

Fifth National Audit Report

2017

Prepared by

David Chadwick BM BCh FRCS MD

Robin Kinsman BSc PhD Peter Walton MBA FRCP

on behalf of The British Association of Endocrine & Thyroid Surgeons

Dendrite Clinical Systems



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David Chadwick BM BCh FRCS MD

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The British Association of Endocrine and Thyroid Surgeons operates the UK Registry of Endocrine and Thyroid Surgery in partnership with Dendrite Clinical Systems Limited. The Society gratefully acknowledges the assistance of Dendrite Clinical Systems for:

- building, maintaining & hosting the web registry
- · data analysis and
- publishing this report

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The Hub, Station Road, Henley-on-Thames,

Oxfordshire RG9 1AY, United Kingdom

phone +44 1491 411 288

fax +44 1491 411 377

e-mail publishing@e-dendrite.com

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Introduction

It is a great pleasure to write the foreword to this, the 5th BAETS National Audit Report, which is based on data from the United Kingdom Registry of Endocrine & Thyroid Surgery (UKRETS) database. David Chadwick and the team at Dendrite are to be congratulated for their presentation of these complex data in a form that is easy to digest and understand. The report describes how we, the members of BAETS, provided surgical management of endocrine disorders over the 5-year period between July 2010 and June 2015.

The database itself goes back to 2004. It began with the idea that by learning more about the quality of our outcomes and complications we would be able to drive up standards. This idea still holds. By enabling members to see how their practice compares to others it allows individual reflection, but also gives us as an association an insight into what can be achieved nationally. To keep the UKRETS relevant we regularly review the data we ask for and are now looking at ways we might triangulate the data with that collected by HES (Hospital Episode Statistics). As well as the UKRETS we continue to support the drive towards best practice with initiatives such as the annual National Masterclass, input to the surgical curriculum and collaboration with patient support groups.

In recent years we have provided our data for inclusion in the Consultant Outcomes Publication (COP) published by the Healthcare Quality Improvement Partnership (HQIP). We were in fact one of the first professional groups within surgery to make consultant level data publicly available on the web, certainly well ahead of the requirement to do so. We have, however, recently seen some misinterpretation and misuse of our data in the independent healthcare sector, which has forced a decision to limit the extent of publicly available consultant-level outcomes data, until this problem has been fully resolved.

Going forward, the strength of the UKRETS will be improved by members taking time out of busy schedules to enter data as fully as is possible, but it will be strengthened even more when surgeons not presently entering data comply with what is, after all, a mandatory requirement. We encourage our membership, not only to enter their data, but also to reflect on analyses of their outcomes, and to use these data in annual appraisal. The results of surgery detailed in this report can assist in this, in providing a national benchmark. Meanwhile, work is in progress to develop the registry website, to allow members to download a dashboard of their own results, with funnel plots generated *live*, in order to improve this important function of our audit.

Mark Lansdown

President, BAETS



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Executive summary

This is the fifth national report of data arising from the BAETS Audit, now re-named as the United Kingdom Registry of Endocrine and Thyroid Surgery (UKRETS).

Since its inception in 2004, this database now holds information on over 71,000 operations for diseases of the thyroid, parathyroid, adrenal and endocrine pancreas.

Over the years, the database has evolved, not only to collect a broader range of information on the details of surgery and its primary outcomes in the form of short-term complications, but also to investigate the utility of pre-operative investigations, MDT discussion, intra-operative adjuncts, and the details of the pathology being treated.

Data quality has come under scrutiny more recently, and the database has been modified to improve various aspects of this, including the institution of mandatory data fields; universal definitions of outcomes with pop-up dialog boxes to aid in their application during data entry; and automatic cross-checking for duplicate entries and rare outcomes, such as mortality.

Although these developments have undoubtedly improved data quality within the UKRETS, there remain some issues regarding how well the outcomes recorded here can be considered truly representative of the practice of endocrine surgery in the United Kingdom. First, not all surgeons performing these operations are BAETS members, and so a substantial number of United Kingdom surgeons do not enter any cases into the UKRETS. Even amongst the BAETS membership there is variation in the extent of data entry, so that overall the data in the UKRETS represent probably only around 40% of thyroidectomy cases in the country, for instance.

Second, the rate of missing data for some key variables remains high, which limits the conclusions that can be drawn. This is particularly the case for outcomes at later follow-up, likely reflecting the greater effort and time required for members to update the case entry for these measures.

Finally, the data are self-reported, and have not to date been subjected to any external validation.

Steps to improve each of these limitations could usefully be undertaken.

Nonetheless, this report details many interesting and valuable findings. Notable amongst these are:

- There remain limitations in definitive pre-operative diagnosis of differentiated thyroid cancer.
- Although a Thy5 fine-needle aspiration cytology (FNAC) result has a very high predictive value for
 cancer, this result is actually obtained in only 38% of papillary thyroid cancers, for instance. There
 is evidence that this leads to more diagnostic surgery, and subsequent need for further procedures
 i.e., completion thyroidectomy or secondary operations for nodal dissection, once a cancer
 diagnosis is secure.
- Diagnostic surgery also often results from a Thy3 or Thy4 FNAC, but final pathology is often benign, suggesting that unnecessary surgery may sometimes be prompted by the FNAC result. This seems to be a particular risk when auto-immune thyroiditis is present.
- There seems little consensus between the membership with respect to: prophylactic central neck dissection for papillary thyroid cancer; assessment of vocal cord function with laryngoscopy either before or after thyroid or parathyroid surgery; or use of intra-operative recurrent laryngeal nerve monitoring.
- Laryngoscopy rates have significantly increased since previous reports. However, the rate of postoperative laryngoscopy averages just over 40%, with an almost 20% average rate of missing data. This makes assessment of the rate of recurrent laryngeal nerve injury/vocal cord palsy difficult, a problem compounded by high rates of missing data for the final outcome of any abnormal vocal cord check; and the lack, until the last revision of the database in October 2014, of a defined time interval by which any cord palsy could be assigned as *persistent*. With such a definition, and with further improvement in data completeness, it may prove possible to give a more reliable estimate of the rate of persistent vocal cord palsy in future.
- Endocrine surgery continues to be consultant-led, with the primary surgeon being a consultant in the majority of cases. When trainees perform surgery, a consultant is usually the assistant, and dual-operating by two consultants is also frequently observed, particularly in adrenal surgery.

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- Lengths of post-operative stay after thyroid and parathyroid surgery continue to shorten, with
 a small increase in the number of true day-cases, particularly for targeted parathyroidectomy.
 Reassuringly, this trend has not been accompanied by any increase in re-admission rates.
- There has been an increase in the extent of pre-operative imaging (frequency of usage and number of modalities) prior to parathyroid surgery, even for first-time surgery. This trend has not, however, been associated with an increase in the rate of targeted surgery nor improved cure rates for primary hyperparathyroidism. Failure to cure hyperparathyroidism is strongly influenced by the presence of multi-gland disease, the inferred incidence of which is higher than commonly quoted, even in apparently sporadic disease. There is great variation between surgeons with respect to the risk factors for persistent hypercalcaemia amongst their patients, which should be considered when using the data to compare surgical performance.
- In adrenal surgery, interesting observations are made on: increasing rates of surgery for metastases to the adrenal gland; the relationship between lesion size and risk of malignancy; the uptake of the posterior endoscopic approach; and on surgical case-loads, particularly for rare diagnoses such as adreno-cortical carcinoma.
- The safety of endocrine surgery is apparent: general complications are infrequent, with respiratory and wound infection/seromas being the commonest, whilst in-hospital mortality is extremely rare. Estimates for the rates of the main specific complications are now more precise, due to the greater number of cases accrued. These estimates can help inform processes of patient consent, surgeons' appraisal and reflection on their practice, and identify areas for future research.

Finally, I congratulate the BAETS membership for continuing to contribute to this valuable resource by investing their time to ascertain and record their patients' data and outcomes.

David Chadwick
Director of Audit, BAETS
December 2016



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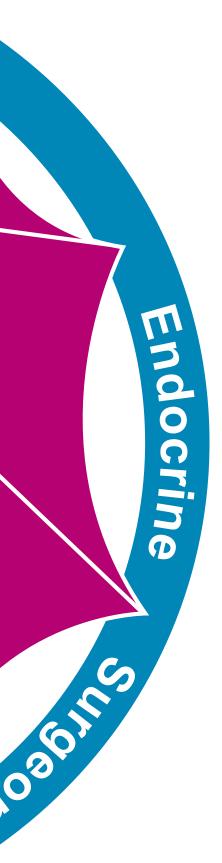
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Prelude



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Consultant surgeon contributors

- Richard **Adamson**
- Anna Aertssen
- Ahmed **Afzaal**
- Avi Agrawal
- Ijaz Ahmad
- Orabi Ahmad
- Ibrahim **Ahmed**
- Irfan Akhtar
- Murat Akyol
- Peyman Alam
- Munther Aldoori
- David Allen
- lain Anderson
- Sebastian **Aspinall**
- Chris Ayshford
- Ekambaram Dinakara **Babu**
- Christopher **Backhouse**
- Saba **Balasubramanian**
- Alistair Balfour
- Neal **Banga**
- Ludger Barthelmes
- Nigel Beasley
- Chris **Bem**
- lan **Black**
- Stephen **Blair**
- Richard **Bliss**
- Victoria BrownRobert Carpenter
- Michael Carr
- Andrew Carswell
- Carmen de Casso Moxo
- David Chadwick
- Habib Charfare
- Andy **Chin**
- Edward **Chisholm**
- Louise Clark
- Peter Clarke
- Helen Cocks
- Peter Conboy

- Luke **Condon**
- Rogan **Corbridge**
- Allan Corder
- Paul Counter
- Stephen Courtney
- Eamonn Coveney
- Hugh Cox
- Wendy Craig
- James Crinnion
- David Cunliffe
- Titus Cvasciuc
- Jeremy Davis
- Stuart **Denholm**
- Ganapathy **Dhanasekar**
- Vikram Dhar
- Ann **Dingle**
- James Docherty
- Helen **Doran**
- Julie Dunn
- Fiona **Eatock**
- Anusha **Edwards**
- Wael El-Saify
- James England
- Abigail Evans
- Roy Farrell
- Brian **Fish**
- Bence Forgacs
- Clare Fowler
- Georgios Fragkiadakis
- Gabriele **Galata**
- Ashu **Gandhi**
- Richard Garth
- Ajith **George**
- Nicholas Gibbins
- Martin **Greaney**
- Thomas Groot-Wassink
- Paul Gurr
- Andrew Guy
- Wayne Halfpenny

- Charles Hall
- Paul **Hans**
- Robert Hardy
- Churunal Hari
- Barney **Harrison**
- Michael Harron
- Simon Hickey
- Omar **Hilmi**
- Tim Hoare
- Jonathan **Hobson**
- Philip **Holland**
- Andrew **Houghton**
- David Howe
- Johnathan Hubbard
- Neil Hulton
- Paul Hurley
- Andrew Husband
- Aidah Isa
- Shaun **Jackson**
- Tony Jacob
- Sharan Chakkyath **Jayaram**
- Jean-Pierre **Jeannon**
- Taleb Jeddy
- Stephanie **Jenkins**
- Bethan Jones
- Anton Joseph
- Bengt **Kald**
- Robert **Kennedy**
- James Kirkby-Bott
- Paul Kirkland
- Ursula **Kirkpatrick**
- Zygmunt Krukowski
- Nirmal Kumar
- Vijayakumar **Kurup**
- Tom Kurzawinski
- Nicholas Lagattolla
- Mark Lansdown
- Nicholas Law
- Thomas **Lennard**

Contributors

The British Association of Endocrine and Thyroid Surgeons

Fifth National Audit Report 2017



- Peter Lewis
- Andrew Locker
- John Logie
- Sean **Loughran**
- Michele Lucarotti
- John **Lynn**
- Alasdair Mace
- Fiona MacGregor
- Paul Maddox
- Arcot Maheshwar
- Zvoru Makura
- Deborah Markham
- Dominic Martin-Hirsch
- Andrew McCombe
- Julian McGlashan
- Andrew McIrvine
- Andrew **McLaren**
- Sandy McPherson
- Hesham **Mehanna**
- Radu **Mihai**
- Faisal Mihaimeed
- Tedla Miroslav
- George Mochloulis
- James Moor
- Peter Moore
- Ram Moorthy
- Pradeep Morar
- Justin Morgan
- lain Muir
- Michael Nicholson
- Stewart Nicholson
- Keshav Nigam
- lain Nixon
- Janet O'Connell
- Olawale **Olarinde**
- Fausto Palazzo
- Michael Papesch
- Neil Parrott
- Laila Parvanta

- Susannah Penney
- Andrew **Pfleiderer**
- Jonathan Philpott
- Lisa Pitkin
- Isabel Quiroga
- David Ratliff
- Duraisamy **Ravichandran**
- Venkat Reddy
- David Rew
- Keith Rigg
- Nick Roland
- Alasdair **Ross**
- Tom Rourke
- Gavin Royle
- Sarwat Sadek
- Greg Sadler
- Mrinal Saharay
- Ahmed Samy
- Klaus-Martin **Schulte**
- David **Scott-Coombes**
- Anup **Sharma**
- Steve **Shering**
- Susannah Shore
- John Shotton
- Richard Sim
- Ricard **Simo**
- Prakash **Sinha**
- Gunasekaran **Sinnappa**
- Anthony Skene
- James Smellie
- David Smith
- lan **Smith**
- Simon Smith
- Roy Spence
- Paul Spraggs
- Adam Stacey-Clear
- Frank Stafford
- Michael Stearns
- Michael Stechman

- Paul **Stimpson**
- Robert Sudderick
- Robert Sutcliffe
- Peter Tassone
- Taranjit **Tatla**
- Gareth Tervit
- Paul Thomas
- Adrian Thompson
- Steven Thrush
- Paul Tierney
- Augustine **Titus**
- Neil **Tolley**
- Mark Tomlinson
- Paul Turner
- Charanjeit **Ubhi**
- Harpreet Uppal
- Srinivasan Venkat
- Richard Vowles
- Alison Waghorn
- John Watkinson Gavin Watters
- John Weighill
- Andrew Welch
- Hugh Wheatley
- Martin Wickham
- Chandana Wijewardena
- Adam Wilde
- Michael Williams
- Simon Williams
- Paul Wilson
- Michail Winkler
- Stephen Wood
- Constantinos **Yiangou**
- Charles Zammitt



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A note on the conventions used throughout this report

There are several conventions used in the report in an attempt to ensure that the data are presented in a simple and consistent way. These conventions relate largely to the tables and the graphs, and some of these conventions are outlined below.

The specifics of the data used in any particular analysis are made clear in the accompanying text, table or chart. For example, many analyses sub-divide the data on the basis of primary diagnosis, and the titles for both tables and charts will reflect this fact.

Conventions used in tables

On the whole, unless otherwise stated, the tables and charts in this report record the number of procedures (see the example below).

Parathyroid surgery: age and pathology

			Pathology				
		Primary	Renal	Unspecified	All		
<21		95	10	4	109		
21-3	30	274	66	20	360		
31-4 41-5 51-6 61-7	10	607	102	38	747		
41-5	50	1,509	199	77	1,785		
51-6	50	2,601	234	157	2,992		
61-7	70	3,332	182	190	3,704		
71-8	30	2,405	74	132	2,611		
>80		609	15	40	664		
	pecified	31	4	5	40		
All		11,463	886	663	13,012		

Each table has a short title that is intended to provide information on the subset from which the data have been drawn, such as the patient's gender or particular operation sub-grouping under examination.

The numbers in each table are colour-coded so that entries with complete data for all of the components under consideration (in this example both patient's age and gender) are shown in regular black text. If one or more of the database questions under analysis is blank, the data are reported as unspecified in purple text. The totals for both rows and columns are highlighted as emboldened text.

Some tables record percentage values; in such cases this is made clear by the use of an appropriate title within the table and a % symbol after the numeric value.

Rows and columns within tables have been ordered so that they are either in ascending order (age at procedure: <21, 21-30, 31-40,41-50, 51-60 years, etc.; post-procedure stay 0, 1, 2, 3, >3 days; etc.) or with negative response options first (No; None) followed by positive response options (Yes; One, Two, etc.).

Row and column titles are as detailed as possible within the confines of the space available on the page. Where a title in either a row or a column is not as detailed as the authors would have liked, then footnotes have been added to provide clarification.

There are some charts in the report that are not accompanied by data in a tabular format. In such cases the tables are omitted for one of a number of reasons:

- insufficient space on the page to accommodate both the table and graph.
- there would be more rows and/or columns of data than could reasonably be accommodated on the page (for example, funnel plots and Kaplan-Meier curves).
- the tabular data had already been presented elsewhere in the report.

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Conventions used in graphs

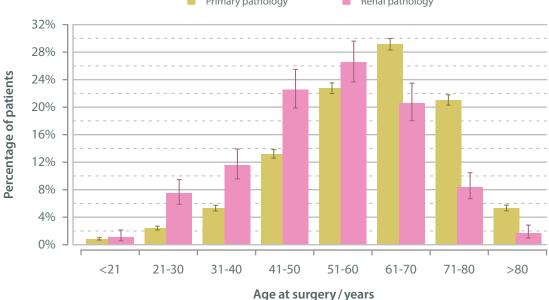
The basic principles applied when preparing graphs for this Fifth National Audit Report were based, as far as possible, upon William S Cleveland's book *The elements of graphing data* ¹. This book details both best practice and the theoretical bases that underlie these practices, demonstrating that there are sound, scientific reasons for plotting charts in particular ways.

Counts: the counts (shown in parentheses at the end of each graph's title as n=) associated with each graph can be affected by a number of independent factors and will therefore vary from chapter to chapter and from page to page. Most obviously, many of the charts in this report are graphic representations of results for a particular group (or subset) extracted from the database, such as patients undergoing first-time surgery. This clearly restricts the total number of database-entries available for any such analysis.

In addition to this, some entries within the group under consideration have data missing in one or more of the database questions under examination (reported as unspecified in the tables); all entries with missing data are excluded from the analysis used to generate the graph because they do not add any useful information.

For example, in the graph below, only the database entries where the patient is having parathyroid surgery and both the patient's age and gender are known are included in the analysis; this comes to 12,314 operation-entries (95 + 274 + 607 + 1,509 + 2,601 + 3,332 + 2,405 + 609 + 10 + 66 + 102 + 199 + 234 + 182 + 74 + 15; the 698 entries with unspecified data are excluded from the chart).

Primary pathology Renal pathology



Confidence intervals: in the charts prepared for this report, most of the bars plotted around rates (percentage values) represent 95% confidence intervals ². The width of the confidence interval provides some idea of how certain we can be about the calculated rate of an event or occurrence. If the intervals around two rates do not overlap, then we can say, with the specified level of confidence, that these rates are different; however, if the bars do overlap, we cannot make such an assertion.

Bars around averaged values (such as patients' age, post-operative length-of-stay, etc.) are classical standard error bars or 95% confidence intervals; they give some idea of the spread of the data around the calculated average. In some analyses that employ these error bars there may be insufficient data to legitimately calculate the standard error around the average for each sub-group under analysis; rather than entirely exclude these low-volume subgroups from the chart their arithmetic average would be plotted without error bars. Such averages without error bars are valid in the sense that they truly represent the data submitted; however, they should not to be taken as definitive and therefore it is recommended that such values are viewed with extra caution.

- 1. Cleveland WS. The elements of graphing data. 1985, 1994. Hobart Press, Summit, New Jersey, USA.
- 2. Wilson EB. Probable inference, the law of succession, and statistical inference. *Journal of American Statistical Association*. 1927; 22: 209-212.



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Funnel plots

There are, of course, many different ways to display crude outcome data. When comparing outcomes for individuals, one method would be to calculate the outcome rate for each and then rank them in ascending order of outcome rate; it is possible to place 95% confidence intervals around the calculated rate to give some indication of the confidence in that result, but this method tends to draw the eye to the upper and lower reaches of the ranking and does not easily provide information on how each clinician sits with respect to the average outcome rate.

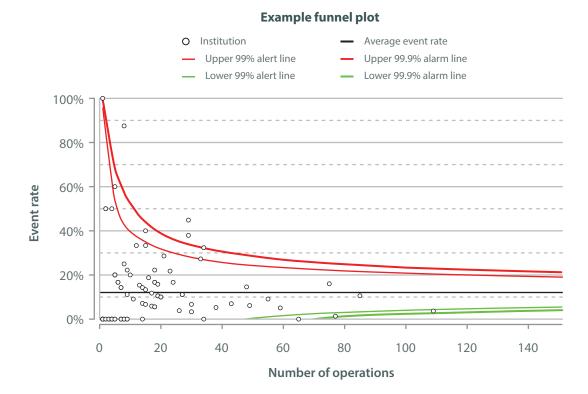
Another method would be to determine the rank-order for the surgeons based on crude or risk-adjusted outcome rates and then plot these ranks with suitable confidence intervals around them. This method will also tend to draw attention to the extremes of the ranking and can generate spurious results.

Shewhart control charts have been suggested as a means of presenting performance in the clinical setting without having to resort to such spurious ranking into league tables. These plots show the number of observed events against the volume of cases on a square-root scale; unfortunately this format is not intuitive, obscures the observed event rate and leads to rather approximate control limits. Applying a minor adjustment to this method (plotting the event rate against the number of cases) generates the so-called funnel plot, which is widely used in meta-analyses to check for publication bias and has been used to compare mortality rates in paediatric cardiac surgery. Exact binomial control limits around the overall rate are superimposed to indicate possible thresholds for alert and alarm respectively.

Funnel plots discourage inappropriate ranking while providing a strong visual indication of divergent performance or special cause variation; they are not a cause for damnation in and of themselves. Advantages over the Shewhart control charts approach include the display of the observed event rates, an informal check on the relationship between the event rate and number of cases, an emphasis on the natural increased variability amongst small-volume centres or individuals, intuitive choice of axes (hence easy plotting) and exact binomial control limits that can be calculated using the most popular spreadsheet packages. This method is, however, not risk-adjusted, and therefore has all the problems associated with not comparing like with like.

The example funnel plot below shows an event rate for a number of institutions (which might be a country, an individual hospital, a consultant surgeon, etc.). Each dot represents an institution, and shows the crude event rate versus the number of procedures performed. The solid, horizontal black line indicates the average rate. The 99% control limits are shown as thin (green and red) lines and 99.9% limits thick (red & green) lines.

It should be obvious that transgressing the upper limits when the case-number is small is very unlikely unless the complication rate is extremely high. Using such an approach should reduce the fear of making unjustified judgements based on small numbers of cases.



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The UK Registry of Endocrine & Thyroid Surgery

The UKRETS database now holds records on over 71,000 endocrine operations.

This fifth National Report mainly details those cases with date of surgery from 1st July 2010 to 30th June 2015. Data were extracted in March 2016, thereby leaving a 9-month interval from the last date of operation under analysis, in which late (6-month) outcomes could be entered.

Data accrual has accelerated over the years, with almost two-thirds of the total number of thyroid, parathyroid and adrenal cases having been entered in the 5 years to end June 2015, compared to one-third in the preceding 7 years since inception of the electronic database.

The Registry can therefore truly be considered the primary source of information on outcomes of endocrine surgery, as currently practiced in the United Kingdom.

The UK Registry of Endocrine & Thyroid Surgery: records entered

	Time p	Time period	
	2011-2015	All years	
Surgery for thyroid disease Surgery for parathyroid disease Surgery for adrenal disease	30,557	47,493	
Surgery for parathyroid disease	13,012	20,528	
Surgery for adrenal disease	2,073	3,206	
Surgery for endocrine pancreatic disease	18	75	
Unspecified	2	2	
All	45,662	71,304	

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In the fourth National Report, information was first presented on some aspects of data quality, and attention has continued to be focused on this issue since.

Entry of cases into the UKRETS is undertaken by the operating surgeon / BAETS member, *via* an electronic link. This can represent both a strength and weakness in terms of data quality: a strength, as the surgeon is often best placed to ascertain many of the primary outcomes, and takes responsibility for his / her own data; a weakness, as inadvertent errors in data entry can occur, and competing time pressures may impair individuals' ability to enter all their data.

Critical aspects of data quality in any registry include:

- duplicate entries.
- data accuracy.
- missing data.

Since the last National Report, developments have been made in each of these aspects:

Duplicates

At the time of production of the 4th National Report, it was noted that the database contained 1,640 apparent duplicate (or triplicate) entries, based on identical date of birth, date of operation and type of endocrine operation. This represented around 5% of the total entries in the database at the time, a significant risk to accurate interpretation of results.

Further investigation revealed the main reasons for these were:

- inadvertent multiple entry of the same case by individual members.
- dual operating, with two members operating jointly, but each entering the case under their own log-in.
- non-duplicates: co-incidental occurrence of same demographic details in separate cases, performed by separate members.

A project was therefore undertaken in 2011, in collaboration with the BAETS membership, to categorise these apparent duplicate entries and to delete relevant duplicates.

The database was also re-configured, to screen for, and prospectively exclude, incorrect multiple entries, at the point of initial registration of a case. This was facilitated by the addition of a mandatory field for *hospital at which surgery is undertaken*.

The ability to identify *dual operated* cases was also added, with one member responsible for data entry, the second member being able to view that entry as *read-only* under their own log-in, but both members' involvement being recognized at data analysis.

Information in the current report dates from after introduction of these changes.

Data accuracy

Ensuring the accuracy of data entry is difficult. To date, no systematic *external validation* of cases has been undertaken, though this ought to be considered in future.

With respect to mortality following thyroid surgery, some scrutiny of data accuracy was undertaken, as part of the Consultant Outcomes Publication programme, instituted by NHS England in 2013, in which the BAETS participated. It was realized that occasionally patient had inadvertently been recorded in the UKRETS as having died in hospital, when in fact this had not occurred. In collaboration with the relevant BAETS members, these inaccuracies have now been corrected, and a *fail-safe* mechanism introduced within the database, to double-check the entry of rare events such as mortality, prospectively.

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Missing data

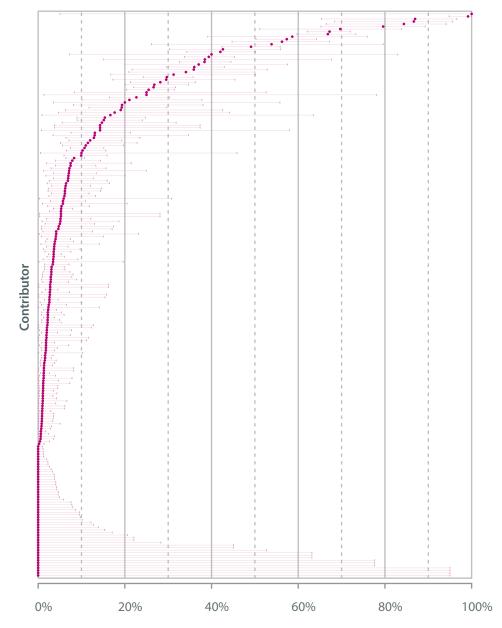
High levels of incomplete data entry can significantly affect the reliability of any conclusions drawn from data analysis. As in the last National Report, this aspect of data quality is included below, examining overall levels of missing data, and variability between members in this regard.

There remains a significant proportion of members registering cases without detailing the extent of surgery. These cases cannot be included in any analyses, and represent a lost opportunity to register the true spectrum of thyroid surgery being undertaken.

In 2014, the database was re-configured to make certain data fields mandatory, with progress to the next page of the electronic pro-forma being dependent upon entry of these items. Extent of surgery is now included as a mandatory field, so it is hoped this aspect of data quality will improve in forthcoming years.

Thyroid surgery

Thyroid surgery: Missing operation type for each member; rate and 95% confidence interval (n=30,557 operations)



Percentage thyroid cases without the operation type recorded



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This table details the levels of missing data for the various individual fields considered in the subsequent funnel plot.

It is clear that rates of data completion are reasonably good for those variables known at the time of surgery. However, this declines for outcomes at later stages of the patient's progress: around 10% or so missing data for details at discharge from hospital; closer to 20% missing for later outcomes, such as pathology result and voice changes.

Rates of missing data are highest for late hypocalcaemia. This finding is intuitive, in that this outcome can only be established for some patients at 6 months post-operatively, with members having to make extra effort to ascertain this outcome, and revisit the database to update the entry. It is possible that the true rate of late hypocalcaemia may be under-estimated substantially by this finding (as it is feasible that the cohort of patients with missing data for late hypocalcaemia are more likely to be those who were hypocalcaemic immediately after surgery).

Thyroid Surgery: missing data for data-items used in the missing data funnel plot

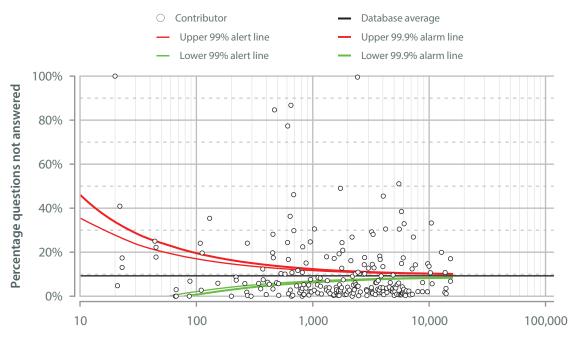
		Data missing		
	No	Yes	Missing rate	
Main indication for surgery	29,021	1,536	5.0%	
Thyroid status at presentation	29,205	1,352	4.4%	
Pre-operative laryngoscopy	29,211	1,346	4.4%	
Re-operation	29,237	1,320	4.3%	
Number of previous operations	2,781	234	7.8%	
FNAC	29,061	1,496	4.9%	
FNAC result	17,035	144	0.8%	
Grade of principal surgeon	29,547	1,010	3.3%	
Grade of assistant surgeon	28,523	2,034	6.7%	
Previous contra-lateral lobectomy	27,897	2,660	8.7%	
Isthmusectomy alone	26,779	3,778	12.4%	
Side of thyroid procedure	30,084	473	1.5%	
Thyroid procedure: right	19,317	3	0.0%	
Thyroid procedure: left	18,484	3	0.0%	
Thymectomy	26,897	3,660	12.0%	
Primary thyroid pathology	25,205	5,352	17.5%	
Re-operation for haemorrhage	27,477	3,080	10.1%	
Hypocalcaemia	27,331	3,226	10.6%	
Hypocalcaemia treatment given	25,275	5,282	17.3%	
Post-operative complications	26,920	3,637	11.9%	
Patient survival	27,281	3,276	10.7%	
Date of discharge	25,908	4,649	15.2%	
Voice change	24,868	5,689	18.6%	
Is the patient on T3 / T4	24,753	5,804	19.0%	
Patient taking calcium / vitamin D at 6 months	23,996	6,561	21.5%	

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This funnel plot demonstrates the variation between members with respect to their completeness of data entry for the above key variables (proportion of all potential data points left unanswered).

Thyroid surgery: Missing data (n=30,557 entries; 672,942 questions)



Total number of questions that require completion (logarithmic scale)

Since the last report, there has been a marginal improvement in the average rate of data completeness (just under 10% missing data, compared to around 14% in the last report). Some of this improvement may have resulted from the introduction of the mandatory data fields mentioned above, although these were only operational during the last few months of the study period, hence would be expected to have only a modest effect.

However, variation between members remains significant. Again, there are several members whose results lie well above the upper alarm line, but also large numbers of surgeons whose data completion approaches 100%, in many cases despite large case volumes. There does not appear to be any relationship between case-load and rate of missing data, implying that other factors are relevant. These may include time constraints, and individual members' engagement with the audit process.



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Parathyroid surgery

Data completeness for parathyroid surgery shows a very similar pattern to that for thyroid surgery, in terms of:

- overall rate of missing data.
- increasing rate of missing data with stage of patient's progress (pre-operatively, at discharge from hospital, late outcomes). Again, this may significantly affect the accuracy of any estimates for certain key outcomes, in particular persistent hypercalcaemia.
- marginal improvement since the last report (average just under 10% missing data, compared to 18% in the fourth report).
- variation between members

Parathyroid surgery: missing data for the data-items used in the missing data funnel plot

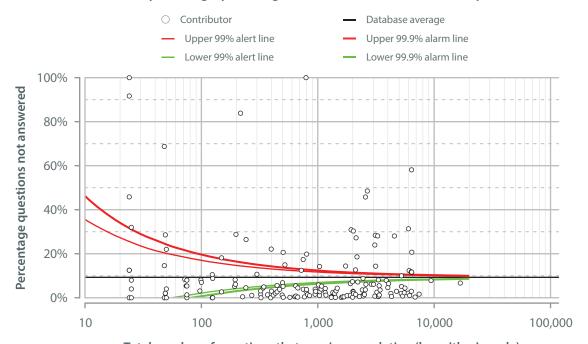
		Data missin	ng
	No	Yes	Missing rate
Pre-operative cord check	12,209	803	6.2%
Nuclear medicine	12,399	613	4.7%
Ultrasound	12,369	643	4.9%
CT / MRI	11,794	1,218	9.4%
Venous sampling	11,841	1,171	9.0%
PET	11,789	1,223	9.4%
Gamma probe	11,762	1,250	9.6%
Methylene blue	11,745	1,267	9.7%
Pathology	12,349	663	5.1%
Grade of principal surgeon	12,561	451	3.5%
Grade of assistant surgeon	12,147	865	6.6%
Number of glands removed	12,345	667	5.1%
Reoperation	12,264	748	5.7%
Number of previous operations	647	60	8.5%
Targeted approach	12,372	640	4.9%
Converted to conventional	5,531	454	7.6%
qPTH measured	11,847	1,165	9.0%
Nerve monitoring used	12,188	824	6.3%
Re-operation for haemorrhage	11,923	1,089	8.4%
Hypocalcaemia	11,824	1,188	9.1%
Post-operative complications	11,605	1,407	10.8%
Patient survival	11,799	1,213	9.3%
Date of discharge or death	11,181	1,831	14.1%
Persisting hypercalcaemia	10,132	2,880	22.1%
Related re-admission	10,371	2,641	20.3%
Voice change	10,330	2,682	20.6%

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Funnel plot showing variation between members with respect to their completeness of data entry for the variables listed on page 22 (proportion of all potential data points left unanswered).

Parathyroid surgery: Missing data (n=13,012 entries; 318,980 questions)



Total number of questions that require completion (logarithmic scale)



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Adrenal surgery

The pattern and overall rate of missing data for adrenal surgery is almost identical to the last report.

For certain data fields there might be justifiable reasons for missing data:

- for the Malignant (yes/no) question, limitations of histo-pathological assessment exist in determining malignant or benign behaviour for some adrenal lesions.
- date of follow-up might not be considered by the membership to be sufficiently important to require entry.

However, the high rate of missing data for the principal outcome measures of re-operation for bleeding, post-operative complications, mortality and related re-admission remains a concern.

Adrenal surgery: missing data for data-items used in the missing data funnel plot

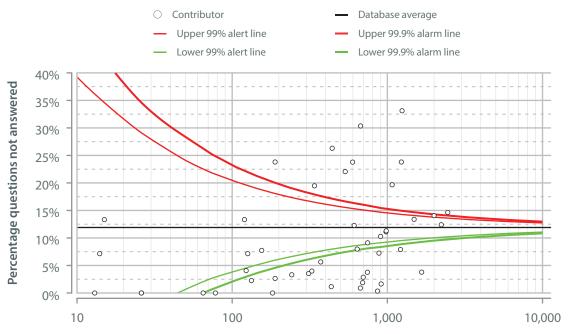
		Data missing		
		No	Yes	Missing rate
	Adrenal diagnosis	1,983	90	4.3%
	Adrenal anatomy	1,958	115	5.5%
	Malignant	1,813	260	12.5%
	Grade of principal surgeon	2,006	67	3.2%
	Grade of assistant surgeon	1,944	129	6.2%
_	Operation type	1,982	91	4.4%
Data item	Operation approach	1,937	136	6.6%
ata	Re-operation for haemorrhage	1,695	378	18.2%
Δ	Post-operative complications	1,810	263	12.7%
	Patient survival	1,840	233	11.2%
	Date of discharge or death	1,638	435	21.0%
	Date of follow up	1,256	817	39.4%
	Related re-admission	1,449	624	30.1%
	Date of related re-admission	36	12	25.0%

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Funnel plot showing variation between members with respect to their completeness of data entry for the variables listed on page 24 (proportion of all potential data points left unanswered).

Adrenal surgery: Missing data (n=2,073 entries; 26,997 questions)



Total number of questions that require completion (logarithmic scale)

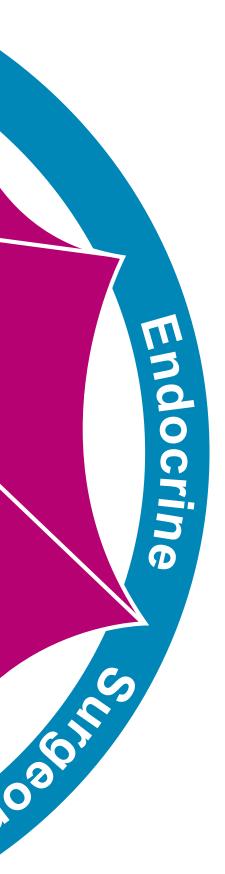
Summary

Since the last report, some improvements in data quality have been attained, but there remains significant variation between surgeons with respect to data completeness, particularly for late / longer-term outcomes, across all endocrine procedures.

Consideration should be given to:

- engagement with members whose missing data rates fall outside the upper alarm line, to ascertain reasons for this.
- incorporation of the UKRETS data entry activity into consultants' job planning.
- introduction of automated reminders to members to update missing entries.
- alternative methods of uploading outcome data from Trusts.





Surgery for thyroid disease



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Surgery for thyroid disease

General information from the database

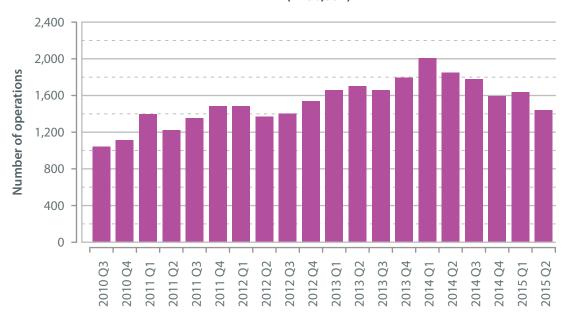
Number of members

The number of thyroid cases entered into the UKRETS has increased over the last several years, from around 200 cases *per* month in 2006 (as detailed in the 2012 national report), to around 300 *per* month in 2010 and around 500 *per* month in 2014. Since 2014, the number of entries has plateaued. The apparent reduction in cases entered in the first two quarters of 2015 may simply reflect the fact that many members retrospectively enter cases in batches, and may not have done so before the data were extracted for analysis of this report.

This is paralleled by an increase in the number of members actively submitting data, which probably largely represents new members joining BAETS to access the audit.

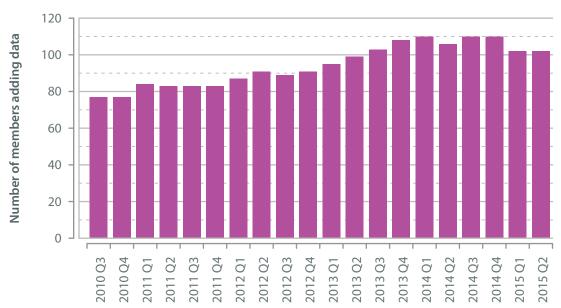
This trend is encouraging.

Thyroid surgery: Number of operations recorded (n=30,557)



Date of operation / calendar year and quarter

Thyroid surgery: Number of members actively entering data (n=30,557 operations)



Date of operation / calendar year and quarter

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The chart opposite shows the number of thyroid operations reported by each individual member over the 5-year study period.

Recent guidelines suggest that, in order to maintain expertise and to facilitate assessment of their results, surgeons performing thyroidectomy should do at least 20 such cases *per* year.

Large numbers of members report total case loads over 5 years that are less than 100 (suggesting less than 20 per year).

However, allowance needs to be made for surgeons newly joining the BAETS, newly entering data into the audit, or retiring from practice mid-way through the study interval, where 5-year case volumes will be artificially low. Hence, if the number of years of data entry, and the number of thyroid cases in each year is calculated, for each consultant, then:

The median case load *per* consultant was 25 (range: 1-139) cases/year.

There were 95 members submitting an average of fewer than 20 cases *per* year of data entry. Of these members, 20 surgeons had data confined to a single year (suggesting new joiners or leavers within that year), with median volumes for that year (or part year) of 3.5 (range: 1-17) cases.

The remaining 75 members had data extending across at least 2 years. For 7 of these latter surgeons, very low volumes in one year were followed by volumes over 20 cases in the subsequent year, implying a *new starter* entering data for only a part-year, but then achieving the case loads suggested by the guidance.

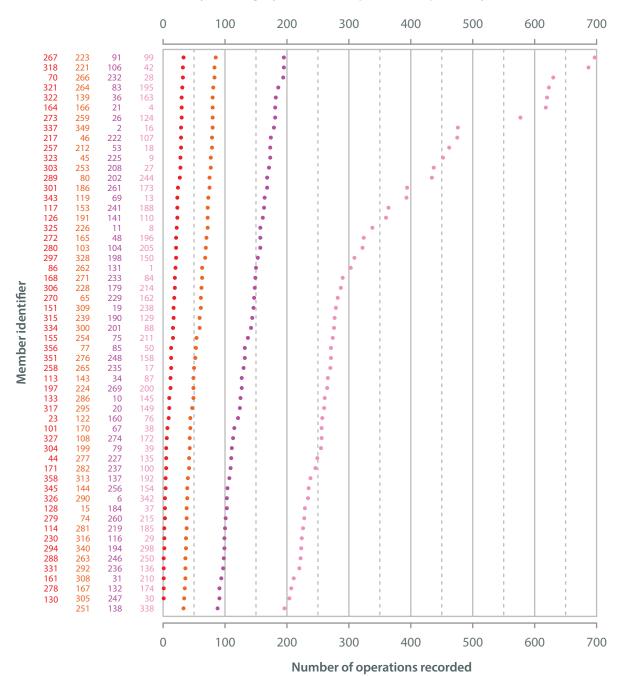
This leaves 68 members whose average case-load of fewer than 20 cases *per* year is not explained by newly joining the BAETS or retiring during the study interval. For this group, median reported case-load was 13 cases *per* year. This may reflect low actual surgical activity or incomplete data entry.

Seven surgeons report an average of over 100 cases *per* year. These are likely to be surgeons with a highly specialized endocrine/thyroid surgical practice, working in large tertiary referral centres.

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Thyroid surgery: Number of operations reported by each member



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Demographics and disease profile

Age and gender

There has been no significant change in demographic profile since the last report. As expected, most thyroid surgery is performed on middle-aged patients, with a strong female predominance (female: male ratio = 4:1).

Thyroid surgery: age statistics according to the patient's gender

		Gender	
	Male	Female	All patients
Count	6,047	24,417	30,487
Average	52.1	48.8	49.4
Standard deviation	15.93	15.75	15.84
10 th percentile	31	28	29
10 th percentile Lower quartile Median	41	37	38
Median	52	48	49
Upper quartile	65	60	61
90 th percentile	73	71	71

Thyroid surgery: Changes in average age over time according to gender; (n=30,464)

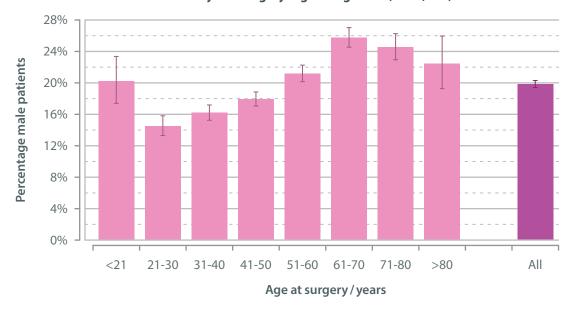


Date of operation / calendar year & quarter

Thyroid surgery: age and gender

		Gender				_
		Male	Female	Unspecified	All	Proportion male
	<21	147	580	0	727	20.2%
	21-30	449	2,645	4	3,098	14.5%
ars	31-40	906	4,689	6	5,601	16.2%
surgery/years	41-50	1,275	5,834	3	7,112	17.9%
Jery	51-60	1,244	4,628	3	5,875	21.2%
surg	61-70	1,239	3,570	5	4,814	25.8%
at	71-80	647	1,987	1	2,635	24.6%
Age	>80	140	484	1	625	22.4%
	Unspecified	13	57	0	70	18.6%
	All	6,060	24,474	23	30,557	19.8%

Thyroid surgery: Age and gender (n=30,464)





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Indication for surgery and thyroid status

Indications for first-time thyroid surgery have altered very little compared to the last report.

In euthyroid patients, the commonest indications for surgery remain biopsy result (36% of cases where indication is recorded), compressive symptoms (30%), quality of life (5%) and recurrent cyst (5%). Surgery in hypothyroid patients is clearly much less frequent, but with a similar spectrum of indications.

There seems some confusion amongst the membership regarding the thyroid status field, which was originally intended to record thyroid status at presentation, rather than necessarily the status at surgery, where pre-operative treatment of thyrotoxicosis will have reverted thyroid function to normal in many cases. This may explain the apparent discrepancy of surgery for thyrotoxicosis taking place in euthyroid or hypothyroid patients.

In thyrotoxic patients the main indication for surgery is the thyrotoxicosis itself, as expected, but in around 1 in 10 patients the main stated reasons for surgery were compressive symptoms from an associated goitre, or nodules that were clinically or cytologically worrying with respect to possible malignancy. In this latter group, where biopsy result was the indication for surgery, malignancy was subsequently recorded as the primary pathology in 27% (predominantly papillary thyroid cancer), and follicular adenoma in 21%.

First-time thyroid surgery: indication for surgery and thyroid status

		Thyroid status			
		Euthyroid	Hyperthyroid	Hypothyroid	Unspecified
	Biopsy result	7,675	128	97	67
	Clinically worrying lesion	3,042	51	67	24
	Completion thyroidectomy for cancer	442	3	3	7
	Compressive symptoms	6,382	193	130	101
ion	Quality of life	1,053	20	15	14
Indication	Recurrent cancer	22	0	1	0
lnd	Recurrent cyst	998	6	6	7
	Thyroglossal cyst	154	1	1	5
	Thyrotoxicosis	1,698	3,162	15	40
	Unspecified	458	64	8	62
	All	21,924	3,628	343	327

Surgery for thyroid disease

The British Association of Endocrine and Thyroid Surgeons

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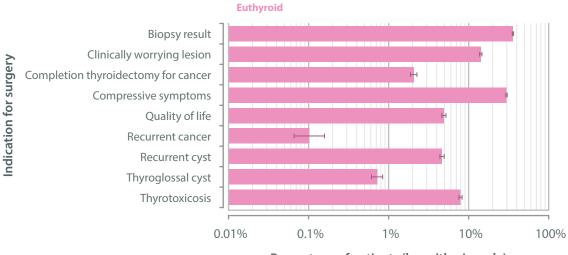
In re-operative thyroid surgery, the commonest indication for surgery is *completion thyroidectomy for cancer*, and the majority of these cases are unilateral lobectomy after a previous contralateral hemithyroidectomy, as detailed later in this report. Re-operative surgery for thyrotoxicosis is unusual, perhaps due to the trend over the last several years to total thyroidectomy as the treatment of choice for Graves' disease and toxic multinodular goitre. Hence, most re-do surgery is in euthyroid patients.

Redo thyroid surgery: indication for surgery and thyroid status

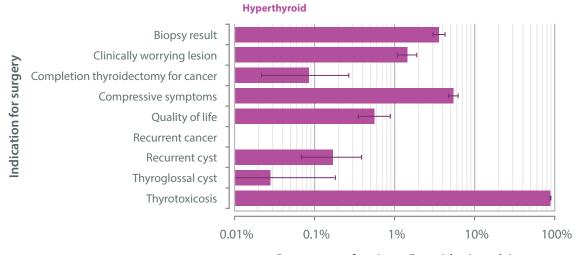
		Thyroid status					
	Euthyroid	Hyperthyroid	Hypothyroid	Unspecified			
Biopsy result	345	0	14	6			
Clinically worrying lesion	115	5	6	1			
Completion thyroidectomy for cancer	1,430	2	17	11			
Compressive symptoms	586	15	23	11			
Quality of life	61	1	4	0			
Quality of life Recurrent cancer Recurrent cyst	213	1	4	2			
Recurrent cyst	24	0	0	1			
Thyroglossal cyst	7	0	0	0			
Thyrotoxicosis	21	35	0	1			
Unspecified	44	2	2	5			
All	2,846	61	70	38			



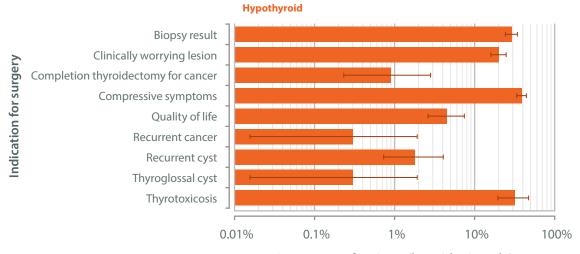
First-time thyroid surgery: Indication for surgery and thyroid status (n=25,365)



Percentage of patients (logarithmic scale)



Percentage of patients (logarithmic scale)



Percentage of patients (logarithmic scale)

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The *goitre type* data field was first introduced into the registry in September 2010, hence this information is now much more mature, and the proportion of missing data for category of goitre is lower, than in the 2012 report.

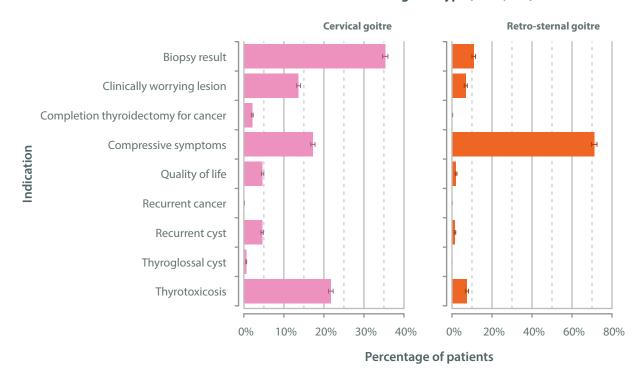
Similar conclusions can be drawn: the majority of operations for purely cervical goitres are done to exclude or treat thyroid cancer, whilst just over 70% of surgery for retrosternal goitres is to relieve compressive symptoms.

Retrosternal goitres comprise: 65% retroclavicular; 27% to the aortic arch; and only 8% below the aortic arch. For goitres extending to or beyond the aortic arch, the incidence of compressive symptoms as an indication for surgery rises to 88%. This is intuitive: anatomically, there is a more confined space in the upper mediastinum, hence a goitre of a given size is more prone to cause tracheal compression; plus these lesions are less accessible, often precluding a pre-operative biopsy.

First-time thyroid surgery: indication and goitre type

	_	Goitre				
		Cervical	Retro-sternal	Unspecified	All	
	Biopsy result	6,977	475	515	7,967	
	Clinically worrying lesion	2,702	301	181	3,184	
	Completion thyroidectomy for cancer	418	7	30	455	
	Compressive symptoms	3,406	3,116	284	6,806	
5	Quality of life	924	88	90	1,102	
	Recurrent cancer	19	1	3	23	
3	Recurrent cyst	901	65	51	1,017	
-	Thyroglossal cyst	113	0	48	161	
	Thyrotoxicosis	4,293	327	295	4,915	
	Unspecified	425	74	93	592	
	All	20,178	4,454	1,590	26,222	

First-time thyroid surgery: Indication for surgery in relation to goitre type (n=24,632)



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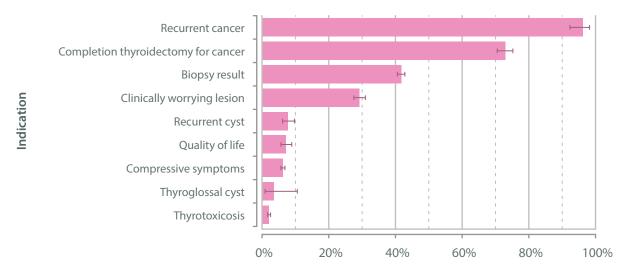
The relationship between indication for surgery and a primary diagnosis of cancer has been stable compared the last two national reports. In the last revision of the database, an additional field to record secondary pathology was added, which may in future help to differentiate between the primary pathology for which the operation was performed, *versus* co-incidental, secondary pathology, which may include incidental carcinomas. These data are not yet sufficiently mature for such an analysis.

Some patients undergoing completion thyroidectomy for cancer will inevitably have no pathology present in the completion specimen, and members have often been unsure as to how these should be entered, which may explain the apparent inconsistency that not all of these procedures have a primary cancer diagnosis. This can also influence the data on cancer staging, mentioned elsewhere in this report.

Thyroid surgery: indication for surgery and primary diagnosis of cancer

	Primary diagnosis of cancer				
	No	Yes	Unspecified	All	
Biopsy result	4,303	3,077	1,057	8,437	
Clinically worrying lesion	1,947	804	594	3,345	
Completion thyroidectomy for cancer	383	1,032	520	1,935	
Compressive symptoms	6,136	408	1,023	7,567	
Quality of life Recurrent cancer Recurrent cyst	964	74	146	1,184	
Recurrent cancer	8	201	38	247	
Recurrent cyst	857	72	133	1,062	
Thyroglossal cyst	83	3	89	175	
Thyrotoxicosis	4,334	92	643	5,069	
Unspecified	341	86	1,109	1,536	
All	19,356	5,849	5,352	30,557	

Thyroid surgery: Indication for surgery and primary diagnosis of cancer (n=24,778)



Percentage of patients with a primary diagnosis of cancer

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Investigations

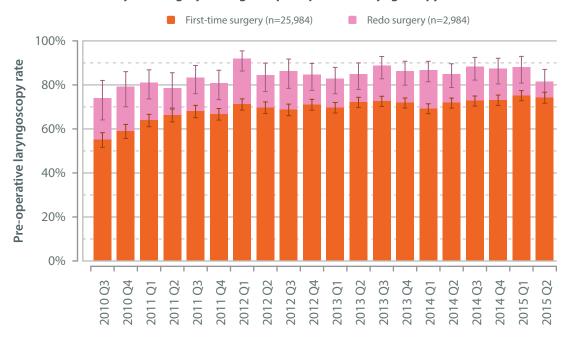
Pre-operative laryngoscopy

The chart below, and the funnel plots on pages 41 and 42, detail the use of laryngoscopy to assess vocal cord function prior to thyroid surgery.

It is clear from these data that:

- there is no consensus on the need to assess the vocal cords prior to thyroid surgery, neither first-time nor re-operative, although rates of pre-operative laryngoscopy have marginally increased over the last few years.
- pre-operative laryngoscopy is more frequently performed prior to re-do thyroid surgery compared to first-time surgery, though is still less than 100%.
- in re-do surgery, there is no difference in pre-operative laryngoscopy rates between cases with surgery on the same side of the neck as the previous operation, compared to those where surgery was on the opposite side of the neck. The principal argument in favour of routine pre-operative laryngoscopy in the latter group is to avoid the rare complication of bilateral vocal cord palsy (due to a pre-existing cord palsy on the previously operated side, which may be asymptomatic prior to the re-do operation). It seems clear that members do not universally consider this a substantial risk.

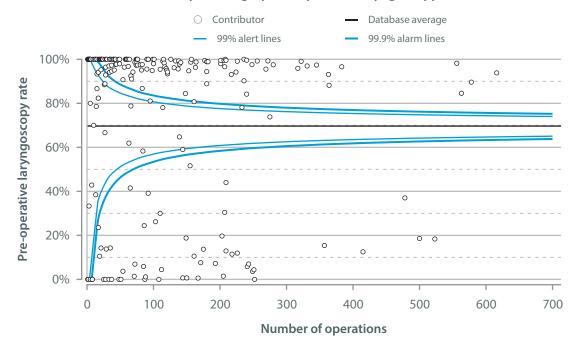
Thyroid surgery: Changes in pre-operative laryngoscopy rates over time



Date of operation / calendar year and quarter



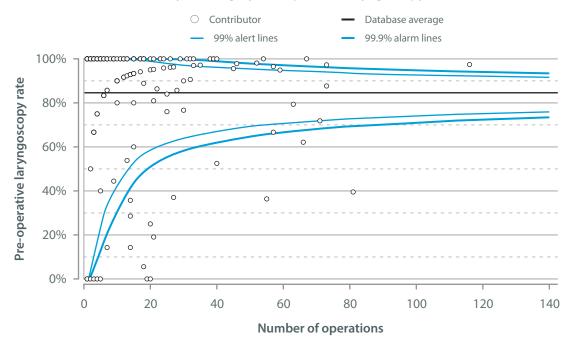
First-time thyroid surgery: Pre-operative laryngoscopy rate (n=25,984)



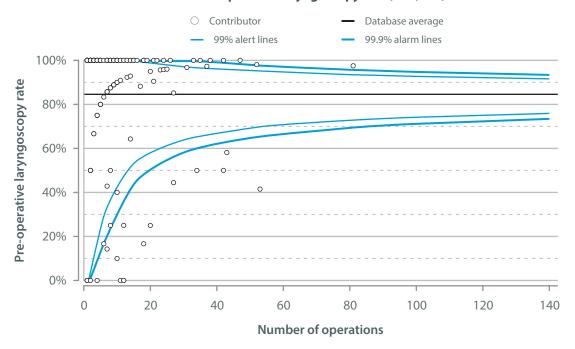


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Redo thyroid surgery: Pre-operative laryngoscopy rate (n=2,984)



Redo thyroid surgery; lobectomy on the opposite side to the previous operation: Pre-operative laryngoscopy rate (n=1,796)



Surgery for thyroid disease

The British Association of Endocrine and Thyroid Surgeons

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Fine needle aspiration cytology (FNAC)

The following tables aim to investigate the use of FNAC prior to thyroid surgery: to assess the extent of such usage, reasons why FNAC might have been omitted, and the utility of FNAC in providing a definitive pre-operative diagnosis of cancer.

Reassuringly, most cases with a primary diagnosis of neoplasia (cancer and follicular/Hürthle cell adenomas) were investigated by FNAC. Where FNAC was not used before first-time surgery, the main indications for surgery were thyrotoxicosis and compressive symptoms, implying that the cancer in these cases may have been a co-incidental finding within thyroids removed for another reason (technically a secondary pathology, but see comments above) or, in the case of toxic follicular adenomas, pre-operative diagnosis with other investigations, such as radio-isotope scintigraphy, was secure.

Cases with no FNAC used, but *biopsy result* as an indication for surgery probably represent diagnosis by an alternative form of biopsy, such as core biopsy from thyroid or cervical lymph nodes, or biopsy from remote sites of thyroid cancer metastases.

In re-operative surgery, the main indication for surgery is *completion thyroidectomy for cancer*. Here, the cancer diagnosis will likely have been established by a previous diagnostic thyroid resection, hence there would not have been a need for FNAC.

Taken together, the data imply that FNAC is being used appropriately.



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Thyroid surgery: primary pathology and the usage of FNAC

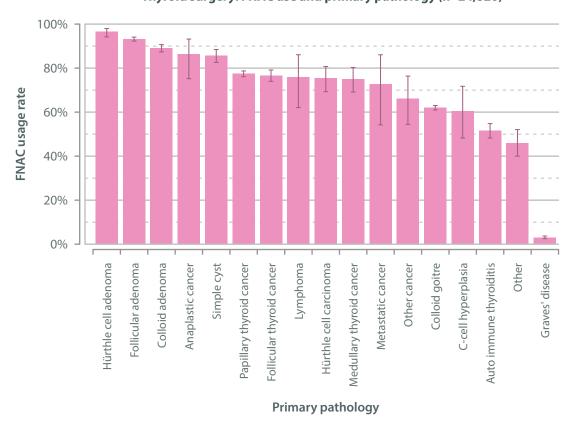
		FNA	C used	
	No	Yes	Unspecified	All
Anaplastic cancer	9	57	1	67
Auto immune thyroiditis	446	474	10	930
C-cell hyperplasia	28	43	0	71
Colloid adenoma	153	1,256	11	1,420
Colloid goitre	3,327	5,430	128	8,885
Follicular adenoma	209	2,883	23	3,115
Follicular thyroid cancer	253	831	20	1,104
Graves' disease	3,371	106	67	3,544
Hürthle cell adenoma	15	416	0	431
Hürthle cell carcinoma	57	175	5	237
Lymphoma	13	41	1	55
Metastatic cancer	9	24	0	33
Medullary thyroid cancer	61	184	6	251
Other cancer	26	51	4	81
Papillary thyroid cancer	906	3,109	61	4,076
Simple cyst	83	500	12	595
Other	148	126	36	310
Unspecified	1,768	2,473	1,111	5,352
All	10,882	18,179	1,496	30,557

Thyroid surgery where FNAC was not used: indication and operation sequence

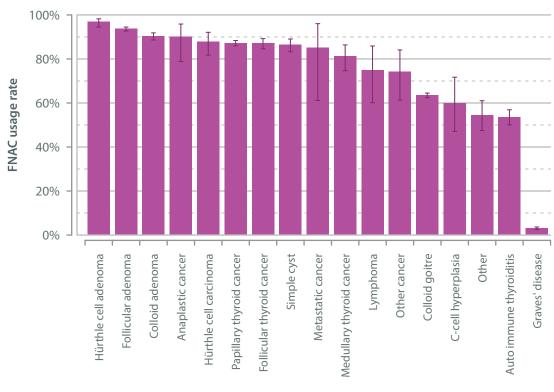
		Operation sequence				
		First-time	Redo	Unspecified	All	
Biop	osy result	116	68	0	184	
Clin	ically worrying lesion	380	42	2	424	
Con	npletion thyroidectomy for cancer	362	1,200	8	1,570	
Con	npressive symptoms	2,942	346	18	3,306	
Qua Rec	ality of life	320	26	4	350	
Rec	urrent cancer	10	74	3	87	
Rec	urrent cyst	51	6	1	58	
Thy	roglossal cyst	71	7	2	80	
Thy	rotoxicosis	4,529	50	64	4,643	
Uns	pecified	156	20	4	180	
All		8,937	1,839	106	10,882	

Surgery for thyroid disease

Thyroid surgery: FNAC use and primary pathology (n=24,820)



First-time thyroid surgery: FNAC use and primary pathology (n=22,181)



Primary pathology



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FNAC result and pathology

The distribution of FNAC results by primary pathology diagnosis has been stable in this and the last two reports.

FNAC performance in cancer diagnosis

In those cases undergoing surgery, where an FNAC was performed, a Thy3-5 result was obtained in:

84% of papillary cancers (81% in 2012 report) 80% of follicular cancers (76% in 2012 report) 90% of Hürthle cell cancers (86% in 2012 report) 93% of medullary cancers (94% in 2012 report)

Definitive Thy5 results were obtained in:

38% of PTC (34% in 2012 report)
 65% of MTC (55% in 2012 report)

Risk estimates for cancer for the FNAC categories

It is important to note that these rates do not equate to the true positive/negative predictive values of each FNAC category, as non-operated cases are not included in this audit.

However, excluding C-cell hyperplasia, the rates of cancer diagnosis (all types) amongst the 5 FNAC categories (where recorded) were:

•	Thy 5	97.9%	(1,414/1,444)
•	Thy4	74.4%	(623/837)
•	Thy3	25.7%	(1,637/6,373)
•	Thy3 (all neoplasia)	62.6%	(3,977/6,358)
•	Thy2	8.0%	(374/4,696)
•	Thy1	15.4%	(347/2,260)

These are very similar to those detailed in the last report.

Surgery for thyroid disease

The British Association of Endocrine and Thyroid Surgeons

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Thy1

The rate of Thy1 aspirates in operated cases has shown a marginal improvement (reduction) since the 2012 report, at 14.5% *versus* 16.4%.

Not surprisingly, the pathology with the highest Thy1 rate is *simple cysts*.

The Thy1 rate in all cancers was 8.0%.

The rate of malignancy after a Thy1 result is almost twice as high as that after a Thy2 result.

Thy2

Where an FNAC was done, 30% of cases had surgery despite a Thy2 aspirate. Presumably, other reasons for surgery existed. This is supported by the observation that in these cases the indication for surgery, where given, was compressive symptoms in 60%, and *clinically worrying lesion* (which might include ultrasound features) in a further 14%.

The Thy2 rate in follicular neoplasms varies between subtypes. In descending order: follicular adenomas 16.4%, follicular thyroid cancer 11.7%, Hurthle cell cancer 4% ($p \le 0.002$).

Thy3

Thy3 is the commonest FNAC category in operated cases (41% of those where FNAC is recorded).

As expected, follicular neoplasms form the majority of the pathology encountered, but a significant proportion are papillary cancers (14% of cases where pathology is documented). The audit design does not allow for analysis of subtypes of papillary cancer, though it might be expected that many of these cases will represent follicular variants of PTC.

The proportion of cases with Thy3 cytology is higher in cases with a diagnosis of auto-immune thyroiditis than those with colloid goitre (54% *versus* 27%; p<0.001). Of these cases, *biopsy result* was the main indication for surgery in just over 75%, implying that the higher incidence of Thy3 cytology in auto-immune thyroiditis may itself lead to more *unnecessary surgery* in this condition.

In the last revision of the database in November 2014, the option to sub-categorize Thy3 into Thy3a and Thy3f was added, but these data are not yet mature enough to include within this report.

Thy4

As expected, the commonest pathology leading to a Thy4 FNAC result is papillary thyroid cancer. However, wholly non-neoplastic causes still account for about 13% of cases, with auto-immune pathology being disproportionately represented, as for Thy3 cytology.

Thy5

A Thy5 FNAC will usually lead to a planned single-stage therapeutic operation for thyroid cancer, and, as detailed elsewhere in this report, that will frequently comprise total thyroidectomy ± central lymph node dissection.

It is reassuring that the positive predictive value of a Thy5 cytology is very high, but inevitably there were some cases with benign pathology only. For first-time operations, all of these cases were treated with total thyroidectomy (which might still be appropriate surgery for some benign pathology). In addition, two cases had unilateral central neck dissection in conjunction with total thyroidectomy: the relevant pathology was auto-immune thyroiditis in one and colloid goitre in the other.

Of malignant diagnoses, medullary and anaplastic thyroid cancer are the most likely to lead to a Thy5 FNAC.



Primary pathology

The British Association of Endocrine and Thyroid Surgeons

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Thyroid surgery patients investigated by FNAC: primary pathology and FNAC result

			F	NAC resu	lt		
	C1	C2	С3	C4	C5	Not recorded	All
Anaplastic cancer	5	3	6	8	35	0	57
Auto immune thyroiditis	60	132	255	22	2	3	474
C-cell hyperplasia	4	24	15	0	0	0	43
Colloid adenoma	242	422	559	25	1	7	1,256
Colloid goitre	899	2,990	1,443	57	5	36	5,430
Follicular adenoma	319	473	2,013	69	3	6	2,883
Follicular thyroid cancer	66	97	571	55	40	2	831
Graves' disease	15	46	41	1	0	3	106
Hürthle cell adenoma	29	39	323	22	2	1	416
Hürthle cell carcinoma	11	7	130	15	12	0	175
Lymphoma	6	8	4	10	13	0	41
Metastatic cancer	4	1	1	6	12	0	24
Medullary thyroid cancer	8	5	27	23	117	4	184
Other cancer	6	2	17	8	18	0	51
Papillary thyroid cancer	247	259	885	508	1,180	30	3,109
Simple cyst	310	160	24	3	0	3	500
Other	29	28	59	5	4	1	126
Unspecified	363	754	1,034	127	147	48	2,473
All	2,623	5,450	7,407	964	1,591	144	18,179

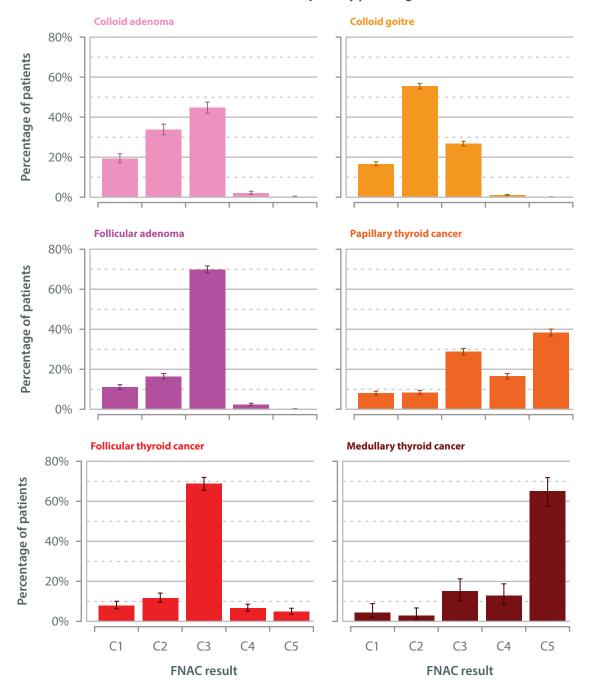
FNAC results are defined as:

- **1.** C1 = Thy1 non-diagnostic.
- **2.** C2 = Thy2 non-neoplastic.
- **3.** C3 = Thy3 follicular lesions / neoplasia cannot be excluded.
- **4.** C4 = Thy4 abnormal: suspicious of malignancy.
- **5.** C5 = Thy5 malignant.

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Thyroid surgery for patients investigated by FNAC: FNAC results for selected primary pathologies (n=12,599)





Primary pathology

Primary pathology for all patients

The distribution of primary pathology is similar to that in previous reports. Most thyroid surgery is performed for benign disease.

There has, however, been no improvement in the rate of missing data for this field, compared to the 2012 report.

Thyroid surgery: primary pathology

		D	ata
		Count	Proportion
	Anaplastic cancer	67	0.3%
	Auto immune thyroiditis	930	3.7%
	C-cell hyperplasia	71	0.3%
	Colloid adenoma	1,420	5.6%
	Colloid goitre	8,885	35.3%
	Follicular adenoma	3,115	12.4%
	Follicular thyroid cancer	1,104	4.4%
go	Graves' disease	3,544	14.1%
Primary patnology	Hürthle cell adenoma	431	1.7%
pa	Hürthle cell carcinoma	237	0.9%
ary	Lymphoma	55	0.2%
<u> </u>	Metastatic	33	0.1%
	Medullary thyroid cancer	251	1.0%
	Other cancer	81	0.3%
	Papillary thyroid cancer	4,076	16.2%
	Simple cyst	595	2.4%
	Other	310	1.2%
	Unspecified	5,352	
	All	30,557	_

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Cancer at first operation

Cancer and age

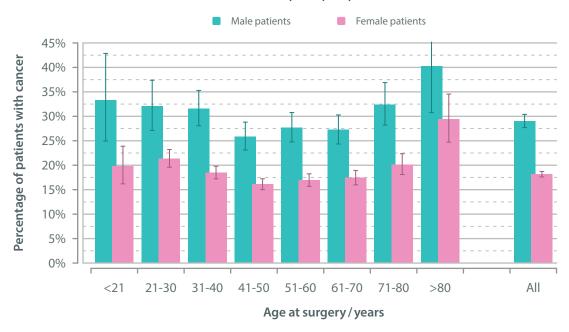
As expected, the malignant: benign ratio in males is higher than in females (due to the much higher incidence of benign pathology in females). The anticipated bi-modal distribution with respect to age is also more apparent in male patients.

Overall, the female: male ratio for benign disease (undergoing surgery) is 4.7 to 1; for malignant disease is 2.6 to 1.

First-time thyroid surgery: age at surgery, gender and primary pathology of cancer

		Gender and primary pathology of cancer								
			Ma	ile			Female			
		No cancer	Cancer	Unspecified	Cancer rate		No cancer	Cancer	Unspecified	Cancer rate
	<21	76	38	12	33.3%	3	49	86	84	19.8%
	21-30	227	107	55	32.0%	1,	585	430	320	21.3%
ars	31-40	453	209	119	31.6%	2,	877	652	586	18.5%
/ye	41-50	694	242	161	25.9%	3,	629	696	724	16.1%
Jery	51-60	638	244	160	27.7%	2,	793	569	582	16.9%
surgery/years	61-70	650	243	139	27.2%	2,	149	453	423	17.4%
at	71-80	315	151	78	32.4%	1,	126	284	213	20.1%
Age	>80	61	41	20	40.2%	2	45	102	52	29.4%
	Unspecified	8	2	2	20.0%		28	7	13	20.0%
	All	3,122	1,277	746	29.0%	14	,781	3,279	2,997	18.2%

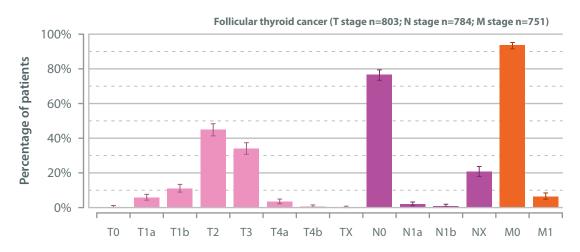
First-time thyroid surgery: Primary pathology of cancer, age and gender (n=22,459)

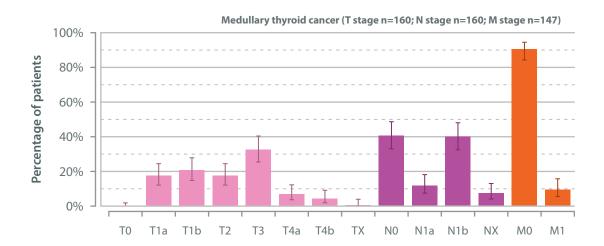


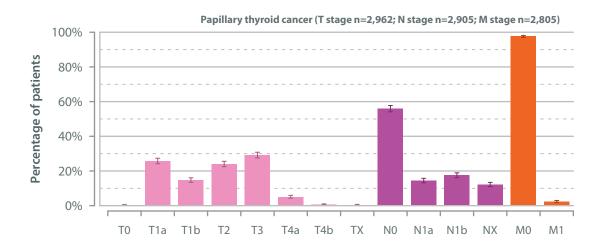
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TNM staging data are easier to interpret than in the last report, in that the vast majority of cases have been staged using TNM version 7 (replacing version 5, since November 2010).

First-time thyroid surgery for cancer: Cancer TNM staging







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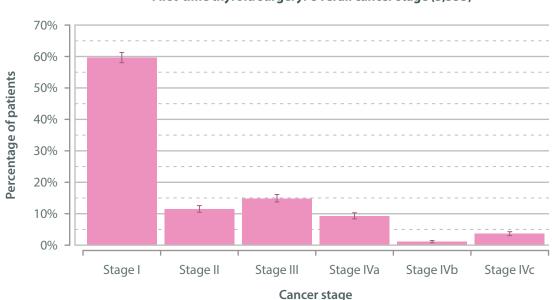
With respect to T-stage:

- follicular cancers are mainly T2 and T3.
- papillary cancers have a more obvious peak of T1a lesions (papillary micro-carcinomas). There does
 not, however, seem to be any significant change since the 2012 report in the relative proportion
 of T1a lesions amongst papillary cancers. This might imply that diagnosis of incidental microcarcinomas has not increased over this time period, although the recording of secondary pathology
 has not been possible, until the last revision of the database in 2014, as discussed previously.
- there is a slightly higher proportion of locally advanced disease in medullary cancer.

With respect to N-stage:

- most cancers are recorded as N0. However, the distinction between N0 and NX is unreliable, given
 that, of those categorized as N0, the actual rates of recorded nodal dissection were only: 23% for
 PTC; 13% for FTC; 59% for MTC. Where lymph nodes are not removed, nodal status should properly
 be recorded as NX.
- the proportion of cases with nodal involvement is higher in MTC than PTC, reflecting probably both cancer biology and the relative rates of prophylactic node dissection for these pathologies.
- for similar reasons, lateral neck nodal disease (N1b) is also commoner for MTC.

Metastases at the time of primary surgery are relatively uncommon, though more likely to be present in MTC than in follicular or papillary cancers.



First-time thyroid surgery: Overall cancer stage (3,553)

The majority of thyroid cancers have overall Stage I or II.

There seems to have been a marginal increase in the proportion of Stage III and IV disease operated upon since the last report. The reasons for this are not clear.



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Surgery for thyrotoxicosis

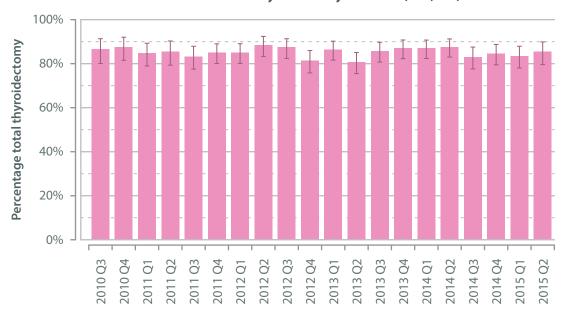
Thyroid status and operation

Thyrotoxicosis continues to be a common indication for thyroidectomy. The majority of cases are treated by total thyroidectomy, and the proportion of all cases treated this way has remained stable for several years.

Thyroid surgery for thyrotoxicosis: operation performed and operation sequence

	Operation sequence					
	First-tir	ne surgery	Re-operation			
	Count	Percentage	Count	Percentage		
Total thyroidectomy	3,894	86.0%	11	20.4%		
Lobectomy + sub-total lobectomy	104	2.3%	0	0.0%		
Lobectomy + sub-total lobectomy Lobectomy Bilateral sub-total lobectomy	330	7.3%	35	64.8%		
Bilateral sub-total lobectomy	173	3.8%	2	3.7%		
	13	0.3%	0	0.0%		
Other	12	0.3%	6	11.1%		
Near total lobectomy Other Unspecified	389		3			
All	4,915		57	_		

Thyroid surgery for thyrotoxicosis: Rates of total thyroidectomy over time (n=4,663)



Date of operation / calendar year and quarter

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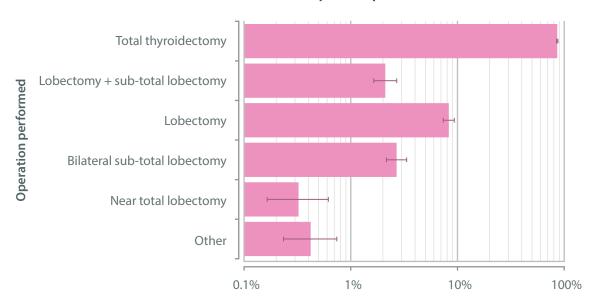


Hyperthyroidism and operation

Thyroid surgery for patients with hyperthyroidism whose indication for surgery was thyrotoxicosis: operation performed

		Data		
		Count	Proportion	
	Total thyroidectomy	2,660	86.2%	
ned	Lobectomy + sub-total lobectomy	65	2.1%	
Operation performed	Lobectomy	256	8.3%	
per	Bilateral sub-total lobectomy	83	2.7%	
lon	Near total lobectomy	10	0.3%	
erati	Other	13	0.4%	
Оре	Unspecified	142	_	
	All	3,229		

Thyroid surgery for patients with hyperthyroidism whose indication for surgery was thyrotoxicosis: Operation performed (n=3,087)



Percentage of operations (logarithmic scale)



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The principal causes of thyrotoxicosis leading to surgery are Graves' disease, toxic multi-nodular (colloid) goitre, and toxic adenomas.

The reasons for unilateral resection in a small number of patients with Graves' disease are not clear.

As expected, the majority of cases with toxic multi-nodular goitre and other auto-immune disease are treated with bilateral resections; whilst most unilateral resections are to treat toxic adenomas.

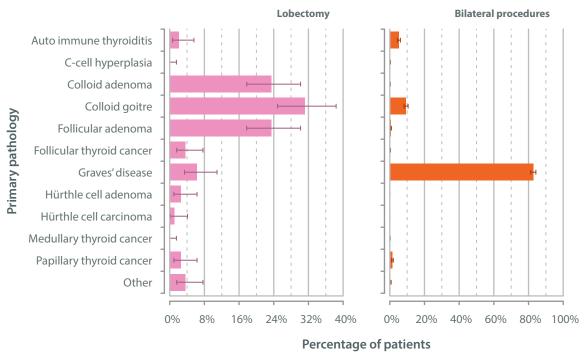
The incidence of papillary thyroid cancer, recorded as the primary pathology, amongst these cases where thyrotoxicosis was the indication for surgery, is 1.5%. These cancers are likely to represent incidental findings. This figure is likely to be an underestimate of the true frequency of incidental PTC, due to the problems of recording primary *versus* secondary pathology, detailed previously.

First-time thyroid surgery for thyrotoxicosis where the indication for surgery was hyperthyroidism: primary pathology and operation performed

		Operation performed				
		Lobectomy	Bilateral procedures	Other procedures	Unspecified	
	Auto immune thyroiditis	4	128	0	16	
	C-cell hyperplasia	0	3	0	0	
	Colloid adenoma	45	2	0	1	
	Colloid goitre	60	232	0	19	
ЭУ	Follicular adenoma	45	13	1	2	
Primary pathology	Follicular thyroid cancer	7	3	0	0	
ath	Graves' disease	12	2,060	3	69	
гур	Hürthle cell adenoma	5	0	0	0	
ima	Hürthle cell carcinoma	2	0	0	0	
Pr	Medullary thyroid cancer	0	1	0	0	
	Papillary thyroid cancer	5	36	0	4	
	Other	7	10	1	0	
	Unspecified	40	299	4	23	
	All	232	2,787	9	134	

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First-time thyroid surgery for patients with hyperthyroidism where the indication for surgery is thyrotoxicosis: Primary pathology and procedure performed



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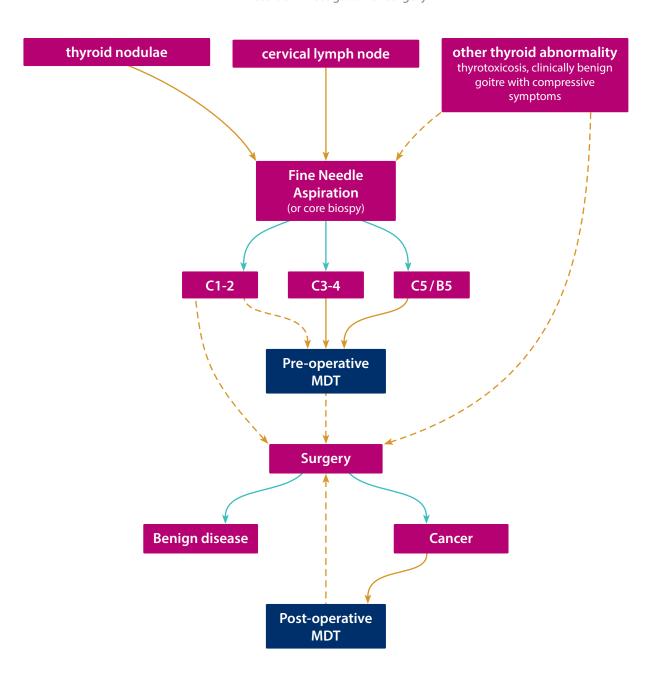
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Multi-disciplinary team (MDT)

There are a number of routes by which patients may be referred for discussion at the Thyroid Cancer MDT, detailed in the accompanying flow diagram.

Flow diagram illustrating potential routes of referral to Thyroid Cancer MDT pre- and post-operatively

Recommended or most frequent route
 Alternative or potential outcomes
 Result of investigation or surgery



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There has been a significant increase in the proportion of cancer cases that had a pre-operative MDT discussion, since the 2012 report: 63% versus 52% (p<0.001). Given the known limitations in pre-operative diagnosis of thyroid cancer, and the frequent occurrence of incidental cancer in thyroid resection specimens, this figure will never be 100%, though there may be scope for further improvement.

This increase is mostly due to a greater rate of discussion of biopsy results, particularly FNAC results Thy3-5:

Rate of	pre-o	perative	MDT	discu	ussion
---------	-------	----------	-----	-------	--------

	2016	2012
Thy 3	52.6%	39.6%
Thy 4	83.6%	65.2%
Thy 5	92.2%	81.7%
All biopsy result	73.3%	58.7%

p<0.001 for all comparisons

This may be due to better recording of MDT discussion and/or a true increase in the proportion of such cases discussed. The rate of unspecified data for this field has indeed reduced from 15.9% in 2012 to 9.9% in 2016, implying that both mechanisms are responsible. This is an encouraging trend.

Post-operative MDT discussion remains high when the primary pathology diagnosis is malignant: 98.6% of cases where MDT discussion is recorded.

Thyroid surgery for patients with cancer: pre-operative MDT and FNAC result; and selected indications for surgery

	_		Pre	e-operative MD	Т
		No	Yes	Unspecified	Rate (95% CI)
	No FNAC	551	604	166	52.3% (49.4-55.2%)
	FNAC result C1	218	93	36	29.9% (24.9-35.4%)
	FNAC result C2	260	77	37	22.8% (18.6-27.8%)
tor FNAC result	FNAC result C3	713	792	132	52.6% (50.1-55.2%)
C re	FNAC result C4	93	473	57	83.6% (80.2-86.5%)
FNA	FNAC result C5	101	1,187	126	92.2% (90.5-93.5%)
- Tac	FNAC result unspecified	5	24	7	82.8% (63.5-93.5%)
ţi k	FNAC unspecified	9	72	16	88.9% (79.5-94.5%)
Pre-operative factor	All	1,950	3,322	577	63.0% (61.7-64.3%)
- P	Biopsy result	756	2,076	245	73.3% (71.6-74.9%)
ے	Clinically worrying lesion	362	363	79	50.1% (46.4-53.8%)
atio	Completion thyroidectomy	334	572	126	63.1% (59.9-66.3%)
Indication	Compressive symptoms	283	79	46	21.8% (17.7-26.5%)
	Recurrent cancer	12	148	41	92.5% (87.0-95.9%)
	All	1,950	3,322	577	63.0% (61.7-64.3%)





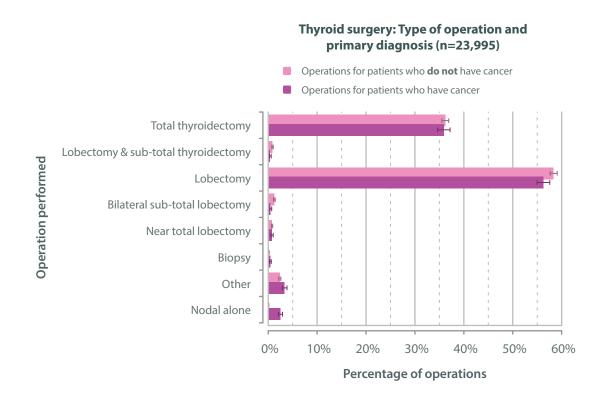
Operations for thyroid cancer

The vast majority of patients with a primary diagnosis of cancer undergo either total thyroidectomy or lobectomy. As detailed in the 2012 report, the audit design does not permit longitudinal follow-up of patients across more than one procedure (due to the lack of unique identifiers for individual patients). Hence, it is not possible to confirm how many patients ultimately had a completion thyroidectomy, and so how many were finally treated by total thyroid resection.

As previously detailed above, however, completion thyroidectomy for cancer remains the commonest indication for re-operative surgery, implying that the large majority of thyroid cancers are treated this way.

Thyroid surgery: operation performed and primary diagnosis

		Cancer				
	No	Yes	Unspecified	All		
Total thyroidectomy	6,652	2,018	1,168	9,838		
Lobectomy & sub-total thyroidectomy	159	22	23	204		
Lobectomy	10,725	3,163	2,605	16,493		
Lobectomy Bilateral sub-total lobectomy Near total lobectomy	229	27	34	290		
Near total lobectomy	142	42	43	227		
	21	23	8	52		
Biopsy Other Nodal alone	433	187	139	759		
Nodal alone	13	139	31	183		
Unspecified	982	228	1,301	2,511		
All	19,356	5,849	5,352	30,557		



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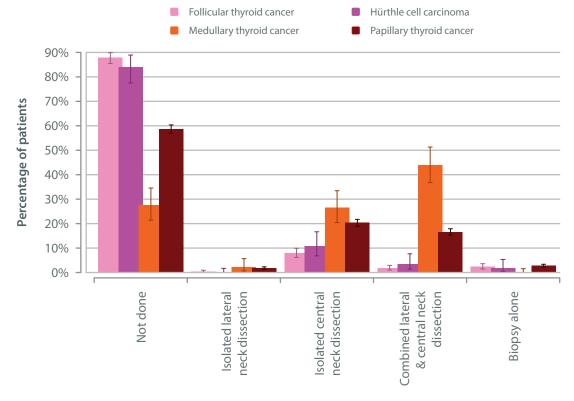
The patterns of nodal dissection for the main subtypes of primary thyroid cancer are shown here. It is clear that:

- for follicular cancer, nodal dissection is rarely performed, and is usually limited to the central compartment, if done. This is logical, given the propensity of this cancer subtype to spread *via* the haematogenous, rather than lymphatic, route. Of those FTC cases with isolated central neck dissection at the first procedure, 74% were recorded as N0, implying that node dissection in most cases was prophylactic in intent.
- there is a slightly higher rate of nodal dissection for Hürthle cell cancer, compared to follicular cancer. It is recognized that nodal disease is commoner in HCC than in usual-type FTC, although interesting to note that 70% of the isolated central neck dissections in HCC were also N0.

First-time surgery for cancer: node dissection and primary pathology

	Primary pathology									
	Follicular thyroid cancer	Hürthle cell carcinoma	Medullary thyroid cancer	Papillary thyroid cancer	All cancers					
Not done	760	147	52	1,867	2,908					
1-5 alone	2	0	4	57	69					
6-7 alone	68	19	50	646	809					
Both	15	6	83	527	657					
Biopsy	20	3	0	87	116					
All	865	175	189	3,184	4,559					

First-time surgery for cancer: nodal dissection and primary pathology



Node dissection

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- around 37% of patients with papillary thyroid cancer have nodal dissection at the first procedure, most frequently isolated central neck dissection (levels 6/7). Of cases undergoing isolated central neck dissection, almost 50% are prophylactic in intent, judging from nodal status recorded as NO.
- nodal dissection is most frequently performed at first-time surgery for medullary thyroid cancer, in keeping with the known biology of this disease, and with current guidelines.

Redo thyroid surgery where the indication for surgery was completion thyroidectomy for cancer: node dissection

		Count
_	Not done	527
dissection	Isolated lateral neck dissection	5
ssec	Isolated central neck dissection	211
	Combined lateral & central neck dissection	20
Node	Biopsy alone	20
2	All	783

Nodal dissection at redo surgery for cancer

The majority of these cases will be a lobectomy contralateral to a previous diagnostic lobectomy. In around two-thirds of these cases (all cancers), no nodal surgery is undertaken at the second procedure, a similar proportion to that for first-time surgery (all cancers).

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Operations for papillary thyroid cancer

As seen in the last national report, for patients with papillary thyroid cancer, the proportion undergoing total thyroidectomy increases with T-stage.

This is likely to be due largely to the confidence of pre-operative diagnosis, as the proportions undergoing total thyroidectomy are very similar to the rates of Thy5 FNAC diagnoses for each T-stage: 25% for T1; 29% for T2; 52% for T3; 73% for T4. In addition:

- lobectomy alone may be considered adequate treatment for some small tumours.
- other clinical/radiological features may increase the pre-operative suspicion of cancer
 with advancing T-stage, which may increase the use of e.g., intra-operative frozen section
 analysis to facilitate a one-stage total thyroidectomy.

As previously discussed, it is not possible to determine, for patients having a lobectomy, how many subsequently go on to a completion thyroidectomy.

This analysis examines those factors known pre-operatively that might influence the probability of a total thyroidectomy being performed at the first operation for cancer.

The results are similar to those observed in the 2012 report, with confidence intervals that are much narrower, due to the much larger number of cases under consideration.

For papillary thyroid cancer, it is clear that the probability of a first-time operation being a total thyroidectomy is dependent upon:

Cytology result

This is by far the strongest predictor, with over 90% of those with a Thy5 cytology having first-time total thyroidectomy.

Factors that may raise the clinical index of suspicion

Male gender and age <21 or >70 years.

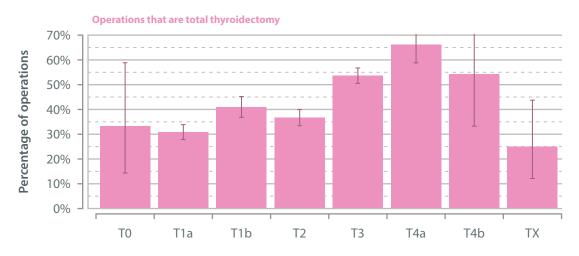
MDT discussion, where cytology is equivocal

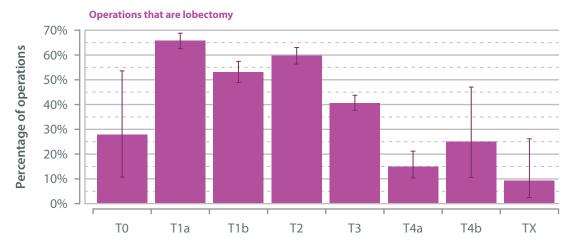
This may reflect the utility of the MDT discussion itself, or the co-existence of other features (*e.g.*, radiological suspicion), which themselves increase the chances of MDT discussion being undertaken.

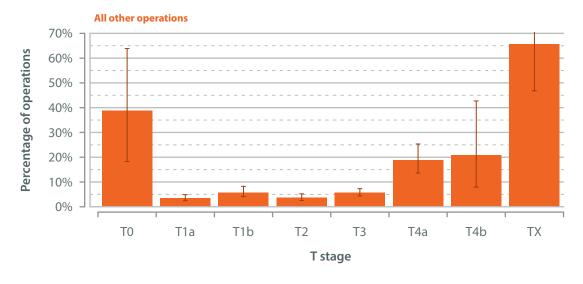
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Thyroid surgery for papillary thyroid cancer: Type of operation and cancer T stage (n=3,608)









Pre-operative factor

The British Association of Endocrine and Thyroid Surgeons

Fifth National Audit Report 2017

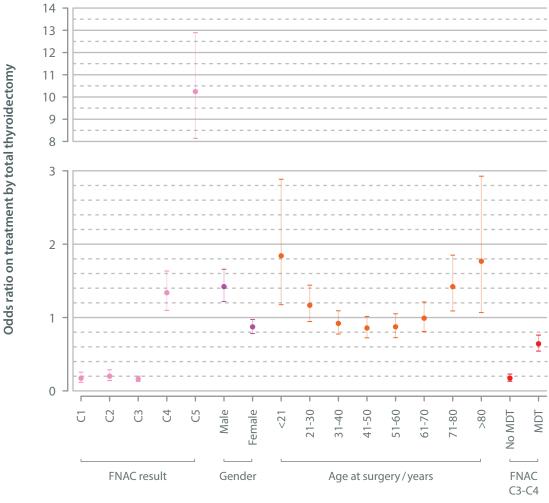
First-time thyroid surgery for papillary thyroid cancer: odds on total thyroidectomy

		No	Yes	Unspecified	Rate	Odds ratio versus
		1,511	1,532	141	50.3%	overall (95% CI)
ت ہ	C1	177	31	12	14.9%	0.17 (0.12-0.25)
FNAC results where FNAC was performed	C2	182	37	15	16.9%	0.20 (0.14-0.29)
s wł rfor	C3	631	103	35	14.0%	0.16 (0.13-0.20)
sult s pe	C4	193	262	23	57.6%	1.34 (1.10-1.63)
C re .wa	C5	88	914	21	91.2%	10.24 (8.14-12.89)
NA VAO	Unspecified	10	7	3		
т п	All	1,281	1,354	109		
	Male	347	500	31	59.0%	1.42 (1.22-1.66)
Gender	Female	1,164	1,030	110	46.9%	0.87 (0.78-0.97)
	Unspecified	0	2	0		
	All	1,511	1,532	141		
	<21	30	56	2	65.1%	1.84 (1.17-2.88)
	21-30	180	213	15	54.2%	1.17 (0.95-1.44)
ars	31-40	328	306	41	48.3%	0.92 (0.78-1.09)
/ye	41-50	351	305	32	46.5%	0.86 (0.72-1.01)
Jery	51-60	279	247	25	47.0%	0.87 (0.73-1.05)
Age at surgery / years	61-70	215	216	16	50.1%	0.99 (0.81-1.21)
at	71-80	100	144	6	59.0%	1.42 (1.09-1.85)
Age	81-90	24	43	3	64.2%	1.77 (1.07-2.93)
	Unspecified	4	2	1		
	All	1,511	1,532	141		
. Q	No MDT	352	62	21	15.0%	0.17 (0.13-0.23)
MDT for -C4 FN/ results	MDT	416	271	23	39.4%	0.64 (0.54-0.76)
MDT for 3-C4 FNAC results	Unspecified	56	32	14		
\Box	All	824	365	58		

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First-time thyroid surgery for papillary thyroid cancer: Odds ratios on total thyroidectomy for various pre-operative factors



Pre-operative factor

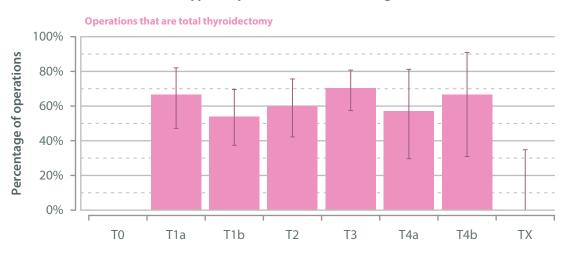


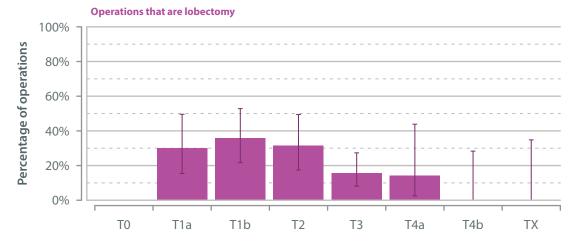


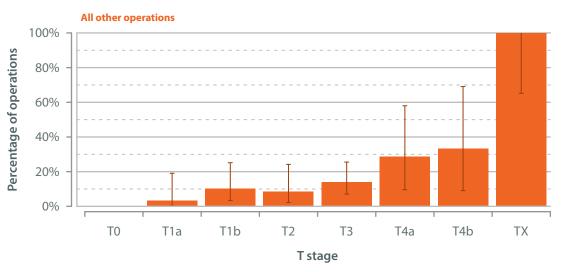
Operations for medullary thyroid cancer

The proportion of cases treated with total thyroidectomy is generally higher across all T-stages for medullary thyroid cancer than for PTC. This is expected, given the biology of the disease and recommendations from current guidelines. However, the principal effect is again likely to be due to the greater confidence of pre-operative diagnosis, both by FNAC (Thy5 diagnosis rate for MTC = 51% for T1; 57% for T2; 71% for T3; 83% for T4), and possibly pre-operative serum calcitonin in some cases.

Thyroid surgery for medullary thyroid cancer: Type of operation and cancer T stage (n=198)







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For medullary thyroid cancer, the effects, on the probability of total thyroidectomy at first-time surgery, of age and gender are less apparent than for PTC. Cytology result and MDT discussion, however, remain significant factors.

Taken together with observations elsewhere in this report, it can be seen that, for PTC and MTC:

- the rate of pre-operative FNAC malignant diagnosis is relatively low.
- when a malignant pre-operative diagnosis is made, most cases are treated with total thyroidectomy at the first operation.
- completion thyroidectomy for cancer remains a frequent indication for re-operative surgery, implying that most patients progress to a completion thyroidectomy after an initial diagnostic lobectomy shows cancer.

It may be logical to conclude, therefore, that there is a need to improve the results of pre-operative diagnosis, particularly that for FNAC.

First-time thyroid surgery for medullary thyroid cancer: odds on total thyroidectomy

		Total thyroidectomy						
		No	Yes	Unspecified	Rate	Odds ratio versus		
		52	133	4	71.9%	overall (95% CI)		
	C1	3	2	0	40.0%	0.26 (0.04-1.61)		
FNAC results where FNAC was performed	C2	1	3	0	75.0%	1.17 (0.12-11.53		
s wł rfor	C3	16	7	1	30.4%	0.17 (0.07-0.44)		
sult s pe	C4	6	13	0	68.4%	0.85 (0.31-2.35)		
. wa	C5	14	80	1	85.1%	2.23 (1.16-4.29)		
NAO NAO	Unspecified	1	3	0				
E E	All	41	108	2				
	Male	24	61	1	71.8%	0.99 (0.56-1.76)		
der	Female	28	72	3	72.0%	1.01 (0.58-1.73)		
Gender	Unspecified	52	133	4				
	All	104	266	8				
	<21	3	4	1	57.1%	0.52 (0.11-2.41)		
	21-30	6	11	1	64.7%	0.72 (0.25-2.04)		
ars	31-40	9	16	1	64.0%	0.70 (0.29-1.67)		
/ye	41-50	6	30	0	83.3%	1.95 (0.77-4.97)		
lery	51-60	8	29	0	78.4%	1.42 (0.61-3.30)		
Age at surgery / years	61-70	10	25	1	71.4%	0.98 (0.44-2.18)		
at	71-80	8	14	0	63.6%	0.68 (0.27-1.73)		
Age	81-90	2	3	0	60.0%	0.59 (0.10-3.61)		
	Unspecified	0	1	0				
	All	52	133	4				
its .	No MDT	6	1	0	14.3%	0.07 (0.01-0.55)		
ADT for C3-C4 AC resu	MDT	14	18	1	56.3%	0.50 (0.23-1.08)		
MDT for C3-C4 FNAC results	Unspecified	2	1	0				
I E	All	22	20	1				



First-time surgery

Type of operation and pathology

The proportion of patients treated with total thyroidectomy is greatest in Graves' disease, reflecting the trend away from subtotal resections for this condition, and a confident pre-operative diagnosis.

The lower rates of total thyroidectomy for papillary and medullary thyroid cancer at first-time surgery are explored elsewhere in this report.

For follicular and Hürthle cell cancers, it would be expected that total thyroidectomy at first-time surgery would be lower, given the limitations of FNAC in differentiating between benign and malignant follicular neoplasms. Many of these cases will have a diagnostic lobectomy as the first procedure, often after a Thy3 FNAC.

Adenomas are often adequately treated by a lobectomy, hence the observed low rate of total thyroidectomy would be anticipated.

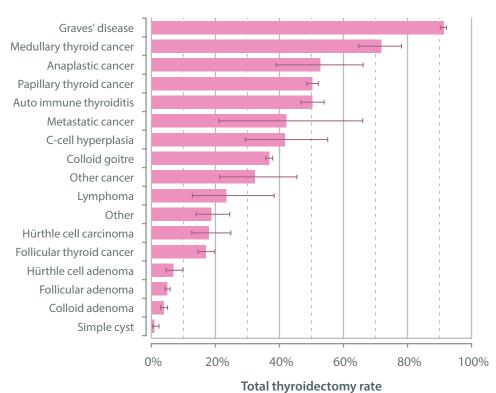
First-time thyroid surgery: primary pathology and operation

				0	peratio	n			
		_			peratio	<u>''</u>			
	Total thyroidectomy	Lobectomy & sub-total thyroidectomy	Lobectomy	Bilateral sub-total thyroidectomy	Near total lobectomy	Biopsy	Other	Unspecified	All
Anaplastic cancer	29	3	18	0	1	1	3	6	61
Auto immune thyroiditis	383	6	336	10	4	2	20	76	837
C-cell hyperplasia	25	0	30	1	0	0	4	5	65
Colloid adenoma	51	1	1,172	2	18	0	81	41	1,366
Colloid goitre	2,776	53	4,447	58	63	3	145	385	7,930
Follicular adenoma	143	3	2,637	1	17	2	68	111	2,982
Follicular thyroid cancer	142	4	658	0	11	4	15	31	865
Graves' disease	2,962	88	35	148	7	0	5	200	3,445
Hürthle cell adenoma	27	1	356	1	2	0	11	13	411
Hürthle cell carcinoma	30	2	133	0	0	0	2	8	175
Lymphoma	11	0	17	1	1	10	7	2	49
Metastatic	8	0	9	0	0	1	1	1	20
Medullary thyroid cancer	133	1	39	1	1	2	8	4	189
Other cancer	20	0	38	0	0	1	3	3	65
Papillary thyroid cancer	1,532	10	1,369	23	22	7	80	141	3,184
Simple cyst	5	0	443	1	8	2	61	58	578
Other	43	1	178	1	0	0	7	25	255
Unspecified	1,080	19	1,995	29	33	6	116	467	3,745
All	9,400	192	13,910	277	188	41	637	1,577	26,222

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First-time thyroid surgery: Type of operation and primary diagnosis (n=21,367)



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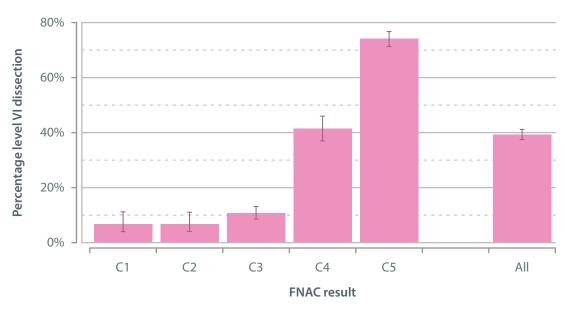
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Lymph node dissection for cancer

Similar conclusions may be drawn regarding the influence of FNAC diagnosis upon the probability of nodal surgery being done at the first operation for PTC, as for the effects on extent of thyroid resection above.

It should be recognized, however, that opinion varies on the need for prophylactic node dissection for PTC, and that recent guidelines suggest a more conservative approach than has often applied traditionally.

First-time thyroid surgery for papillary thyroid cancer: Level VI node dissection rates according to FNAC result (2,744)



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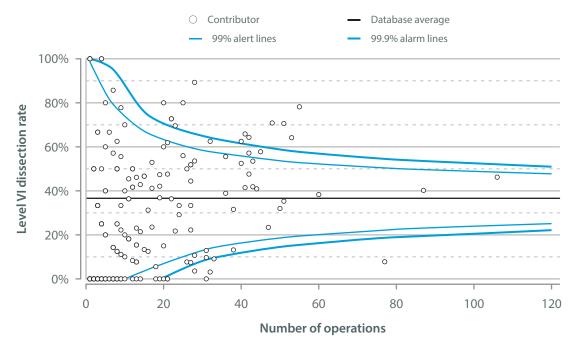


There remains considerable variation between members in rates of central neck dissection at first surgery for PTC. The distribution of node dissection rates is similar to the 2012 report. With the addition of more contributing members and considerably larger numbers of cases, the lack of consensus is, if anything, more obvious.

This may be due to:

- differences between members with respect to rates of pre-operative / FNAC diagnosis, as above
- variation in case mix between surgeons *e.g.*, with respect to T-stage; effects of tertiary referral practice.
- variation between surgeons in their thresholds for performing lymphadenectomy for PTC.

First-time thyroid surgery for papillary thyroid cancer: Level VI dissection rate (n=3,184)



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Re-operative surgery

The commonest indication for re-operative thyroid surgery is completion thyroidectomy for cancer, here representing 49% of cases where indication for surgery is recorded (53% in 2012 report). As expected, the majority of these are contralateral lobectomy alone.

The commonest reasons to re-operate on the same side as a previous procedure are compressive symptoms, recurrent cancer, and biopsy result (the latter likely also to represent some recurrent cancer cases, or new primary disease).

Redo thyroid surgery: indication for surgery and side of previous surgery

		Same sid	Same side as previous surgery			
		No	Yes	Unspecified	Ipsilateral rate	
	Biopsy result	170	153	42	47.4%	
	Clinically worrying lesion	69	44	14	38.9%	
	Completion thyroidectomy for cancer	1,265	97	98	7.1%	
	Compressive symptoms	334	244	57	42.2%	
ion	Quality of life	43	18	5	29.5%	
Indication	Recurrent cancer	21	165	34	88.7%	
Ind	Recurrent cyst	14	8	3	36.4%	
	Thyroglossal cyst	3	4		57.1%	
	Thyrotoxicosis	23	30	4	56.6%	
	Unspecified	32	9	12	22.0%	
	All	1,974	772	269	28.1%	

Redo thyroid surgery: Indication for surgery and side of previous surgery (n=2,746) Completion thyroidectomy for cancer Quality of life Recurrent cyst Clinically worrying lesion Indication Compressive symptoms Biopsy result Thyrotoxicosis Thyroglossal cyst Recurrent cancer ΑII 0% 20% 40% 60% 80% 100% **Ipsilateral surgery rate**

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Surgeon

The involvement of trainees as primary surgeon has altered very little over several years, and is very similar to that detailed in the last report. The great majority of thyroid surgery is performed with a Consultant as primary surgeon, in both first-time, and, to an even greater extent, in re-operative surgery.

Again, this implies that few trainees will have extensive experience in thyroidectomy as the primary surgeon. The database does not allow recognition of trainees' performing part of a procedure, however, and may therefore underestimate the extent of such experience.

Thyroid surgery: surgeon and operating sequence

	Operation sequence					
	First-time	Redo	Unspecified	All		
Consultant	21,907	2,639	441	24,987		
Fellow	502	67	7	576		
Staff grade	243	19	8	270		
Registrar (year 1-3)	987	53	11	1,051		
Registrar (year 1-3) Registrar (year 4+) RST	2,368	211	41	2,620		
BST	22	1	0	23		
Other	18	2	0	20		
Unspecified	175	23	812	1,010		
All	26,222	3,015	1,320	30,557		

Thyroid surgery: The proportion of operations performed by trainees; (total operations = 29,547; operations by trainees = 3,694)

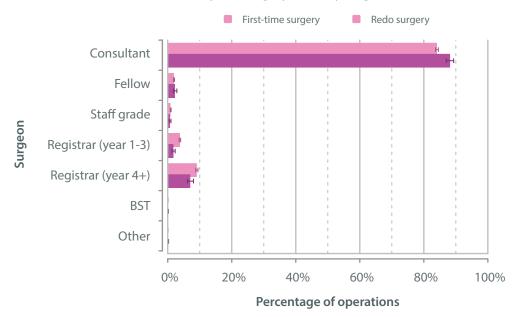


Date of operation / calendar year and quarter

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Thyroid surgery: Primary surgeon (n=29,039)





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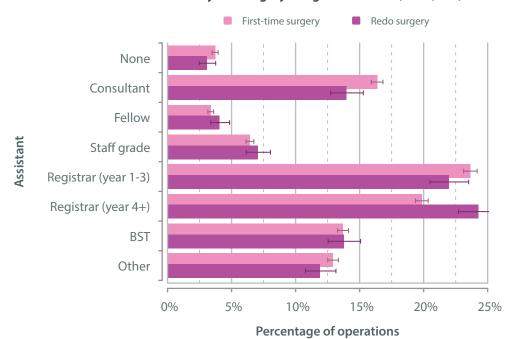
Assistant

Data on surgical assistant are also stable over time. In the majority of cases, the assistant is a Registrar.

Thyroid surgery: surgical assistant and operation sequence

	Operation sequence				
	First-time	Redo	Unspecified	All	
None	935	89	8	1,032	
Consultant	4,123	407	60	4,590	
Fellow	849	118	15	982	
, Staff grade	1,620	205	33	1,858	
Registrar (year 1-3) Registrar (year 4+)	5,959	640	73	6,672	
Registrar (year 4+)	5,003	707	68	5,778	
BST	3,453	401	82	3,936	
Other	3,256	347	72	3,675	
Unspecified	1,024	101	909	2,034	
All	26,222	3,015	1,320	30,557	

Thyroid surgery: Surgical assistant (n=28,112)



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Consultant involvement

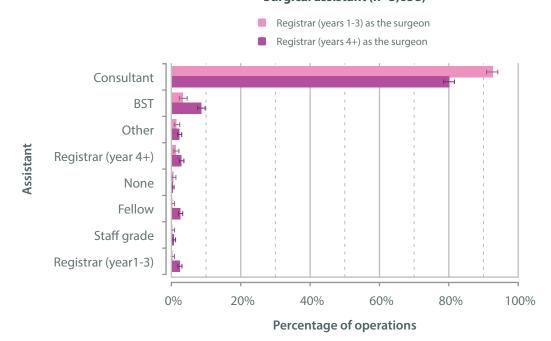
Dual operating by two consultants occurred in 3.3% of those cases where both the surgeon and assistant were recorded (2.9% in 2012 report, p=0.01). Since the 2012 report, the database has been re-configured, to recognize the involvement of more than one BAETS member as surgeon within an individual case, without risking entry of duplicate cases. The frequency of such dual operating reinforces the need for such an approach.

Where a surgical trainee is the primary surgeon, most are more senior trainees (year 4+), and a consultant is the assistant in the vast majority of cases. This is perhaps reassuring from the perspective of supervision of training in thyroidectomy.

Thyroid surgery: surgeon and assistant combinations

			Surgical assistant							
		None	Consultant	Fellow	Staff grade	Registrar (year 1-3)	Registrar (year 4+)	BST	Other	Unspecified
	Consultant	1,008	948	907	1,831	6,537	5,581	3,611	3,544	1,020
	Fellow	4	380	5	4	39	80	49	13	2
	Staff grade	0	171	0	0	21	22	14	41	1
on	Registrar (year 1-3)	6	972	3	3	3	13	34	15	2
Surgeon	Registrar (year 4+)	11	2,090	67	20	62	75	224	60	11
Su	BST	0	20	0	0	0	3	0	0	0
	Other	0	9	0	0	5	2	3	1	0
	Unspecified	3	0	0	0	5	2	1	1	998
	All	1,032	4,590	982	1,858	6,672	5,778	3,936	3,675	2,034

Thyroid surgery performed by a trainee: Surgical assistant (n=3,658)



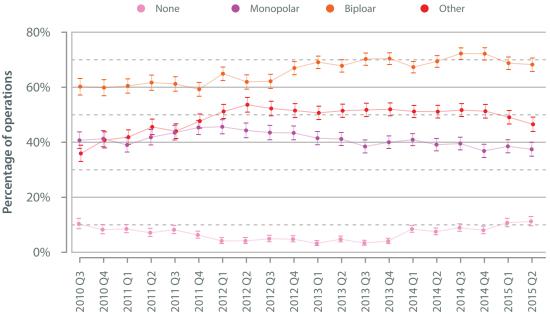


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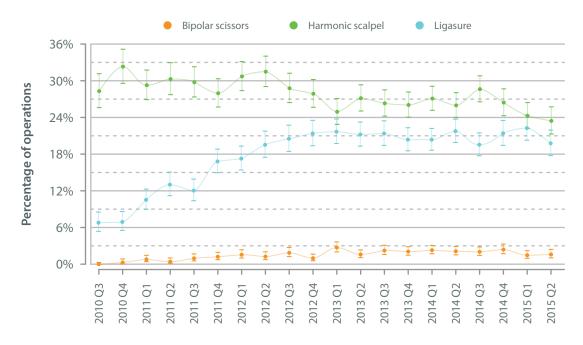
Energy source

The expansion in the use of advanced tissue sealing and cutting devices has plateaued out since the last report, with the Harmonic scalpel and Ligasure devices being most popular. Over the whole 5-year study period, 28% of cases were performed with the Harmonic scalpel and 18% with the Ligasure. Again, there is some evidence of selective usage for more extensive surgery: the rates for total thyroidectomy being 32% and 25% respectively for Harmonic scalpel and Ligasure, likely due to economic considerations.





Date of operation / calendar year and quarter



Date of operation / calendar year and quarter

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Nerve monitoring

Nerve monitoring refers to the use of a variety of devices that help to confirm the identification and preservation of the recurrent laryngeal nerve during thyroid surgery.

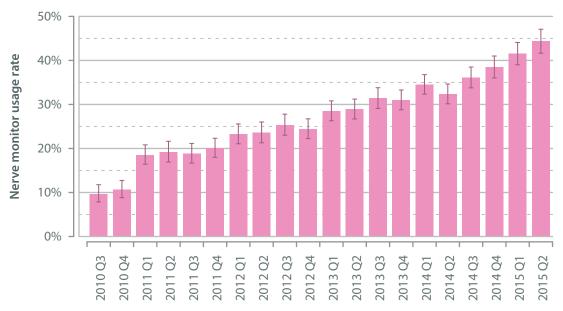
Although use of these devices has not been proven to reduce the incidence of vocal cord palsy, it is interesting to note that there has been a very remarkable increase in their usage since the 2012 report (from less than 10% to over 40% by the final 3 months of the study period).

There is a slightly higher rate of nerve monitoring in cancer *versus* non-cancer cases (33.2% *versus* 26.8%), and in re-operative *versus* first-time cases (with little difference between cases ipsilateral or contralateral to the previous surgery).

Thyroid surgery: nerve monitoring and operation sequence

		Operation sequence						
		Count		Rat	te			
	First-time	Redo	Unspecified	First-time	Redo			
None	18,028	1,981	184	72.2%	68.3%			
Medtronic NM	5,213	720	38	20.9%	24.8%			
Magstim Other monitor	978	100	2	3.9%	3.4%			
Other monitor	446	59	4	1.8%	2.0%			
Unspecified monitor	291	40	7	1.2%	1.4%			
Unspecified	1,266	115	1,085					
All	26,222	3,015	1,320					

Thyroid surgery: Nerve monitoring usage rates over time (n=28,091)



Date of operation / calendar year and quarter



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The predominant influence on the rate of use of nerve monitoring, however, is clearly the preference of the

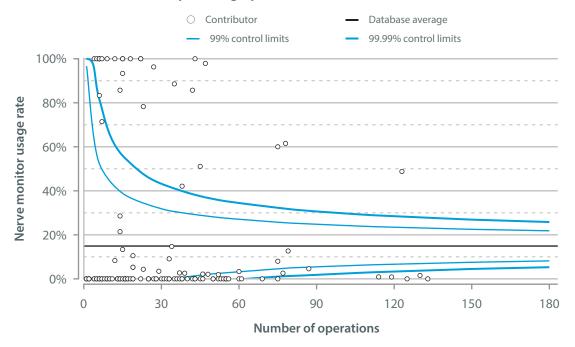
operating surgeon. A significant proportion of the membership never uses nerve monitoring, some surgeons do so selectively (i.e., in >0% but <90% of their cases), and others use it almost invariably (>90% of their cases).

For cases where information on nerve monitoring is present, the proportions of surgeons falling into each category

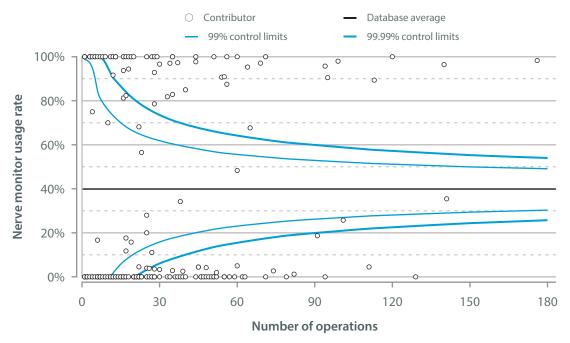
•	never users	41%	(63% in 2012 report)
•	selective users	39%	(29% in 2012 report)
•	routine users	20%	(8% in 2012 report)

It appears that the large increase in the number of patients having surgery with use of nerve monitoring since 2010 has been due to ubiquitous usage amongst many new BAETS members, and a shift to more frequent usage amongst existing users. The number of never-users remains stable, but they now comprise a minority of the membership.

Thyroid surgery: Nerve monitor use in 2011 (n=4,279)



Thyroid surgery: Nerve monitor use in 2015 (n=5,929)



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Thyroid surgery: use of intra-operative nerve monitoring over time

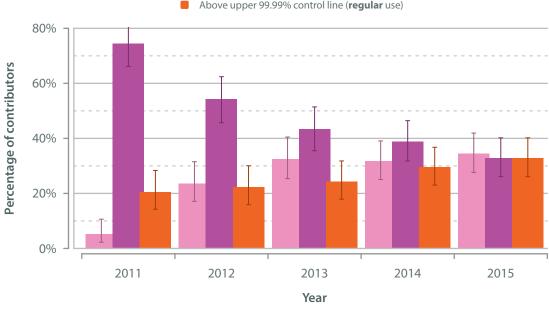
				Year		
		2011	2012	2013	2014	2015
	Below lower alarm	7	34	51	57	62
Contributor's	Between lower alert & alarm	31	29	18	31	21
position on	Within funnel	70	47	46	38	35
the funnel	Between upper alert & alarm	1	2	4	1	3
plot	Above upper alarm	28	32	38	53	59
	All	137	144	157	180	180
	Total count	4,279	5,248	5,912	6,722	5,929
Funnel plot	Baseline rate for usage	14.9%	21.5%	26.9%	32.4%	39.9%
data	Min count per contributor	1	1	1	1	1
	Max count per contributor	133	137	150	169	176

Thyroid surgery: Changes in the use of intra-operative nerve monitoring per contributor as assessed by regions of a funnel plot analysis



Between lower & upper 99.99% control lines (occasional use)

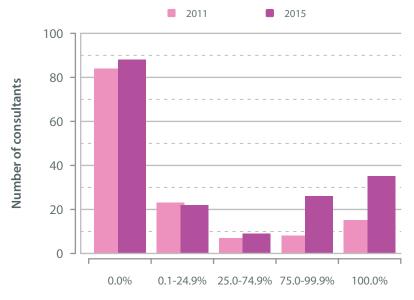
Above upper 99.99% control line (regular use)



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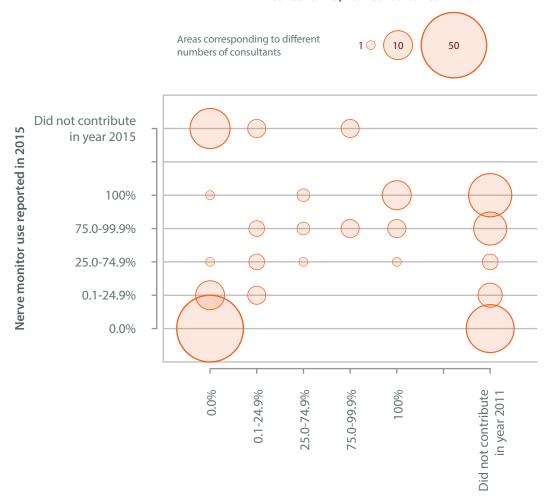






Nerve monitor usage rate per consultant

Thyroid surgery: Changes in the use of nerve monitoring by consultants; 197 consultants



Nerve monitor use reported in 2011



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General outcomes

Hypocalcaemia

This refers to the incidence of low serum calcium levels in the immediate post-operative period, usually during the index admission. This is an important outcome measure, because hypocalcaemia can cause troublesome symptoms, impairs quality-of-life, and has the potential to be life-threatening if inadequately treated. In addition, avoidance of hypocalcaemia may relate closely to the ability of a surgeon to preserve the function of the parathyroid glands during thyroidectomy, and hence be a surrogate marker of surgical performance.

This outcome principally applies to bilateral thyroid resections (as all 4 parathyroid glands are at risk), rather than isolated lobectomy, hence only total thyroidectomies are considered in this section.

The definition of hypocalcaemia has been stable over the large majority of the study period for this report (since September 2010, defined as corrected calcium $<2.10 \text{ mmol } l^{-1}$ or ionized calcium $<1.2 \text{ mmol } l^{-1}$ on the first post-operative day). Consistency in applying the definition is aided by the availability of a pop-up dialog box adjacent to the relevant data entry field, within the electronic *pro forma*.

Changes in the definition of hypocalcaemia at discharge from hospital may partly account for an observed reduction in the incidence of this outcome over time. For instance, for first-time total thyroidectomy the current rate of early hypocalcaemia is 23.6%, compared to 27.4% in the 2012 report, and 29.6% in the 2009 report. These figures probably represent an under-estimate of the true rate of early hypo-parathyroidism, as some patients receive prophylactic calcium supplements, to prevent hypocalcaemia, as detailed later in this section.

Hypocalcaemia after total thyroidectomy

Total thyroidectomy: post-operative hypocalcaemia

			Post-operative hypocalcaemia					
		No	Yes	Unspecified	Rate (95% CI)			
_ a	First time	6,660	2,056	684	23.6% (22.7-24.5%)			
atio enc	Redo	175	57	36	24.6% (19.3-30.7%)			
Operation sequence	Unspecified	107	22	41	17.1% (11.2-24.9%)			
Où	All	6,942	2,135	761	23.5% (22.7-24.4%)			

Hypocalcaemia is commoner when central neck dissection is added to total thyroidectomy, probably due to the greater potential for damage to the parathyroid glands or their blood supply. Over one-third of cases where central neck dissection was performed for PTC develop early hypocalcaemia.

Total thyroidectomy for papillary thyroid cancer: post-operative hypocalcaemia

			Post-operative hypocalcaemia					
		No	Yes	Unspecified	Rate (95% CI)			
	None	59	20	9	25.3% (16.5-36.6%)			
io N	Unilateral	204	110	10	35.0% (29.8-40.6%)			
Level VI dissection	Bilateral	467	249	33	34.8% (31.3-38.4%)			
Le diss	Unspecified	373	102	0	21.5% (17.9-25.5%)			
	All	1,103	481	52	30.4% (28.1-32.7%)			

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Hypocalcaemia after total thyroidectomy for multi-nodular goitre

Hypocalcaemia is also the commonest early post-operative complication after total thyroidectomy for multinodular goitre, with just over one-fifth of patients affected after first-time surgery.

Total thyroidectomy for multi-nodular goitre: post-operative hypocalcaemia

		Post-operative hypocalcaemia					
		No	Yes	Unspecified	Rate (95% CI)		
_ a	First time	2,199	593	40	21.2% (19.7-22.8%)		
Operation sequence	Redo	80	23	1	22.3% (15.0-31.8%)		
pera	Unspecified	33	5	0	13.2% (4.9-28.9%)		
OÑ	All	2,312	621	41	21.2% (19.7-22.7%)		

The funnel plot below demonstrates the variation between surgeons with respect to their rates of post-operative hypocalcaemia after total thyroidectomy for multi-nodular goitre.

First-time total thyroidectomy for multi-nodular goitre: Post-operative hypocalcaemia rates (n=2,792)





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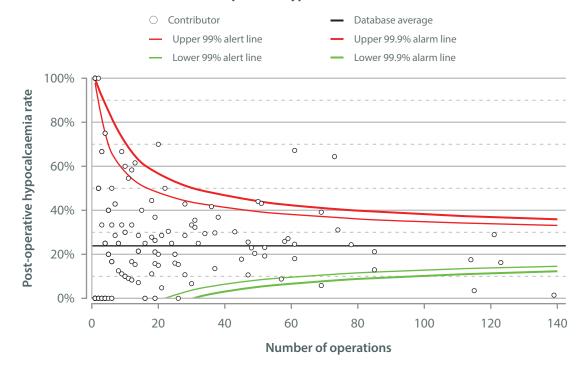
Early hypocalcaemia is commoner after total thyroidectomy for Graves' disease than for multinodular goitre (p=0.012). This may be due to increased difficulty in identifying or preserving parathyroid glands, secondary to the inflammatory process in the central compartment of the neck, associated with Graves' disease; or may reflect the metabolic effects of thyrotoxicosis on bone turnover (hungry bone syndrome).

Thyroid surgery for Graves' disease: post-operative hypocalcaemia

			Post-operative hypocalcaemia					
		No	Yes	Unspecified	Rate (95% CI)			
Ξø	First time	2,577	811	57	23.9% (22.5-25.4%)			
Operation sequence	Redo	26	4	0	13.3% (4.4-31.6%)			
pergedn	Unspecified	51	16	2	23.9% (14.7-36.1%)			
OÑ	All	2,654	831	59	23.8% (22.4-25.3%)			

The funnel plot below demonstrates the variation between surgeons with respect to their rates of post-operative hypocalcaemia after total thyroidectomy for Graves' disease.

Thyroid surgery for Graves' disease: Post-operative hypocalcaemia rates (n=3,485)



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Hypocalcaemia treatment

The true rate of early hypo-parathyroidism is difficult to assess, due to variation between surgeons with respect to the use of calcium / vitamin D supplements after thyroid surgery, as detailed here. There is also a high rate of missing data on hypocalcaemia treatment, which impairs interpretation.

After first-time total thyroidectomy, where data on hypocalcaemia and calcium supplementation are complete:

- 60% of patients neither develop hypocalcaemia nor receive calcium supplements.
- a further 2.2% of patients are reported as developing hypocalcaemia, but do not receive treatment for this, presumably reflecting some surgeons' preference to manage mild hypocalcaemia conservatively, with the expectation that many cases will resolve without treatment.
- of those cases developing hypocalcaemia, just over 90% receive treatment, presumably with calcium/vitamin D supplements. This treated group accounts for 22.3% of the total.
- finally, 15.6% of cases receive calcium / vitamin D supplements, despite not developing hypocalcaemia. This may reflect some surgeons' preference for *prophylactic* treatment, often to expedite earlier discharge from hospital, or to manage mild hypocalcaemia (*i.e.*, serum calcium below normal, but above the 2.1 mmol l⁻¹ definition) more intensively.

In total, therefore, almost 40% of patients receive calcium/vitamin D supplementation by the time of hospital discharge.

Surgeons vary greatly in their usage of *prophylactic* calcium supplementation, (*i.e.*, hypocalcaemia treatment being given, despite no hypocalcaemia being recorded). Most surgeons do this very selectively (0-10% of their non-hypocalcaemic patients being treated with calcium supplements; 70% of surgeons), whereas a few surgeons do so universally. Patients treated in this way may not develop low serum calcium levels despite impaired parathyroid function, hence it seems unwise to use early hypocalcaemia rates to compare performance between surgeons (although a persistent requirement for calcium / vitamin D after 6 months might be a more reasonable measure in this regard).

Thyroid surgery: treatment for hypocalcaemia and the occurrence of post-operative hypocalcaemia

		Trea	Treatment for hypocalcaemia post-operatively					
		No	Yes	Unspecified	Rate (95% CI)			
ive nia	No	20,603	1,777	2,150	7.9% (7.6-8.3%)			
Post-operativ Nypocalcaemi	Yes	271	2,504	26	90.2% (89.1-91.3%)			
Post-op 1ypocal	Unspecified	95	25	3,106	20.8% (14.2-29.4%)			
Pos hyp	All	20,969	4,306	5,282	17.0% (16.6-17.5%)			

First-time total thyroidectomy: treatment for hypocalcaemia and the occurrence of post-operative hypocalcaemia

		Trea	Treatment for hypocalcaemia post-operatively				
		No	Yes	Unspecified	Rate (95% CI)		
ive nia	No	4,981	1,300	379	20.7% (19.7-21.7%)		
erativ Icaemi	Yes	183	1,856	17	91.0% (89.7-92.2%)		
Post-opory	Unspecified	28	16	640	36.4% (22.8-52.3%)		
Pos hyp	All	5,192	3,172	1,036	37.9% (36.9-39.0%)		

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Post-operative stay

The trend towards shorter length of hospital stay after thyroid surgery has continued since the 2012 report, although the rate of change is now slowing. Again, the main shift is an increase in one-night stays at the expense of two-night stays. True day cases (zero night stays) have remained stable, comprise the minority of cases, and are more likely to be lobectomies than total thyroidectomies. This may reflect members' opinions that the potential for life-threatening airway compromise from post-operative bleeding is greater after bilateral than after unilateral resections.

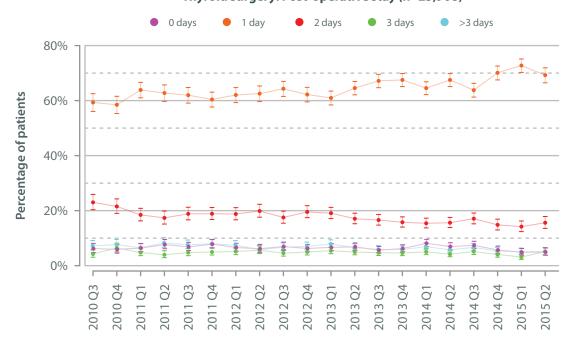
Length-of-stay beyond 2 days is also commoner after total thyroidectomy than less extensive resections. Some of this difference is likely to be due to monitoring and/or treatment of hypocalcaemia, as the proportion of patients staying >2 days after first-time total thyroidectomy is higher when hypocalcaemia is recorded than when the patient remains eucalcaemic (39% *versus* 15% respectively, p<0.001).

It is reassuring to note that, despite this trend towards shorter hospital stay during the index admission, there has not been any increase in the rate of re-admission recorded. Indeed, as detailed later in this report, there has if anything been a downward trend in re-admission.

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Thyroid surgery: Post-operative stay (n=25,908)



Date of operation / calendar year & quarter



Date of operation / calendar year & quarter

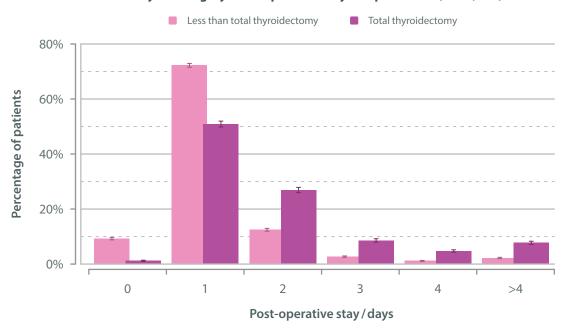


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Thyroid surgery: Post-operative stay and procedure

	Total thyroidectomy					
	No	Yes	Unspecified	All		
0 days	1,470	99	126	1,695		
1 day	11,482	4,364	871	16,717		
1 day 2 days 3 days 4 days >4 days	1,980	2,308	256	4,544		
3 days	428	737	73	1,238		
4 days	184	405	43	632		
>4 days	351	661	70	1,082		
Unspecified	2,313	1,264	1,072	4,649		
All	18,208	9,838	2,511	30,557		

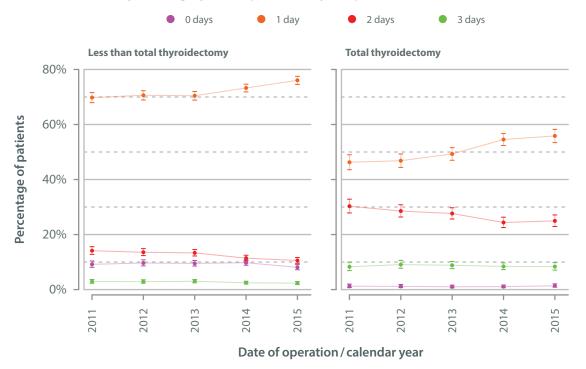
Thyroid surgery: Post-operative stay and procedure (n=24,469)



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Thyroid surgery: Post-operative stay and procedure over time (n=24,469)



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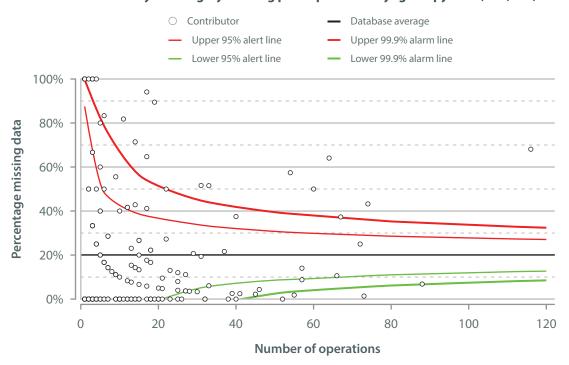
There has been only a marginal improvement in the completeness of data entry for post-operative laryngoscopy since the 2012 report. Almost one-fifth of cases have no information on whether or not the vocal cords were assessed post-operatively. There is considerable variation between surgeons in this regard, with rates of missing data ranging from 0-100%.

This adds to the difficulties in analysing post-operative vocal cord palsy rates, detailed later in this report.

First-time thyroid surgery: Missing post-operative laryngoscopy data (n=26,222)



Redo thyroid surgery: Missing post-operative laryngoscopy data (n=3,015)

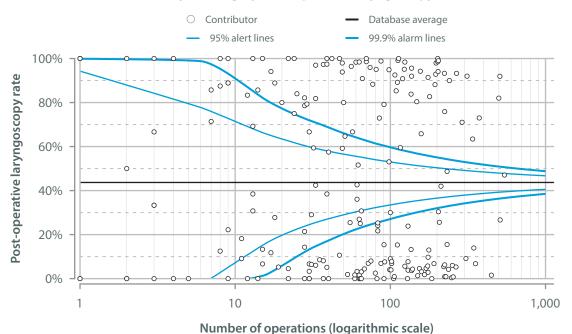


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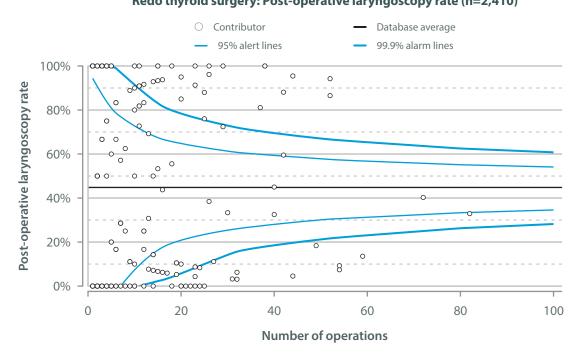


Where data are complete, the proportion of cases undergoing post-operative laryngoscopy have significantly increased since the 2012 report, effectively more than doubling over this time interval. Variation between surgeons remains high, however, with rates between 0-100%.

First-time thyroid surgery: Post-operative laryngoscopy rate (n=21,497)



Redo thyroid surgery: Post-operative laryngoscopy rate (n=2,410)





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The variation between members with respect to their policies for routine *versus* selective laryngoscopy, both pre- and post-operative, is clear. There has been a slight shift since the 2012 report towards more liberal use of laryngoscopy at both time intervals, but significant variation in practice persists.

Accurate estimation of the true incidence of recurrent laryngeal nerve injury therefore remains difficult.

First-time thyroid surgery: Pre- and post-operative laryngoscopy rates for each member (n=21,369 operations) Pre-operative rate <40% AND Post-operative rate <30% Pre-operative rate >40% AND Post-operative rate <30% Post-operative rate 30-80% Post-operative rate >80% 100% Number Post-operative laryngoscopy rate 80% of cases 60% 40% 100 20% 0% 0% 20% 40% 60% 80% 100%

Pre-operative laryngoscopy rate

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Outcomes for first-time operations

Overview of post-operative events

The large numbers of cases registered in the database now make for relatively narrow confidence intervals around the estimates for complication rates after thyroid surgery. This information can therefore be useful in terms of providing informed consent to patients, and guiding areas of future research and service improvement.

The primary outcomes recorded here have remained remarkably stable over the years.

Mortality

Mortality after thyroid surgery is reassuringly very low. It is important to note that this rate refers to deaths occurring at any time during the admission at which surgery was performed (as opposed to e.g., 30-day mortality, often used in other specialties as a reference point). Some deaths potentially related to the surgery may therefore be missed, although the re-design of the database in 2014 now allows for death after discharge from the index admission to be recorded.

As part of the UKRETS involvement in the national Consultant Outcomes Publication programme, the cause of death for all reported mortalities was examined individually (covering the period from June 2010 onwards). This revealed that:

- some patients were incorrectly identified as dying, when in fact the patient had survived to
 hospital discharge. In collaboration with the relevant BAETS members, these inaccuracies
 were corrected, and a fail-safe mechanism introduced within the database, to doublecheck the entry of rare events such as mortality, prospectively.
- most deaths were related to palliative procedures for advanced cancer, or resulted from medical events not directly related to any surgical complications.

Mortality would therefore seem not to be an appropriate outcome measure by which to compare surgeons with respect to their performance of thyroid surgery.

As expected, mortality after thyroid surgery is also related to patient age, with around 70% of patients who died in hospital after thyroidectomy being aged over 60 years of age.

Given that this outcome is universally known during the index admission, and lacks any problems of definition, it is disappointing that the rate of missing data for mortality is so high.

Re-operation for haemorrhage

Bleeding in the neck after thyroid surgery may require immediate re-operation to relieve or prevent compromise of the airway.

This complication is serious, but thankfully relatively infrequent. Rates have been steady at around 1% of all cases for many years, and are about twice as common after total thyroidectomy than after lobectomy. This is intuitive, as the extent of dissection in the central compartment of the neck is greater with total thyroidectomy than unilateral surgery, plus the degree of airway compromise caused by any bleeding may be greater if the whole central compartment has been dissected.

Again, the high rate of missing data is disappointing, for an outcome so well defined and generally known about within 24 hours of surgery.

Post-operative complications

General complications are infrequent, reflecting the lower risk of thyroid, compared to many other types of, surgery.

For all thyroid operations, the reported rates of these complications were:

•	MI	0.03%.
•	DVT/PE	0.04%.
•	Respiratory	0.6%.
•	CVA	0.02%.

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In addition to these listed complications, the database allows a free text box to detail *other complications*. Over the 5-year study period, for all first-time thyroid surgery, the commonest of these were:

i. Wound infection (n = 133)

This represents around 0.5% of all these cases. This is likely to be an under-estimate of the true incidence of wound infection after thyroidectomy, as not all infections may be deemed significant enough by the surgeon to merit recording, some infections will only become apparent after hospital discharge and would then require revision of the discharge outcome fields, assuming that the surgical team were always aware of the diagnosis of wound infection (if made, for instance by the patient's GP or hospitals other than the original unit at which surgery took place).

ii. Wound haematoma or seroma (n=133)

Presumably, many of these haematomas were not deemed large enough to require reoperation (or they would have been recorded in the *re-operation for haemorrhage* field).

iii. Other thyroidectomy-specific complications

•	Chyle leak	(n = 25).	
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Tracheal injury / fistula (n = 7).

Oesophageal injury/fistula (n = 3).

• Thyroid storm (n = 4).

Scalp hair loss from pressure of head ring (n = 3).

Related re-admission

Re-admission rates have, if anything, reduced slightly over recent years. This may relate to improvements in surgical care, or to an issue identified during the Consultant Outcomes Publication process, where some members were entering planned re-admission (*e.g.*, for completion thyroidectomy) in this field. Resolution of this latter issue in recent years would be expected to lead to a reduction in the recorded re-admission rate.

Re-admission after total thyroidectomy is higher than after lobectomy. Some of this difference may relate to the potential for delayed presentations of hypocalcaemia, but the database design does not allow this hypothesis to be examined.

Voice changes

Voice change after thyroidectomy is not uncommon, and not always related to recurrent laryngeal nerve palsy.

The *true* rate of voice change is likely to be under-estimated here, as this outcome is not well defined within the database, and surgeons will vary in their subjective assessment of patients' voices post-operatively.

Recurrent laryngeal nerve palsy

There are numerous problems in interpretation of the reported rates of RLN palsy:

- Rates of RLN palsy depend greatly upon the proportion of patients undergoing routine vocal cord assessment post-operatively, which in turn varies to a large degree between surgeons, as seen in previous sections.
- The rate of missing data for post-operative cord checks and for the *details of abnormal vocal cord check* is high.
- The timing of any post-operative laryngoscopy is not standardized, and may substantially affect the observed rate of any new RLN palsy.
- The time interval by which RLN palsy might be deemed *persistent* was not defined, prior to the last revision of the database in October 2014. Since then, outcome of any RLN palsy at 6 months post-operation has been the definition for persistence.



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- The data outlined below refer to the outcome at 6 months, from the limited data accumulated since this database revision. Transient vocal cord palsy will certainly be much higher than this, but its exact incidence is difficult to determine, due to the above constraints. Looking only at completion of the *vocal cord check* field (first-time, post-operative), the number recorded as *abnormal* (likely implying vocal cord palsy) represented 3.4% of all cases where this field was completed (including those recorded as *not done*), or 7.8% of cases where post-operative cord checks were recorded as being done. The first figure is likely to under-estimate early RLN palsy, as this cannot be diagnosed without a post-operative laryngoscopy, but may be asymptomatic; the second figure may well be a better estimate of the incidence of early cord palsy, where this is systematically looked for. It is accepted that many early cord palsies are transient, and persistence at 6 months is likely to be a better measure of surgical performance.
- Only since the last revision of the database has it been possible to record the outcome for each recurrent laryngeal nerve separately. Previously, it was not possible to determine the rate of bilateral RLN palsy, for instance.
- Ideally, the rate of RLN palsy should be adjusted for the number of nerves at risk during the procedure (one for lobectomy, two during total thyroidectomy). The degree of missing data on extent of surgery, detailed in previous sections, makes calculation of this rate difficult.

The reported rate of persistent RLN palsy of just over 1% of nerves at risk is therefore likely to represent a considerable underestimate of the true rate of early nerve injury, whilst estimation of the longer-term outcome with respect to RLN palsy will need to await accrual of sufficient data from the time of the last database revision.

Immediate post-o	perative o	outcomes	Outcomes at follo	w up	
	2011	0.03% (0.00-0.17%)		2011	2.0% (1.6-2.6%)
	2012	0.07% (0.02-0.21%)	Related re- admission	2012	2.1% (1.7-2.6%)
Mortality	2013	0.13% (0.06-0.29%)		2013	1.8% (1.5-2.3%)
	2014	0.07% (0.02-0.19%)	darriission	2014	1.5% (1.2-1.9%)
	2015	0.08% (0.03-0.22%)		2015	1.2% (0.9-1.6%)
	2011	1.1% (0.8-1.5%)		2011	5.9% (5.1-6.7%)
	2012	0.9% (0.7-1.3%)		2012	7.1% (6.3-8.0%)
Re-operation for haemorrhage	2013	1.3% (1.0-1.6%)	Voice change	2013	7.4% (6.7-8.1%)
Hacmonnage	2014	0.9% (0.6-1.1%)		2014	6.4% (5.7-7.1%)
	2015	1.5% (1.1-1.8%)		2015	6.8% (6.1-7.6%)
	2011	2.8% (2.3-3.4%)		2011	4.2% (3.5-4.9%)
Any post-	2012	4.2% (3.7-4.9%)	Calcium supplements	2012	4.9% (4.3-5.6%)
operative	2013	4.1% (3.6-4.7%)		2013	4.3% (3.7-4.9%)
complication	2014	3.8% (3.3-4.4%)	заррістість	2014	2.7% (2.2-3.1%)
	2015	2.7% (2.3-3.2%)		2015	2.2% (1.8-2.7%)
	2011	2.8% (2.3-3.4%)		2011	48.7% (47.0-50.3%)
	2012	4.2% (3.7-4.9%)		2012	48.9% (47.4-50.5%)
Hypocalcaemia	2013	4.1% (3.6-4.7%)	T3/T4	2013	48.9% (47.5-50.3%)
	2014	3.8% (3.3-4.4%)		2014	46.9% (45.5-48.2%)
	2015	2.7% (2.3-3.2%)		2015	44.5% (43.0-46.1%)

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First-time thyroid surgery: post-operative events for all cases; July 2010-June 2015

		Event incidence				
	-	No	Yes	Unspecified	Rate (95% CI)	
	Mortality	24,138	19	2,065	0.1% (0.0-0.1%)	
Post-op	Re-operation for haemorrhage	24,054	272	1,896	1.1% (1.0-1.3%)	
Post	Post-operative complications	22,972	852	2,398	3.6% (3.3-3.8%)	
	Hypocalcaemia	21,745	2,463	2,014	10.2% (9.8-10.6%)	
	Persistent RLN palsy at 6/12	2,387	25	3,544	1.0% (0.7-1.6%)	
dn v	Related re-admission	21,485	379	4,358	1.7% (1.6-1.9%)	
Follow	Voice change	20,543	1,482	4,197	6.7% (6.4-7.1%)	
№	Calcium supplements at 6/12	20,497	761	4,964	3.6% (3.3-3.8%)	
	T3/T4	11,493	10,417	4,312	47.5% (46.9-48.2%)	

First-time thyroid surgery: post-operative events after total thyroidectomy; July 2010-June 2015

		Event incidence				
		No	Yes	Unspecified	Rate (95% CI)	
	Mortality	8,687	8	705	0.1% (0.0-0.2%)	
Post-op	Re-operation for haemorrhage	8,624	143	633	1.6% (1.4-1.9%)	
Post	Post-operative complications	8,155	437	808	5.1% (4.6-5.6%)	
dn v	Hypocalcaemia	6,660	2,056	684	23.6% (22.7-24.5%)	
	Persistent RLN palsy at 6/12	851	10	1,271	1.2% (0.6-2.2%)	
d	Related re-admission	7,660	199	1,541	2.5% (2.2-2.9%)	
Follow	Voice change	7,224	708	1,468	8.9% (8.3-9.6%)	
- E	Calcium supplements at 6/12	7,166	565	1,669	7.3% (6.7-7.9%)	
	T3/T4	227	7,731	1,442	97.1% (96.8-97.5%)	

First-time thyroid surgery: post-operative events after lobectomy; July 2010-June 2015

	_	Event incidence				
		No	Yes	Unspecified	Rate (95% CI)	
	Mortality	12,837	7	1,066	0.1% (0.0-0.1%)	
do-i	Re-operation for haemorrhage	12,807	101	1,002	0.8% (0.6-1.0%)	
Post-op	Post-operative complications	12,368	326	1,216	2.6% (2.3-2.9%)	
uming or even.	Hypocalcaemia	12,723	149	1,038	1.2% (1.0-1.4%)	
2	Persistent RLN palsy at 6/12	1,429	13	1,884	0.9% (0.5-1.6%)	
유	Related re-admission	11,625	127	2,158	1.1% (0.9-1.3%)	
Follow	Voice change	11,207	630	2,073	5.3% (4.9-5.7%)	
모	Calcium supplements at 6/12	11,350	107	2,453	0.9% (0.8-1.1%)	
	T3/T4	10,122	1,655	2,133	14.1% (13.4-14.7%	



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Hypocalcaemia

Hypocalcaemia and type of operation

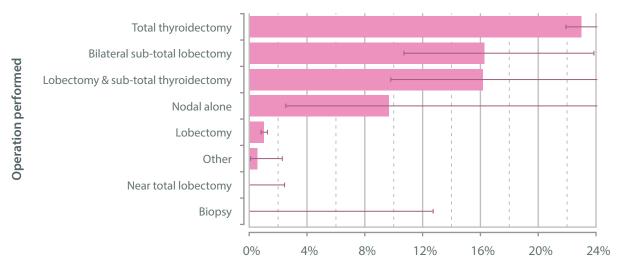
There is a trend towards more frequent early hypocalcaemia after total thyroidectomy compared to less-than-total bilateral thyroid resection, which might reflect better preservation of parathyroid function in the latter cases. Whether or not this is due solely to the extent of thyroid resection is difficult to determine, as total thyroidectomy is more likely to be associated with cancer diagnosis and with simultaneous central lymph node dissection.

Unilateral lobectomy has a very low incidence of hypocalcaemia, as expected.

First-time thyroid surgery: post-operative hypocalcaemia and operation; operations performed in the period July 2012 - June 2015

		Post-operative hypocalcaemia				
	No	Yes	Unspecified	Rate (95% CI)		
Total thyroidectomy	4,414	1,318	488	23.0% (21.9-24.1%)		
Lobectomy & sub-total thyroidectomy	y 83	16	6	16.2% (9.8-25.2%)		
Lobectomy	8,540	88	739	1.0% (0.8-1.3%)		
Bilateral sub-total lobectomy	113	22	7	16.3% (10.7-23.9%)		
Lobectomy Bilateral sub-total lobectomy Near total lobectomy	121	0	11	0.0% (0.0-2.4%)		
	22	0	4	0.0% (0.0-12.7%)		
Other	346	2	41	0.6% (0.1-2.3%)		
Biopsy Other Nodal alone	28	3	3	9.7% (2.5-26.9%)		
Unspecified	717	93	131	11.5% (9.4-13.9%)		
All	14,384	1,542	1,430	9.7% (9.2-10.2%)		

First-time thyroid surgery: Post-operative hypocalcaemia and operation; July 2012 - June 2015 (n=15,116)



Post-operative hypocalcaemia rate

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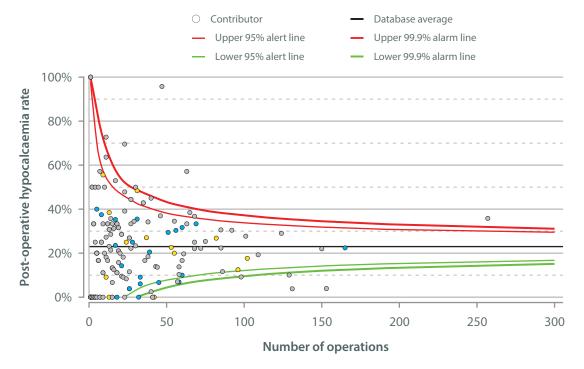


Hypocalcaemia and workload

There remains variation between surgeons with respect to their rates of early hypocalcaemia. This might be influenced not only by surgical *performance* but also by:

- surgeons' varying policies on usage of calcium supplementation post-operatively (prophylactic *versus* selective), as detailed in previous sections.
- data quality issues. Here, hypocalcaemia rates have been stratified by the corresponding
 rates of each surgeon's missing data for this outcome. There does not seem to be any
 systematic effect of this stratification on reported hypocalcaemia rates, although it is
 interesting that all surgeons with results outside the upper alarm line also have the most
 complete data.

First-time total thyroidectomy: Post-operative hypocalcaemia; July 2012 - June 2015 (n=5,732)



- **1.** Grey <5% missing hypocalcaemia data for this group
- **2.** Blue 5-20% missing hypocalcaemia data for this group
- **3.** Yellow >20% missing hypocalcaemia data for this group



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Late hypocalcaemia

Late hypocalcaemia and type of operation

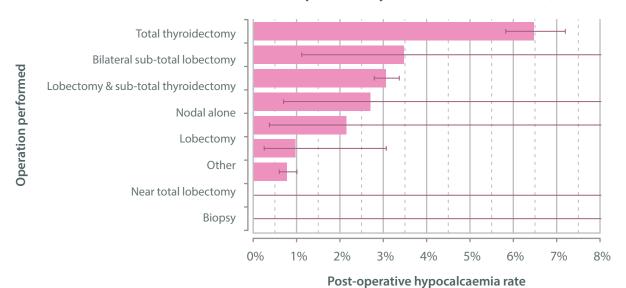
Late hypocalcaemia refers to an ongoing requirement for calcium \pm vitamin D supplements at 6 months post-operatively, to prevent hypocalcaemia (a definition that has applied since the database revision of September 2010). It is intended to act as a surrogate marker of hypoparathyroidism, and is likely to be a better marker of surgical performance (in preserving parathyroid function) than early hypocalcaemia, as *prophylactic* supplementation should have been discontinued before this interval.

It does not equate to *permanent hypoparathyroidism*, as a significant proportion of patients requiring calcium supplements at 6 months post-operatively might subsequently be weaned off this treatment.

First-time thyroid surgery: late hypocalcaemia and operation; operations performed in the period July 2012 - June 2015

	Late hypocalcaemia				
	No	Yes	Unspecified	Rate (95% CI)	
Total thyroidectomy	4,763	330	1,127	6.5% (5.8-7.2%)	
Lobectomy & sub-total thyroidectomy	91	2	12	2.2% (0.4-8.3%)	
Lobectomy	7,642	60	1,665	0.8% (0.6-1.0%)	
Bilateral sub-total lobectomy	111	4	27	3.5% (1.1-9.2%)	
Near total lobectomy	108	3	21	2.7% (0.7-8.3%)	
Biopsy	19	0	7	0.0% (0.0-14.6%)	
Other	304	3	82	1.0% (0.3-3.1%)	
Nodal alone	22	0	12	0.0% (0.0-12.7%)	
Unspecified	528	28	385	5.0% (3.4-7.3%)	
All	13,588	430	3,338	3.1% (2.8-3.4%)	

First-time thyroid surgery: Late hypocalcaemia and operation; July 2012 - June 2015 (n=13,462)



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There is a much higher rate of missing data for this outcome than for early hypocalcaemia, probably due to the need for surgeons to revisit the case entry some time after initial follow-up is complete, particularly for those patients who were initially hypocalcaemic. The *true* rate of hypoparathyroidism at 6 months post-operatively may therefore be higher than reported here.

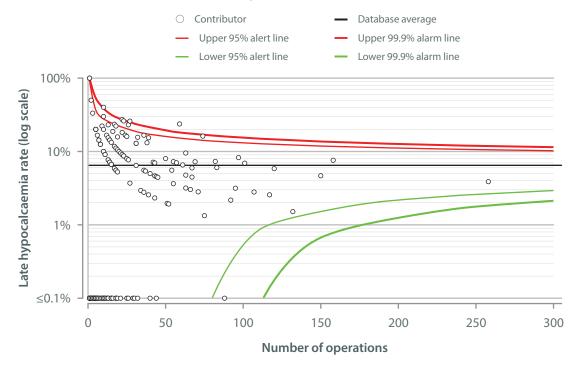
There has been a very marked reduction in the rate of late hypocalcaemia since the 2012 report, which may reflect the more consistent definition of this outcome or represent an improvement in surgical performance.

There is a trend towards lower rates of hypocalcaemia after less-than-total bilateral thyroid resections than after total thyroidectomy, similar to that seen for early hypocalcaemia.

Variation between surgeons with respect to late hypocalcaemia rates after total thyroidectomy may be due to various factors:

- data quality issues, as previously outlined.
- differences in case-mix.
- differences in rates of concomitant central node dissection.
- differences in departmental policies for weaning patients off calcium supplementation.
- variation in surgical performance and ability to preserve parathyroid function.

First-time total thyroidectomy: Late hypocalcaemia rates; July 2012 - June 2015 (n=5,093)





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Outcomes for redo operations

Overview of post-operative events

Rates of practically all complications are higher after re-operative than first-time thyroid surgery.

The majority of re-operations in the database are completion lobectomies after a previous contralateral resection (most often for cancer treatment).

It is therefore logical that the most dramatic increases in complications for re-do *versus* first-time surgery are seen for:

Late hypocalcaemia, as many re-operative lobectomy cases will have had dissection on both sides of the neck over two procedures, hence all 4 parathyroid glands would have been at risk of damage, whereas after first-time lobectomy, only the 2 parathyroids on the ipsilateral side would have been at risk.

New RLN palsy, as a proportion of re-do cases (particularly re-operative total thyroidectomy) would involve dissection on the same side as previous surgery, when scar tissue may make identification and preservation of the recurrent laryngeal nerve more challenging.

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Redo thyroid surgery: post-operative events for all cases; July 2010-June 2015

			ı	Event incidence	
		No	Yes	Unspecified	Rate (95% CI)
	Mortality	2,720	0	295	0.0% (0.0-0.1%)
Post-op	Re-operation for haemorrhage	2,699	37	279	1.4% (1.0-1.9%)
Post	Post-operative complications	2,581	114	320	4.2% (3.5-5.1%)
	Hypocalcaemia	2,402	311	302	11.5% (10.3-12.7%)
5	Persistent RLN palsy at 6/12	245	6	349	2.4% (1.0-5.4%)
dn v	Related re-admission	2,404	42	569	1.7% (1.3-2.3%)
Follow	Voice change	2,268	198	549	8.0% (7.0-9.2%)
밀	Calcium supplements at 6/12	2,240	144	631	6.0% (5.1-7.1%)
	T3/T4	283	2,190	542	88.6% (87.2-89.8%)

Redo thyroid surgery: post-operative events after total thyroidectomy; July 2010-June 2015

				Event incidence	
	_	No	Yes	Unspecified	Rate (95% CI)
	Mortality	236	0	32	0.0% (0.0-1.3%)
do	Re-operation for haemorrhage	231	5	32	2.1% (0.8-5.2%)
Post-op	Post-operative complications	215	18	35	7.7% (4.8-12.1%)
dn ,	Hypocalcaemia	175	57	36	24.6% (19.3-30.7%)
2	Persistent RLN palsy at 6/12	22	1	28	4.3% (0.2-24.0%)
g d	Related re-admission	200	2	66	1.0% (0.2-3.9%)
Follow	Voice change	178	31	59	14.8% (10.4-20.5%)
밀	Calcium supplements at 6/12	184	22	62	10.7% (7.0-15.9%)
	T3/T4	4	206	58	98.1% (94.9-99.4%)

Redo thyroid surgery: post-operative events after lobectomy; July 2010-June 2015

	_		I	Event incidence	
		No	Yes	Unspecified	Rate (95% CI)
	Mortality	2,088	0	207	0.0% (0.0-0.1%)
do-	Re-operation for haemorrhage	2,074	27	194	1.3% (0.9-1.9%)
Post-op	Post-operative complications	1,996	72	227	3.5% (2.8-4.4%)
	Hypocalcaemia	1,858	225	212	10.8% (9.5-12.2%)
20	Persistent RLN palsy at 6/12	209	5	254	2.3% (0.9-5.7%)
dn ∧	Related re-admission	1,867	33	395	1.7% (1.2-2.5%)
Follow	Voice change	1,776	133	386	7.0% (5.9-8.2%)
- P	Calcium supplements at 6/as	1,748	99	448	5.4% (4.4-6.5%)
	T3/T4	231	1,686	378	87.9% (86.4-89.4%)





Surgery for parathyroid disease



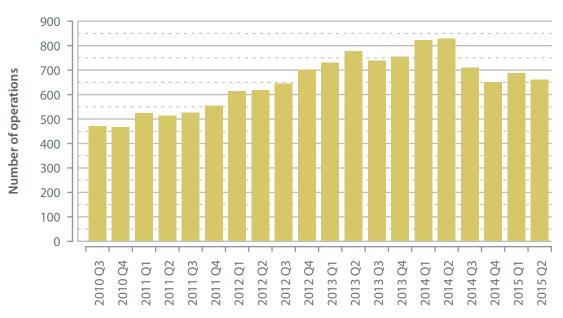
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Surgery for parathyroid disease

General information from the database

As with thyroid surgery, there has been an increase over the last several years in the number of parathyroid cases registered in the UKRETS, which is an encouraging trend.

Number of parathyroid operations recorded (n=13,012)

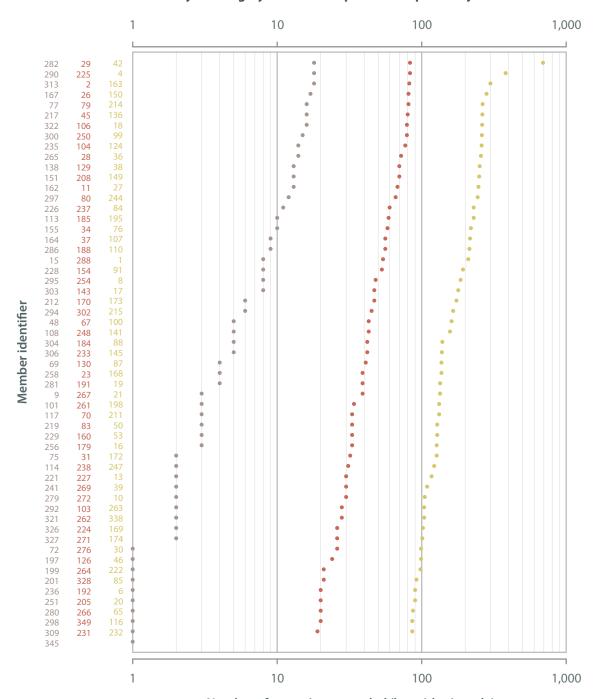


Date of operation / calendar year and quarter



There appears to be a large proportion of members submitting a relatively low volume of parathyroid operations, with only around one-third of surgeons doing more than 20 cases *per* year on average.

Parathyroid surgery: Number of operations reported by each member



Number of operations recorded (logarithmic scale)



Demographics and disease profile

Pathology

Age and pathology

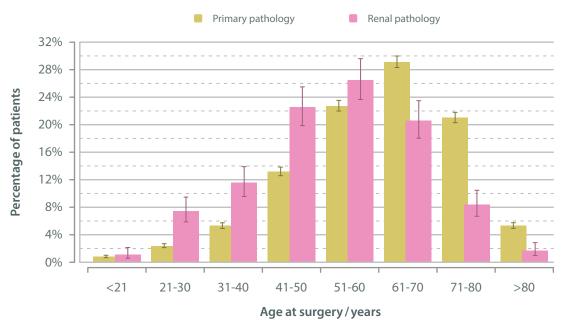
The age profile clearly reflects the known variation in incidence of parathyroid disease with age. For primary HPT, there is a steep increase in rate of surgery from around 40 years of age. Reduced rates after 80 years of age are likely to reflect the increased occurrence of co-morbidities, which make surgery less likely to be offered (rather than a reduction in the incidence of HPT).

Surgery for renal HPT shows a similar pattern, but patients are around 10 years younger on average than for primary HPT, reflecting the younger age profile of renal failure and dialysis.

Parathyroid surgery: age and pathology

		Pat	hology	
	Primary	Renal	Unspecified	All
<21	95	10	4	109
21-30	274	66	20	360
31-40	607	102	38	747
41-50	1,509	199	77	1,785
51-60	2,601	234	157	2,992
61-70	3,332	182	190	3,704
71-80	2,405	74	132	2,611
>80	609	15	40	664
Unspecified	31	4	5	40
All	11,463	886	663	13,012

Parathyroid surgery: Age and pathology (n=12,314)



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Renal pathology

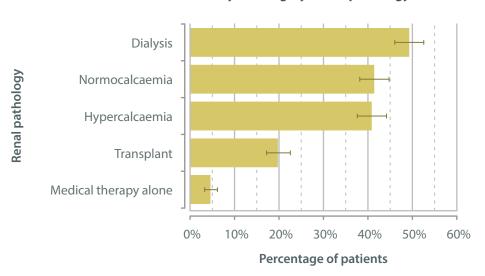
As expected, the majority of patients undergoing surgery for renal HPT have end-stage renal failure, being either on dialysis or post-transplant.

Since the last report, there has been an increase in the ratio of hypercalcaemic to normocalcaemic patients, and in the proportion of cases that are post-transplant. The reasons for this are not clear. One possibility is that normocalcaemic patients on dialysis are nowadays medically treated more intensively, *e.g.*, with calcimimetic agents, with surgery being reserved for more severe and *tertiary* disease.

Parathyroid surgery: renal pathology detail

		D	Pata
		Count	Percentage
	Normocalcaemia	367	41.4%
g	Hypercalcaemia	362	40.9%
Renal pathology	Medical therapy alone	40	4.5%
path	Dialysis	459	51.8%
nalı	Transplant	175	19.8%
Rel	Unspecified	0	
	All	886	

Parathyroid surgery: Renal pathology (n=886)





Investigations

Localisation techniques

An overview of localisation techniques used

The following section outlines the use of techniques to localize abnormal parathyroid tissue prior to, or during, surgery.

There has been a steady increase in the use of pre-operative imaging since inception of the electronic database, with the vast majority of primary HPT cases now undergoing at least one of these investigations prior to first-time surgery.

When performed, and where the outcome of investigation is recorded, the positivity rate for each pre-operative localization technique in first-time primary HPT is:

- 73% for nuclear medicine (largely MIBI scanning)
- 61% for ultrasound.
- 66% for CT/MRI.
- 61% for selective venous sampling.
- 70% for PET.

The rate of cross-sectional imaging (CT/MRI) prior to first-time surgery has markedly increased since the last report (15.3% *versus* 5.1%). In the majority of cases, ultrasound and MIBI were also performed, implying that the cross-sectional imaging was a third-line investigation. In keeping with this, in 48% of cases undergoing CT/MRI, the USS and MIBI were negative or discordant. In 36% of cases, however, both USS and MIBI were positive, raising the question as to the added utility of the cross-sectional imaging. Incorporation of CT as part of the nuclear medicine scan (SPECT) may also explain some of this effect.

The rate of PET scanning has also increased since the last report (2% versus 0.3%), although it remains an uncommon investigation. In almost all cases undergoing PET scan, ultrasound, MIBI and CT/MRI were also performed, implying that the PET scan was a fourth-line test. Interestingly, in 67% of cases undergoing PET scan, the associated MIBI scan was positive. Again, this raises the question as to the added utility of the PET scan. The audit does not collect data on the exact methodology of PET scanning (FDG-PET, methionine-PET, etc.). The sensitivity of PET scan in this series seems higher than expected, which may also be a reflection of the high rate of MIBI-positive cases undergoing this investigation.

Use of intra-operative localization techniques, such as the gamma probe or methylene blue remains uncommon.

First-time parathyroid surgery for primary HPT: localisation technique used

				Test	result	
		Not done	Negative	Positive	Unspecified	Test rate (95% CI)
<u>e</u>	Nuclear medicine	762	2,644	6,996	154	92.7% (92.2-93.2%)
technique	Ultrasound	1,792	3,332	5,267	165	82.8% (82.0-83.5%)
ech	CT / MRI	8,428	522	1,003	603	15.3% (14.6-16.0%)
	Venous sampling	9,747	102	162	545	2.6% (2.3-3.0%)
sati	PET	9,767	61	141	587	2.0% (1.8-2.3%)
Localisation	Gamma probe	9,901	38	6	611	0.4% (0.3-0.6%)
Po	Methylene blue	8,525	227	1,177	627	14.1% (13.5-14.8%)

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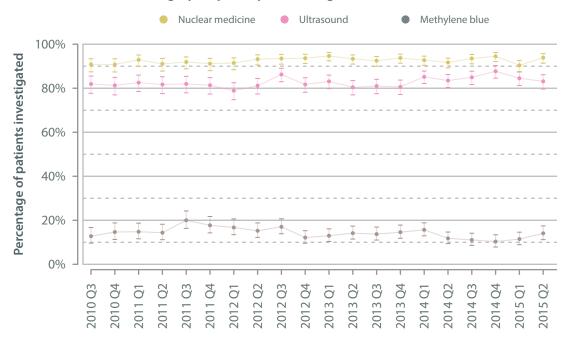
Since the last report, the number of cases performed with the aid of intravenous methylene blue has reduced from 21.8% to 14.1%, mainly due to an increase in the number of *never users* amongst surgeons:

never users:
 109 members.

selective users (0.4-90.0% of that surgeon's cases): 39 members.

• routine users (>90.0% of that surgeon's cases): 19 members.

First-time surgery for primary HPT: Changes in the use of localisation over time



Date of operation / calendar year & quarter

Nuclear medicine Ultrasound CT/MRI Venous sampling PET Gamma probe Methylene blue 0% 20% 40% 60% 80% 100%

Percentage of patients undergoing the test

First-time surgery for primary HPT:



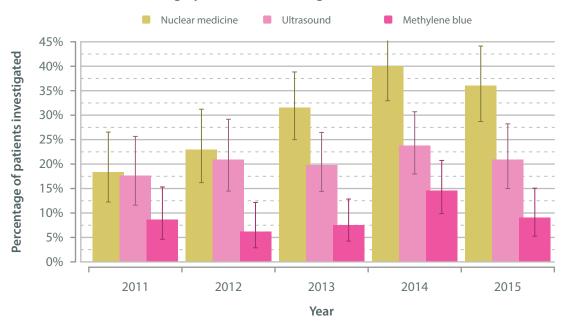
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Pre-operative imaging is much less frequently performed prior to surgery for renal HPT than for primary HPT. This is logical, given that renal HPT is usually due to 4-gland hyperplasia, and therefore for the majority of cases a targeted operation is not feasible. It is interesting, therefore, that the use of imaging, particularly nuclear medicine, has increased significantly over the last few years. This may also be related to the increased proportion of hypercalcaemic patients amongst renal HPT cases, alluded to above.

First-time parathyroid surgery for renal HPT: localisation technique used

	Not done	Negative	Positive	Unspecified	Test rate (95% CI)
Nuclear medicine	541	79	163	8	30.9% (27.7-34.3%)
Ultrasound	617	70	92	12	20.8% (18.0-23.9%)
CT / MRI	738	10	14	29	3.1% (2.1-4.7%)
Venous sampling	755	7	5	24	1.6% (0.8-2.8%)
PET	758	4	1	28	0.7% (0.2-1.6%)
Gamma probe	756	3	0	32	0.4% (0.1-1.3%)
Methylene blue	690	6	66	29	9.4% (7.5-11.8%)
	Ultrasound CT / MRI Venous sampling PET Gamma probe	Nuclear medicine 541 Ultrasound 617 CT / MRI 738 Venous sampling 755 PET 758 Gamma probe 756	Nuclear medicine 541 79 Ultrasound 617 70 CT / MRI 738 10 Venous sampling 755 7 PET 758 4 Gamma probe 756 3	Nuclear medicine 541 79 163 Ultrasound 617 70 92 CT / MRI 738 10 14 Venous sampling 755 7 5 PET 758 4 1 Gamma probe 756 3 0	Nuclear medicine 541 79 163 8 Ultrasound 617 70 92 12 CT / MRI 738 10 14 29 Venous sampling 755 7 5 24 PET 758 4 1 28 Gamma probe 756 3 0 32

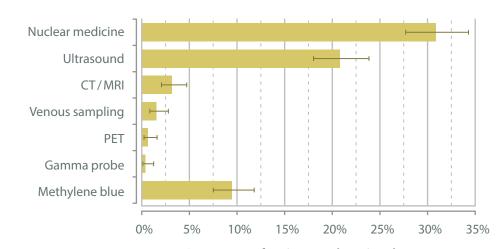
First-time surgery for renal HPT: Changes in the use of localisation over time



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First-time surgery for renal HPT: Localisation techniques used



Localisation technique

Percentage of patients undergoing the test



Along with a reduction in the proportion of HPT cases having surgery without any pre-operative localization, there seems to be an increase in the number of imaging studies undertaken *per* patient. The main reason to undertake additional imaging is to facilitate a targeted approach, so it is interesting to reflect that the rate of targeted surgery is almost identical (at around 50%) across the groups having 1, 2, 3 or 4+ modalities of imaging.

There appears, therefore, to be an increasing reluctance amongst surgeons to proceed to a standard bilateral neck exploration after initial negative imaging with USS and MIBI.

Parathyroid surgery: the targeted approach and the number of localisation techniques used

			Nur	mber of loc	alisation te	chniques	used	
		None	One	Two	Three	Four or more	Unspecified	All
	No	698	846	2,952	1,065	224	602	6,387
Targeted approach	Yes	0	879	3,101	1,144	215	646	5,985
arg	Unspecified	14	20	66	23	9	508	640
<u> </u>	All	712	1,745	6,119	2,232	448	1,756	13,012

The concept of targeted surgery in HPT is to utilize pre-operative imaging to identify those cases with single accessible adenomas, which may then proceed to surgery by minimal access techniques, potentially improving cosmesis, and reducing some morbidity.

Targeted surgery may include mini-incision open techniques, endoscopic methods or even unilateral neck exploration. The audit design does not specifically examine which of these methods was used.

It is interesting to note that, where pre-operative imaging was used (in first-time primary HPT), presumably with the intention of performing targeted surgery, a targeted operation was actually performed in just over half of patients (55% for MIBI, 52% for USS).

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First time parathyroid surgery: localisation technique used

				Localisa	tion techniq	ue result	
			Not done	Negative	Positive	Unspecified	Test rate
		Nuclear medicine	1,133	2,405	2,171	63	80.2%
	_	Ultrasound	1,455	2,650	1,591	76	74.5%
	etec	CT / MRI	4,706	419	304	343	13.3%
<u>چ</u>	Not targeted	Venous sampling	5,352	63	76	281	2.5%
oacl	lot t	PET	5,400	42	27	303	1.3%
ppr niq	_	Gamma probe	5,439	26	1	306	0.5%
Use of the targeted approach & localisation technique		Methylene blue	4,656	155	663	298	14.9%
targe		Nuclear medicine	161	325	5,009	102	97.1%
the		Ultrasound	953	776	3,762	106	82.6%
of t	eq	CT / MRI	4,438	120	715	324	15.8%
Use	Targeted	Venous sampling	5,142	46	86	323	2.5%
	Tar	PET	5,105	24	117	351	2.7%
		Gamma probe	5,200	16	5	376	0.4%
		Methylene blue	4,547	78	576	396	12.6%

First time primary parathyroid surgery: localisation technique used

		597 2,286 2,015 52 87.89 849 2,531 1,508 62 82.69 3,979 402 286 283 14.79 4,598 55 71 226 2.7% 4,643 37 26 244 1.3% 4,684 22 1 243 0.5% 3,968 148 596 238 15.89 156 317 4,907 89 97.19 924 764 3,691 90 82.89 4,360 117 703 289 15.89 5,065 46 84 274 2.5%				
		Not done	Negative	Positive	Unspecified	Test rate
	Nuclear medicine	597	2,286	2,015	52	87.8%
~	Ultrasound	849	2,531	1,508	62	82.6%
etec	CT / MRI	3,979	402	286	283	14.7%
Not targeted	Venous sampling	4,598	55	71	226	2.7%
lot t	PET	4,643	37	26	244	1.3%
_	Gamma probe	4,684	22	1	243	0.5%
	Methylene blue	3,968	148	596	238	15.8%
	Nuclear medicine	156	317	4,907	89	97.1%
	Ultrasound	924	764	3,691	90	82.8%
eq	CT / MRI	4,360	117	703	289	15.8%
Targeted	Venous sampling	5,065	46	84	274	2.5%
<u>T</u> al	PET	5,028	24	115	302	2.7%
	Gamma probe	5,122	16	5	326	0.4%
	Methylene blue	4,475	77	570	347	12.6%

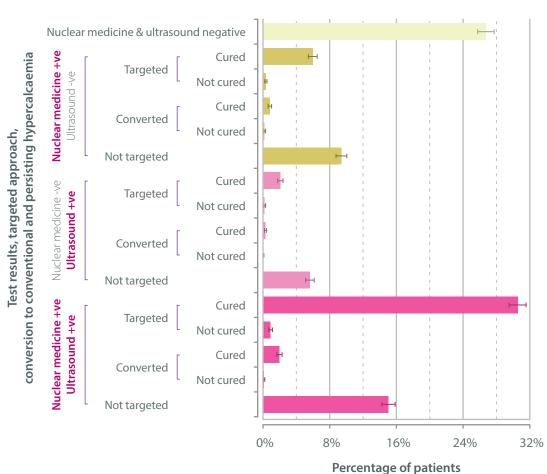




The utility of localization studies in first-time surgery for HPT is in facilitating successful targeted surgery. For the commonest combination of imaging (MIBI + USS):

- About 42% of cases have either one or both scans negative, and go on to non-targeted surgery (presumably bilateral neck exploration).
- Around a further 15% have both scans positive, but go on to non-targeted surgery (presumably bilateral neck exploration). This may be due to discrepancy in exact location of the abnormality between MIBI and USS, or the detection of multi-gland disease.
- The remaining patients go on to targeted surgery, with some patients requiring conversion
 to a standard approach (presumably due to failure to find an adenoma, other intraoperative difficulties such as bleeding, or the discovery of multi-gland disease). As with
 BNE, a small proportion of targeted operations do not result in biochemical cure of
 hypercalcaemia.
- Overall, around 38% of cases have a *successful targeted operation* (targeted, non-converted and cured). This rate has marginally reduced since the 2012 report, despite the increase in additional imaging.

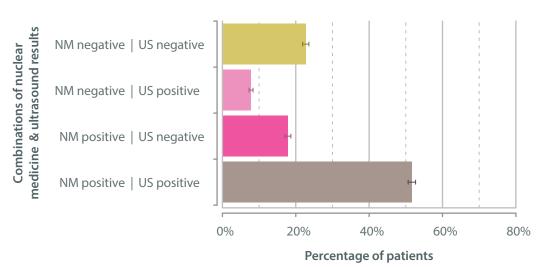
Parathyroid surgery: Concordance between nuclear medicine and ultrasound (n=7,887)



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Parathyroid surgery: Agreement between nuclear medicine and ultrasound tests (n=9,281)

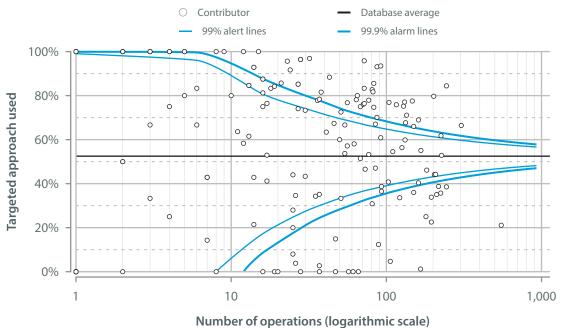


There is wide variation between surgeons with respect to the proportion of their cases having an initial targeted approach at first-time surgery for primary HPT.

This may reflect:

- different philosophies between surgeons regarding the advantages of targeted surgery versus traditional bilateral neck exploration.
- variation in the accuracy of pre-operative imaging, and in surgeons' confidence in this.
- differences in local referral practice/case-mix.
- variation in surgeons' confidence in performing bilateral neck exploration, with some surgeons referring on cases with negative imaging to colleagues.

First-time parathyroid surgery for primary HPT: Use of the targeted approach (n=10,419)



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qPTH and conversion

Intra-operative, or *quick* PTH (qPTH) refers to the rapid measurement of parathyroid hormone during surgery, in order to confirm correction of the hyperparathyroidism following excision of any abnormal parathyroid glands. This may be particularly useful during targeted surgery, as it may either confirm single-gland disease, or demonstrate the need for further exploration if PTH levels do not drop adequately (indicating likely multi-gland disease or excision of non-parathyroid tissue).

During planned targeted surgery, only 23.5% of cases are performed using qPTH.

Reasons for this low uptake may include the added expense of this investigation, or the time taken to perform PTH analysis, which may extend the length of surgery and impact upon operating theatre scheduling. If a more rapid method of PTH analysis were available, it is possible that qPTH would be used more widely.

When qPTH is used, however, the conversion rate to conventional surgery (presumably bilateral neck exploration) is higher: 12.0% *versus* 6.4% ($\chi^2 = 42.8$; 1 degree of freedom; p<0.001).

Following conversion there is a slightly higher rate of presumed multi-gland disease (2 or more glands excised) in the cases performed using qPTH, although this is not statistically significant ($\chi^2 = 1.27$; 1 degree of freedom; p=0.26).

As seen later in this report, the success rate of surgery (cure of hypercalcaemia) is also slightly improved by the use of qPTH.

qPTH is also more commonly used (35%) in re-operative, compared to first-time, primary HPT cases.

Parathyroid surgery using the targeted approach: qPTH and conversion

			Con	verted to conven	tional	
		No	Yes	Unspecified	All	Conversion rate
ō	No	3,819	260	288	4,367	6.4%
nsed	Yes	1,081	148	109	1,338	12.0%
qРТН	Unspecified	198	25	57	280	11.2%
Ь	All	5,098	433	454	5,985	7.8%

Parathyroid surgery using the targeted approach that were converted to a conventional approach: number of glands removed

		qPTH used				
	No	Yes	Unspecified	All		
No glands	5	7	1	13		
1 gland	171	86	14	271		
2 glands	61	31	8	100		
3 glands	11	16	0	27		
3.5 glands	8	5	0	13		
2 glands 3 glands 3.5 glands 4 glands	0	2	0	2		
Unspecified	4	1	2	7		
All	260	148	25	433		

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Glands removed and the targeted approach

The overall rate of conversion to conventional surgery (presumably bilateral neck exploration) following a planned, targeted parathyroidectomy for primary HPT is 7.8%.

The data suggest that the main reason for conversion is multi-gland disease, as a significant proportion of converted cases have excision of 2 or more parathyroid glands.

Multi-gland disease may have been suspected at targeted surgery due to:

- appearances of a gland being more suggestive of hyperplasia than adenoma.
- observation of a second abnormal gland adjacent to the targeted gland.
- use of qPTH, with absence of a diagnostic drop in PTH levels.

Conversion may also occur due to failure to locate the abnormal parathyroid gland during minimal access surgery, or due to a requirement for greater access due to intra-operative difficulties such as large lesion size or bleeding.

It is interesting that 274 patients had excision of two parathyroid glands and yet were not converted to bilateral exploration, which would usually be appropriate for multi-gland disease. Most of these patients were cured, so it may be that one of the excised parathyroid glands may have been non-pathological or qPTH had confirmed the absence of other abnormal parathyroid glands.

It is hard to reconcile excision of 3 or more glands with a targeted operation, as this implies that exploration of both sides of the neck must have occurred. There may be some confusion amongst the membership as to the definition of targeted (which is taken to mean the targeting of a single abnormal gland in order to facilitate a minimal access approach, rather than use of pre-operative imaging to ease bilateral exploration).

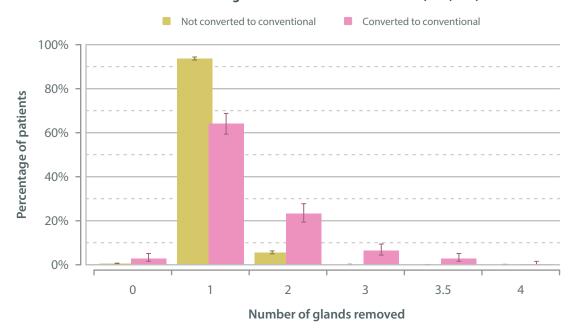
Parathyroid surgery using the targeted approach for patients with a primary pathology: number of glands removed and conversion to the conventional approach

		C	Converted to conventional				
		No	Yes	Unspecified	All		
ed	No glands	24	12	5	41		
٦٥ ١٥	1 gland	4,607	267	373	5,247		
Number of glands removed	2 glands	274	97	18	389		
מ	3 glands	5	27	3	35		
918	3.5 glands	1	12	0	13		
פֿרַ	4 glands	3	1	0	4		
gu	Unspecified	61	7	18	86		
	All	4,975	423	417	5,815		

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Parathyroid surgery using the targeted approach for primary pathology: Number of glands removed and conversion (n=5,330)





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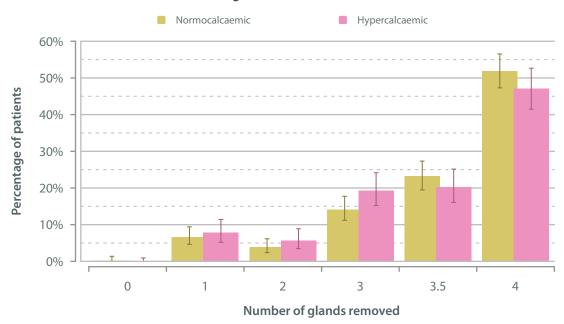
The extent of surgery for renal HPT is similar between normocalcaemic and hypercalcaemic patients, with total parathyroidectomy apparently being favoured over subtotal resection. The audit does not collect information on whether or not parathyroid auto-transplantation or cervical thymectomy is carried out, and it may be useful to include these as additional data fields in future.

The excision of one or two glands seems at variance with the usual findings of four-gland hyperplasia in renal HPT.

Parathyroid surgery for patients with a renal pathology: number of glands removed and normocalcaemia versus hypercalcaemia

	Nor	mocalcaemic / hyp	ercalcaemic	
	Normocalcaemic	Hypercalcaemic	Unspecified	All
No glands	1	0	0	1
1 gland	31	25	0	56
2 glands	18	18	0	36
3 glands	66	62	0	128
3.5 glands	108	65	0	173
4 glands	242	151	0	393
No glands 1 gland 2 glands 3 glands 3.5 glands 4 glands Unspecified	4	0	0	4
Z All	470	321	0	791

Parathyroid surgery for renal pathology: Number of glands removed and conversion (n=787)



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Operation

Operation sequence

Most re-operative cases have only had one previous exploration, though the audit design does not identify the extent of any previous surgery *e.g.*, targeted or bilateral exploration.

The number of re-operative parathyroidectomies being performed is relatively small, which might argue in favour of greater sub-specialization of this surgery.

The rate of unspecified data for this field has improved since the last two reports.

Parathyroid surgery: operation sequence

			Operation sequence					
		First-time	Redo	Unspecified	All			
ın.	None	11,557	0	0	11,557			
Number of previous operations	One	0	575	0	575			
or prev rations	Two	0	62	0	62			
rati	Three	0	8	0	8			
opei	Four	0	2	0	2			
	Unspecified	0	60	748	808			
•	All	11,557	707	748	13,012			

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Information on the location of any parathyroid glands excised at re-operative surgery is included in this report for the first time.

It is noteworthy that in the majority of cases a single gland is excised, implying that most are due to solitary adenomas missed at previous surgery or possibly a missed second adenoma (rather than hyperplasia, when more radical excision might be expected at the second procedure).

In addition, most glands excised at re-operative surgery are located in the neck, usually in a conventional anatomical location. This might arise due to:

- inadequate exploration at the first procedure, if this had been a bilateral exploration.
- failure of a previous targeted operation, due to multi-gland disease not detected by preoperative imaging (particularly if qPTH had not been used).

The definition of *ectopic neck* is not explicit in the database, but accounts for the next most common category of parathyroid gland location. This category might include lesions within the carotid sheath, or intra-thyroidal parathyroid adenomas, for instance.

True ectopic location in the chest is relatively uncommon, and usually involves only a single gland. The audit does not collect information on the technique used to access these mediastinal glands *e.g.*, mediastinoscopy, thoracoscopy, thoracotomy or *via* cervical re-exploration.

It is difficult to understand how the location of the tumour could have been established with certainty for those cases where no parathyroid glands were excised at the re-do operation.

Redo parathyroid surgery: number of glands removed and location of tumour

		Location of tumour						
		Ectopic chest	Ectopic neck	Eutopic	Unspecified	All		
ed	0 glands	4	2	6	26	38		
removed	1 gland	44	139	283	63	529		
_	2 glands	6	21	54	11	92		
ב מ	3 glands	0	2	20	0	22		
r gle	3.5 glands	0	0	3	2	5		
er o	4 glands	0	3	0	2	5		
Number of glands	Unspecified	2	3	6	5	16		
2	All	56	170	372	109	707		

Glands removed and operation sequence

The distribution of number of glands removed is similar for first-time and re-operative surgery, with most involving excision of only one parathyroid gland. In conjunction with the above data on tumour location at re-operative surgery, it appears that many re-operations arise from failure to find a solitary adenoma in the neck, at the first operation.

For first-time hyperparathyroidism (excluding multiple endocrine neoplasia, usually abbreviated to MEN), a condition usually associated with the presence of multiple abnormal parathyroid glands, as well as abnormalities in other endocrine organs):

- no abnormal parathyroid glands are excised (implying a definite failed exploration) in 1.8% of cases.
- a solitary gland is excised in 81.0% of cases. Of these cases, persistent hypercalcaemia is recorded in 3.2%, implying residual abnormal parathyroid tissue.
- multiple glands are excised in the remaining 17.2%.

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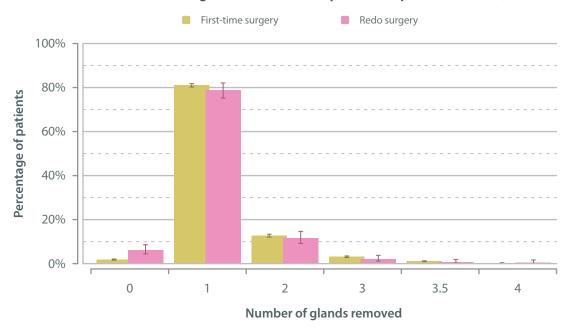
The true rate of multi-gland disease cannot be established with certainty, as the audit does not interrogate the details of pathology individually for each excised parathyroid gland (and hence cannot allow for excision of histologically normal glands). However, the above data would imply that this rate may be as high as around 20%, which is higher than frequently quoted in the literature.

The diagnosis of MEN may not, however, always be apparent at the time of first surgery for HPT, and a subsequent diagnosis may not always be entered retrospectively into the relevant case entry. The rate of multi-gland disease in truly sporadic primary HPT may therefore be over-estimated here.

Parathyroid surgery for patients with a non-MEN primary pathology: number of glands removed and operation sequence

		Operation sequence					
	First-time	Redo	Unspecified	All			
No glands	187	35	3	225			
1 gland	8,332	447	179	8,958			
2 glands	1,308	66	30	1,404			
3 glands	322	12	7	341			
3.5 glands	109	4	5	118			
4 glands	28	3	0	31			
Unspecified	156	11	46	213			
All	10,442	578	270	11,290			

Parathyroid surgery for patients with a non-MEN primary pathology: Number of glands removed and operation sequence (n=10,853)





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Glands removed and MEN for patients with a primary pathology

Glands removed and MEN

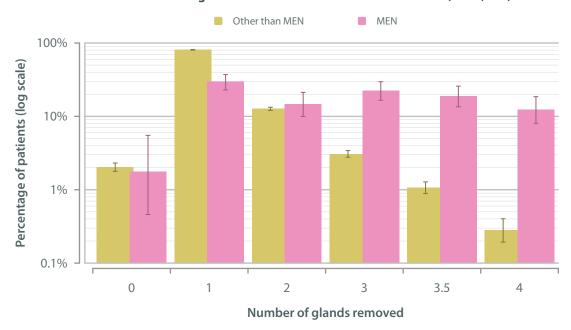
As expected, the incidence of multi-gland excision (presumably reflecting disease) is higher in cases with a diagnosis of MEN recorded, although around 30% have only a single gland excised. As noted above, the diagnosis of MEN may not be known at the time of surgery, and may be under-represented in these data.

Sub-total and total parathyroidectomy are used to a similar extent in MEN patients. As documented above for renal HPT, the audit does not collect details on the use of auto-transplantation of parathyroid tissue, nor on cervical thymectomy during parathyroidectomy.

Parathyroid surgery for patients with a primary pathology: number of glands removed

		MEN			
	No	Yes	Unspecified	All	
No glands	225	3	0	228	
1 gland	8,958	50	0	9,008	
2 glands	1,404	25	0	1,429	
3 glands	341	38	0	379	
3.5 glands	118	32	0	150	
4 glands	31	21	0	52	
Unspecified	213	4	0	217	
All	11,290	173	0	11,463	

Parathyroid surgery for primary pathology: Number of glands removed and the incidence of MEN (n=11,246)



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Glands removed and age at operation

It is reasonable to presume that excision of one or two parathyroid glands usually implies single or double *adenoma*, whilst excision of 3-4 glands implies diffuse hyperplasia.

On this assumption, the highest relative proportion of hyperplasia occurs in younger patients (<40 years of age), although at all ages single-gland excision remains the commonest procedure.

First-time parathyroid surgery for non-MEN primary HPT: number of glands removed and age at surgery

		Numb	er of glands re	emoved	
	<=1 gland	2 glands	>2 glands	Unspecified	All
<21	61	11	14	2	88
21-30	184	28	38	4	254
31-40	437	56	43	7	543
41-50	1,125	178	67	19	1,389
51-60	1,977	270	129	40	2,416
61-70	2,469	391	142	50	3,052
71-80	1,787	309	90	22	2,208
>80	471	77	18	12	578
Unspecified	23	4	1	0	28
All	8,534	1,324	542	156	10,556

First-time surgery for non-MEN HPT: Age and number of glands removed (n=10,372)





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Surgeon

As with thyroid surgery, consultants are the primary surgeon in the majority of cases, and registrars the main assistants, a situation which has remained stable over the last two national reports.

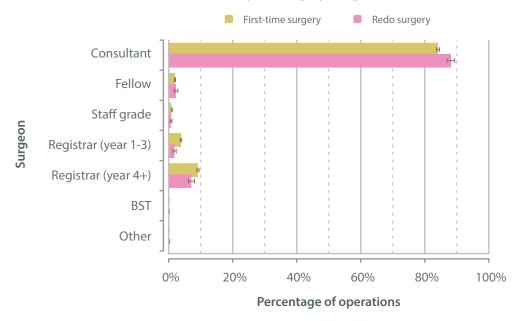
Parathyroid surgery: surgeon and operating sequence

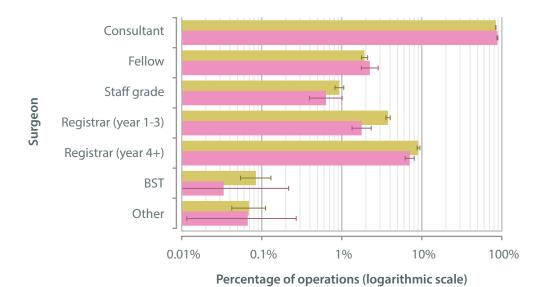
		Operation sequence					
		First-time	Redo	Unspecified	All		
Consultan	t	9,728	661	299	10,688		
Fellow		191	11	7	209		
Staff grad	5	100	3	3	106		
Registrar (year 1-3)	357	6	4	367		
Registrar (Registrar (BST	year 4+)	1,104	26	20	1,150		
BST		39	0	0	39		
Other		2	0	0	2		
Unspecifie	ed .	36	0	415	451		
All		11,557	707	748	13,012		

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Parathyroid surgery: Surgeon (n=12,228)





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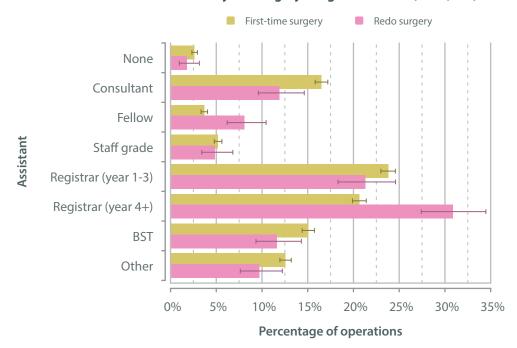


Assistant

Parathyroid surgery: surgical assistant and operation sequence

	Operation sequence					
	First-time	Redo	Unspecified	All		
None	292	12	10	314		
Consultant	1,839	81	42	1,962		
Fellow	410	55	6	471		
S taff grade	578	33	11	622		
Registrar (year 1-3) Registrar (year 4+)	2,652	145	74	2,871		
Registrar (year 4+)	2,301	210	57	2,568		
BST	1,678	79	75	1,832		
Other	1,401	66	40	1,507		
Unspecified	406	26	433	865		
All	11,557	707	748	13,012		

Parathyroid surgery: Surgical assistant (n=11,832)



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Consultant involvement

- All surgery 97.4%
- First-time surgery 97.3%
- Redo surgery 98.4%

Parathyroid surgery: Proportion of procedures performed by trainees (n=11,401)





Date of operation / calendar year and quarter



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Nerve monitoring

Intra-operative nerve monitoring is used in a lower proportion of parathyroid than thyroid operations. As with thyroidectomy, however, it is more likely to be used during re-do than first-time surgery, but there is little difference between targeted and non-targeted surgery.

Parathyroid surgery for patients with a primary pathology: nerve monitoring and operation sequence

	Operation sequence							
		Count			te			
	First-time	Redo	Unspecified	First-time	Redo			
None	8,886	459	190	86.5%	73.7%			
Medtronic NM	1,119	143	20	10.9%	23.0%			
Magstim	172	3	4	1.7%	0.5%			
Other monitor	57	5	1	0.6%	0.8%			
Unspecified monitor	44	13	1	0.4%	2.1%			
Unspecified	278	11	57					
All	10,556	634	273					

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Outcomes

Persisting hypercalcaemia

Persistent hypercalcaemia is a key outcome measure after parathyroid surgery, as it implies a failure to cure the disease that necessitated surgery (hyperparathyroidism).

The results are very similar to those presented in the 2012 report, with a headline *failure rate* of 4.4% for first-time primary HPT, and significantly higher rates after re-operative surgery or surgery in MEN patients.

Use of intra-operative PTH assay significantly improves the cure rate, although the absolute improvement is relatively small. This, along with the added expense and time taken to perform qPTH during surgery, may explain why it has not been more uniformly adopted.

As seen in the 2012 report, the most prevalent, strong predictor of success remains the result of nuclear medicine scanning: when MIBI is positive, cure rates are better than the average, but when negative are significantly worse than this. This effect almost certainly explains the slightly better outcomes for targeted *versus* non-targeted surgery, as the former is usually only performed if the nuclear medicine scan is positive. In addition, there is no significant difference between these approaches when only a single gland is excised in first-time surgery for primary HPT (persistent hypercalcaemia = 2.9% targeted *versus* 3.6% non-targeted, p=0.09).

The reason why nuclear medicine negativity is linked to reduced cure rates is not clear from the audit data, although may relate to the known limitations of MIBI scanning in detecting very small adenomas (which may then also be harder to identify at neck exploration) and to the fact that multi-gland disease may be more common when MIBI scans are negative.

Parathyroid surgery for primary pathology:

Persisting hypercalcaemia rate

12%

16%

Persisting hypercalcaemia All primary pathology Not MEN MEN First-time surgery Redo surgery qPTH not used Groupings qPTH used Not targeted **Targeted** Nuclear medicine not done Nuclear medicine negative Nuclear medicine positive Methylene blue not done Methylene blue negative Methylene blue positive

4%

0%

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Parathyroid surgery for patients with a primary pathology: persisting hypercalcaemia

			Persis	ting hypercalcae	mia
		No	Yes	Unspecified	Rate (95% CI)
ogy	All primary pathology	8,791	454	2,218	4.9% (4.5-5.4%)
Pathology	Not MEN	8,682	438	2,170	4.8% (4.4-5.3%)
Pat	MEN	109	16	48	12.8% (7.7-20.2%)
ion	First-time surgery	8,160	379	2,017	4.4% (4.0-4.9%)
Operation sequence	Redo surgery	435	64	135	12.8% (10.1-16.2%)
Ope	Unspecified	196	11	66	5.3% (2.8-9.6%)
sed	No	6,498	352	1,618	5.1% (4.6-5.7%)
qPTH used	Yes	1,860	74	445	3.8% (3.0-4.8%)
qPT	Unspecified	433	28	155	6.1% (4.1-8.8%)
rgeted	No	4,220	262	983	5.8% (5.2-6.6%)
Targeted	Yes	4,452	187	1,176	4.0% (3.5-4.6%)
Tar	Unspecified	119	5	59	4.0% (1.5-9.6%)
	Not done	684	38	119	5.3% (3.8-7.2%)
Nuclear	Negative	2,147	173	587	7.5% (6.4-8.6%)
Nuclear	Positive	5,836	239	1,470	3.9% (3.5-4.5%)
	Unspecified	124	4	42	3.1% (1.0-8.3%)
a	Not done	7,104	373	1,773	5.0% (4.5-5.5%)
ylen	Negative	188	32	34	14.5% (10.3-20.1%)
Methylene blue	Positive	1,028	28	215	2.7% (1.8-3.9%)
\	Unspecified	471	21	196	4.3% (2.7-6.6%)

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Cure of hyperparathyroidism is also clearly linked to the number of glands removed at surgery.

Particularly for first-time surgery, cure is most likely if only a single gland was excised, implying removal of a solitary adenoma. The need for removal of more than one gland implies the presence of multi-gland disease, which, as may be expected, has a higher risk of persistent HPT.

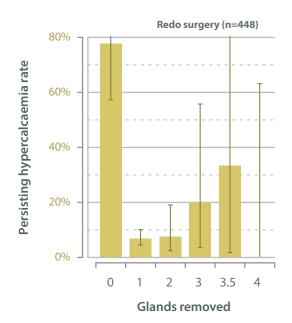
It is interesting to note that even total parathyroidectomy (4-gland excision) did not guarantee cure (perhaps implying the presence of supernumerary parathyroid glands), and also that persistent hypercalcaemia was not ubiquitous amongst those cases where no parathyroid glands were excised (although there must remain doubt as to the long-term outcome in such cases).

Parathyroid surgery for patients with a non-MEN primary pathology: operation sequence, number of glands removed and persisting hypercalcaemia

			Previo	us surgery	for HPT and	d persisting	g hyperca	lcaemia	
			First-time surgery				Redos	surgery	
		ON.	Yes	Unspecified	Rate	ON O	Yes	Unspecified	Rate
_{red}	No glands	115	55	17	32.4%	6	21	8	77.8%
nov	1 gland	6,528	216	1,588	3.2%	328	24	95	6.8%
s rei	2 glands	991	74	243	6.9%	49	4	13	7.5%
nds	3 glands	228	19	75	7.7%	8	2	2	20.0%
fgla	3.5 glands	83	5	21	5.7%	2	1	1	33.3%
er O	4 glands	22	1	5	4.3%	3	0	0	0.0%
Number of glands removed	Unspecified	118	4	34	3.3%	6	1	4	14.3%
N	All	8,085	374	1,983	4.4%	402	53	123	11.6%

Parathyroid surgery for non-MEN primary pathology: Persisting hypercalcaemia and number of glands removed





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Regarding cure of primary hyperparathyroidism, variation between surgeons is largely within the expected statistical confidence limits.

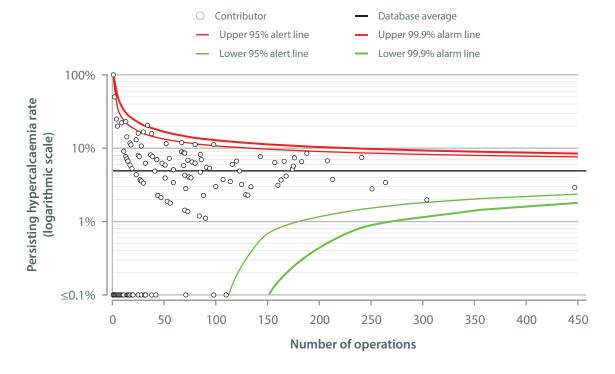
It should be noted, however, that there is considerable variation between surgeons with respect to the risk factors for persistent hyperparathyroidism, as identified above, amongst their patients. For instance, the prevalence of the following risk factors (where all are recorded as present/absent) by surgeon is:

	Median	IQR	Range
Re-do surgery	3%	0-7%	0-50%
Nuclear medicine positive	73%	63-89%	0-100%
MEN	0%	0-1%	0-100%
Targeted	62%	35-81%	0-100%

Hence, some surgeons rarely, or never operate without a positive MIBI scan, whilst some more regularly perform bilateral exploration with negative imaging. This might reflect local referral practices as well as the preference of the individual surgeon.

If cure rate of hypercalcaemia is to be considered a measure of surgical performance, however, these effects should be taken into consideration.

Parathyroid surgery for primary pathology: Persisting hypercalcaemia rates (n=9,245)





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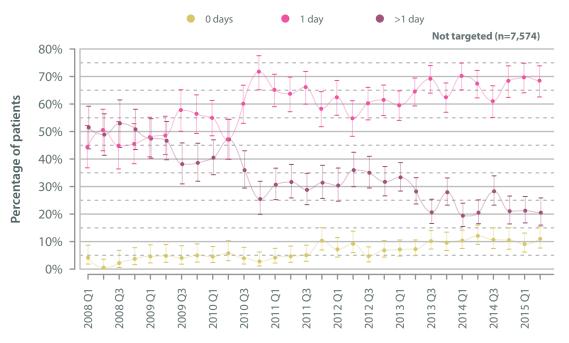
Post-operative stay

As with thyroid surgery, there has been a continuing trend towards shorter length-of-stay after parathyroidectomy.

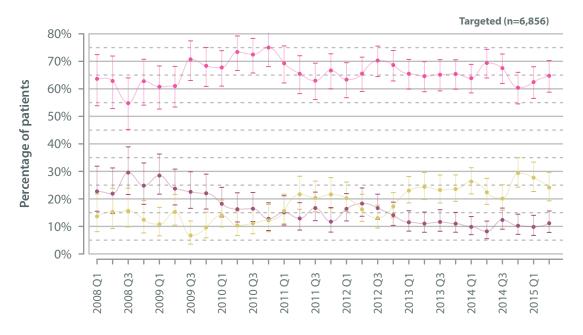
For non-targeted surgery (essentially bilateral exploration), this has largely been due to an increase in the proportion of patients staying for one night, at the expense of 2 or more nights, although there has also been an increase in true day-case parathyroidectomy, to about 10% of the total, by the end of the study interval. For targeted surgery the main change has been an increase in the rate of true day-case surgery, to about 25% of cases, by the end of the study interval.

True day-case parathyroidectomy has not been universally adopted by all surgeons: 65 members have none of their recorded cases discharged on the day of surgery. This may be due to previous guidelines suggesting that day-case neck surgery should be avoided, due to the risks of airway compromise from delayed bleeding into the neck. This risk would be expected to be much lower after targeted surgery, which may be reflected in the data presented here.





Date of operation / COP year and quarter



Date of operation / COP year and quarter



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Re-operation for haemorrhage

Re-operation for haemorrhage is reassuringly very low after parathyroid surgery, at about 0.4%, with very little difference between targeted and non-targeted surgery in the present report.

The slightly higher rate for renal than for primary HPT may reflect the much higher incidence of bilateral exploration in this group.

Parathyroid surgery: pathology, operation sequence and re-operation for haemorrhage

				Re-oper	ation for haemo	rrhage
			No	Yes	Unspecified	Rate (95% CI)
au	>	First-time	9,976	39	541	0.4% (0.3-0.5%)
	Primary	Redo	584	3	47	0.5% (0.1-1.6%)
operation sequence	Ā	Unspecified	244	0	29	0.0% (0.0-1.2%)
	_	First-time	706	5	80	0.7% (0.3-1.7%)
שׁבַּע	Renal	Redo	59	0	6	0.0% (0.0-5.0%)
<u>ן</u> נו	œ	Unspecified	25	0	5	0.0% (0.0-11.3%)
	fied	First-time	205	0	5	0.0% (0.0-1.5%)
	Jnspecified	Redo	6	0	2	0.0% (0.0-39.3%)
Σ .	Jus	Unspecified	70	1	374	1.4% (0.1-8.7%)

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Related re-admission

Re-admission after parathyroid surgery is also relatively uncommon, though is more frequently seen in reoperative than first-time primary HPT, and in patients with renal HPT. This may reflect the greater difficulty of re-operative surgery, or the greater likelihood of hypocalcaemia after sub-total or total thyroidectomy in renal HPT cases. In addition, patients with renal HPT tend to have a greater burden of co-morbidities, which may make re-admission more likely.

Parathyroid surgery: pathology, operation sequence and related re-admission

				Rel	ated re-admissio	on
			No	Yes	Unspecified	Rate (95% CI)
.	≥	First-time	8,618	111	1,827	1.3% (1.1-1.5%)
ם ב	Primary	Redo	490	19	125	3.7% (2.3-5.9%)
sedn	Ą	Unspecified	212	1	60	0.5% (0.0-3.0%)
3	_	First-time	589	18	184	3.0% (1.8-4.7%)
Pathology and operation sequence	Renal	Redo	49	2	14	3.9% (0.7-14.6%)
5	Œ	Unspecified	17	1	12	5.6% (0.3-29.4%)
6601	fied	First-time	167	1	42	0.6% (0.0-3.8%)
	Unspecified	Redo	5		3	0.0% (0.0-45.1%)
	Uns	Unspecified	70	1	374	1.4% (0.1-8.7%)

The difficulties in interpretation of vocal cord palsy data, described in the Thyroid Surgery section, apply equally to parathyroid surgery.

Since the last revision of the database, the number of parathyroid cases with complete data on persistent cord palsy is too low to draw any conclusions, and assessment of this outcome will need to await further maturation of the data.



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Late hypocalcaemia

The requirement for calcium ± vitamin D supplementation at 6 months post-operatively is significantly greater after non-targeted (presumed bilateral exploration) than targeted surgery for first-time primary HPT.

This is, however, almost solely related to the number of glands excised. Where only a single gland is removed, the rate of late hypocalcaemia is no different between the two approaches (1.3% targeted versus 1.8% non-targeted, p>0.12), implying that inspection/dissection of non-pathological glands during bilateral exploration does not contribute significantly to late hypocalcaemia.

Bilateral exploration is usually required for multi-gland disease, and the need for excision of more than one parathyroid gland in these cases accounts for most of the difference in late hypocalcaemia, compared to a targeted operation. The audit does not, however, interrogate the pathology of each parathyroid gland individually, hence it is not possible to determine to what extent over-diagnosis of multi-gland disease at bilateral exploration occurs. This might influence the rate of *avoidable* late hypocalcaemia in non-targeted surgery.

First-time parathyroid surgery for patients with a primary pathology: late hypocalcaemia

			La	te hypocalcaemi	a
		No	Yes	Unspecified	Rate
eq	No	3,893	143	914	3.5% (3.0-4.2%)
Targeted	Yes	4,196	68	1,205	1.6% (1.2-2.0%)
Tar	Unspecified	101	3	33	2.9% (0.7-8.8%)
	No glands	170	1	17	0.6% (0.0-3.7%)
SE	1 gland	6,553	107	1,686	1.6% (1.3-1.9%)
ed a	2 glands	1,014	32	278	3.1% (2.1-4.3%)
per or gr removed	3 glands	246	23	85	8.6% (5.6-12.7%)
Number or glands removed	3.5 glands	83	25	32	23.1% (15.8-32.4%)
	4 glands	9	25	14	73.5% (55.3-86.5%)
	Unspecified	115	1	40	0.9% (0.0-5.4%)

The rate of general complications is similar to that seen for thyroid surgery:

•	myocardial infarction	0.06%.
•	deep vein thrombosis/pulmonary embolus	0.01%.
•	Respiratory	0.47%.
•	cerebrovascular accident	0.04%

Other complications recorded as free text include:

. . . .

•	wound infection	(n=43).
•	seroma	(n=9).
•	bleeding	(n=23).
•	reaction to methylene blue	$(n=4)^{-1}$.
•	thyrotoxicosis	(n=3).

1. Equivalent to 0.25% of cases where methylene blue was used

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Mortality

Mortality after parathyroid surgery is very infrequent.

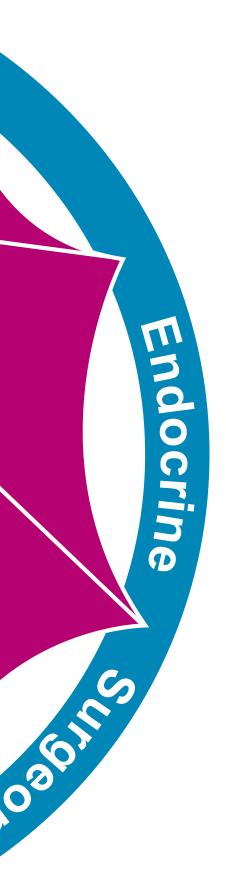
Parathyroid surgery: in-hospital mortality

		In-hospital mortality				
	_	Alive	Deceased	Unspecified	Rate (95% CI)	
	2011	1,810	3	165	0.17% (0.04-0.53%)	
	2012	2,048	3	266	0.15% (0.04-0.47%)	
ar	2013	2,682	2	172	0.07% (0.01-0.30%)	
Year	2014	2,810	6	332	0.21% (0.09-0.49%)	
	2015	2,435	0	278	0.00% (0.00-0.12%)	
	All	11,785	14	1,213	0.12% (0.07-0.20%)	

In contrast to the 2012 report, mortality in the present series was not higher in renal HPT cases compared to primary HPT, although the absolute number of deaths was very small; but was influenced by patient age; age of survivors (median age 62 years; IQR: 52-71 years) compared to those who died (median age 73 years; IQR: 56-78 years); p=0.045 (Mann-Whitney U-test).

Unlike the situation for thyroidectomy, detailed in the previous chapter, the data on mortality have not been investigated to exclude the possibility of inadvertent entry of *death in hospital* (hence mortality rate may be over-estimated here), nor to establish cause of death.





Surgery for adrenal disease

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Surgery for adrenal disease

General information from the database

Number of procedures

The rate of accrual of adrenal operations into the UKRETS has increased only marginally since the 2012 report, the present rate being around 400 cases *per* year.

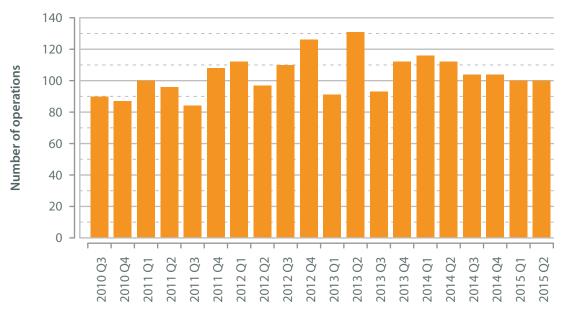
These cases have been entered by 47 members, whose collective median of reported adrenal case-load was 35 (range: 1-160) cases *per* 5 years, or around 7 (up to 32) cases *per* year.

These estimates of annual case-load should be interpreted with caution, because:

- surgeons may not enter all their cases onto the UKRETS.
- *dual operated* cases (more commonly an issue in adrenal surgery, as detailed below, under *surgical team*) are attributed here only to the primary surgeon.
- case-loads may be under-estimated for those surgeons newly joining the BAETS or retiring part-way through the study period.

Nonetheless, it is interesting to note that only 21 members performed an average of 6 or more adrenal operations *per* year, which is the recommended minimum annual volume of practice contained in recent UK guidelines for adrenal surgery. Also, there were 6 surgeons reporting an average of 1 or fewer adrenal operations *per* year.

Number of adrenal operations recorded (n=2,073)



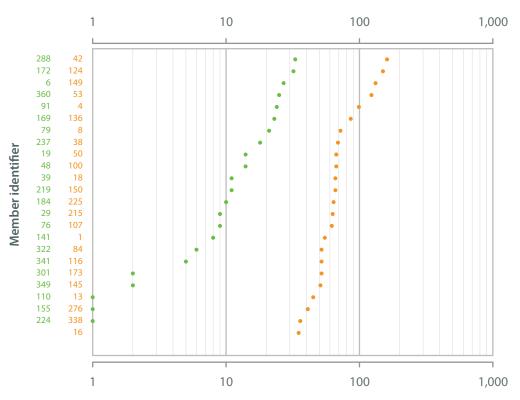
Date of operation /calendar year and quarter

Surgery for adrenal disease

The British Association of Endocrine and Thyroid Surgeons

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Adrenal surgery: Number of operations reported by each member



Number of operations recorded (logarithmic scale)



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Demographics and disease profile

Age and gender

The demographic profile for adrenal disease is similar to that seen in previous reports, with most operations being performed in the age groups 40-70 years, and with a female: male ratio of 1.2:1.

Adrenal surgery: age and gender

			Ge	ender		
		Male	Female	Unspecified	All	Proportion male
	<21	17	25	0	42	40.5%
	21-30	39	72	0	111	35.1%
ars	31-40	89	130	0	219	40.6%
surgery / years	41-50	191	247	0	438	43.6%
lery	51-60	246	234	0	480	51.2%
iurg	61-70	256	246	0	502	51.0%
aţ	71-80	100	135	0	235	42.6%
Age	>80	12	23	0	35	34.3%
,	Unspecified	3	8	0	11	27.3%
	All	953	1,120	0	2,073	46.0%

Adrenal surgery: Age distributions (n=2,062)



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Diagnosis

The majority of adrenal surgery is carried out for functional tumours, with phaeochromocytoma being the commonest of these.

The proportion of surgery performed for metastases to the adrenal gland has steadily increased since the inception of the audit, and is again higher here than in the 2012 report (7.4% *versus* 5.0%). The reasons for this are not apparent from the data, but could conceivably include:

- a trend towards more aggressive management of known metastatic cancer where this involves the adrenal gland. In support of this, it is noted that 8 of the 146 cases involved bilateral adrenal ectomy.
- increasing diagnosis of metastases amongst incidentalomas of the adrenal gland.
- more conservative management of non-functioning adrenal lesions with more benign appearances on imaging.

For non-functioning adenomas, the indication for surgery may be to exclude malignancy, based on equivocal radiological findings. Lesion size over 4 or 5 cm diameter is traditionally considered important in this regard, and so it is interesting to note that the median lesion size (where recorded) in this group was 5 cm (IQR: 4-6 cm).

Adrenocortical carcinoma (ACC; carcinoma in the table below) was recorded in 105 cases over the 5-year study period. These operations were performed by 27 surgeons, whose median number of ACC's treated was 2 in 5 years (range: 1-20). Only 5 surgeons performed an average of more than one adrenalectomy *per* year for ACC. These figures might argue in favour of greater concentration of surgery for this rare disease in a small number of regional centres, given the more complex issues arising in management of this highly lethal condition.

The database does not record the mode of presentation (hormonal dysfunction, incidental, cancer staging, etc.), hence it is difficult to assess potential reasons for temporal trends in the surgical management of adrenal disease. The database could readily be revised to collect this information.

Adrenal surgery: diagnosis

			Data
		Count	Rate (95% CI)
	Adenoma	200	10.1% (8.8-11.5%)
	Carcinoma	105	5.3% (4.4-6.4%)
	Conn's	333	16.8% (15.2-18.5%)
Sis	Cushing's	333	16.8% (15.2-18.5%)
Diagnosis	Metastasis	146	7.4% (6.3-8.6%)
Dia	Phaeo	603	30.4% (28.4-32.5%)
	Other	263	13.3% (11.8-14.9%)
	Unspecified	90	
	All	2,073	



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Other diagnoses

There is a wide range of pathology recorded under Other diagnosis.

Many of these procedures are likely to have been performed for diagnostic purposes, given the limitations of non-operative diagnosis for many solid adrenal lesions.

Myelolipoma of the adrenal gland, however, is considered definitively benign, and often has diagnostic appearances on imaging. Larger lesions may be more prone to haemorrhage, and this consideration may explain the finding of a relatively large lesion size for excised myelolipomas (median = 9.7 cm; range: 6-18 cm).

Several members recorded *dual secreting* lesions under *Other* diagnoses, mainly combined Conn's/Cushing's syndromes. Consideration should be given to revision of the database, to allow for this situation to be recorded more robustly.

A further 5 operations for metastasis were also recorded here, indicating that the percentage of operations for this indication is marginally higher than that recorded above.

Where provided (n=216) the *Other* diagnoses were as follows:

•	Adenoma	6
•	Cyst / pseudocyst	32
•	Ganglioneuroma	21
•	Hyperplasia	15
•	Metastasis	5
•	Myelolipoma	19
•	Nerve sheath tumours	11
•	Oncocytoma	3
•	Paraganglioma	29
•	Vascular abnormalities	6
•	Other functional diagnoses	18
•	Other / non-specific	51

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Malignancy

Malignancy and diagnosis

Malignancy is recorded as a separate field in the database, allowing some comparison of malignancy rates for the various functioning / non-functioning lesions.

The degree of missing data for this field is lower than in the 2012 report, at 12.6%, though is highest, amongst the functional tumours, for phaeochromocytoma. This may reflect the difficulty in assigning a definite malignant diagnosis based on histopathology for many adrenal lesions.

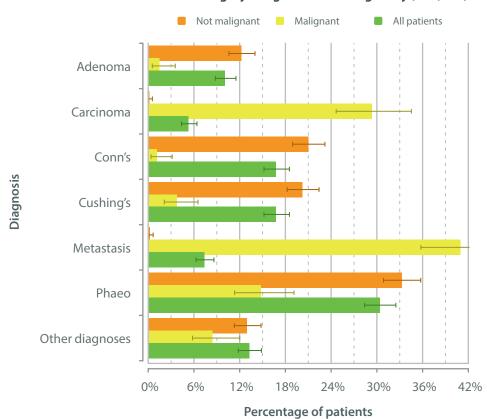
The commonest malignant diagnoses are adrenocortical carcinoma, metastases and phaeochromocytoma.

The commonest benign diagnoses are phaeochromocytoma, Conn's and Cushing's adenomas.

For functioning tumours, the recorded rates of malignancy are:

•	Conn's	1.3%.
•	Cushing's	4.2%.
•	Phaeochromocytoma	9.5%.

Adrenal surgery: Diagnosis and malignancy (n=1,983)



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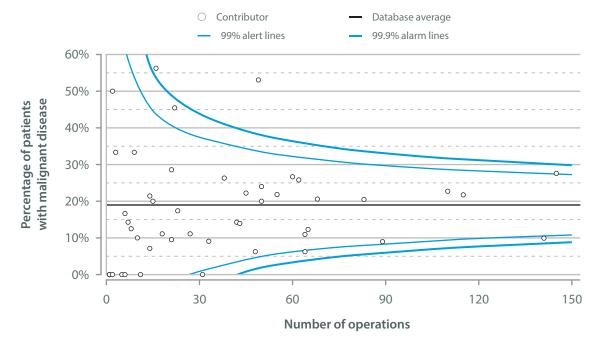


Malignancy rates for each member

Variation between surgeons with respect to their rates of malignancy is largely within the expected statistical confidence limits.

Additional, non-random variation may be due to differences in referral practice / sub-specialisation, or due to varying interpretation of the *malignant* data field, as detailed above.

Adrenal surgery: Rates of malignancy (n=1,813)



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Malignancy and maximum size on radiology

The data on radiological lesion size are now much more mature (this was an additional data field in the September 2010 revision of the database). They show, much more clearly than in the last report, the relationship between size and stated rate of malignancy.

The traditional teaching that lesions over 5 cm diameter have a higher risk of malignancy is supported.

However:

- the point at which risk starts to rise more steeply seems closer to 6 cm than 5 cm.
- only by 10 cm size does the malignant: benign ratio exceed unity.

For those lesions of <5 cm diameter which were labelled malignant, the following diagnoses were recorded:

1. Adenoma n = 1.

Presumably an error in data entry, as this diagnosis implies benignity.

2. Carcinoma (ACC) n = 8.

These lesions ranged in size from 16-47 mm, and represented 7.6% of all ACCs. Absolute confirmation of malignancy may be difficult for lesions at the lower end of this size spectrum (unless metastases to other organs exist).

3. Conn's n = 4.

Representing 1.2% of all Conn's lesions.

4. Cushing's n = 2.

Presumably, these were ACCs. The *adrenal diagnosis* field has only mutually exclusive options, and might usefully be revised to resolve this dilemma in data entry.

5. Metastasis n = 81.

Representing 58% of all metastatic lesions. Hence, the majority of *small* malignant lesions are metastases, and the majority of metastases are <50 mm diameter.

6. Phaeochromocytoma n = 11.

Representing 44% of phaeochromocytomas.

7. Othern = 4.

These included one further metastasis, one case of Castleman's disease (technically not malignant), one local invasion from renal cancer and one para-aortic paraganglioma.

For malignant lesions of 10 cm or greater diameter, 31% were ACC, 31% Other and 22% phaeochromocytomas.

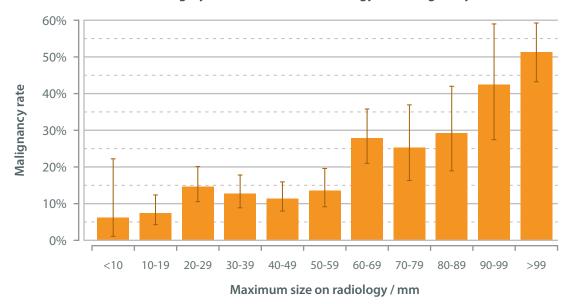
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Adrenal surgery: maximum size on radiology and malignancy

			Malignancy	
	No	Yes	Unspecified	Malignancy rate (95% CI)
<10	30	2	1	6.3% (1.1-22.2%)
10-19	175	14	4	7.4% (4.3-12.4%)
20-29 30-39 40-49 50-59 60-69	197	34	20	14.7% (10.5-20.1%)
30-39	206	30	9	12.7% (8.9-17.8%)
40-49	241	31	23	11.4% (8.0-15.9%)
50-59	159	25	18	13.6% (9.1-19.6%)
60-69	109	42	10	27.8% (21.0-35.8%)
70-79	56	19	8	25.3% (16.3-36.9%)
80-79	46	19	4	29.2% (18.9-42.0%)
90-99	23	17	4	42.5% (27.4-59.0%)
>99	77	81	14	51.3% (43.2-59.2%)
Unspecified	150	30	145	
All	1,469	344	260	

Adrenal surgery: Maximum size on radiology and malignancy (n=1,633)





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Diagnosis and anatomy

Where adrenal pathology was unilateral, there was a slight, but significant, predominance of left-sided lesions (all pathology, z=2.94, p=0.003), although for phaeochromocytoma and *Other* diagnoses, the incidence of right-and left-sided lesions was equal.

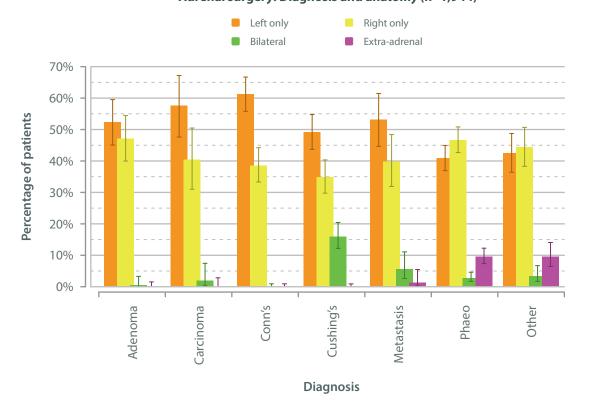
As expected, most bilateral adrenalectomies were performed for Cushing's disease and for phaeochromocytoma.

For extra-adrenal lesions, the majority were phaeochromocytomas / paragangliomas (of the 25 Other diagnoses, 13 were recorded in various free text as paragangliomas). Technically, phaeochromocytoma refers to tumours of this type occurring within the adrenal gland, and the Adrenal diagnosis field could usefully be amended to ensure accurate recording of these lesions.

Adrenal surgery: diagnosis and anatomy

		Anatomy					
		Left	Right	Bilateral	Extra- adrenal	Unspecified	AII
	Adenoma	101	91	1	0	7	200
	Carcinoma	60	42	2	0	1	105
	Conn's	197	124	0	0	12	333
Sis	Cushing's	161	114	52	0	6	333
Diagnosis	Metastasis	76	57	8	2	3	146
<u>Dia</u>	Phaeo	244	279	17	57	6	603
	Other	110	115	9	25	4	263
	Unspecified	5	8	1	0	76	90
	All	954	830	90	84	115	2,073





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Operation

Operation type

As seen in the last report, the laparoscopic approach to adrenalectomy is favoured, with 83% of cases having laparoscopic surgery, of which 5.8% are converted to open surgery. Conversion is more common in malignant than benign cases (18.8% *versus* 3.8% respectively), as might be expected.

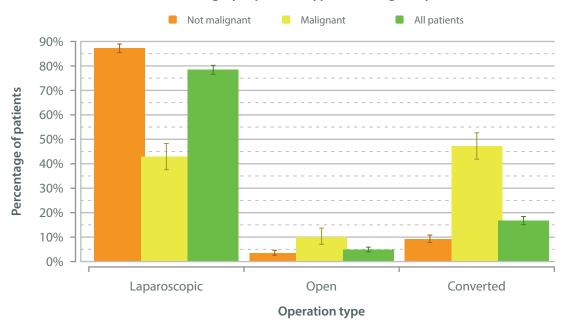
For laparoscopic surgery, the trans-peritoneal approach remains favoured over the endoscopic posterior approach (89% of laparoscopic procedures being performed *via* the trans-peritoneal route).

The posterior endoscopic approach was performed by only 14 surgeons, whose median number of cases performed by this route was 5 (range: 1-73), over the 5-year interval.

Adrenal surgery: operation type and malignancy

			Ma	lignant	
		No	Yes	Unspecified	All
e C	Laparoscopic	1,280	147	128	1,555
type	Converted	51	34	11	96
ţior	Open	135	162	34	331
Operation	Unspecified	3	1	87	91
ŏ	All	1,469	344	260	2,073

Adrenal surgery: Operation type and malignancy (n=1,982)



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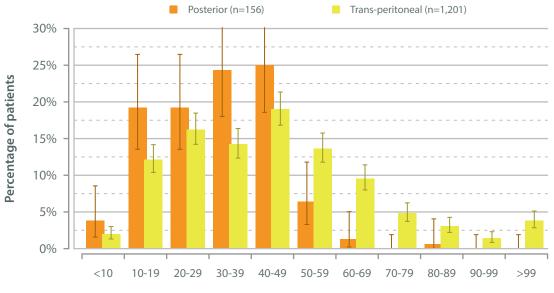


Operative approach is clearly dependent upon lesion size, as expected.

The posterior endoscopic approach is rarely used for lesions over 50 mm diameter, whilst a significant number of larger lesions are removed by trans-peritoneal laparoscopic surgery.

The probability of any laparoscopic approach being employed (as opposed to open surgery) was 93% for lesions <50 mm diameter, 88% for lesions 50-70 mm diameter, 79% for lesions 70-90 mm diameter, and 36% for lesions >90 mm diameter

Laparoscopic adrenal surgery: Operative approach & lesion size



Maximum size on radiology / mm

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Adrenal surgery is clearly consultant-led, with 96% of cases having a consultant involved, either as primary surgeon or assistant.

Where a consultant was primary surgeon, the assistant was also a consultant in 18.3% of operations. As with thyroid surgery, such dual-operating can now be registered prospectively, to allow for each consultant's involvement to be recognized, when calculating their patients' outcomes.

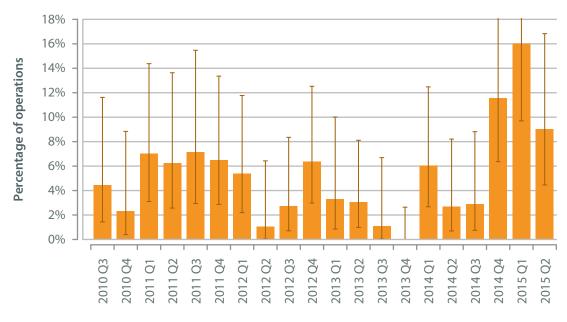
The incidence of dual-operating by two consultants is relatively stable over time.

Where the primary surgeon was not a consultant, this role was almost exclusively performed by a Fellow, or a senior Registrar. In these cases, a consultant was the assistant in 85% of cases.

Adrenal surgery: surgical personnel

		Surgical po	ersonnel		
	Surgeon		Ass	istant	
	Count	Proportion	Count	Proportion	
None	0	0.0%	12	0.6%	
Consultant	1,849	89.2%	512	24.7%	
Fellow	42	2.0%	158	7.6%	
Staff grade	1	0.0%	18	0.9%	
Registrar (year 1-3)	4	0.2%	267	12.9%	
Registrar (year 4+)	110	5.3%	732	35.3%	
BST	0	0.0%	168	8.1%	
Other	0	0.0%	77	3.7%	
Unspecified	67		129		
All	2,073	_	2,073		

Adrenal surgery: Dual operating over time (n=2,073)

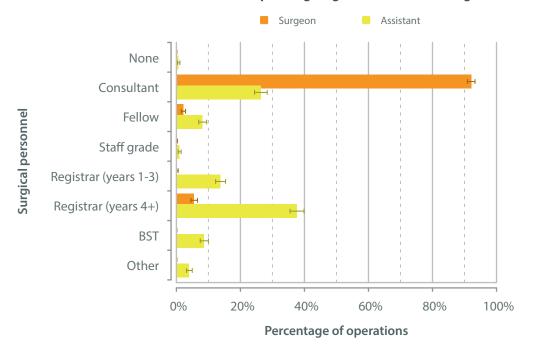


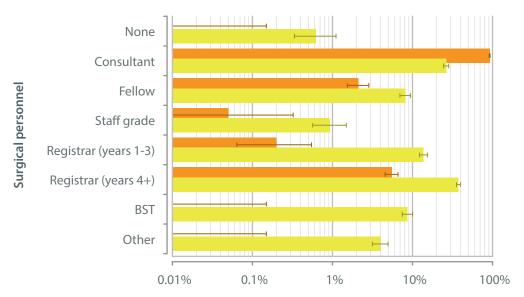
Date of operation / calendar year & quarter

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Adrenal surgery:
Most senior operating surgeon and assistant surgeon





Percentage of operations (logarithmic scale)

Surgery for adrenal disease

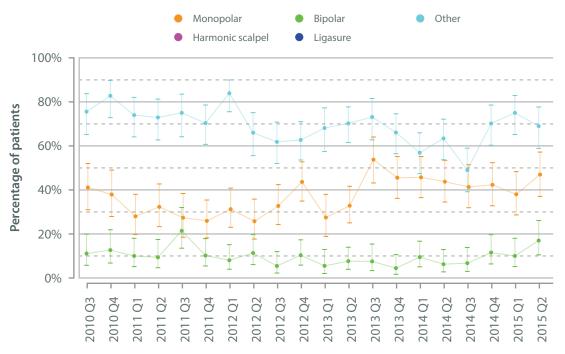
The British Association of Endocrine and Thyroid Surgeons

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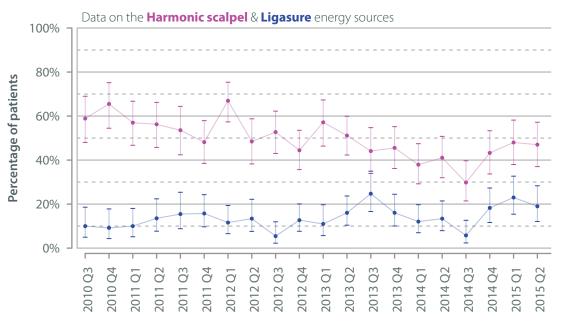
Energy source used

Around 70% of adrenal surgery is carried out using alternative energy devices, mainly the Harmonic scalpel and Ligasure devices. There has been a marginal increase in the use of the Ligasure device, at the expense of Harmonic scalpel, over the last 5 years.





Date of operation / calendar year and quarter



Date of operation / calendar year and quarter

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Outcomes

Post-operative stay

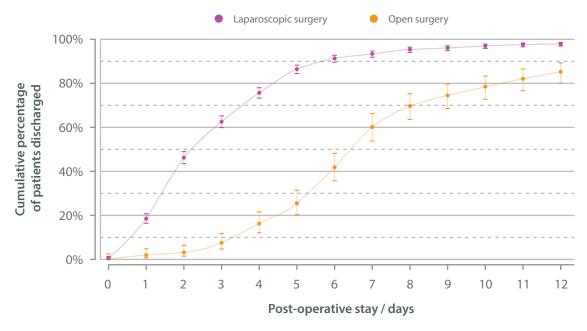
Exactly as seen in the last report, the principal determinant of length-of-stay after adrenal surgery is whether it was laparoscopic or open. Median length-of-stay is around 4 days longer after open than after laparoscopic surgery.

Even when laparoscopic surgery is successful, length-of-stay is shortest for Conn's and non-functioning adenomas, compared to phaeochromocytoma, Cushing's or malignant cases. This likely reflects the greater co-morbidity or management of haemo-dynamic/metabolic issues in the latter cases.

Adrenal surgery: post-operative stay

		1	Post-operative sta	ау
		Count	Median / days	IQR / days
	Adenoma	180	2	2-4
	Carcinoma	81	7	4-10
	Conn's	280	2	1-4
2	Cushing's	280	4	2-5
Viaginosis	Metastasis	118	4	2-6
7	Phaeo	477	4	2-6
	Other	219	3	2-6
	Unspecified	3	3	1-4
	All	1,638	3	2-6
ע	Laparoscopic	1,302	3	2.0-4.0
5	Converted	78	6.5	5.0-9.5
	Open	251	7	5.0-10.0
סאבו מנוסוו נאאב	Unspecified	7	3	1.0-5.0
5	All	1,638	3	2.0-6.0

Adrenal surgery: Post-operative stay (n=1,553)



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Related re-admission

Re-admission after adrenal surgery is relatively uncommon, with surprisingly little difference between open and laparoscopic approaches, particularly given that post-operative complications by the time of initial discharge are much commoner after open surgery.

Re-operation for bleeding is also very uncommon. It is more frequent after open than laparoscopic surgery, probably reflecting the range of pathology and lesion size requiring open surgery, as detailed above.

Adrenal surgery: related re-admission and operation type

			Related re-admission					
		No	Yes	Unspecified	Rate (95% CI)			
e O	Laparoscopic	1,106	37	412	3.2% (2.3-4.5%)			
type	Converted	67	2	27	2.9% (0.5-11.0%)			
	Open	219	9	103	3.9% (1.9-7.6%)			
peration	Unspecified	9	0	82	0.0% (0.0-28.3%)			
5	All	1,401	48	624	3.3% (2.5-4.4%)			

Post-operative complications

Adrenal surgery: post-operative complications and operation type

			Post-operative complications					
		No	Yes	Unspecified	Rate (95% CI)			
ə	Laparoscopic	1,305	112	138	7.9% (6.6-9.5%)			
peration type	Converted	68	20	8	22.7% (14.8-33.1%)			
	Open	234	56	41	19.3% (15.0-24.4%)			
	Unspecified	15		76	0.0% (0.0-18.1%)			
5	All	1,622	188	263	10.4% (9.0-11.9%)			

Complications were:

•	MI	0.22%.
•	DVT/PE	0.33%.
•	Respiratory	4.03%.
•	CVA	0.06%.

Other complications recorded in the free text field included:

•	wound infection	n = 21.
•	bleeding	n = 10.
•	urinary retention / infection	n = 6.



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Re-operation for bleeding

Adrenal surgery: re-operation for bleeding and operation type

		Re-operation for bleeding					
	No	Yes	Unspecified	Rate (95% CI)			
Laparoscopic	1,323	8	224	0.6% (0.3-1.2%)			
Converted	85	0	11	0.0% (0.0-3.5%)			
Open	269	5	57	1.8% (0.7-4.4%)			
Unspecified	5	0	86	0.0% (0.0-45.1%)			
All	1,682	13	378	0.8% (0.4-1.3%)			

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Mortality

Death during the index admission is a rare outcome after adrenal surgery.

Adrenal surgery: in-hospital mortality

		In-hospital mortality						
	Alive	Deceased	Unspecified	Rate (95% CI)				
2011	335	3	35	0.89% (0.23-2.79%)				
2012	335	3	63	0.89% (0.23-2.79%)				
2013	428	2	28	0.47% (0.08-1.86%)				
2013	376	0	57	0.00% (0.00-0.79%)				
2015	357	1	50	0.28% (0.01-1.79%)				
All	1,831	9	233	0.49% (0.24-0.96%)				

Unlike the situation for thyroidectomy detailed in previous sections, the data on mortality have not been investigated to exclude the possibility of inadvertent entry of *death in hospital* (hence mortality rate may be over-estimated here), nor to establish cause of death.

- 9 deaths / 1,839 (233 unspecified) = 0.5% (95% CI: 0.2-1.0%)
- 3 female; 6 male
- ages: 47, 49, 58, 60, 63, 65, 70, 72, 83 years
- diagnoses: carcinoma ×2; Conn's ×1; Cushing's ×2; metastasis ×2; Phaeo ×2
- 2 open; 2 converted; 5 laparoscopic





Appendix



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Appendix

Database forms

The Bristish Association of Endocrine & Thyroid Surgeons National database: Thyroid surgery Baseline section; Page 1; Version 3.0 (10 Oct 2014) **Basic demographic data** All baseline data refer to the condition of the patient when they were originally diagnosed. Unique patient identifier Date of birth dd/mm/yyyy O Male O Female Gender **Dual-operating case** O Yes (please complete the name of the second consultant) Name of the principal operating surgeon Name of the second operating surgeon Hospital where the procedure was performed Powered by **Dendrite Clinical Systems**



Nati	ona	ciation of Endocrine & Thyroid Sur I database: Thyroid surgery on; Page 2; Version 3.0 (10 Oct 20 dd/mm/yyyy	_	
		ial registry data		
Main indication for thyroid surgery	0000	Thyrotoxicosis Compressive symptoms Completion thyroidectomy for cancer Quality of life Recurrent cancer	0	Recurrent cyst Biopsy result Thyroglossal cyst Clinically worrying lesion
Thyroid status at presentation	l .	Euthyroid Hyperthyroid	0	Hypothyroid
Goitre type	0	Cervical Retroclavicular		Upper border AA Below AA
Sternal split / thoracotomy required	0	No	0	Yes
Pre-operative voice change	0	No	0	Yes
Pre-op laryngoscopy	0	No	0	Yes
Re-operation	0	No	0	Yes
Same side as previous operation	0	No	0	Yes
FNAC	0	No	0	Yes
FNAC result	000	C1 - non-diagnostic C2 - non-neoplastic C3 - follicular lesions / neoplasia canno C4 - abnormal; suspicious of malignand C5 - malignant		excluded
Thy 3 sub-categorization		Thy3a Thy 3f	0	Not recorded
MEN	0	No	0	Yes





Unique patient identifier					
Date of operation			dd / mm / yyyy		
	Thy	roid surgery p	rocedure		
Grade of principal surgeon	0 0 0	Registrar (year		0	Staff grade Fellow Other
Grade of assistant surgeon	0 0 0	Consultant Registrar (year		0	BST Staff grade Fellow Other
Side of thyroid procedure	0	None	☐ Left		Right
Side of nodal procedure	0	None	☐ Left		Right
Previous contralateral lobectomy	0	No		0	Yes
Isthmusectomy alone	0	No		0	Yes
Thyroid procedure: left	000	Sub / near tota		0	Biopsy Other
Thyroid procedure: right	0 0 0	· · · · · · · · · · · · · · · · · · ·		0	Biopsy Other
Thyroid node dissection: left		I II III			V VI VII Biopsy only
Thyroid node dissection: right		I II III			V VI VII Biopsy only
Recurrent laryngeal nerve sacrificed	0	No		0	Yes
Thymectomy	0	No		0	Yes



The Bristish Association of Endocrine & Thyroid Surgeons National database: Thyroid surgery Baseline section; Page 4; Version 3.0 (10 Oct 2014) Unique patient identifier Date of operation dd/mm/yyyy								
Thyroid surgery procedure								
Nerve monitoring used	0	No	0	Yes				
Nerve monitoring method	0	Continuous	0	Intermittent				
Monitor	0	Medtronic NM Magstim	0	Other				
Other monitor details								
ET tube with integrated electrodes	0	No	0	Yes				
Energy source used		Monopolar diathermy Bipolar diathermy		Other				
Other energy source used	0 0 0	Bipolar scissors Harmonic scalpel Ligasure	0 0	Lotus Gyrus Other				
Details of other energy source								





Baseline s		I database: Thyroid surg on; Page 5; Version 3.0 (10 ()	
Unique patient identifier					
Date of operation		dd / mm / yyyy	,		
	Prin	nary thyroid pathology			
Thyroid pathology	0	Single pathology	0	Multiple pathologies	;
Primary thyroid pathology	000000000	Colloid adenoma Simple cyst Follicular adenoma Hurthle cell adenoma FTC Hurthle cell carcinoma PTC	0 0 0 0 0	Anaplastic Lymphoma Metastatic C-cell hyperplasia Graves' disease Auto immune thyroi Other cancer Other	ditis
Details of other primary thyroid pathology					
Thyroid malignancy resectable	0	No Yes	0	Unknown	
Т	0	T0 O T1b T1a O T2	0		T4b TX
N	0	NO O N1a	0	N1b O	NX
M	0	MO	0	M1	
TNM staging (version 7)	0 0 0	Stage I Stage II Stage III	0 0	2	
Was patient discussed at MDM before first operation	0	No Yes			
Was patient discussed at MDM after first operation	0	No Yes			
Side of this malignancy	0	Left Right	0	Bilateral	
• Powered by					



		I database: T on; Page 6; Ve)		
Unique patient identifier								
Date of operation			dd/	mm / yyyy				
	Sec	ondary thyroid	path	nology				
Additional thyroid pathology	0000000	Colloid goitre Colloid adenom Simple cyst Follicular adenc Hurthle cell ade FTC Hurthle cell care PTC MTC	oma enoma		00000	Anaplastic Lymphoma Metastatic C-cell hyperpl. Graves' disease Auto immune Other cancer Other	5	ditis
Details of other additional thyroid pathology								
Thyroid malignancy resectable	0	No Yes			0	Unknown		
Т	0	T0 T1a	_	T1b T2	_	T3 T4a	_	T4b TX
N	0	N0	0	N1a	0	N1b	0	NX
M	0	M0			0	M1		
TNM staging (version 7)	0	Stage I Stage II Stage III			0 0	9		
Was patient discussed at MDM before first operation	0	No Yes						
Was patient discussed at MDM after first operation	0	No Yes						
Side of this malignancy	0	Left Right			0	Bilateral		





	ectic	on ; Page 7; Version 3.0 (10	Oct 2014)	
Unique patient identifier					
Date of operation		dd/mm/yyyy	у		
	Thyr	roid surgery discharge detai	ils		
Re-operation for haemorrhage		No		Yes	
Hypocalcaemia	0	No	0	Yes	
Hypocalcaemia treatment given	0	No	0	Yes	
Post-operative complications	0 🗆 🗆	None MI DVT / PE		Respiratory CVA Other	
Details of other complications					
Patient survival	0	Discharged alive	0	Died in hospital	
Date of discharge / death		dd / mm / yyyy	у		



			ocrine & Thyroid : Thyroid surger		ns
Baseline s	ecti	on ; Page 8; Ve	rsion 3.0 (10 Oc	t 2014	
Unique patient identifier					
Date of operation			dd/mm/yyyy		
	Thy	roid follow up			
Patient lost to follow up within 6 / 12 after surgery	0	No Yes			
Date of follow up			dd/mm/yyyy		
Related re-admission	0	No		0	Yes
Date of related re-admission			dd/mm/yyyy		
Voice change	0	No		0	Yes
Vocal cord check	0	Not done Normal		0	Abnormal
Date of first post-op vocal cord check			dd/mm/yyyy		
Side of vocal cord abnormality	0	Left palsy alone Right palsy alor		0	Bilateral palsy
Outcome of abnormal (cord palsy) vocal cord check at 6 / 12: left	0	Recovered Persistent		0	Pre-existing
Outcome of abnormal (cord palsy)	0	Recovered			
vocal cord check at 6 / 12: right Is the patient on T3 / T4	0	Persistent No		0	Pre-existing Yes
Is the patient taking calcium or Vitamin D	0	No			103
to maintain normocalcaemia at 6 months	0	Yes			
Patient comments					
Database comments					
Powered by Dendrite Clinical Systems					



The British Association of Endocrine and Thyroid Surgeons

Fifth National Audit Report 2017

The Bristish Association of Endocrine & Thyroid Surgeons

National database: Parathyroid surgery

Baseline section; Page 1; Version 3.0 (10 Oct 2014)



	Basic demographic data
	All baseline data refer to the condition of the patient when they were originally diagnosed. $ \\$
Unique patient identifier	
Date of birth	dd/mm/yyyy
Gender	O Male O Female
Dual-operating case	O No O Yes (please complete the name of the second consultant)
Name of the principal operating surgeon	
Name of the second operating surgeon	
Hospital where the procedure was performed	



Appendix

The British Association of Endocrine and Thyroid Surgeons

Fifth National Audit Report 2017



The Bristish Association of Endocrine & Thyroid Surgeons **National database: Parathyroid surgery** Baseline section; Page 2; Version 3.0 (10 Oct 2014) Unique patient identifier dd/mm/yyyy Date of operation **Initial registry data Pre-operative parathyroid details** Pre-op cord check O Yes Nuclear medicine O Negative 0 Positive O Not done Ultrasound O Negative O Positive O Not done CT / MRI O Negative O Positive O Not done O Negative O Positive PET O Not done O Positive Venous sampling O Negative O Not done O Positive Methylene blue Negative O Not done Gamma probe O Negative O Positive O Not done Primary O Renal Hyperparathyroid is mO Familial HPT Sporadic Primary hyperparathyroidism MEN O Carcinoma Normocalcaemic Renal hyperparathyroidism ☐ Hypercalcaemic Dialysis ☐ Medical Rx alone ■ Post-transplant





The British Association of Endocrine and Thyroid Surgeons

Fifth National Audit Report 2017

Natio	nal d	ciation of Endocrin latabase: Parath on; Page 3; Versio	yroid surger	y			
Unique patient identifier							
Date of operation		dd /	mm/yyyy				
	Para	athyroid procedure					
Grade of principal surgeon	0	Consultant Registrar (year 4+) Registrar (year 1-3) BST		0	Staff grade Fellow Other		
Grade of assistant surgeon	0	None Consultant Registrar (year 4+) Registrar (year 1-3)		0	BST Staff grade Fellow Other		
Re-operation	0	No		0	Yes		
Number of previous operations	0	One O	Two	0	Three	0	Four
Location of tumour		Eutopic Ectopic neck		0	Ectopic chest		
Supernumary	0	No		0	Yes		
Number of glands removed	0 0		2 3		3.5 4		
Targeted approach	0	No		0	Yes		
Converted to conventional	0	No		0	Yes		
Converted to conventional	0	No		0	Yes		
qPTH measured	0	No		0	Yes		
Nerve monitoring used	0	No		0	Yes		
Monitor	0	Medtronic NM Magstim		0	Other		
Other monitor details							





Nation	nal d	latabase: Pa	ocrine & Thyroid Surgery arathyroid surgery ersion 3.0 (10 Oct 20			
Unique patient identifier						
Date of operation			dd/mm/yyyy			
	Para	athyroid disch	arge details			
Re-operation for haemorrhage	0	No		0	Yes	
Hypocalcaemia	0	No		0	Yes	
Hypocal caemia treatment given	0	No		0	Yes	
Post-operative complications	0 🗆 🗆	None MI DVT / PE			Respiratory CVA Other	
Details of other complications						
Patient survival	0	Discharged ali	ve	0	Died in hospital	
Date of discharge / death			dd / mm / yyyy			





Natio	nal d	latabase: Pa	docrine & Thyroid S arathyroid surge ersion 3.0 (10 Oct	ry		
Unique patient identifier						
Date of operation			dd/mm/yyyy			
	Para	athyroid follo	w up			
Patient lost to follow up within 6 / 12 after surgery	0	No Yes				
Date of follow up			dd/mm/yyyy			
Persisting hypercalcaemia	0	No		0	Yes	
Related re-admission	0	No		0	Yes	
Date of related re-admission			dd/mm/yyyy			
Voice change	0	No		0	Yes	
Vocal cord check	0	Not done Normal		0	Abnormal	
Date of first post-op vocal cord check			dd / mm / yyyy			
Side of vocal cord abnormality	0	Left palsy alor Right palsy alo		0	Bilateral palsy	
Outcome of abnormal (cord palsy) vocal cord check at 6 / 12: left	0	Recovered Persistent		0	Pre-existing	
Outcome of abnormal (cord palsy) vocal cord check at 6 / 12: right	0	Recovered Persistent		0	Pre-existing	
Is the patient taking calcium or Vitamin D to maintain normocalcaemia at 6 months	0	No Yes				
Patient comments						
Database comments						
Confirmed parathyroid histopathology	0	Adenoma Hyperplasia			Cancer Uncertain	
Powered by						



All baseline data refer to the condition of the patient when they were originally diagnosed. Unique patient identifier Date of birth Gender Dual-operating case Dual-operating surgeon Name of the principal operating surgeon Hospital where the procedure was performed Initial registry data Pre-operative adrenal details Conn's Cushing's Carcinoma Other Details of other adrenal diagnosis Adrenal anatomy Men Cheft Right Cheft C		Bas	ic demograp	ohic data		
Date of birth Gender Male Female Dual-operating case No Yes (please complete the name of the second consultant) Name of the principal operating surgeon Name of the second operating surgeon Hospital where the procedure was performed Initial registry data Pre-operative adrenal details Conn's Cushing's Carcinoma Metastasis Phaeo Metastasis Adrenal diagnosis Adrenal diagnosis Details of other adrenal diagnosis Adrenal anatomy Left Bilateral Right Extra-adrenal MEN No Yes Malignant No Yes				fer to the condition of t	ne pa	atient when they were originally
Gender Dual-operating case Ves (please complete the name of the second consultant) Name of the principal operating surgeon Name of the second operating surgeon Hospital where the procedure was performed Initial registry data Pre-operative adrenal details Adrenal diagnosis Adrenal diagnosis Details of other adrenal diagnosis Adrenal anatomy Left Right Right Extra-adrenal MEN No Yes Malignant No Yes	Unique patient identifier					
Dual-operating case O No O Yes (please complete the name of the second consultant) Name of the principal operating surgeon Name of the second operating surgeon Hospital where the procedure was performed Initial registry data Pre-operative adrenal details O Conn's O Cushing's O Carcinoma O Heastasis O Adenoma Details of other adrenal diagnosis Adrenal anatomy MEN O No O Yes Malignant O No O Yes	Date of birth			dd/mm/yyyy		
Name of the principal operating surgeon Name of the second operating surgeon Hospital where the procedure was performed Initial registry data Pre-operative adrenal details Adrenal diagnosis Adrenal diagnosis Details of other adrenal diagnosis Adrenal anatomy MEN No Yes (please complete the name of the second consultant) Yes (please complete the name of the second consultant) Or Consultant Details of the second operating surgeon Linitial registry data Pre-operative adrenal details Or Carcinoma Or Metastasis Or Adenoma Orther Bilateral Orther MEN No Orther Mess Malignant Orthor No Orther Mess Malignant Orther No Orther	Gender	0	Male		0	Female
Name of the second operating surgeon Hospital where the procedure was performed Initial registry data Pre-operative adrenal details O Conn's O Cushing's O Phaeo O Metastasis O Adenoma O Other Details of other adrenal diagnosis Adrenal anatomy MEN No O No O Yes Malignant No O Yes	Dual-operating case			omplete the name of the	seco	nd consultant)
Hospital where the procedure was performed Initial registry data Pre-operative adrenal details Adrenal diagnosis O Conn's O Cushing's O Phaeo O Metastasis O Adenoma O Other Details of other adrenal diagnosis Adrenal anatomy O Left O Right O Right O Yes Malignant O No O Yes	Name of the principal operating surgeon					
Initial registry data Pre-operative adrenal details Adrenal diagnosis Adrenal diagnosis Details of other adrenal diagnosis Adrenal anatomy MEN Malignant No No No No No No No No No N	Name of the second operating surgeon					
Adrenal diagnosis Adrenal diagnosis O Conn's O Cushing's O Phaeo O Metastasis O Adenoma O Other Details of other adrenal diagnosis Adrenal anatomy O Left O Right O No O Yes Malignant O No O Yes						
Adrenal diagnosis O Cushing's O Phaeo O Metastasis O Other Details of other adrenal diagnosis Adrenal anatomy O Left O Right O Extra-adrenal MEN O No O Yes Malignant O No O Yes		Pre-	operative ad			
Adrenal anatomy O Left O Right O Extra-adrenal MEN O No O Yes Malignant O No O Yes	Adrenal diagnosis	0	Cushing's Phaeo		0	Metastasis
Adrenal anatomy O Right O Extra-adrenal MEN O No O Yes Malignant O No O Yes	Details of other adrenal diagnosis					
Malignant O No O Yes	Adrenal anatomy				_	
	MEN	0	No		0	Yes
Maximum diameter by radiology	Malignant	0	No		0	Yes
waxiiiuii ulaileel by raulology	Maximum diameter by radiology			mm		

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	ional database: Adrenal su section; Page 2; Version 3.0 (1		
Unique patient identifier			
Date of operation	dd/mm/yy	ууу	
	Adrenal procedure		
Grade of principal surgeon	O Consultant O Registrar (year 4+) O Registrar (year 1-3) O BST	O Staff grade O Fellow O Other	
Grade of assistant surgeon	O None O Consultant O Registrar (year 4+) O Registrar (year 1-3)	O BST O Staff grade O Fellow O Other	
Adrenal operation type	O Open O Laparoscopic	O Converted	
Adrenal operation approach	O Trans-peritoneal	O Posterior	
Energy source used	☐ Monopolar diathermy ☐ Bipolar diathermy	☐ Other	
Other energy source used	O Bipolar scissors O Harmonic scalpel O Ligasure	O Lotus O Gyrus O Other	
Details of other energy source			



Nati	iona	l database:	ocrine & Thyroid St Adrenal surgery	_		
	ecti	on ; Page 3; Ve	ersion 3.0 (10 Oct	2014)	
Unique patient identifier]			
Date of operation			dd/mm/yyyy			
	Adr	enal discharge	e details			
Re-operation for haemorrhage	0	No		0	Yes	
Post-operative complications	0	None MI DVT / PE			Respiratory CVA Other	
Details of other complications						
Patient survival	0	Discharged ali	ve	0	Died in hospital	
Date of discharge / death			dd/mm/yyyy			
	_	enal follow up)			
Patient lost to follow up within 6 / 12 after surgery	0	No Yes				
Date of follow up			dd / mm / yyyy			
Related re-admission	0	No	1	0	Yes	
Date of related re-admission			dd/mm/yyyy			
Patient comments						
Database comments						
Powered by Dendrite Clinical Systems						



The British Association of Endocrine and Thyroid Surgeons

Fifth National Audit Report 2017

The Bristish Association of Endocrine & Thyroid Surgeons National database: Pancreas surgery Baseline section; Page 1; Version 3.0 (10 Oct 2014) **Basic demographic data** All baseline data refer to the condition of the patient when they were originally diagnosed. Unique patient identifier Date of birth dd/mm/yyyy O Male Gender O Female **Dual-operating case** O Yes (please complete the name of the second consultant) Name of the principal operating surgeon Name of the second operating surgeon Hospital where the procedure was performed **Initial registry data Pre-operative pancreas details** O Insulinoma O VIPoma Pancreas diagnosis Ppoma 0 Somatostatinoma O Glucagonoma 0 Other Details of other pancreas diagnosis O No O Yes MEN Powered by **Dendrite Clinical Systems**



	onal database: Pancreas surge ection; Page 2; Version 3.0 (10 Oc	
Unique patient identifier		
Date of operation	dd/mm/yyyy	
	Pancreas procedure	
Grade of principal surgeon	O Consultant O Registrar (year 4+) O Registrar (year 1-3) O BST	O Staff grade O Fellow O Other
Grade of assistant surgeon	O None O Consultant O Registrar (year 4+) O Registrar (year 1-3)	O BST O Staff grade O Fellow O Other
Pancreas operation type	O Open O Laparoscopic	O Converted
Pancreas procedure	Enucleation Distal resection Right-sided pancreatectomy	O Total pancreatectomy O Other
Energy source used	☐ Monopolar diathermy ☐ Bipolar diathermy	☐ Other
Other energy source used	O Bipolar scissors O Harmonic scalpel O Ligasure	O Lotus O Gyrus O Other
Details of other energy source		
	Pancreas discharge details	
Re-operation for haemorrhage	O No	O Yes
Post-operative complications	O None MI DVT/PE	Respiratory CVA Other
Details of other complications		
Fistula	O No	O Yes
Pancreatitis	O No	O Yes
Patient survival	O Discharged alive	O Died in hospital
Date of discharge / death	dd/mm/yyyy	O Died III Nospital



Natio	Association of Endocrine & Thyroid Surgeons ional database: Pancreas surgery section; Page 3; Version 3.0 (10 Oct 2014)
	section, rage 3, version 3.0 (10 oct 2014)
Unique patient identifier	
Date of operation	dd/mm/yyyy
	Pancreas follow up
Patient lost to follow up within 6 / 12 after surgery	O No O Yes
Date of follow up	dd/mm/yyyy
Related re-admission	O No O Yes
Date of related re-admission	dd/mm/yyyy
Patient comments	
Database comments	

Latest data from the UK Register of Endocrine & Thyroid Surgery

Auditing the outcomes of surgery has become increasingly important in recent years.

- The General Medical Council's revalidation process is now in place, and requires surgeons to reflect on their results. In order to do so effectively, surgeons must first collect their outcome data, and have a national benchmark against which to compare their results.
- The Consultant Outcomes Publication programme, instituted by NHS England, continues to publish outcome data at individual surgeon and hospital level, in the public domain, helping to satisfy an increasing public demand for information on the results of surgery.
- As financial constraints increasingly influence strategic planning in the NHS, agencies
 which commission surgical services seek reassurance on the effectiveness of surgery, and
 may use audit information to direct patients to providers who can best demonstrate such
 effectiveness.

The British Association of Endocrine and Thyroid Surgeons has operated a Registry of its members' surgical activity and outcomes for many years, and this latest, 5th report highlights many interesting findings arising from analysis of the audit data. The Association's membership is to be congratulated on their contribution to an increasingly valuable resource, which should be of interest to a wide audience, not least surgeons themselves, and their current and future patients.



Mr David Chadwick Director of Audit

The British Association of Endocrine & Thyroid Surgeons

Department of Endocrine Surgery Nottingham University Hospitals City Campus, Hucknall Road

Nottingham, NG5 1PB

United Kingdom

phone +44 1159 691 169

e-mail david.chadwick1@nhs.net

www.baets.co.uk



Dr Peter K H Walton Managing Director

Dendrite Clinical Systems

The Hub
Station Road
Henley-on-Thames
Oxfordshire RG9 1AY
United Kingdom

phone +44 1491 411 288

e-mail peter.walton@e-dendrite.com

www.e-dendrite.com