was shown that 565/1890 (29.9%) of patients had a trial of extubation prior to the tracheostomy. Table 7.5 summarises whether it occurred for those patients who underwent an early decannulation.

Table 7.5 Patients undergoing an early decannulation who underwent a trial of extubation prior to tracheostomy formation

	n	%
Yes	56	39.7
No	85	60.3
Subtotal	**141**	
Unknown	5	
Not applicable	10	
Total	**156**	

There were 85 patients in total who did not undergo a trial of extubation prior to tracheostomy formation and also underwent early decannulation (See Figure 3.8). Some of these cases were planned surgically inserted tracheostomies as part of a larger head and neck procedure and therefore a trial of extubation would not have been indicated. Of the 156 early decannulations, 38 patients had undergone a surgical tracheostomy and in 13 of these it was part of a planned head and neck procedure. All percutaneously inserted tracheostomies where early decannulation occurred were reviewed with respect to how many patients had had a trial of extubation prior to tracheostomy formation. This revealed that 48/116 patients had not undergone a trial. So of the 85 patients who did not have a trial of extubation the majority (68) were percutaneous. In some groups of patients it is known that a trial of extubation may have been regarded as unwarranted e.g. those who had suffered a serious head injury.

Whilst the decision about timing of tracheostomy is notoriously difficult and there are obvious advantages in terms of providing early tracheostomy in terms of greater patient comfort, and an expected reduction in sedation requirements, it is now known from Trachman data[31,35] that early tracheostomy does not result in improved patient outcomes. Serious complications may arise from a tracheostomy and it important that it is not necessarily regarded as being a safer alternative to an endotracheal tube. In most patients admitted to critical care and requiring respiratory support the ultimate aim is still to make them independent of an artificial airway. Whilst patients can often be managed with a tracheostomy in a wider number of hospital locations, there must also be very good levels of competence and equipment available to do so safely.

Airway assessment

Airway assessment with or without airway endoscopy is recommended in preparation for decannulation.[2,27] Most tracheostomies in critical care are carried out for weaning and patients do not have an abnormal upper airway per se. However upper airway endoscopy may be useful to check upper airway anatomy in preparation for decannulation to assess for e.g. granulation tissue at the tip of the tube and other potential causes of obstruction and/or bleeding once the tracheostomy tube is removed (Table 7.6).[32] A functional assessment of the upper airway may also be particularly useful made by speech and language therapists to look at the patient's ability to deal with saliva, and therefore to more accurately quantify aspiration risk.

Table 7.6 Airway endoscopy was performed prior to decannulation

	n	%
Yes	16	1.9
No	845	98.1
Subtotal	**861**	
Unknown	65	
Not answered	18	
Total	**944**	

In this study upper airway endoscopy was a procedure which was rarely undertaken, with less than 2% (16) patients having this assessment recorded. Even if an upper airway endoscopy is not performed it would be good practice to document that it has been considered. It is possible that this finding reflect the fact that it may only be routine to perform endoscopy if there is a doubt about the success of decannulation. Advisors commented that it may also be that this very low rate also reflects a lack of routine involvement of SLT at this point in the care pathway, and/or a lack of access to an appropriate (fine) fibrescope suitable for nasendoscopy in many critical care units. Despite this investigation not being carried out, the vast majority of decannulations in the critical care unit were successful.

In cases which were peer reviewed Advisors were asked whether they believed that a sufficiently careful airway assessment had been made prior to decannulation. Of the 232 cases where decannulation occurred there were 153 in which Advisors could determine whether an airway assessment had been sufficiently careful. In 31 of these (about 1 in 5) this was felt to be inadequate (Table 7.7).

The lack of a more formal decannulation process in some of the cases reviewed was also commented upon by Advisors. Whilst in 232/396 cases a successful decannulation attempt was made, in 23/166 cases there were problems which were attributed to the weaning process and in 11/22 this was because the process was judged to have been too rapid.

Whilst these data relate predominantly to critical care patients, there were also ward based patients represented in the peer reviewed cases.

Table 7.7 Sufficiently careful airway assessment was made prior to decannulation *(Advisors' view)*

	n	%
Yes	122	79.7
No	31	20.3
Subtotal	**153**	
Insufficient data	70	
Not answered	9	
Total	**232**	

Ward decannulation

334 patients were successfully decannulated on the ward, with 24.9% (79/317) within 7 days of insertion (or 52%, 167/321 within 7 days of ward admission) (Figure 7.3). 96.1% (249/259) of these decannulations occurred during the working day (08:00-17:59).

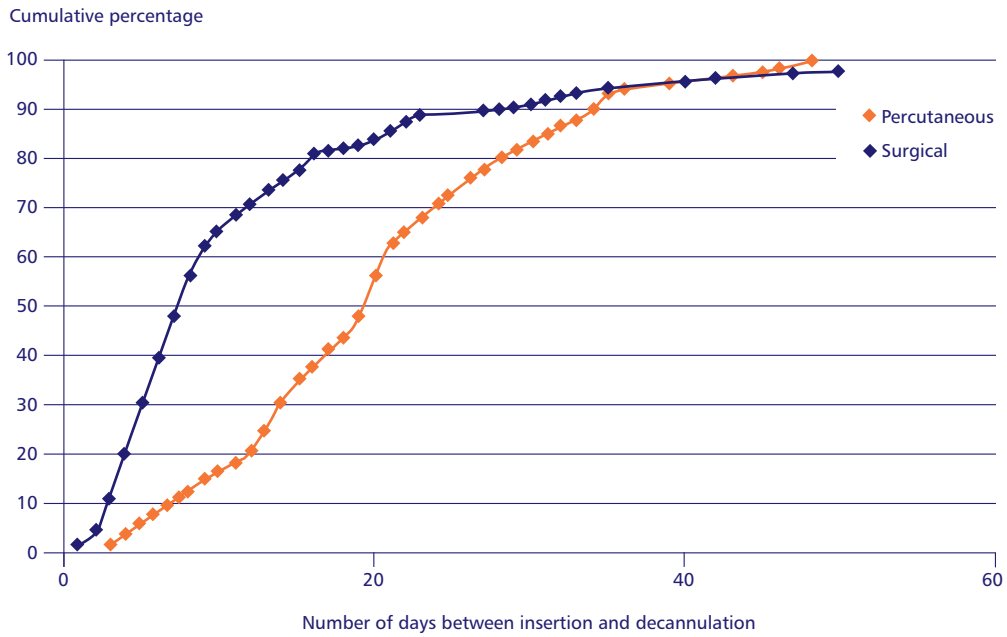

Figure 7.3 Ward patients – timing of decannulation vs. type of insertion

Table 7.8 Grade of clinician undertaking removal of tracheostomy on ward

	n	%
Consultant	34	11.5
Staff grade/Associate specialist	6	2.0
Trainee with CCT	1	0.3
Senior specialist trainee	24	8.1
Junior specialist trainee	10	3.4
Basic grade	3	1.0
Nurse	151	51.2
Physiotherapist	59	20.0
Other	7	2.4
Subtotal	**295**	
Not answered	39	
Total	**334**	

39.4% (65/165) of surgically placed tracheostomies vs. 7.9% (11/140) of percutaneous tracheostomies were decannulated before day 7. Again this relates to the indication for tracheostomy which in the surgical group often was part of a planned head and neck procedure with early decannulation being possible when swelling is reduced and the risk of bleeding and other complications which may disturb the airway is much less. In comparison the percutaneous population was a much more diverse group of patients most of whom had been provided with an artificial airway to facilitate more prolonged respiratory support and/or airway protection.

Most ward decannulations were carried out by nurses or physiotherapists (71.2% in total), with less than one third by medical staff of various levels of seniority, with consultants being the most common medical grade involved (Table 7.8).

Discharge from the critical care unit and admission to ward areas

657/1941 cases were ultimately discharged from the critical care unit with a tracheostomy still in place. Discharges occurred on all days of the week with a relatively larger number Monday-Friday (Figure 7.4).

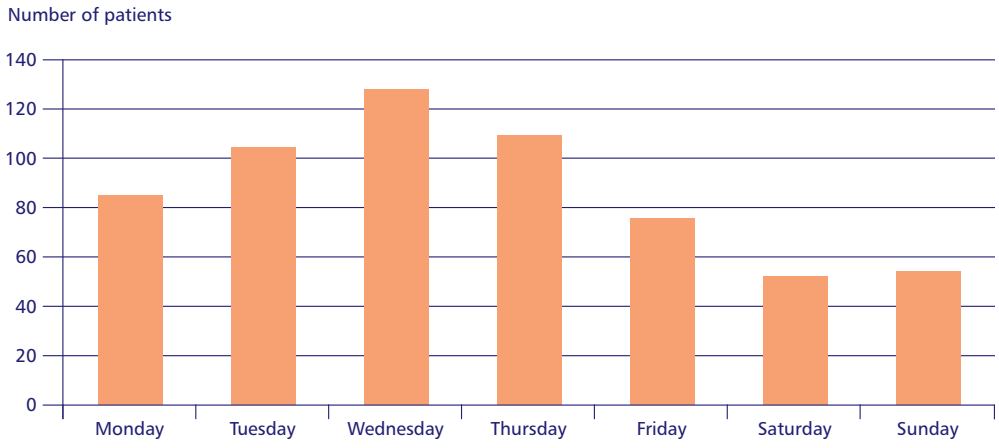

Figure 7.4 Critical care unit discharges with tracheostomy

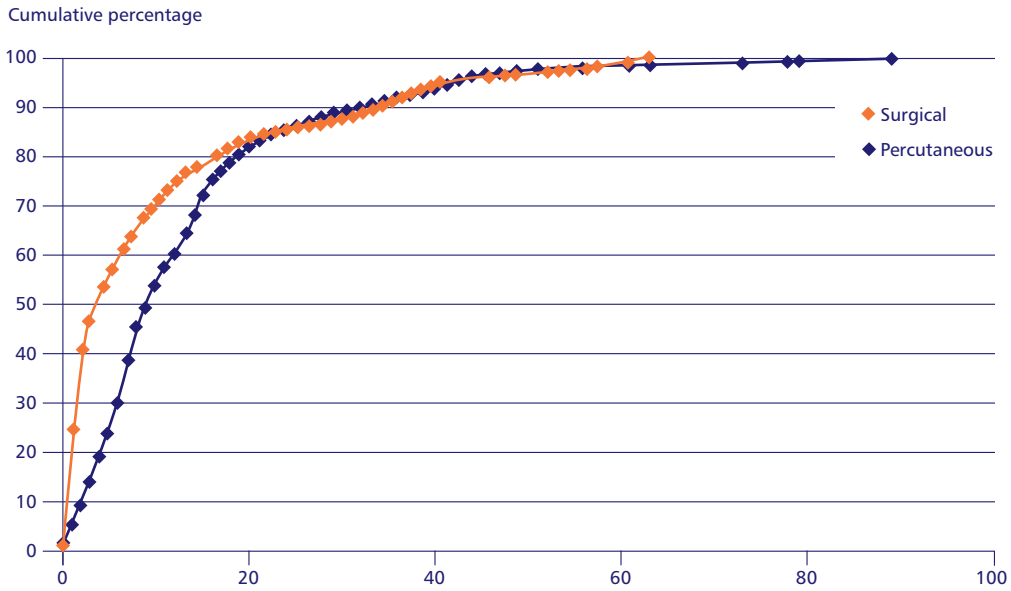

Figure 7.5 Days between tracheostomy insertion and discharge from the critical care unit

Case study 13

A middle aged patient was admitted from clinic with a squamous cell carcinoma of the mouth and had a surgical tracheostomy under general anesthetic prior to major head and neck resection and flap reconstruction. The patient was discharged to a surgical ward from critical care and decannulated very rapidly after a ward round decision by the registrar, a total of just 3 days after tracheostomy formation. No checks to confirm adequate cough, swallow etc. were performed.

Whilst the decannulation was successful, Advisors questioned why a simple bedside test of airway patency had not been performed first, and accompanied by basic documentation to explain the rationale for early decannulation.

Days between insertion and discharge in the critical care unit

The number of days between insertion and discharge from the critical care unit was reviewed. In 245/594 (41.2%) of cases discharged the tracheostomy had been formed 7 or fewer days previously.

56.6% (116/204) of surgical and 30% (100/333) of percutaneous tracheostomy patients were discharged less than day 7, and 24.5% (50/204) of surgical patients were discharged at 24 hours or less post insertion (Figure 7.5)

This was not unexpected as it is common practice for patients after a planned head and neck procedure to spend a first post operative night on the critical care unit with a newly formed tracheostomy. It is important to note that some patients spent very much longer periods of time on the critical care unit.

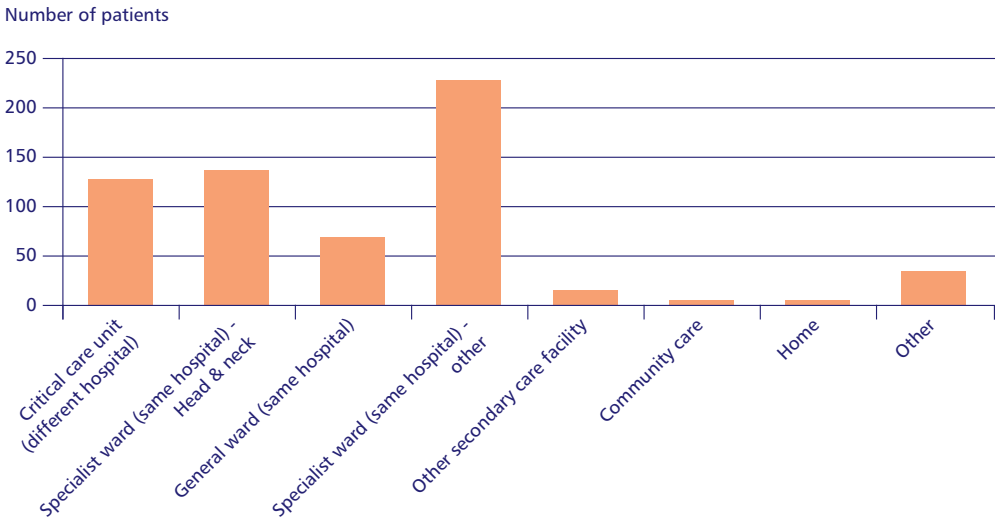

Figure 7.6 Location of tracheostomy patients after discharge from the critical care unit

Most patients were discharged to a specialist ward in the same hospital, but in the majority this specialist ward was not head and neck. Over 100 patients were transferred to a the critical care unit in a different hospital. There were 67 patients discharged to a general ward area (Figure 7.6).

Organisational data (Chapter 2) showed that there was considerable variability of equipment and competences between different wards. The 'other' locations included 36 patients; of these 6 were discharged to another hospital ward area or a specialist rehabilitation centre, and 24 to Level 1 or Level 2 care within the same hospital (the latter generally under a sub-specialist team). In 49 cases the data about discharge location was not provided. There is some variation in what hospitals term as high dependency care with some using it to define both Level 1 and 2 care. Likewise there is considerable variation in the staffing and competences within such units.

Timing of critical care unit discharges

Data were not available in all cases on time of discharge, but in 157 cases (31.2%) this event occurred after 18.00 in the evening and before 08.00 in the morning (Table 7.9). Whilst this probably reflects the need to achieve maximum throughput in the critical care unit at all times of day and night together with the pressure of new admissions with a higher acuity of illness, discharging patients with a tracheostomy puts additional pressure on the staffing of receiving ward areas, and senior members of the multidisciplinary ward team may be less readily available. From the point of view of the patient, a poorly planned or hurried discharge in the middle of the night is particularly stressful. The patient will be immediately aware of the change of nursing dependency, and will also be often have limited ability to communicate their fears.

Table 7.9 Timing of discharge from the critical care unit

	n	%
08:00 - 17:59	346	68.8
18:00 - 07:59	157	31.2
Subtotal	**503**	
Not answered	154	
Total	**657**	

There were a total of 157 discharges at or after 18.00 and before 08.00. Table 7.10 provides a summary of discharge location.

Table 7.10 Destination after the critical care unit discharge

	n	%
Critical care unit (different hospital)	20	12.9
Specialist ward - head and neck (same hospital)	26	16.8
General ward (same hospital)	21	13.5
Specialist ward - other (same hospital)	74	47.7
Other secondary care facility	1	0.6
Other	13	8.4
Subtotal	**155**	
Not answered	2	
Total	**157**	

The additional need for discharge to a ward with the correct equipment and competences has already been noted, and the undesirability of night time discharges from the critical care unit is addressed in generic ICS standards for organisation of care from 2013.[33]

Of the 20/155 patients transferred to a critical care unit in another hospital, 6 were between the hours of 21.00 and 06.00 in the morning.

Table 7.11 Out of hours discharge to a location designated for patients with tracheostomy

	n	%
Yes	151	96.8
No	5	3.2
Subtotal	**156**	
Not answered	1	
Total	**157**	

There were 5/156 patients discharged out of hours from the critical care unit to locations which were not designated to provide routine tracheostomy care (Table 7.11). Whilst it was felt that in the vast majority of cases the discharge location was appropriate, in nine cases concerns was expressed about care. Free field comments about these concerns were given in 4/9 cases with concern about staff training, numbers and/or risk assessment for tracheostomy care being the overwhelming theme.

Clinicians on the critical care unit were asked whether a discharge summary formed part of the record which accompanied the patient. Whilst in 90.9% of cases (541/595) it was provided, in 9.1% (54/595) it was not and in many it did not contain several important elements which would be expected to facilitate a high standard of ongoing tracheostomy care.

In particular clinicians themselves indicated that the following details were included in only a minority of summaries:

- Care requirements for the tracheostomy – included in 35.3% (174/494)
- Follow up plan for the tracheostomy – included in 31.5% (155/493)
- Weaning plan for the tracheostomy – included in 26.6% (131/493)
- Who to contact if problems with the tracheostomy – included in 31.8% (158/497)
- Responsibility for decisions about the tracheostomy – included in 25.0% (122/488)

From the critical care unit discharge questionnaire it is known that 568 patients were discharged to a further ward area. Whilst not all these discharges would have prompted the completion of a subsequent ward questionnaire NCEPOD received 553 ward questionnaires and data on type of insertion was completed in 524, with 240 percutaneous and 284 surgically inserted tracheostomies (Table 7.12). These patients were a mixture from both the critical care unit (the majority) or the operating theatre.

Table 7.12 Type of insertion of tracheostomy-patients discharged to ward

	n	%
Surgical	284	54.2
Percutaneous	240	45.8
Subtotal	**524**	
Not answered	29	
Total	**553**	

Admission to ward care

Where data was available from ward questionnaires 165/348 (47.4%) admissions were after 18.00 and before 08.00 (Table 7.13). Whilst some wards had specialist head and neck facilities with a high level of dependency and enhanced competencies in care of tracheostomy, some patients went to general wards. Seventy-three patients were admitted between 21:00 – 06:00.

Table 7.13 Time of admission to ward

	n	%
08:00 - 17:59	219	57.0
18:00 - 07:59	165	43.0
Subtotal	**384**	
Unknown	126	
Not answered	43	
Total	**553**	

Case study 14

An elderly patient who previously lived independently had several falls and was admitted to hospital with a chest infection. This was initially managed with non invasive ventilation, before intubation and ventilation. The patient had a percutaneous tracheostomy 5 days after intubation, was weaned and decannulated rapidly and sent to a ward 2 days later. Over the next 2 weeks the patient's chest deteriorated and they died on the ward without any clear discussion about re-escalation of care.

Advisors commented that they felt care had effectively been withdrawn and that the patient was being allowed to die. After initial aggressive and successful treatment this was not easy to understand without a clear documented rationale or plan in the notes.

It was questioned as to whether comprehensive risk assessment(s) relating to the care of the tracheostomy were undertaken on the patient before admission (Table 7.14).

Table 7.14 Risk assessments carried out before ward admission

	n	%
Yes	341	73.2
No	125	26.8
Subtotal	**466**	
Unknown	68	
Not answered	19	
Total	**553**	

This was carried out in only two thirds of cases. This compounds the concern that discharge documentation about the patient was not always complete when a patient left the critical care unit. When risk assessments had been carried out questions were asked about whether this included specific attention to the patient's dependency, level of observation and visibility required. Clinicians completing questionnaires felt that this had been addressed in the vast majority (more than 95%) of cases.

In most (92.8%) cases the correct competences seem to have been provided on the ward, but there were 36 cases where this was not felt to have been achieved, and a further 52 where the question was not answered or the information was unknown by the clinicians completing questionnaires (Table 7.15).

Table 7.15 Routine allocation of staff with correct competencies to care for patients on ward

	n	%
Yes	465	92.8
No	36	7.2
Subtotal	**501**	
Unknown	31	
Not answered	21	
Total	**553**	

Ward discharge

A total of 82 patients were discharged by day 30 with a tracheostomy still in place (Figure 7.7). They were discharged to a variety of locations with 27 going to other hospital wards including nine to a critical care unit in a different hospital and 18 to a specialist ward within the same hospital. A total of 27 patients were discharged home and five to community care facilities.

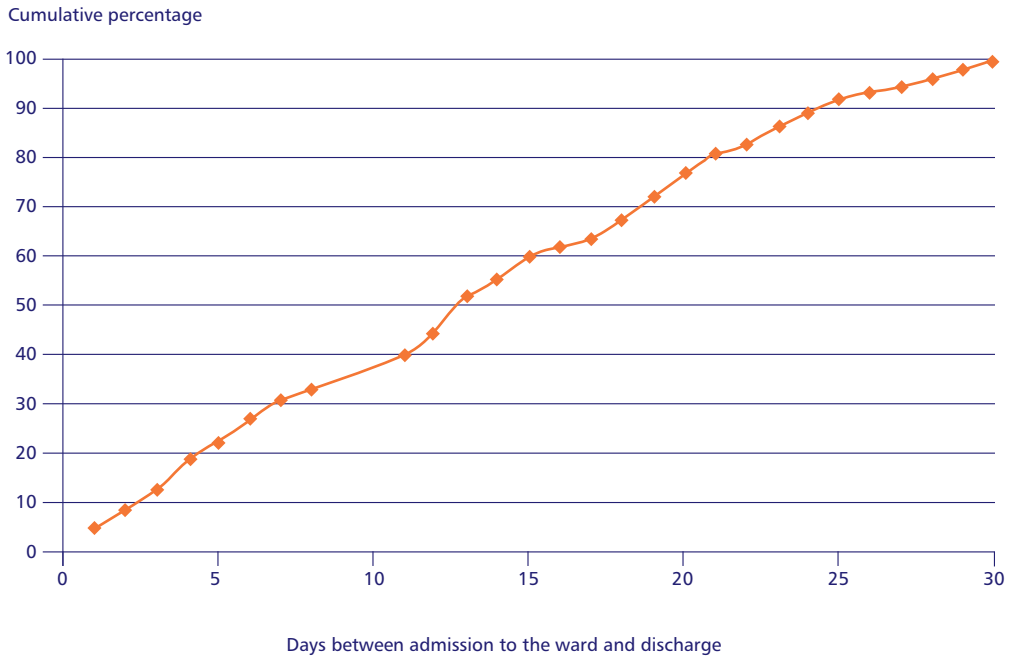

Figure 7.7 Discharge from ward with tracheostomy in place by day 30

Eleven ward discharges occurred after 18.00 in the evening and before 08.00 in the morning. This would be a particular concern in relation to those patients discharged home as GP services and community nursing would not generally have been so readily available. The timing of discharge and locations of the 11 patients who left the ward were reviewed (Table 7.16).

Table 7.16 Tracheostomy in place-discharge time (out of hours) and location from ward areas

	n
Critical care unit (different hospital)	1
General ward (same hospital)	1
Specialist ward (same hospital) - other	6
Other secondary care facility	1
Home	2
Total	**11**

These data are important, and other authors have highlighted the risks of managing tracheostomy beyond the hospital setting.[34] Whilst moving patients around the same Trust is necessary on occasion (e.g. to provide barrier nursing or highly specialist services such as dialysis), this can be highly disruptive to care, especially when it occurs at night/in the very early morning. It is also very stressful to the patient. Some of these discharges would have been arranged at very short notice, and this may reduce the ability to provide a smooth pathway of care for the patient e.g. clear and detailed handover, correct competences in receiving area for tracheostomy care, and correct equipment being available. Moving patients to the community did not tend to occur as late in the day but would still have posed problems if there had been a need to discuss with services such as GPs and community based nursing staff.

Ward based clinicians were asked if they had concerns about the discharge and in the majority (69/73) this was not the case. However there were four patients where concern was expressed and this related to the ability of the part of the discharge location to provide routine tracheostomy care (n=2), and to recognize (n=1) and manage (n=1) tracheostomy complications.

Patients on the ward at day 30

A total of 91 patients remained on the ward with a tracheostomy still in place at day 30 after insertion. The reasons for this are outlined in Table 7.17. Whilst many had an ongoing need for secondary care, in a total of 29 instances there were difficulties in securing adequate rehabilitation and/or community care facilities. In just 41/67 there was a plan for discharge in place.

Table 7.17 Reasons for patients with tracheostomy being still on ward at day 30 after insertion *(Answers may be multiple)*

	n
Ongoing need for secondary medical care	45
Difficulties in securing appropriate community care	14
Difficulties in finding a specialist rehabilitation unit	16
Other	9
Subtotal	**84**
Not answered	20

Advisors commented that the competences for tracheostomy care are not widely available in the community, outside of selected settings. At this stage there is a need on the ward for continued multidisciplinary team input to provide co-ordinated discharge planning and provide a comprehensive package of care.

Case study 15

A young patient had a major stroke and needed airway support/protection. After initial intubation a percutaneous tracheostomy was performed on critical care to facilitate ongoing needs. Whilst the patient received good SLT and physiotherapy input on the ward to which they were discharged, there were several problems with humidification during the ward stay. Ultimately the patient was prepared for discharge to a nursing home and there was evidence of good levels of training of receiving staff.

Advisors commented upon the general lack of provision for such training in many parts of the country which often caused major delays in hospital discharge.

Death in the critical care unit

340 patients died in the critical care unit with a tracheostomy still in place. The majority of these deaths were expected by the clinicians completing the critical care questionnaire (Table 7.18). However there were 35 cases of unexpected deaths on the critical care unit, and of these three were felt to relate directly to a tracheostomy related complication.

Table 7.18 Death in the critical care unit

	n	%
Expected	290	89.2
Not expected	35	10.8
Subtotal	**325**	
Not answered	15	
Total	**340**	

Deaths on the ward

Thirty-nine patients died before day 30 on the ward with a tracheostomy in place. Of these three were felt to be unexpected. One of these was attributed to a tracheostomy related complication.

There were 284 surgical and 240 percutaneous tracheostomy patients cared for on the ward so there was a slight excess of deaths in the percutaneous tracheostomy group (Table 7.19). This can be explained by case mix, with the percutaneous group including mainly patients who had been admitted as an emergency (89.3%), whereas the surgical group contained a relatively large number of patients (31.9%) who had a tracheostomy as part of a planned head and neck procedure.

Table 7.19 Deaths in ward surgical vs. percutaneous

	n
Surgical	13
Percutaneous	25
Subtotal	**38**
Not answered	1
Total	**39**

Advisor data on deaths

In those 396 cases from both critical care and the ward reviewed by Advisors, 80 deaths were identified in clinical notes. Of these there were three deaths which were identified as a result of a tracheostomy related complication, and of these two were felt to be potentially avoidable. Some of the findings from these cases are presented throughout this report but have not been presented in full to avoid loss of anonymisation.

Advisor opinion on care

Of the 396 cases assessed by the Advisors, 372 cases had a critical care stay. These data should be seen in context and looked at alongside the (larger) amount of ward and critical care data from questionnaires, including information about complications.

In 40% of cases Advisors felt that practice in relation to tracheostomy care was good (Figure 7.8). The reasons stated for room for improvement in all areas and the cases where less than satisfactory care was most commonly issues with clinical care (39/108), cuff management (36/108), monitoring and/or the frequency of observations (21/108), tube selection (18/108) and weaning process unclear and/or inappropriate (28/108).

The most common non clinical/organisational reasons for sub optimal care were documentation (116/124).

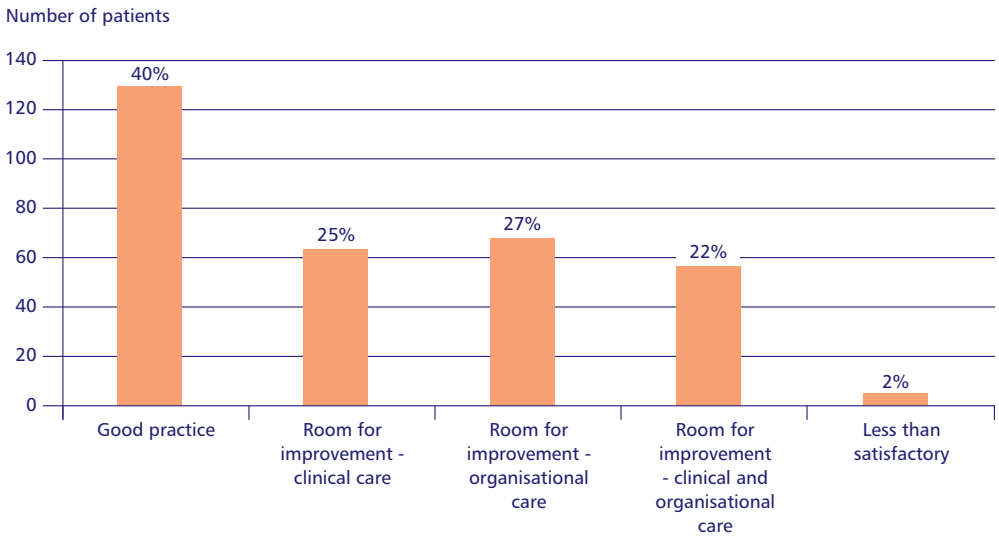

Figure 7.8 Overall assessment of care - critical care unit

Overall assessment of care on the ward

Figure 7.9 represents the overall assessment of care in a small subset of ward based patients with a tracheostomy in whom questionnaires and case notes were reviewed by Advisors and an assessment was made (88/103). There were 103 cases in which at least part of the patient journey involved a stay in a ward area. Whilst numbers are relatively small, decisions about the quality of care are strikingly similar to those made about care in the critical care unit. In ward areas the most common problem in relation to clinical care was felt to be around cuff management (10/32), the monitoring and/or frequency of observation inadequate (11/32) and the weaning process (10/32). In terms of the organisation of care the most common problems related to documentation (30/36).

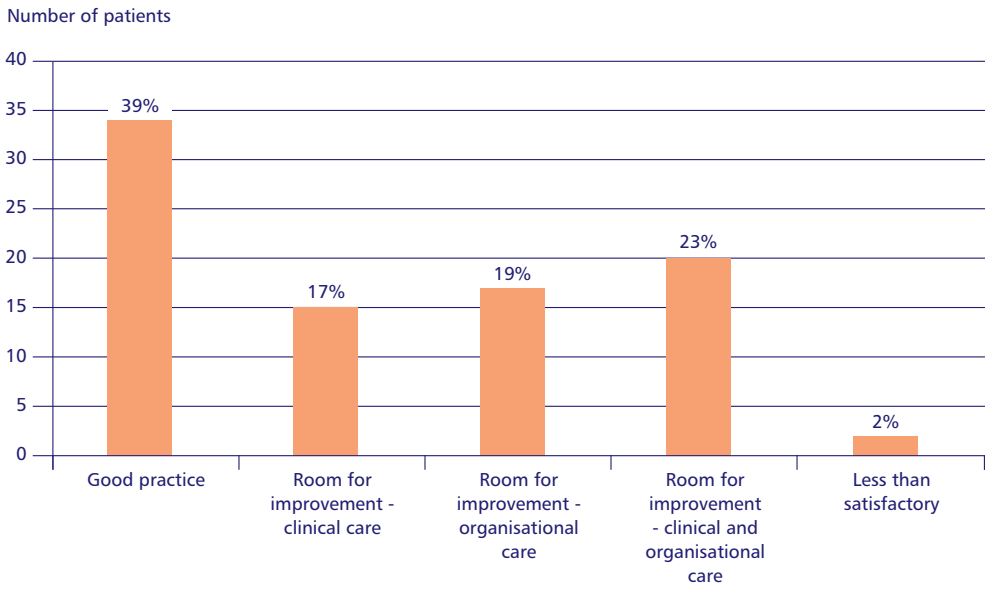

Figure 7.9 Overall assessment of care ward tracheostomy patients

Key findings

18% (161/910) of patients underwent decannulation in under 7 days in the critical care unit.

85/141 patients who had an early decannulation did not undergo a trial of extubation before tracheostomy insertion. 68 of these were percutaneous insertions.

157/503 discharges of patients from the critical care unit occurred after 18.00 in the evening and before 08.00 in the morning. 165/348 (47.4%) ward admissions occurred after 18.00 and before 08.00.

46 patients were discharged from a critical care unit to a ward or different critical care unit area after 21.00 at night and before 06.00 in the morning.

5/156 patients were discharged out of hours from the critical care unit to locations which were not designated to provide routine tracheostomy care.

341/466 (73.2%) of patients had a comprehensive risk assessment carried out prior to ward admission.

90.9% (541/595) of patients had a discharge summary provided when they left the critical care unit, but 460/541 (85%) summaries did not contain several important elements such as weaning plans for the tracheostomy and who had responsibility for decisions about the tracheostomy.

27 patients were discharged home from a ward area and 5 to community care facilities.

Discharge from ward areas to other hospital locations and to community care occurred outside the normal working day in 11 cases.

Recommendations

21. In patients undergoing a tracheostomy without a trial of extubation the reason should be clearly documented. *(All Health Care Professionals)*

22. Unplanned and night time critical care discharge is not recommended, particularly in patients with a newly formed tracheostomy and/or patients recently weaned from respiratory support. This reinforces the Intensive Care Society's general recommendation about night time discharges. *(Clinical Directors and Risk Managers)*

23. Wards accepting tracheostomy patients should be in a state of readiness in terms of equipment and competences. *(Clinical Directors and Directors of Nursing)*

24. Multidisciplinary agreement about minimum airway assessments prior to decannulation needs to be established including availability of equipment and competences. *(Professional Health Care Bodies)*

25. Quality of discharge documentation should be improved. A structured and detailed summary must be provided between wards and between hospitals and the community at the point of transfer. *(All Health Care Professionals and Tracheostomy Leads)*

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Summary

This study looked at the pathway of tracheostomy care for patients beginning with a surgical or percutaneous insertion, followed in most by a stay on critical care and/or up to 30 days on a hospital ward. Patients with a new tracheostomy are a high risk population, not just because of potential airway complications but because most have associated major co-morbidity.

At the outset NCEPOD was unable to use existing OPCS codes to provide an accurate estimate of numbers of all new tracheostomies, as only those inserted surgically tend to be coded. An estimate of between 5,000 to 15,000 was made which provided a challenge to our existing method and to everyone taking part in this study. An important lesson for the future is that in order to facilitate care planning and ongoing review of tracheostomy care, both locally and nationally, there is a need for routine coding and data collection to occur for all tracheostomy insertions.

There are many recommended improvements in care at all steps of the patient pathway in this report, some of which do not involve additional expenditure. This includes the use of checklists for tracheostomy insertion which should be performed for patients in intensive care. These checks ensure that preparation for the tracheostomy is equivalent to those performed as a surgical procedure.

There are other opportunities to improve quality of care and reduce complications if hospitals ensure that adequate equipment is available to care for patients with tracheostomies in intensive care and ward areas, including fibreoptic scopes, difficult intubation kit, and capnography. Whilst this recommendation has been made by other authors, NCEPOD has found that in many centres such equipment is still not readily available or in use.

Before insertion and at every tube change tracheostomy tubes need to be selected according to patient anatomy and the position checked to provide as good a "fit" as possible, whilst selecting equipment with essential safety features such as inner cannulae which help prevent unnecessary serious complications. More serious complications arise during the after care of tracheostomies than at insertion, and attending staff must be able to deal with blocked and displaced tubes. When a patient with a tracheostomy requires resuscitation, there is also a need for staff to be able to use correct airway management techniques in patients with both a simple tracheostomy and post laryngectomy.

The involvement of a large multidisciplinary team of nurses, physiotherapists, physicians and surgeons, speech and language therapists and dietitians is essential for the good aftercare of patients with a tracheostomy, and they should be present in a timely fashion. Adequate numbers of these support staff are required to ensure this happens for each and every patient. Discharge arrangements when transferring patients from critical care, and from wards to the community need to include concise but adequate documentation, with good handover in daylight hours to suitably trained staff in the receiving area.

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Appendices

Appendix 1 – Glossary

ASA grade	American Society of Anesthesiologists grade for physical status	1. Healthy person. 2. Mild systemic disease 3. Severe systemic disease 4. Severe systemic disease that is a constant threat to life. 5. A moribund person who is not expected to survive without the operation. 6. A declared brain-dead person whose organs are being removed for donor purposes.
Aspiration		This is caused by material being inhaled into the patient's airway from e.g. the throat or stomach.
Barotrauma		This refers to injuries caused by increased air or water pressure.
Björk flap		A flap raised in the wall of the trachea.
BMI	Body Mass Index	A measure of body fat based on height and weight that applies to adults.
Bougie		A thin flexible cylinder of plastic or elastic material which is inserted into the upper airway to guide tube insertion.
Capnography		Monitoring of the concentration or partial pressure of carbon dioxide (CO2) in the respiratory gases.
Chest auscultation		Listening to breath sounds in the chest.
Decannulation		The process whereby a tracheostomy tube is removed once patient no longer needs it.
Dissection		Surgical parting of tissue planes to identify/locate important anatomical structures.

Appendix 1 – Glossary (continued)

Dysphagia		The medical term for swallowing difficulties.
Fistula		An abnormal connection or passageway between two organs or vessels. It is generally a condition of a disease but a fistula may be surgically created for therapeutic reasons.
Flange		An external or internal ridge, or rim (lip).
Form 4 consent		Form for adults who lack the capacity to consent to surgical/medical procedures.
Haemorrhage		The medical term for bleeding.
Hypoxia		A condition in which the body or a region of the body is deprived of adequate oxygen supply.
Inner cannula		An inner tube inside a tracheostomy tube that is either disposable or reusable.
Laryngectomy		The removal of the larynx and separation of the airway from the mouth, nose and oesophagus.
Level 2 care		High dependency unit.
Level 3 care		Intensive care unit.
Mallampati score		A score used to predict the ease of intubation. A high Mallampati score (class 3 or 4) is associated with more difficult intubation.
MDT	Multidisciplinary Team	A team comprising all specialties relevant to a particular topic.
Mediastinitis		Inflammation of the tissues in the mid-chest (mediastinum).
NAP4	4th National Audit Project	A joint national project led by the Royal College of anaesthetists which reviewed serious airway complications.
Neck-breather		A person who has a tracheostomy or laryngectomy.
Pneumo-mediastinum		A condition in which air is present in the mid-chest.

Pneumothorax		An abnormal collection of air or gas in the space that separates the lungs from the chest wall.
SLT	Speech and Language Therapy	SLT assess and treat speech, language and communication problems in people of all ages to help them better communicate.
Stridor		A (usually high pitched) sound coming from the upper airway of the patient.
Trachea		The medical term for windpipe.
Tracheal stenosis		An abnormal narrowing of the central air passageways.
Tracheal stoma		A hole in the trachea (windpipe).
Tracheomalacia		An abnormal collapse of the tracheal walls.
Tracheostomy		A procedure where an opening in the neck at the front of the windpipe and a tube inserted to aid breathing.
WHO checklist	World Health Organisation Surgical Checklist	The checklist identifies three phases of an operation, each corresponding to a specific period in the normal flow of work: Before the induction of anaesthesia ("sign in"), before the incision of the skin ("time out") and before the patient leaves the operating room ("sign out"). In each phase, a checklist coordinator must confirm that the surgery team has completed the listed tasks before it proceeds with the operation.

Appendix 2 – Types of tracheostomy

Percutaneous

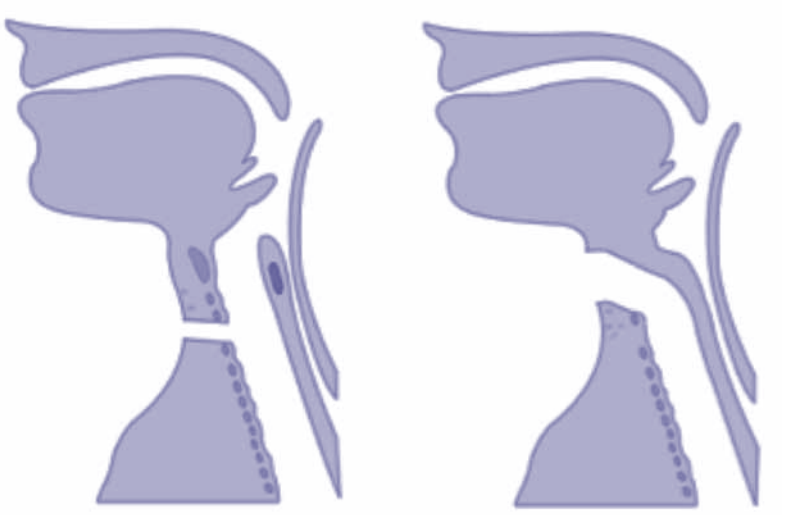
The percutaneous technique is potentially less invasive, and usually performed under general anaesthesia or deep sedation. It is usually performed on a bed in a critical care unit environment, rather than in an operating theatre. The technique requires a small skin incision in the midline of the neck. A tract is then created down to the trachea. A needle and guide wire is inserted into the tracheal lumen, usually under fibreoptic airway endoscopic observation. The tract is then dilated, and a tracheostomy tube inserted over the dilator. Airway endoscopic examination allows the position of the tip of the tracheostomy tube and the cuff position to be confirmed, and helps prevent the creation of an undetected false passage.

Surgical

In the open surgical technique, a longer skin incision is made of about 3-6cm in length, between the cricoid cartilage and the sternal notch. A combination of sharp and blunt dissection is employed to identify the trachea under direct vision. This open approach permits blood vessels to be tied or coagulated under direct vision as the dissection proceeds. A scalpel is used to penetrate the tracheal wall, and create either a vertical slit opening, remove a piece of cartilage to create a window, or create a trap door (Björk flap). The tracheostomy tube is then inserted into the tracheal lumen under direct vision. Usually this is performed under general anaesthesia, and the endotracheal tube is carefully partially withdrawn to permit the tracheostomy tube to be inserted, and its position checked, before the endotracheal tube is fully removed. If a tracheostomy is performed as part of a laryngectomy, an end tracheostomy is performed, bringing the tracheal lumen out to the skin and creating a permanent stoma.

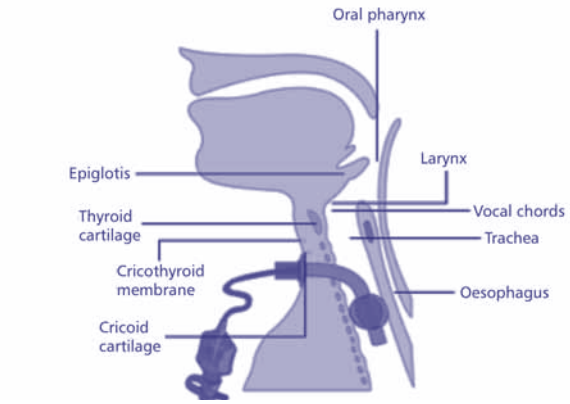
Both the percutaneous and open techniques can be performed under local anaesthesia, but this can be uncomfortable for the patient, and is usually reserved for emergency situations, or where general anaesthesia is contra-indicated.

A2.1 Placement of a tracheostomy compared with a laryngectomy

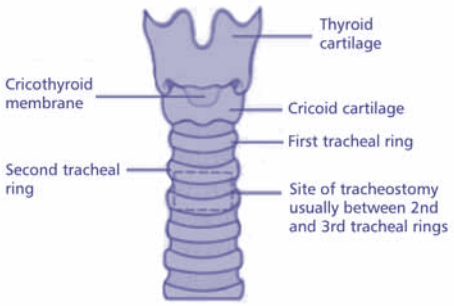


Tracheostomy Larygectomy

Placement and anatomy related to a tracheostomy



A2.2



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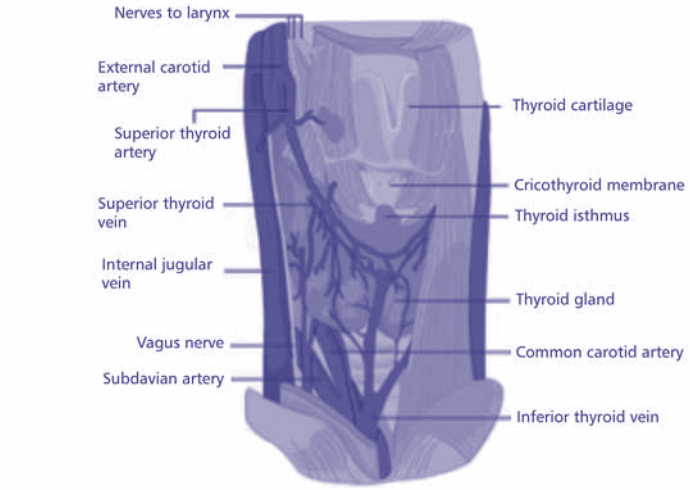


A2.4

Types of incision

A2.5
Horizontal incision

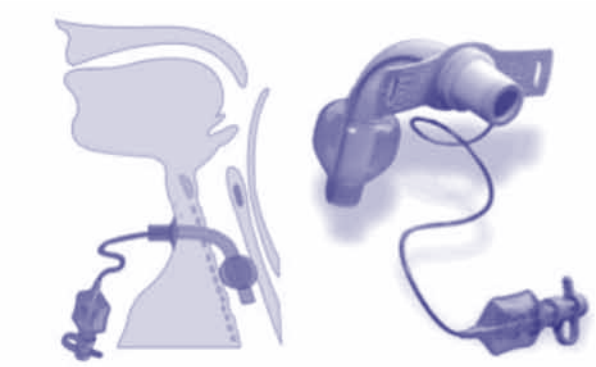
A2.6
Vertical incision

A2.7
Björk flap

A2.8
Window

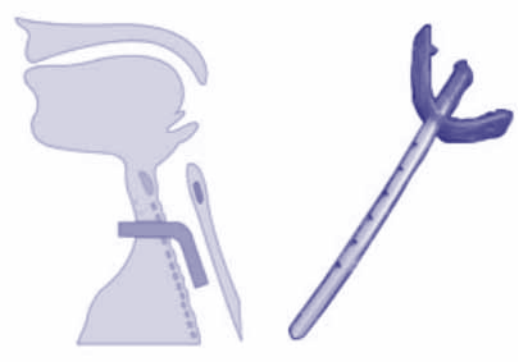
Appendix 2 – Types of tracheostomy (continued)

Types of tubes



A2.9 Cuffed tube

A2.10 Uncuffed tube



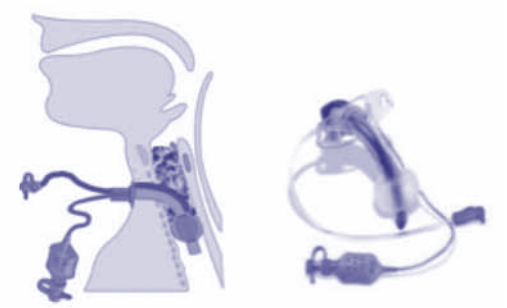
A2.11 Minitracheostomy

A2.12 Fenestrated tubes

A2.13 Non fenestrated cannulae

A2.14 Fenestrated cannulae

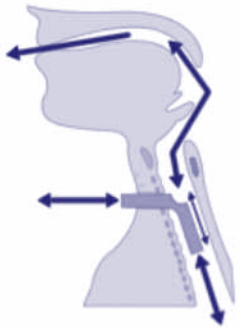
Types of tubes (continued)



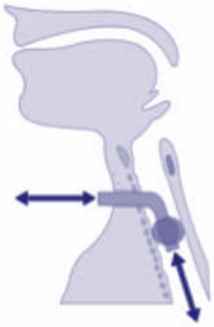
A2.15 Sub-glottic suction

A2.16 Adjustable flange tubes

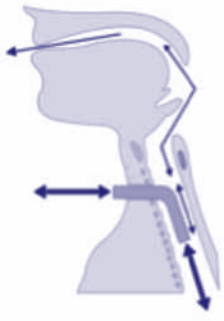
Airflow pattern



A2.17 Fenestrated uncuffed



A2.18 Cuffed



A2.19 Uncuffed

Figures A2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 2.10, 2.11, 2.17, 2.18, 2.19
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Figures A2.12, 2.13, 2.14, 2.15, 2.16
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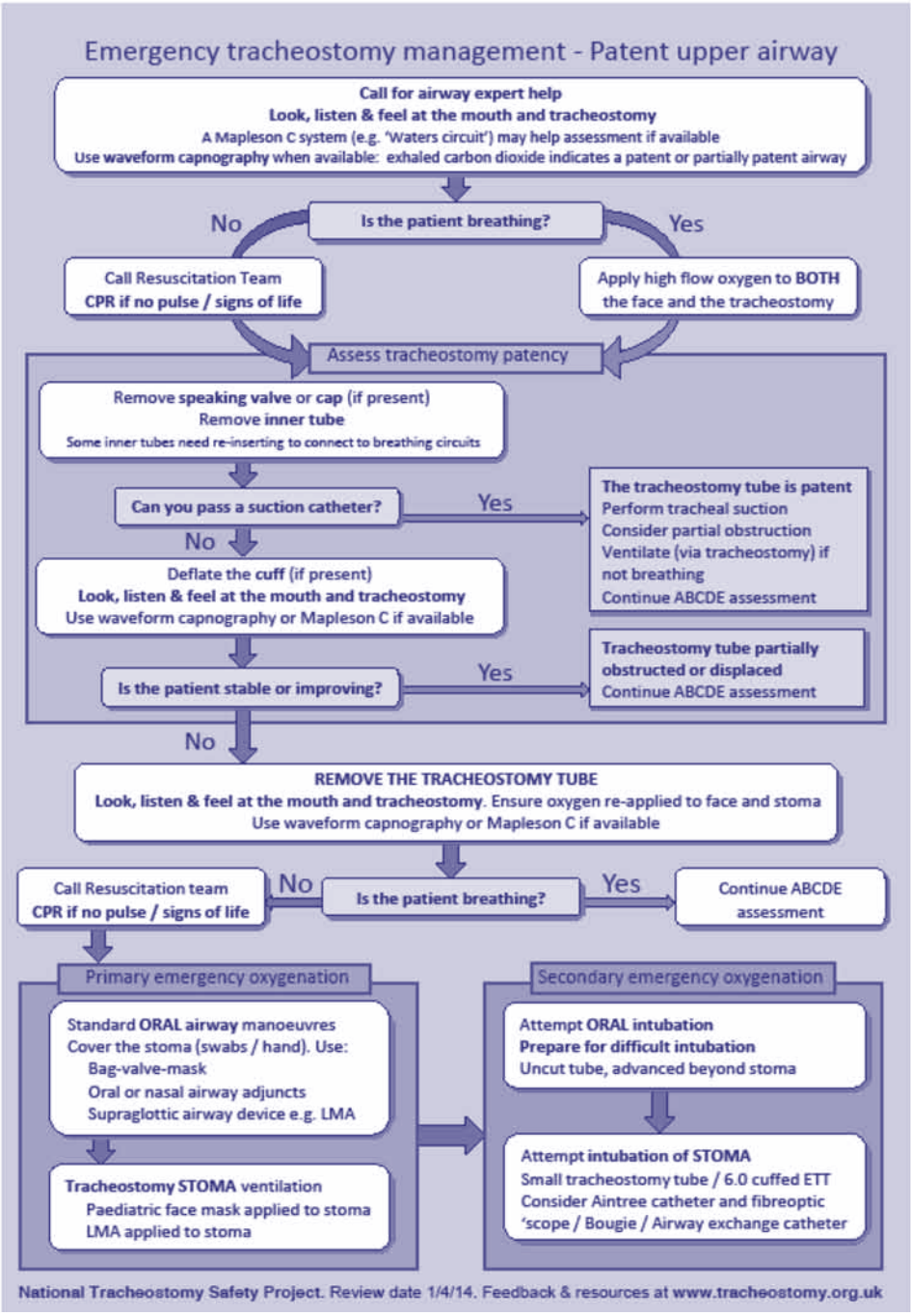
Appendix 3 – Algorithms for the emergency management of tracheostomies and laryngectomies management



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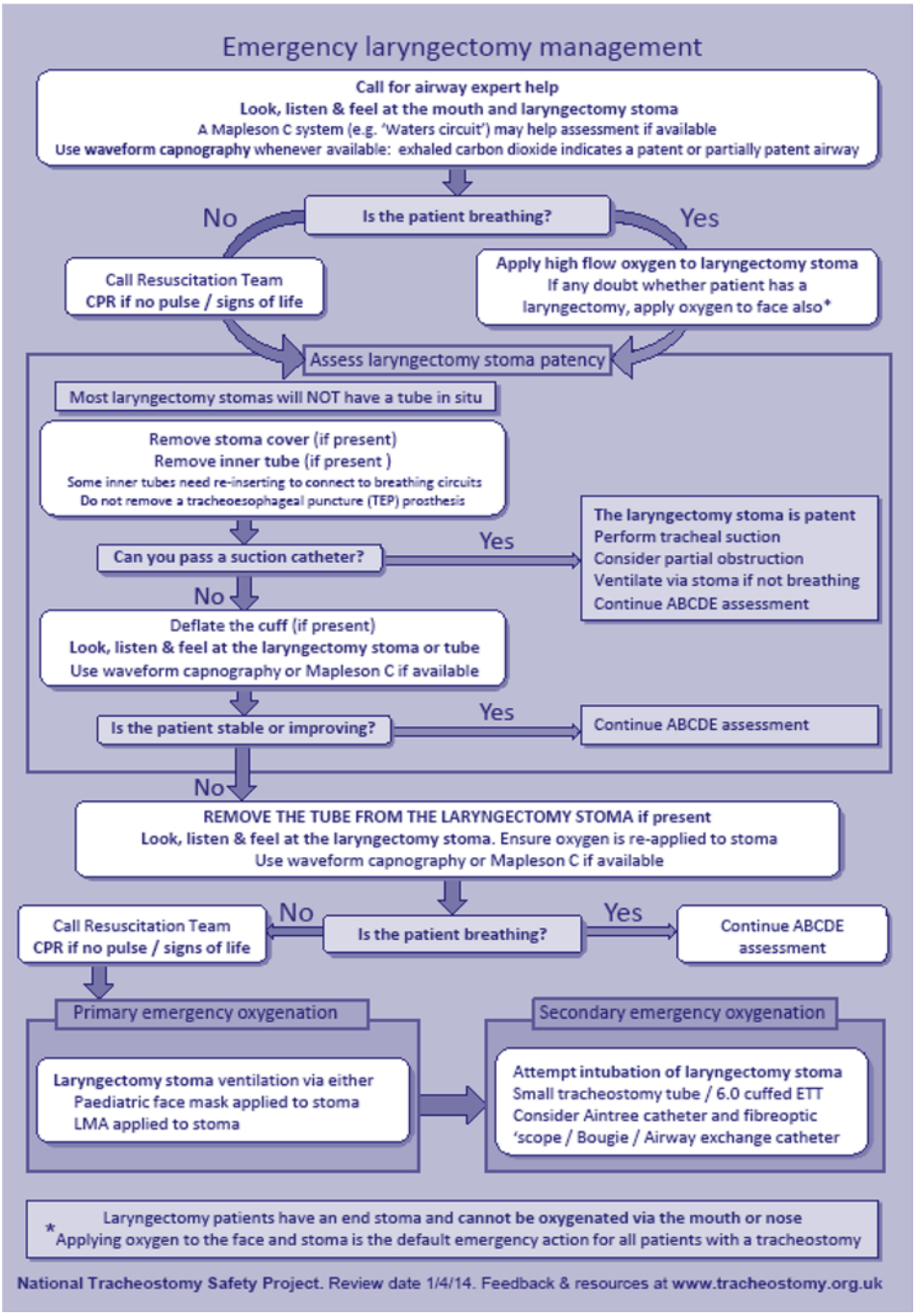

Reproduced from McGrath BA, Bates L, Atkinson D, Moore JA. Multidisciplinary guidelines for the management of tracheostomy and larynectomy airway emergencies. Anaesthesia 2012 Jun 26. doi: 10. 1111/j.1365.2044.2012.07217, with permission from the Association of Anaesthetists of Great Britain & Ireland/Blackwell Publishing Ltd.

Nottingham University Hospitals NHS
NHS Trust

Percutaneous Tracheostomy

Critical Care Time-outs

Time-out 1: Pre-Procedure (before operator scrubs)

- Assent? (Assent obtained & form 4 complete)
- Contra-indications considered? (eg C-spine, coagulopathy, anatomy and drug allergies)
- Feed? **STOP INSULIN?** (Plans regarding enteral feeding and risk of hypoglycaemia understood)
- Roles? (Operator, anaesthetist, nurse and runner roles delegated)
- Trache tube? (Trache type and size considered and available)
- Kit? (Tracheostomy trolley complete and airway equipment to hand)

The team agree tracheostomy in patient's best interest and it is safe to proceed

Time-out 2: Prior to Incision (operator scrubbed)

The team agree:

- The patient is anaesthetised, paralysed and appropriately ventilated
- The patient is optimally positioned, the neck is clean and local anaesthetic has been infiltrated
- No one has any unvoiced concerns

Time-out 3: Post procedure (operator happy airway secure)

The team agree:

- Chest X-ray and audit form responsibility delegated
- Scope decontamination and documentation responsibility delegated
- Feed (with or without insulin) restarted
- No one has any unvoiced concerns

Appendix 5 - The role and structure of NCEPOD

The National Confidential Enquiry into Patient Outcome and Death (NCEPOD) is an independent body to which a corporate commitment has been made by the Medical and Surgical Colleges, Associations and Faculties related to its area of activity. Each of these bodies nominates members on to NCEPOD's Steering Group.

Steering Group as at 13th June 2014

Dr W Harrop-Griffiths	Association of Anaesthetists of Great Britain and Ireland
Mr F Smith	Association of Surgeons of Great Britain and Ireland
Dr C Mann	College of Emergency Medicine
Vacancy	Faculty of Public Health Medicine
Ms S Payne	Lay Representative
Dr J Fazackerley	Royal College of Anaesthetists
Dr A Batchelor	Royal College of Anaesthetists
Dr D Cox	Royal College of General Practitioners
Mrs J Greaves	Royal College of Nursing
Dr E Morris	Royal College of Obstetricians and Gynaecologists
Mr W Karwatowski	Royal College of Ophthalmologists
Dr I Doughty	Royal College of Paediatrics and Child Health
Dr M Osborn	Royal College of Pathologists
Dr A McCune	Royal College of Physicians
Dr M Ostermann	Royal College of Physicians
Dr M Cusack	Royal College of Physicians
Dr T Sabharwal	Royal College of Radiologists
Mr J Abercrombie	Royal College of Surgeons of England
Mr M Bircher	Royal College of Surgeons of England
Mr K Altman	Faculty of Dental Surgery, Royal College of Surgeons of England

Observers

Dr R Hunter	Coroners' Society of England and Wales
Mrs J Mooney	Healthcare Quality in Partnership (HQIP)
Dr M Jones	Royal College of Physicians of Edinburgh
Mr W Tennant	Royal College of Surgeons of Edinburgh

Appendix 5 - The role and structure of NCEPOD (continued)

NCEPOD is a company, limited by guarantee (Company number: 3019382) and a registered charity (Charity number: 1075588)

Trustees

Mr Bertie Leigh	Chairman
Dr D Mason	Honorary Treasurer
Professor L Regan	
Professor R Endacott	
Mr I Martin	
Mr T Hendra	
Company Secretary	Dr M Mason

Clinical Co-ordinators

The Steering Group appoint a Lead Clinical Co-ordinator for a defined tenure. In addition there are six Clinical Co-ordinators who work on each study. All Co-ordinators are engaged in active academic/clinical practice (in the NHS) during their term of office.

Lead Clinical Co-ordinator	Dr M Juniper (Medicine)
Clinical Co-ordinators	Dr K Wilkinson (Anaesthesia)
	Dr A P L Goodwin (Anaesthesia)
	Professor M J Gough (Surgery)
	Mr M Sinclair (Surgery)
	Dr S McPherson (Radiology)
	Dr V Srivastava (Medicine)

Supporting organisations

This project was undertaken as part of the Clinical Outcome Review Programme into Medical and Surgical Care.

The Clinical Outcome Review Programme into Medical and Surgical Care is commissioned by the Healthcare Quality Improvement Partnership (HQIP) on behalf of NHS England, NHS Wales, the Northern Ireland Department of Health, Social Services and Public Safety (DHSSPS), the States of Jersey, Guernsey, and the Isle of Man.

The organisations that provided additional funding to cover the cost of this study:
Aspen Healthcare
Beneden Hospital
BMI Healthcare
BUPA Cromwell
East Kent Medical Services Ltd
Fairfield Independent Hospital
HCA International
Hospital of St John and St Elizabeth
King Edward VII's Hospital Sister Agnes
New Victoria Hospital
Nuffield Health
Ramsay Health Care UK
Spire Health Care
St Anthony's Hospital
St Joseph's Hospital
The Horder Centre
The London Clinic
Ulster Independent Clinic

Appendix 6 - Participation

Trust	Number of sites	Number of organisational questionnaires received	Number of cases data received on	Number of sets of case notes requested	Number of sets of case notes returned
Abertawe Bro Morgannwg University Health Board	3	3	19	5	5
Aintree Hospitals NHS Foundation Trust	1	1	4	2	2
Airedale NHS Foundation Trust	1	1	1	1	1
Aneurin Bevan Local Health Board	2	2	16	4	2
Ashford & St Peter's Hospital NHS Trust	1	1	2	2	2
Barking, Havering & Redbridge University Hospitals NHS Trust	2	2	4	2	2
Barnet and Chase Farm Hospitals NHS Trust	2	2	11	4	4
Barnsley Hospital NHS Foundation Trust	1	0	2	2	2
Barts Health NHS Trust	5	5	59	8	8
Basildon & Thurrock University Hospitals NHS FoundationTrust	2	2	19	4	4
Bedford Hospital NHS Trust	1	1	3	2	0
Belfast Health and Social Care Trust	3	2	38	6	6
Betsi Cadwaladr University Local Health Board	3	3	33	6	6
Birmingham Childrens Hospital NHS Foundation Trust	1	1	0	NA	NA
Blackpool Teaching Hospitals NHS Foundation Trust	1	1	16	2	2
Bradford Teaching Hospitals NHS Foundation Trust	1	1	18	2	2
Brighton and Sussex University Hospitals NHS Trust	3	3	23	5	5
Buckinghamshire Healthcare NHS Trust	2	2	0	NA	NA
Burton Hospitals NHS Foundation Trust	1	1	10	2	2
Calderdale & Huddersfield NHS Foundation Trust	2	2	2	2	2
Cambridge University Hospitals NHS Foundation Trust	1	1	60	2	2
Cardiff and Vale University Health Board	1	1	49	2	2
Central Manchester University Hospitals NHS Foundation Trust	3	3	13	2	2

Appendix 6 - Participation (continued)

Trust	Number of sites	Number of organisational questionnaires received	Number of cases data received on	Number of sets of case notes requested	Number of sets of case notes returned
Chelsea & Westminster Healthcare NHS Trust	1	1	5	2	2
Chesterfield Royal Hospital NHS Foundation Trust	1	1	12	2	2
City Hospitals Sunderland NHS Foundation Trust	1	1	11	2	2
Colchester Hospital University NHS Foundation Trust	1	1	10	2	2
Countess of Chester Hospital NHS Foundation Trust	1	1	17	2	2
County Durham and Darlington NHS Foundation Trust	2	1	7	3	3
Croydon Health Services NHS Trust	1	1	11	2	2
Cwm Taf Local Health Board	2	2	14	4	4
Dartford & Gravesham NHS Trust	1	1	23	2	1
Derby Hospitals NHS Foundation Trust	1	1	4	2	2
Doncaster and Bassetlaw Hospitals NHS Foundation Trust	2	2	25	4	3
Dorset County Hospital NHS Foundation Trust	1	1	5	2	2
Ealing Hospital NHS Trust	1	1	5	2	2
East & North Hertfordshire NHS Trust	2	2	11	3	3
East Cheshire NHS Trust	1	1	5	2	2
East Kent Hospitals University NHS Foundation Trust	3	1	20	6	1
East Lancashire Hospitals NHS Trust	1	1	39	2	2
East Sussex Healthcare NHS Trust	2	2	23	4	4
Epsom and St Helier University Hospitals NHS Trust	1	1	3	1	1
Frimley Park Hospitals NHS Trust	1	1	15	2	2
Gateshead Health NHS Foundation Trust	1	1	9	2	0
George Eliot Hospital NHS Trust	1	1	4	2	2
Gloucestershire Hospitals NHS Foundation Trust	2	1	10	4	4
Great Western Hospitals NHS Foundation Trust	1	1	13	2	2
Guy's & St Thomas' NHS Foundation Trust	2	2	51	4	4

Trust	Number of sites	Number of organisational questionnaires received	Number of cases data received on	Number of sets of case notes requested	Number of sets of case notes returned
Hampshire Hospitals NHS Foundation Trust	2	2	6	4	4
Harrogate and District NHS Foundation Trust	1	1	2	2	2
HCA International	2	2	7	4	4
Health and Social Services Department, States of Guernsey	1	1	0	NA	NA
Heart of England NHS Foundation Trust	2	2	25	4	4
Heatherwood & Wexham Park Hospitals NHS Foundation Trust	1	1	5	2	2
Hillingdon Hospitals NHS Foundation Trust (The)	1	1	6	2	2
Hinchingbrooke Health Care NHS Trust	1	1	6	2	2
Homerton University Hospital NHS Foundation Trust	1	1	4	2	2
Hospital of St John and St Elizabeth	1	1	0	NA	NA
Hull and East Yorkshire Hospitals NHS Trust	2	2	50	4	4
Hywel Dda Local Health Board	4	4	13	5	5
Imperial College Healthcare NHS Trust	3	3	56	6	6
Ipswich Hospital NHS Trust	1	1	8	2	2
Isle of Wight NHS Trust	1	1	4	2	2
Isle of Man Department of Health & Social Security	1	1	5	2	2
James Paget Healthcare NHS Trust	1	1	8	2	2
Kettering General Hospital NHS Foundation Trust	1	1	12	2	2
King's College Hospital NHS Foundation Trust	1	1	38	2	2
Kingston Hospital NHS Trust	1	1	4	2	2
Lancashire Teaching Hospitals NHS Foundation Trust	1	0	10	3	0
Lewisham Hospital NHS Trust	1	1	6	2	2
Liverpool Heart and Chest Hospital NHS Trust	1	1	20	2	2
London Clinic	1	1	1	1	1

Appendix 6 - Participation (continued)

Trust	Number of sites	Number of organisational questionnaires received	Number of cases data received on	Number of sets of case notes requested	Number of sets of case notes returned
Luton and Dunstable Hospital NHS Foundation Trust	1	1	11	2	2
Maidstone and Tunbridge Wells NHS Trust	2	2	27	4	4
Medway NHS Foundation Trust	1	1	11	2	2
Mid Cheshire Hospitals NHS Foundation Trust	1	1	4	2	2
Mid Essex Hospitals NHS Trust	1	1	26	2	0
Mid Staffordshire NHS Foundation Trust	1	1	4	2	2
Mid Yorkshire Hospitals NHS Trust	2	2	11	4	4
Milton Keynes Hospital NHS Foundation Trust	1	1	7	2	2
Newcastle upon Tyne Hospitals NHS Foundation Trust	2	2	52	4	4
Norfolk & Norwich University Hospital NHS Trust	1	1	28	2	2
North Bristol NHS Trust	2	2	39	4	4
North Cumbria University Hospitals NHS Trust	2	2	31	4	4
North Middlesex University Hospital NHS Trust	1	1	0	NA	NA
North Tees and Hartlepool NHS Foundation Trust	2	2	15	2	2
North West London Hospitals NHS Trust	2	2	16	4	4
Northampton General Hospital NHS Trust	1	1	12	2	2
Northern Devon Healthcare NHS Trust	1	1	12	2	2
Northern Lincolnshire & Goole Hospitals NHS Foundation Trust	2	2	14	4	4
Northumbria Healthcare NHS Foundation Trust	2	2	8	4	4
Nottingham University Hospitals NHS Trust	2	2	69	4	4
Oxford University Hospitals NHS Trust	3	1	46	4	4
Papworth Hospital NHS Foundation Trust	1	1	11	2	2
Pennine Acute Hospitals NHS Trust (The)	3	3	28	5	5

Trust	Number of sites	Number of organisational questionnaires received	Number of cases data received on	Number of sets of case notes requested	Number of sets of case notes returned
Portsmouth Hospitals NHS Trust	1	0	17	2	2
Queen Victoria Hospital NHS Foundation Trust	1	1	3	2	2
Royal Berkshire NHS Foundation Trust	1	1	14	2	2
Royal Bolton Hospital NHS Foundation Trust	1	1	21	2	2
Royal Bournemouth and Christchurch Hospitals NHS Trust	1	1	3	2	2
Royal Brompton and Harefield NHS Foundation Trust	2	2	42	4	4
Royal Cornwall Hospitals NHS Trust	1	1	9	2	2
Royal Devon and Exeter NHS Foundation Trust	1	1	20	2	2
Royal Free London NHS Foundation Trust	1	1	20	2	2
Royal Liverpool & Broadgreen University Hospitals NHS Trust	1	1	16	2	2
Royal Marsden NHS Foundation Trust (The)	1	1	10	2	2
Royal National Orthopaedic Hospital NHS Trust	1	1	1	1	1
Royal Surrey County Hospital NHS Trust	1	1	7	2	2
Royal United Hospital Bath NHS Trust	1	1	8	2	2
Royal Wolverhampton Hospitals NHS Trust (The)	1	1	9	2	2
Salford Royal Hospitals NHS Foundation Trust	1	1	34	2	2
Salisbury NHS FoundationTrust	1	1	9	2	2
Sandwell and West Birmingham Hospitals NHS Trust	2	2	16	4	4
Sheffield Teaching Hospitals NHS Foundation Trust	2	2	34	4	4
Sherwood Forest Hospitals NHS Foundation Trust	1	1	3	2	2
Shrewsbury and Telford Hospitals NHS Trust	2	2	16	4	4
South Devon Healthcare NHS Foundation Trust	1	0	8	2	2
South Eastern Health & Social Care Trust	1	1	13	2	2

Appendix 6 - Participation (continued)

Trust	Number of sites	Number of organisational questionnaires received	Number of cases data received on	Number of sets of case notes requested	Number of sets of case notes returned
South London Healthcare NHS Trust	2	1	26	4	4
South Tees Hospitals NHS Foundation Trust	2	2	36	4	4
South Tyneside NHS Foundation Trust	1	1	7	2	2
South Warwickshire NHS Foundation Trust	1	1	2	2	2
Southampton University Hospitals NHS Trust	1	1	12	2	2
Southend University Hospital NHS Foundation Trust	1	1	8	2	2
Southern Health & Social Care Trust	1	1	1	1	1
Southport and Ormskirk Hospitals NHS Trust	1	1	6	2	2
Spire Healthcare	1	1	0	NA	NA
St Anthony's Hospital	1	1	0	NA	NA
St George's Healthcare NHS Trust	1	1	24	2	2
St Helens and Knowsley Teaching Hospitals NHS Trust	1	1	7	2	2
States of Jersey Health & Social Services	1	1	3	2	2
Stockport NHS Foundation Trust	1	1	11	2	2
Surrey & Sussex Healthcare NHS Trust	1	1	14	2	2
Tameside Hospital NHS Foundation Trust	1	1	9	2	2
Taunton & Somerset NHS Foundation Trust	1	1	4	2	2
The Dudley Group NHS Foundation Trust	1	1	6	2	1
The Leeds Teaching Hospitals NHS Trust	2	2	7	4	2
The Princess Alexandra Hospital NHS Trust	1	1	4	2	2
The Queen Elizabeth Hospital King's Lynn NHS FoundationTrust	1	1	1	1	1
The Rotherham NHS Foundation Trust	1	1	10	2	2
The Walton Centre NHS Foundation Trust	1	1	34	2	2
United Lincolnshire Hospitals NHS Trust	2	2	18	4	4

Trust	Number of sites	Number of organisational questionnaires received	Number of cases data received on	Number of sets of case notes requested	Number of sets of case notes returned
Univ. Hospital of South Manchester NHS Foundation Trust	1	1	37	2	2
University College London Hospitals NHS Foundation Trust	4	4	42	6	6
University Hospital of North Staffordshire NHS Trust	1	1	49	2	2
University Hospitals Birmingham NHS Foundation Trust	1	1	71	2	2
University Hospitals Coventry and Warwickshire NHS Trust	1	1	40	2	2
University Hospitals of Bristol NHS Foundation Trust	1	1	27	2	2
University Hospitals of Leicester NHS Trust	3	3	49	6	6
University Hospitals of Morecambe Bay NHS Trust	2	2	15	4	4
Walsall Healthcare NHS Trust	1	1	1	1	1
Warrington & Halton Hospitals NHS Foundation Trust	1	0	10	2	2
West Hertfordshire Hospitals NHS Trust	1	1	11	2	2
West Middlesex University Hospital NHS Trust	1	1	2	2	2
West Suffolk NHS Foundation Trust	1	1	5	2	2
Western Health & Social Care Trust	1	1	2	2	2
Western Sussex Hospitals NHS Trust	2	2	8	4	4
Weston Area Health Trust	1	1	2	2	0
Whittington Health	1	1	5	2	2
Wirral University Teaching Hospital NHS Foundation Trust	1	1	2	2	2
Worcestershire Acute Hospitals NHS Trust	2	0	10	3	2
Wrightington, Wigan & Leigh NHS Foundation Trust	1	1	4	2	2
Wye Valley NHS Trust	1	1	5	2	2
Yeovil District Hospital NHS Foundation Trust	1	1	7	2	2
York Teaching Hospitals NHS Foundation Trust	2	2	9	4	4

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Ground Floor
Abbey House
74-76 St John Street
London EC1M 4DZ

T 0207 251 9060
F 0207 250 0020
E info@ncepod.org.uk
w www.ncepod.org.uk

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