The British Association of Endocrine & Thyroid Surgeons

Sixth National Audit Report

2021

Prepared by

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on behalf of The British Association of Endocrine & Thyroid Surgeons

Robin Kinsman BSc PhD

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Dendrite Clinical Systems

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Foreword

I am very pleased to write the foreword to this Sixth BAETS National Audit Report, which is based on data from the United Kingdom Registry of Endocrine & Thyroid Surgery (UKRETS) database for the period July 2015 to June 2020, including a comparison of this period to earlier years.

Sebastian Aspinall, as BAETS audit lead, has worked hard with Radu Mihai and Dendrite colleagues including Robin Kinsman and Peter Walton to present in a clear format the UKRETS data. I congratulate them on the excellent report they have produced.

Sebastian Aspinall has led the development of individual thyroid dashboards that members can access, with parathyroid and adrenal dashboards to come, allowing surgeons to easily compare their operative numbers, outcomes, and complications to those of others. This is a significant step forward in supporting the aims of the database to allow us to understand our outcomes and complications, to drive up standards in endocrine surgery, and to be able to inform patients more realistically about the likelihood of particular complications occurring in individual practice.

BAETS continues to support best practice in endocrine surgery, through the thyroid and parathyroid masterclass, the new adrenal masterclass and through our annual scientific meeting and regular webinar series.

The 2021 Endocrine GIRFT specialty report highlights the importance surgeons participating in the UKRETS database.

Surgeons do need to be given support and time to enter the data is as fully as possible, and we would ask employers to ensure that their surgeons are supported in this process.

This Sixth BAETS National Audit Report makes a significant contribution to understanding current endocrine surgical practice in the United Kingdom, allowing clinicians to target areas for continuing improvement in patient care.

Jeremy Davis

President, BAETS

Executive summary

This is the Sixth National Audit Report from the United Kingdom Registry of Endocrine and Thyroid Surgery (UKRETS) and builds on the excellent work in the previous reports.

In this report the majority of analysis was undertaken on data in UKRETS from 2016 to 2020. Where possible this has been compared to data from the Fourth (2006-2010) and Fifth (2011-2015) reports to identify trends in practice over this time. When analysing data on redo, renal and familial parathyroid surgery the entire dataset from the inception of UKRETS was used, as numbers of cases in these categories are relatively small, so this seemed more appropriate.

Many of the figures and tables in this report are similar to those in the previous reports so allowing direct comparison of outcomes between reports. A number of new analyses have been included in this report as new data fields have been added to UKRETS since the publication of the Fifth Report. Also, some new analyses of existing data fields have been carried out to enhance the report, and some of the previously published analyses have been dropped.

I have tried to link the results in this report to British and European surgical guidelines where possible, and have also included relevant published analyses from UKRETS and Hospital Episode Statistics (HES).

UKRETS collects data on thyroid, parathyroid and adrenal operations performed by BAETS members in the United Kingdom. The data fields are outlined in the appendix at the end of this report. There were only nine pancreatic endocrine operations added to the database by BAETS members since 2016, too few to be analysed. It would seem these operations are now undertaken by hepatobiliary surgeons who do not contribute to UKRETS.

Missing data has always been an issue with UKRETS and this is discussed later in the introduction. It is particularly frustrating when key outcomes from surgery (such as date of discharge, mortality, re-admission, re-operation for haemorrhage, recurrent laryngeal nerve palsy and early / late hypocalcaemia) are missing, as these are they key variables upon which the quality of surgery can be determined. Without them the database becomes more a surgical logbook than a tool for meaningful analysis of quality outcomes.

Solutions to the problem of missing data include making these key outcomes mandatory fields, which need completion for the entry to count; alternatively, the Society could contact those members whose data consistently fall below a set standard for data completeness.

As the specialty evolves it adopts new technologies that will need to be covered in UKRETS. Hence there will be a need shortly to add new data fields to UKRETS for robotic adrenalectomy, autofluorescence and possibly remote access thyroidectomy. It also becomes apparent that there are areas where the existing data fields can be improved, such as adding data on ultrasound risk stratification scores for thyroid nodules, linking the operative findings at parathyroidectomy to localisation results, adding prophylactic or therapeutic intent to level 6 / 7 lymph node dissections, and daycase intent to thyroid and parathyroid surgery.

There are now over 130,000 operation entries in UKRETS, which is considerably more than there were at the time of the last audit report. The data are self-reported and therefore are not subject to external validation, which is a weakness of the database.

The results of the analyses presented in this report are interesting and valuable. There is no doubt that the Covid-19 pandemic has had an impact on the data from 2020, with BAETS having issued recommendations on how surgery should be undertaken during this time. Where possible this has been accounted for in the analyses as the fall in the numbers of cases reported in 2020 and changes in practice (such as a reduction in pre- and post-operative laryngoscopy) are certainly due to the pandemic.

A summary of the key findings from this report are presented below:

1. The number of thyroid operations and members adding these to UKRETS *per* year seems to have plateaued out since 2014 / 2015. As approximately half of all thyroid operations undertaken in the United Kingdom are added to UKRETS, further efforts need to be made to get thyroid surgeons not currently contributing to UKRETS to do so.

2. Sternal split is rarely (<2%) undertaken for retrosternal goitre unless the goitre extends below the aortic arch in which case it is performed in 23% of cases.

3. The use of laryngoscopy pre- and post-operatively continues to increase, and since 2015 over half of thyroidectomies underwent both pre- and post-operative laryngoscopy. This should improve the accuracy of reporting recurrent laryngeal nerve palsy, as it is apparent that unless laryngoscopy is undertaken the recurrent laryngeal nerve palsy rate is underestimated.

4. Use of intra-operative nerve monitoring in thyroid surgery continues to increase year on year and was used in nearly two-thirds of thyroid operations in 2020.

5. Fewer thyroid cancers are operated on following a Thy1 (inadequate), Thy2 (non-neoplastic) or Thy4 (suspicious) fine needle aspiration cytology (FNAC) and more after a Thy5 (malignant) result. This would suggest that we are improving the accuracy of pre-operative work-up and selection of patients for thyroid cancer surgery.

6. The risk of malignancy in patients operated on with a Thy3a (atypical) and Thy3f (follicular neoplasm) FNAC seems to be similar (about one in four), but fewer patients are operated on following a Thy3a FNAC than Thy3f.

7. There has been a slight increase in the proportion of patients undergoing thyroid lobectomy for papillary thyroid cancer compared to the Fifth Audit Report. Lobectomy was the commonest procedure undertaken for papillary thyroid cancer up to and including T2 tumours (TNM staging). Perhaps mirroring a more conservative surgical approach to thyroid cancer there was also a reduction in proportion that underwent nodal (including central) surgery since the last report.

8. More discussion of cases with a Thy1 / 2 or 3 FNAC was undertaken in the multi-disciplinary team, perhaps contributing to the reduction of thyroid cancers found following a Thy1 / 2 result.

9. The number of thyroid (and parathyroid) operations performed by trainees has halved over the past decade, raising some concerns about the amount of training being delivered, or perhaps about the numbers of trainees entering the specialty, both of which need to be addressed.

10. Rates of mortality and re-operation for bleeding remain reassuring low. Also rates of post-operative and late hypocalcaemia following thyroidectomy continue to fall with time, which is good to see.

11. The length-of-stay following thyroidectomy continues to fall, with an increase in the proportion of patients staying one night or having their operation as a daycase procedure (though these still account for less than one in ten).

12. The number of parathyroidectomies and members adding data on these operations to UKRETS *per* year continues to rise.

13. Nuclear medicine and ultrasound remain the commonest parathyroid localisation techniques, though use of CT / MRI and 4DCT is increasing with time. Pre-operative localisation is undertaken less often in familial and renal disease, but its use is increasing in the latter.

14. Targeted parathyroidectomy is undertaken in approximately half of first-time parathyroidectomies, and the proportion undergoing targeted surgery has not changed much over the past decade. Conventional parathyroidectomy is often undertaken in first-time parathyroidectomy even when localisation is positive. Whether this reflects patient or surgeon preference, or discordant localisation is not known.

15. Prior to 2013 intra-operative parathyroid hormone (PTH) monitoring was used significantly more often in targeted parathyroidectomy than conventional surgery, but since then its use has increased in both surgical approaches, and over the past couple of years it is used equally in >30% conventional and targeted first-time surgery.

16. The benefit of intra-operative PTH in first-time parathyroidectomy seems small (<2%) with a significant improvement seen in persistent hypercalcaemia overall in first-time parathyroid surgery, but not in targeted parathyroidectomy with intra-operative PTH in the 2016-2020 dataset.

17. Early and late hypocalcaemia following first-time parathyroidectomy are declining with time, without any significant change in the incidence of persistent hypercalcaemia. These results probably reflect the successful adoption of targeted parathyroidectomy since the inception of the database.

18. Length-of-stay following first-time and redo parathyroidectomy is falling, with increasing proportion of patients staying one night or having their surgery as a daycase procedure with time. Approximately 30% of targeted and >20% conventional operations are now daycase procedures.

19. The use of targeted approach and intra-operative PTH is improving in redo parathyroidectomy in line with current guidelines.

20. Use of intra-operative nerve monitoring is increasing in parathyroid surgery. In 2020 it was used in >40% first-time, >50% redo and 40% renal parathyroid operations.

21. The number of adrenal operations added to the database *per* year continues to increase with each audit report.

22. Two-thirds of adrenal operations were undertaken for functional tumours with phaeochromocytoma being the commonest indication.

23. The proportion of adrenalectomies for metastases is increasing and now represents 9% of adrenal operations recorded.

24. The proportion of laparoscopic (more correctly endoscopic) adrenalectomies has increased with time with a decline in the transabdominal and increase in the retroperitoneal approach, which accounted for 15% in recent years, mostly for tumours less than five centimetres.

25. The median length-of-stay following adrenalectomy has declined and was shorter for retroperitoneal (two days), than transabdominal (three days) or open surgery (six days).

26. The incidence of re-operation for bleeding, complications and mortality, particularly following minimally invasive adrenalectomy remain reassuringly low.

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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 endocrine casetype, 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).

Thyroid surgery: age and gender; audit years 2016-2020

		Gender			
		Male	Female	All	Percentage male
Age at operation / years	<21	165	656	**821**	20.1%
	21-30	523	3,007	**3,530**	14.8%
	31-40	1,074	5,583	**6,657**	16.1%
	41-50	1,486	6,417	**7,903**	18.8%
	51-60	1,791	5,813	**7,604**	23.6%
	61-70	1,451	4,078	**5,529**	26.2%
	71-80	846	2,547	**3,393**	24.9%
	>80	173	491	**664**	26.1%
	Unspecified	23	80	**103**	22.3%
	All	**7,532**	**28,672**	**36,204**	**20.8%**

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 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 orange 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 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, the data for a Kaplan-Meier curve).
- the tabular data had already been presented elsewhere in the report.

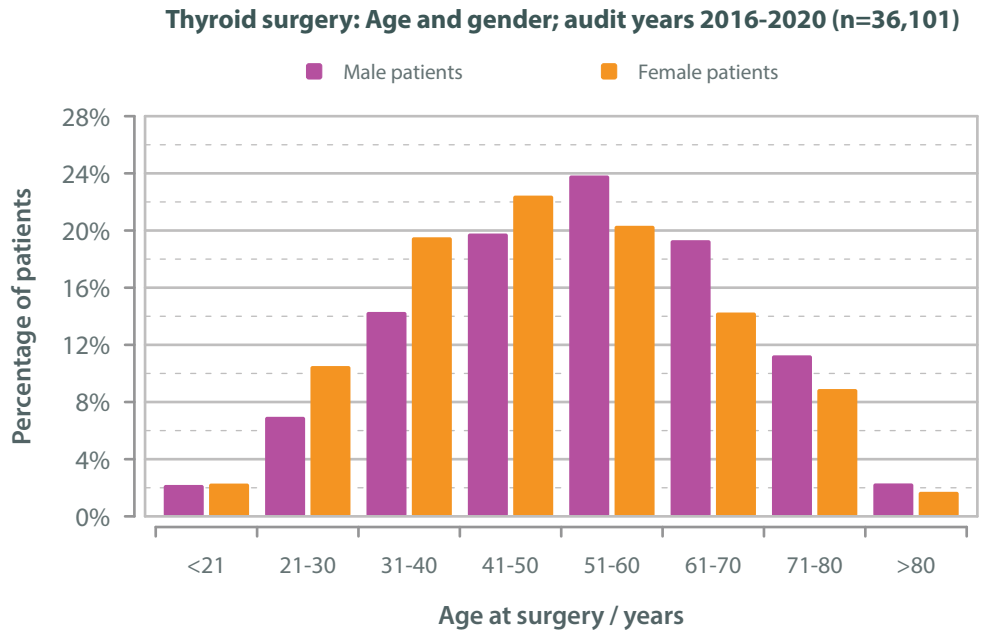
Conventions used in graphs

The basic principles applied when preparing graphs for this Sixth 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 thyroid 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 thyroid surgery and both the patient's age and gender are known are included in the analysis; this comes to 36,101 patient-entries (165 + 656 + 523 + 3,007 + 1,074 + 5,583 + 1,486 + 6,417 + 1,791 + 5,813 + 1,451 + 4,078 + 846 + 2,547 + 173 + 491 ; the 103 entries with unspecified data are excluded from the chart).



Confidence interval: 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.

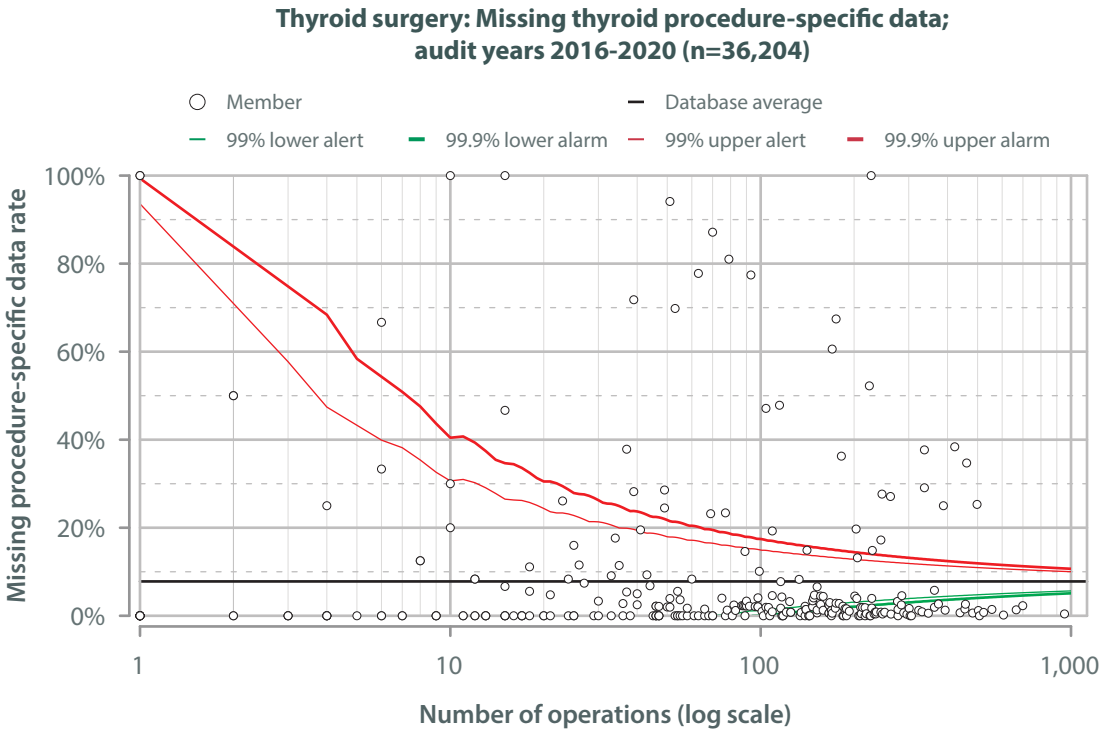
Bars around averaged values (such as patients' age, post-operative length-of-stay, *etc.*) are classical standard error bars or 95% confidence intervals; they give some idea of the spread of the data around the calculated average. In some analyses that employ these error bars there may be insufficient data to legitimately calculate the standard error around the average for each sub-group under analysis; rather than entirely exclude these low-volume sub-groups 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.

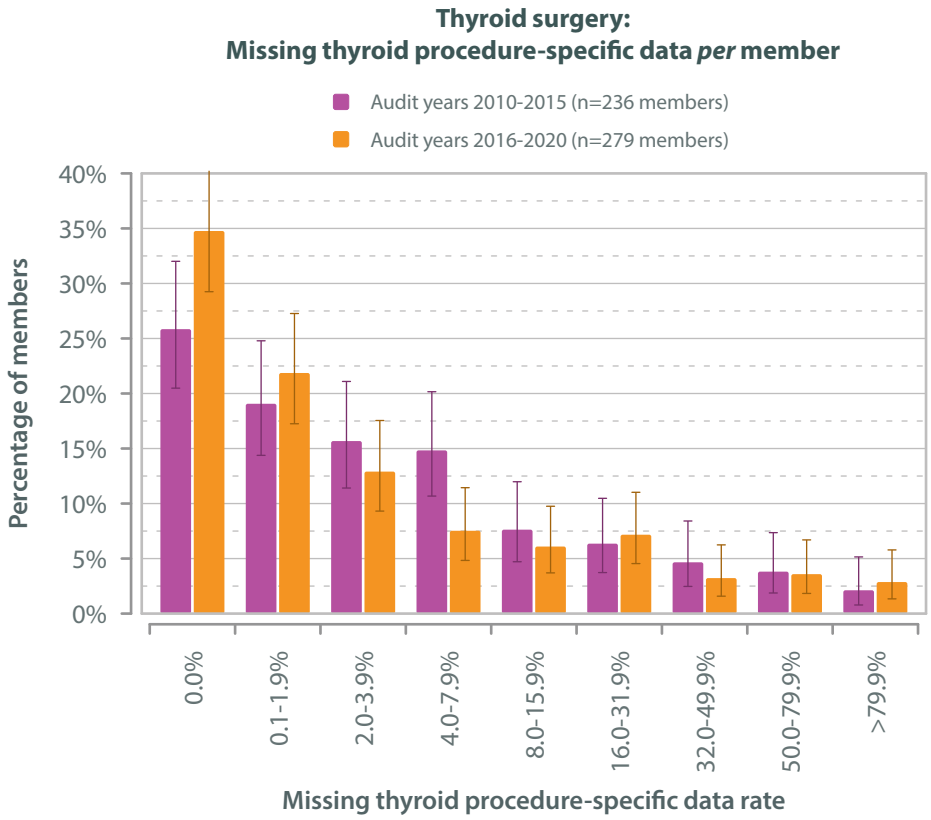
Data quality

Thyroid surgery

The following funnel plot for thyroid surgery shows the missing thyroid procedure data rate against the number of operations recorded in UKRETS *per* member. The database average was <10% which is similar to the Fifth National Audit Report. Variation between members in the completeness of data entry was considerable, with some members having high proportions of missing data. The solution to this may be to increase the number of mandatory data fields in UKRETS, particularly in the key performance outcomes.



The bar chart below compares the proportion of members with different amounts of missing thyroid procedure data. It is clear when analysing data from UKRETS that a small number of members are simply creating a thyroid surgery database entry, and then adding no further data. This leaves operations logged where the kind of thyroidectomy is not defined, and there are neither any pathology nor any outcome data. These records are of little value for analysis.



However, it seems that there has been an improvement in this metric when comparing the current five-year audit period to the previous audit period ... more members have no undefined thyroid operations. But there are still a recalcitrant few who persist in entering the vast majority of their thyroid operations without any qualifying data. The Society would like to find a way to avoid the accumulation of these kinds of database records, as they simply serve to add to the volume of unspecified data in any data analysis, and add no real value beyond counting number of thyroid operations performed.

The funnel plots presented here on missing thyroid procedure data and key data-items use the **calculated** average missing data rate as the *standard*. At the moment, it would seem pertinent to contact all those whose data-point falls above the 99.9% alarm line on these funnel plots, to try and encourage them to improve their data completion rates, as the average missing data rate is, at present, relatively high.

If the completion rates improve, the calculated average missing data rate should fall. Eventually, some members with objectively acceptable missing data rates will fall outside a funnel defined by this improved calculated average rate. In this instance, the Society would not want to pillorize these members, but would still want to identify those whose database records are not adequately completed. This could be achieved by setting a **fixed** standard, such as 5% missing key data, and then contacting any members whose missing data rates fall outside the upper 99.9% alarm line defined by that fixed standard.

The table below shows the missing data rates in selected key data-items in UKRETS. The missing data rates in these data fields appear to be higher in 2016-2020 than 2011-2015.

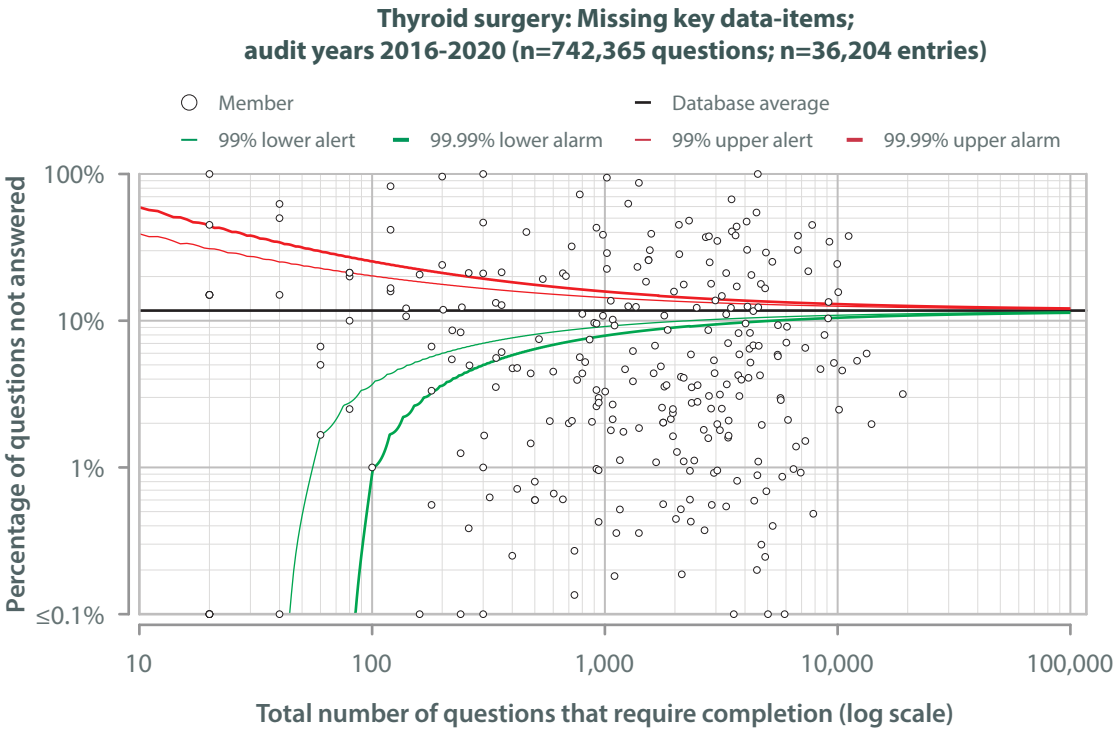
The top five data-items with the highest missing data rates were identical in the last two audit reports. Three were from the follow up section (taking calcium / vitamin D, T3 / 4 and voice change); primary thyroid pathology and date of discharge / death. There were also high rates of missing data in post-operative complications, hypocalcaemia and re-operation for bleeding in both audit reports.

Analysis of data for the National Audit Report is undertaken on data entered up to six months prior to the extraction date to allow members six months to complete their outcomes / follow up data entry. It is possible that some members undertake further data entry after this cut-off so improving the missing data rate with time.

However, if the database is to accurately reflect the true outcomes from endocrine surgical operations in the United Kingdom, it is of the utmost importance that certain key performance indicators (such as voice change, early and late hypocalcaemia, length-of-stay, reoperation for bleeding, pathology and survival) are recorded in UKRETS. The solution to this persistent problem of missing data may be to make these key data-items mandatory.

Thyroid surgery: missing data rates for key data-items across the last two audit periods

Data-item	Missing data rate	
	2011-2015	2016-2020
Main indication for surgery	4.9%	7.0%
Thyroid status at presentation	4.5%	9.7%
Pre-operative laryngoscopy	4.3%	10.3%
Re-operation	4.0%	4.5%
Number previous operations	0.7%	0.2%
FNAC	4.9%	9.1%
FNAC result	0.5%	0.5%
Grade of principal surgeon	3.5%	7.2%
Grade of assistant surgeon	7.0%	12.2%
Side thyroid procedure	1.4%	4.9%
Thyroid procedure: left	0.01%	0.03%
Thyroid procedure: right	0.01%	0.03%
Isthmusectomy alone	11.6%	4.9%
Thymectomy	11.6%	11.2%
Previous contralateral lobectomy	8.2%	4.9%
Primary thyroid pathology	16.1%	18.6%
Re-operation for haemorrhage	8.7%	11.5%
Hypocalcaemia	9.2%	13.0%
Hypocalcaemia treatment given	0.1%	0.1%
Post-operative complications	10.5%	13.0%
Patient survival	9.2%	11.3%
Date of discharge / death	13.5%	15.2%
Voice change	16.4%	20.9%
Is the patient on T3 / T4	16.7%	21.3%
Patient taking calcium or vitamin D at 6 months	19.1%	23.2%
Operation denominator	**31,965**	**36,204**


Thyroid surgery: Missing key data-items;
audit years 2016-2020 (n=742,365 questions; n=36,204 entries)
Member
Database average
99% lower alert
99.99% lower alarm
99% upper alert
99.99% upper alarm
Percentage of questions not answered
100%
10%
1%
≤0.1%
10
100
1,000
10,000
100,000
Total number of questions that require completion (log scale)

Parathyroid surgery

Similar issues were found with missing data rates in the parathyroid section. There were high rates of missing data in the details of localisation techniques from the initial registry data section; presumably this occurred as members only filled the data fields relating to the type of scan that they actually used.

Apart from this, the top five data fields for missing data were the same as in analyses from the last two audit reports. Three from the follow up section (persistent hypercalcaemia, voice change and re-admission) and two from the discharge section (date of death / discharge and post-operative complications). There were also high rates of missing data in the key performance indicators for parathyroid surgery hypocalcaemia: re-operation for bleeding and survival.

The same points outlined above in relation to thyroid surgery pertain to parathyroid surgery missing data rates, and making some of these key data parathyroid outcomes mandatory need to be considered.

Parathyroid surgery: missing data rates for key data-items across the last two audit periods

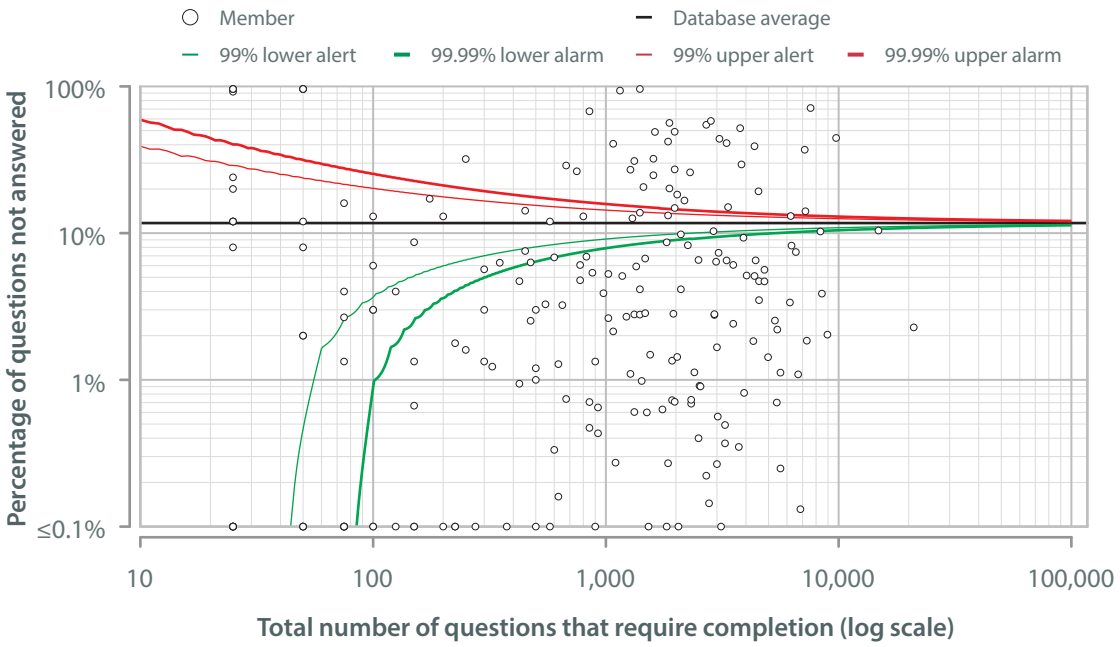
Data-item	Missing data rate 2011-2015	Missing data rate 2016-2020
Pre-op cord check	5.9%	10.9%
Nuclear medicine	4.3%	9.5%
Ultrasound	4.7%	9.6%
CT / MRI	9.3%	13.4%
Venous sampling	8.9%	15.2%
PET	9.3%	14.7%
Gamma probe	9.6%	16.7%
Methylene blue	9.6%	15.7%
Hyperparathyroidism	4.5%	4.2%
Primary hyperparathyroidism	0.13%	0.59%
Renal hyperparathyroidism	0.00%	0.01%
Number of glands removed	4.6%	4.6%
Grade of principal surgeon	3.2%	7.8%
Grade of assistant surgeon	6.6%	13.2%
Re-operation	5.2%	4.6%
Number previous operations	0.45%	0.06%
Targeted approach	4.4%	4.6%
Converted to conventional	7.1%	0.0%
qPTH measured	8.8%	9.9%
Nerve monitoring used	6.3%	11.6%
Re-operation for haemorrhage	7.4%	10.2%
Hypocalcaemia	8.1%	12.1%
Post-operative complications	9.7%	12.3%
Patient survival	8.2%	9.8%
Date of discharge / death	12.7%	12.3%
Persisting hypercalcaemia	19.4%	22.8%
Related re-admission	17.7%	23.7%
Voice change	18.0%	22.8%
Operation denominator	**13,483**	**17,255**

This funnel plot shows, for each member, the proportion of questions not answered in the parathyroid section by the total number of questions.

Overall just over 10% of parathyroid questions were not completed, which was similar to the results reported in the last audit report. There was a wide variation between members in the proportion of questions answered.

The comments relating to missing data for thyroid key data-items also apply here to parathyroid surgery.

Parathyroid surgery: Missing key data-items;
audit years 2016-2020 (n=431,385 questions; n=17,255 entries)



Adrenal surgery

The top three data fields for missing adrenal data were the same in 2011-2015 and 2016-2020 *i.e.,* date of follow up, re-admission and date of discharge.

It is understandable that data in the follow up section in UKRETS is less complete, though there were also high rates of missing data in the discharge section (date of discharge, re-operation for bleeding and post-operative complications) as well as the pathology (malignant yes / no).

It is possible that this last question is confusing as it appears in the initial registry details, which may be completed before the pathology is known. Moving this question to a later section in UKRETS may solve this issue.

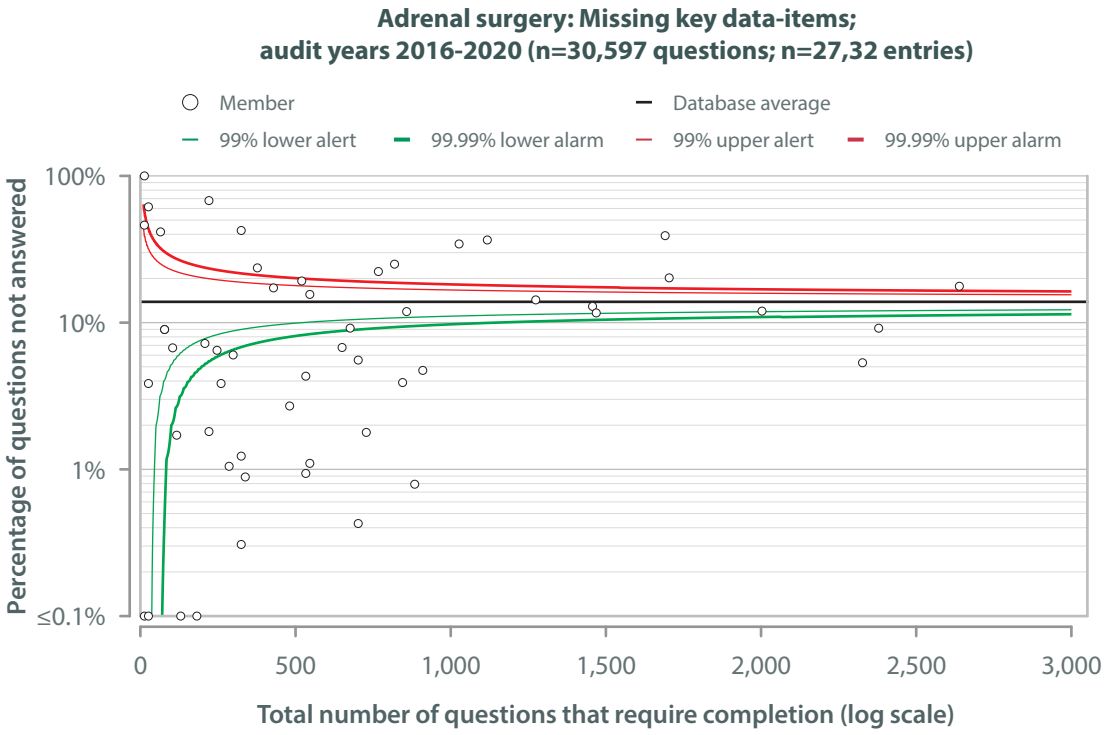
As in the thyroid and parathyroid sections, making adrenal key performance indicators mandatory in UKRETS may improve the missing data rates.

Adrenal surgery: missing data rates for key data-items across the last two audit periods

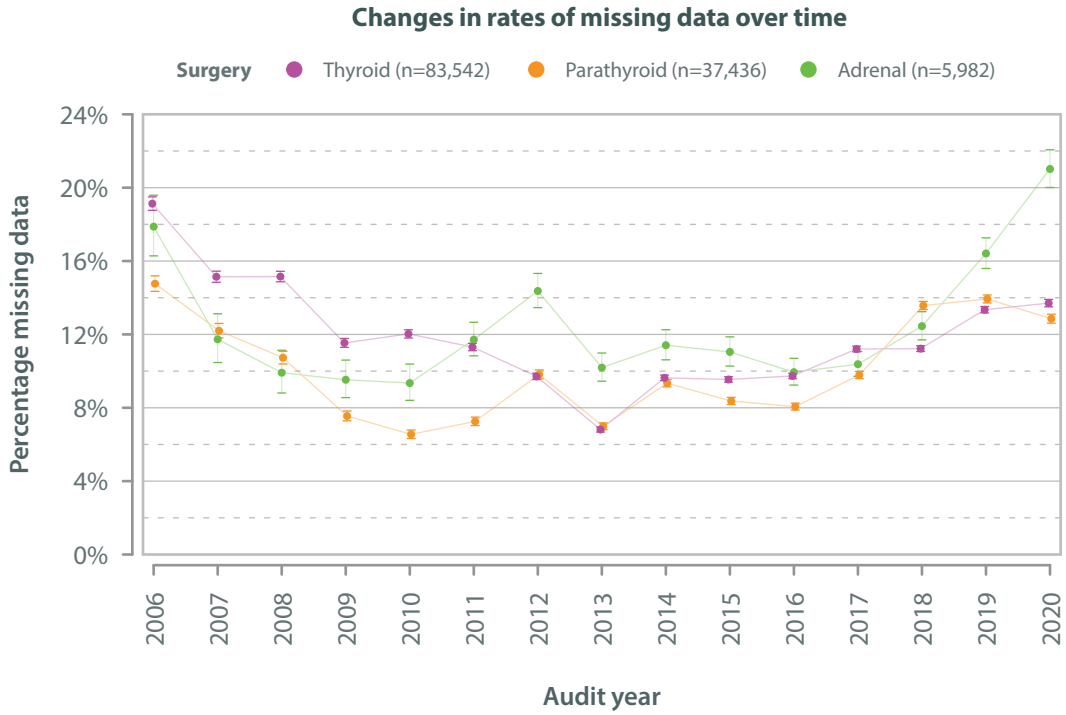
Data-item	Data missing	
	2011-2015	2016-2020
Adrenal diagnosis	3.4%	3.5%
Adrenal anatomy	4.6%	3.6%
Malignant	11.1%	15.7%
Grade surgeon	2.3%	10.1%
Assistant surgeon	5.4%	15.7%
Adrenal operation type	3.4%	4.3%
Adrenal operation approach	5.4%	4.4%
Re-operation for haemorrhage	16.1%	10.2%
Post-operative complications	11.0%	10.7%
Patient survival	9.5%	7.9%
Date of discharge death	18.7%	19.3%
Date of follow up	34.9%	37.7%
Related re-admission	26.0%	37.0%
Date of related re-admission	0.5%	0.1%
Operation denominator	**2,192**	**2,732**

The proportion of questions not answered in the adrenal section is slightly higher than observed in the thyroid and parathyroid sections. Subjectively there seems to be less variation in the proportion of missing questions by member than seen in the thyroid and parathyroid data.

The comments relating to missing data for thyroid key data-items also apply here to adrenal surgery.



This figure shows changes in the rates of missing thyroid, parathyroid and adrenal data with time. Rates of missing data seemed to improve from the inception of the database in 2007 to about 2010-2013. Since then the proportion of missing data seems to have increased, which is a concern.




British
Association

Surgery for thyroid disease

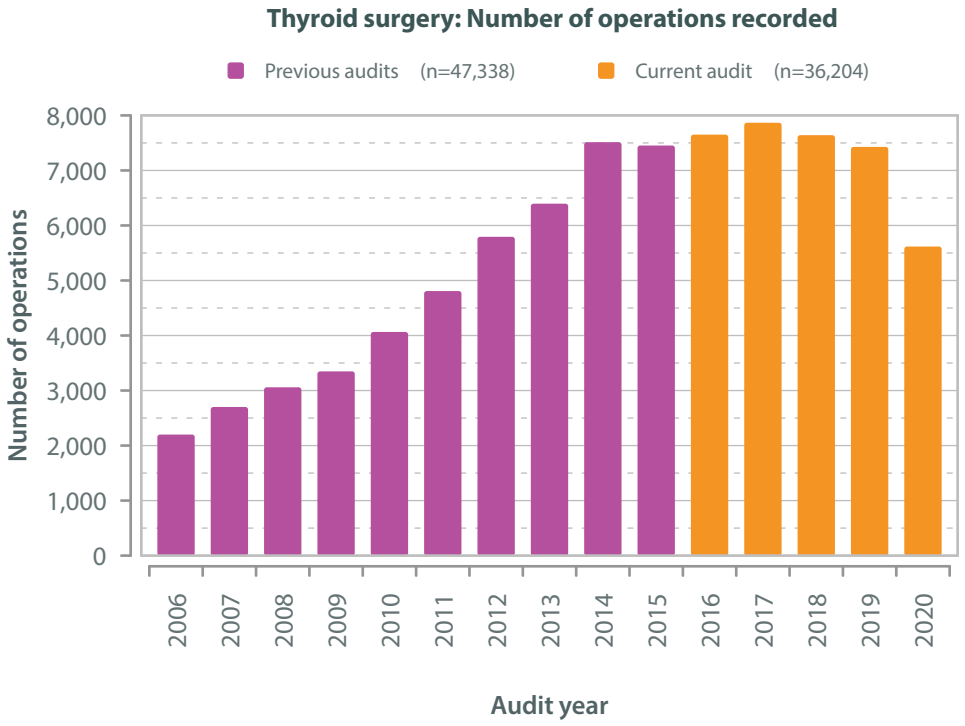
Surgery for thyroid disease

General information in the database

Number of thyroid operations

The number of thyroid operations added *per* year to UKRETS has increased since its inception until 2017, then fallen slightly, peaking at just under 8,000 cases *per* year. Comparing the numbers of total thyroidectomies recorded in UKRETS and data from the Hospital Episode Statistics (HES) over six years from April 2012, it would appear that just less than half of cases (49% or 11,242/23,427) were added to UKRETS.

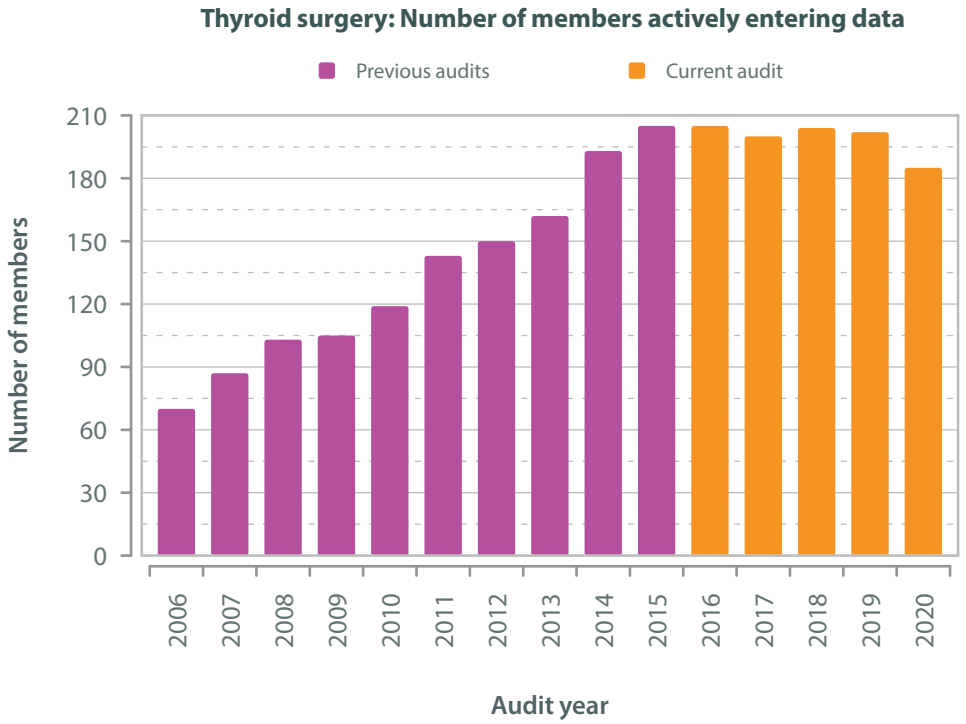
The reduction in the number of operations seen in 2020 is no doubt due to the impact of the Covid-19 pandemic on routine thyroid surgical operations.



Number of members entering data

The number of members adding data to the database also seems to have plateaued, having peaked at 205 in 2015 / 2016.

One of the objectives of BAETS is to increase the proportion of thyroid operations performed in the United Kingdom that are added to UKRETS. So, efforts are needed to raise the profile of UKRETS and recruit more members to BAETS in order to achieve this.



Database records per member

The figure opposite shows the number of thyroid operations performed by each member for the five audit years 2016-2020. Obviously, the audit year 2020 was unusual, in that surgery was severely impacted by the COVID-19 pandemic.

In the four years 2016-2019, 279 members entered data, of whom 16 added no data in 2016-2019, 44 only added data in one year, 37 in two years and 35 in 3 years. This leaves 147 members who added one or more operations in each of the four years. We excluded data for members who had a count in one or more of the four years that was <50% of their four-year average, as this would suggest that they had either started or stopped entering data into UKRETS during that time-frame. For the 112 members who fulfilled our inclusion criteria the annualised number of cases entered into UKRETS was: average 47, median 39, inter-quartile range 24-59 and range 4-198 *per* year.

There is a national recommendation that surgeons should perform 20 thyroid operations *per* year to maintain their competency. In this recent four-year time period 21 members (18.8%) whose data fulfilled the inclusion criteria reported <20 thyroid cases *per* year. Whether these members are under-reporting their workload in UKRETS or actually have a low-volume thyroid surgical practice is unknown. At the other end of the spectrum, there were 11 surgeons who fulfilled the inclusion criteria and performed >100 cases *per* year.

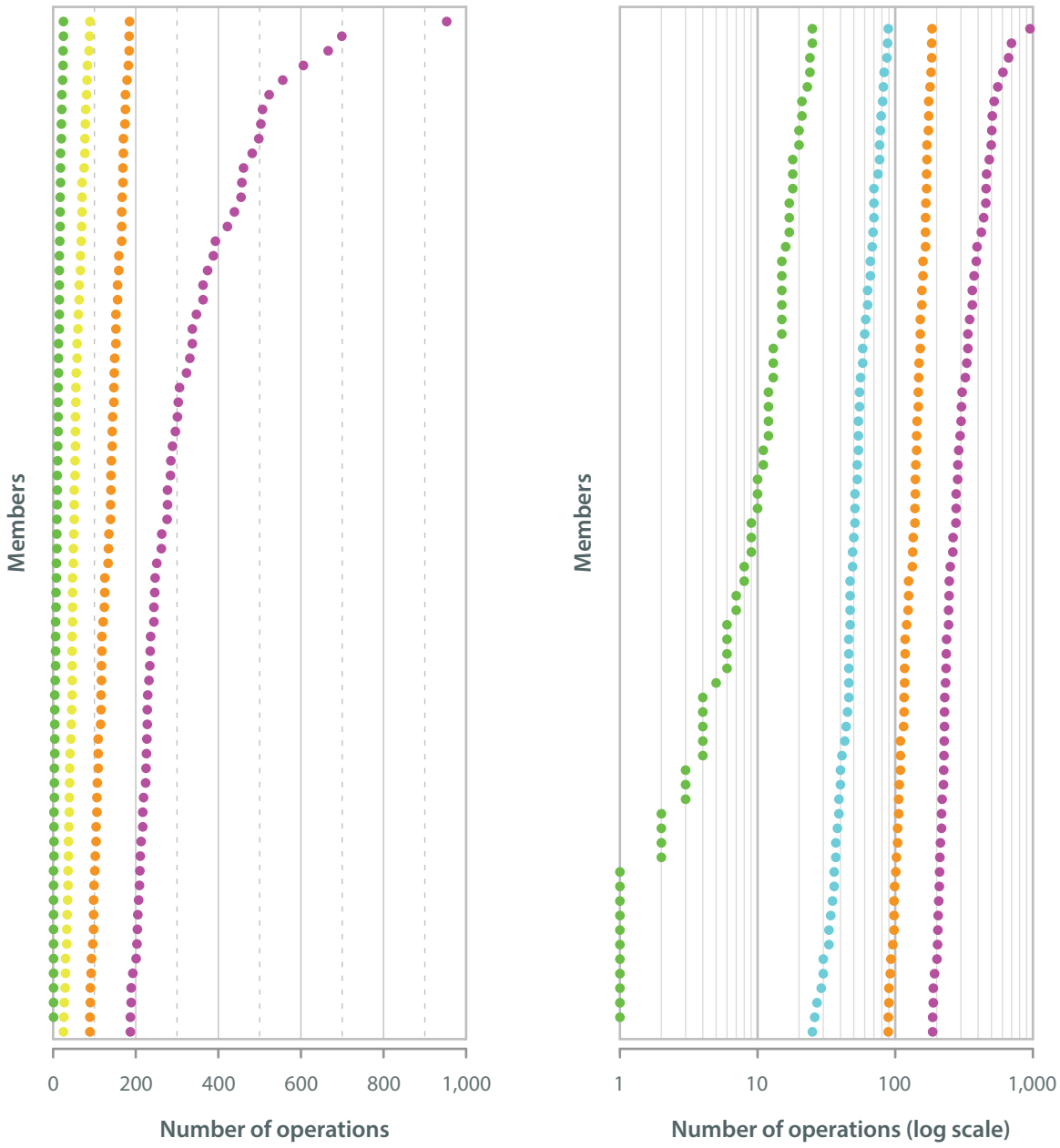
There are now three publications based on United Kingdom data from either UKRETS or HES (Hospital Episode Statistics) that show a relationship between surgeon volume and outcome in thyroidectomy:

1. Gray WK et al. The Volume and Outcome Relationship for Thyroidectomy in England. *Langenbecks Archive of Surgery*. 2021; 1-12. doi: 10.1007/s00423-021-02223-8
2. Nourai et al. A National Analysis of Trends, Outcomes and Volume-Outcome Relationships in Thyroid Surgery. *Clinical Otolaryngology*. 2017; **42**: 354-365.
3. Aspinall et al. Effect of surgeons' annual operative volume on the risk of permanent hypoparathyroidism, recurrent laryngeal nerve palsy and haematoma following thyroidectomy: analysis of United Kingdom registry of endocrine and thyroid surgery (UKRETS). *Langenbecks Archive of Surgery*. 2019; **404(4)**: 421-430.

Although the actual threshold remains debated, there is a strong evidence-base from our own data for the recommendation that thyroid surgeons undertake a minimum number of thyroid operations annually.

Currently both BAETS and GIRFT recommend at least 20 thyroid cases are undertaken *per* year (GIRFT Programme National Specialty Report 2021 J Wass / M Lansdown).

Thyroid surgery: Number of operations reported by each member; audit years 2016-2020



Demographics

Age and gender

The gender distribution of patients that underwent thyroidectomy remains very similar to that reported in previous Audit Reports, with a strong female predominance and a female : male ratio of about 4 : 1.

The mean and median age, inter-quartile range and 10th / 90th percentiles of age of patients who underwent thyroidectomy was very similar to those reported from the 2010-2015 dataset.

Thyroid surgery: age statistics according to the patient's gender; audit years 2016-2020

		Gender		
		Male	**Female**	**All patients**
Age / years	Count	7,509	28,592	**36,101**
	Average	52.6	49.0	**49.8**
	Standard deviation	15.6	15.8	**15.8**
	10th percentile	31	29	**29**
	Lower quartile	41	37	**38**
	Median	53	49	**50**
	Upper quartile	65	60	**61**
	90th percentile	73	71	**71**

As reported in the Fifth Audit Report, the majority of thyroid surgery occurred in patients aged between 31 and 70 years, peaking in the 41-50 years age group.

At the extremes of age approximately 2% of operations were undertaken on the <21 and >80 year-old age group.

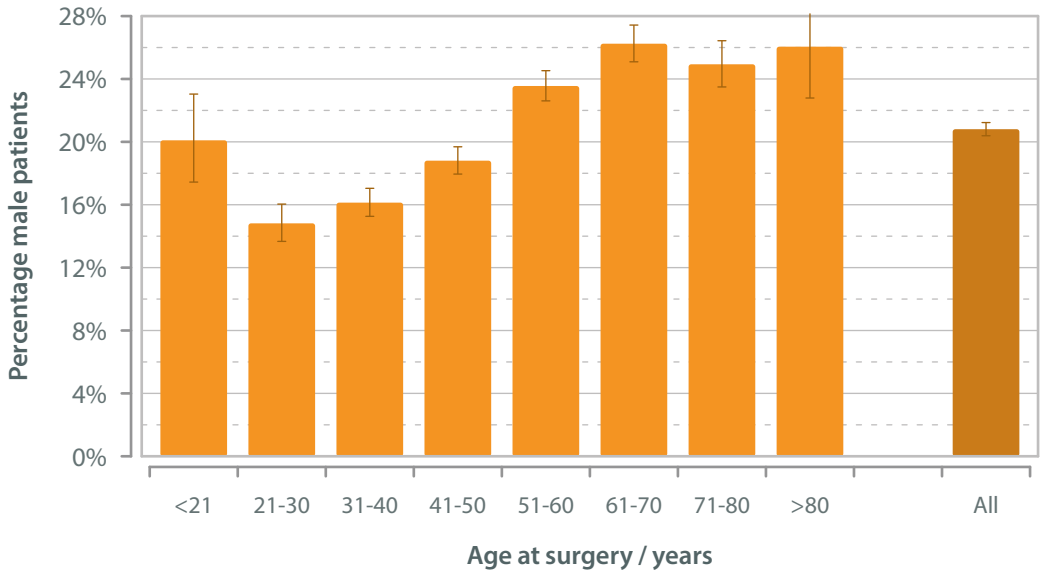
Overall, men make up about one-fifth of the thyroid surgical population. The change in the proportion of thyroid operations for men by age showed a similar distribution to that reported in the Fifth Audit Report, with about 20% of cases being undertaken for males <21 years, falling to a minimum of about 14% in the 21-30 year age group, then rising to a peak at 26% in the 61-70 age group, before falling again.

It is unlikely that all paediatric thyroid operations are entered into UKRETS. A breakdown of paediatric thyroid operations recorded by BAETS members from the current audit period shows that 59 operations were undertaken in children under the age of 11 years; these operations were performed by 28 surgeons. Most of these 28 members recorded fewer than one case *per* year and only three surgeons more than or equal to one case *per* year. Given these low volumes of paediatric thyroid surgery, centralising these procedures to designated surgeons should be considered.

Thyroid surgery: age and gender; audit years 2016-2020

Age at operation / years	Gender			
	Male	Female	All	Percentage male
<21	165	656	**821**	20.1%
21-30	523	3,007	**3,530**	14.8%
31-40	1,074	5,583	**6,657**	16.1%
41-50	1,486	6,417	**7,903**	18.8%
51-60	1,791	5,813	**7,604**	23.6%
61-70	1,451	4,078	**5,529**	26.2%
71-80	846	2,547	**3,393**	24.9%
>80	173	491	**664**	26.1%
Unspecified	23	80	**103**	22.3%
All	**7,532**	**28,672**	**36,204**	**20.8%**

Thyroid surgery: Age and gender; audit years 2016-2020 (n=36,204)



Indication

In first-time thyroid surgery the commonest indication for surgery was biopsy result (38%), followed by compressive symptoms (24%) and thyrotoxicosis (19%), whereas in redo thyroid surgery the commonest indication was completion for cancer (52%), followed by compressive symptoms (17%), biopsy result (13%) then recurrent cancer (10%).

Thyroid surgery: indication and operation sequence; audit years 2016-2020

Indication	Operation sequence				
	First-time surgery		Redo surgery		Unspecified
	Count	Percent	Count	Percent	Count
Biopsy result	11,668	38.0%	387	13.0%	2
Clinically worrying lesion	3,457	11.3%	128	4.3%	2
Completion thyroidectomy for cancer	873	2.8%	1,540	51.6%	0
Compressive symptoms	7,396	24.1%	492	16.5%	1
Quality of life	797	2.6%	36	1.2%	0
Recurrent cancer	57	0.2%	292	9.8%	0
Recurrent cyst	516	1.7%	15	0.5%	0
Thyroglossal cyst	153	0.5%	12	0.4%	0
Thyrotoxicosis	5,775	18.8%	84	2.8%	2
Unspecified	822		67		1,630
All	**31,514**		**3,053**		**1,637**

Changes in indication over time

Illustrated in the table and figure below are some trends in the indications for thyroid surgery observed over the last three five-year audit periods, suggesting that the frequency of indications for thyroid surgical practice are changing over time.

A higher proportion of first-time and redo cases are now undertaken on the basis of the biopsy result and a lower proportion on the basis of compressive symptoms and quality-of-life.

Reported rates of completion surgery for cancer are slightly increased compared to data from the last Audit Report, but very similar to data from the 2006-2010 dataset.

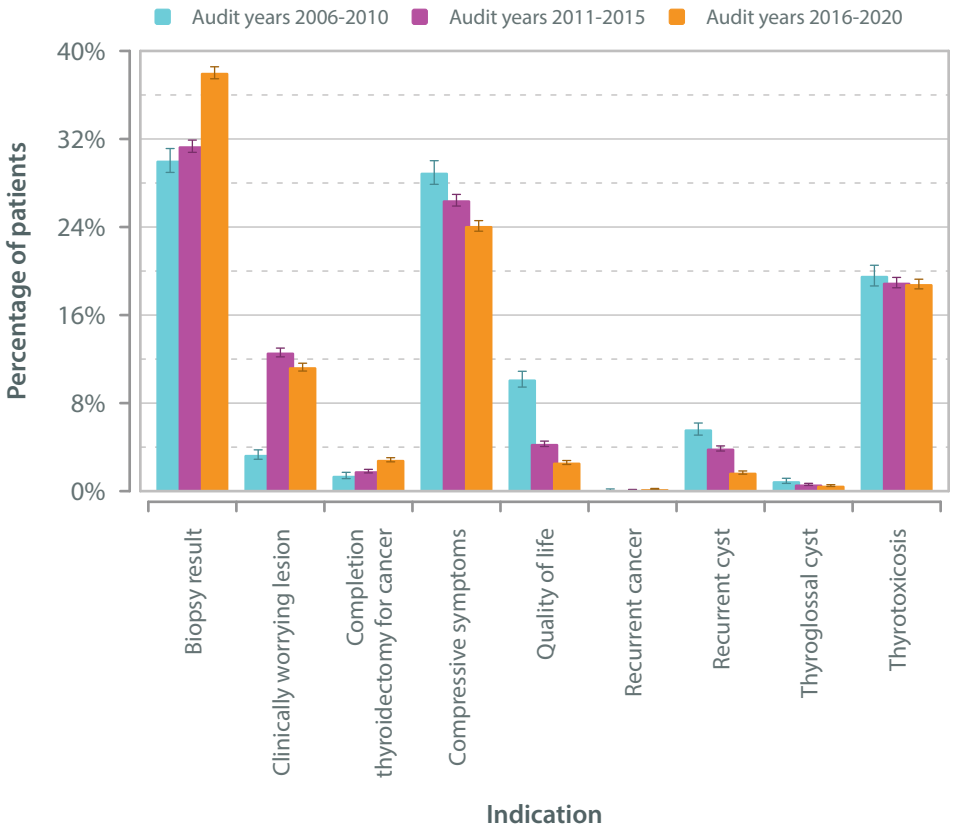
The proportions of first-time surgery done for recurrent and thyroglossal cyst also continue to decline, whereas the proportion of redo cases done for recurrent cancer, thyroglossal cyst and thyrotoxicosis are trending upwards with time.

Presumably the first-time data entered with an indication of completion for cancer represents a data entry error as this does not make sense.

Thyroid surgery: changes in recorded indications over time for first-time and redo surgery

		Audit periods					
		Count			Percentage		
		2006-2010	2011-2015	2016-2020	2006-2010	2011-2015	2016-2020
First-time surgery indications	Biopsy result	2,086	8,428	11,668	30.0%	31.3%	38.0%
	Clinically worrying lesion	229	3,387	3,457	3.3%	12.6%	11.3%
	Completion thyroidectomy for cancer	97	487	873	1.4%	1.8%	2.8%
	Compressive symptoms	2,010	7,108	7,396	28.9%	26.4%	24.1%
	Quality of life	705	1,155	797	10.2%	4.3%	2.6%
	Recurrent cancer	6	28	57	0.1%	0.1%	0.2%
	Recurrent cyst	390	1,041	516	5.6%	3.9%	1.7%
	Thyroglossal cyst	63	163	153	0.9%	0.6%	0.5%
	Thyrotoxicosis	1,359	5,095	5,775	19.6%	18.9%	18.8%
	Unspecified	6,312	650	822			
	All	**13,257**	**27,542**	**31,514**			
Redo surgery indications	Biopsy result	81	388	387	10.8%	12.6%	13.0%
	Clinically worrying lesion	8	133	128	1.1%	4.3%	4.3%
	Completion thyroidectomy for cancer	385	1,513	1,540	51.3%	49.2%	51.6%
	Compressive symptoms	186	652	492	24.8%	21.2%	16.5%
	Quality of life	25	68	36	3.3%	2.2%	1.2%
	Recurrent cancer	52	229	292	6.9%	7.4%	9.8%
	Recurrent cyst	4	26	15	0.5%	0.8%	0.5%
	Thyroglossal cyst	0	7	12	0.0%	0.2%	0.4%
	Thyrotoxicosis	9	59	84	1.2%	1.9%	2.8%
	Unspecified	763	54	67			
	All	**1,513**	**3,129**	**3,053**			

First-time thyroid surgery:
Changes in indication for surgery over time (n=64,529)



Goitre and sternal split

This table has been included for the first time in this Audit Report and clearly shows that overall sternal split is rarely required in retrosternal goitre (135 / 5,160; 2.6%), unless the goitre extends below the aortic arch in which 23% of cases required sternotomy.

This information may be helpful to thyroid surgeons when deciding on the need for sternotomy in retrosternal goitre.

Thyroid surgery: goitre type and sternal split / thoracotomy; audit years 2016-2020

		Sternal split / thoracotomy				
		No	**Yes**	**Unspecified**	**All**	**Rate** (95% CI)
Goitre	Cervical	0	0	26,621	**26,621**	NA
	Retroclavicular	3,477	28	67	**3,572**	0.8% (0.5-1.2%)
	Upper border AA	1,258	21	16	**1,295**	1.6% (1.0-2.5%)
	Below AA	290	86	5	**381**	22.9% (18.8-27.5%)
	Unspecified	0	0	4,335	**4,335**	NA
	All	**5,025**	**135**	**31,044**	**36,204**	

Laryngoscopy and nerve monitoring

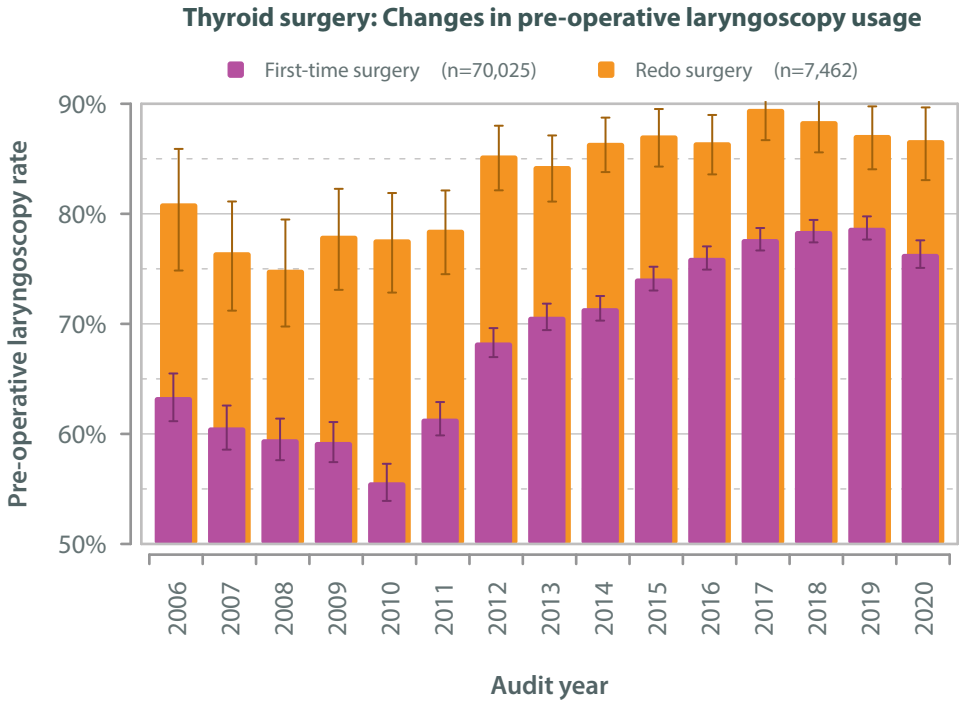
Pre-operative laryngoscopy

Changes in the use of pre-operative laryngoscopy over time

As expected, the proportion of patients undergoing pre-operative laryngoscopy was higher in redo than first-time thyroid surgery.

No doubt the lower rates observed in 2020 were due to the Covid-19 pandemic when BAETS published guidance to avoid laryngoscopy when possible.

The proportion of redo cases undergoing laryngoscopy peaked at 89.5% in 2017 and has declined slightly thereafter; whereas the proportion of cases undergoing pre-operative laryngoscopy in first-time surgery has risen in subsequent years since 2010 to 78.7% in 2019.



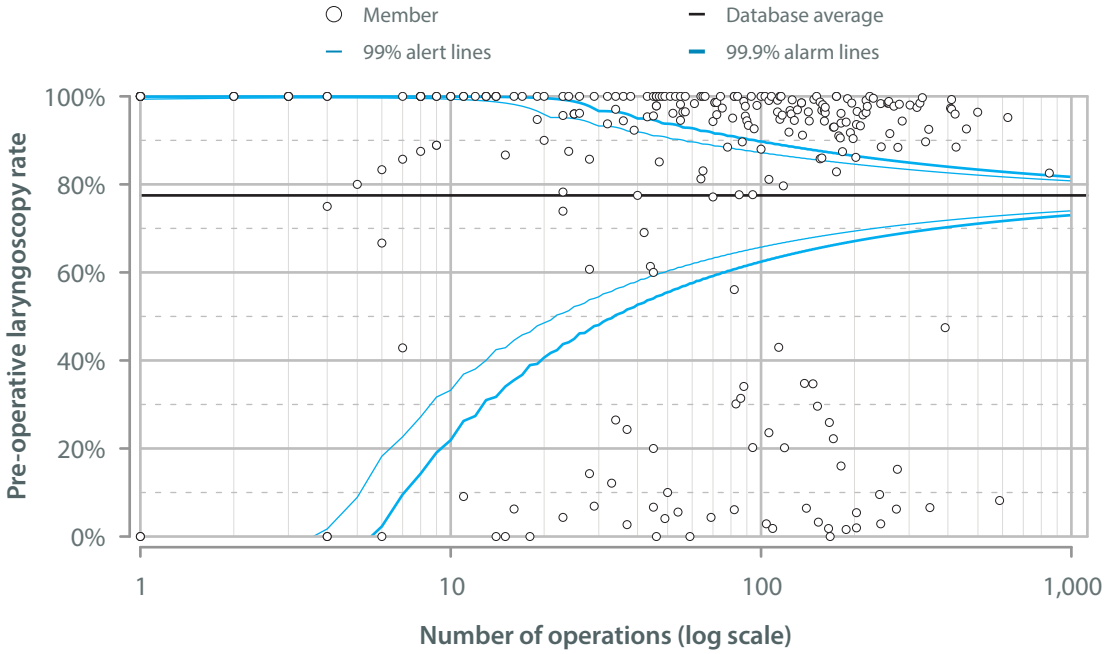
Pre-operative laryngoscopy per member

Similarly to data from the last Audit Report, the funnel plot opposite shows that prior to first-time thyroid surgery there is still a group of surgeons (even among those entering high numbers of cases in UKRETS) with very low (below the 99.9% alarm line) rates of pre-operative laryngoscopy use.

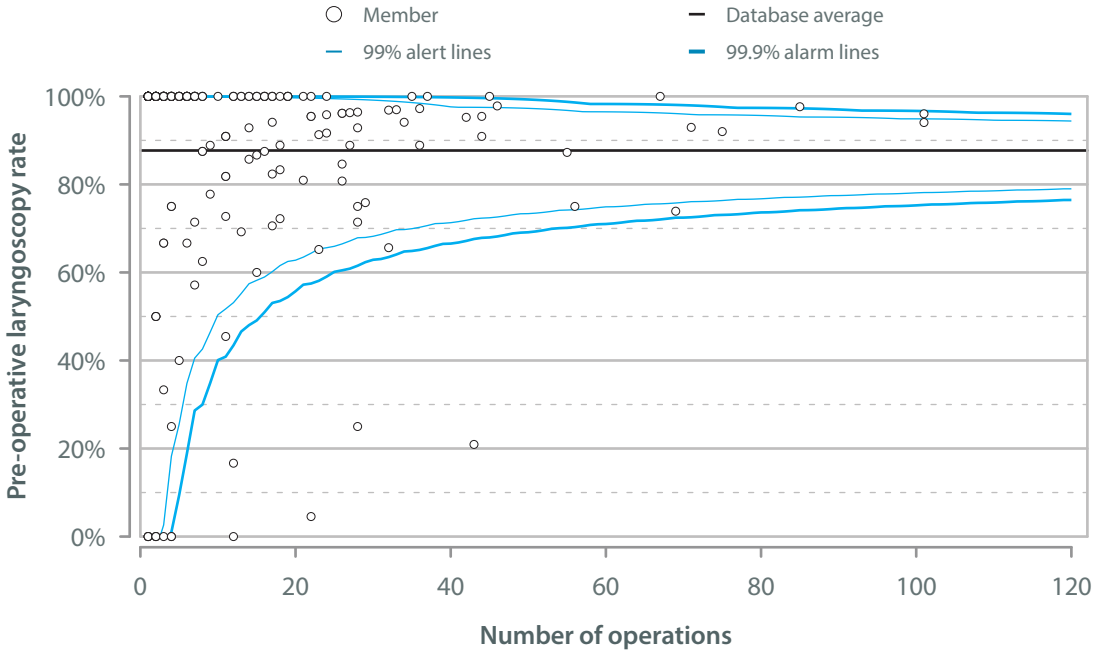
Likewise, in redo thyroidectomy the proportion of patients undergoing pre-operative laryngoscopy has increased from 84.8%in the previous 5-year audit period to 87.7% in the current audit period.

It is notable that there were no surgeons who have entered >50 redo cases in UKRETS over the five-year time-period whose data-point falls below the 99.9% lower alarm line for pre-operative laryngoscopy use, suggesting that higher volume surgeons are more likely to perform pre-operative laryngoscopy in redo cases.

First-time thyroid surgery: Pre-operative laryngoscopy rate; audit years 2016-2020 (n=29,631)



Redo thyroid surgery: Pre-operative laryngoscopy rate; audit years 2016-2020 (n=2,854)



Pre-operative laryngoscopy and indication

The table below has been included for the first time in this series of Audit Reports, in order to investigate whether the use of pre-operative laryngoscopy depends on the indication for surgery.

The highest (>80%) rates of pre-operative laryngoscopy use were observed in completion surgery for cancer, clinically worrying lesion and biopsy result. The lowest rates (<70%) were observed in thyroglossal cyst, quality-of-life and thyrotoxicosis.

These findings would suggest that pre-operative laryngoscopy is used more in suspected or proven malignancy rather than benign disease, although it is interesting to see that pre-operative laryngoscopy was only undertaken in 75% of patients with recurrent cancer.

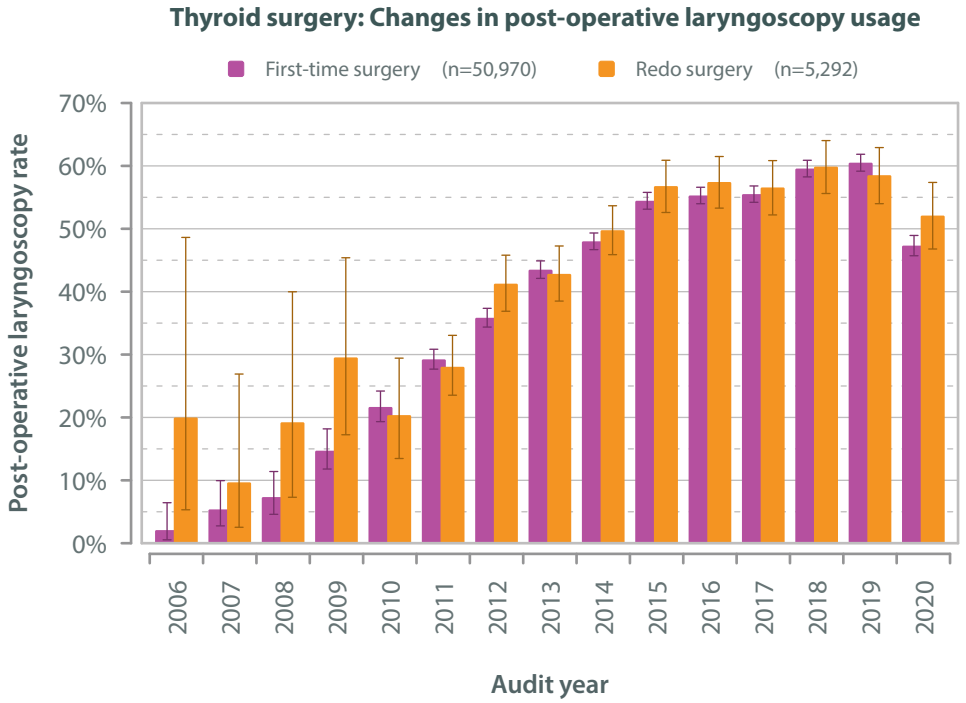
Thyroid surgery: pre-operative laryngoscopy and indication for surgery; audit years 2016-2020

Indication	Pre-operative laryngoscopy			
	No	Yes	Unspecified	Rate
Biopsy result	2,058	9,400	599	82.0%
Clinically worrying lesion	611	2,808	168	82.1%
Completion thyroidectomy for cancer	271	2,015	127	88.1%
Compressive symptoms	1,705	5,968	216	77.8%
Quality of life	282	543	8	65.8%
Recurrent cancer	82	248	19	75.2%
Recurrent cyst	147	374	10	71.8%
Thyroglossal cyst	83	72	10	46.5%
Thyrotoxicosis	1,749	3,902	210	69.0%
Unspecified	32	136	2,351	81.0%
All	**7,020**	**25,466**	**3,718**	**78.4%**

Post-operative laryngoscopy

Changes in the use of post-operative laryngoscopy over time

The proportion of patients undergoing post-operative laryngoscopy in first-time thyroid surgery has increased year-on-year since the inception of the audit and now stands at about 60% (excluding 2020 data). The proportion undergoing post-operative laryngoscopy following redo surgery is very similar, and has also increased since 2010.

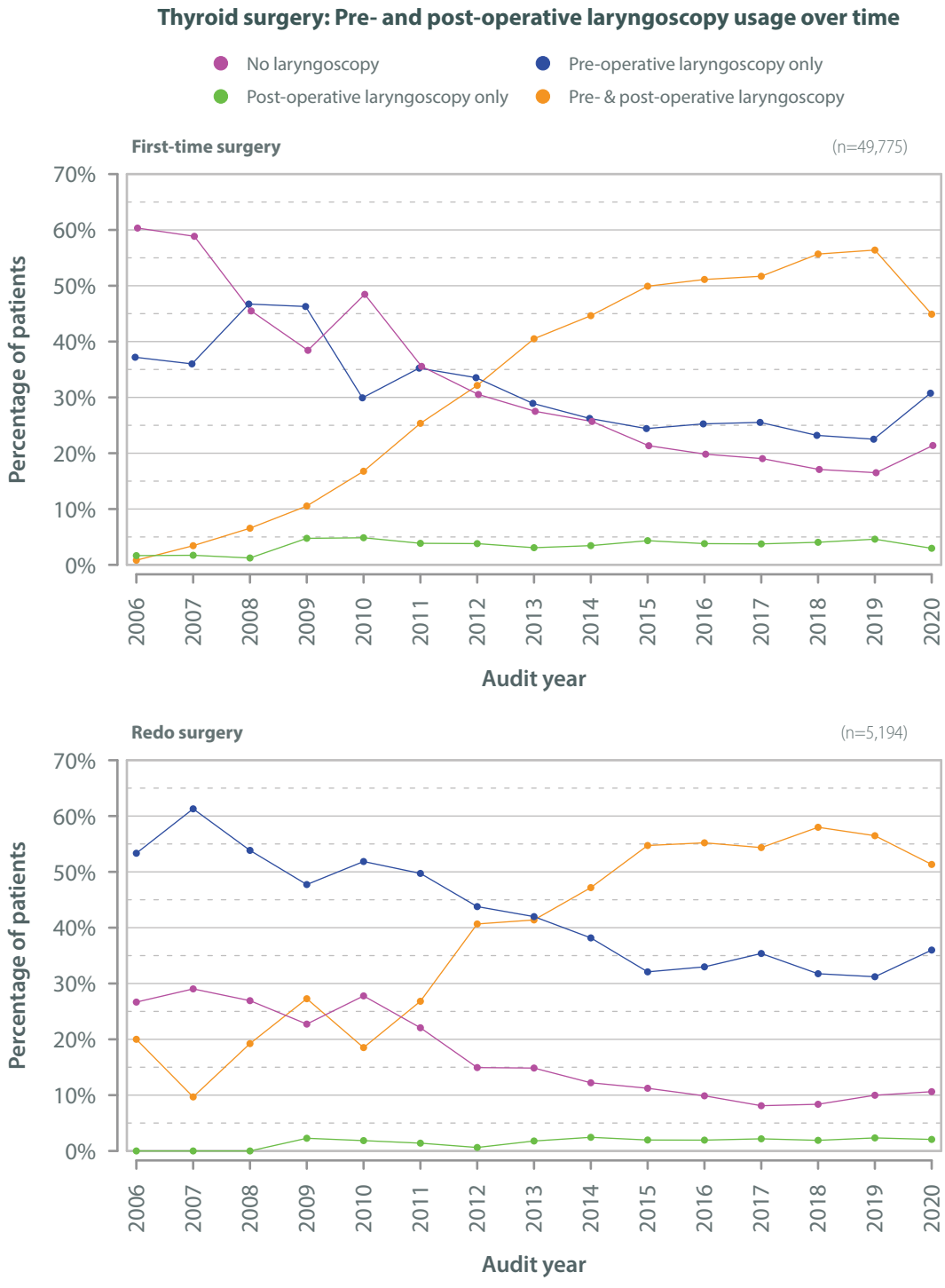


It would be interesting to investigate whether the use of intra-operative nerve monitoring affects the rate of post-operative laryngoscopy, as confirmation of a signal on stimulating the recurrent laryngeal nerve at the end of the operation could obviate the need for post-operative laryngoscopy.

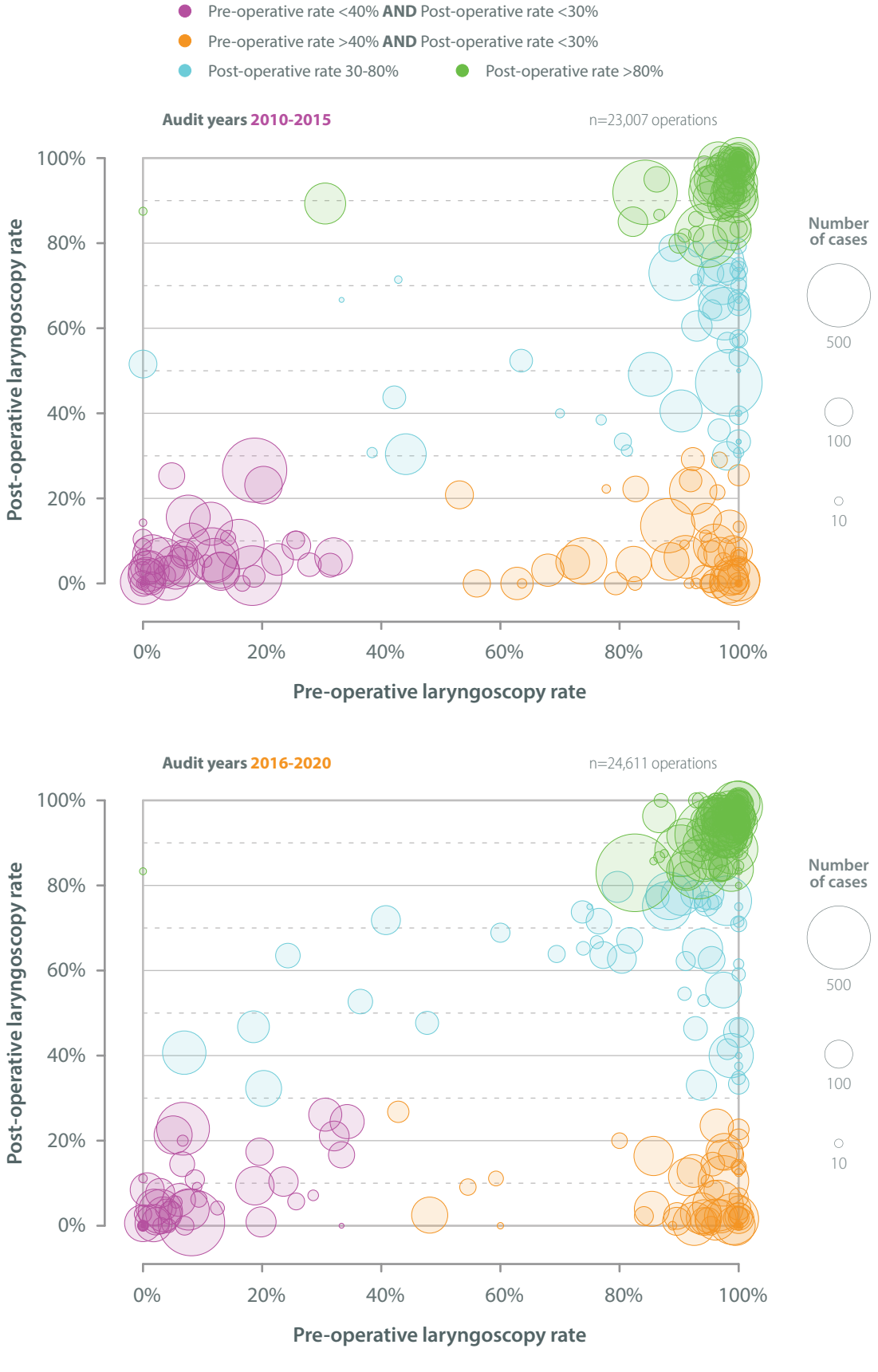
Pre- and post-operative laryngoscopy

In both first-time and redo thyroidectomy the proportions of patients not undergoing any form of laryngoscopy, or just undergoing pre-operative laryngoscopy, have both shown a downward trend with time, whilst the proportion undergoing both pre- and post-operative laryngoscopy has increased to about 56% in 2019. This would suggest that routine pre- and post-operative laryngoscopy is increasing in popularity and this should improve the accuracy of the assessment of recurrent laryngeal nerve palsy, one of the key indicators in thyroid surgery in UKRETS.

In the two bubble plots, data from the previous audit period is compared to the current one. Each bubble represents a single surgeon, with the size of the bubble being proportional to the number of cases that the surgeon has entered into the database. Surgeons not undertaking laryngoscopy are grouped around the bottom left-hand corner; those undertaking just pre-operative laryngoscopy at the bottom right, and those performing both pre- and post-operative laryngoscopy at the top right-hand corner.



First-time thyroid surgery: Pre- and post-operative laryngoscopy rates for each member



Nerve monitoring

Recurrent laryngeal nerve monitoring was used more often in redo (59%) than first-time (54%) thyroidectomy.

Medtronic was the most popular of the nerve monitoring devices.

Nerve monitoring use has increased with time, and was used in 65% of thyroidectomies in 2020.

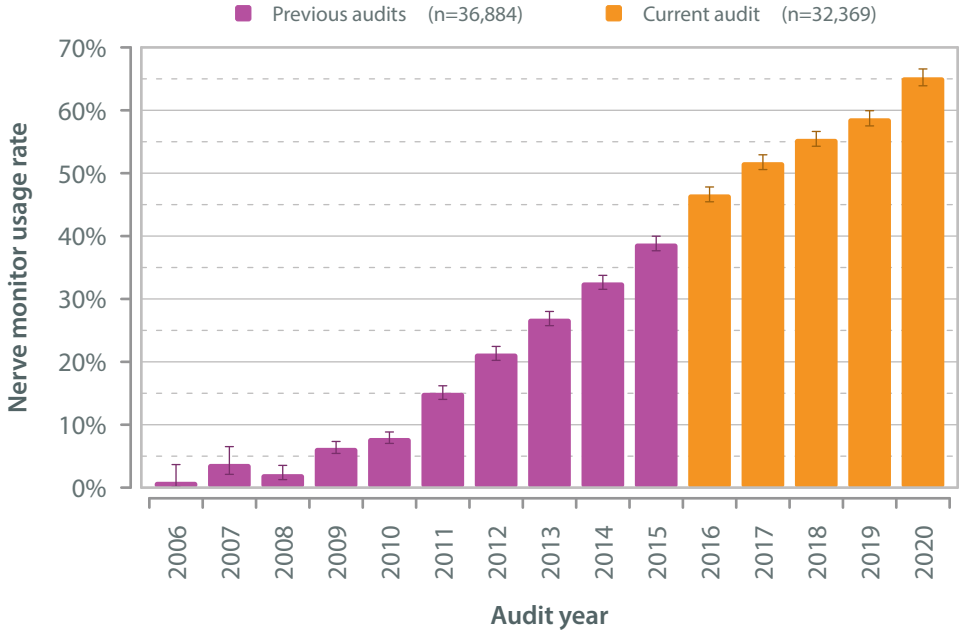
Since the inception of UKRETS the proportion of surgeons using nerve monitoring in thyroid surgery regularly (>80% of cases) has increased from 9% to 44%, whereas the proportion of surgeons never using laryngoscopy has declined from 68% to 31%.

An analysis of data from UKRETS on the use of nerve monitoring in thyroid surgery to prevent recurrent laryngeal nerve palsy suggested a benefit (Abdelhamid *et al.* Intra-operative nerve monitoring in thyroid surgery: analysis of United Kingdom Registry of Endocrine and Thyroid Surgeons database. British Journal of Surgery. 2021;108: 182-7). The trend to increasing use of nerve monitoring in thyroid surgery is therefore encouraging.

Thyroid surgery: nerve monitoring and operation sequence; audit years 2016-2020

		Operation sequence				
		Count			Percentage	
		First-time	Redo	Unspecified	First-time	Redo
Nerve monitor	No	13,419	1,163	17	45.5%	40.9%
	Medtronic NM	11,286	1,266	13	38.3%	44.5%
	Magstim	2,254	131	4	7.6%	4.6%
	Inomed	850	104	5	2.9%	3.7%
	Dr Langer	1	0	0	0.0%	0.0%
	Other monitor	1,304	153	8	4.4%	5.4%
	Unspecified monitor	360	29	2	1.2%	1.0%
	Unspecified	2,040	207	1,588		
	All	**31,514**	**3,053**	**1,637**		

Thyroid surgery: Nerve monitoring usage rates over time



Thyroid surgery: rates of nerve monitor use per member over time

		Audit period					
		2006-2010		2011-2015		2016-2020	
		Count	Rate	Count	Rate	Count	Rate
Nerve monitor usage	Never[1]	85	67.5%	95	40.3%	84	30.5%
	Occasional[2]	30	23.8%	87	36.9%	71	25.8%
	Regular[3]	11	8.7%	54	22.9%	120	43.6%

1. 0% of operations
2. >0 and <80% of operations
3. >80% of operations

Thyroid cancer

Primary pathology

Colloid goitre (28%) was the commonest primary pathology found at thyroidectomy, followed by papillary thyroid cancer (21%), Graves' disease (14%) and follicular adenoma (13%). The missing data rate was particularly high for this data field at 19% (6,726 / 36,204) and measures need to taken to improve this.

Thyroid surgery: primary pathology; audit years 2016-2020

		Data	
		Count	Proportion
Primary pathology	Anaplastic cancer	58	0.2%
	Auto immune thyroiditis	928	3.1%
	C-cell hyperplasia	98	0.3%
	Colloid goitre	8,098	27.5%
	Colloid nodule	2,183	7.4%
	Follicular adenoma	3,744	12.7%
	Follicular thyroid cancer	1,306	4.4%
	Graves' disease	4,003	13.6%
	Lymphoma	27	0.1%
	Metastatic cancer	31	0.1%
	Medullary thyroid cancer	290	1.0%
	Oncocytic adenoma	419	1.4%
	Oncocytic carcinoma	236	0.8%
	Other cancer	109	0.4%
	Papillary thyroid cancer	6,072	20.6%
	Simple cyst	432	1.5%
	Other	1,444	4.9%
	Unspecified	6,726	
	All	**36,204**	

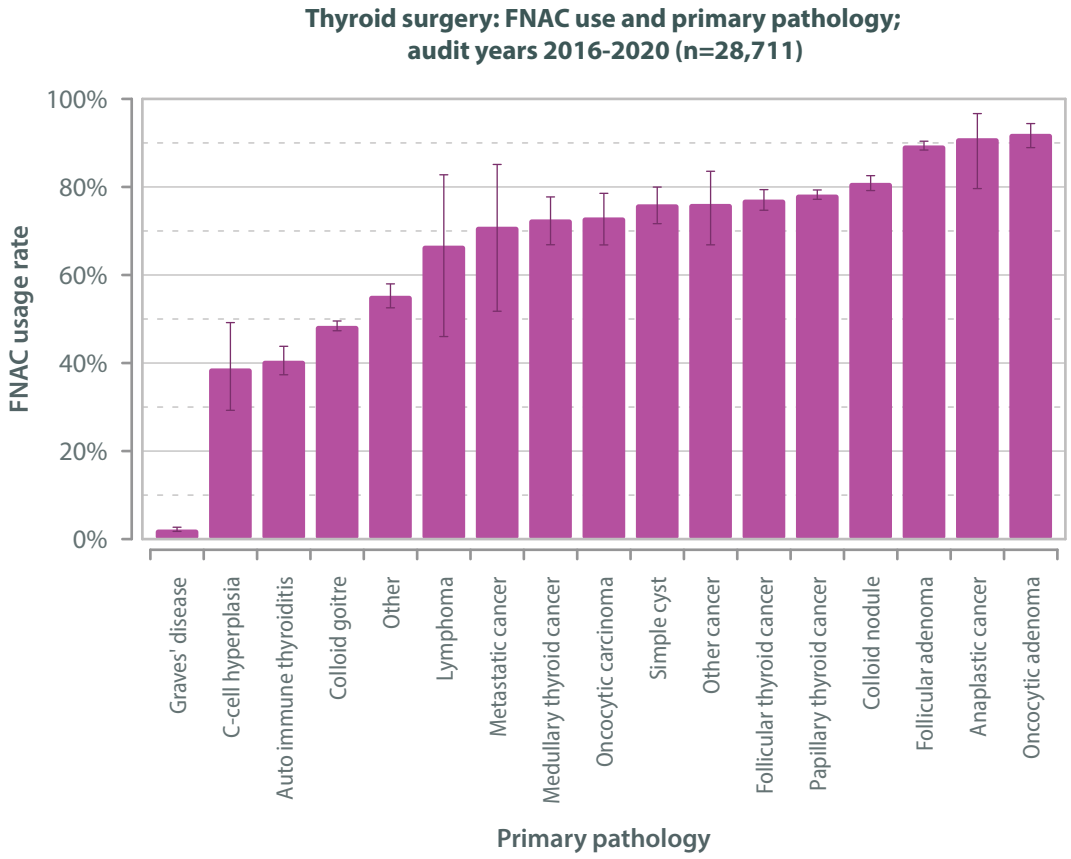
Fine needle aspiration cytology

Fine needle aspiration cytology (FNAC) usage was highest in oncocytic adenoma (92%) followed by anaplastic cancer (91%), follicular adenoma (89%), colloid nodule (81%), papillary thyroid cancer (78%), follicular thyroid cancer (77%), other cancer and simple cyst (76%), oncocytic and medullary thyroid cancer (73%), metastatic cancer (71%) and lymphoma (67%). These results demonstrate reassuringly high FNAC usage for neoplastic thyroid disease and are similar to those found in the previous Audit Report.

There is a clear surgical bias affecting these results due to the fact that UKRETS only records operated cases. For example, it is unlikely that an oncocytic or follicular adenoma would be excised unless they were symptomatic or had undergone an FNAC, which most often gives a Thy3F for these lesions, warranting diagnostic surgery to exclude a malignant neoplasm.

Thyroid surgery: primary pathology and the use of fine needle aspiration cytology; audit years 2016-2020

Primary pathology	FNAC used				
	No	Yes	Unspecified	All	FNAC rate
Anaplastic cancer	5	51	2	**58**	91.1%
Auto immune thyroiditis	543	370	15	**928**	40.5%
C-cell hyperplasia	60	38	0	**98**	38.8%
Colloid goitre	4,069	3,823	206	**8,098**	48.4%
Colloid nodule	406	1,723	54	**2,183**	80.9%
Follicular adenoma	391	3,308	45	**3,744**	89.4%
Follicular thyroid cancer	292	985	29	**1,306**	77.1%
Graves' disease	3,818	85	100	**4,003**	2.2%
Lymphoma	9	18	0	**27**	66.7%
Metastatic cancer	9	22	0	**31**	71.0%
Medullary thyroid cancer	75	199	16	**290**	72.6%
Oncocytic adenoma	33	383	3	**419**	92.1%
Oncocytic carcinoma	63	171	2	**236**	73.1%
Other cancer	26	83	0	**109**	76.1%
Papillary thyroid cancer	1,284	4,626	162	**6,072**	78.3%
Simple cyst	102	324	6	**432**	76.1%
Other	589	728	127	**1,444**	55.3%
Unspecified	1,784	2,414	2,528	**6,726**	57.5%
All	**13,558**	**19,351**	**3,295**	**36,204**	**58.8%**


Thyroid surgery: FNAC use and primary pathology;
audit years 2016-2020 (n=28,711)
FNAC usage rate
100%
80%
60%
40%
20%
0%
Graves' disease
C-cell hyperplasia
Auto immune thyroiditis
Colloid goitre
Other
Lymphoma
Metastatic cancer
Medullary thyroid cancer
Oncocytic carcinoma
Simple cyst
Other cancer
Follicular thyroid cancer
Papillary thyroid cancer
Colloid nodule
Follicular adenoma
Anaplastic cancer
Oncocytic adenoma
Primary pathology

The first table below shows the proportion of cases in each FNAC category with a primary thyroid cancer on pathology *i.e.,* [number in FNAC category / number with primary thyroid cancer] × 100%.

There are some encouraging trends in these data, with fewer patients with primary thyroid cancer seen in subsequent Audit Reports following a Thy1 (10% to 4%) and Thy2 (11% to 5%) and fewer patients with Thy4 FNAC (16% to 13%). Also the proportion of cases with a Thy5 FNAC has risen in subsequent audit periods (26% to 41%). It is good to see that the proportion of thyroid cancer patients operated on with a inadequate (Thy1), benign (Thy2) or suspicious (Thy4) FNAC is falling with time and the proportion with a definitive pre-operative diagnosis (Thy5) is increasing.

There is a confounding factor in interpreting these data, in that a secondary pathology data field was added to the database in the last audit period. Prior to this incidental malignant pathology may have been included as primary pathology, which could have potentially increased proportion of cases with malignancy following a Thy1 / 2 FNAC.

It is difficult to compare Thy3 / 3a / 3f results as the Thy3a / f sub categories were introduced in November 2014, so the current Audit Report is the first to contain the Thy3a / f sub-category throughout. In total the proportion of cases with primary thyroid cancer following Thy3 FNAC was similar across the three audit periods (36.4%, 37.0% and 36.5%).

A higher proportion had primary thyroid cancer following a Thy3f (25.6%) than a Thy3a (8.3%), which might suggest surgery is performed less often after a Thy3a FNAC, though, of course, this is unknown as we do not record the number or pathology in patients with a Thy3a / 3f who did not undergo surgery. So the risk of malignancy is only known in those cases that underwent surgery. This is a potential concern as the second table, opposite, shows that the risk of malignancy is similar following Thy3a (27.0%) and Thy3f (26.9%). It is interesting to note that when UKRETS data on the risk of malignancy for each FNAC category was compared with the European (Eurocrine) and North American (CESQIP) databases, the latter two reported a slightly higher risk of malignancy in the Thy3f than Thy3a category, though UKRETS did not [1].

Thyroid surgery for patients with a primary pathology of cancer investigated by FNAC: FNAC results

		Counts			Rate		
		2006-2010	2011-2015	2016-2020	2006-2010	2011-2015	2016-2020
FNAC result	Thy 1	106	369	266	10.3%	7.9%	4.4%
	Thy 2	108	398	319	10.5%	8.5%	5.3%
	Thy 3a	0	104	503	0.0%	2.2%	8.3%
	Thy 3f	3	356	1,558	0.3%	7.6%	25.6%
	Thy 3.	371	1,274	155	36.1%	27.2%	2.6%
	Thy 4	168	673	808	16.4%	14.4%	13.3%
	Thy 5	271	1,512	2,467	26.4%	32.3%	40.6%
	Unspecified	15	38	61			
	All	**1,042**	**4,724**	**6,137**			

1. Inabnet et al. Correlating the Bethesda System for Reporting Thyroid Cytopathology with Histology and Extent of Surgery: A Review of 21,746 Patients from Four Endocrine Surgery Registries Across Two Continents. *World Journal of Surgery*. 2020; **44**: 426-435.

This second table shows the proportion of cases with a cancer diagnosis rate in each FNAC category *i.e.,* for Thy1 = [number Thy1 with primary thyroid cancer / number with Thy1] ×100%.

These results show that although the proportion of thyroid cancer patients operated on following a Thy1 / 2 FNAC are falling with time, the risk of malignancy with Thy1 / 2 FNAC is actually increasing (14% to 17% respectively) and (7% to 9%) . This suggests members are increasingly looking at other factors (probably radiology results) to decide which patients with Thy1 / 2 FNAC results need surgery.

It is interesting to note the increase in MDT discussion for Thy1 / 2 FNAC with time (see later), which may have influenced this finding. It is worth noting that the Eurocrine and CESQIP reported similar rates of malignancy in patients undergoing surgery with the equivalent of Thy1 / 2 FNAC.

In line with data from papers already published, the rate of malignancy in patients operated for Thy3a and Thy3f cytology appear to be identical. It remains unclear how many patients with cytology reports are not operated, but once a decision to offer surgery is made the risk of malignancy is equal at 1 : 4 in both sub-groups.

The risk of malignancy following a Thy4 / 5 FNAC has remained similar over the last two audit periods at 75% and 98% respectively.

Thyroid surgery for patients investigated by FNAC: FNAC result and cancer diagnosis rate

		Audit years **cancer diagnosis rate** (count of FNAC tests performed)		
		2006-2010	**2011-2015**	**2016-2020**
FNAC result	Thy 1	13.5% (n=784)	15.4% (n=2,135)	16.7% (n=2,398)
	Thy 2	7.2% (n=1,491)	8.0% (n=4,665)	9.4% (n=4,955)
	Thy 3a	(n=0)	24.9% (n=313)	27.0% (n=417)
	Thy 3f	50.0% (n=6)	28.1% (n=916)	26.9% (n=1,269)
	Thy 3.	22.2% (n=1,673)	24.8% (n=4,227)	27.8% (n=5,130)
	Thy 4	65.4% (n=257)	74.7% (n=396)	75.2% (n=901)
	Thy 5	96.1% (n=282)	97.8% (n=305)	97.9% (n=1,546)
	Unspecified	20.3% (n=74)	38.0% (n=77)	46.2% (n=100)
	All	**22.8%** (n=4,567)	**28.3%** (n=13,034)	**36.2%** (n=16,716)

1. Inabnet et al. Correlating the Bethesda System for Reporting Thyroid Cytopathology with Histology and Extent of Surgery: A Review of 21,746 Patients from Four Endocrine Surgery Registries Across Two Continents. *World Journal of Surgery*. 2020; **44**: 426-435.

The following table and figures show the FNAC category by primary pathology in detail. The results are as expected, with the majority of follicular and oncocytic adenomas having Thy3 FNAC (60% and 65% respectively). Likewise 65% of follicular and oncocytic thyroid cancer were preceded by Thy3 FNAC.

63% of papillary thyroid cancer was Thy4 / 5, which is an improvement from the last audit and 28% of papillary thyroid cancer was Thy3 on FNAC, which is similar to the findings in the last Audit Report. 80% of medullary thyroid cancer was Thy4 / 5 and 16% Thy3.

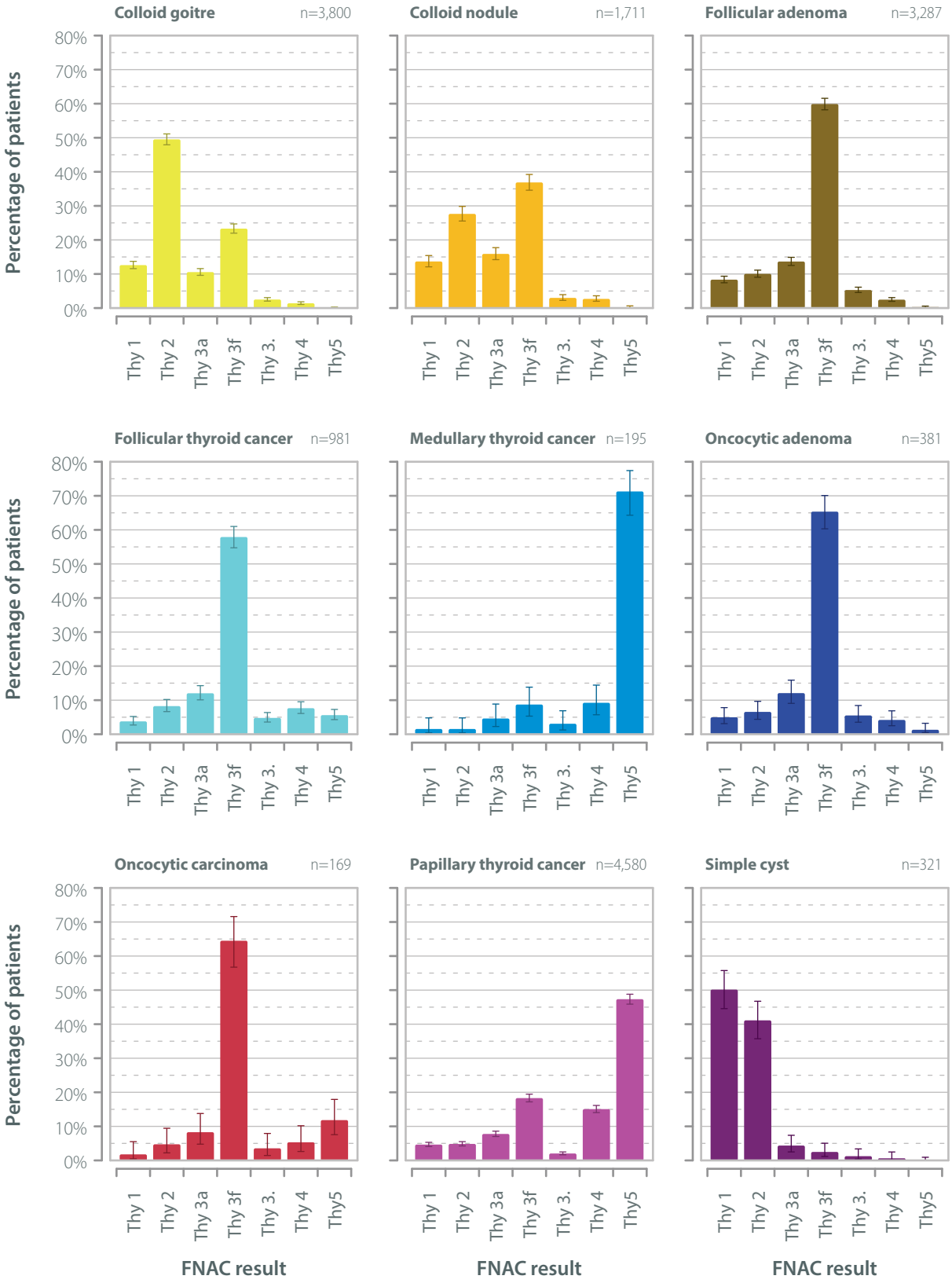
90% of simple cysts were Thy1 / 2. Data on colloid goitre and nodule are no doubt subject to bias as UKRETS is a surgical audit and so only records the outcomes of nodules treated surgically. The results show that 56% of colloid nodules and 36% of colloid goitres have Thy3 FNAC, and 28% of colloid nodules and 49% of colloid goitres undergoing surgery have Thy2 on FNAC.

Thy4 / 5 rates in non-neoplastic disease were reassuringly low.

Thyroid surgery patients investigated by FNAC: primary pathology and FNAC result; audit years 2016-2020

Primary pathology	FNAC result							
	Thy 1	Thy 2	Thy 3a	Thy 3f	Thy 3.	Thy 4	Thy 5	Unspecified
Anaplastic	2	1	2	5	0	6	34	1
Auto immune thyroiditis	47	61	67	161	11	17	3	3
C-cell hyperplasia	8	5	7	14	3	1	0	0
Colloid goitre	479	1,882	401	886	95	53	4	23
Colloid nodule	234	473	272	631	51	46	4	12
Follicular adenoma	274	330	449	1,969	174	81	10	21
Follicular thyroid cancer	37	81	118	568	47	75	55	4
Graves' disease	6	35	6	27	3	7	1	0
Lymphoma	6	3	4	1	2	1	1	0
Metastatic cancer	2	1	1	1	2	3	11	1
Medullary thyroid cancer	3	3	9	17	6	18	139	4
Oncocytic adenoma	19	25	46	249	21	16	5	2
Oncocytic carcinoma	3	8	14	109	6	9	20	2
Other cancer	6	3	3	20	1	7	40	3
Papillary thyroid cancer	213	222	356	838	93	690	2,168	46
Simple cyst	161	132	14	8	4	2	0	3
Other	94	131	92	297	38	43	26	7
Unspecified	241	436	323	864	86	158	265	41
All	**1,835**	**3,832**	**2,184**	**6,665**	**643**	**1,233**	**2,786**	**173**

Thyroid surgery for patients investigated by FNAC: FNAC results for selected primary pathologies; audit years 2016-2020



Secondary pathology

The commonest secondary pathology is papillary thyroid cancer, which accounts for one-third of additional pathology, followed by auto immune thyroiditis and colloid goitre.

Thyroid surgery where primary pathology is recorded: additional pathology; audit years 2016-2020

Secondary pathology	Count	Percentage
Anaplastic cancer	5	0.2%
Auto immune thyroiditis	553	21.8%
C-cell hyperplasia	17	0.7%
Colloid goitre	326	12.8%
Colloid nodule	138	5.4%
Follicular adenoma	198	7.8%
Follicular thyroid cancer	52	2.0%
Graves' disease	93	3.7%
Lymphoma	3	0.1%
Metastatic	7	0.3%
Medullary thyroid cancer	11	0.4%
Oncocytic adenoma	53	2.1%
Oncocytic carcinoma	6	0.2%
Other cancer	30	1.2%
Papillary thyroid cancer	839	33.0%
Simple cyst	23	0.9%
Other	186	7.3%
Unspecified	109	
All	**2,649**	

Thyroid surgery where primary pathology is recorded: additional pathology and primary pathology; audit years 2016-2020

Secondary pathology	Primary pathology of cancer				
	No	Yes	Unspecified	All	Percentage in the cancer group
Anaplastic cancer	0	5	0	**5**	0.5%
Auto immune thyroiditis	362	191	0	**553**	20.4%
C-cell hyperplasia	11	6	0	**17**	0.6%
Colloid goitre	133	193	0	**326**	20.6%
Colloid nodule	62	76	0	**138**	8.1%
Follicular adenoma	86	112	0	**198**	12.0%
Follicular thyroid cancer	18	34	0	**52**	3.6%
Graves' disease	41	52	0	**93**	5.6%
Lymphoma	1	2	0	**3**	0.2%
Metastatic	0	7	0	**7**	0.7%
Medullary thyroid cancer	6	5	0	**11**	0.5%
Oncocytic adenoma	19	34	0	**53**	3.6%
Oncocytic carcinoma	4	2	0	**6**	0.2%
Other cancer	19	11	0	**30**	1.2%
Papillary thyroid cancer	704	135	0	**839**	14.4%
Simple cyst	16	7	0	**23**	0.7%
Other	123	63	0	**186**	6.7%
Unspecified	80	29	0	**109**	
All	**1,685**	**964**	**0**	2,649	

Cancer at first operation

Cancer, age and gender

These results are very similar to those reported in the Fifth National Audit Report, and show a higher incidence of thyroid cancer and benign thyroid disease in women, but a higher malignant : benign ratio in men, due to the fact that benign disease is much more common in women.

Hence, men are less likely to undergo thyroid surgery, but when they do it is more likely to be for cancer.

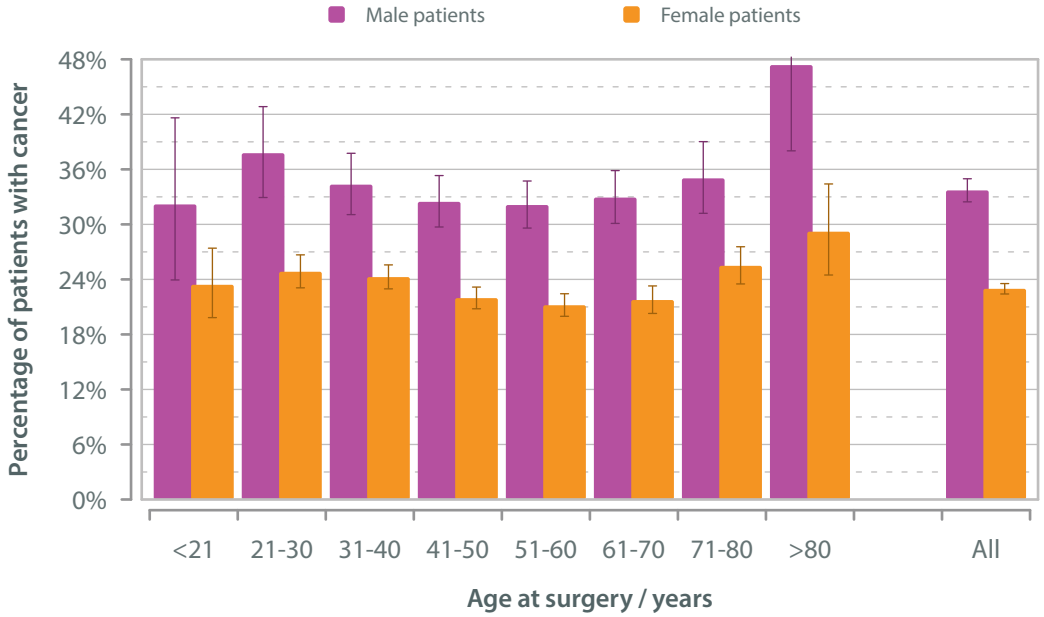
A bimodal age distribution of thyroid cancer is also seen with peaks of incidence in the third and ninth decades.

Hence it is important to be more suspicious of thyroid nodules in young people and the elderly.

First-time thyroid surgery: age at surgery and primary pathology of cancer; audit years 2016-2020

Age at surgery / years	Gender and primary pathology of cancer							
	Male				Female			
	No cancer	Cancer	Unspecified	Cancer rate	No cancer	Cancer	Unspecified	Cancer rate
<21	78	37	26	32.2%	386	118	73	23.4%
21-30	239	145	65	37.8%	1,707	564	376	24.8%
31-40	526	275	132	34.3%	3,186	1,020	740	24.3%
41-50	745	358	182	32.5%	3,732	1,050	825	22.0%
51-60	888	420	242	32.1%	3,405	915	780	21.2%
61-70	707	347	181	32.9%	2,324	646	567	21.8%
71-80	386	208	126	35.0%	1,357	464	319	25.5%
>80	60	54	34	47.4%	240	99	74	29.2%
Unspecified	12	7	2	36.8%	39	8	18	17.0%
All	**3,641**	**1,851**	**990**	**33.7%**	**16,376**	**4,884**	**3,772**	**23.0%**

First-time thyroid surgery: Primary pathology of cancer, age and gender; audit years 2016-2020 (n=26,752)



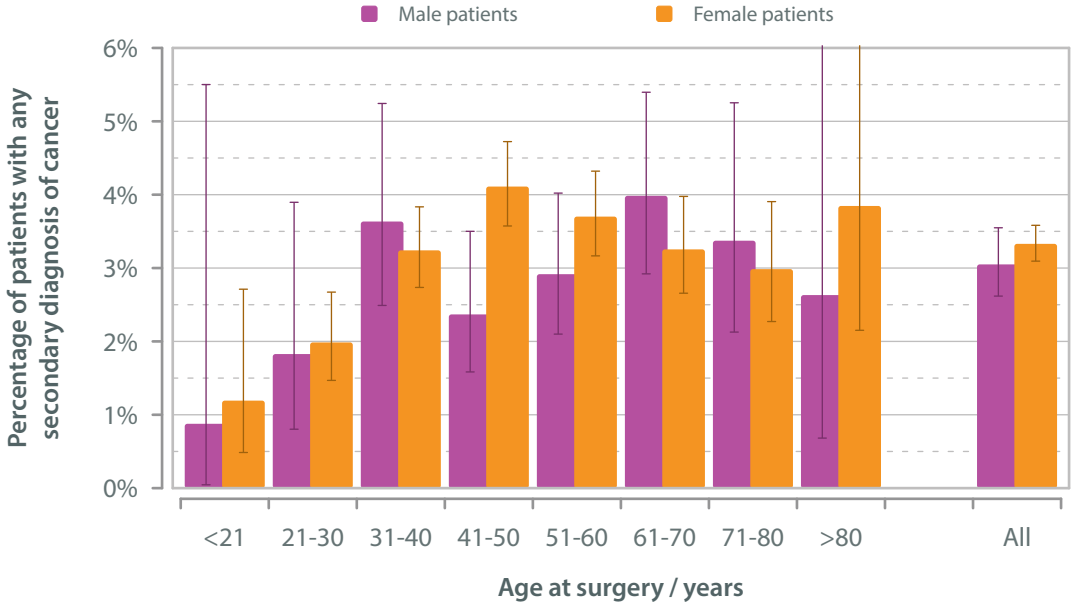
Secondary cancer, age and gender

The incidence of secondary thyroid cancer is low (<4%) in all age groups, but follows a different distribution to that seen for primary thyroid cancer, with an increase in incidence with age to a peak in middle age. A further peak was also seen in women in their ninth decade.

First-time thyroid surgery: Age, gender and cancer diagnoses; audit years 2016-2020

Gender and age at surgery / years		Primary or secondary cancer diagnosis							
		Count					Proportion		
		Neither	Primary	Secondary	Primary & secondary	Unspecified	Primary	Secondary	Primary & secondary
Male	<21	76	37	1	0	27	32.5%	0.9%	0.0%
	21-30	234	142	5	2	66	37.1%	1.3%	0.5%
	31-40	502	267	22	7	135	33.5%	2.8%	0.9%
	41-50	721	351	22	4	187	32.0%	2.0%	0.4%
	51-60	849	416	35	3	247	31.9%	2.7%	0.2%
	61-70	680	332	27	15	181	31.5%	2.6%	1.4%
	71-80	375	198	10	10	127	33.4%	1.7%	1.7%
	>80	58	53	2	1	34	46.5%	1.8%	0.9%
	Unspecified	11	7	1	0	2	36.8%	5.3%	0.0%
	All	**3,506**	**1,803**	**125**	**42**	**1,006**	**32.9%**	**2.3%**	**0.8%**
Female	<21	380	117	6		74	23.3%	1.2%	0.0%
	21-30	1,668	553	35	10	381	24.4%	1.5%	0.4%
	31-40	3,069	991	108	28	750	23.6%	2.6%	0.7%
	41-50	3,553	1,019	168	28	839	21.4%	3.5%	0.6%
	51-60	3,255	882	132	27	804	20.5%	3.1%	0.6%
	61-70	2,225	629	84	12	587	21.3%	2.8%	0.4%
	71-80	1,311	444	37	17	331	24.5%	2.0%	0.9%
	>80	229	96	10	3	75	28.4%	3.0%	0.9%
	Unspecified	39	8	0	0	18	17.0%	0.0%	0.0%
	All	**15,729**	**4,739**	**580**	**125**	**3,859**	**22.4%**	**2.7%**	**0.6%**

First-time thyroid surgery: Any secondary pathology of cancer, age and gender; audit years 2016-2020 (n=26,583)



Cancer staging for primary pathologies

The distribution of cancer stage for all three types of thyroid cancer in the 2016-2020 dataset was very similar to that seen in the previous 2010-2015 audit period.

Follicular thyroid cancers mostly present as T2 / 3 tumours; the highest proportion of medullary thyroid cancers present as T3 lesions; and there are two peaks of papillary thyroid cancer at T1a, representing papillary thyroid microcarcinoma, and at T3.

The vast majority of follicular thyroid cancers are either N0 / Nx *i.e.,* do not have lymph node metastases, though the distinction between N0 and Nx is unreliable given that the majority of these patients did not, in fact, undergo lymph node dissection.

Just less than 30% of patients with papillary thyroid cancer have lymph node metastases with a slightly higher incidence in the lateral compartment of the neck than the central compartment.

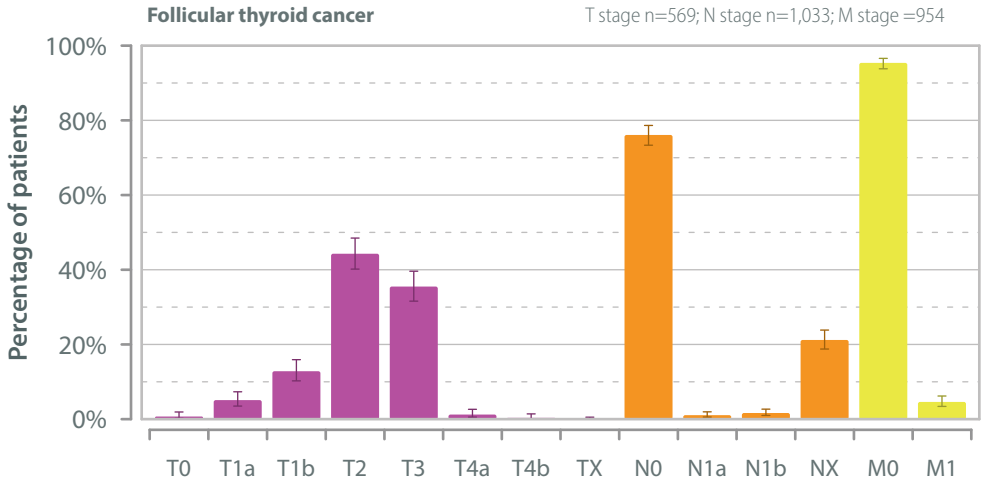
Medullary thyroid cancer had the highest incidence of lymph node metastases, as would be expected, with just over 40% occurring in the lateral compartment of the neck.

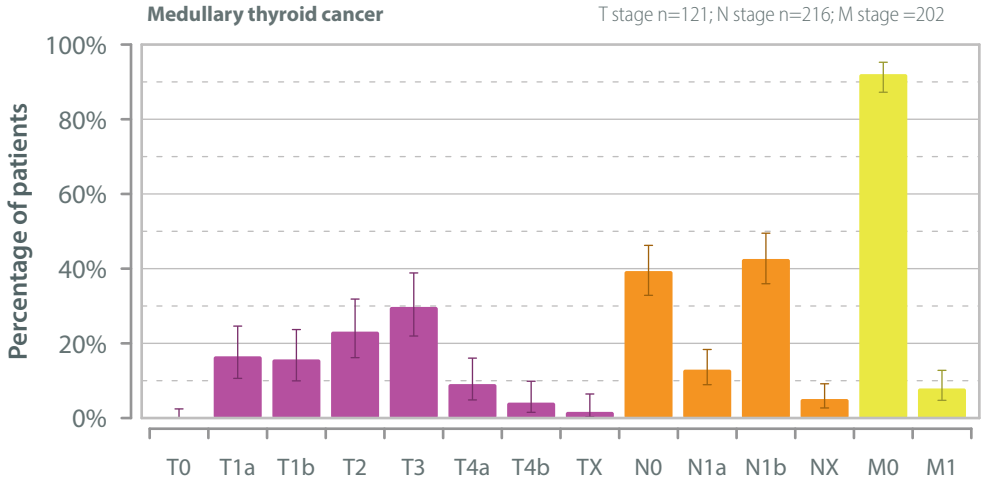
Surgery on patients with distant metastases was uncommon, though more likely in medullary thyroid cancer.

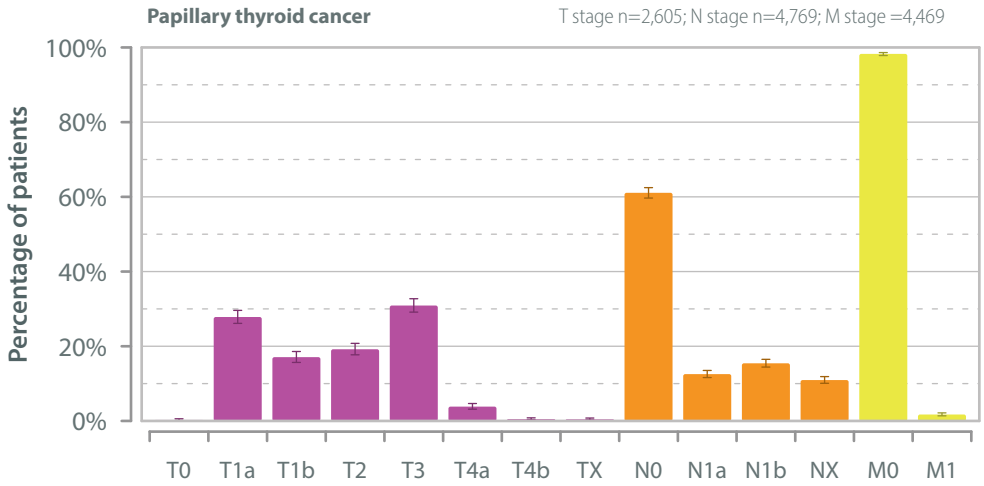
Cancer staging for primary pathologies continued …

The following set of charts report data recorded on version 7 of the TNM classification system.

First-time thyroid surgery for cancer: Cancer TNM staging version 7; audit years 2016-2020

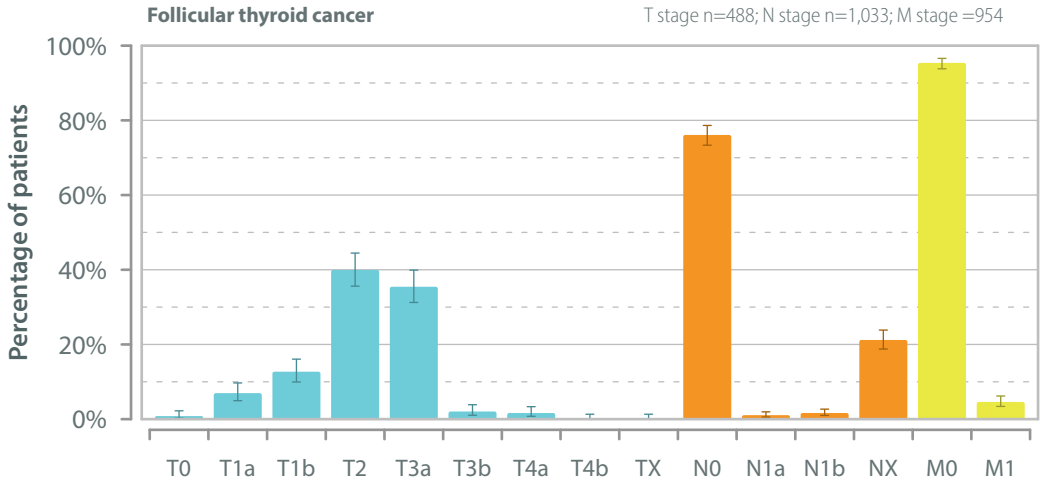


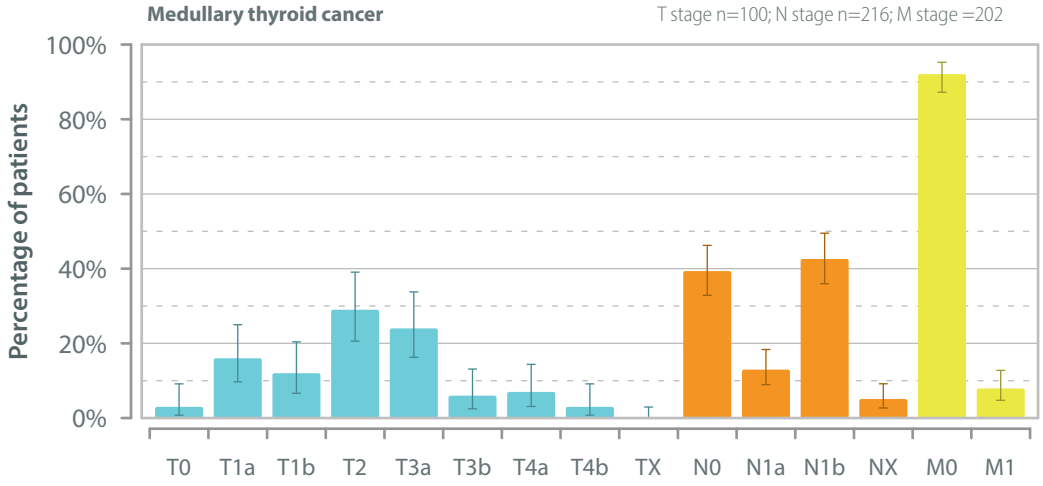


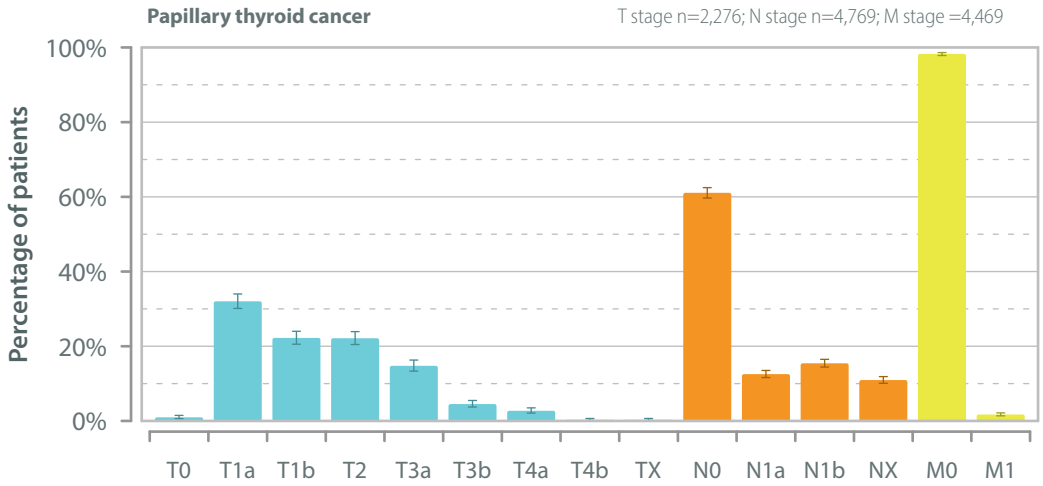


The next set of charts report data recorded on version 8 of the TNM classification system.

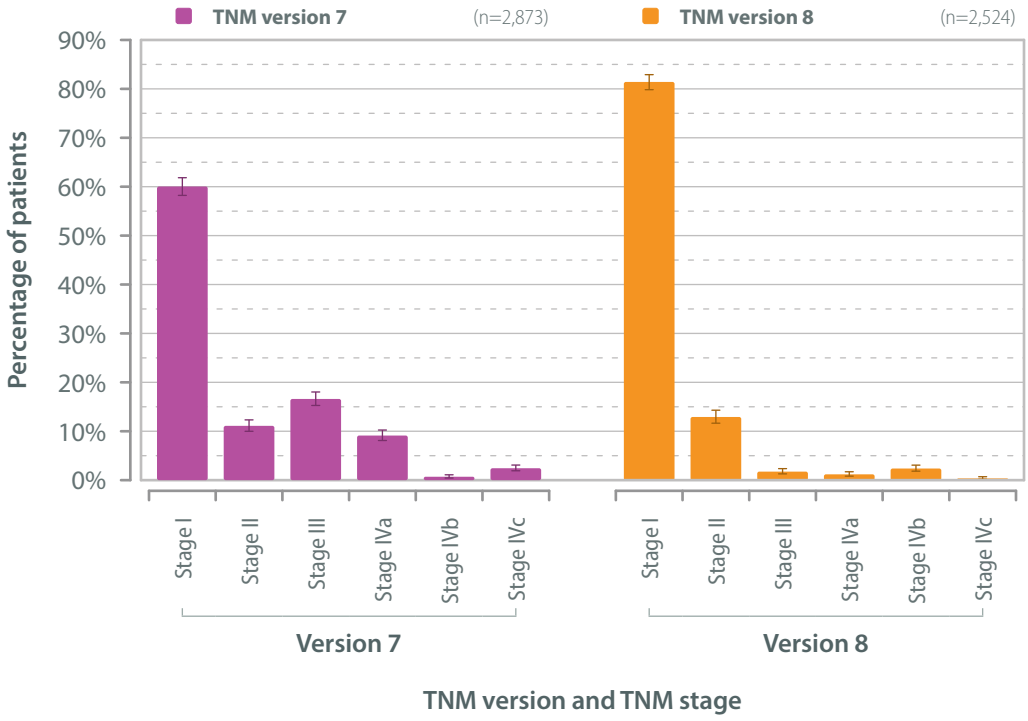
First-time thyroid surgery for cancer: Cancer TNM staging version 8; audit years 2016-2020







First time thyroid surgery: Overall cancer stage for primary pathologies; audit years 2016-2020



Operations for thyroid cancer

The proportion of patients who underwent lobectomy for papillary thyroid cancer has increased slightly to 51% (2,508/4,903) in the current audit period compared to 45% (1,473/3,267) in the data reported for the Fifth Audit Report. This would be in keeping with a trend towards more conservative surgery in thyroid cancer.

The majority of patients with follicular (82%) and oncocytic (78%) thyroid cancer underwent thyroid lobectomy, which is a slight increase in the proportion that underwent lobectomy (76%) for both compared to data presented the Fifth Audit Report.

In contrast, the majority (75%) of patients with medullary thyroid cancer underwent total thyroidectomy, which was an increase compared to the rate in the same group from the previously-published five-year audit period (70%).

First-time thyroid surgery for cancer: operation performed and primary diagnosis; audit years 2016-2020

		Primary pathology				
		Papillary thyroid cancer	Follicular thyroid cancer	Medullary thyroid cancer	Oncocytic carcinoma	All cancers
Operation performed – Counts	Total thyroidectomy	2,203	162	165	31	**2,627**
	Lobectomy + sub-total thyroidectomy	13	1	1	0	**18**
	Lobectomy	2,508	880	42	135	**3,642**
	Bilateral sub-total lobectomy	8	0	3	0	**13**
	Near total lobectomy	28	10	0	2	**43**
	Biopsy	5	0	1	0	**10**
	Other	102	19	2	5	**133**
	Nodal alone	36	4	6	0	**51**
	Unspecified	163	19	10	5	**198**
	All	**5,066**	**1,095**	**230**	**178**	6,735
Percentage of operations	Total thyroidectomy	44.9%	15.1%	75.0%	17.9%	**40.2%**
	Lobectomy + sub-total thyroidectomy	0.3%	0.1%	0.5%	0.0%	**0.3%**
	Lobectomy	51.2%	81.8%	19.1%	78.0%	**55.7%**
	Bilateral sub-total lobectomy	0.2%	0.0%	1.4%	0.0%	**0.2%**
	Near total lobectomy	0.6%	0.9%	0.0%	1.2%	**0.7%**
	Biopsy	0.1%	0.0%	0.5%	0.0%	**0.2%**
	Other	2.1%	1.8%	0.9%	2.9%	**2.0%**
	Nodal alone	0.7%	0.4%	2.7%	0.0%	**0.8%**

Node dissection

Fewer (29%) patients with papillary thyroid cancer underwent nodal surgery in 2016-2020 compared to 2010-2015 (38%) and fewer (14%) patients underwent level 6-7 nodal dissection in 2016-2020 compared to 2010-2015 (20%). As UKRETS does not record whether central lymph node dissection was undertaken with prophylactic or therapeutic intent, we cannot determine whether or not there has been a decline in the practice of prophylactic central lymph node dissection since the British Thyroid Association published their advice to restrict this to high risk patients [1].

In the data from the current audit period, fewer patients underwent nodal surgery for follicular thyroid cancer (5%) and oncocytic carcinoma (6%) compared to the same pathological groups treated in the previous five-year audit period (10% and 14% respectively).

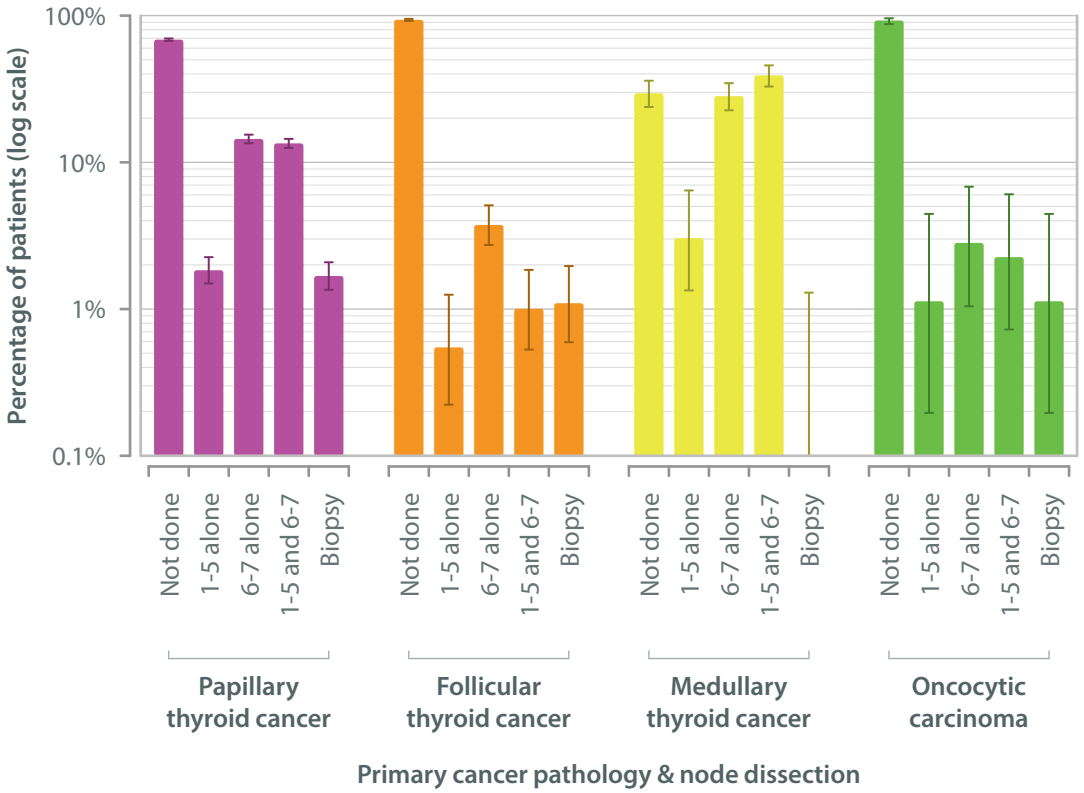
Similar proportions underwent nodal dissection for medullary thyroid cancer in the current audit period (70%) compared to data from the last report (72%) with slightly more undergoing level 6-7 alone (28% *versus* 25%) and fewer undergoing level 1-7 (39% *versus* 44%) respectively (comparing the 2010-2015 audit period to the 2016-2020 audit period).

First-time thyroid surgery for cancer: node dissection and primary pathology; audit years 2016-2020

		Primary pathology				
		Papillary thyroid cancer	Follicular thyroid cancer	Medullary thyroid cancer	Oncocytic carcinoma	All cancers
Nodal surgery	Not done	3,469	1,025	68	164	**4,825**
	1-5 alone	93	6	7	2	**116**
	6-7 alone	730	41	65	5	**854**
	Both	681	11	90	4	**826**
	Biopsy	85	12	0	2	**105**
	Unspecified	8	0	0	1	**9**
	All	**5,066**	**1,095**	**230**	**178**	**6,735**

1. British Thyroid Association Guidelines for the Management of Thyroid Cancer Clinical Endocrinology. 2014: 81 (supplement 1)

First-time surgery for cancer: Nodal dissection and primary pathology; audit years 2016-2020



Surgery for papillary thyroid cancer

Lobectomy was the most common thyroid procedure for papillary thyroid cancer up to T2. For T3 tumours and above total thyroidectomy was undertaken more frequently.

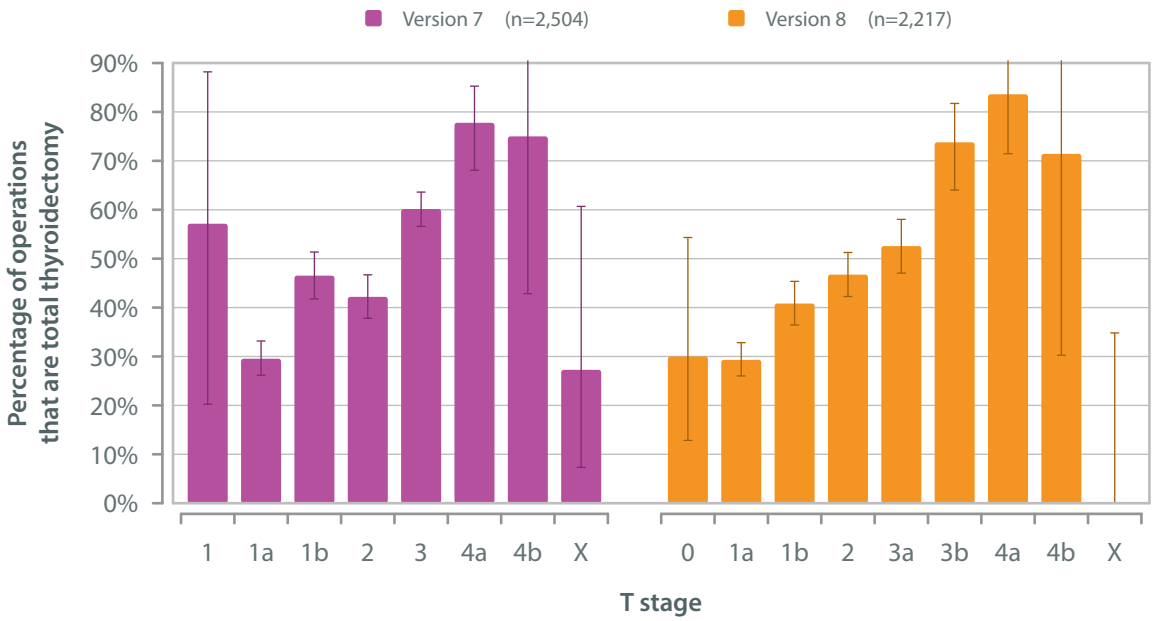
The extent of thyroid surgery in low-risk thyroid cancer is controversial and is currently being investigated in the HOT (Hemithyroidectomy or Total thyroidectomy in low-risk thyroid cancer) trial. It is interesting to observe what proportion of patients underwent each procedure according to T stage, FNAC category, age and gender over the past four years in UKRETS.

First-time surgery for papillary thyroid cancer: T stage and type of operation; audit years 2016-2020

		Operation performed						
		Counts				Percentage of operations		
		Total thyroidectomy	Lobectomy	Others	Unspecified	Total thyroidectomy	Lobectomy	Others
T stage (TNM version 7)	T0	4	3	0	0	57.1%	42.9%	0.0%
	T1a	200	446	31	48	29.5%	65.9%	4.6%
	T1b	201	214	17	13	46.5%	49.5%	3.9%
	T2	208	273	12	7	42.2%	55.4%	2.4%
	T3	465	283	25	32	60.2%	36.6%	3.2%
	T4a	77	17	5	1	77.8%	17.2%	5.1%
	T4b	9	1	2	0	75.0%	8.3%	16.7%
	TX	3	2	6	0	27.3%	18.2%	54.5%
	Unspecified	1,036	1,269	94	62	43.2%	52.9%	3.9%
	All	**2,203**	**2,508**	**192**	**163**	**44.9%**	**51.2%**	**3.9%**
		Total thyroidectomy	Lobectomy	Others	Unspecified	Total thyroidectomy	Lobectomy	Others
T stage (TNM version 8)	T0	6	10	4	2	30.0%	50.0%	20.0%
	T1a	209	472	32	16	29.3%	66.2%	4.5%
	T1b	198	265	22	21	40.8%	54.6%	4.5%
	T2	229	250	11	14	46.7%	51.0%	2.2%
	T3a	174	152	5	5	52.6%	45.9%	1.5%
	T3b	76	25	2	0	73.8%	24.3%	1.9%
	T4a	51	9	1	1	83.6%	14.8%	1.6%
	T4b	5	1	1	0	71.4%	14.3%	14.3%
	TX	0	2	5	0	0.0%	28.6%	71.4%
	Unspecified	1,255	1,322	109	104	46.7%	49.2%	4.1%
	All	**2,203**	**2,508**	**192**	**163**	**44.9%**	**51.2%**	**3.9%**

The odds ratio for undergoing a total thyroidectomy for papillary thyroid cancer was significantly higher after a Thy4 (0.84; 95% CI: 0.71-1.00) and Thy5 (4.13; 95% CI: 3.66-4.66) than after Thy1-3 FNAC, which is similar to the findings quoted in the Fifth Audit Report.

**First-time thyroid surgery for papillary thyroid cancer:
Type of operation and cancer T stage; audit years 2016-2020**



Men were more likely to undergo total thyroidectomy for papillary thyroid cancer (OR 1.24; 95% CI: 1.10-1.40) than women (OR 0.92; 95% CI: 0.85-1.01) as was also reported in the 2010-2015 data.

Total thyroidectomy for papillary thyroid cancer was also undertaken significantly more often in the young (<21 years; OR 2.11; 95% CI: 1.41-3.14) and the elderly (>80 years; OR 2.32; 95% CI: 1.48-3.66) compared to all other age groups.

MDT discussion was more likely to occur (OR 0.43; 95% CI: 0.37-0.49) for patients with papillary thyroid cancer after Thy3 / 4 FNAC than not (OR 0.21; 95% CI: 0.16-0.27).

First-time thyroid surgery for papillary thyroid cancer: odds on total thyroidectomy; audit years 2016-2020

			Total thyroidectomy			Odds ratio versus overall (95% CI)
			No	Yes	Unspecified	Rate	
All patients			**2,700**	**2,203**	**163**	**44.9%**	
Pre-operative factor	FNAC result where FNAC was performed	Thy 1	173	20	2	10.4%	**0.14** (0.09-0.23)
		Thy 2	167	38	4	18.5%	**0.28** (0.20-0.40)
		Thy 3a	272	45	5	14.2%	**0.20** (0.15-0.28)
		Thy 3f	679	87	15	11.4%	**0.16** (0.12-0.20)
		Thy 3.	66	8	9	10.8%	**0.15** (0.07-0.31)
		Thy 4	377	259	24	40.7%	**0.84** (0.71-1.00)
		Thy 5	435	1,465	41	77.1%	**4.13** (3.66-4.66)
		Unspecified	20	21	2		
		All	**2,189**	**1,943**	**102**		
	Gender	Male	642	651	42	50.3%	**1.24** (1.10-1.40)
		Female	2,058	1,552	121	43.0%	**0.92** (0.85-1.01)
		All	**2,700**	**2,203**	**163**		
	Age at operation / years	<21	39	67	8	63.2%	**2.11** (1.41-3.14)
		21-30	289	266	15	47.9%	**1.13** (0.95-1.34)
		31-40	582	443	39	43.2%	**0.93** (0.81-1.07)
		41-50	617	459	39	42.7%	**0.91** (0.80-1.04)
		51-60	559	415	29	42.6%	**0.91** (0.79-1.05)
		61-70	359	320	21	47.1%	**1.09** (0.93-1.28)
		71-80	221	174	8	44.1%	**0.96** (0.78-1.19)
		>80	29	55	1	65.5%	**2.32** (1.48-3.66)
		Unspecified	5	4	3		
		All	**2,700**	**2,203**	**163**		
	Pre-operative MDT for Thy 3-4 results	No	465	79	10	14.5%	**0.21** (0.16-0.27)
		Yes	912	318	43	25.9%	**0.43** (0.37-0.49)
		Unspecified	17	2	0		
		All	**1,394**	**399**	**53**		

First-time thyroid surgery for papillary thyroid cancer: T and N stage and nodal surgery; audit years 2016-2020

		Nodal surgery						
		Known	Unspecified	Not done	1-5 alone	6-7 alone	Both	Biopsy
T stage (version 7)	T0	7	0	42.9%	14.3%	14.3%	14.3%	14.3%
	T1a	723	2	82.6%	1.0%	8.4%	6.2%	1.8%
	T1b	445	0	68.5%	1.8%	15.5%	10.6%	3.6%
	T2	500	0	72.0%	1.2%	16.8%	8.0%	2.0%
	T3	803	2	56.7%	2.7%	17.7%	21.3%	1.6%
	T4a	100	0	29.0%	3.0%	24.0%	44.0%	0.0%
	T4b	12	0	8.3%	8.3%	8.3%	75.0%	0.0%
	TX	11	0	18.2%	54.5%	9.1%	18.2%	0.0%
	Unspecified	2,457	4	69.9%	1.6%	14.1%	13.1%	1.3%
	All	**5,058**	**8**	**68.6%**	**1.8%**	**14.4%**	**13.5%**	**1.7%**
T stage (version 8)	T0	22	0	72.7%	9.1%	13.6%	4.5%	0.0%
	T1a	727	2	83.1%	1.1%	7.8%	5.8%	2.2%
	T1b	504	2	73.4%	1.4%	14.9%	8.9%	1.4%
	T2	504	0	66.9%	1.4%	17.3%	13.3%	1.2%
	T3a	336	0	61.6%	0.6%	17.9%	19.0%	0.9%
	T3b	103	0	38.8%	1.0%	24.3%	35.9%	0.0%
	T4a	62	0	38.7%	0.0%	12.9%	48.4%	0.0%
	T4b	7	0	28.6%	0.0%	14.3%	57.1%	0.0%
	TX	7	0	28.6%	42.9%	14.3%	14.3%	0.0%
	Unspecified	2,786	4	67.0%	2.3%	14.8%	14.0%	1.9%
	All	**5,058**	**8**	**68.6%**	**1.8%**	**14.4%**	**13.5%**	**1.7%**
N stage	N0	2,906	7	85.5%	0.5%	11.1%	0.8%	2.1%
	N1a	598	0	34.4%	1.5%	54.7%	5.9%	3.5%
	N1b	736	0	5.7%	8.3%	6.1%	79.8%	0.1%
	NX	521	1	98.7%	0.2%	0.6%	0.2%	0.4%
	Unspecified	297	0	75.1%	2.4%	10.8%	11.8%	0.0%
	All	**5,058**	**8**	**68.6%**	**1.8%**	**14.4%**	**13.5%**	**1.7%**

Surgery for follicular thyroid cancer

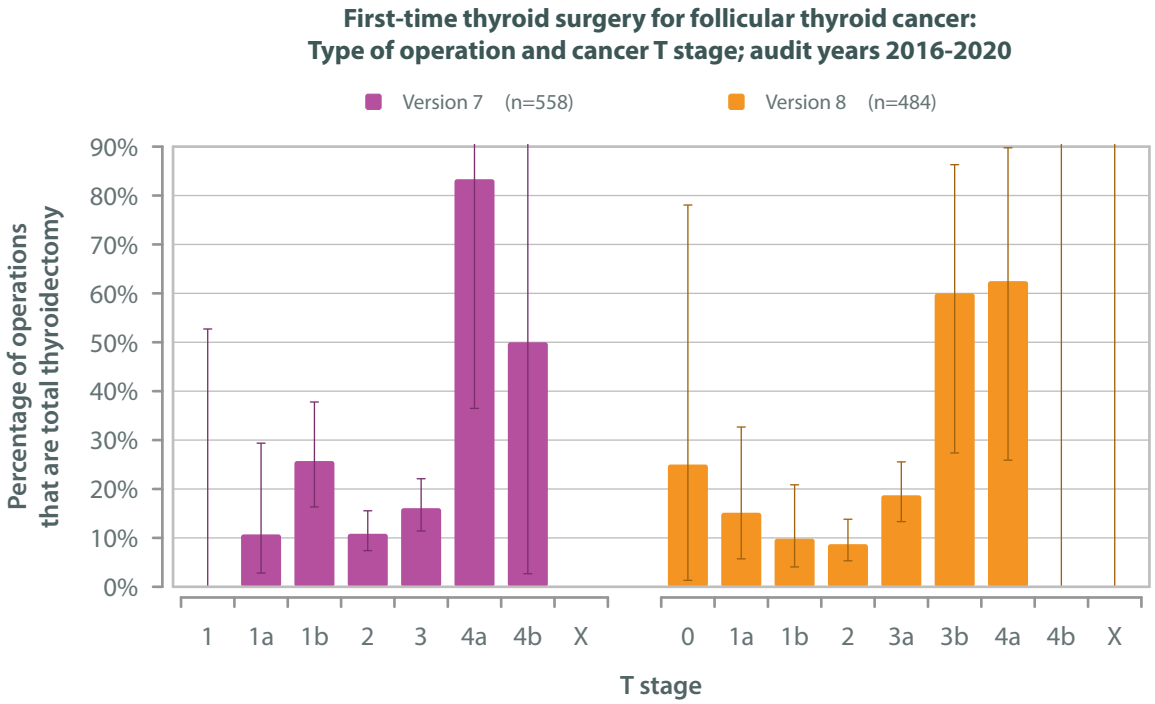
Lobectomy was more likely to be undertaken for follicular thyroid cancer up to T3 (TNM version 7) or T3a (TNM version 8). Higher T stage follicular thyroid cancers underwent total thyroidectomy more often.

The odds ratio of undergoing a total thyroidectomy for follicular thyroid cancer was significantly higher following a Thy5 FNAC (OR 17.5; 95% CI: 8.4-36.4) than other FNAC categories.

First-time surgery for follicular thyroid cancer: T stage and type of operation; audit years 2016-2020

T stage (TNM version 7)	Operation performed: Counts				Operation performed: Percentage of operations		
	Total thyroidectomy	Lobectomy	Others	Unspecified	Total thyroidectomy	Lobectomy	Others
T0	0	4	0	0	0.0%	100.0%	0.0%
T1a	3	24	1	1	10.7%	85.7%	3.6%
T1b	18	50	2	3	25.7%	71.4%	2.9%
T2	27	216	6	3	10.8%	86.7%	2.4%
T3	32	163	4	3	16.1%	81.9%	2.0%
T4a	5	1	0	1	83.3%	16.7%	0.0%
T4b	1	0	1	0	50.0%	0.0%	50.0%
TX	0	0	0	0			
Unspecified	76	422	20	8	14.7%	81.5%	3.9%
All	**162**	**880**	**34**	**19**	**15.1%**	**81.8%**	**3.2%**

T stage (TNM version 8)	Total thyroidectomy	Lobectomy	Others	Unspecified	Total thyroidectomy	Lobectomy	Others
T0	1	2	1	0	25.0%	50.0%	25.0%
T1a	5	25	3	1	15.2%	75.8%	9.1%
T1b	6	52	3	1	9.8%	85.2%	4.9%
T2	17	169	9	0	8.7%	86.7%	4.6%
T3a	32	136	3	2	18.7%	79.5%	1.8%
T3b	6	4	0	0	60.0%	40.0%	0.0%
T4a	5	3	0	0	62.5%	37.5%	0.0%
T4b	0	1	0	0	0.0%	100.0%	0.0%
TX	0	0	1	0	0.0%	0.0%	100.0%
Unspecified	90	488	14	15	15.2%	82.4%	2.4%
All	**162**	**880**	**34**	**19**	**15.1%**	**81.8%**	**3.2%**


First-time thyroid surgery for follicular thyroid cancer:
Type of operation and cancer T stage; audit years 2016-2020
Version 7 (n=558)
Version 8 (n=484)
Percentage of operations that are total thyroidectomy
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1
1a
1b
2
3
4a
4b
X
0
1a
1b
2
3a
3b
4a
4b
X
T stage

Unlike the data for patients with papillary thyroid cancer, age and gender had no significant affect on the probability of undergoing total thyroidectomy for patients with follicular thyroid cancer, and there was no significant difference in the proportion of patients discussed pre-operatively in the MDT after a Thy3-4 FNAC result.

First-time thyroid surgery for follicular thyroid cancer: odds on total thyroidectomy; audit years 2016-2020

			Total thyroidectomy				Odds ratio versus overall (95% CI)
			No	Yes	Unspecified	Rate	
All patients			**914**	**162**	**19**	**15.1%**	
Pre-operative factor	FNAC result where FNAC was performed	Thy 1	34	2	0	5.6%	**0.33** (0.08-1.39)
		Thy 2	62	12	2	16.2%	**1.09** (0.58-2.07)
		Thy 3a	102	7	1	6.4%	**0.39** (0.18-0.85)
		Thy 3f	478	59	7	11.0%	**0.70** (0.51-0.96)
		Thy 3.	41	4	0	8.9%	**0.55** (0.19-1.56)
		Thy 4	47	15	3	24.2%	**1.80** (0.98-3.30)
		Thy 5	10	31	3	75.6%	**17.49** (8.41-36.37)
		Unspecified	2	1	1		
		All	**776**	**131**	**17**		
	Gender	Male	248	43	5	14.8%	**0.98** (0.68-1.41)
		Female	666	119	14	15.2%	**1.01** (0.78-1.30)
		All	**914**	**162**	**19**		
	Age at operation / years	<21	26	1	1	3.7%	**0.22** (0.03-1.61)
		21-30	101	13		11.4%	**0.73** (0.40-1.32)
		31-40	159	13	2	7.6%	**0.46** (0.26-0.83)
		41-50	166	26	7	13.5%	**0.88** (0.57-1.38)
		51-60	184	32	2	14.8%	**0.98** (0.65-1.48)
		61-70	135	33	3	19.6%	**1.38** (0.91-2.09)
		71-80	117	31	3	20.9%	**1.49** (0.97-2.30)
		>80	25	12	1	32.4%	**2.71** (1.33-5.50)
		Unspecified	1	1	0		
		All	**914**	**162**	**19**		
	Pre-operative MDT for Thy 3-4 results	No	221	20	0	8.3%	**0.51** (0.31-0.83)
		Yes	433	64	11	12.9%	**0.83** (0.61-1.14)
		Unspecified	14	1	0		
		All	**668**	**85**	**11**		

First-time thyroid surgery for follicular thyroid cancer: T and N stage and nodal surgery; audit years 2016-2020

		Nodal surgery						
		Known	Unspecified	Not done	1-5 alone	6-7 alone	Both	Biopsy
T stage (version 7)	T0	4	0	100.0%	0.0%	0.0%	0.0%	0.0%
	T1a	29	0	93.1%	0.0%	3.4%	3.4%	0.0%
	T1b	73	0	95.9%	0.0%	1.4%	1.4%	1.4%
	T2	252	0	94.8%	0.8%	3.6%	0.0%	0.8%
	T3	202	0	90.6%	0.5%	5.9%	1.5%	1.5%
	T4a	7	0	85.7%	0.0%	14.3%	0.0%	0.0%
	T4b	2	0	50.0%	0.0%	50.0%	0.0%	0.0%
	TX	0	0					
	Unspecified	526	0	94.1%	0.6%	3.0%	1.1%	1.1%
	All	**1,095**	**0**	**93.6%**	**0.5%**	**3.7%**	**1.0%**	**1.1%**
T stage (version 8)	T0	4	0	75.0%	0.0%	25.0%	0.0%	0.0%
	T1a	34	0	97.1%	0.0%	0.0%	2.9%	0.0%
	T1b	62	0	91.9%	1.6%	0.0%	1.6%	4.8%
	T2	195	0	94.9%	0.0%	3.6%	0.5%	1.0%
	T3a	173	0	95.4%	0.6%	2.9%	0.6%	0.6%
	T3b	10	0	80.0%	0.0%	0.0%	20.0%	0.0%
	T4a	8	0	75.0%	0.0%	25.0%	0.0%	0.0%
	T4b	1	0	100.0%	0.0%	0.0%	0.0%	0.0%
	TX	1	0	0.0%	100.0%	0.0%	0.0%	0.0%
	Unspecified	607	0	93.4%	0.5%	4.3%	0.8%	1.0%
	All	**1,095**	**0**	**93.6%**	**0.5%**	**3.7%**	**1.0%**	**1.1%**
N stage	N0	786	0	94.5%	0.4%	3.8%	0.0%	1.3%
	N1a	11	0	9.1%	0.0%	54.5%	18.2%	18.2%
	N1b	17	0	29.4%	11.8%	5.9%	52.9%	0.0%
	NX	219	0	97.7%	0.5%	1.8%	0.0%	0.0%
	Unspecified	62	0	100.0%	0.0%	0.0%	0.0%	0.0%
	All	**1,095**	**0**	**93.6%**	**0.5%**	**3.7%**	**1.0%**	**1.1%**

Surgery for medullary thyroid cancer

Total thyroidectomy was more common irrespective of T stage for patients with medullary thyroid cancer.

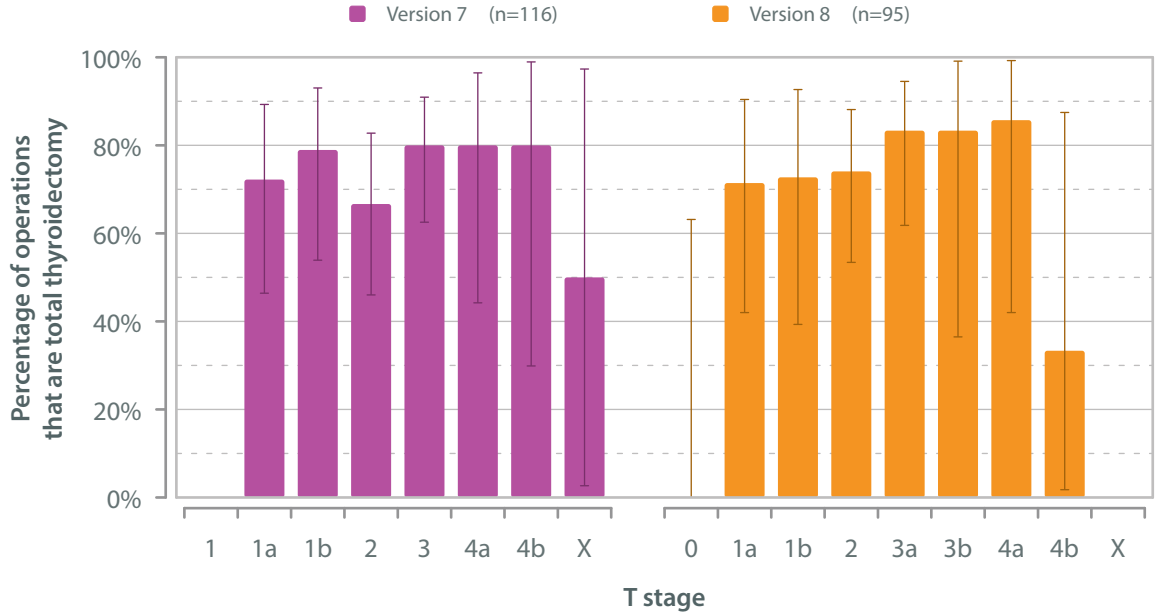
Significantly fewer patients with a Thy3a (OR 0.04; 95% CI: 0.01-0.34) and Thy3f (OR 0.06; 95% CI: 0.01-0.26) underwent total thyroidectomy for medullary thyroid cancer compared to Thy4 (OR 2.5; 95% CI: 0.55-11.28) and Thy5 (OR 2.64; 95% CI: 1.38-5.07).

First-time surgery for medullary thyroid cancer: T stage and type of operation; audit years 2016-2020

		Operation performed						
		Counts				Percentage of operations		
		Total thyroidectomy	Lobectomy	Others	Unspecified	Total thyroidectomy	Lobectomy	Others
T stage (TNM version 7)	T0	0	0	0	0			
	T1a	13	5	0	2	72.2%	27.8%	0.0%
	T1b	15	4	0	0	78.9%	21.1%	0.0%
	T2	18	9	0	1	66.7%	33.3%	0.0%
	T3	28	5	2	1	80.0%	14.3%	5.7%
	T4a	8	1	1	1	80.0%	10.0%	10.0%
	T4b	4	1	0	0	80.0%	20.0%	0.0%
	TX	1	0	1	0	50.0%	0.0%	50.0%
	Unspecified	78	17	9	5	75.0%	16.3%	8.7%
	All	**165**	**42**	**13**	**10**	**75.0%**	**19.1%**	**5.9%**

		Total thyroidectomy	Lobectomy	Others	Unspecified	Total thyroidectomy	Lobectomy	Others
T stage (TNM version 8)	T0	0	2	1	0	0.0%	66.7%	33.3%
	T1a	10	3	1	2	71.4%	21.4%	7.1%
	T1b	8	3	0	1	72.7%	27.3%	0.0%
	T2	20	7	0	2	74.1%	25.9%	0.0%
	T3a	20	2	2	0	83.3%	8.3%	8.3%
	T3b	5	1	0	0	83.3%	16.7%	0.0%
	T4a	6	0	1	0	85.7%	0.0%	14.3%
	T4b	1	0	2	0	33.3%	0.0%	66.7%
	TX	0	0	0	0			
	Unspecified	95	24	6	5	76.0%	19.2%	4.8%
	All	**165**	**42**	**13**	**10**	**75.0%**	**19.1%**	**5.9%**

First-time thyroid surgery for medullary thyroid cancer: Type of operation and cancer T stage; audit years 2016-2020



Age and gender had no significant affect on the probability of undergoing total thyroidectomy for patients with medullary thyroid cancer and neither was there any significant difference in the proportion of patients discussed pre-operatively in the MDT after a Thy3-4 FNAC.

First-time thyroid surgery for medullary thyroid cancer: odds on total thyroidectomy; audit years 2016-2020

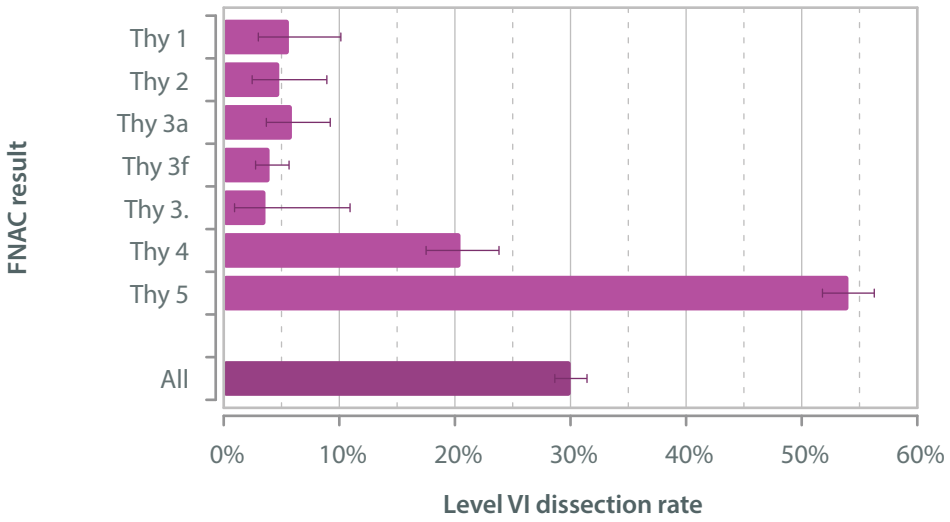
			Total thyroidectomy				Odds ratio versus overall (95% CI)
			No	Yes	Unspecified	Rate	
All patients			**55**	**165**	**10**	**75.0%**	
Pre-operative factor	FNAC result where FNAC was performed	Thy 1	1	2	0	66.7%	0.67 (0.06-7.50)
		Thy 2	1	2	0	66.7%	0.67 (0.06-7.50)
		Thy 3a	8	1	0	11.1%	0.04 (0.01-0.34)
		Thy 3f	12	2	2	14.3%	0.06 (0.01-0.26)
		Thy 3.	3	2	0	40.0%	0.22 (0.04-1.36)
		Thy 4	2	15	1	88.2%	2.50 (0.55-11.28)
		Thy 5	13	103	1	88.8%	2.64 (1.38-5.07)
		Unspecified	0	2	0		
		All	**40**	**129**	**4**		
	Gender	Male	17	81	6	82.7%	1.59 (0.87-2.91)
		Female	38	84	4	68.9%	0.74 (0.45-1.20)
		All	**55**	**165**	**10**		
	Age at operation / years	<21	0	11	0	100.0%	
		21-30	1	13	1	92.9%	4.33 (0.55-33.89)
		31-40	8	17	0	68.0%	0.71 (0.29-1.73)
		41-50	8	35	1	81.4%	1.46 (0.64-3.33)
		51-60	10	27	3	73.0%	0.90 (0.41-1.98)
		61-70	18	40	4	69.0%	0.74 (0.39-1.40)
		71-80	8	17	1	68.0%	0.71 (0.29-1.73)
		>80	2	5	0	71.4%	0.83 (0.16-4.42)
		Unspecified	0	0	0		
		All	**55**	**165**	**10**		
	Pre-operative MDT for Thy 3-4 results	No	4	2	0	33.3%	0.17 (0.03-0.94)
		Yes	21	18	3	46.2%	0.29 (0.14-0.58)
		Unspecified	0	0	0		
		All	**25**	**20**	**3**		

First-time thyroid surgery for medullary thyroid cancer: T and N stage and nodal surgery; audit years 2016-2020

		Nodal surgery						
		Known	Unspecified	Not done	1-5 alone	6-7 alone	Both	Biopsy
T stage (version 7)	T0	0	0					
	T1a	20	0	45.0%	0.0%	50.0%	5.0%	0.0%
	T1b	19	0	31.6%	10.5%	36.8%	21.1%	0.0%
	T2	28	0	28.6%	0.0%	28.6%	42.9%	0.0%
	T3	36	0	13.9%	2.8%	11.1%	72.2%	0.0%
	T4a	11	0	9.1%	9.1%	18.2%	63.6%	0.0%
	T4b	5	0	20.0%	0.0%	0.0%	80.0%	0.0%
	TX	2	0					
	Unspecified	109	0	34.9%	1.8%	30.3%	33.0%	0.0%
	All	**230**	**0**	**29.6%**	**3.0%**	**28.3%**	**39.1%**	**0.0%**
T stage (version 8)	T0	3	0	66.7%	0.0%	0.0%	33.3%	0.0%
	T1a	16	0	68.8%	6.3%	12.5%	12.5%	0.0%
	T1b	12	0	41.7%	0.0%	50.0%	8.3%	0.0%
	T2	29	0	44.8%	0.0%	31.0%	24.1%	0.0%
	T3a	24	0	12.5%	0.0%	45.8%	41.7%	0.0%
	T3b	6	0	0.0%	16.7%	16.7%	66.7%	0.0%
	T4a	7	0	14.3%	0.0%	0.0%	85.7%	0.0%
	T4b	3	0	66.7%	0.0%	0.0%	33.3%	0.0%
	TX	0	0					
	Unspecified	130	0	23.8%	3.8%	27.7%	44.6%	0.0%
	All	**230**	**0**	**29.6%**	**3.0%**	**28.3%**	**39.1%**	**0.0%**
N stage	N0	85	0	50.6%	0.0%	37.6%	11.8%	0.0%
	N1a	28	0	14.3%	3.6%	67.9%	14.3%	0.0%
	N1b	92	0	7.6%	5.4%	8.7%	78.3%	0.0%
	NX	11	0	90.9%	0.0%	9.1%	0.0%	0.0%
	Unspecified	14	0	28.6%	7.1%	35.7%	28.6%	0.0%
	All	**230**	**0**	**29.6%**	**3.0%**	**28.3%**	**39.1%**	**0.0%**

Overall 30% of patients with papillary thyroid cancer underwent central lymph node dissection. After Thy1-3 on FNAC central lymph node dissection rates were low (<7%) but this increased significantly for those with Thy 4 (21%) and Thy5 (54%) FNAC.

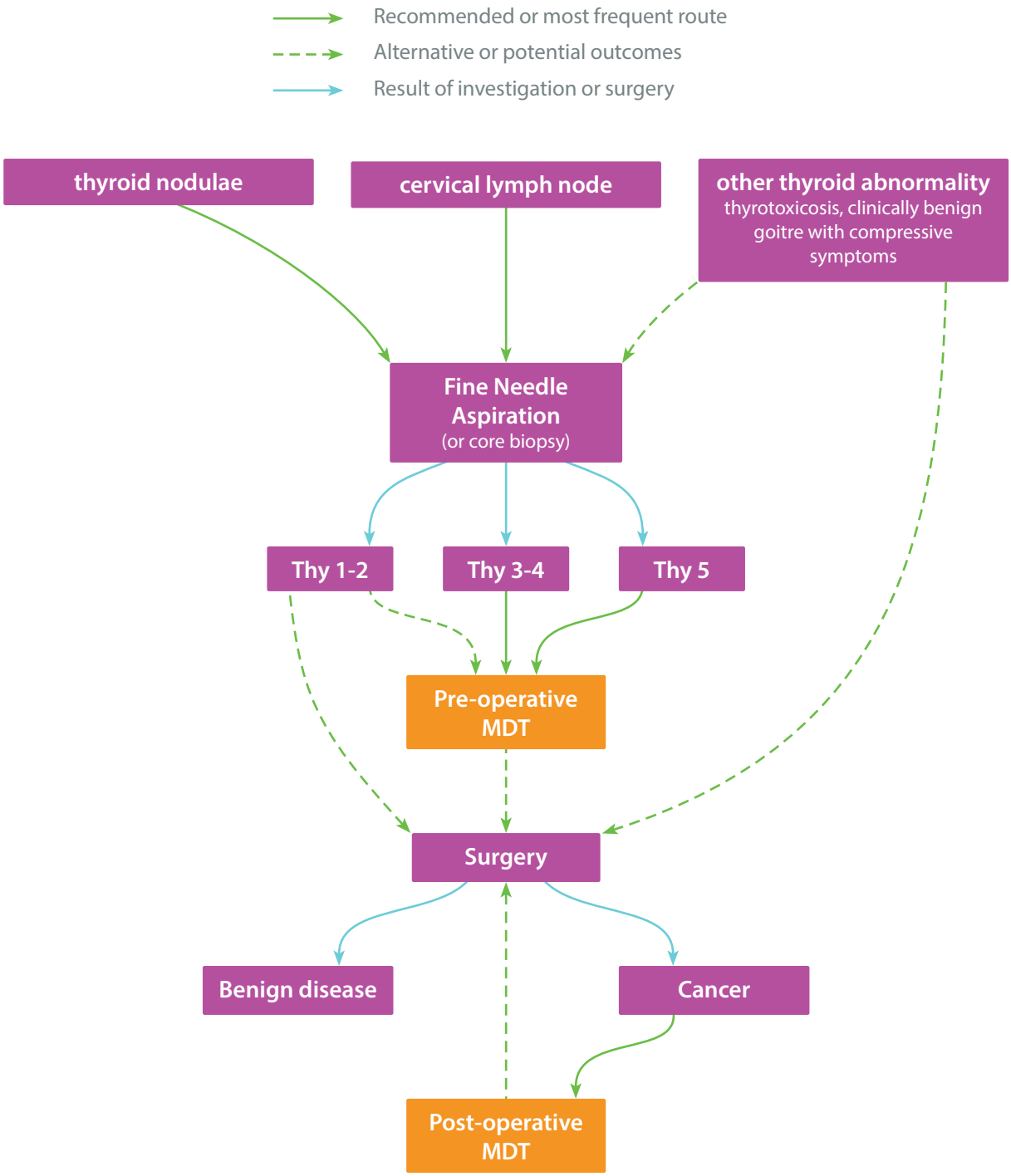
First-time thyroid surgery for papillary thyroid cancer: FNAC result and level VI node dissection; audit years 2016-2020



Multi-disciplinary team

There are a number of routes by which patients may be referred for discussion at the Thyroid Cancer Multi-disciplinary Meeting (MDT) outlined in the following flow diagram.

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



There is a clear trend over time towards increasing rates of pre-operative discussion of patients undergoing thyroid surgery in the MDT - this is particularly apparent following Thy1 (23% to 51%), Thy2 (12% to 33%) and Thy3 (37% to 65%) FNAC results.

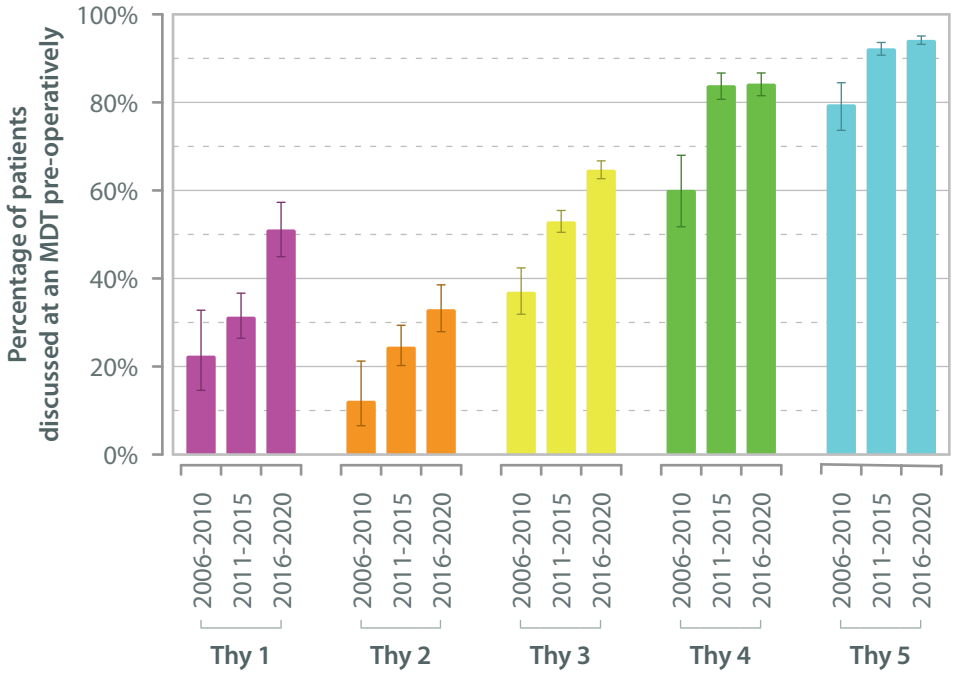
Although the proportion of cases with a Thy4 / 5 that were discussed pre-operatively in the MDT increased significantly from 2006-2010 to 2011-2015, there was only a marginal increase in the discussion rate for these groups in the current audit period.

It is possible that this pre-operative MDT discussion may have contributed to the reduction in proportion of Thy1 / 2 cases undergoing surgery shown earlier in this report, which would suggest this discussion is worthwhile.

Thyroid surgery for patients with cancer: changes in rates of pre-operative MDT discussion over the last three audit periods

FNAC result	**Audit years** (pre-operative MDT discussion rate)		
	2006-2010	**2011-2015**	**2016-2020**
Not done	46.0% (n=315)	53.0% (n=1,251)	65.7% (n=1,733)
Thy 1	22.5% (n=89)	31.3% (n=332)	51.1% (n=264)
Thy 2	12.2% (n=90)	24.5% (n=359)	33.0% (n=315)
Thy 3	37.0% (n=338)	53.0% (n=1,597)	64.7% (n=2,185)
Thy 4	60.1% (n=148)	83.9% (n=615)	84.3% (n=801)
Thy 5	79.6% (n=230)	92.3% (n=1,387)	94.2% (n=2,433)
Unspecified FNAC result	66.7% (n=9)	83.9% (n=31)	85.4% (n=48)
FNAC unspecified	50.0% (n=8)	87.5% (n=88)	75.6% (n=160)
All	**47.5%** (n=1,227)	**63.6%** (n=5,660)	**74.6%** (n=7,939)

Thyroid surgery for cancer: Changes in pre-operative MDT discussion rates over time and FNAC result



Of the patients with thyroid cancer on primary pathology, those with a Thy2 FNAC result were least likely to be discussed at MDT, which is understandable given that Thy2 is a diagnostic FNAC, although it does suggest that FNAC was misleading in these group of patients, and Thy2 result on FNAC does not completely rule out an underlying malignancy. The radiology findings for this group are not known, as we do not yet record these data in UKRETS.

51% of patients with Thy1 FNAC who underwent surgery and had thyroid cancer on primary pathology were discussed in the MDT; 64% of Thy3f, 67% of Thy3a, 84% of Thy4 and 94% of Thy5. This seems appropriate with increasing proportions of cases undergoing pre-operative MDT discussion as the suspicion of malignancy increases.

A similar trend was seen with pre-operative MDT discussion and indication for surgery, with the minority of patients who had thyroid cancer on primary pathology operated for a non-suspicious indication (thyrotoxicosis, recurrent cyst and compressive symptoms) and the majority with suspicious indication (clinically worrying lesion, completion thyroidectomy, recurrent cancer) undergoing pre-operative MDT discussion.

Thyroid surgery for patients with a primary pathology of cancer: pre-operative MDT according to FNAC result and indication for surgery; audit years 2016-2020

Pre-operative factor			Pre-operative MDT			
			No	Yes	Unspecified	Rate (95% CI)
	FNAC result	No FNAC	595	1,138	21	65.7% (63.4-67.9%)
		FNAC result Thy 1	129	135	2	51.1% (44.9-57.3%)
		FNAC result Thy 2	211	104	4	33.0% (27.9-38.5%)
		FNAC result Thy 3a	163	335	5	67.3% (62.9-71.3%)
		FNAC result Thy 3f	561	979	18	63.6% (61.1-66.0%)
		FNAC result Thy 3.	47	100	8	68.0% (59.8-75.3%)
		FNAC result Thy 4	126	675	7	84.3% (81.5-86.7%)
		FNAC result Thy 5	141	2,292	34	94.2% (93.2-95.1%)
		FNAC result not specified	7	41	13	85.4% (71.6-93.5%)
		FNAC unspecified	39	121	51	75.6% (68.1-81.9%)
		All	**2,019**	**5,920**	**163**	**74.6%** (73.6-75.5%)
	Indication	Biopsy result	902	3,911	80	81.3% (80.1-82.3%)
		Clinically worrying lesion	328	555	21	62.9% (59.6-66.0%)
		Completion thyroidectomy	262	990	21	79.1% (76.7-81.3%)
		Compressive symptoms	325	106	9	24.6% (20.7-29.0%)
		Quality of life	35	18	0	34.0% (21.9-48.4%)
		Recurrent cancer	16	256	8	94.1% (90.4-96.5%)
		Recurrent cyst	39	11	1	22.0% (12.0-36.3%)
		Thyroglossal cyst	4	5	0	55.6% (22.7-84.7%)
		Thyrotoxicosis	91	24	4	20.9% (14.1-29.7%)
		Unspecified	17	44	19	72.1% (59.0-82.5%)
		All	**2,019**	**5,920**	**163**	**74.6%** (73.6-75.5%)

Training

Surgeon

Consultants performed the majority of first-time (85%) and redo (89%) thyroid surgery, followed by registrar (year 4+), registrar (year 3+) and Fellow.

There was a trend towards a decrease in the proportion of operations performed by trainees over time, which is a cause for concern from a training perspective. The reason for this is not clear. Could it be due to fewer general surgical trainees choosing endocrine surgery as a sub-specialty? It would be interesting to see if this trend is affecting general surgical and ENT trainees equally, though these data are not recorded in UKRETS.

Approximately 18% thyroid operations were performed by trainees in 2008 compared to only 10% in 2020.

Thyroid surgery: surgeon and operating sequence; audit years 2016-2020

		Operation sequence				
		Count			Percentage	
		First-time	Redo	Unspecified	First-time	Redo
Surgeon	Consultant	25,931	2,638	47	84.8%	88.7%
	Fellow	929	80	1	3.0%	2.7%
	Staff grade	231	13	0	0.8%	0.4%
	Registrar (year 1-3)	1,080	91	3	3.5%	3.1%
	Registrar (year 4+)	2,343	149	2	7.7%	5.0%
	BST	49	0	0	0.2%	0.0%
	Other	14	2	0	0.0%	0.1%
	Unspecified	937	80	1,584		
	All	**31,514**	**3,053**	**1,637**		

Thyroid surgery: Changes in the proportion of operations performed by trainees over time

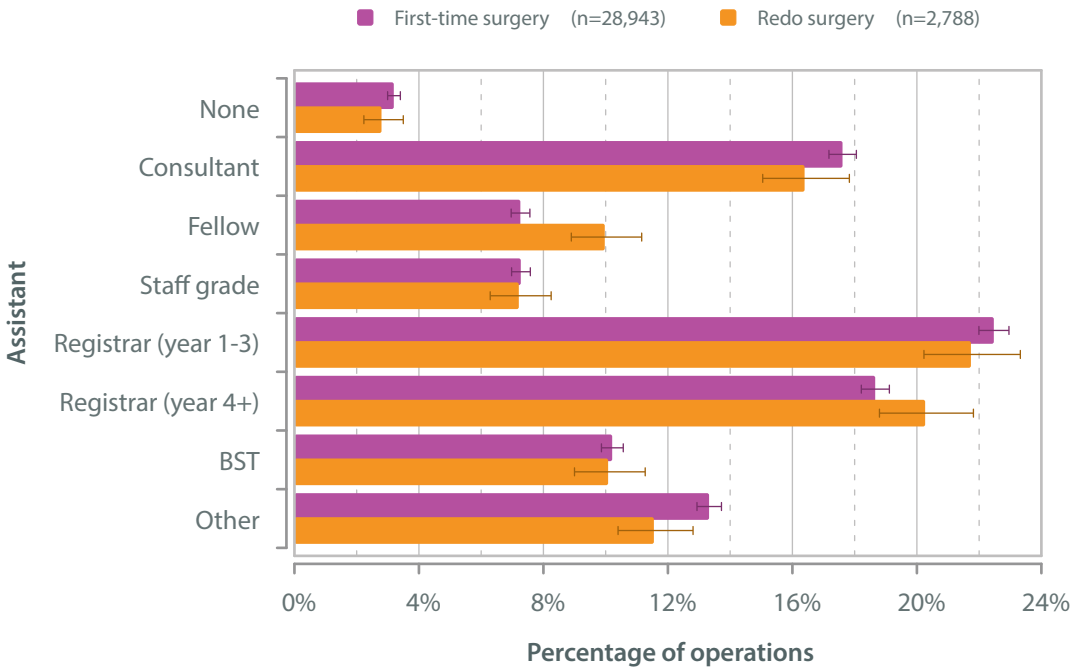
Assistant

A registrar (year 1-3) was most likely to be the assistant for thyroid surgery, followed by a registrar (year 1-4), consultant, basic surgical trainee, fellow and staff grade.

Thyroid surgery: surgical assistant and operation sequence; audit years 2016-2020

Assistant	Operation sequence				
	Count			Percentage	
	First-time	Redo	Unspecified	First-time	Redo
None	924	78	3	3.2%	2.8%
Consultant	5,097	457	11	17.6%	16.4%
Fellow	2,101	278	3	7.3%	10.0%
Staff grade	2,105	201	6	7.3%	7.2%
Registrar (year 1-3)	6,504	606	10	22.5%	21.7%
Registrar (year 4+)	5,401	565	9	18.7%	20.3%
BST	2,955	281	1	10.2%	10.1%
Other	3,856	322	6	13.3%	11.5%
Unspecified	2,571	265	1,588		
All	**31,514**	**3,053**	**1,637**		

Thyroid surgery: Surgical assistant; audit years 2016-2020



Consultant involvement

A consultant assisted in >70% of operations performed by a trainee, with significantly higher consultant involvement in operations performed by registrars compared to operations conducted by fellows or staff grades.

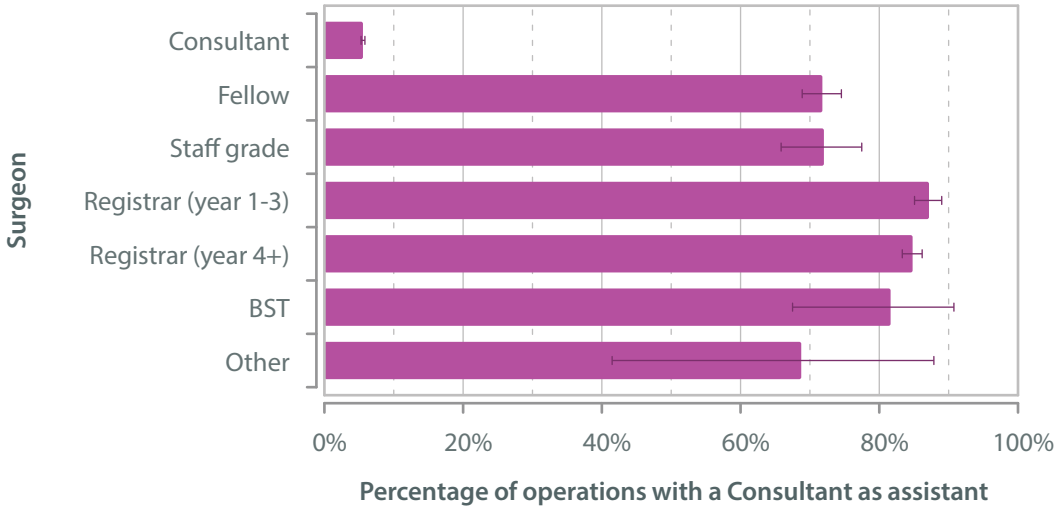
Consultants also assisted in >80% of operations performed by basic surgical trainees.

There appears to be a trend towards increasing proportion of operations performed by fellows and registrars (years 4+) and decreasing trend for operations performed by registrars (years 1-3) in which the consultant assisted.

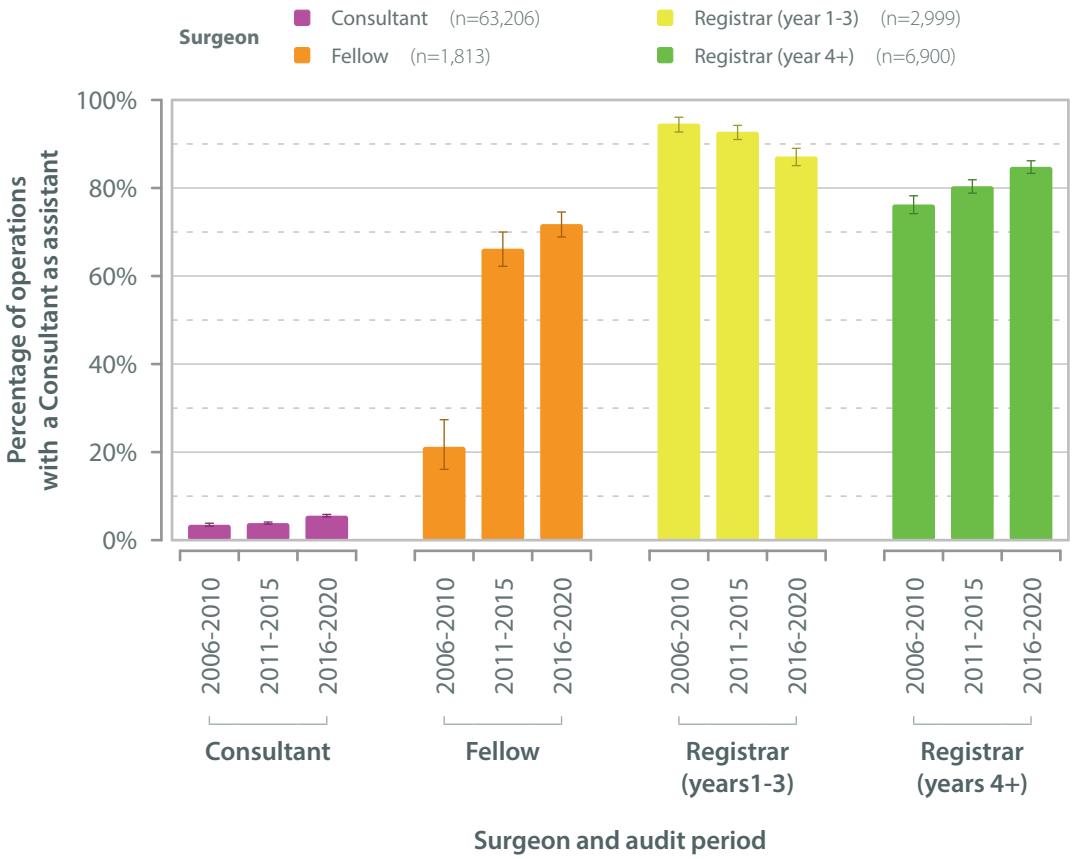
Thyroid surgery: surgeon and surgical assistant combinations; audit years 2016-2020

		Assistant								
		None	Consultant	Fellow	Staff grade	Registrar (year 1-3)	Registrar (year 4+)	BST	Other	Unspecified
Surgeon	Consultant	986	1,490	2,222	2,261	6,982	5,725	3,041	4,100	1,809
	Fellow	0	723	18	0	53	166	22	25	3
	Staff grade	4	175	2	3	14	6	13	26	1
	Registrar (year 1-3)	0	1,019	40	14	9	36	36	15	5
	Registrar (year 4+)	14	2,104	96	34	55	36	124	18	13
	BST	1	40	3	0	2	3	0	0	0
	Other	0	11	0	0	5	0	0	0	0
	Unspecified	0	3	1	0	0	3	1	0	2,593
	All	**1,005**	**5,565**	**2,382**	**2,312**	**7,120**	**5,975**	**3,237**	**4,184**	**4,424**

Thyroid surgery: Consultant involvement; audit years 2016-2020 (n=31,772)



Thyroid surgery: Changes in Consultant involvement over time



Surgery for thyrotoxicosis and multi-nodular goitre

Pathology and thyroid status

The majority of patients undergoing surgery for Graves' disease (59%) were recorded as being hyperthyroid at presentation. There is clearly, therefore, ongoing confusion regarding whether this data field in UKRETS refers to the thyroid status at presentation or at operation.

21% of patients with auto immune thyroiditis were recorded as being hyperthyroid at presentation. 6% of colloid goitres, 4% of colloid nodules and C-cell hyperplasia, and 3% of follicular adenomas were also hyperthyroid at presentation.

15% of patients with lymphoma were recorded as being hypothyroid at presentation, which would be expected given the known association between auto immune thyroiditis and lymphoma. 9% of patients with auto immune thyroiditis were hypothyroid at presentation.

All other pathologies were unlikely to be hypothyroid at presentation.

Thyroid surgery: primary pathology and thyroid status; audit years 2016-2020

Primary pathology	Thyroid status: Counts: Euthyroid	Counts: Hyperthyroid	Counts: Hypothyroid	Counts: Unspecified	Percentage: Euthyroid	Percentage: Hyperthyroid	Percentage: Hypothyroid
Anaplastic cancer	55	0	1	2	98.2%	0.0%	1.8%
Auto immune thyroiditis	639	187	82	20	70.4%	20.6%	9.0%
C-cell hyperplasia	91	4	1	2	94.8%	4.2%	1.0%
Colloid goitre	7,312	439	88	259	93.3%	5.6%	1.1%
Colloid nodule	2,018	94	13	58	95.0%	4.4%	0.6%
Follicular adenoma	3,456	117	38	133	95.7%	3.2%	1.1%
Follicular thyroid cancer	1,224	21	18	43	96.9%	1.7%	1.4%
Graves' disease	1,606	2,298	13	86	41.0%	58.7%	0.3%
Lymphoma	22	0	4	1	84.6%	0.0%	15.4%
Metastatic cancer	30	0	1	0	96.8%	0.0%	3.2%
Medullary thyroid cancer	265	2	2	21	98.5%	0.7%	0.7%
Oncocytic adenoma	395	8	8	8	96.1%	1.9%	1.9%
Oncocytic carcinoma	221	4	7	4	95.3%	1.7%	3.0%
Other cancer	107	1	1	0	98.2%	0.9%	0.9%
Papillary thyroid cancer	5,627	116	79	250	96.7%	2.0%	1.4%
Simple cyst	406	2	7	17	97.8%	0.5%	1.7%
Other	1,180	105	21	138	90.4%	8.0%	1.6%
Unspecified	3,709	506	58	2,453			
All	**28,363**	**3,904**	**442**	**3,495**			

Thyrotoxicosis

Operation performed

87% of first-time operations for thyrotoxicosis were total thyroidectomies, which is similar to data presented in the Fifth Audit Report (86%).

Lobectomy accounted for 9% of operations for thyrotoxicosis compared to 7% previously and bilateral sub-total thyroidectomy 2% compared to 4% reported in the 2010-2015 dataset.

There were a lot fewer redo operations performed for thyrotoxicosis, the majority (74%) of which were lobectomies.

Thyroid surgery for thyrotoxicosis: operation performed and operation sequence; audit years 2016-2020

Operation performed	Operation sequence: Counts: First-time	Operation sequence: Counts: Redo	Operation sequence: Counts: Unspecified	Operation sequence: Percentage: First-time	Operation sequence: Percentage: Redo
Total thyroidectomy	3,924	21	5	86.9%	14.7%
Lobectomy + sub-total thyroidectomy	44	4	0	1.0%	2.8%
Lobectomy	414	106	0	9.2%	74.1%
Bilateral sub-total thyroidectomy	92	1	0	2.0%	0.7%
Near total lobectomy	8	1	0	0.2%	0.7%
Biopsy	1	0	0	0.0%	0.0%
Other	32	6	0	0.7%	4.2%
Nodal alone	0	4	0	0.0%	2.8%
Unspecified	265	0	0		
All	**4,780**	**143**	**5**		

Hyperthyroidism and operation

This table suggests that the vast majority of operations for Graves' disease were total thyroidectomy.

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

Operation performed	Data: Count	Data: Percentage
Total thyroidectomy	2,286	94.3%
Lobectomy + sub-total thyroidectomy	31	1.3%
Lobectomy	47	1.9%
Bilateral sub-total thyroidectomy	47	1.9%
Near total lobectomy	2	0.1%
Other	10	0.4%
Unspecified	62	
All	**2,485**	

Multi-nodular goitre

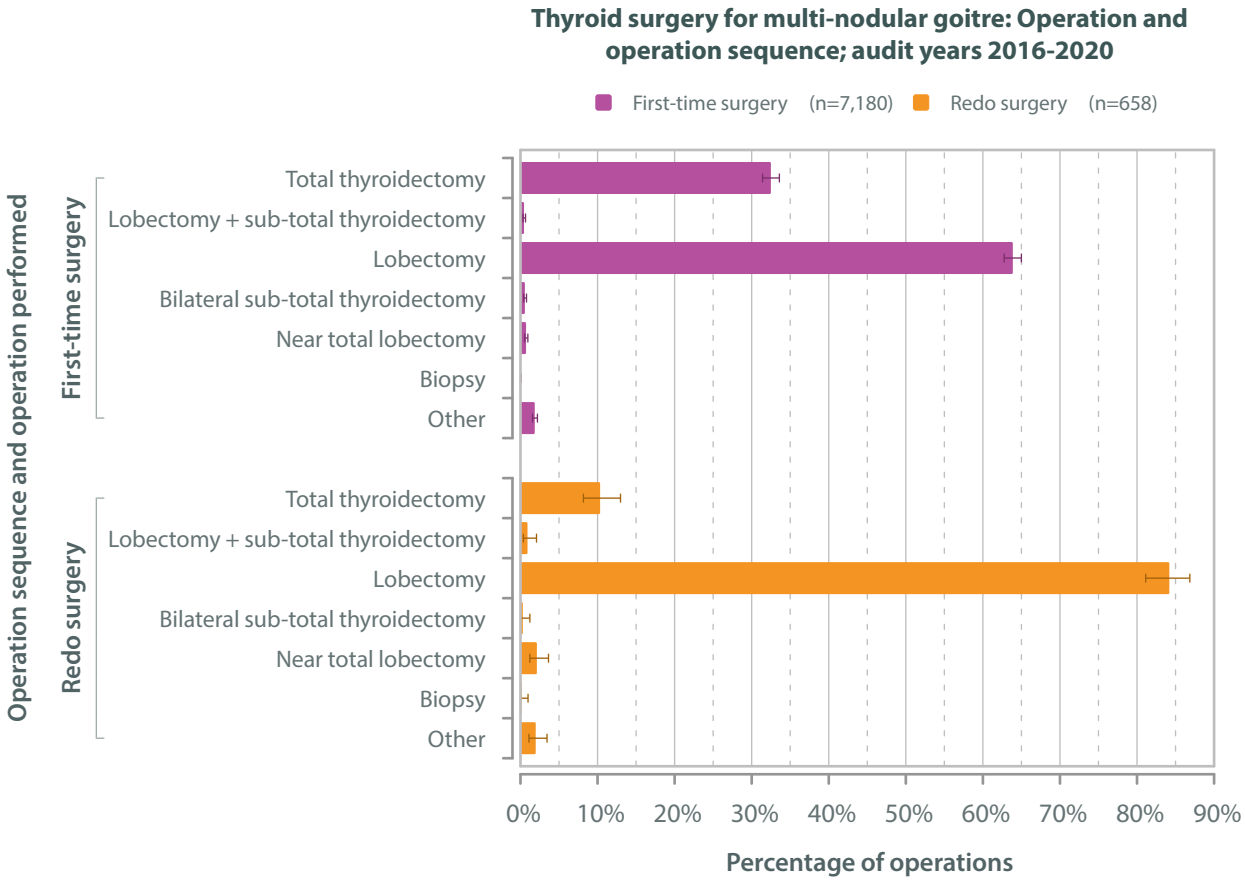
Operation performed

The majority (64%) of first-time operations for colloid goitre were lobectomies, with total thyroidectomy accounting for most of the remainder (33%).

Lobectomy accounted for 84% of the redo cases for colloid goitre, with 10% of redo cases being total thyroidectomies.

Thyroid surgery for thyrotoxicosis: operation performed and operation sequence; audit years 2016-2020

Operation performed	Operation sequence: Counts: First-time	Counts: Redo	Counts: Unspecified	Percentage: First-time	Percentage: Redo
Total thyroidectomy	2,333	68	4	32.5%	10.3%
Lobectomy + sub-total thyroidectomy	33	6	0	0.5%	0.9%
Lobectomy	4,587	554	7	63.9%	84.2%
Bilateral sub-total thyroidectomy	41	2	0	0.6%	0.3%
Near total lobectomy	52	14	0	0.7%	2.1%
Biopsy	1	1	0	0.0%	0.2%
Other	133	13	0	1.9%	2.0%
Nodal alone	0	0	0	0.0%	0.0%
Unspecified	226	6	0		
All	**7,406**	**664**	**11**		


Thyroid surgery for multi-nodular goitre: Operation and operation sequence; audit years 2016-2020
First-time surgery (n=7,180)
Redo surgery (n=658)
Operation sequence and operation performed
First-time surgery
Total thyroidectomy
Lobectomy + sub-total thyroidectomy
Lobectomy
Bilateral sub-total thyroidectomy
Near total lobectomy
Biopsy
Other
Redo surgery
Total thyroidectomy
Lobectomy + sub-total thyroidectomy
Lobectomy
Bilateral sub-total thyroidectomy
Near total lobectomy
Biopsy
Other
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
Percentage of operations
Surgery for thyroid disease

Adjuncts

Energy source

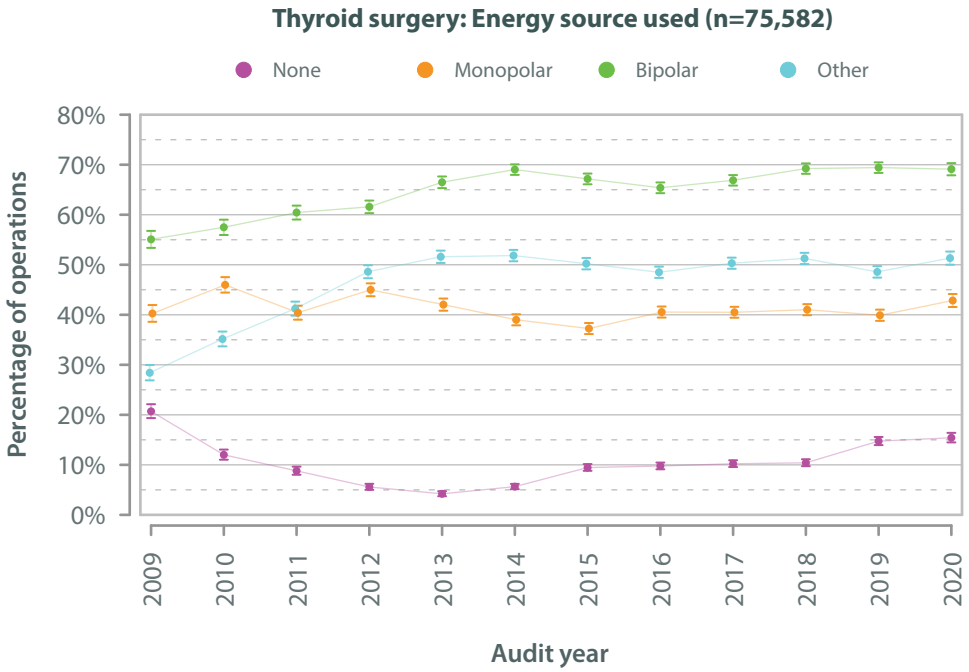
Additional energy devices were used in half of all thyroidectomies in the current audit period, with Ligasure™ now being slightly more popular than Harmonic™ scalpel. Of the standard diathermy devices bipolar forceps were used most commonly (68%) followed by monopolar diathermy (41%).

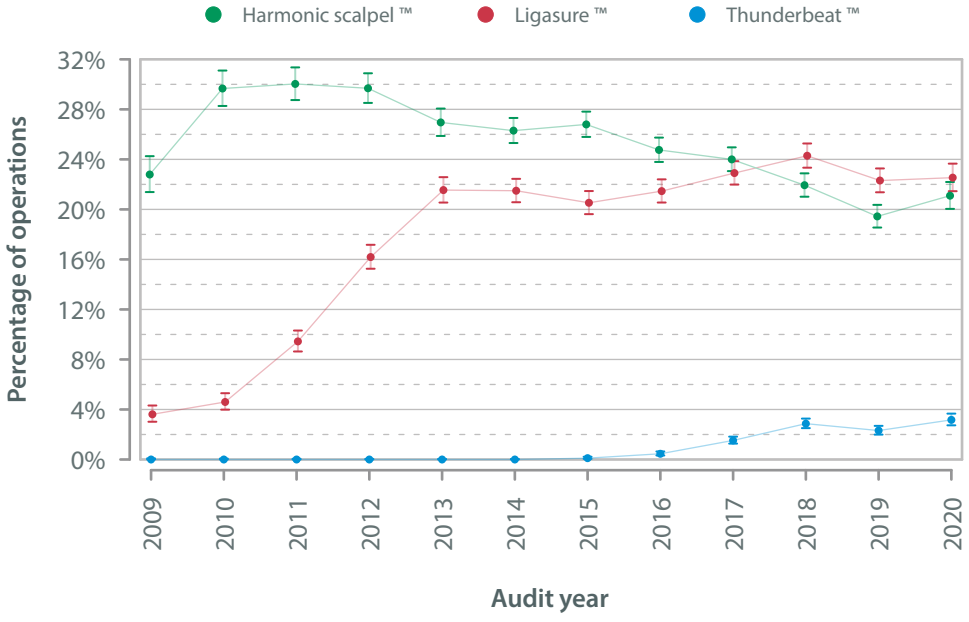
Thyroid surgery: Energy source used; audit years 2016-2020

		Data	
		Count	Percentage
Energy source used	None	4,307	11.9%
	Monopolar	14,793	40.9%
	Bipolar	24,594	67.9%
	Other	18,077	49.9%
	Bipolar scissors	134	0.4%
	Gyrus	2	0.0%
	Harmonic scalpel ™	8,087	22.3%
	Ligasure ™	8,223	22.7%
	Lotus ™	196	0.5%
	Thunderbeat ™	724	2.0%
	Voyant ™ (Applied)	531	1.5%
	Other energy source	20	0.1%
	Unspecified other energy source	160	0.4%
Operation denominator		**36,204**	

There was an increase in the use of bipolar forceps and other energy devices in the period since 2009.

Since 2010 there has been a decline in the use of Harmonic scalpel™ and an increase in the use of Ligasure™ and Thunderbeat™.





Outcomes for first-time surgery

Immediate post-operative outcomes

Mortality

Mortality from thyroidectomy remains a very rare event, at a reported rate of 0.03% (95% CI: 0.01%-0.06%). All mortalities from thyroidectomy in this audit period were individually investigated as part of the Clinical Outcome Publication programme. Generally these events are related to significant co-morbidity, often from advanced malignancy for which the patients underwent palliative procedures.

Re-operation for bleeding

Re-operation for bleeding was also uncommon, occurring in approximately one in 100 thyroidectomies in the current report, which was not significantly different from the rate reported for the 2010-2015 dataset.

Re-operation for bleeding occurred in 1.1% (95% CI: 0.9%-1.2%) of first-time thyroid operations, which was similar to the rate reported for first-time surgery in the Fifth Audit Report (1.1%; 95% CI: 1.0%-1.3%) and also the re-operation for bleeding in redo thyroidectomy in the current report (1.0%; 95% CI: 0.7%-1.5%).

Re-operation for bleeding was significantly lower for thyroid lobectomy (0.8%; 95% CI: 0.7%-1.0%) than total thyroidectomy (1.5%, 95% CI: 1.3%-1.8%). This finding was also reported in the Fifth Audit Report.

Risk factors for post-operative bleeding have been investigated in detail in a paper by Doran *et al.* based on UKRETS data entitled *Post-thyroidectomy bleeding: analysis of risk factors from a national registry* published in the British Journal of Surgery, February 2021.

Male gender, increasing age, redo surgery, retrosternal goitre and total thyroidectomy were risk factors for post-thyroidectomy bleeding. Thyroid lobectomy in patients without risk factors was found to have a very low risk of bleeding and daycase surgery was advocated for these patients.

Immediate post-operative outcomes

Mortality	2016	0.05% (6,315; 0.01-0.15%)
	2017	0.02% (6,368; 0.00-0.10%)
	2018	0.03% (6,151; 0.01-0.13%)
	2019	0.03% (5,930; 0.01-0.14%)
	2020	0.00% (4,401; 0.00-0.07%)
Re-operation for haemorrhage	2016	1.0% (6,303; 0.8-1.3%)
	2017	1.1% (6,399; 0.9-1.4%)
	2018	1.1% (6,164; 0.8-1.4%)
	2019	1.1% (5,874; 0.8-1.4%)
	2020	1.0% (4,359; 0.7-1.4%)
Hypocalcaemia	2016	7.9% (6,216; 7.3-8.6%)
	2017	8.5% (6,259; 7.9-9.3%)
	2018	7.8% (6,048; 7.1-8.5%)
	2019	7.3% (5,796; 6.7-8.0%)
	2020	7.3% (4,298; 6.5-8.1%)
Any post-operative complications	2016	3.1% (6,199; 2.7-3.6%)
	2017	3.0% (6,223; 2.6-3.5%)
	2018	2.4% (6,077; 2.0-2.8%)
	2019	3.0% (5,815; 2.6-3.5%)
	2020	2.5% (4,291; 2.1-3.0%)

Outcomes at follow up

Related re-admission	2016	1.9% (5,494; 1.5-2.3%)
	2017	1.6% (5,594; 1.3-1.9%)
	2018	1.9% (5,273; 1.6-2.3%)
	2019	1.7% (5,020; 1.4-2.1%)
	2020	1.7% (3,680; 1.3-2.2%)
Voice change	2016	6.8% (5,634; 6.1-7.5%)
	2017	7.8% (5,753; 7.2-8.6%)
	2018	7.4% (5,490; 6.7-8.1%)
	2019	7.5% (5,279; 6.8-8.2%)
	2020	6.7% (3,842; 6.0-7.6%)
Calcium supplements	2016	2.8% (5,551; 2.4-3.3%)
	2017	3.3% (5,654; 2.8-3.8%)
	2018	3.7% (5,332; 3.2-4.2%)
	2019	3.1% (5,055; 2.7-3.7%)
	2020	2.8% (3,665; 2.3-3.4%)
T3 / T4	2016	47.7% (5,608; 46.4-49.0%)
	2017	46.0% (5,711; 44.7-47.3%)
	2018	46.8% (5,467; 45.4-48.1%)
	2019	46.3% (5,265; 45.0-47.7%)
	2020	46.5% (3,822; 45.0-48.1%)

Post-operative hypocalcaemia

The range of post-operative hypocalcaemia rates at 7.3%-8.5% was higher overall in the current Audit Report than the Fifth Audit Report (2.7% to 4.2%).

However given that the rates of hypocalcaemia following first-time thyroidectomy 7.8% (95% CI: 7.5%-8.1%) and redo thyroidectomy 8.7% (95% CI: 7.7%-9.8%) reported in the current report were significantly lower than those reported in the last Audit Report, which were 10.2% (95% CI: 9.8%-10.6%) and 11.5% (95% CI: 10.3%-12.7%) respectively, this leads me to think that the hypocalcaemia rates reported on page 100 of the Fifth Audit Report were incorrect.

As expected, hypocalcaemia was very unusual following first-time thyroid lobectomy 0.6% (95% CI: 0.5%-0.8%), but was significantly higher following total thyroidectomy at 18.3% (95% CI: 17.5%-19.0%).

General post-operative complications

The range of general post-operative complications was 2.4-3.1% of patients for 2016-2020, which was slightly lower than the rates reported in the Fifth Audit Report 2.7%-4.2%.

General post-operative complications occurred in 2.8% (95% CI: 2.6%-3.0%) of first-time thyroidectomies, which was significantly lower than the rate reported in the Fifth Audit Report of 3.6% (95% CI: 3.3% - 3.8%).

General post-operative complications occurred more frequently after total thyroidectomy 3.5% (95% CI: 3.2%-3.9%) than thyroid lobectomy 2.3% (95% CI: 1.0%-2.5%) in the current report, in agreement with the findings of the Fifth Audit Report.

Outcomes at follow-up

Related re-admission

Related re-admission was uncommon, occurring in <2% of patients in this Audit Report, which is similar to the rate reported for the 2010-2015 dataset.

Overall, related re-admission occurred in 1.8% (95% CI: 1.6%-1.9%) of first-time thyroid surgery, which was similar to the rate quoted in the Fifth Audit Report 1.7% (95% CI: 1.6%-1.95%).

Re-admission was more common after total thyroidectomy (2.9%; 95% CI: 2.5%-3.3.%) than thyroid lobectomy (1.1%; 95% CI: 0.9-1.3%). The most likely cause of this is due to hypocalcaemia-related problems as the incidence of this complication is so much higher after total thyroidectomy than lobectomy. However, it is noted that the incidence of bleeding, RLN palsy and general complications is also higher after total thyroidectomy than lobectomy.

Voice change and persistent RLN palsy

Voice change following thyroidectomy is a subjective assessment recorded in UKRETS that may be due to a recurrent laryngeal nerve palsy sustained during surgery, though this is not necessarily the case. The reported range in rates of voice change following thyroidectomy were similar (range: 6.7% to 7.8%) in this audit period as those reported in the previous period (range: 5.9% to 7.4%).

Overall voice change occurred after 7.3% (95% CI: 7.0%-7.6%) of first-time thyroidectomies, which was non-significantly higher than the rate of voice change reported for the 2010-2015 dataset at 6.7% (95% CI: 6.4%-7.1%).

Voice change was more common after total thyroidectomy 9.7% (95% CI: 9.1%-10.4%) than thyroid lobectomy 5.9% (95% CI: 5.5%-6.3%) in agreement with the findings of the Fifth Audit Report.

Analyses of recurrent laryngeal nerve palsy following thyroidectomy are complex, being affected by the frequency and timing of laryngoscopy. They have been investigated in a paper by Abdelhamid *et al.* based on UKRETS data entitled *Intra-operative nerve monitoring in thyroid surgery: analysis of UKRETS database* published in the British Journal of Surgery in January 2021. Recurrent laryngeal nerve palsy occurred in 3.0% of thyroidectomies in this analysis, representing a palsy rate *per* nerve at risk of 2.1%. Increasing age, re-operation, total thyroidectomy, retrosternal goitre, and lymph node dissection were found to increase the risk of recurrent laryngeal nerve palsy, and intra-operative nerve monitoring was found to decrease the risk.

In the current report persistent RLN palsy occurred after 1.8% (95% CI: 1.6%-2.0%) of first-time thyroidectomies compared to 1.0% (95% CI: 0.7%-1.6%) as reported in the Fifth Audit Report. Persistent RLN palsy was more common after total thyroidectomy 2.8% (95% CI: 2.3%-3.3%) than thyroid lobectomy 1.2% (95% CI: 1.0%-1.4%). This finding is expected as total thyroidectomy doubles the RLN at risk during surgery compared to lobectomy.

Late hypocalcaemia

Late hypocalcaemia is defined in UKRETS by the need for ongoing calcium ± vitamin D supplements at follow-up. Overall late hypocalcaemia rate ranges (2.8% to 3.7%) were similar to those reported in the Fifth Audit Report (2.2% to 4.9%).

The incidence of late hypocalcaemia following first-time thyroidectomy reported in the current report was 3.2% (95% CI: 3.0%-3.4%) compared to 3.6% (95% CI: 3.3%-3.8%) in the previous report. As expected late hypocalcaemia was more frequent after total thyroidectomy (6.0%, 95% CI: 5.5%-6.5%) than lobectomy (0.8%, 95% CI: 0.6%-0.9%).

T3 / T4

Following first-time thyroid lobectomy 15.5% (95% CI: 14.9%-16.1%) of patients required thyroxine supplements. This is higher than the rate reported in the Fifth Audit Report (14.1% 95% CI: 13.4%-14.7%). Following total thyroidectomy we would expect all patients to be on thyroxine supplements.

First-time thyroid surgery: post-operative events for **all operations**; audit years 2016-2020

Timing of event			Event incidence			
			No	Yes	Unspecified	Rate (95% CI)
Timing of event	Immediate	Mortality	29,157	8	2,349	0.03% (0.01-0.06%)
		Re-operation for haemorrhage	28,790	309	2,415	1.1% (0.9-1.2%)
		Hypocalcaemia	26,383	2,234	2,897	7.8% (7.5-8.1%)
		Any post-operative complication	27,799	806	2,909	2.8% (2.6-3.0%)
	Follow up	Related re-admission	24,622	439	6,453	1.8% (1.6-1.9%)
		Voice change	24,109	1,889	5,516	7.3% (7.0-7.6%)
		Calcium supplements	24,455	802	6,257	3.2% (3.0-3.4%)
		T3 / T4	13,797	12,076	5,641	46.7% (46.1-47.3%)
		Persistent RLN palsy	13,876	254	17,384	1.8% (1.6-2.0%)

First-time thyroid surgery: post-operative events after **total thyroidectomy**; audit years 2016-2020

Timing of event			Event incidence			
			No	Yes	Unspecified	Rate (95% CI)
Timing of event	Immediate	Mortality	10,142	5	735	0.05% (0.02-0.12%)
		Re-operation for haemorrhage	10,000	157	725	1.5% (1.3-1.8%)
		Hypocalcaemia	8,248	1,843	791	18.3% (17.5-19.0%)
		Any post-operative complication	9,688	352	842	3.5% (3.2-3.9%)
	Follow up	Related re-admission	8,562	254	2,066	2.9% (2.5-3.3%)
		Voice change	8,261	890	1,731	9.7% (9.1-10.4%)
		Calcium supplements	8,415	538	1,929	6.0% (5.5-6.5%)
		T3 / T4	339	8,830	1,713	96.3% (95.9-96.7%)
		Persistent RLN palsy	4,697	133	6,052	2.8% (2.3-3.3%)

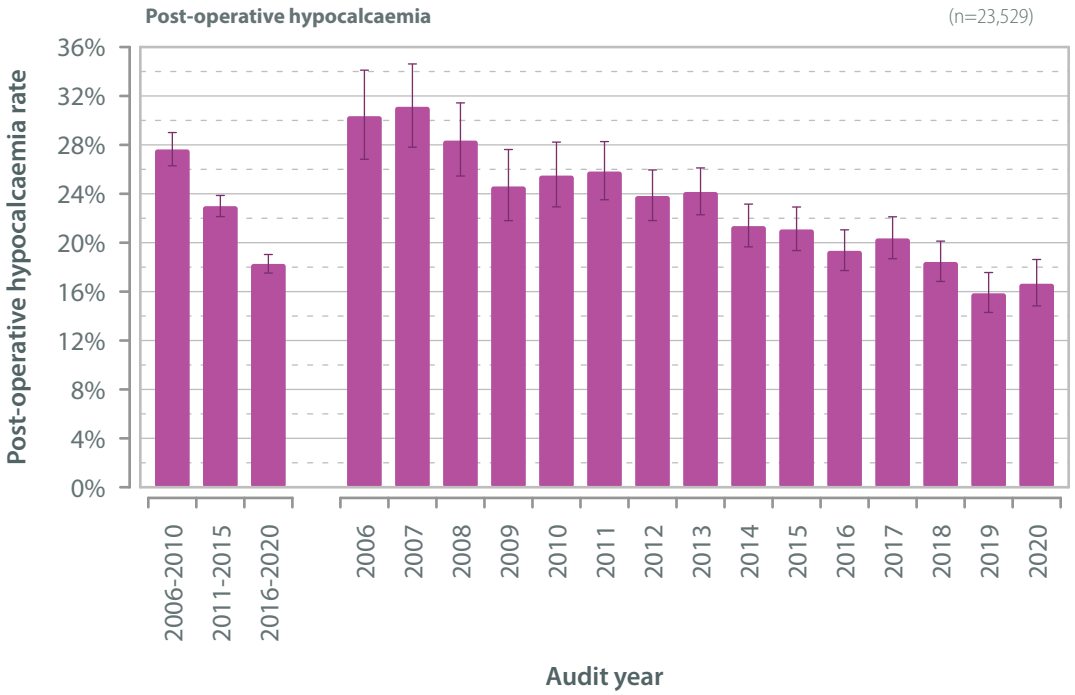
First-time thyroid surgery: post-operative events after **lobectomy**; audit years 2016-2020

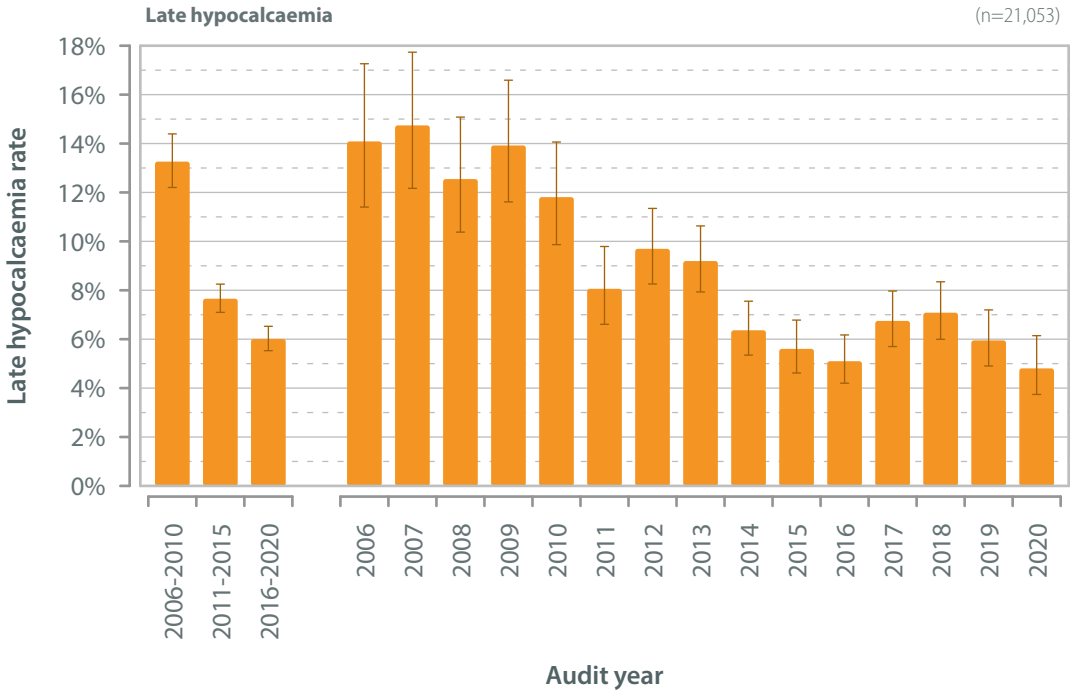
Timing of event			Event incidence			
			No	Yes	Unspecified	Rate (95% CI)
Timing of event	Immediate	Mortality	16,826	2	1,313	0.01% (0.00-0.05%)
		Re-operation for haemorrhage	16,635	137	1,369	0.8% (0.7-1.0%)
		Hypocalcaemia	16361	107	1673	0.6% (0.5-0.8%)
		Any post-operative complication	16,113	371	1,657	2.3% (2.0-2.5%)
	Follow up	Related re-admission	14,382	158	3,601	1.1% (0.9-1.3%)
		Voice change	14,187	885	3,069	5.9% (5.5-6.3%)
		Calcium supplements	14,526	113	3,502	0.8% (0.6-0.9%)
		T3 / T4	12,591	2,310	3,240	15.5% (14.9-16.1%)
		Persistent RLN palsy	8,647	104	9,390	1.2% (1.0-1.4%)

These figures show that significant improvements in the incidence of post-operative (X^2 test for trend through time = 202; p<0.001) and late hypocalcaemia (X^2 test for trend through time = 182; p<0.001) been reported over time. The incidence of post-operative and late hypocalcaemia following total thyroidectomy in the current report were 18% and 6% respectively.

This trend is very encouraging. The reasons behind this are a matter of speculation, but could include an increasing awareness of the importance of avoiding this complication and attention to operative technique to preserve the blood supply to the parathyroid glands during thyroidectomy; decreasing use of prophylactic central lymph node dissection in thyroid cancer surgery and increasing specialisation in high-volume centres.

First-time total thyroidectomy: Changes in the rate of hypocalcaemia over time





Hypocalcaemia

Hypocalcaemia and operation

The highest incidence of post-operative hypocalcaemia (22%) occurred after bilateral sub-total thyroidectomy, which is now an infrequently practiced operation, accounting for only 0.5% of all thyroid operations in the current report.

First-time lobectomy / near total lobectomy is rarely (0.6%) complicated by post-operative hypocalcaemia, as was shown in the last Audit Report.

The UKRETS data would suggest that in two-thirds of patients who have a total thyroidectomy post-operative hypocalcaemia will resolve with time as only 6% of patients were taking calcium or vitamin D supplements to maintain normocalcaemia at six months.

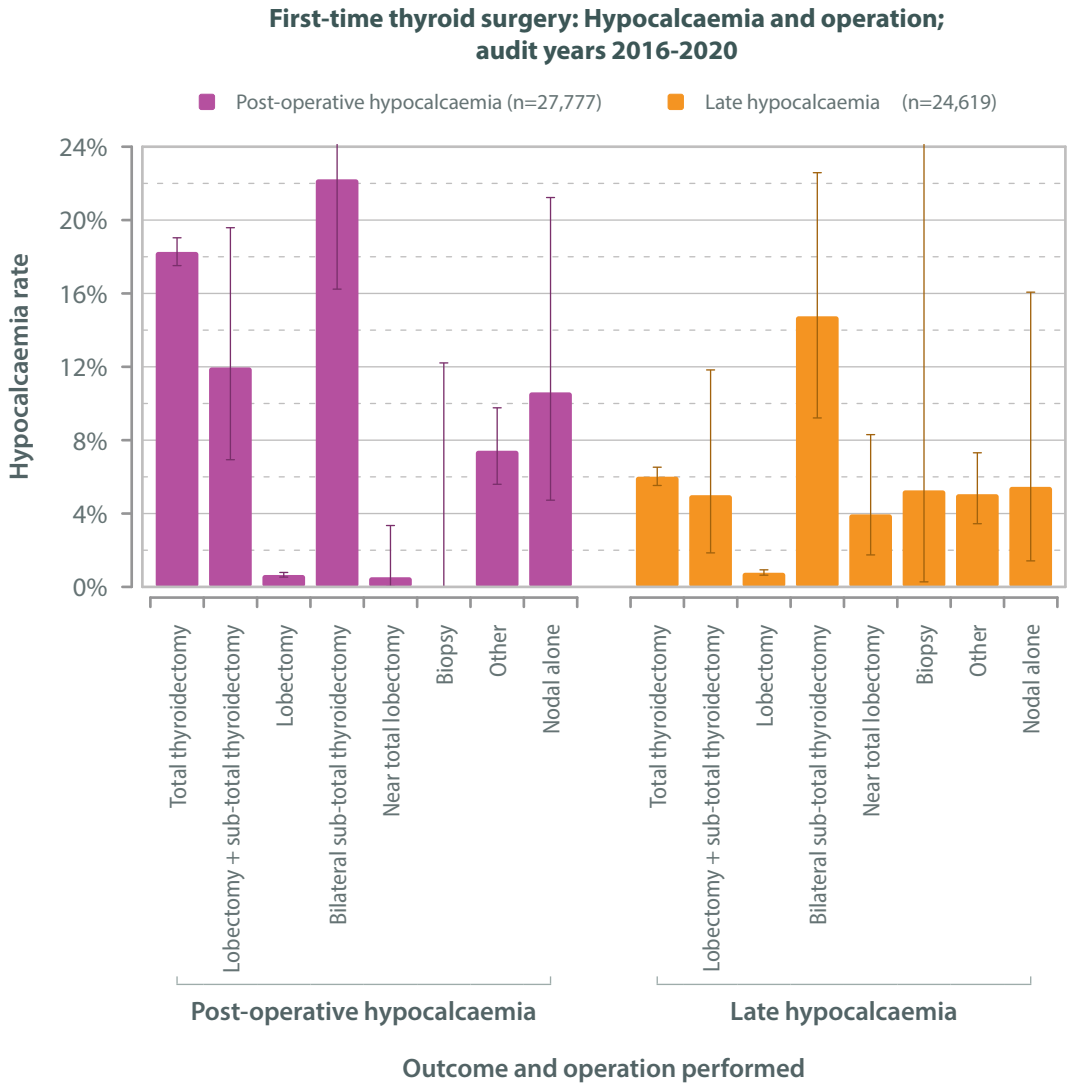
It is also noted that the highest rate of late hypocalcaemia (15%) occurred in those patients who underwent bilateral sub-total thyroidectomy. It is not known what confounding factors (*e.g.*, surgeon volume, pathology *etc.*) may have affected this result, but given this operation is now performed so uncommonly, perhaps further practice of this operation should be discouraged.

First-time thyroid surgery: post-operative and late (calcium supplements at 6/12) hypocalcaemia; audit years 2016-2020

Operation performed	Post-operative hypocalcaemia			
	No	Yes	Unspecified	Rate 95% CI)
Total thyroidectomy	8,248	1,843	791	18.3% (17.5-19.0%)
Lobectomy + sub-total thyroidectomy	103	14	8	12.0% (6.9-19.6%)
Lobectomy	16,361	107	1,673	0.6% (0.5-0.8%)
Bilateral sub-total thyroidectomy	126	36	25	22.2% (16.2-29.6%)
Near total lobectomy	189	1	7	0.5% (0.0-3.3%)
Biopsy	23	0	3	0.0% (0.0-12.2%)
Other	611	49	46	7.4% (5.6-9.8%)
Nodal alone	59	7	6	10.6% (4.7-21.2%)
Unspecified	663	177	338	21.1% (18.4-24.0%)
All	**26,383**	**2,234**	**2,897**	**7.8%** (7.5-8.1%)

Operation performed	Late hypocalcaemia			
	No	Yes	Unspecified	Rate 95% CI)
Total thyroidectomy	8,415	538	1,929	6.0% (5.5-6.5%)
Lobectomy + sub-total thyroidectomy	95	5	25	5.0% (1.9-11.8%)
Lobectomy	14,526	113	3,502	0.8% (0.6-0.9%)
Bilateral sub-total thyroidectomy	104	18	65	14.8% (9.2-22.6%)
Near total lobectomy	170	7	20	4.0% (1.7-8.3%)
Biopsy	18	1	7	5.3% (0.3-28.1%)
Other	526	28	152	5.1% (3.4-7.3%)
Nodal alone	52	3	17	5.5% (1.4-16.1%)
Unspecified	549	89	540	13.9% (11.4-16.9%)
All	**24,455**	**802**	**6,257**	**3.2%** (3.0-3.4%)

These figures have to be interpreted in light of the knowledge that missing data rates were high in UKRETS for these data fields, at 9% for early and 20% for late hypocalcaemia. So, these rates may be an underestimate of the true incidence of hypocalcaemia. Furthermore, the incidence of early post-operative hypocalcaemia may be affected by the practice of starting calcium supplements routinely following thyroid surgery.



Post-operative hypocalcaemia after total thyroidectomy according to workload

The relationship between the rate of post-operative hypocalcaemia, the number of operations recorded and the missing (outcome) data rate is shown in the funnel plot opposite.

There does not seem to be any clear association between the incidence of post-operative hypocalcaemia and number of operations recorded, with the majority of surgeons lying within the 99% confidence intervals.

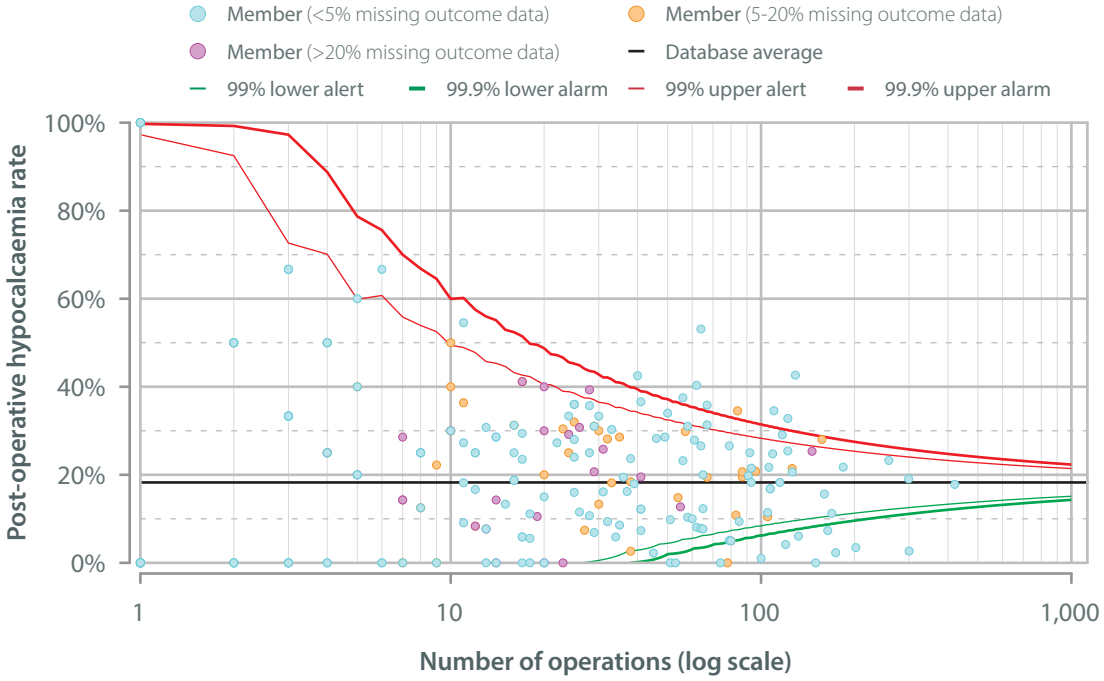
Also, surgeons with >20% and 5-20% missing data seemed to be reasonably equally distributed above and below the database average, suggesting that there was no association between missing data rates and reported post-operative hypocalcaemia rates.

With regard to late hypocalcaemia the findings are different. There is definitely a group of surgeons with >20% and 5-20% missing data rates with reported late hypocalcaemia rates <0.1%, suggesting that the reason these surgeons have such low hypocalcaemia rates is that they did not record this variable in the first place.

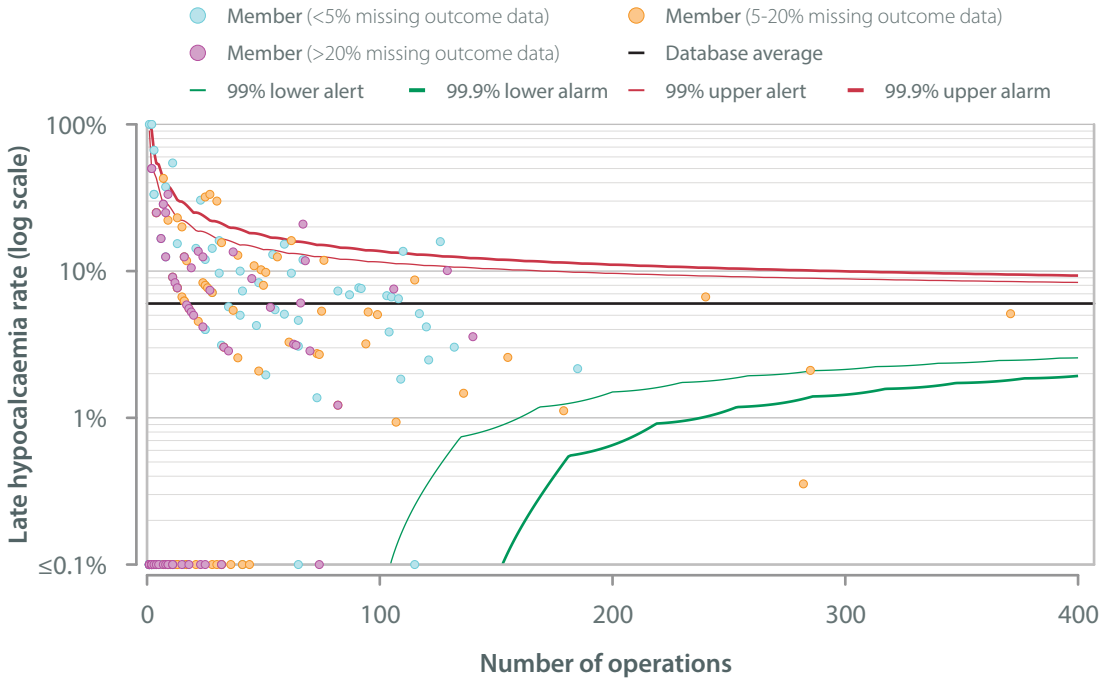
The pattern is otherwise remarkably similar to that seen in the last audit report with the majority of members reporting late hypocalcaemia rates above the database average or above the 99% confidence interval being among those that recorded <100 thyroidectomies in UKRETS during the audit period.

It seems likely that we are seeing a volume-outcome affect here in thyroid surgery with higher-volume surgeons reporting lower rates of late hypocalcaemia.

First-time total thyroidectomy: Post-operative hypocalcaemia; audit years 2016-2020 (n=10,091)



First-time total thyroidectomy: Late hypocalcaemia; audit years 2016-2020 (n=8,953)



Hypocalcaemia and pathology

This table shows the effect of pathology on the incidence of early and late hypocalcaemia following total thyroidectomy. It shows that early hypocalcaemia was commonest (21%) after total thyroidectomy for Graves' disease, followed by papillary thyroid cancer (19%) and colloid goitre (16%). However, this hypocalcaemia resolved in approximately three-quarters of patients with Graves' disease and colloid goitre at follow up, with 5% and 4% of patients respectively suffering late hypocalcaemia suggesting *hungry bones* or temporary impairment of parathyroid function was responsible in these cases. Hypocalcaemia resolved in just less than half of patients who underwent total thyroidectomy for papillary thyroid cancer, with the highest proportion of patients (9%) reported to suffer this complication in this group. These results suggest that post-operative hypocalcaemia following total thyroidectomy for papillary thyroid cancer is much more likely to be permanent than in benign pathologies, presumably due to excision or devascularisation of the parathyroid glands during cancer surgery.

First-time total thyroidectomy: post-operative and late (calcium supplements at 6/12) hypocalcaemia; audit years 2016-2020

Primary pathology	Post-operative hypocalcaemia			
	No	**Yes**	**Unspecified**	**Rate** (95% CI)
Colloid goitre	1,955	360	18	**15.6%** (14.1-17.1%)
Graves' disease	2,751	708	61	**20.5%** (19.1-21.9%)
Papillary thyroid cancer	1,748	416	39	**19.2%** (17.6-21.0%)
All total thyroidectomies	**8,248**	**1,843**	**791**	18.3% (17.5-19.0%)

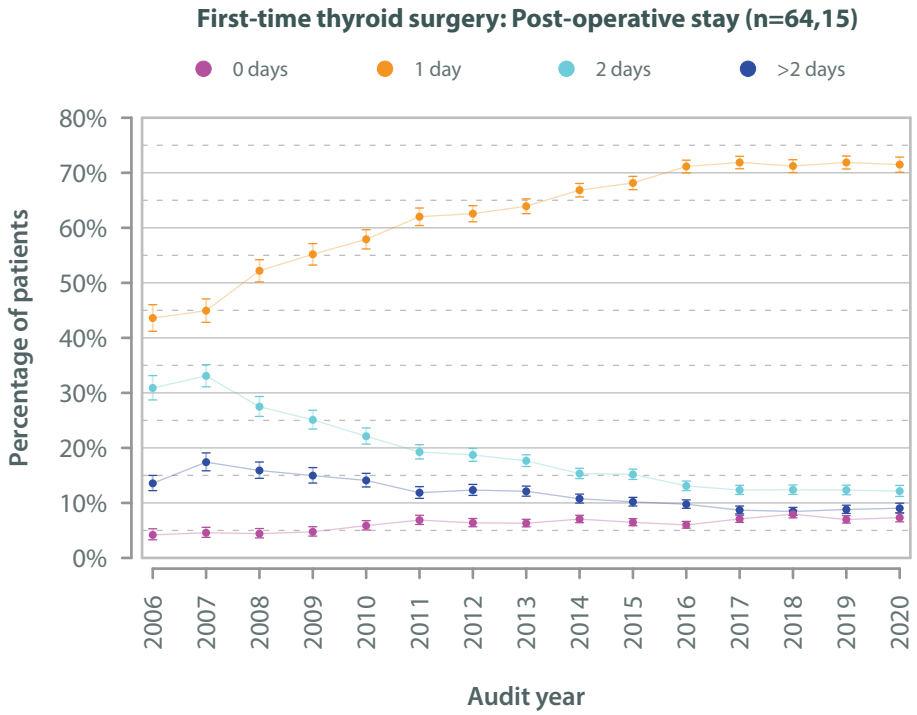
Primary pathology	Late hypocalcaemia			
	No	**Yes**	**Unspecified**	**Rate** (95% CI)
Colloid goitre	2,048	87	198	**4.1%** (3.3-5.0%)
Graves' disease	2,981	168	371	**5.3%** (4.6-6.2%)
Papillary thyroid cancer	1,825	182	196	**9.1%** (7.9-10.4%)
All total thyroidectomies	**8,415**	**538**	**1,929**	6.0% (5.5-6.5%)

Post-operative stay

Changes in post-operative stay over time

After first-time thyroid surgery there is a clear trend towards shorter hospital stay with increasing proportions of patients staying for one day and decreasing proportions staying for two or more days. However this trend seems to have plateaued out since 2016 with just over 70% of patients now staying one day and just over 10% of patients staying two days following thyroidectomy.

There is an upward trend in the proportion of patients undergoing daycase surgery with time, though this still applies to <10% of first-time thyroidectomies overall. We will hopefully see an increase in daycase thyroid surgery in the next audit report in view of the current endorsement of daycase thyroid surgery by BAETS, for suitably selected patients at low-risk of bleeding, now published on the BAETS website.



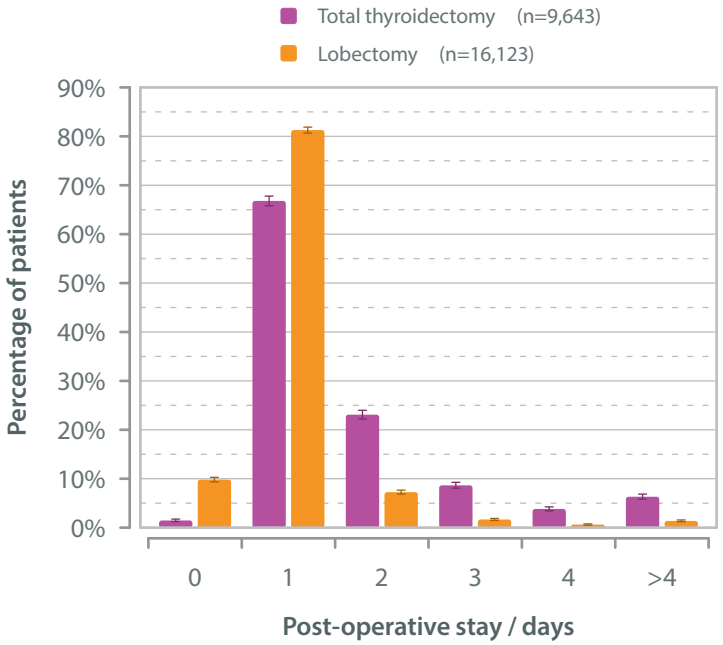
Post-operative stay and operation

In the current dataset, the majority (67%) of patients stay one day following first-time total thyroidectomy with 23% staying two days and 9% three. In contrast, 10% of first-time lobectomy patients had their surgery as a daycase, 81% stayed one day and 7% two.

First-time thyroid surgery: post-operative stay; audit years 2016-2020

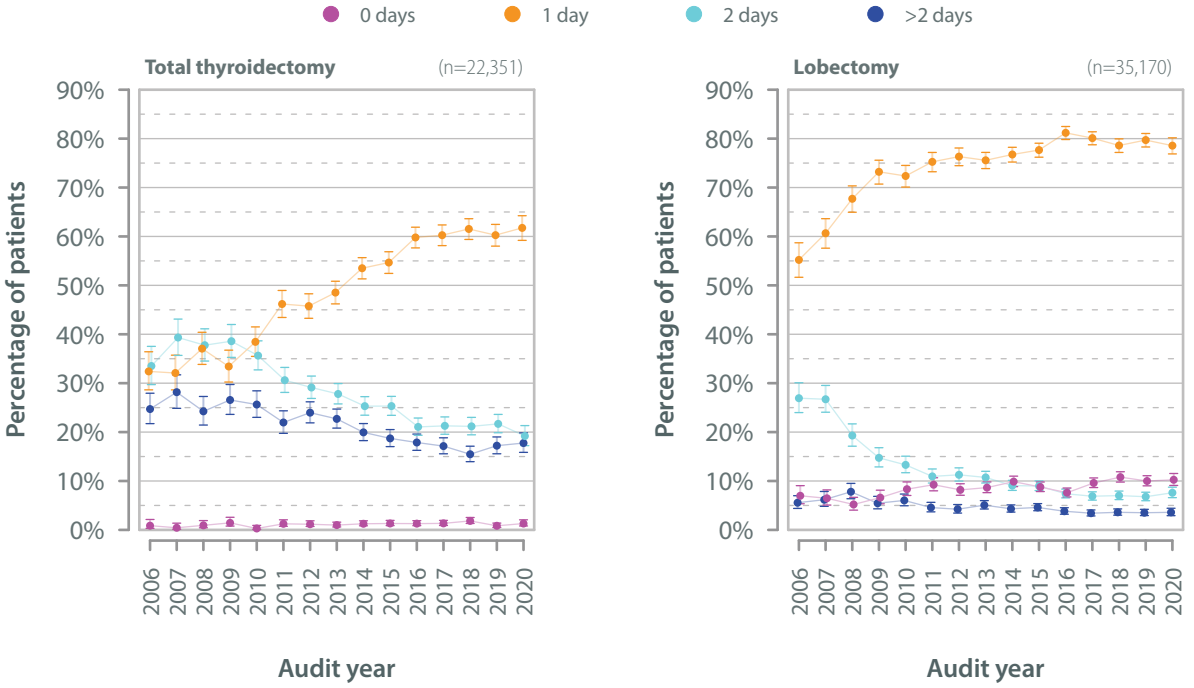
			Operation performed				
			Total thyroidectomy	Lobectomy	Other operations	Unspecified	All
Post-operative stay / days	Counts	0	128	1,550	212	75	**1,965**
		1	5,849	12,849	710	528	**19,936**
		2	2,022	1,146	126	185	**3,479**
		3	757	263	59	57	**1,136**
		4	334	98	23	39	**494**
		>4	553	217	45	48	**863**
		Unspecified	1,239	2,018	138	246	**3,641**
		All	**10,882**	**18,141**	**1,313**	**1,178**	**31,514**
	Percentage	0	1.5%	9.8%	19.2%	8.9%	**7.4%**
		1	66.8%	81.3%	64.1%	62.5%	**75.2%**
		2	23.1%	7.2%	11.4%	21.9%	**13.1%**
		3	8.6%	1.7%	5.3%	6.7%	**4.3%**
		4	3.8%	0.6%	2.1%	4.6%	**1.9%**
		>4	6.3%	1.4%	4.1%	5.7%	**3.3%**

First-time thyroid surgery: Post operative stay & operation performed; audit years 2016-2020



The proportions of patients staying one day following first-time total thyroidectomy and lobectomy have increased with time, but have plateaued at just about 60% and 80% respectively in the current audit period. Likewise the proportion of patients staying two days has fallen with time to about 20% after first-time total thyroidectomy and <10% after lobectomy. Daycase total thyroidectomy is seldom undertaken, but daycase lobectomy has increased with time to about 10% over the past four years.

First-time thyroid surgery: Changes in post-operative stay over time for total thyroidectomy and lobectomy procedures



Outcomes for redo surgery

Post-operative and follow up outcomes

Although rates of hypocalcaemia (8.7%) and any post-operative complications (3.2%) were marginally higher after redo than first-time thyroid surgery (7.8% and 2.8% respectively) these rates did not differ significantly, and immediate outcomes were not different when comparing first-time and redo surgery.

At follow-up, however, voice change (8.8%), calcium supplements (4.3%) and persistent RLN palsy (2.7%) were all significantly more likely after redo than first-time thyroid surgery (7.3%, 3.2%, and 1.8% respectively) in the 2016-2020 dataset.

The number of redo total thyroidectomies performed was small. Presumably these represented bilateral thyroidectomy cases in which as less than total / subtotal lobectomy / biopsy or isthmusectomy had been performed previously. Statistically, only voice change at follow up occurred more frequently (17%) after redo than first-time total thyroidectomy, though the rates of calcium supplements (7.6%) and persistent RLN palsy (6.6%) were non-significantly higher than after first-time total thyroidectomy (6.0% and 2.8% respectively).

Following redo thyroid lobectomy the most notable difference in outcome was the significantly higher rate of early (8.9%) and late (4.0%) hypocalcaemia compared to first-time lobectomy (0.6% and 0.8% respectively). The reason for this is, no doubt, due to the high proportion of redo lobectomy cases being performed for completion thyroidectomy, and therefore having previously undergone contralateral lobectomy in which the function of the parathyroid glands may have been compromised.

At follow-up related re-admission (2.0%) and late hypocalcaemia (4.0%) were also significantly more likely after redo lobectomy than first-time lobectomy (1.1% and 0.8% respectively), which is not surprising as both these outcomes are likely to be related to hypoparathyroidism.

Voice change (7.7%) was also significantly more likely after redo lobectomy than first time surgery (5.9%); although persistent RLN palsy was higher after redo (2.0%) than first-time lobectomy, the difference was not significantly significant.

Redo thyroid surgery: post-operative events for **all operations**; audit years 2016-2020

Timing of event			Event incidence			
			No	Yes	Unspecified	Rate (95% CI)
Immediate		Mortality	2,848	1	204	0.04% (2,849; 0.00-0.23%)
		Re-operation for haemorrhage	2,801	29	223	1.0% (2,830; 0.7-1.5%)
		Hypocalcaemia	2,528	241	284	8.7% (2,769; 7.7-9.8%)
		Any post-operative complication	2,678	89	286	3.2% (2,767; 2.6-4.0%)
Follow up		Related re-admission	2,395	50	608	2.0% (2,445; 1.5-2.7%)
		Voice change	2,311	222	520	8.8% (2,533; 7.7-9.9%)
		Calcium supplements	2,347	106	600	4.3% (2,453; 3.6-5.2%)
		T3 / T4	283	2,248	522	88.8% (2,531; 87.5-90.0%)
		Persistent RLN palsy	1,360	38	1,655	2.7% (1,398; 2.0-3.7%)

Redo thyroid surgery: post-operative events after **total thyroidectomy**; audit years 2016-2020

Timing of event			Event incidence			
			No	Yes	Unspecified	Rate (95% CI)
Immediate		Mortality	225	0	9	0.00% (225; 0.00-1.32%)
		Re-operation for haemorrhage	221	4	9	1.8% (225; 0.6-4.8%)
		Hypocalcaemia	195	30	9	13.3% (225; 9.3-18.6%)
		Any post-operative complication	212	13	9	5.8% (225; 3.2-9.9%)
Follow up		Related re-admission	185	5	44	2.6% (190; 1.0-6.4%)
		Voice change	171	35	28	17.0% (206; 12.3-23.0%)
		Calcium supplements	183	15	36	7.6% (198; 4.5-12.4%)
		T3 / T4	11	194	29	94.6% (205; 90.3-97.2%)
		Persistent RLN palsy	114	8	112	6.6% (122; 3.1-12.9%)

Redo thyroid surgery: post-operative events after **lobectomy**; audit years 2016-2020

Timing of event			Event incidence			
			No	Yes	Unspecified	Rate (95% CI)
Immediate		Mortality	2,170	1	144	0.05% (2,171; 0.00-0.30%)
		Re-operation for haemorrhage	2,133	21	161	1.0% (2,154; 0.6-1.5%)
		Hypocalcaemia	1,907	187	221	8.9% (2,094; 7.8-10.3%)
		Any post-operative complication	2,049	53	213	2.5% (2,102; 1.9-3.3%)
Follow up		Related re-admission	1,841	38	436	2.0% (1,879; 1.5-2.8%)
		Voice change	1,783	148	384	7.7% (1,931; 6.5-9.0%)
		Calcium supplements	1,794	74	447	4.0% (1,868; 3.1-5.0%)
		T3 / T4	240	1,692	383	87.6% (1,932; 86.0-89.0%)
		Persistent RLN palsy	1,090	22	1,203	2.0% (1,112; 1.3-3.0%)

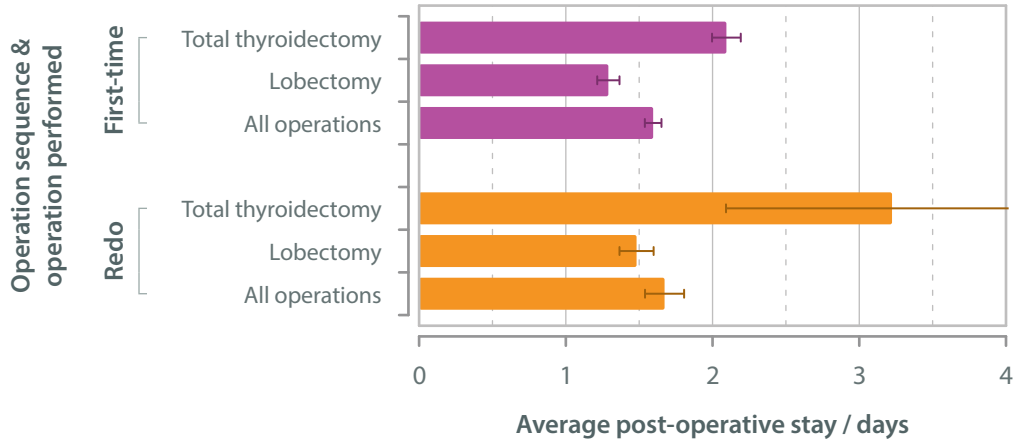
Post-operative stay

Comparing length-of-stay after first-time and redo thyroid surgery, the median length-of-stay was one day for all procedures except redo total thyroidectomy where it was two days. Length-of-stay tended to be higher after redo surgery, but this difference was only significant for lobectomy, presumably due to higher incidence of calcium-related problems associated with redo lobectomy for the reasons outlined above.

Thyroid surgery: post-operative stay, operation sequence and operation performed; audit years 2016-2020

Operation sequence & operation performed			Post-operative stay statistics / days	
			Average (95% CI)	Median (inter-quartile range)
First-time surgery		Total thyroidectomy	2.09 (2.00-2.19)	1.0 (1.0-2.0)
		Lobectomy	1.29 (1.21-1.37)	1.0 (1.0-1.0)
		All operations	1.60 (1.54-1.65)	1.0 (1.0-1.0)
Redo surgery		Total thyroidectomy	3.22 (2.09-4.35)	2.0 (1.0-2.0)
		Lobectomy	1.48 (1.37-1.60)	1.0 (1.0-1.0)
		All operations	1.67 (1.54-1.81)	1.0 (1.0-2.0)

Thyroid surgery: Average post operative stay and operation performed; audit years 2016-2020




British
Association

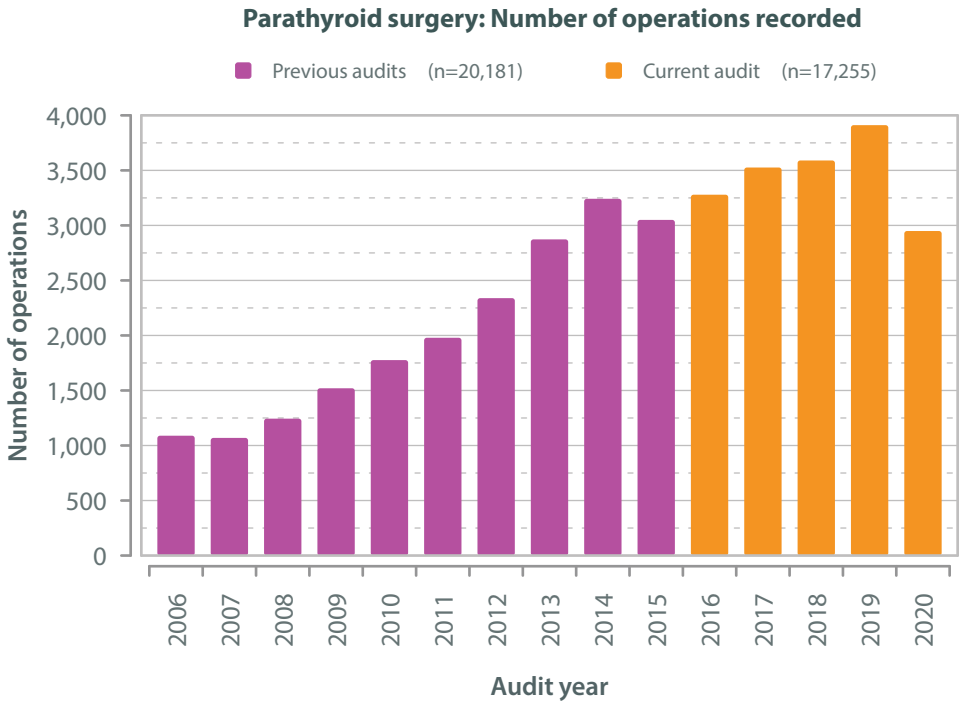
Surgery for parathyroid disease

Surgery for parathyroid disease

General information in the database

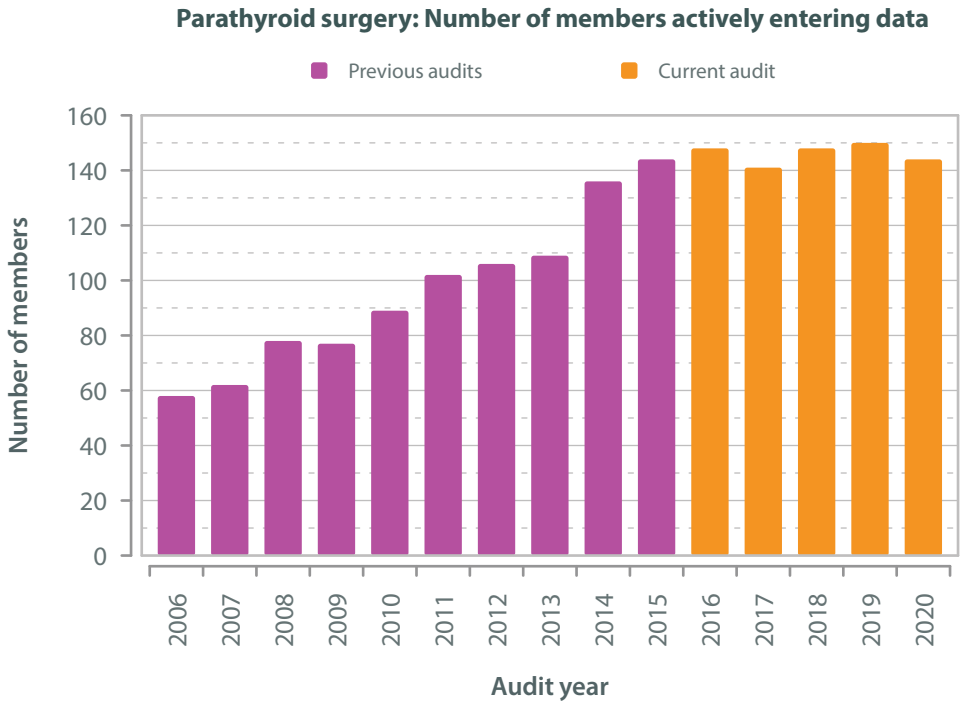
Number of parathyroid operations and members entering data

The number of parathyroidectomies added to UKRETS continues to increase year on year since 2006, except for a small fall in the number of cases added from 2014 to 2015. Approximately 3,900 cases were added in 2019.



Number of members entering data

The number of members adding data on parathyroidectomy has also increased year on year to 150 in 2019, despite a small fall from 2016 to 2017.



Database records per member

This figure shows data from the audit period 2016-2020.

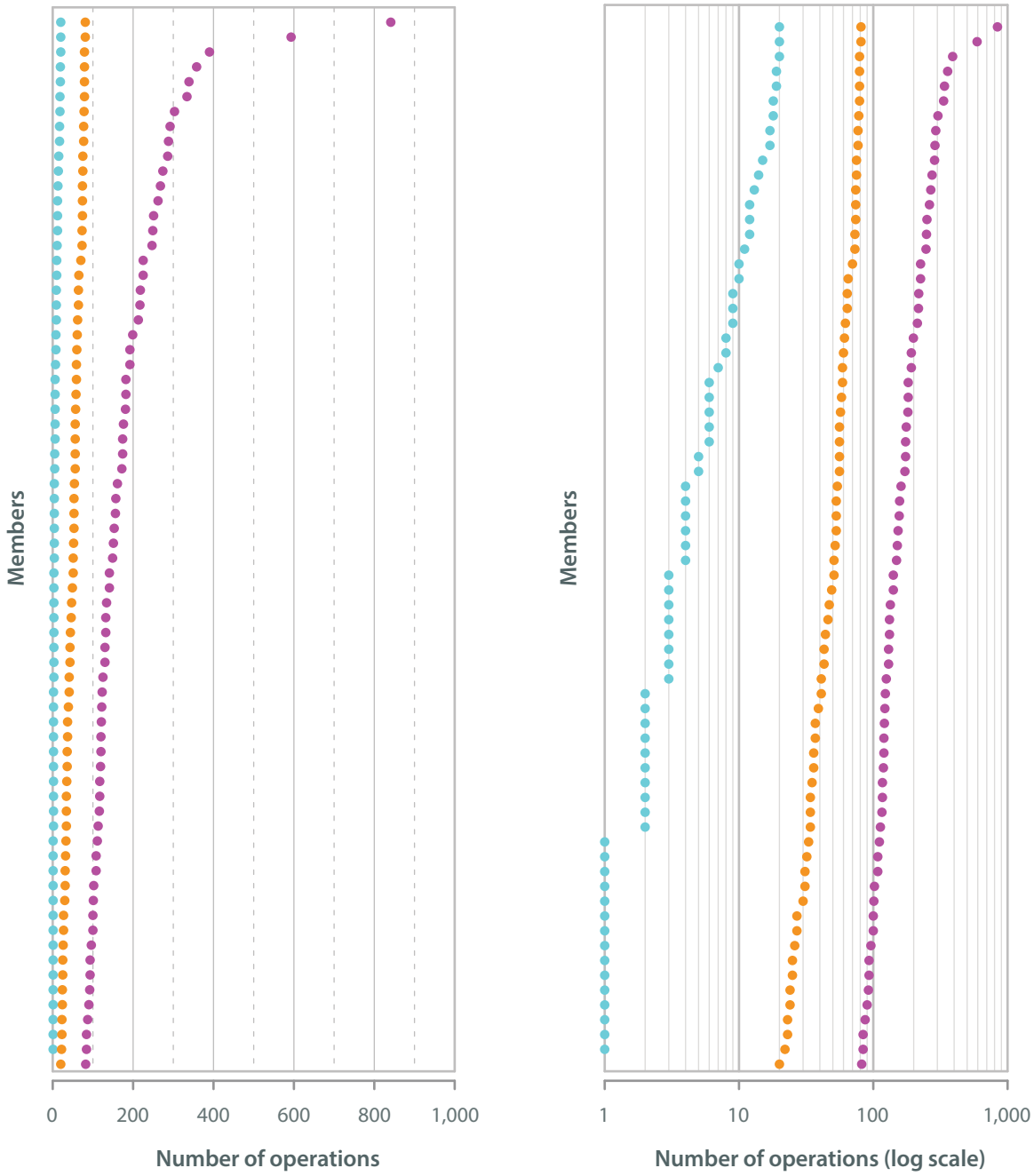
The following annualised statistics take data from the four audit years 2016-2019, excluding 2020, which was unusual because of the impact of the COVID pandemic. Also excluded from this annualised workload assessment are the data for Consultants for whom the count in one or more of these four years was <50% of their average across that period, as this would suggest that they either started or finished adding data to UKRETS in this time period.

On this basis, 212 members added data on parathyroidectomy from 2016-2019, of whom 199 reported one or more operations in each of the four years (13 none of the four years; 44 one year only; 25 two years; 27 three years; 103 four years). 74 / 103 consultants had a consistent count of operations across the four-year period 2016-2019; amongst these members the average number of parathyroidectomies undertaken *per* year was 34, range 2-172, median 25, inter-quartile range 17-45; only 6 members reported an average of <10 procedures *per* year, and 14 reported >50 procedures *per* year.

The European Society of Endocrine Surgery currently recommends that surgeons undertaking parathyroid surgery perform a minimum of 15 first-time surgical cases *per* year [1]. The majority of BAETS surgeons would comply with these guidelines.

1. Iacabone et al. Parathyroid surgery: an evidenced-based volume outcome analysis: European Society of Endocrine Surgeons position statement. *Langenbecks Archive of Surgery*. 2019; **404**: 919-927

Parathyroid surgery: Number of operations reported by each member; audit years 2016-2020



Demographics and disease profile

Age and pathology

The age profile of patients undergoing surgery for sporadic hyperparathyroidism shows a similar distribution to that seen in the Fifth Audit Report, with a peak incidence of surgery occurring in the seventh decade. Less than1% of operations for sporadic hyperparathyroidism were performed for patients aged <20 years and <5% in patients >80 years old.

Surgery for renal hyperparathyroidism showed a similar age profile to sporadic disease, but with a peak in incidence of surgery in the sixth rather than seventh decade. This pattern was also reported in the Fifth Audit Report.

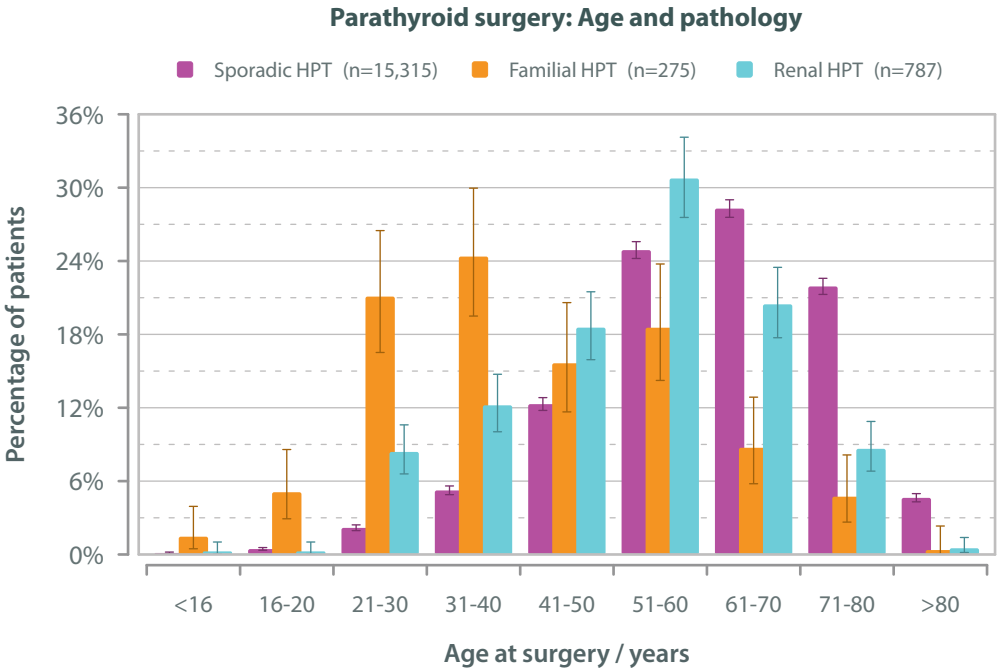
Fewer operations were undertaken for familial hyperparathyroidism. As expected, a higher proportion of these operations were undertaken for younger patients with a sharp increase in surgery occurring in the third decade to a peak in the fourth decade of life. Rates of surgery for familial disease declined in the fifth decade and peaked again in the sixth decade before falling.

The familial hyperparathyroidism group include a variety of aetiologies, prominent among which are multiple endocrine neoplasia types 1 and 2, which present with hyperparathyroidism at different ages. This might account for the bimodal distribution of age observed here.

Parathyroid surgery: age and pathology; audit years 2016-2020

Age at surgery / years	Pathology				
	Sporadic HPT [1]	Familial HPT [2]	Primary HPT NOS [3]	Renal HPT	Unspecified
<16	19	4	0	2	1
16-20	68	14	0	2	7
21-30	333	58	1	66	22
31-40	802	67	9	96	45
41-50	1,883	43	15	146	90
51-60	3,812	51	27	242	169
61-70	4,332	24	25	161	203
71-80	3,357	13	15	68	162
>80	709	1	9	4	28
Unspecified	46	0	1	0	3
All	**15,361**	**275**	**102**	**787**	**730**

1. Sporadic HPT includes patients with primary hyperparathyroidism recorded as either Sporadic or Carcinoma.
2. Familial HPT includes patients with primary hyperparathyroidism recorded as either Familial HPT or MEN.
3. Primary NOS includes those patients with primary HPT pathology where the kind of primary hyperparathyroidism is not recorded.


Parathyroid surgery: Age and pathology
Sporadic HPT (n=15,315)
Familial HPT (n=275)
Renal HPT (n=787)
Percentage of patients
36%
30%
24%
18%
12%
6%
0%
<16
16-20
21-30
31-40
41-50
51-60
61-70
71-80
>80
Age at surgery / years

First-time surgery for primary hyperparathyroidism

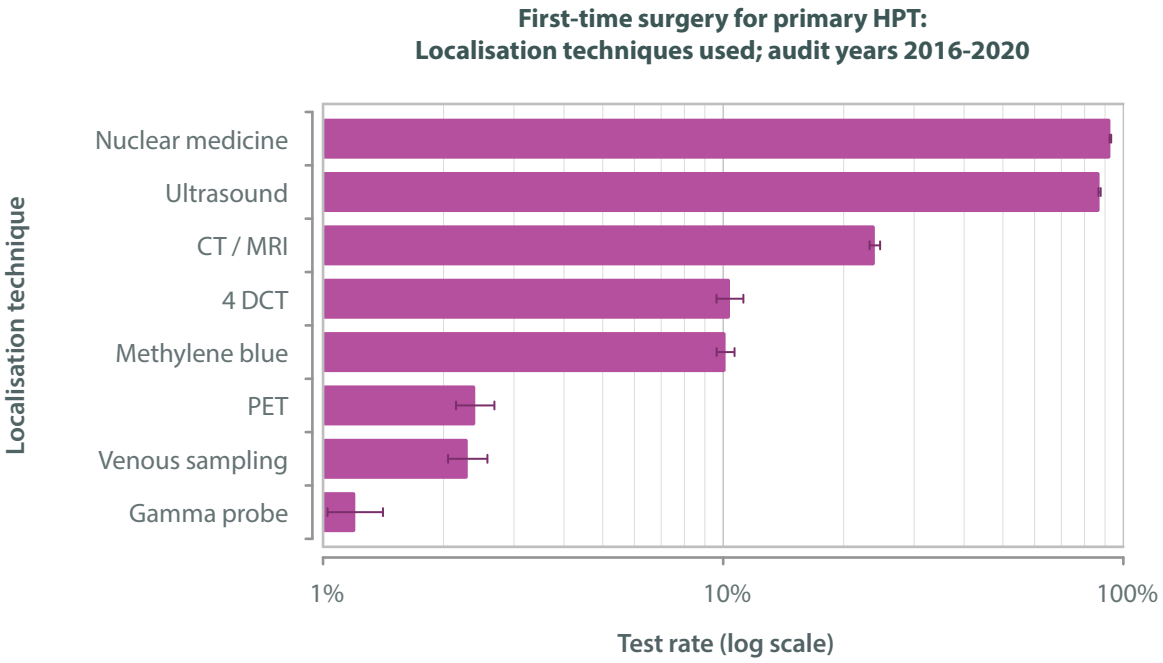
Investigations

Nuclear medicine and ultrasound were the commonest localisation techniques used prior to parathyroidectomy, with similar test rates to those reported in the Fifth Audit Report (92.7% and 82.8%, respectively).

4DCT was only added as a data field within the current audit period so we cannot compare these data to previous time-periods, and it is possible that some 4DCT scans were recorded under CT / MRI prior to this new data field being added to UKRETS.

First-time surgery for primary HPT: localisation techniques used; audit years 2016-2020

Localisation technique	Localisation technique result					
	Not done	Negative	Positive	Unspecified	Test rate	Positivity rate
Nuclear medicine	1,004	3,710	9,284	811	92.8%	71.4%
Ultrasound	1,788	4,374	7,826	821	87.2%	64.1%
CT / MRI	10,167	798	2,401	1,443	23.9%	75.1%
4 DCT	5,058	159	428	9,164	10.4%	72.9%
Methylene blue	11,698	197	1,123	1,791	10.1%	85.1%
PET	12,845	124	192	1,648	2.4%	60.8%
Venous sampling	12,787	135	166	1,721	2.3%	55.1%
Gamma probe	12,718	139	16	1,936	1.2%	10.3%



There has been an increase in the use of CT and / or MRI as an imaging modality in parathyroid localisation in first-time parathyroid surgery compared to data from the last audit report from 15.3% to 23.9% overall, perhaps reflecting the increasing popularity of 4DCT. Use of PET and venous sampling in first-time parathyroidectomy remains low in about 2% of cases. When undertaken, the positivity rate (*i.e.*, the proportion of scans that identified an adenoma) was highest with CT / MRI (75.1%), followed by 4DCT (72.9%), nuclear medicine (71.4%), ultrasound (64.1%), PET (60.8%) and venous sampling (55.1%).

The corresponding positivity rates reported in the Fifth Audit Report were nuclear medicine (73%), PET (70%), CT / MRI (66%) and ultrasound / venous sampling (61%). The current data show an improvement in positivity rates of CT and / or MRI, probably due to the advent of 4DCT for parathyroid localisation.

The accuracy of parathyroid localisation is not recorded in UKRETS as operative findings are not correlated with imaging results. Hence it is not possible to comment on the proportion of positive scans that correctly localised the adenoma. This is something that could be improved in UKRETS in the future.

When comparing the positivity rates of localisation scans, we need to bear in mind that the indications for these scans differ. For example, it would be unusual to undertake venous sampling or PET scan as a first-line investigation in first-time parathyroid surgery, as these scans are usually used to localise disease in patients in whom first-line imaging such as nuclear medicine or ultrasound have not been successful; as the indications for these scans differ their positivity rates are not directly comparable.

The following figure shows changes in the number of localisation scans undertaken over time in first-time parathyroid surgery for primary hyperparathyroidism.

The proportion of patients operated on without any localisation scans decreased from 10% in 2006 to about 3% in 2015, but has increased since then.

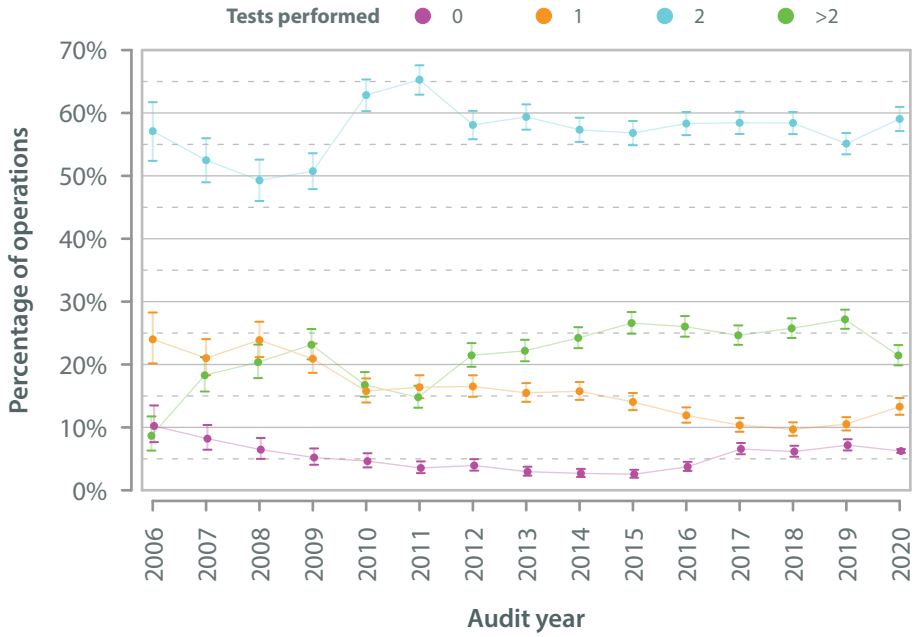
The proportion of patients operated following a single localisation scan has also decreased from 24% in 2006 to 10% in 2018.

The proportion of patients having first-time parathyroid surgery after two localisation scans has varied between 50% and 65% from 2006 to 2020, but has remained fairly constant between 55% and 60% from 2012 to 2020.

The proportion of patients receiving more than two localisation scans has increased from 15% in 2011 to 27% in 2019. Presumably these scans were done in the hope of undertaking targeted surgery, though this practice maybe a concern if patients were exposed to excessive ionising radiation as a consequence. Also, the cost-benefit of more than two localisation techniques for first-time parathyroid surgery needs to be questioned in a publicly-funded health service, when bilateral neck exploration remains a good option in patients with non-localised disease following two scans.

It is worth noting that the National Institute for Health and Care Excellence (NICE) guidelines on primary hyperparathyroidism 2019 (NG132) did not recommend further imaging if ultrasound and nuclear medicine scans could not establish the location of the adenoma, but to proceed to four gland parathyroid exploration. Hopefully we will see a decline in the proportion of these first-time cases with >2 localisation scans by the next audit report.

First-time surgery for primary HPT:
Number of localisation techniques used (n=30,669)



The following figures show trends in the use of different localisation techniques over time in first-time parathyroid surgery.

- Nuclear medicine, ultrasound and CT / MRI all show increasing use from 2006 to 2018 with some plateauing out since then.
- Methylene blue started to decline in popularity since 2008, and that downward trend has continued thereafter.
- 4DCT seemed to peak in use in 2017 after which its popularity declined, but this has increased since 2018.
- PET was seldom used in first-time surgery until 2013 when its use increased to a peak of 4% of cases in 2015, after which it has declined in use.

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

Targeted approach

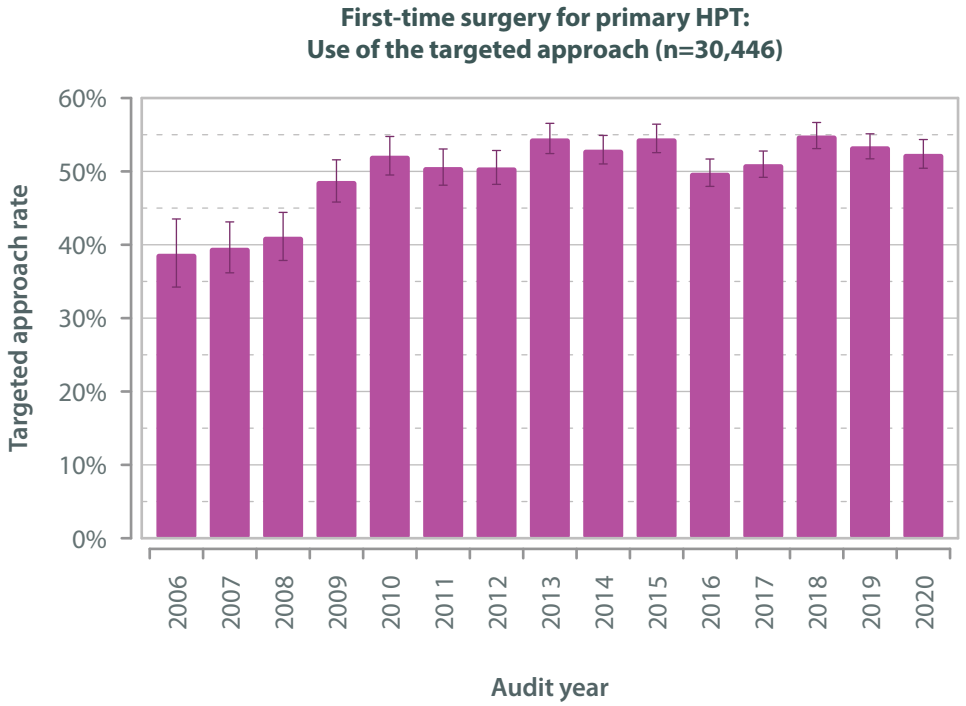
Targeted parathyroidectomy increased in popularity from 2006 to 2010, but since then its use has not increased in frequency, being undertaken in between 50% and 55% of first-time parathyroidectomies for primary hyperparathyroidism; 52% of patients underwent targeted parathyroidectomy for first-time hyperparathyroidism in the period 2016-2020.

The proportion of patients who underwent targeted parathyroidectomy was highest (69%) in patients who had undergone a single localisation scan, followed by those who underwent more than three localisation scans (58%); two localisation scans (52%) and three scans (50%). Presumably, the registry entries where patients underwent targeted parathyroidectomy without prior localisation represent some kind of data-entry error, as this sequence of events does not make sense.

It is ambiguous in UKRETS as to whether localisation techniques such as MIBI SPECT CT, that consist of two imaging modalities MIBI and CT, should be recorded as a single or double localisation. This will no doubt have affected these results.

First-time surgery for primary HPT: use of the targeted approach and the number of localisation techniques used; audit years 2016-2020

		Targeted			
		No	Yes	Unspecified	Rate
Number of localisation techniques used	0	637	255	0	28.6%
	1	514	1,123	0	68.6%
	2	4,090	4,465	0	52.2%
	3	1,503	1,480	0	49.6%
	>3	310	431	1	58.2%
	All	**7,054**	**7,754**	**1**	**52.4%**



Localisation and the targeted approach

Each localisation technique was used (labelled as the test rate in the table) equally often in first-time conventional and targeted parathyroidectomy for primary hyperparathyroidism. Though, as expected, the proportion of scans that identified an adenoma (labelled as the positivity rate in the table) was higher in patients undergoing a targeted parathyroidectomy than in conventional parathyroidectomy.

NICE guidance (NG132) 2019 recommends that conventional and targeted parathyroidectomy are offered to patients in whom a single adenoma has been identified on pre-operative localisation. The fact that conventional parathyroidectomy was often undertaken in patients with positive imaging suggests this recommendation is being followed.

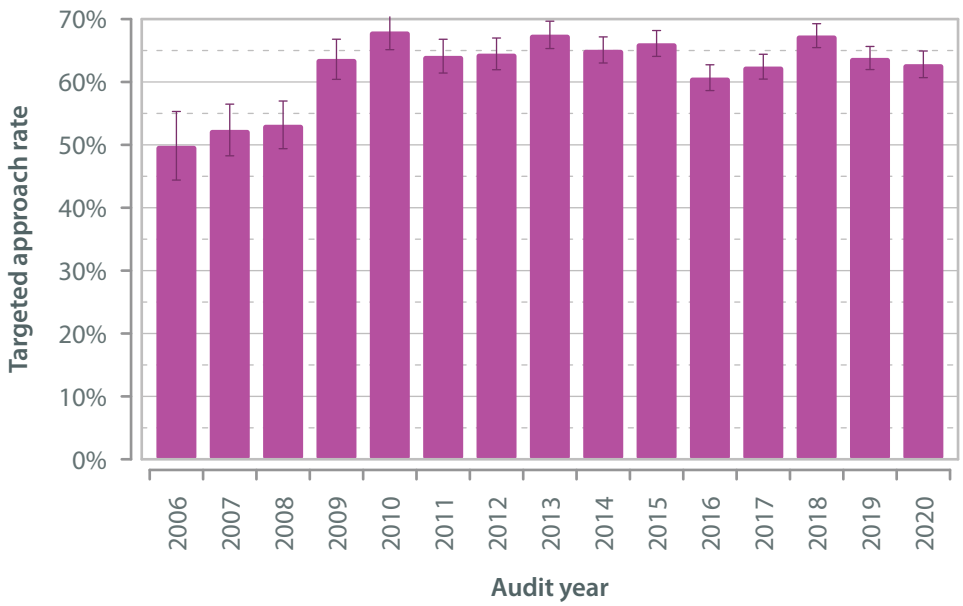
First-time surgery for primary HPT: use of the targeted approach and localisation technique used; audit years 2016-2020

		Localisation technique results					
		Not done	Negative	Positive	Unspecified	Test rate	Positivity rate
Conventional	Nuclear medicine	588	3,057	2,964	445	91.1%	49.2%
	Ultrasound	813	3,254	2,534	453	87.7%	43.8%
	CT / MRI	4,587	662	1,004	801	26.6%	60.3%
	4 DCT	2,308	116	123	4,507	9.4%	51.5%
	Methylene blue	5,554	93	475	932	9.3%	83.6%
	PET	6,059	60	69	866	2.1%	53.5%
	Venous sampling	6,039	58	58	899	1.9%	50.0%
	Gamma probe	5,993	56	12	993	1.1%	17.6%
Targeted	Nuclear medicine	416	653	6,319	366	94.4%	90.6%
	Ultrasound	975	1,120	5,291	368	86.8%	82.5%
	CT / MRI	5,580	136	1,396	642	21.5%	91.1%
	4 DCT	2,750	43	305	4,656	11.2%	87.6%
	Methylene blue	6,144	103	648	859	10.9%	86.3%
	PET	6,786	63	123	782	2.7%	66.1%
	Venous sampling	6,748	76	108	822	2.7%	58.7%
	Gamma probe	6,725	82	4	943	1.3%	4.7%

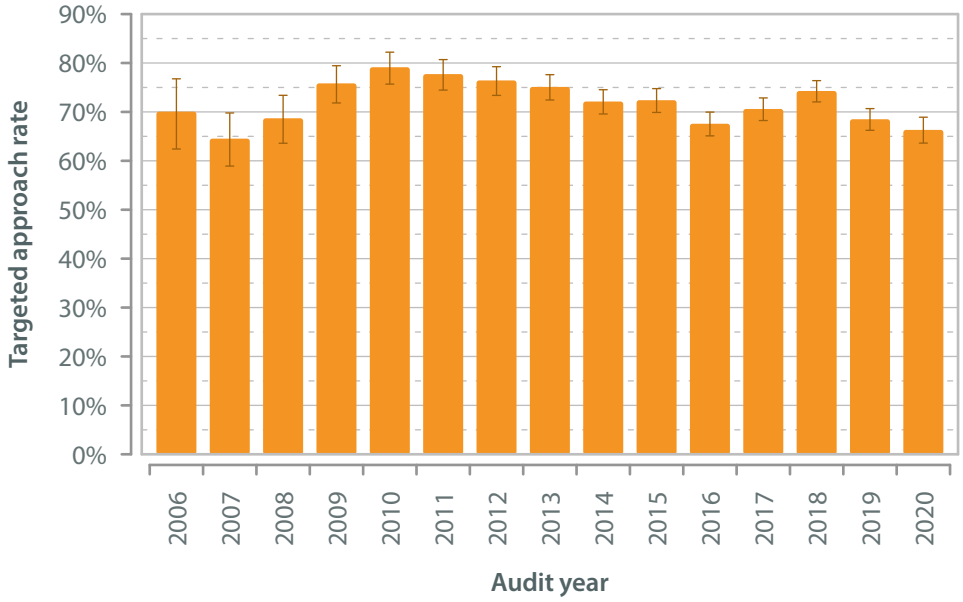
Since 2009 the proportion of patients undergoing targeted parathyroidectomy following one or more positive localisation technique has not increased, but varied between 60% and 68%.

However, the proportion of patients undergoing targeted parathyroidectomy after two or more positive localisation results seems to be declining now compared to ten years ago. This, perhaps, indicates a trend in practice away from targeted parathyroidectomy and towards conventional parathyroidectomy in patients with two or more positive localisation results. Although the benefits of targeted parathyroidectomy are established there is now more awareness that it may miss a small proportion of patients with multi-gland disease who present with late recurrence. Whether this underlies the decline in patients undergoing targeted surgery after two or more scans is unclear.

First-time surgery for primary HPT: Use of the targeted approach for patients with one or more positive localisation results (n=23,925)

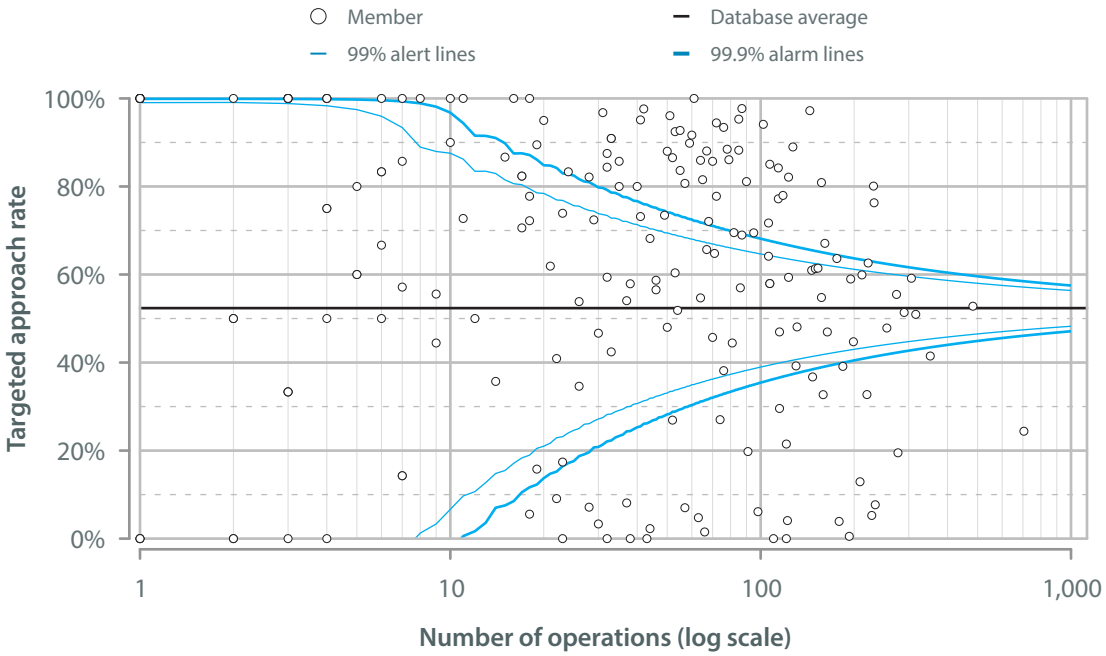


First-time surgery for primary HPT: Use of the targeted approach for patients with two or more positive localisation results (n=14,836)



This funnel-plot showing the proportion of targeted parathyroidectomies *per* surgeon *versus* the number of parathyroid operations recorded in UKRETS looks similar to that published in the Fifth Audit Report, and no doubt reflects different beliefs of surgeons regarding the benefits of targeted surgery, variations in the accuracy of pre-operative imaging, local referral patterns and case-mix. It is clear that a significant proportion of higher-volume parathyroid surgeons undertake targeted parathyroidectomy in a minority of cases (below the 99.9% lower alarm line). Surgeons undertaking targeted parathyroidectomy in near 100% of cases may refer their non-localised cases to other centres, which may explain a handful of lower-volume surgeons who reported targeted parathyroidectomy rates of 100%.

First-time surgery for primary HPT: Use of the targeted approach; audit years 2016-2020 (n=14,808)



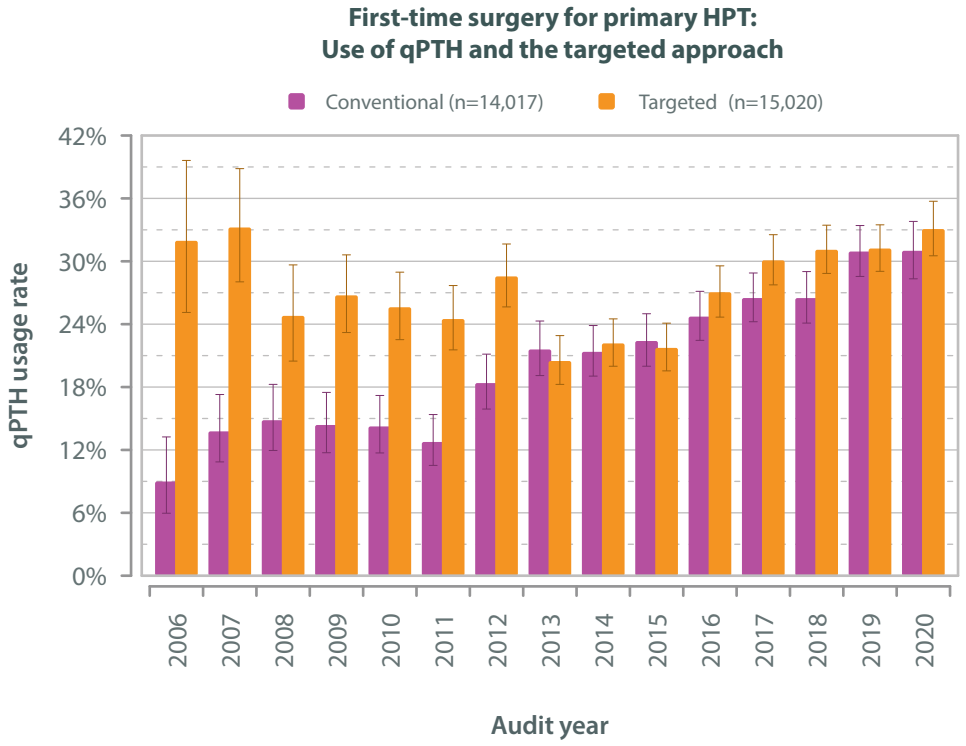
qPTH and the targeted approach

The data on the use of intra-operative parathyroid hormone monitoring with time are interesting. In targeted parathyroidectomy it seemed to have declined in frequency until 2013, but has steadily increased in popularity since then, and is now used in about a third of first-time parathyroidectomies for primary hyperparathyroidism.

In the early years (2006-2012) of UKRETS intra-operative parathyroid hormone monitoring was undertaken significantly more often in targeted than conventional parathyroidectomy. But since 2013 it has been used with similar frequency in both targeted and conventional surgery.

Intra-operative parathyroid hormone monitoring has increased in popularity with time in bilateral neck exploration, being used in 8% of these cases in 2006 and 31% in 2020.

The European Society of Endocrine Surgeons recommended the use of intra-operative parathyroid hormone monitoring only in targeted first-time parathyroidectomy if done in patients with a single adenoma on one localisation scan or with non-concordant localisation scans [1]. NICE does not recommend the use of qPTH in first-time parathyroidectomy (NG132 2019). Its difficult to understand from United Kingdom or European guidelines why intra-operative parathyroid hormone monitoring is being used increasingly in conventional and targeted first-time parathyroid surgery.



1. Bergenfelz et al. Position Statement of European Society of Endocrine Surgeons on modern techniques in primary hyperparathyroidism surgery. *Langenbecks Archive of Surgery*. 2009; **394**: 761-4.

qPTH and conversion

Use of quick parathyroid hormone (qPTH) or intra-operative parathyroid hormone monitoring refers to the measurement of parathyroid hormone levels during surgery in order to exclude multi-gland disease. This is particularly useful in targeted parathyroidectomy where only a single gland has been visualised. The use of qPTH would be expected to increase the proportion of targeted parathyroidectomies converted to conventional parathyroidectomy. In the current dataset the use of qPTH almost doubled the conversion rate from 5% to 10%. This is similar to the findings published in the Fifth Audit Report (6% and 12%, respectively).

First-time surgery for primary HPT using the targeted approach: qPTH and conversion to conventional; audit years 2016-2020

		Converted to conventional				
		No	Yes	Unspecified	All	Conversion rate
qPTH used	No	4,844	265	0	**5,109**	5.2%
	Yes	2,033	215	0	**2,248**	9.6%
	Unspecified	374	23	0	**397**	5.8%
	All	**7,251**	**503**	**0**	**7,754**	**6.5%**

The use of qPTH overall in first-time surgery for primary hyperparathyroidism has been analysed using data from UKRETS [1]. The benefit in terms of reducing the incidence of persistent hyperparathyroidism was small (1.5%) but statistically significant in (and probably due to) the large number of operations (21,738) analysed.

When analysing targeted parathyroidectomy alone, only in the 2011-2015 period was there observed any significant reduction in the incidence of persistent disease with qPTH and post-operative hypocalcaemia rates were not significantly influenced by qPTH use in first-time parathyroid surgery.

First-time surgery for primary HPT using the targeted approach: the use of qPTH and hypocalcaemia

		qPTH used	
		No	Yes
Post-operative hypocalcaemia rates	2006-2010	**3.3%** (1,506; 2.5-4.4%)	**2.1%** (567; 1.2-3.8%)
	2011-2015	**2.1%** (4,032; 1.7-2.6%)	**1.7%** (1,249; 1.1-2.6%)
	2016-2020	**1.3%** (4,624; 1.0-1.7%)	**1.7%** (2,164; 1.2-2.4%)
Persistent hypercalcaemia rates	2006-2010	**3.4%** (1,335; 2.6-4.6%)	**2.1%** (524; 1.1-3.8%)
	2011-2015	**4.1%** (3,498; 3.5-4.8%)	**2.0%** (1,091; 1.3-3.1%)
	2016-2020	**3.1%** (4,018; 2.6-3.7%)	**2.1%** (1,941; 1.5-2.9%)

1. Ishii et al. A Review of Parathyroid Surgery for Primary Hyperparathyroidism from the United Kingdom Registry of Endocrine and Thyroid Surgery. *World Journal of Surgery*. 2021; **45**: 782-789.

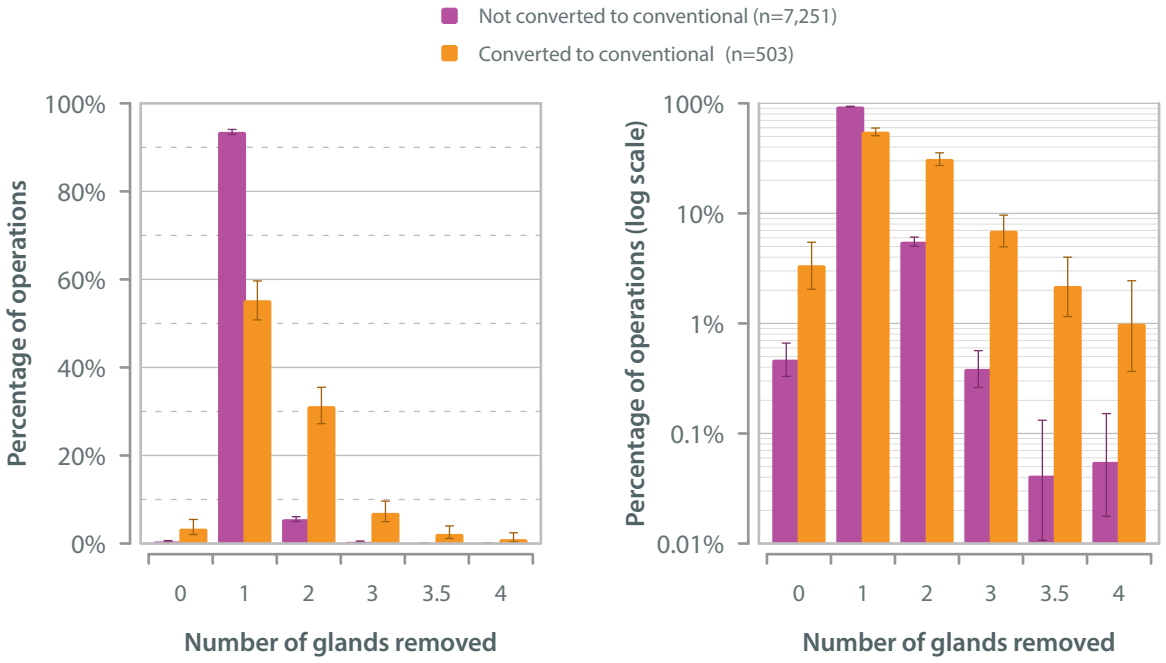
Glands removed and conversion to conventional

4% (278/7,059) of targeted first-time parathyroidectomies in which a single adenoma was excised were converted to bilateral neck exploration compared to 28% (157/558) in which two glands were removed; 56% (35/63) in which three glands were removed and 79% (11/14) in which three-and-a-half glands were removed. A third (17/51) in which no parathyroid adenoma was identified were also converted from targeted to conventional parathyroidectomy. This suggests, as expected, that the main reason for conversion to bilateral neck exploration is the presence of multi-gland disease.

First-time surgery for primary HPT using the targeted approach: number of glands removed and conversion to the conventional approach; audit years 2016-2020

Glands removed	Converted to conventional: No	Yes	Unspecified	All
0 glands	34	17	0	**51**
1 glands	6,781	278	0	**7,059**
2 glands	401	157	0	**558**
3 glands	28	35	0	**63**
3.5 glands	3	11	0	**14**
4 glands	4	5	0	**9**
All	**7,251**	**503**	**0**	**7,754**

First-time surgery for primary HPT using the targeted approach: Use of qPTH and the targeted approach; audit years 2016-2020



Outcomes

Changes in outcome rates over time

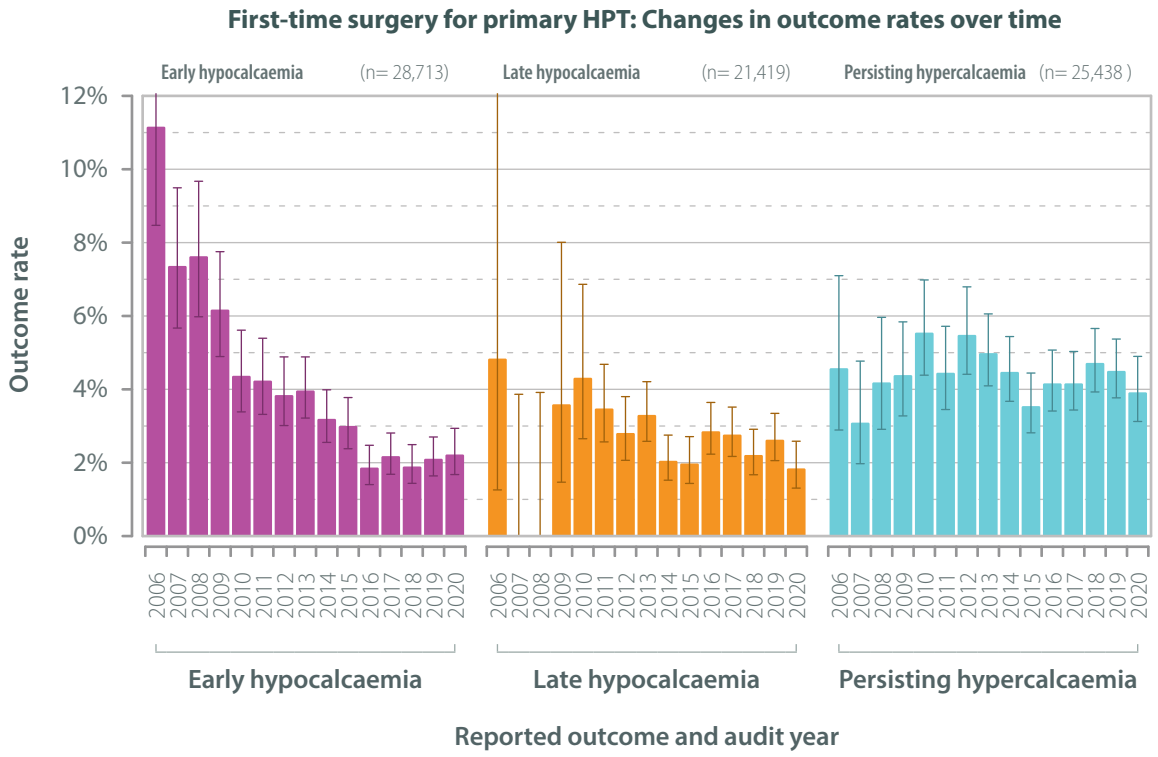
These figures show how the key performance indicators of early and late hypocalcaemia, and persistent hypercalcaemia following first-time parathyroid surgery have changed over time.

The incidence of early hypocalcaemia has fallen with time (X^2 test for trend through time = 225; p<0.001), being significantly higher in the early years of UKRETS than in the current dataset. One of the established benefits of targeted parathyroidectomy is a reduction in post-operative hypocalcaemia, and it is likely that the increased popularity of targeted parathyroidectomy [1] since 2010 is therefore responsible for this finding.

The rates of late hypocalcaemia have also significantly fallen with time (X^2 test for trend through time = 6.78, p=0.009).

The concern regarding targeted parathyroidectomy is the possibility of missing multi-gland disease, which would be manifested in an increase in persistent disease. The figure below shows that the incidence of persistent disease has not changed significantly over time. The incidence of persistent disease following first-time parathyroidectomy for primary hyperparathyroidism has varied from 3% to 5.5% since 2006, but no significant trend is apparent (X^2 test for trend through time = 0.7, p=0.403).

These data could be interpreted as showing that the trend towards targeted parathyroidectomy in UKRETS has been accomplished without compromising the rates of persistent disease, and that this has been accompanied by a decline in the rates of post-operative and late hypocalcaemia.



1. Ishii et al. A Review of Parathyroid Surgery for Primary Hyperparathyroidism from the United Kingdom Registry of Endocrine and Thyroid Surgery. *World Journal of Surgery*. 2021; **45**: 782-789.

Persisting hypercalcaemia summary

When comparing the incidence of persistent disease following first-time parathyroidectomy for primary hyperparathyroidism it is important to bear in mind that we are often not comparing like with like.

Multi-gland disease is much more likely in familial than sporadic hyperparathyroidism; conventional than targeted parathyroidectomy; and scan-negative compared to scan-positive cases. For this reason we would expect the incidence of persistent disease to be higher in familial, conventional and scan negative cases, which is shown in the following table of data drawn from the current dataset.

However, there does appear to be a small but significant benefit of using qPTH, reducing the incidence of persistent disease from 4.7% to 3.3%. Whether this justifies the added expense of qPTH in first-time parathyroid surgery for primary hyperparathyroidism is another matter, and has been the subject of much debate. This was also seen in the review of parathyroid surgery in UKRETS published earlier this year [1].

First-time surgery for primary HPT: persisting hypercalcaemia; audit years 2016-2020

		Persisting hypercalcaemia			
		No	**Yes**	**Unspecified**	**Rate** (95% CI)
Pathology	Sporadic	11,272	504	2,741	**4.3%** (3.9-4.7%)
	Familial	160	12	34	**7.0%** (3.8-12.1%)
	Primary NOS	60	2	24	**3.2%** (0.6-12.2%)
qPTH	No	7,608	376	1,889	**4.7%** (4.3-5.2%)
	Yes	3,417	116	555	**3.3%** (2.7-3.9%)
	Unspecified	467	26	355	**5.3%** (3.5-7.7%)
Targeted approach	No	5,545	347	1,162	**5.9%** (5.3-6.5%)
	Yes	5,947	171	1,636	**2.8%** (2.4-3.2%)
	Unspecified	0	0	1	
Scan results	All negative	1,736	144	348	**7.7%** (6.5-9.0%)
	One or more positive	9,150	344	2,195	**3.6%** (3.3-4.0%)
	Unspecified	606	30	256	**4.7%** (3.3-6.7%)

Persisting hypercalcaemia and glands removed

The following tables show how the key performance indicators in parathyroid surgery, persistent hypercalcaemia, early and late hypocalcaemia, depend on the number of glands excised.

The incidence of persistent disease following first-time parathyroidectomy for hyperparathyroidism in the current dataset is very similar to that reported in the 2010-2015 dataset; *i.e.,* the incidence is lowest (3%) when one gland is excised, presumably because the vast majority of these cases have single-gland disease.

The incidence of persistent disease then rises as more glands are excised to a maximum of 8.6% following operations in which three glands are removed. The incidence then falls in cases where three-and-a-half or four glands are removed.

However, this improvement in persistent hypercalcaemia with increasing numbers of glands excised in patients with multi-gland disease comes at the expense of increasing incidence of early and late hypocalcaemia, which have their own associated problems. Hence three-and-a-half and four-gland excision in first-time parathyroidectomy for primary hyperparathyroidism achieves excellent cure rates of 96.4% and 96.8% respectively, but at the cost of an unacceptably high rate of late hypocalcaemia of 23% and 48%. Whereas, three-gland excision improves the incidence (6.8%) of late hypocalaemia, but at the expense of increasing the rate of persistent disease (8.6%).

This all goes to show that patients with multi-gland parathyroid disease are a difficult group to manage, and pre-operative discussions with them need to cover what the risks and priorities are in managing their disease, as there is an imperative to strike a compromise between disease persistence and long-term hypoparathyroidism.

It is worth noting that the incidence of persistent hypercalcaemia was only 34% and not 100% when zero glands were removed. There are several potential reasons for this: firstly the absence of persistence hypercalcaemia does not exclude the possibility of persistent hyperparathyroidism, which would be more accurately defined if parathyroid hormone, urine calcium and vitamin D levels were recorded in UKRETS; secondly, the diagnosis of primary hyperparathyroidism may have been incorrect in these patients; and, thirdly, surgery might have devascularised these glands with resulting loss of function.

These data also show that targeted parathyroidectomy results in a reduction in early and late hypocalcaemia compared to conventional surgery, though the proviso made above regarding the incidence of multi-gland disease when comparing targeted and conventional parathyroidectomy needs to be taken into account when interpreting this result.

First-time surgery for primary HPT: number of glands removed and persisting hypercalcaemia; audit years 2016-2020

		Persisting hypercalcaemia			
		No	**Yes**	**Unspecified**	**Rate**
Number of glands removed	0 glands	149	76	34	33.8%
	1 gland	9,207	280	2,294	3.0%
	2 glands	1,618	121	352	7.0%
	3 glands	381	36	93	8.6%
	3.5 glands	107	4	19	3.6%
	4 glands	30	1	7	3.2%
	All	**11,492**	**518**	**2,799**	**4.3%**

First-time surgery for primary HPT: early and late hypocalcaemia outcomes; audit years 2016-2020

		Early hypocalcaemia			
		No	Yes	Unspecified	Rate
Targeted approach	No	6,392	173	489	2.6% (2.3-3.1%)
	Yes	6,928	106	720	1.5% (1.2-1.8%)
	Unspecified	0	0	1	
Number of glands removed	0 glands	241	4	14	1.6% (0.5-4.4%)
	1 gland	10,637	170	974	1.6% (1.4-1.8%)
	2 glands	1,890	38	163	2.0% (1.4-2.7%)
	3 glands	421	39	50	8.5% (6.2-11.5%)
	3.5 glands	100	22	8	18.0% (11.9-26.3%)
	4 glands	31	6	1	16.2% (6.8-32.7%)

		Late hypocalcaemia			
		No	Yes	Unspecified	Rate
Targeted approach	No	5,453	203	1,398	3.6% (3.1-4.1%)
	Yes	5,825	85	1,844	1.4% (1.2-1.8%)
	Unspecified	0	0	1	
Number of glands removed	0 glands	214	5	40	2.3% (0.8-5.5%)
	1 gland	8,972	172	2,637	1.9% (1.6-2.2%)
	2 glands	1,629	47	415	2.8% (2.1-3.7%)
	3 glands	369	27	114	6.8% (4.6-9.9%)
	3.5 glands	80	24	26	23.1% (15.6-32.6%)
	4 glands	14	13	11	48.1% (29.2-67.6%)

Post-operative stay

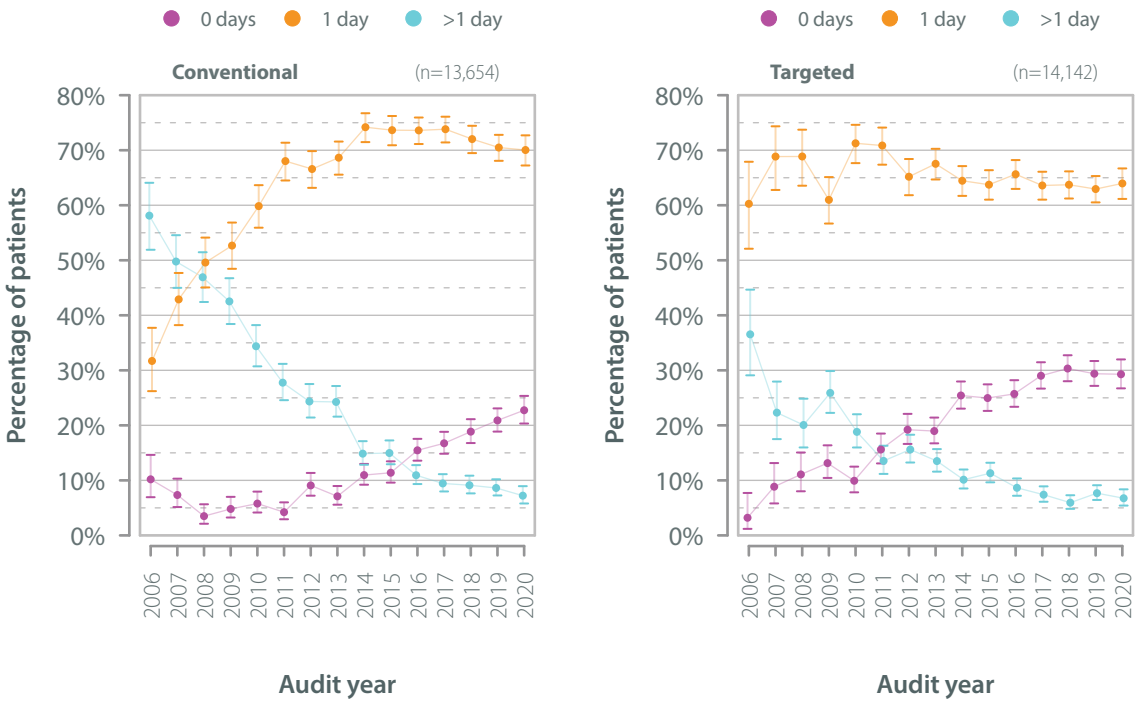
The following figures show a clear reduction in the length-of-stay with time over the past 15 years, in both conventional and targeted parathyroidectomy.

The proportion of patients staying more than one day following bilateral neck exploration has fallen from almost 60% in 2006 to <10% in 2020. The proportion staying one night only increased from about 30% in 2006 to 75% in 2014 and has fallen since then as the number of daycase bilateral neck explorations has increased, which accounted for >20% of cases in 2020.

A similar reduction with time in the proportion of patients staying more than one night is also evident after targeted parathyroidectomy, with a concomitant rise in daycase targeted parathyroidectomy, which accounted for approximately 30% of cases in 2020.

There will have to be a considerable increase in the proportion of daycase parathyroidectomies undertaken if the recommendation of the Get it Right First Time (GIRFT) Programme National Specialty Report (Wass J, Lansdown M; 2021) that 90% of parathyroid surgery is to be done as a daycase is followed, particularly as a significant proportion of this surgery is done on elderly, co-morbid patients, and is conventional parathyroid surgery, which has a higher incidence of post-operative hypocalcaemia.

First-time surgery for primary HPT:
Changes in post-operative stay distributions over time

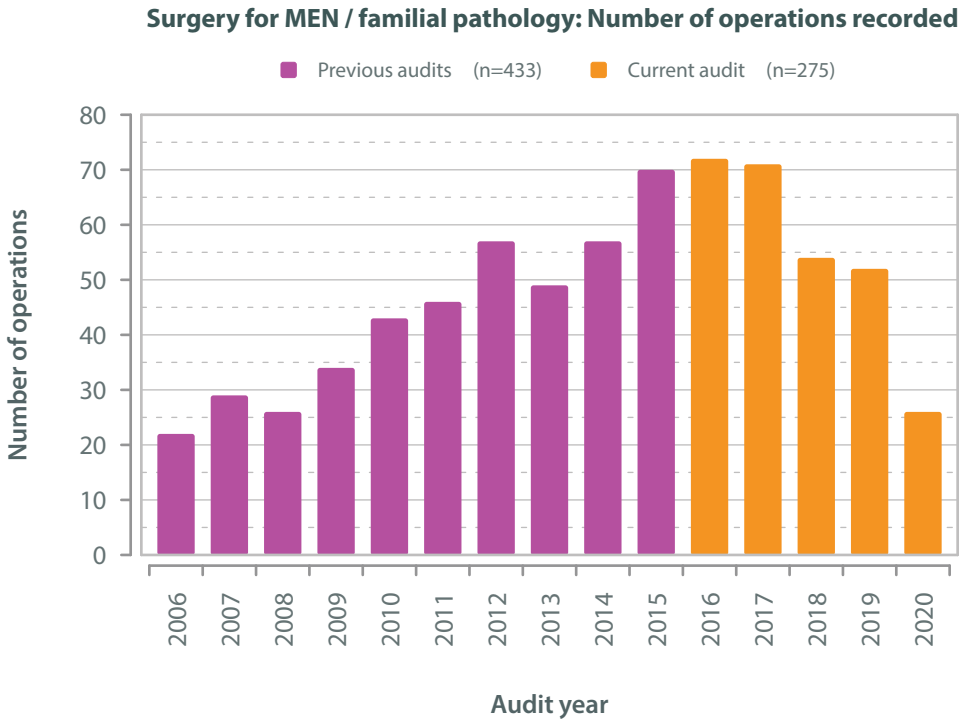


Surgery for MEN / familial pathology

Number of parathyroid operations

As expected, a lot fewer operations were performed for familial parathyroid disease, the majority of which will have been for multiple endocrine neoplasia type 1 and type 2. The UKRETS does not record which familial disease is responsible, so the results outlined below are a collection of outcomes from all familial parathyroid operations. As small numbers of cases were performed annually, the results are presented for this group since the inception of the database.

The number of parathyroidectomies performed for familial disease has increased over the first decade of the database to just over 70 cases *per* year in 2016, following which the number of such cases added to the database has decreased.



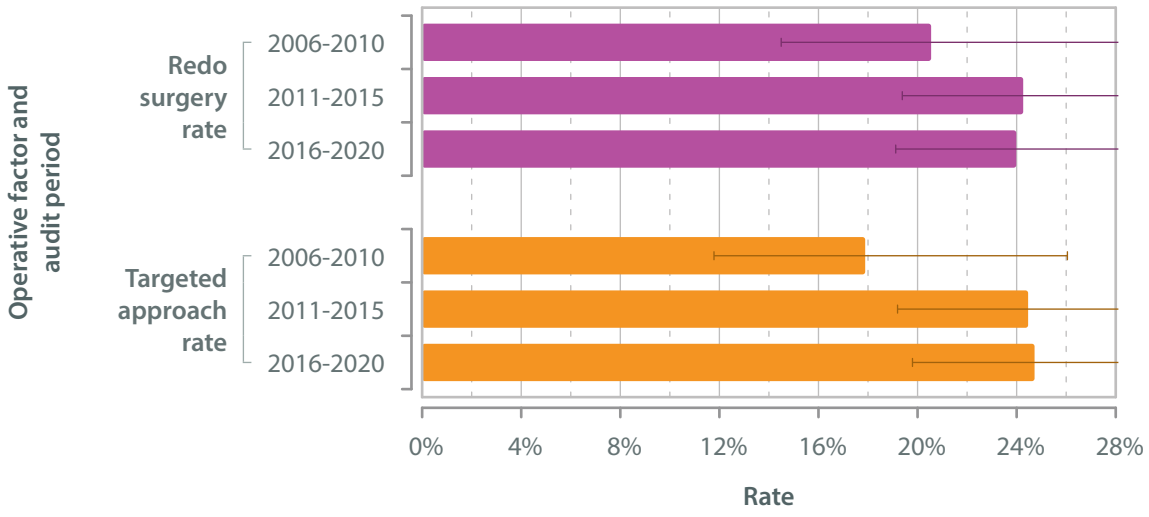
Compared to first-time parathyroid surgery, surgery for familial disease is much more likely to be re-operative (161/689 or 23%) and less likely to be targeted (146/627 or 23%) . This no doubt reflects the higher incidence of multi-gland disease and underlying gene mutations increasing the risk of recurrent disease, which present particular challenges in this patient group.

Surgery for MEN / familial pathologies: operation sequence and use of the targeted approach over time

		5-year period (audit years)			
		2006-2010	**2011-2015**	**2016-2020**	**All**
Operation sequence	First-time	116	206	206	**528**
	Re-operation	30	66	65	**161**
	Unspecified	8	7	4	**19**
	Redo surgery rate	20.5%	24.3%	24.0%	**23.4%**

		5-year period (audit years)			
		2006-2010	**2011-2015**	**2016-2020**	**All**
Targeted approach	No	101	176	204	**481**
	Yes	22	57	67	**146**
	Unspecified	31	46	4	**81**
	Targeted approach rate	17.9%	24.5%	24.7%	**23.3%**

Surgery for MEN / familial pathology: Changes in operative factors over time



Investigations

Nuclear medicine (72%) and ultrasound (69%) were used (test rate) less frequently for patients with familial disease than those with sporadic disease (93% and 72%, respectively), but had similar positivity rates in both the familial and sporadic disease groups. Venous sampling was probably used more often in familial disease due to the fact that there are proportionately more redo cases in this group.

Other localisation techniques were used with similar frequency.

Surgery for MEN / familial pathologies: localisation techniques used; audit years 2006-2020

Localisation technique	Localisation technique result					
	Not done	Negative	Positive	Unspecified	Test rate	Positivity rate
Nuclear medicine	191	149	335	33	71.7%	69.2%
Ultrasound	205	177	280	46	69.0%	61.3%
CT / MRI	475	39	108	86	23.6%	73.5%
4 DCT	59	2	4	643	9.2%	66.7%
Methylene blue	514	18	58	118	12.9%	76.3%
PET	581	8	9	110	2.8%	52.9%
Venous sampling	552	9	21	126	5.2%	70.0%
Gamma probe	580	5	0	123	0.9%	0.0%

Outcomes

Persisting hypercalcaemia

Comparing outcomes after surgery for familial disease to those after first-time surgery for sporadic disease in the current audit period (2016-2020): persistent disease was more likely to occur following surgery for familial disease (35/441 or 7.9%) than sporadic (504/11,776 or 4.3%); intra-operative qPTH did not show any significant benefit in reducing the incidence of persistent disease in the familial group, in contrast to the findings in first-time surgery for sporadic disease; furthermore, the targeted approach was not associated with a increase in the incidence of persistent disease.

This familial group consists of both first-time and redo patients and so any comparison with first-time surgery for sporadic hyperparathyroidism does not compare like with like, but does illustrate some of the challenges involved in the treatment of patients in the familial group.

Surgery for MEN / familial pathologies: persisting hypercalcaemia; audit years 2006-2020

		Persisting hypercalcaemia			
		No	**Yes**	**Unspecified**	**Rate** (95% CI)
Operation sequence	First-time	406	35	87	**7.9%** (5.7-11.0%)
	Reoperation	110	20	31	**15.4%** (9.9-23.0%)
	Unspecified	12	2	5	**14.3%** (2.5-43.8%)
qPTH used	No	303	39	82	**11.4%** (8.3-15.4%)
	Yes	112	14	27	**11.1%** (6.4-18.3%)
	Unspecified	113	4	14	**3.4%** (1.1-9.0%)
Targeted approach	No	347	39	95	**10.1%** (7.4-13.7%)
	Yes	112	15	19	**11.8%** (7.0-19.0%)
	Unspecified	69	3	9	**4.2%** (1.1-12.5%)

Surgery for MEN / familial pathologies: persisting hypercalcaemia & number of glands removed; audit years 2006-2020

		Persisting hypercalcaemia			
		No	**Yes**	**Unspecified**	**Rate**
Number of glands removed	0 glands	4	5	0	**55.6%** (22.7-84.7%)
	1 gland	225	30	36	**11.8%** (8.2-16.5%)
	2 glands	78	12	24	**13.3%** (7.4-22.5%)
	3 glands	82	6	30	**6.8%** (2.8-14.8%)
	3.5 glands	82	1	17	**1.2%** (0.1-7.5%)
	4 glands	42	2	10	**4.5%** (0.8-16.7%)
	Unspecified	15	1	6	**6.3%** (0.3-32.3%)
	All	**528**	**57**	**123**	**9.7%** (7.5-12.5%)

Hypocalcaemia

The relationship between the incidence of persistent hypercalcaemia, early and late hypocalcaemia and the number of glands removed is interesting, and may help inform discussions with patients with familial parathyroid disease on the extent of surgery.

As with sporadic disease, there is a balance between reducing the incidences of persistent disease and post-operative hypocalcaemia.

Persistent hypercalcaemia was lowest (1.2%) when three-and-a-half glands were removed, but this came at the expense of a high incidence of early (32%) and late (32%) hypocalcaemia. The occurrence of post-operative hypocalcaemia decreased when fewer glands were removed, but rates of persistent disease were relatively elevated.

These outcomes reflect a mixture of first-time and redo surgery from a variety of familial parathyroid aetiologies, so it is difficult to generalise these results, but it does illustrate the difficulties involved in treating the familial group, and the importance of pre-operative discussions with these patients about the objectives of surgery.

Surgery for MEN / familial pathologies: early and late hypocalcaemia outcomes; audit years 2006-2020

		Early hypocalcaemia			
		No	**Yes**	**Unspecified**	**Rate** (95% CI)
Number of glands removed	0 glands	8	1	0	11.1% (0.6-49.3%)
	1 gland	248	25	18	9.2% (6.1-13.4%)
	2 glands	91	16	7	15.0% (9.0-23.4%)
	3 glands	92	17	9	15.6% (9.6-24.1%)
	3.5 glands	62	29	9	31.9% (22.7-42.6%)
	4 glands	30	19	5	38.8% (25.5-53.8%)
	Unspecified	18	0	4	0.0% (0.0-15.3%)
	All	**549**	**107**	**52**	**16.3%** (13.6-19.4%)

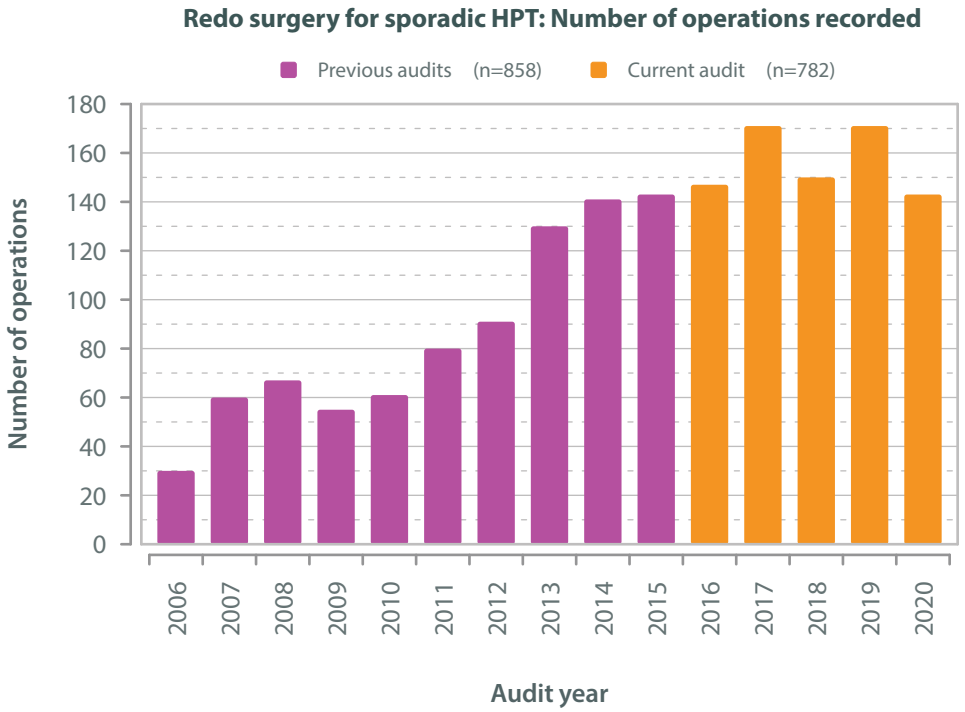
		Late hypocalcaemia			
		No	**Yes**	**Unspecified**	**Rate** (95% CI)
Number of glands removed	0 glands	8	1	0	11.1% (0.6-49.3%)
	1 gland	164	28	99	14.6% (10.1-20.6%)
	2 glands	63	7	44	10.0% (4.5-20.1%)
	3 glands	52	15	51	22.4% (13.5-34.5%)
	3.5 glands	45	21	34	31.8% (21.2-44.6%)
	4 glands	10	20	24	66.7% (47.1-82.1%)
	Unspecified	8	0	14	0.0% (0.0-31.2%)
	All	**350**	**92**	**266**	**20.8%** (17.2-25.0%)

Redo surgery for sporadic hyperparathyroidism

Number of operations

This section on redo parathyroid surgery for sporadic hyperparathyroidism covers outcomes since the start of the BAETS audit, due to the relatively low numbers of re-operative procedures being undertaken each year.

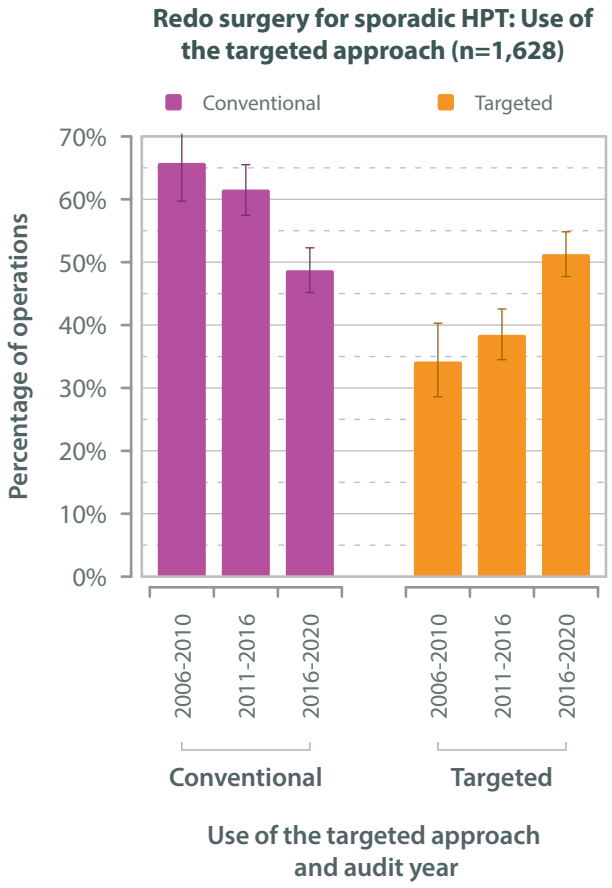
There has been an upward trend in the number of redo operations recorded since 2006, which peaked at 170 cases *per* year in 2017 and 2019.



Use of the targeted approach

Targeted parathyroidectomy is generally considered to be the optimum approach in redo surgery [1], and it is encouraging to see that there has been a significant increase in the proportion of targeted redo operations since the last audit report. For the first time, in the current audit period (2016-2020), the majority of redo operations are now reported as using the targeted approach, though there is clearly scope for further improvement in this regard.

In some instances it might be appropriate to undertake bilateral neck exploration for recurrent disease following a targeted parathyroidectomy, particularly if a second enlarged gland is found on localisation on the same side as the first operation. This would require re-exploration of this side of the neck and also imply the presence of multi-gland disease, so warranting exploration of the contralateral side.



1. Stack et al. Optimizing outcomes in reoperative parathyroid surgery: definitive multidisciplinary joint consensus guidelines of the American Head and Neck Society and the British Association of Endocrine and Thyroid Surgeons. *Head and Neck*. 2018; **40**:1617-29.

Number of glands removed and location of tumour

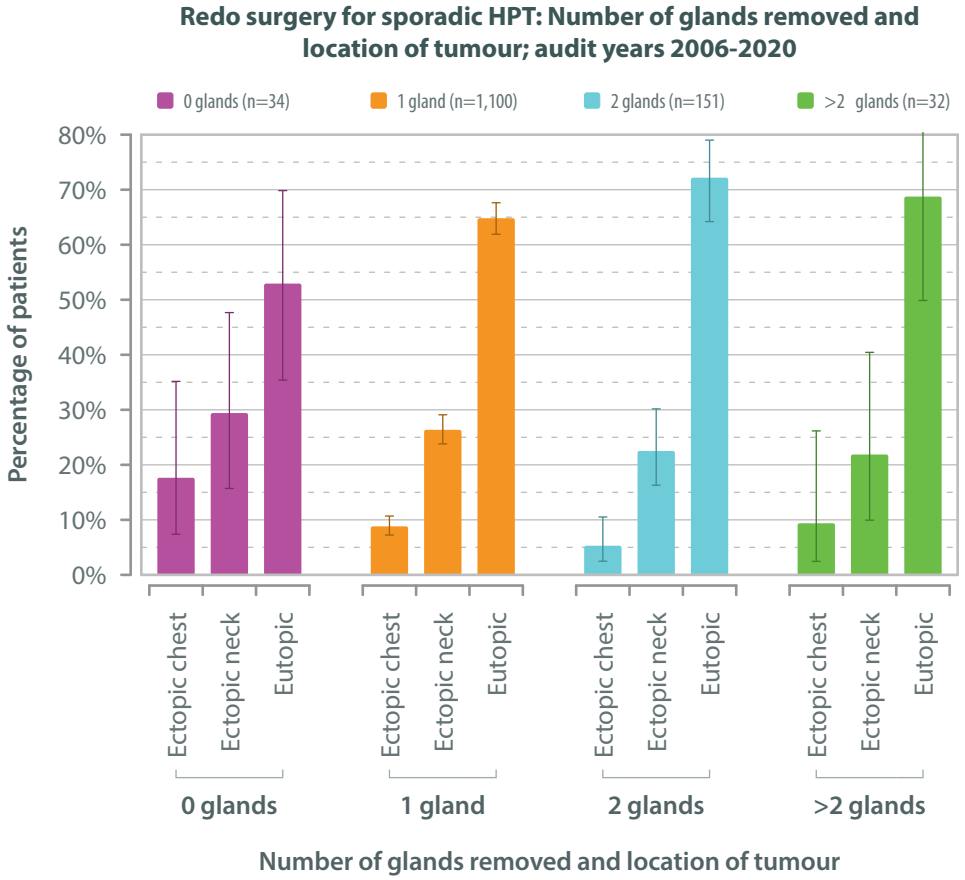
This table and figure, showing the number and location of parathyroid glands removed at redo surgery, is included, as it was in the last audit report, to illustrate the frequency of anatomic location of glands causing recurrent or persistent hyperparathyroidism.

In 81% (1,308 / 1,606) of redo operations a single gland is excised and in the majority (868 / 1,329 or 65%) this gland is in a eutopic location. In 35% (461 / 1,329) of redo cases the gland is located ectopically, either in the neck in 26% (344 / 1,329) or less often the chest in 9% (117 / 1,329).

These results are broadly similar to those reported in the Fifth Audit Report.

Redo surgery for sporadic HPT: number of glands removed and location of tumour; audit years 2006-2020

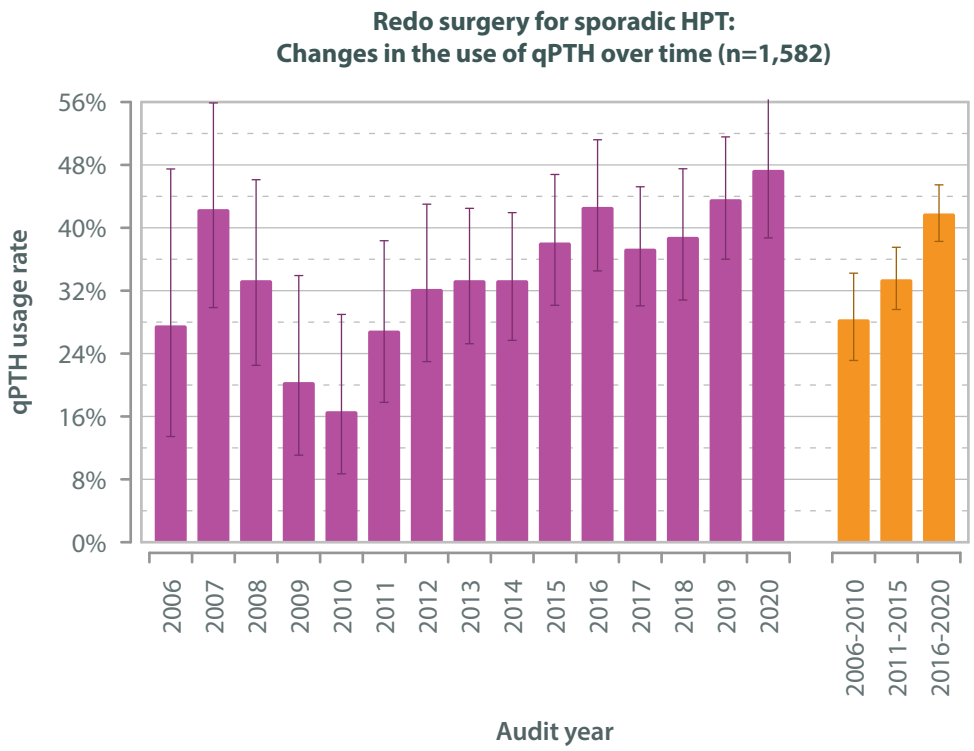
Number of glands removed	Location of tumour: Ectopic chest	Ectopic neck	Eutopic	Unspecified	All
0 glands	6	10	18	34	**68**
1 gland	97	290	713	208	**1,308**
2 glands	8	34	109	33	**184**
3 glands	3	4	18	9	**34**
3.5 glands	0	0	4	2	**6**
4 glands	0	3	0	3	**6**
Unspecified	3	3	6	22	**34**
All	**117**	**344**	**868**	**311**	1,640



qPTH

Intra-operative PTH monitoring is recommended in redo parathyroid surgery, due to the increased surgical complexity and risks associated with the operation [1].

It is encouraging to see this is reflected in the following figure, which shows a steady increase in the use of qPTH from 2010 and a significant increase in qPTH use reported in the current audit period compared to the last 5-year audit period.



1. NICE Guideline NG132 Hyperparathyroidism (primary): diagnosis, assessment, and initial management 2019.

Outcomes

Persisting hypercalcaemia

Comparing the outcomes from the current audit period for redo *versus* first-time parathyroid surgery for sporadic disease, the incidence of persistent hypercalcaemia following redo parathyroid surgery across UKRETS was, as expected, higher after both targeted (8.3% *versus* 2.8%) and conventional (13.2% *versus* 5.9%) surgery.

Supporting the recommendation to restrict redo surgery to the cases in which a target has been identified on localisation scans pre-operatively [1], the incidence of persistent hypercalcaemia was significantly lower in targeted than conventional redo parathyroid surgery.

Although the use of qPTH is recommended in re-operative surgery there was no significant benefit shown for qPTH use in redo parathyroidectomy in this audit report.

The incidence of persistent disease was particularly high (17%) when performing redo parathyroid surgery for patients with negative localisation, which should discourage members from undertaking redo surgery in this situation. Approximately one-in-ten redo operations were complicated by persistent disease even when localisation scans had identified a target for surgery.

Redo surgery for sporadic HPT: persisting hypercalcaemia; audit years 2006-2020

		Persisting hypercalcaemia			
		No	**Yes**	**Unspecified**	**Rate** (95% CI)
Targeted approach	No	651	99	163	**13.2%** (10.9-15.9%)
	Yes	522	47	146	**8.3%** (6.2-10.9%)
	Unspecified	5	1	6	**16.7%** (0.9-63.5%)
qPTH used	No	712	94	198	**11.7%** (9.6-14.1%)
	Yes	442	44	92	**9.1%** (6.7-12.1%)
	Unspecified	24	9	25	**27.3%** (13.9-45.8%)
Scan results	All negative	144	30	37	**17.2%** (12.1-23.9%)
	One or more positive	992	105	265	**9.6%** (7.9-11.5%)
	Unspecified	42	12	13	**22.2%** (12.5-35.9%)
Number of glands removed	0 glands	14	42	12	**75.0%** (61.4-85.2%)
	1 glands	984	76	248	**7.2%** (5.7-8.9%)
	2 glands	132	14	38	**9.6%** (5.5-15.9%)
	3 glands	28	2	4	**6.7%** (1.2-23.5%)
	3.5 glands	3	1	2	**25.0%** (1.3-78.1%)
	4 glands	3	0	3	**0.0%** (0.0-63.2%)
	Unspecified	14	12	8	**46.2%** (27.1-66.3%)

As expected, the incidence of persistent hypercalcaemia was particularly high (42/56 or 75%) when no glands were excised during redo parathyroidectomy. The failure to remove a gland would imply that a causative gland was not identified at operation. Though the number of these cases recorded over the last 15 years is small, it is noticeable that persistent hypercalcaemia did not occur in one in four of these cases.

The incidence of persistent hypercalcaemia was <10% for those cases in which one, two or three glands were removed at redo parathyroidectomy. Those patients in whom one gland was removed at redo parathyroidectomy may have had single-gland disease missed at first-time surgery, or multi-gland disease. Likewise, we do not collect data on whether patients in whom more than one gland was removed at redo surgery had pathologically enlarged glands excised, but it seems likely that the incidence of multi-gland disease would be higher in this group. All of these factors would affect the findings reported here.

Hypocalcaemia

As in first-time parathyroid surgery, the incidence of early and late post-operative hypocalcaemia increases as more glands are removed. However, in redo surgery the majority of the time either one or two glands are removed, so the confidence intervals for outcomes when more than two glands were removed are very wide.

Redo surgery for sporadic HPT: early and late hypocalcaemia; audit years 2006-2020

		Early hypocalcaemia			
		No	Yes	Unspecified	Rate (95% CI)
Number of glands removed	0 glands	63	0	5	0.0% (0.0-4.6%)
	1 gland	1,135	97	76	7.9% (6.5-9.6%)
	2 glands	149	24	11	13.9% (9.3-20.1%)
	3 glands	23	9	2	28.1% (14.4-47.0%)
	3.5 glands	2	4	0	66.7% (24.1-94.0%)
	4 glands	5	0	1	0.0% (0.0-45.1%)
	Unspecified	28	3	3	9.7% (2.5-26.9%)
	All	**1,405**	**137**	**98**	**8.9%** (7.5-10.4%)

		Late hypocalcaemia			
		No	Yes	Unspecified	Rate (95% CI)
Number of glands removed	0 glands	55	0	13	0.0% (0.0-5.3%)
	1 gland	812	54	442	6.2% (4.8-8.1%)
	2 glands	104	16	64	13.3% (8.0-21.0%)
	3 glands	14	8	12	36.4% (18.0-59.2%)
	3.5 glands	5	0	1	0.0% (0.0-45.1%)
	4 glands	1	2	3	66.7% (12.5-98.2%)
	Unspecified	6	1	27	14.3% (0.8-58.0%)
	All	**997**	**81**	**562**	**7.5%** (6.0-9.3%)

1. Stack et al. Optimizing outcomes in reoperative parathyroid surgery: definitive multidisciplinary joint consensus guidelines of the American Head and Neck Society and the British Association of Endocrine and Thyroid Surgeons. *Head and Neck*. 2018; **40**: 1617-29.

Surgery for renal hyperparathyroidism

Pathology

As with the familial and redo parathyroid surgery sections, because there are relatively few records in the UKRETS database that relate to surgery for renal hyperparathyroid, these data have been analysed across the period 2006-2020 in this section.

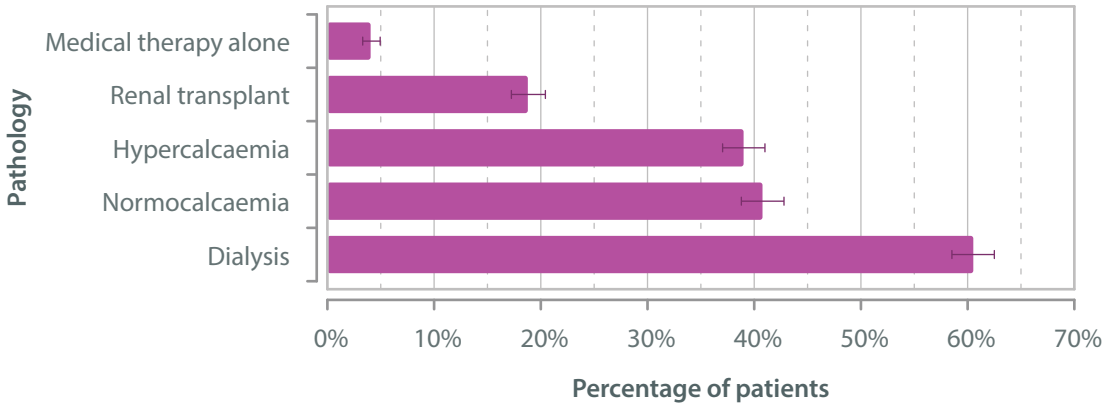
Each patient-entry can have more than one option selected under the pre-operative renal hyperparathyroidism detail question in UKRETS. Over the lifetime of UKRETS, the majority (61%) of renal patients who underwent parathyroidectomy were receiving dialysis and 19% had undergone renal transplant. The proportion of renal patients on dialysis undergoing parathyroidectomy fell to 52% in 2011-2015, but has since increased to 65% in the current audit period, which was similar to the rate in 2006-2010.

Approximately equal proportions of renal patients undergoing parathyroidectomy were normocalcaemic or hypercalcaemic, and only a minority <5% were on medical therapy alone.

Surgery for renal HPT: pathology; audit years 2006-2020

		Audit period			
		2006-2010	2011-2015	2016-2020	All
Pathology – Counts	Normocalcaemia	278	380	308	**966**
	Hypercalcaemia	230	374	320	**924**
	Medical therapy alone	31	41	24	**96**
	Dialysis	447	476	511	**1,434**
	Renal transplant	87	180	178	**445**
	Unspecified	0	0	1	**1**
	All	**668**	**915**	**787**	**2,370**
		2006-2010	2011-2015	2016-2020	All
Pathology – Rates	Normocalcaemia	41.6%	41.5%	39.2%	**40.8%**
	Hypercalcaemia	34.4%	40.9%	40.7%	**39.0%**
	Medical therapy alone	4.6%	4.5%	3.1%	**4.1%**
	Dialysis	66.9%	52.0%	65.0%	**60.5%**
	Renal transplant	13.0%	19.7%	22.6%	**18.8%**

Surgery for renal HPT:
Renal pathology; audit years 2006-2020 (n=2,369)



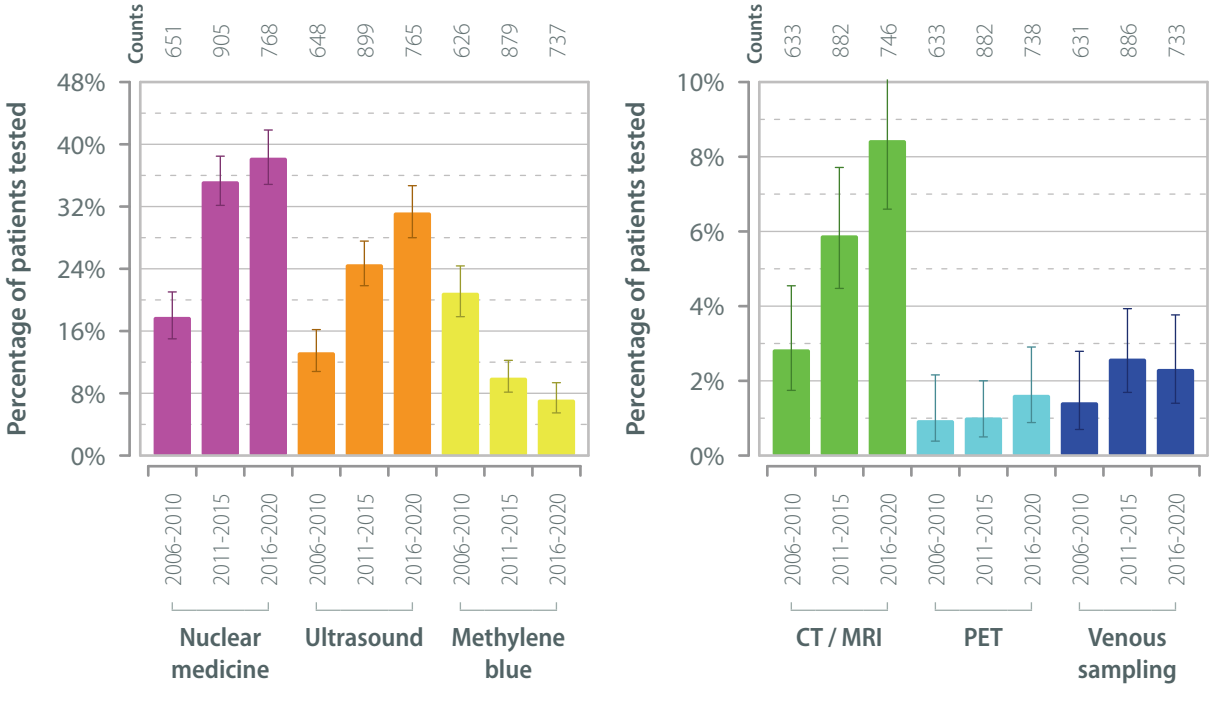
Investigations

The need for pre-operative localisation in renal hyperparathyroidism is controversial and so, as expected, the table and figure below demonstrate that these scans are used much less frequently for renal patients than for those patients undergoing first-time parathyroid surgery for sporadic hyperparathyroidism. Compared to the data on sporadic patients from the current audit period, nuclear medicine was used (test rate) in 31% of renal patients compared to 93% of sporadic patients, ultrasound in 24% compared to 87%, and CT / MRI 6% compared to 24%. There does appear to be an upward trend in the rates of pre-operative localisation in renal hyperparathyroidism with time, particularly with regard to nuclear medicine, ultrasound and CT / MRI. Looking at these data, it would be useful to reach a consensus on the benefit of pre-operative localisation in renal parathyroid surgery, and whether this should be undertaken in first-time renal parathyroidectomy. The purported benefits of pre-operative imaging in renal hyperparathyroidism are to exclude ectopic disease, exclude concurrent thyroid disease and guide the surgeon to the location of the enlarged parathyroid glands.

Surgery for renal HPT: localisation techniques used; audit years 2006-2020

Localisation technique	Localisation technique result					
	Not done	Negative	Positive	Unspecified	Test rate	Positivity rate
Nuclear medicine	1,595	172	557	46	31.4%	76.4%
Ultrasound	1,766	204	342	58	23.6%	62.6%
Methylene blue	1,970	34	238	128	12.1%	87.5%
4 DCT	197	3	12	2,158	7.1%	80.0%
CT / MRI	2,128	30	103	109	5.9%	77.4%
Venous sampling	2,201	22	27	120	2.2%	55.1%
PET	2,226	15	12	117	1.2%	44.4%
Gamma probe	2,209	19	3	139	1.0%	13.6%

Surgery for renal HPT: Changes in the use of localisation techniques over time



Glands removed

The surgical strategy in first-time renal parathyroidectomy depends on the clinical scenario. Four-gland excision is associated with a lower incidence of recurrence, so may be the best option for renal patients who are not expected to receive a renal transplant. Lesser parathyroid resections intentionally leave at least a remnant of parathyroid gland, and so may be a better option for patients on dialysis awaiting transplant or those with tertiary hyperparathyroidism following renal transplant. UKRETS does not record this level of detail, but some trends are illustrated in the following table and figure opposite.

Surgery for renal HPT: operation sequence, number of glands removed and pathology; audit years 2006-2020

Operation sequence and number of glands removed		Pathology: Normocalcaemia	Hypercalcaemia	Medical therapy alone	Dialysis	Renal transplant	Unspecified	Denominator
First-time surgery	0 glands	1	2	0	1	1	0	**3**
	1 glands	42	54	6	7	24	1	**111**
	2 glands	28	55	11	36	32	0	**107**
	3 glands	111	155	21	164	89	0	**318**
	3.5 glands	200	171	21	308	131	0	**484**
	4 glands	452	382	30	716	127	0	**1,042**
	Unspecified	10	2	0	9	0	0	**14**
	All	**844**	**821**	**89**	**1,241**	**404**	**1**	**2,079**
Redo surgery	0 glands	2	1	0	3	0	0	**3**
	1 glands	34	52	2	62	23	0	**108**
	2 glands	15	19	4	23	8	0	**41**
	3 glands	1	4	0	7	1	0	**9**
	3.5 glands	0	1	0	4	1	0	**4**
	4 glands	3	0	0	3	1	0	**5**
	Unspecified	1	1	0	4	0	0	**4**
	All	**56**	**78**	**6**	**106**	**34**	**0**	**174**

In first-time renal parathyroid surgery four-gland excision is the most popular operation in all categories except renal transplant patients. Four gland excision was undertaken significantly more often for dialysis patients than lesser parathyroid resections.

Most commonly a single gland was excised at redo renal parathyroid surgery in all diagnostic categories except medical therapy alone; however, the number of patients undergoing redo parathyroidectomy who were on medical therapy alone was small, so the confidence intervals around the calculated rates for this group are wide. These results are expected as redo renal hyperparathyroidism is likely to be due to progression of a remnant left behind from a previous subtotal parathyroid resection.

Surgery for renal HPT: Operation sequence, renal pathology and number of glands removed; audit years 2006-2020

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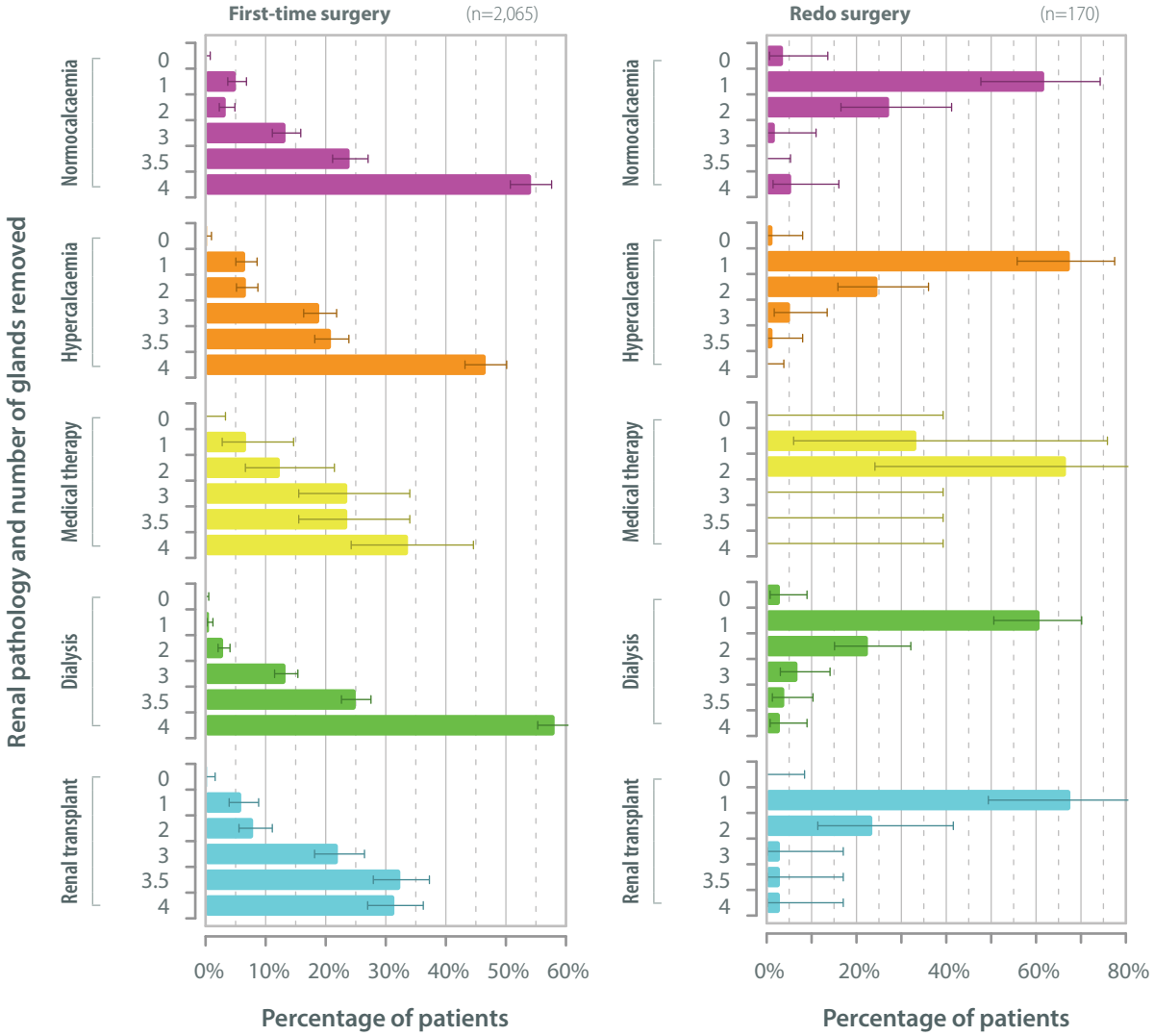


Outcomes

Persisting hypercalcaemia

It must be born in mind that the outcomes below are from a mixture of first-time and redo renal parathyroidectomy, which is clearly a heterogeneous group.

Persistent hypercalcaemia was observed more often following targeted renal parathyroidectomy (14%) than the conventional approach (3%). This is almost certainly due to the fact that targeted renal parathyroid surgery should only really undertaken in redo cases, which itself is a risk factor for persistent disease.

Intra-operative PTH has been used in very few renal patients in UKRETS, but the data do not show any significant benefit in reducing the incidence of persistent disease. There was no significant difference in the incidence of persistent disease if pre-operative localisation scans were positive or not.

Persistent hypercalcaemia was significantly less likely after three-and-a-half or four-gland excision than lesser parathyroid resections for renal hyperparathyroidism.

Surgery for renal HPT: persisting hypercalcaemia; audit years 2006-2020

		Persisting hypercalcaemia			
		No	Yes	Unspecified	Rate (95% CI)
Targeted approach	No	1,522	54	584	3.4% (2.6-4.5%)
	Yes	84	14	36	14.3% (8.3-23.1%)
	Unspecified	38	2	36	5.0% (0.9-18.2%)
qPTH used	No	1,506	64	543	4.1% (3.2-5.2%)
	Yes	81	2	61	2.4% (0.4-9.2%)
	Unspecified	57	4	52	6.6% (2.1-16.7%)
Scan results	All negative	95	5	51	5.0% (1.9-11.8%)
	One or more positive	556	38	286	6.4% (4.6-8.8%)
	Unspecified	993	27	319	2.6% (1.8-3.9%)
Number of glands removed	0 glands	2	2	2	50.0% (9.2-90.8%)
	1 glands	158	19	51	10.7% (6.8-16.5%)
	2 glands	107	9	36	7.8% (3.8-14.6%)
	3 glands	236	21	78	8.2% (5.2-12.4%)
	3.5 glands	333	5	188	1.5% (0.5-3.6%)
	4 glands	795	14	264	1.7% (1.0-3.0%)
	Unspecified	13	0	37	0.0% (0.0-20.6%)

Hypocalcaemia

Although rates of persisting hypercalcaemia are lower after three-and-a-half or four-gland excisions, early post-operative hypocalcaemia occurred in the majority of patients who underwent three-and-a-half (57%) and four (58%) gland resections, and was significantly more likely to occur after these two operations than after lesser parathyroid resections.

Late hypocalcaemia was very common (61% overall) following renal parathyroid surgery and increased significantly in severity with increasing numbers of glands excised from two, three, three-and-a-half to a peak of 76% after four-gland excisions.

Surgery for renal HPT: early and late hypocalcaemia; audit years 2006-2020

		Early hypocalcaemia			
		No	Yes	Unspecified	Rate (95% CI)
Number of glands removed	0 glands	5	0	1	0.0% (0.0-45.1%)
	1 gland	174	37	17	17.5% (12.8-23.5%)
	2 glands	103	35	14	25.4% (18.5-33.6%)
	3 glands	197	104	34	34.6% (29.2-40.3%)
	3.5 glands	200	268	58	57.3% (52.6-61.8%)
	4 glands	395	554	124	58.4% (55.2-61.5%)
	Unspecified	13	6	31	31.6% (13.6-56.5%)
	All	**1,087**	**1,004**	**279**	**48.0%** (45.9-50.2%)

		Late hypocalcaemia			
		No	Yes	Unspecified	Rate (95% CI)
Number of glands removed	0 glands	4	0	2	0.0% (0.0-52.7%)
	1 gland	90	45	93	33.3% (25.6-42.0%)
	2 glands	69	29	54	29.6% (21.0-39.8%)
	3 glands	112	102	121	47.7% (40.8-54.6%)
	3.5 glands	100	178	248	64.0% (58.0-69.6%)
	4 glands	140	454	479	76.4% (72.8-79.7%)
	Unspecified	4	6	40	60.0% (27.4-86.3%)
	All	**519**	**814**	**1,037**	**61.1%** (58.4-63.7%)

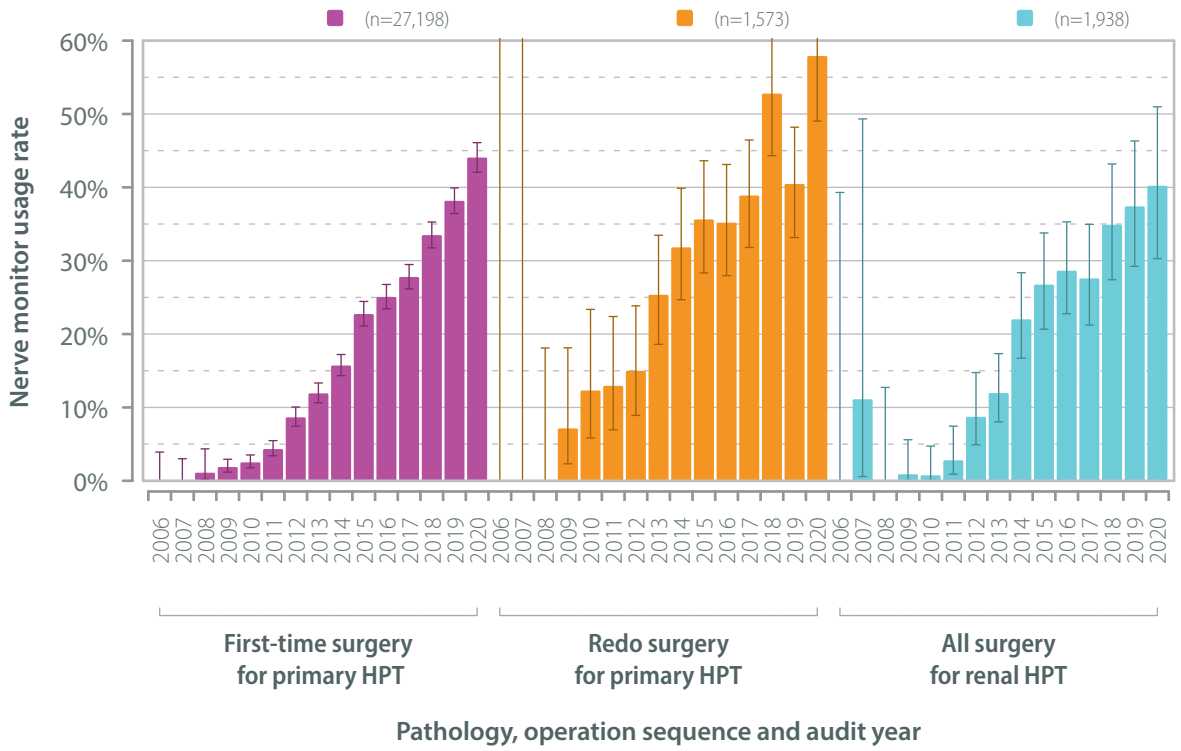
Nerve monitoring

Nerve monitoring use is reported here across the lifetime of UKRETS. Its use is increasing with time, though it was still only used in the minority (44%) of first-time parathyroidectomies for primary hyperparathyroidism. As expected, it was used more often in redo parathyroid surgery, and in 2020 approximately 57% of all redo parathyroidectomies for primary hyperparathyroidism were performed with nerve monitoring.

Parathyroid surgery: pathology, operation sequence and nerve monitoring; audit years 2006-2020

			Pathology and operation sequence				
			Primary HPT			Renal HPT	Unspecified
			First-time	Redo	Unspecified	All operations	All operations
Nerve monitoring	Counts	No monitor used	21,093	1,043	237	1,550	272
		Medtronic NM	4,378	388	19	285	39
		Magstim	801	39	4	49	3
		Inomed	504	48	0	15	0
		Other	312	29	1	29	0
		Unspecified monitor	110	26	3	10	1
		Unspecified	3,471	238	628	432	1,379
		All	**30,669**	**1,811**	**892**	**2,370**	**1,694**
	Percentages	No monitor used	77.6%	66.3%	89.8%	80.0%	86.3%
		Medtronic NM	16.1%	24.7%	7.2%	14.7%	12.4%
		Magstim	2.9%	2.5%	1.5%	2.5%	1.0%
		Inomed	1.9%	3.1%	0.0%	0.8%	0.0%
		Other	1.1%	1.8%	0.4%	1.5%	0.0%
		Unspecified monitor	0.4%	1.7%	1.1%	0.5%	0.3%

Parathyroid surgery:
Nerve monitoring usage rates over time, pathology and operation sequence



The proportion of surgeons who never use nerve monitoring for parathyroidectomy has fallen in consecutive audit periods from 84% in 2006-2010 to 42% in 2016-2020; and the proportion of regular (>80% of cases) users has increased from 4% to 36%.

Given these findings it would be helpful to reach a consensus on whether or not there is a benefit of nerve monitoring in targeted and conventional first-time parathyroidectomy.

Parathyroid surgery: changes in nerve monitor usage per member over time

Audit period			Nerve monitor usage: Never [1]	Occasional [2]	Regular [3]	Unspecified	Number of members
	Counts	2006-2010	78	11	4	13	**106**
		2011-2015	104	41	26	4	**175**
		2016-2020	86	44	73	9	**212**
	Percentages	2006-2010	83.9%	11.8%	4.3%		
		2011-2015	60.8%	24.0%	15.2%		
		2016-2020	42.4%	21.7%	36.0%		

1. 0% of operations
2. >0 and <80% of operations
3. >80% of operations

Training

Surgeon

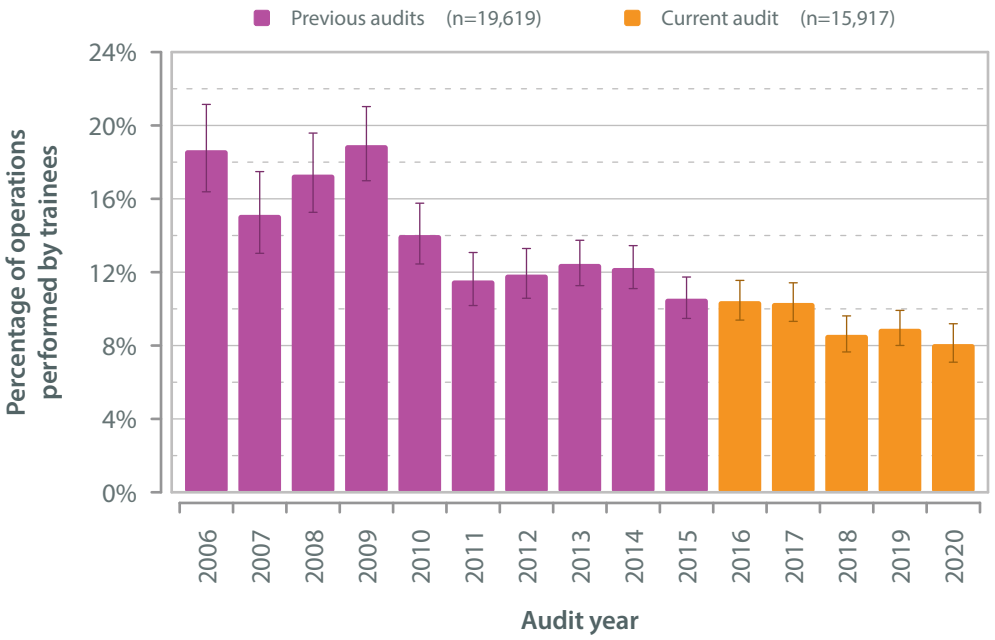
The following table and figure show the proportion of parathyroid operations recorded in UKRETS performed by trainees over time. The results are of some concern with regard to training and are similar to those seen for thyroidectomy: there is a clear reduction in the proportion of parathyroidectomies performed by trainees with time (X^2 test for a trend through time: $p<0.001$). This trend needs to be reversed if we are to train adequate surgeons in the future. The same comments (above) with regard to thyroid surgery also apply here, as these data may be influenced by the number of general surgical trainees choosing endocrine as a sub-specialty.

Consultants performed the majority of first-time and redo parathyroid surgery. Registrars (year 4+) undertook 6.9% of first-time operations, followed by fellows (4.5%), registrars (year 1-3) (2.8%) and staff grades (1.1%). Understandably, due to the increased complexity and risks associated redo parathyroid surgery, the proportion of these operations undertaken by consultants was higher (96%), but only 35 such operations were done by trainees over the latest audit period.

Parathyroid surgery: surgeon and operating sequence; audit years 2016-2020

		Operation sequence				
		Count			Percentage	
		First-time	Redo	Unspecified	First-time	Redo
Surgeon	Consultant	12,695	856	0	84.5%	96.1%
	Fellow	673	14	0	4.5%	1.6%
	Staff grade	168	0	0	1.1%	0.0%
	Registrar (year 1-3)	424	3	0	2.8%	0.3%
	Registrar (year 4+)	1,037	16	0	6.9%	1.8%
	BST	28	2	0	0.2%	0.2%
	Other	1	0	0	0.0%	0.0%
	Unspecified	520	27	791		
	All	**15,546**	**918**	**791**		

Parathyroid surgery: Changes in the proportion of operations performed by trainees over time



Assistant

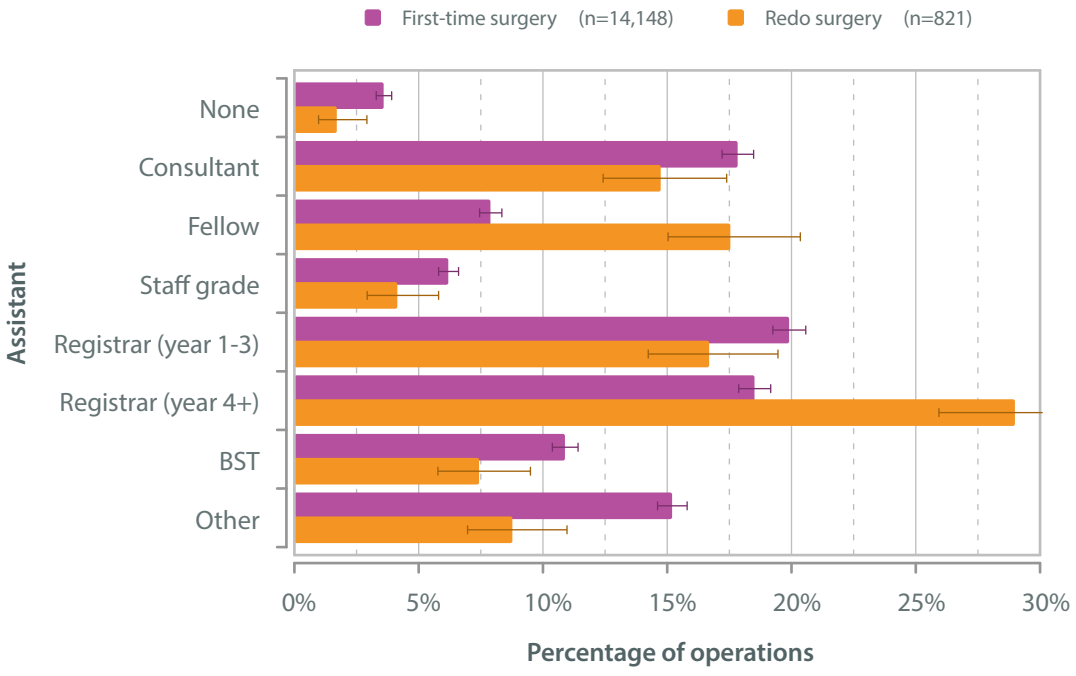
In first-time parathyroid surgery the registrar (year 1-3) was the commonest assistant (19.9%), followed by registrar (year 4+) (18.5%), consultant (17.8%), other (15.2%), BST (10.9%), fellow (7.9%) and staff grade (6.2%). In redo parathyroid surgery registrars (year 4+) and fellows were significantly more likely to assist and BST / other significantly less likely to do so.

This is understandable as the more experienced trainee / fellow would want to attend the redo cases, which are performed less commonly and are often more technically challenging.

Parathyroid surgery: surgical assistant and operation sequence; audit years 2016-2020

Assistant	Operation sequence				
	Count			Percentage	
	First-time	Redo	Unspecified	First-time	Redo
None	508	14	0	3.6%	1.7%
Consultant	2,523	121	0	17.8%	14.7%
Fellow	1,116	144	0	7.9%	17.5%
Staff grade	876	34	0	6.2%	4.1%
Registrar (year 1-3)	2,816	137	0	19.9%	16.7%
Registrar (year 4+)	2,619	238	0	18.5%	29.0%
BST	1,540	61	0	10.9%	7.4%
Other	2,150	72	0	15.2%	8.8%
Unspecified	1,398	97	791		
All	**15,546**	**918**	**791**		

Parathyroid surgery: Surgical assistant; audit years 2016-2020



General outcomes

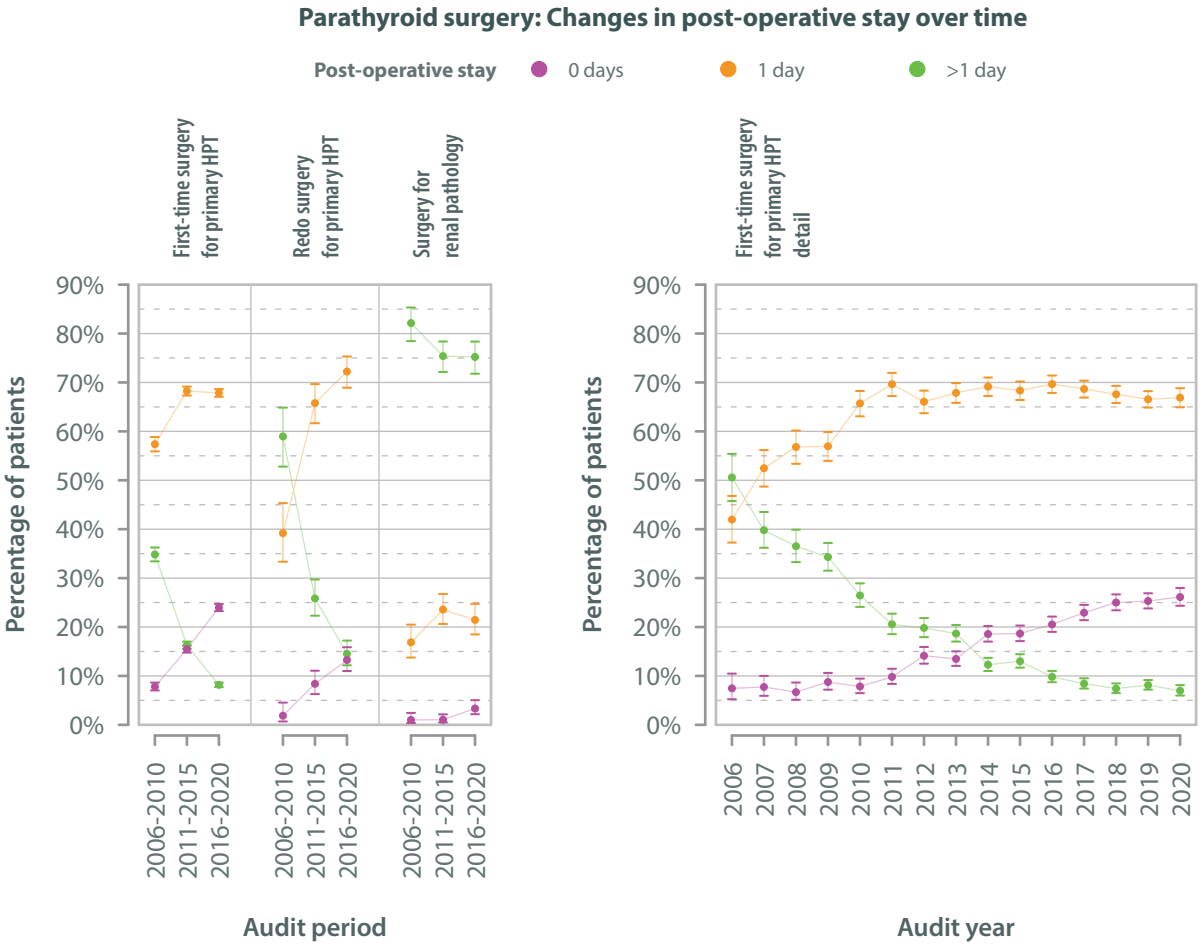
Post-operative stay

The following figures show changes in the patterns of recorded post-operative stay following parathyroid surgery.

One-day stay following first-time parathyroidectomy for primary hyperparathyroidism increased from 2006 to 2011, but has been reported for between 65% and 70% of patients since then. Daycase parathyroidectomy continues to increase in popularity with time and was undertaken in approximately one-in-four first-time parathyroidectomies for primary hyperparathyroidism in 2020, whilst the proportion of patients staying more than one day in this group continues to decline from 50% in 2006 to <10% since 2017. There will have to be a considerable increase in the proportion of daycase parathyroidectomies undertaken if the recommendation of the Get it Right First Time (GIRFT) Programme National Specialty Report (Wass J, Lansdown M 2021) that 90% of parathyroid surgery is to be done as a daycase, particularly as a significant proportion of this surgery is done on elderly, co-morbid patients and is conventional parathyroid surgery, which has a higher incidence of post-operative hypocalcaemia.

Post-operative stay following redo parathyroidectomy has shown a similar pattern, with an increase in one-day and daycase surgery over time, and a decrease in the proportion of redo parathyroid patients staying more than one day.

Renal parathyroid patients generally have more complex medical needs than those patients with sporadic hyperparathyroidism, and it is not surprising that the majority of the renal patients stayed more than one day. Fewer than one-in-four renal patients stayed one day and <5% were done as a daycase.



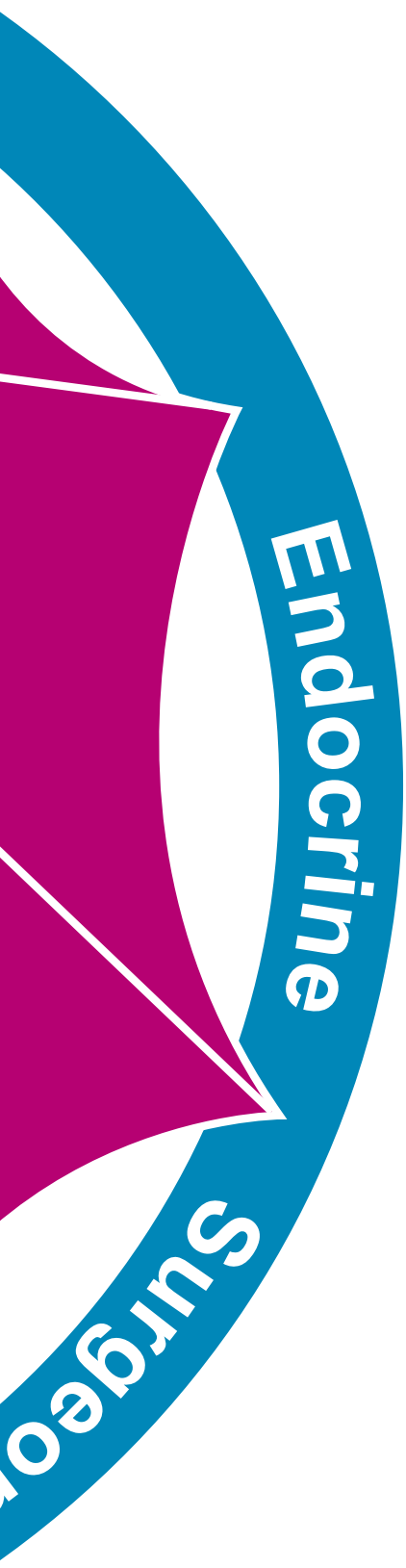
Re-operation for haemorrhage

Re-operation for haemorrhage occurred uncommonly after parathyroidectomy (0.5% or below). There was no significant differences in the incidence of haemorrhage rates between groups. This finding would support the practice of safe daycase parathyroid surgery in low risk patients.

Parathyroid surgery: pathology, operation sequence and re-operation for haemorrhage; audit years 2016-2020

Pathology and operation sequence		Re-operation for haemorrhage			
		No	**Yes**	**Unspecified**	**Rate** (95% CI)
Sporadic HPT	First-time	13,577	37	903	**0.3%** (0.2-0.4%)
	Redo	744	4	34	**0.5%** (0.2-1.5%)
	Unspecified	23	0	39	**0.0%** (0.0-12.2%)
Familial HPT	First-time	194	1	11	**0.5%** (0.0-3.3%)
	Redo	62	0	3	**0.0%** (0.0-4.7%)
	Unspecified	2	0	2	**0.0%** (0.0-77.6%)
Primary NOS	First-time	85	0	1	**0.0%** (0.0-3.5%)
	Redo	9	0	0	**0.0%** (0.0-28.3%)
	Unspecified	0	0	7	NA
Renal HPT	First-time	660	2	56	**0.3%** (0.1-1.2%)
	Redo	59	0	3	**0.0%** (0.0-5.0%)
	Unspecified	3	0	4	**0.0%** (0.0-63.2%)
Unspecified	First-time	13	0	6	**0.0%** (0.0-20.6%)
	Redo	0	0	0	NA
	Unspecified	16	0	695	**0.0%** (0.0-17.1%)


British
Association



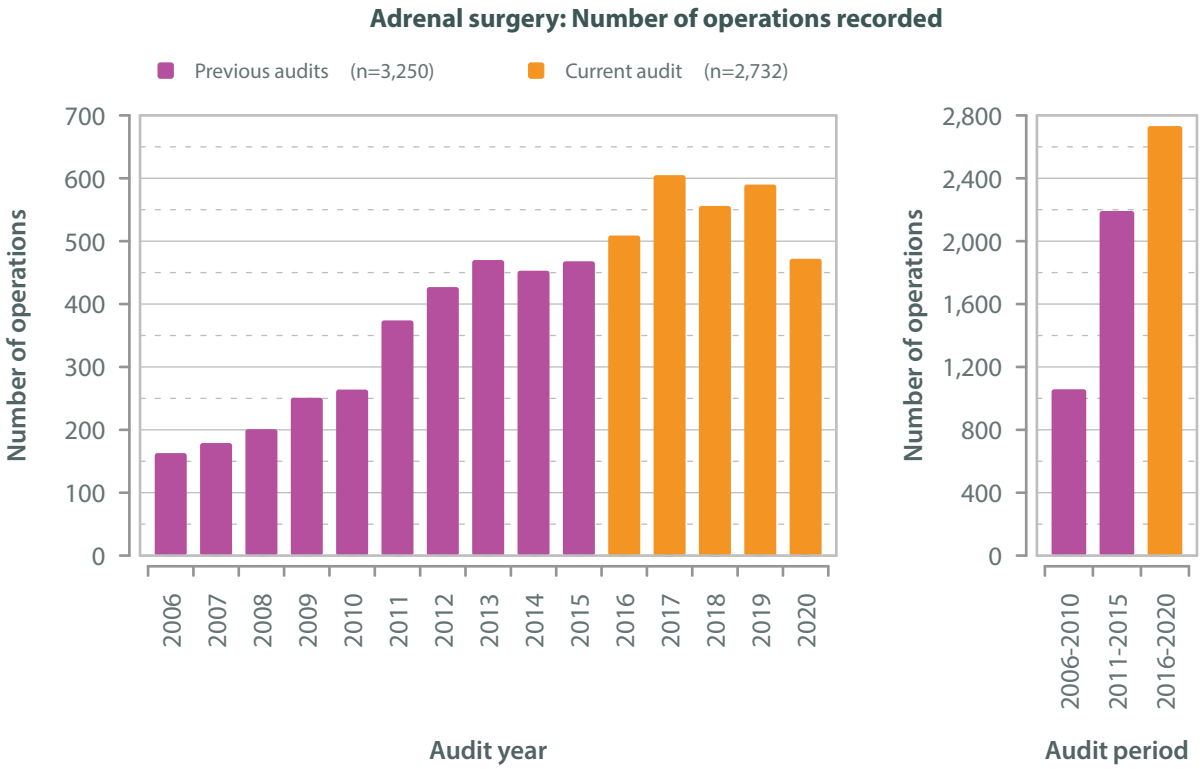
Surgery for adrenal disease

Surgery for adrenal disease

General information in the database

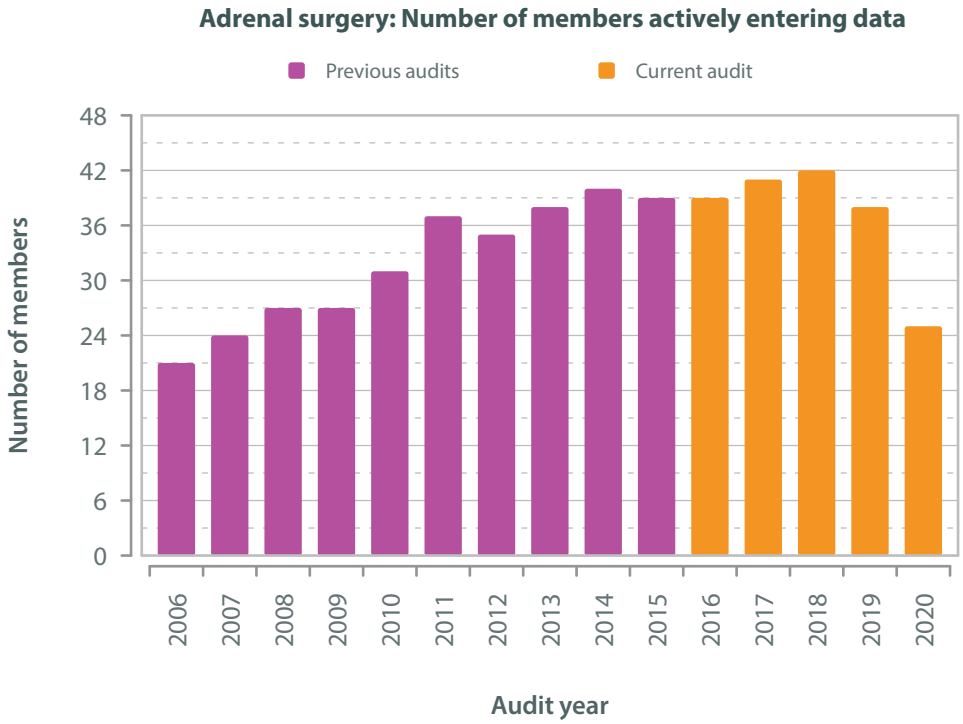
Number of operations

The number of adrenal operations analysed in the 2020 BAETS audit is nearly three times higher compared with the initial report 2006-2010. Based on HES data reports, it is expected that 800-1,000 adrenal operations are done annually in the United Kingdom; therefore this Sixth BAETS Audit Report covers the majority of these cases. It would be interesting to know if the majority of missing operations comprise incomplete data submission by BAETS members or operations performed by surgeons who do not contribute to the BAETS audit.



Number of members entering data

In the audit years 2016-2019 54 members recorded at least one operation record. The number of surgeons who reported >6 operations in any year was 37; and a total of 28 members reported >12 operations.

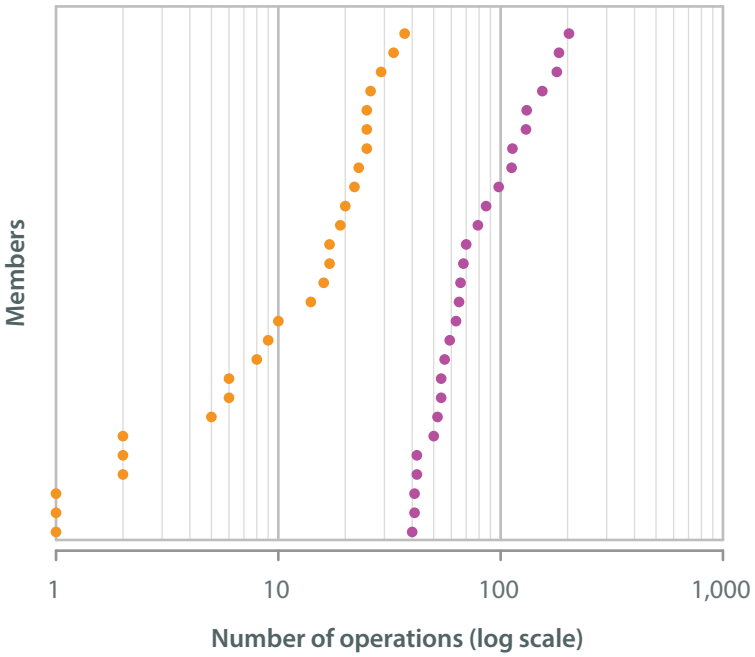


12 members reported ≤10 operations within this five-year period. 25 members reported <30 cases within the same five-year period, *i.e.,* under the average of 6 cases *per* year recommended by the recent GIRFT report; analysis of HES data (Palazzo *et al.* Adrenal surgery in England: better outcomes in high-volume practices. Clinical Endocrinology. 2016; 85: 17-20) and the European Society of Endocrine Surgeons (Mihai *et al.* Volume-outcome correlation in adrenal surgery - an ESES consensus statement Langenbeck's Archives of Surgery. 2019; 404: 795-806).

16 members reported over 60 cases within the five years, *i.e.,* above the average of 12 cases *per* year recommended to be performed by those offering surgery for more complex pathologies, such as adrenocortical cancer and large phaeochromocytomas.

These figures are unchanged compared with the data presented in the 2017 BAETS audit report, therefore there is no evidence of centralisation of work towards a smaller number of centres.

Adrenal surgery: Number of operations reported by each member; audit years 2016-2020



Demographics and disease profile

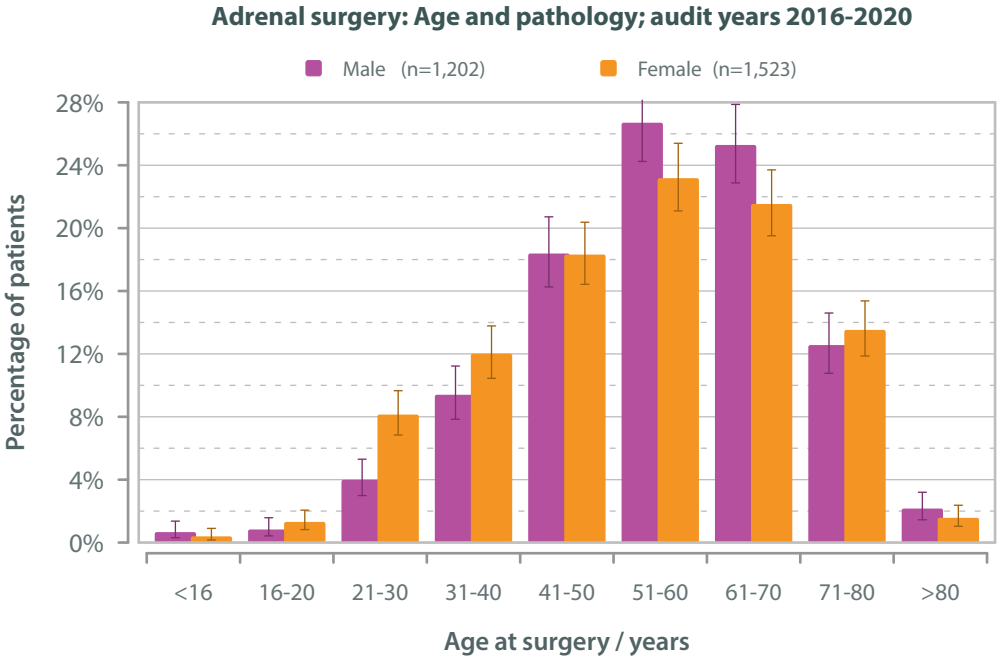
Age and gender

The demographic profile for adrenal surgery is similar to that shown in previous reports, with a slightly higher prevalence of women (female : male ratio 3 : 2), and most operations performed in the age groups 40-70 years.

Adrenalectomy in children and teenagers remains very rare, and future work could explore how the registered figures compare with the total number of such operations done outside BAETS membership.

Adrenal surgery: age and gender; audit years 2016-2020

Age at surgery / years	Gender			
	Male	Female	All	Percentage male
<16	8	6	**14**	57.1%
16-20	10	20	**30**	33.3%
21-30	48	124	**172**	27.9%
31-40	113	183	**296**	38.2%
41-50	221	279	**500**	44.2%
51-60	321	353	**674**	47.6%
61-70	304	328	**632**	48.1%
71-80	151	206	**357**	42.3%
>80	26	24	**50**	52.0%
Unspecified	1	6	**7**	14.3%
All	**1,203**	**1,529**	**2,732**	**44.0%**



Diagnosis

Over two-thirds of adrenal operations were done for functional tumours, with phaeochromocytoma being the most common indication.

There has been a continuous rise in the proportion of operations performed for metastases, such cases being now twice as common as in the early 2000s. This is likely related to a trend towards more aggressive management of other primary cancers, so that an MDT decision includes adrenalectomy as a preferred option for patients with oligometastatic disease.

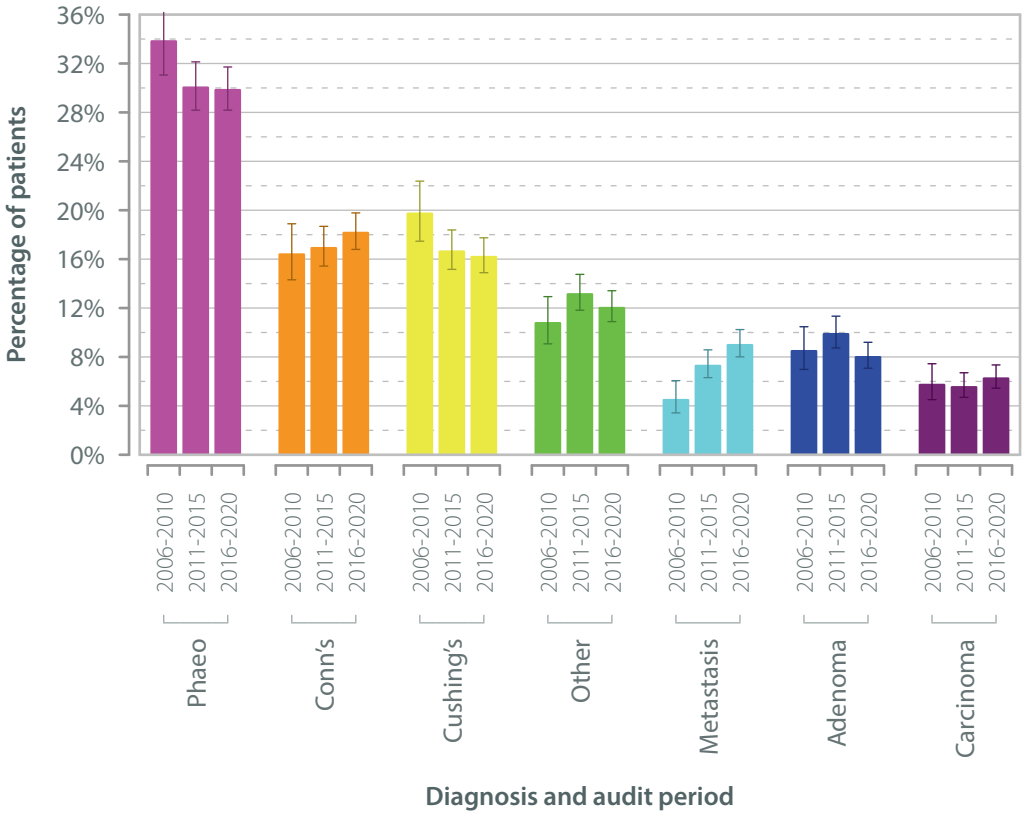
Following an update to the BAETS dataset, the primary site of metastatic cancers has only been included in data collection for the last 2 years. The most common primary tumours were kidney (n=20), lung (n=19), melanoma (n=12), gastrointestinal tumours (n=7), and breast (n=4). These figures are very similar to data reported from recent large multi-centre studies.

Surgery for adrenocortical cancer (ACC) was recorded for 167 patients in the current audit period. These operations were performed by 32 surgeons, whose personal experience ranged between 1-33 operations over the five-year period (median =3). Few surgeons performed more than one adrenalectomy *per* year for ACC (1 surgeon recorded >1 operation in each of the five years 2016-2020; 8 reported an average caseload of >1 in the same period). These figures are unchanged compared to data presented in previous reports and demonstrate that current service delivery is far from the expected standards recommended by the GIRFT report.

Adrenal surgery: diagnosis and audit period; audit years 2006-2020

		Audit period		
		2006-2010	**2011-2015**	**2016-2020**
Diagnosis – Counts	Phaeo	356	638	789
	Conn's	173	360	481
	Cushing's	208	354	429
	Other	114	280	319
	Metastasis	48	156	239
	Adenoma	90	211	213
	Carcinoma	61	119	167
	Unspecified	8	74	95
	All	**1,058**	**2,192**	**2,732**
Diagnosis – Percentage	Phaeo	**33.9%** (31.1-36.9%)	**30.1%** (28.2-32.1%)	**29.9%** (28.2-31.7%)
	Conn's	**16.5%** (14.3-18.9%)	**17.0%** (15.4-18.7%)	**18.2%** (16.8-19.8%)
	Cushing's	**19.8%** (17.5-22.4%)	**16.7%** (15.2-18.4%)	**16.3%** (14.9-17.7%)
	Other	**10.9%** (9.1-12.9%)	**13.2%** (11.8-14.8%)	**12.1%** (10.9-13.4%)
	Metastasis	**4.6%** (3.4-6.1%)	**7.4%** (6.3-8.6%)	**9.1%** (8.0-10.2%)
	Adenoma	**8.6%** (7.0-10.5%)	**10.0%** (8.7-11.3%)	**8.1%** (7.1-9.2%)
	Carcinoma	**5.8%** (4.5-7.4%)	**5.6%** (4.7-6.7%)	**6.3%** (5.4-7.3%)

Adrenal surgery: Changes in the rates of each diagnosis over time



Malignancy and diagnosis

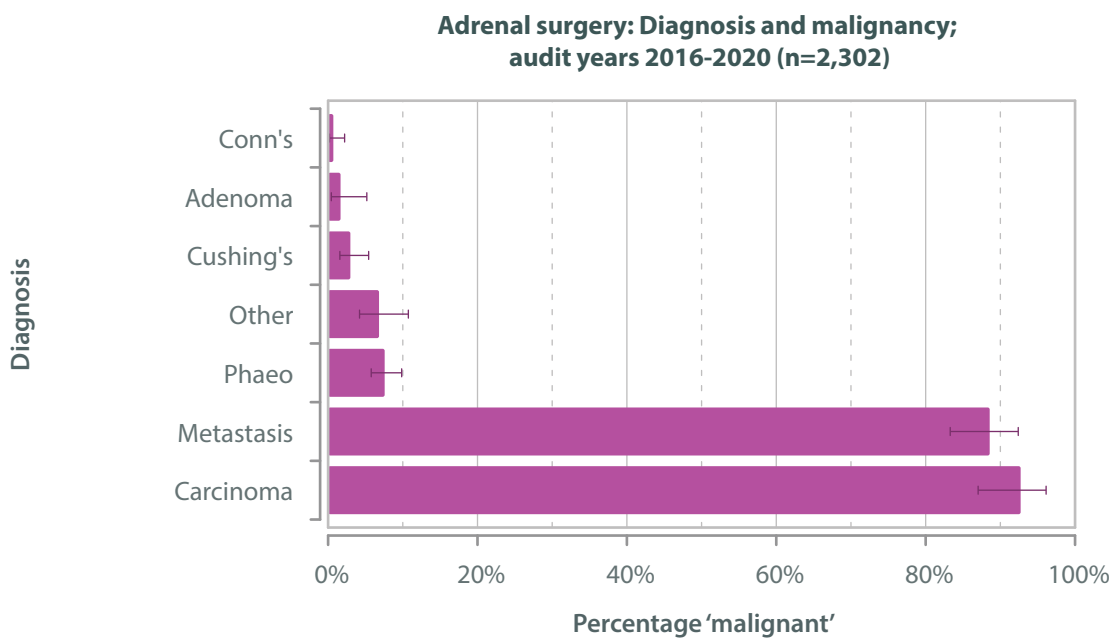
There is a persistent degree of missing data for the field recording malignancy. Some data could be missing by omission (*e.g.*, 53/481 patients with Conn's syndrome as for them malignancy is highly unlikely).

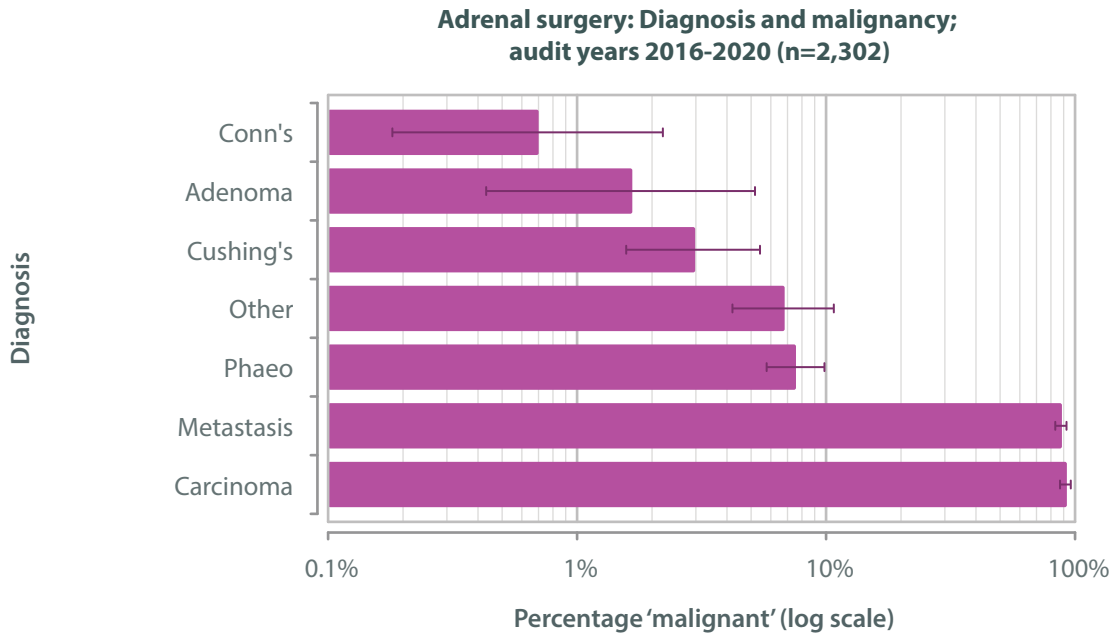
More commonly it might be due to a hesitation to attribute a definitive diagnosis of malignancy for patients with phaeochromocytoma. Following a recent update in the structure of the database, the PASS score for phaeochromocytomas has been collected over the last 2 years (median = 3; inter-quartile range = 1-5; range = 0-20).

Adrenal surgery: Diagnosis and malignancy; audit years 2016-2020

Diagnosis	Malignant			
	No	Yes	Unspecified	All
Adenoma	177	3	33	**213**
Carcinoma	11	140	16	**167**
Conn's	425	3	53	**481**
Cushing's	358	11	60	**429**
Metastasis	24	186	29	**239**
Phaeo	647	53	89	**789**
Other	246	18	55	**319**
Unspecified	0	0	95	**95**
All	**1,888**	**414**	**430**	2,732

For patients operated for an expected adrenocortical carcinoma (ACC) the malignancy rate reported was 92.7%. It remains possible that for a small number of cases the pre-operative suspicion of ACC was not confirmed on final histology. In the last update to the BAETS dataset, the Weiss score was added, so for the last 2 years, these scores should have been collected for patients with ACC. In the latest five-year audit period the Weiss scores were available for only 13 patients with a diagnosis of carcinoma (median = 6; range 2-9).





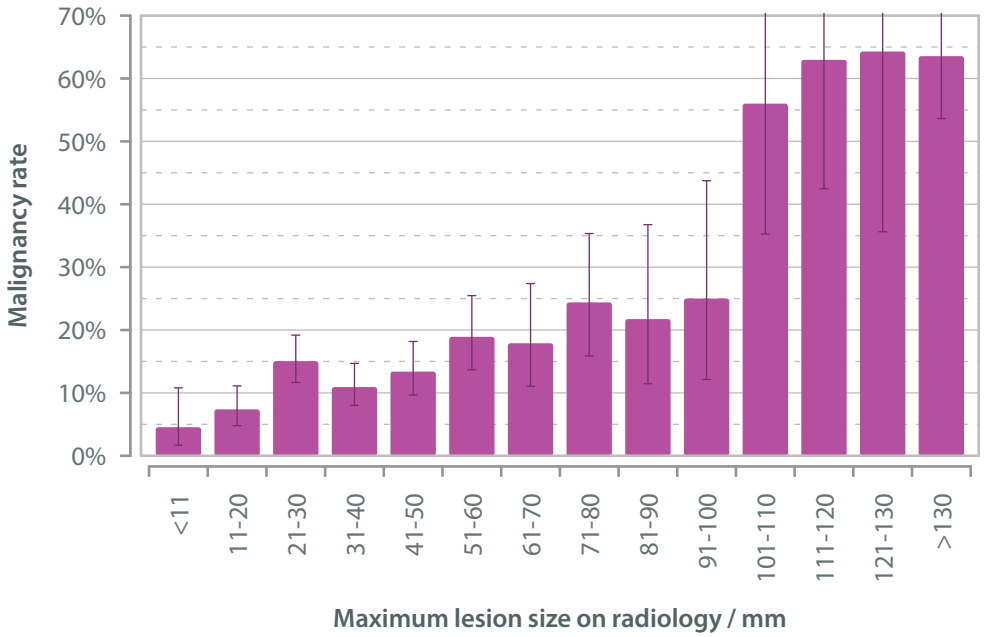
Malignancy and maximum lesion size

It is surprising to see a higher than expected malignancy rate for tumours <4 cm. As most such tumours are never resected, it is likely that those who underwent adrenalectomy had peri-operative radiological features that raised the suspicion of malignancy, and this could explain a significant proportion of them proving to be malignant on final histology. The chart demonstrates a progressive increase in the risk of malignancy with increasing lesion size, with the vast majority of tumours >10 cm being reported as malignant

Adrenal surgery: maximum lesion size on radiology and malignancy; audit years 2016-2020

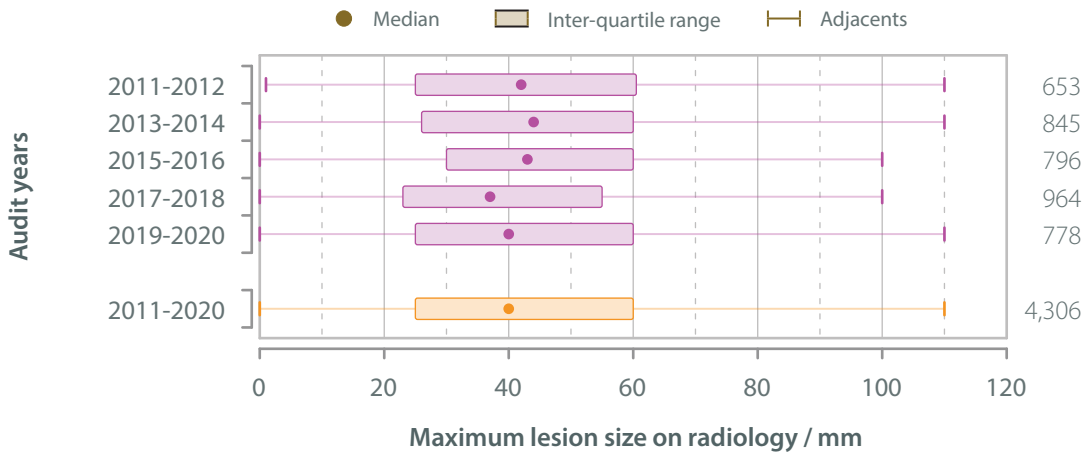
Maximum lesion size on radiology / mm	Malignant			
	No	Yes	Unspecified	Malignancy rate (95% CI)
<11	105	5	3	**4.5%** (1.7-10.8%)
11-20	276	22	15	**7.4%** (4.8-11.1%)
21-30	316	56	15	**15.1%** (11.7-19.2%)
31-40	326	40	20	**10.9%** (8.0-14.7%)
41-50	233	36	22	**13.4%** (9.7-18.2%)
51-60	150	35	16	**18.9%** (13.7-25.5%)
61-70	78	17	9	**17.9%** (11.1-27.4%)
71-80	62	20	3	**24.4%** (15.9-35.3%)
81-90	36	10	5	**21.7%** (11.5-36.8%)
91-100	24	8	4	**25.0%** (12.1-43.8%)
101-110	11	14	1	**56.0%** (35.3-75.0%)
111-120	10	17	0	**63.0%** (42.5-79.9%)
121-130	5	9	0	**64.3%** (35.6-86.0%)
>130	39	68	5	**63.6%** (53.6-72.5%)
Unspecified	217	57	312	**20.8%** (16.3-26.2%)
All	**1,888**	**414**	**430**	**18.0%** (16.4-19.6%)

Adrenal surgery: Maximum size of lesion on radiology and malignancy; audit years 2016-2020 (n=2,028)



Over the last 10 years there has been no significant change in the median size of tumours being removed.

Adrenal surgery: Statistics on the maximum lesion size on radiology over the last 10 audit years



Operation type

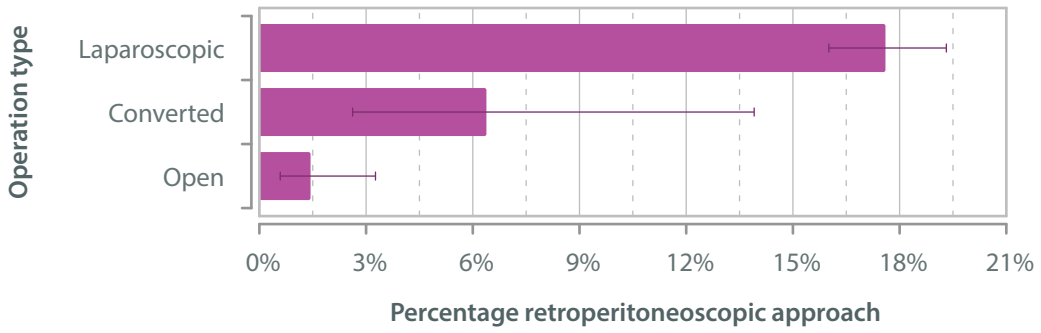
For the first time, this 2020 BAETS audit report presents data on retroperitoneoscopic adrenalectomy. In recent years this approach was used in 14.6% of cases, an increase from 11% reported in the previous report. Such operations were performed by 23 surgeons out of the 54 surgeons who submitted cases of adrenal surgery within the latest audit period; this group of 23 surgeons performed a median of 25 retroperitoneoscopic operations during the 5 years (range: 1-63 operations). It is reassuring to see that the conversion rate is low for both the retroperitoneoscopic (6/376; 1.5%) and trans-peritoneal (88/1,820; 4.8%) approaches.

Adrenal surgery: operation type, operative approach and malignancy; audit years 2016-2020

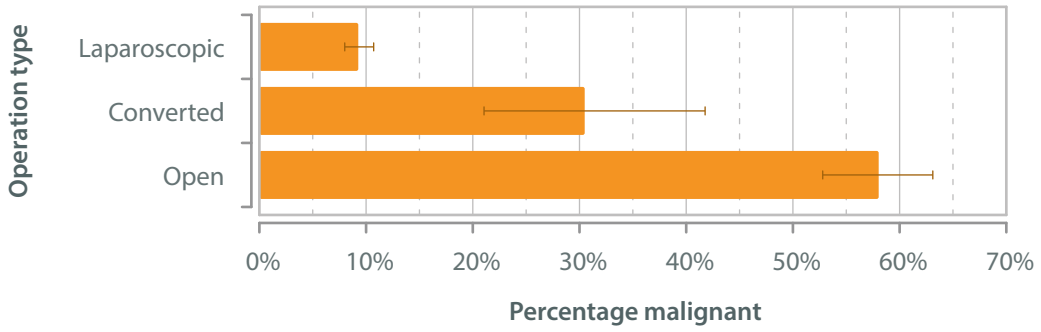
		Operation type				
		Laparoscopic	Converted	Open	Unspecified	All
Approach	Retroperitoneoscopic	370	6	6	0	**382**
	Trans-peritoneal	1,732	88	411	0	**2,231**
	Unspecified	1	0	0	118	**119**
	Retroperitoneoscopic rate	17.6%	6.4%	1.4%	NA	**14.6%**

		Laparoscopic	Converted	Open	Unspecified	All
Malignant	No	1,664	57	154	13	**1,888**
	Yes	170	25	213	6	**414**
	Unspecified	269	12	50	99	**430**
	Proportion malignant	9.3%	30.5%	58.0%	31.6%	**18.0%**

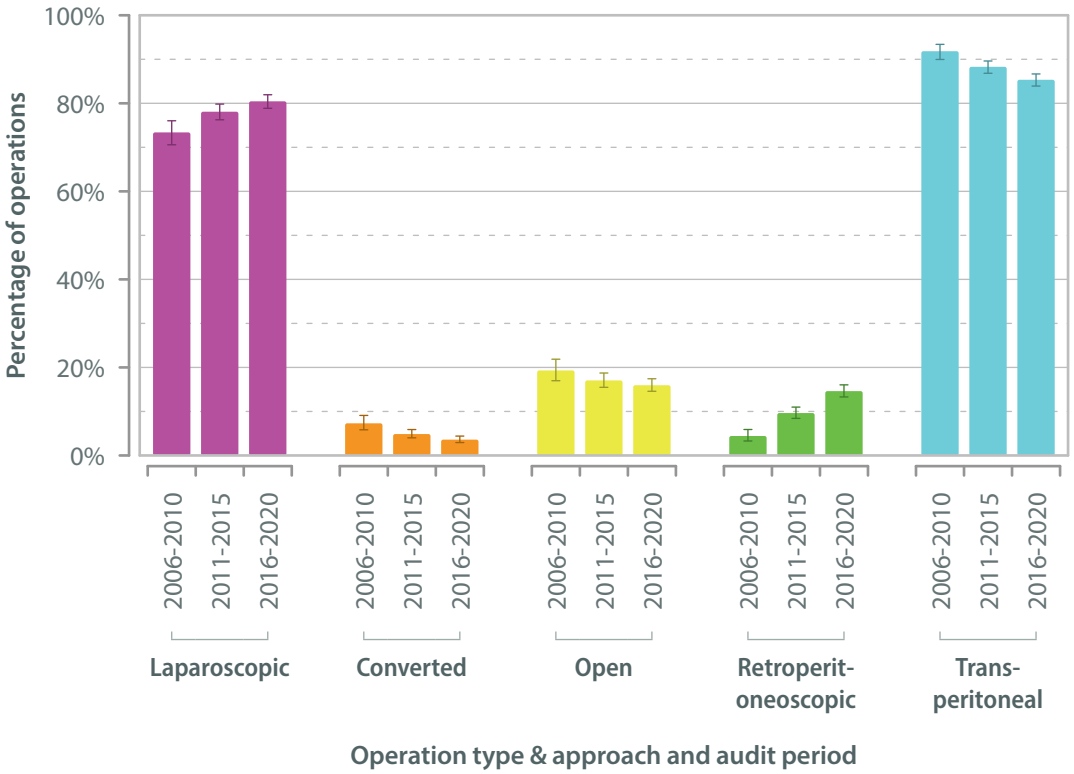
Adrenal surgery: Operation type and use of the retroperitoneoscopic approach ; audit years 2016-2020 (n=2,613)



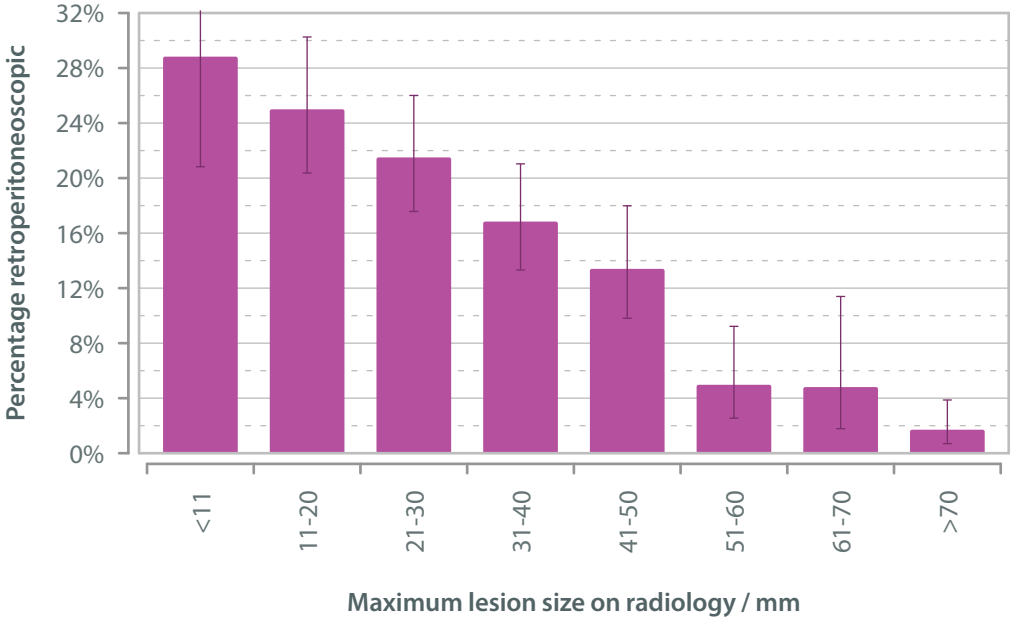
Adrenal surgery: Operation type and malignancy; audit years 2016-2020 (n=2,283)



Adrenal surgery: Changes in operation type and approach over time (operation type n=5,773; operation approach n=5,689)



Adrenal surgery: Operation approach and maximum lesion size; audit years 2016-2020 (n=2,142)



The surgical team

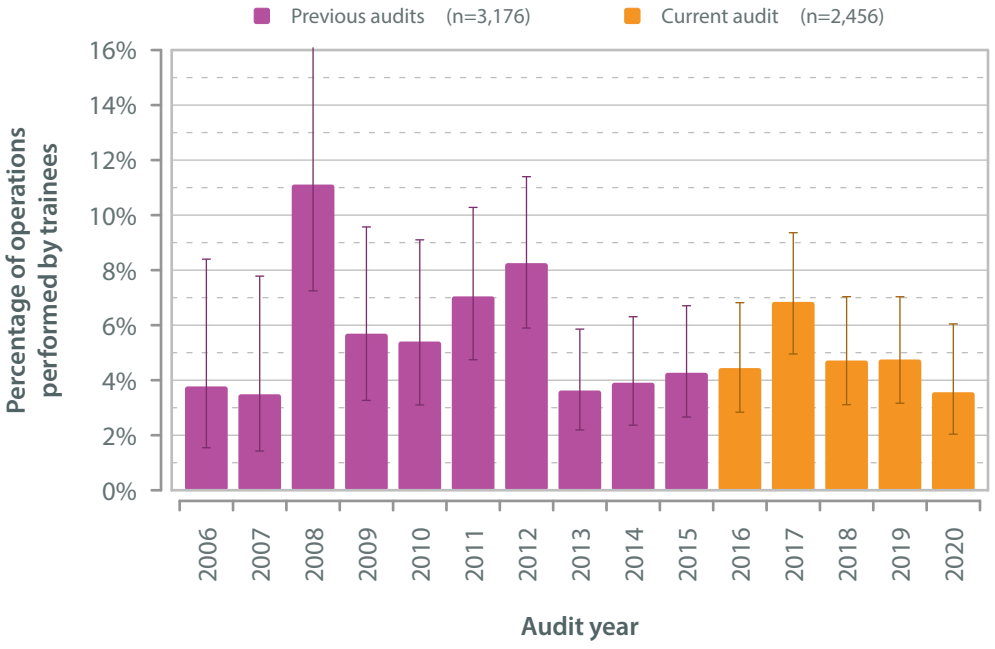
Adrenal surgery remains very much Consultant-led, with 90% of cases having a Consultant as the primary surgeon. In 30% of operations the assistant is also a Consultant, which obviously means that in many cases there are two Consultant surgeons operating together.

The percentage of cases with a Fellow as primary surgeon has increased from 2.0% in the audit period 2011-2015, to 4.8% in the current five-year audit period, while the involvement of registrars as the primary surgeon has remained relatively constant.

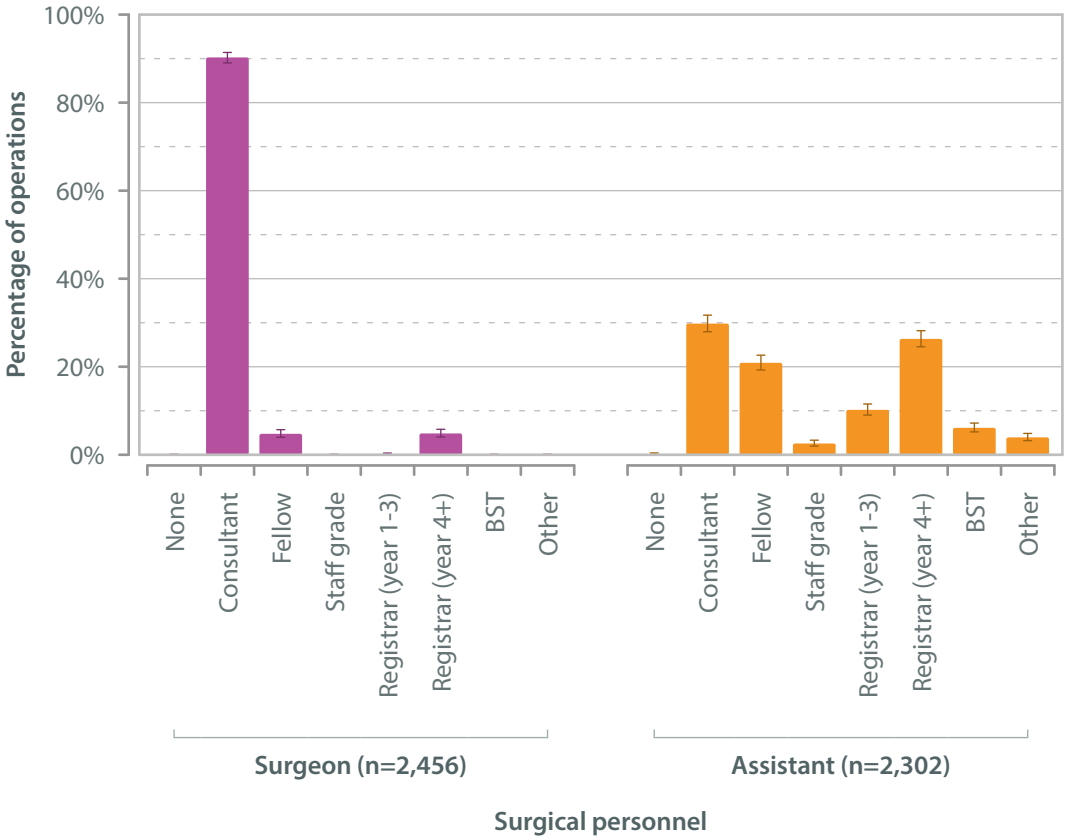
Adrenal surgery: surgical personnel; audit years 2016-2020

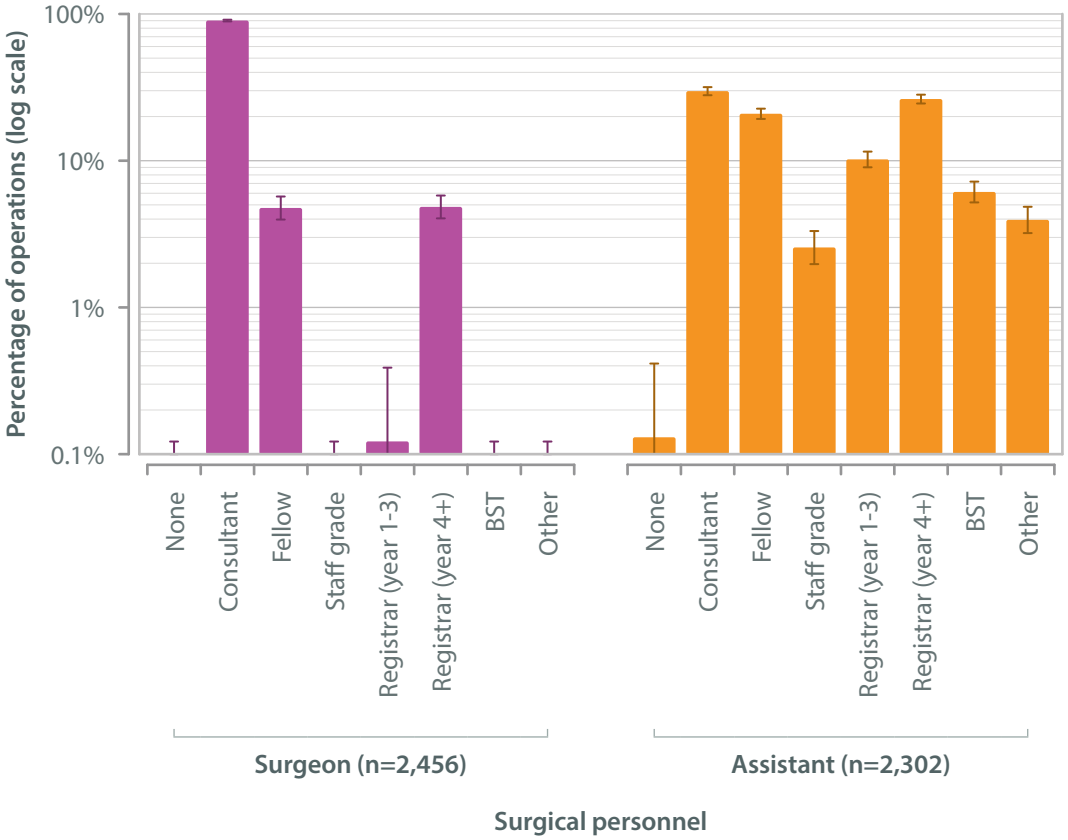
Grade	Surgical personnel: Surgeon Count	Surgeon Percentage	Assistant Count	Assistant Percentage
None	0	0.0%	3	0.1%
Consultant	2,217	90.3%	686	29.8%
Fellow	117	4.8%	481	20.9%
Staff grade	0	0.0%	59	2.6%
Registrar (year 1-3)	3	0.1%	235	10.2%
Registrar (year 4+)	119	4.8%	606	26.3%
BST	0	0.0%	141	6.1%
Other	0	0.0%	91	4.0%
Unspecified	276		430	
All	**2,732**		**2,732**	

Adrenal surgery: Changes in the proportion of operations performed by trainees over time



Adrenal surgery: Surgical personnel; audit years 2016-2020





Energy source used

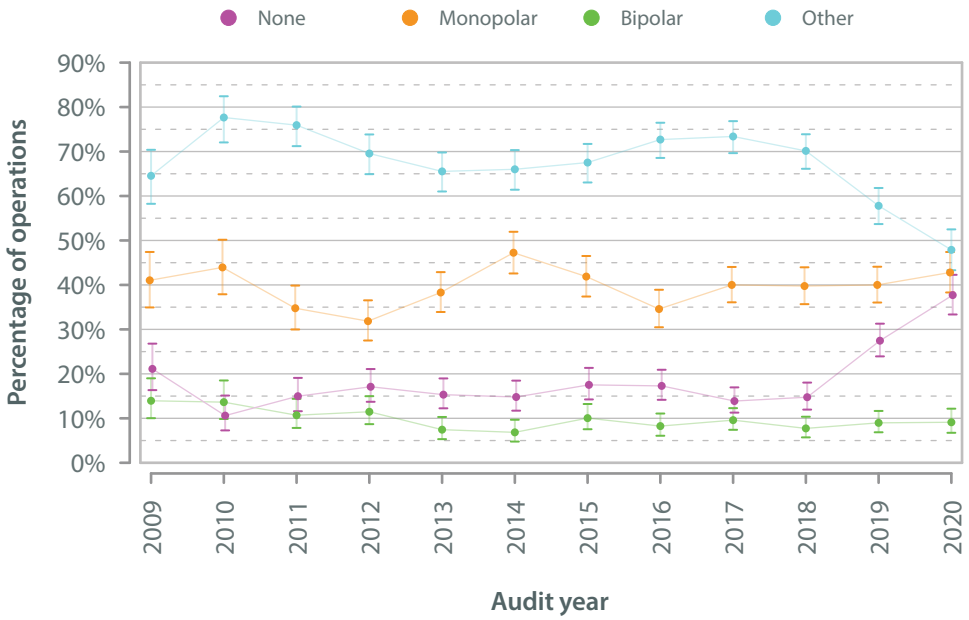
Based on the data available, one-third of cases are operated using monopolar diathermy and energy devices are used in two-thirds of cases. Whether this is an incomplete reporting of data or whether, indeed, many surgeons operated without the use of energy devices could be explored in future audits.

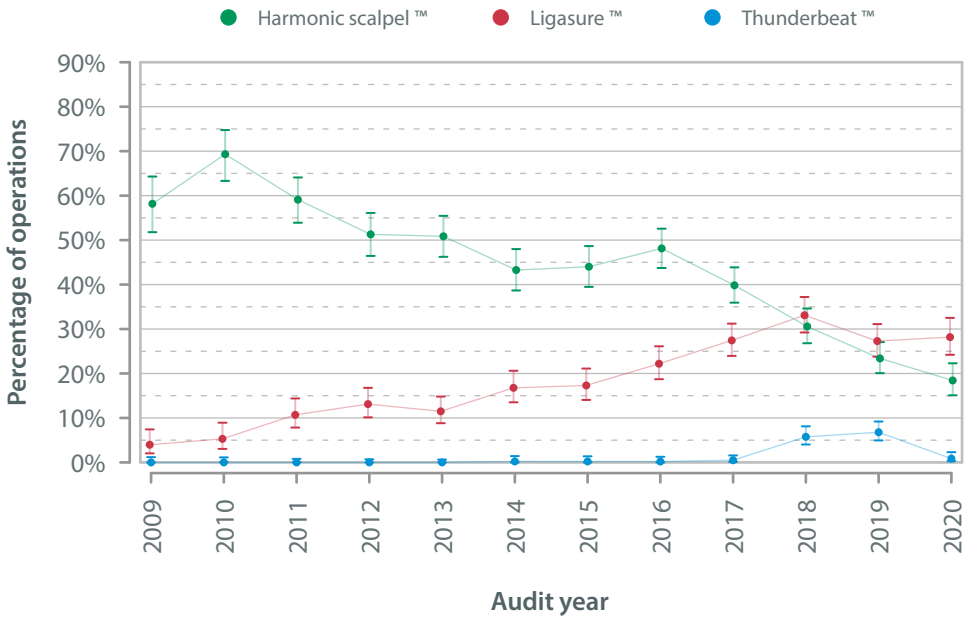
It remains unknown whether financial factors or technical preferences explain the significant decrease in the use of Harmonic scalpel ™ in the last 5 years.

Adrenal surgery: Energy source used; audit years 2016-2020

		Data	
		Count	**Percentage**
Energy source used	None	594	21.7%
	Monopolar	1,077	39.4%
	Bipolar	239	8.7%
	Other	1,771	64.8%
	Bipolar scissors	7	0.3%
	Gyrus	0	0.0%
	Harmonic scalpel ™	881	32.2%
	Ligasure ™	757	27.7%
	Lotus ™	3	0.1%
	Thunderbeat ™	80	2.9%
	Voyant ™ (Applied)	0	0.0%
	Other energy source	0	0.0%
	Unspecified other energy source	0	0.0%
Operation denominator		**2,732**	

Adrenal surgery: Energy source used (n=5,982)





Outcomes

Post-operative stay

As anticipated, the length-of-stay is dependent on the surgical approach (shorter for retroperitoneoscopic *versus* laparoscopic *versus* open, 2 *versus* 3 *versus* 6 days median stay respectively). Such differences are also explained by the difference in patient-populations for each of these approaches, each with specific challenges related to the size of the tumour or the patient's hormonal profile.

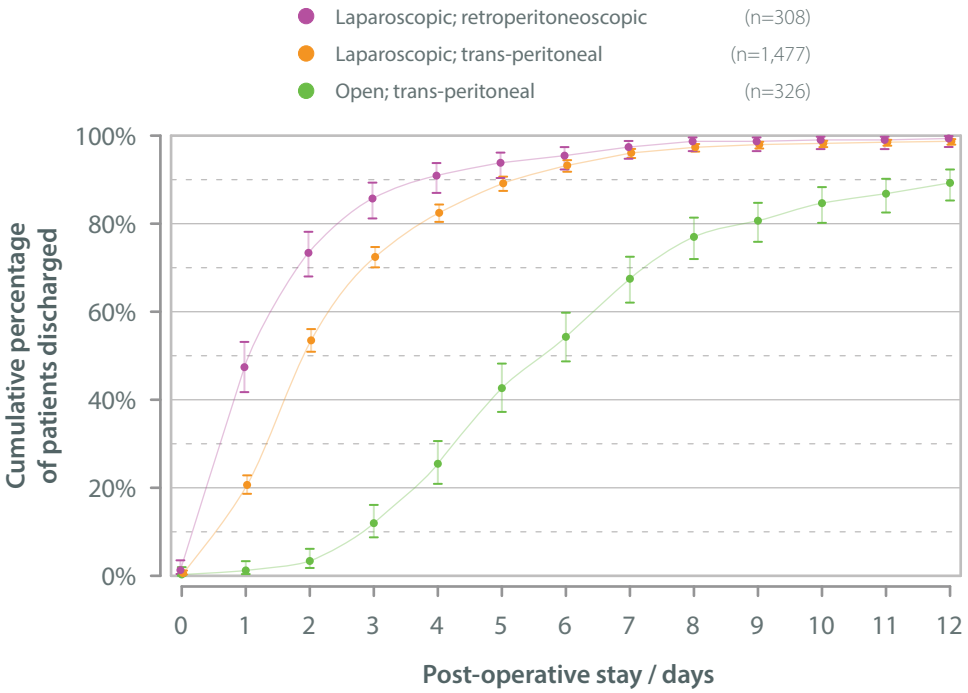
Factors related to peri-operative care would explain the slightly longer admission after adrenal surgery for phaeochromocytomas compared with admission for Conn's syndrome.

Interestingly, in comparison with the 2017 report, the median length-of-stay has decreased by 1 day across the entire spectrum of adrenal surgery.

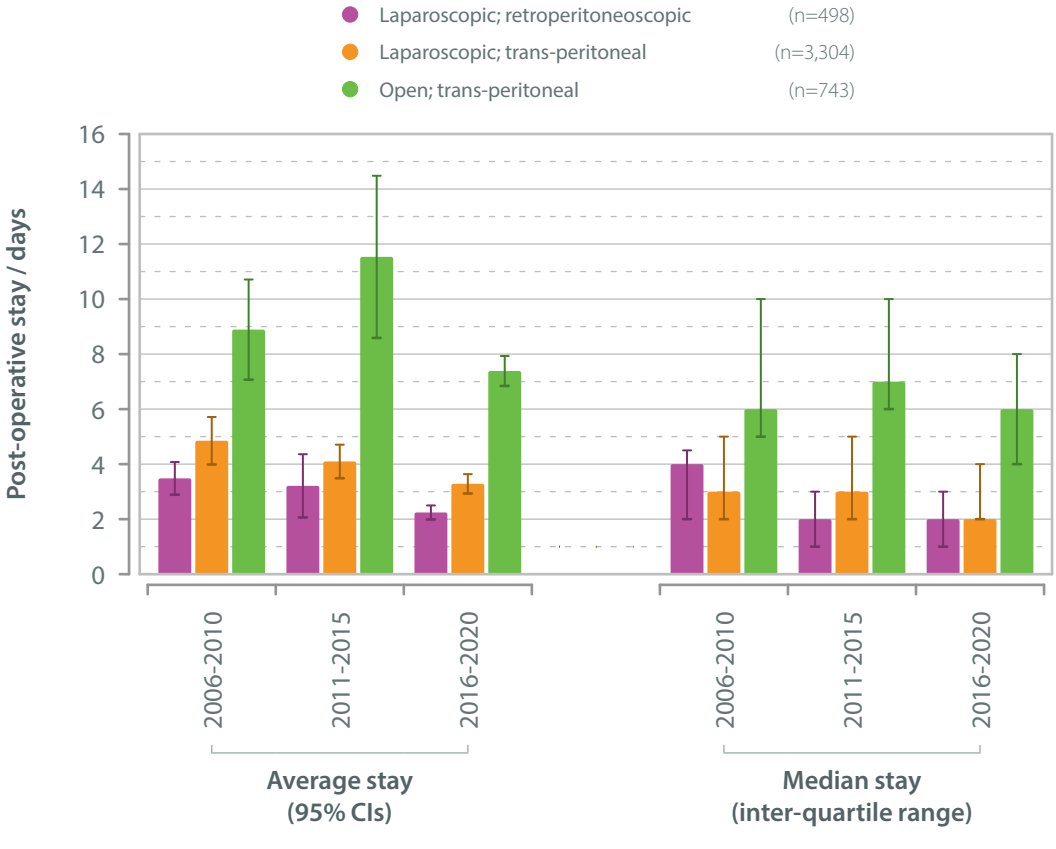
Adrenal surgery: post-operative stay; audit years 2016-2020

		Post-operative stay data		
		Count	**Median / days**	**Inter-quartile range / days**
Diagnosis	Adenoma	172	2.0	1.0-4.0
	Carcinoma	124	6.0	4.0-8.0
	Conn's	401	2.0	1.0-3.0
	Cushing's	365	2.0	2.0-4.0
	Metastasis	199	3.0	2.0-5.0
	Phaeo	664	3.0	2.0-5.0
	Other	276	3.0	2.0-5.0
	Unspecified	2	9.0	2.0-16.0
	All	**2,203**	**3.0**	**2.0-5.0**
Approach	Retroperitoneoscopic	319	2.0	1.0-3.0
	Trans-peritoneal	1,879	3.0	2.0-5.0
	Unspecified	5	2.0	1.5-3.5
	All	**2,203**	**3.0**	**2.0-5.0**
Operation type	Laparoscopic	1,785	2.0	1.0-4.0
	Converted	81	6.0	4.0-8.0
	Open	332	6.0	4.0-8.0
	Unspecified	5	2.0	1.5-3.5
	All	**2,203**	**3.0**	**2.0-5.0**

Adrenal surgery: Post-operative stay and operation; audit years 2016-2020



Adrenal surgery: Changes in post-operative stay over time



Outcomes

Re-operation for bleeding

As one of the most serious peri-operative complications, re-operation for bleeding remains exceedingly rare. Though still small, the risk is six times higher after open surgery, reflecting the complexity of dealing with the more challenging tumours that need open surgery rather than minimally invasive surgery.

Adrenal surgery: re-operation for bleeding and operation; audit years 2016-2020

		Re-operation for bleeding			
		No	Yes	Unspecified	Re-operation rate (95% CI)
Operation	Laparoscopic - retroperitoneoscopic	336	0	34	0.00% (0.00-0.89%)
	Laparoscopic - trans-peritoneal	1,632	4	96	0.24% (0.08-0.67%)
	Laparoscopic unspecified approach	0	0	1	NA
	Laparoscopic	**1,968**	**4**	**131**	**0.20%** (0.06-0.56%)
	Converted	**85**	**0**	**9**	**0.00%** (0.00-3.46%)
	Open	**387**	**5**	**25**	**1.28%** (0.47-3.13%)
	Unspecified	5	0	113	0.00% (0.00-45.07%)
	All	**2,445**	**9**	**278**	**0.37%** (0.18-0.72%)

Post-operative complications

Overall complication rates for successfully accomplished minimally invasive adrenalectomy (retro- or trans-peritoneal) remain very small. Interestingly, the complications are most common after conversion from a minimally invasive to an open approach; this emphasizes the need for appropriate patient-selection for each approach.

Adrenal surgery: post-operative complications and operation; audit years 2016-2020

		Post-operative complications			
		No	Yes	Unspecified	Complication rate (95% CI)
Operation	Laparoscopic - retroperitoneoscopic	317	13	40	3.9% (2.2-6.8%)
	Laparoscopic - trans-peritoneal	1,526	107	99	6.6% (5.4-7.9%)
	Laparoscopic unspecified approach	0	0	1	NA
	Laparoscopic	**1,843**	**120**	**140**	**6.1%** (5.1-7.3%)
	Converted	**64**	**21**	**9**	**24.7%** (16.3-35.5%)
	Open	**329**	**58**	**30**	**15.0%** (11.7-19.0%)
	Unspecified	4	1	113	20.0% (1.1-70.1%)
	All	**2,240**	**200**	**292**	**8.2%** (7.2-9.4%)

Recorded complications were:

- MI 0.08%
- DVT / PE 0.25%
- Respiratory 2.8%
- CVA 0.16%
- Other 5.3% (8× wound infection; 7× UTI; 6× haematoma; 6× leak)

Related re-admission

Adrenal surgery: related re-admission and operation; audit years 2016-2020

Operation	Related re-admission			
	No	Yes	Unspecified	Re-admission rate (95% CI)
Laparoscopic - retroperitoneoscopic	250	5	115	2.0% (0.7-4.8%)
Laparoscopic - trans-peritoneal	1,128	24	580	2.1% (1.4-3.1%)
Laparoscopic unspecified approach	0	0	1	NA
Laparoscopic	**1,378**	**29**	**696**	**2.1%** (1.4-3.0%)
Converted	**60**	**5**	**29**	**7.7%** (2.9-17.8%)
Open	**233**	**11**	**173**	**4.5%** (2.4-8.1%)
Unspecified	5	0	113	0.0% (0.0-45.1%)
All	**1,676**	**45**	**1,011**	**2.6%** (1.9-3.5%)

Mortality

Analysis of outcomes from adrenalectomy from UKRETS has been published in the British Journal of Surgery [1]. Malignant disease and tumour size were independently linked to mortality on multi-variable analysis in this study.

The risk of peri-operative mortality remains exceedingly small. The six cases reported occurred after laparoscopic (n=1) and open surgery (n=5), in patients operated for adenoma (n=2), carcinoma (n=1), and phaeochromocytoma (n=3). Based on the very small number of cases recorded over 4 years, in-hospital deaths can not be used to stratify individual surgeons or units, and this parameter cannot be used for comparison between surgeons.

Adrenal surgery: in-hospital mortality; audit years 2016-2020

Audit year	In-hospital mortality			
	Alive	Died	Unspecified	Mortality rate (95% CI)
2016	480	1	28	0.21% (0.01-1.34%)
2017	578	1	26	0.17% (0.01-1.11%)
2018	517	1	38	0.19% (0.01-1.24%)
2019	540	1	49	0.18% (0.01-1.19%)
2020	395	2	75	0.50% (0.09-2.01%)
All	**2,510**	**6**	**216**	**0.24%** (0.10-0.55%)

1. Patel et al. Outcomes of surgery for benign and malignant adrenal disease from the BAETS national registry. *British Journal of Surgery*. 2019; **106(11)**: 1495-1503.

Appendix

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Convensions

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Parathyroid surgery

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4. Stack et al. Optimizing outcomes in reoperative parathyroid surgery: definitive multidisciplinary joint consensus guidelines of the American Head and Neck Society and the British Association of Endocrine and Thyroid Surgeons. *Head and Neck*. 2018; **40**: 1617-29.

Adrenal surgery

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2. Mihai et al. Volume-outcome correlation in adrenal surgery - an ESES consensus statement. Langenbeck's Archives of Surgery. 2019; **404**: 795-80
3. Patel et al. Outcomes of surgery for benign and malignant adrenal disease from the BAETS national registry. *British Journal of Surgery*. 2019; **106(11)**: 1495-1503

Database form

Form T

The British Association of Endocrine & Thyroid Surgeons
UK Registry of Endocrine & Thyroid Surgery: Thyroid surgery
Baseline section; Page 1; Version 3.2 (23 Oct 2019)

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	○ Male ○ Female
Dual-operating case	○ No ○ Yes
Name of principal consultant surgeon	
Name of second consultant surgeon	

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Appendix

Form T

The British Association of Endocrine & Thyroid Surgeons
UK Registry of Endocrine & Thyroid Surgery: Thyroid surgery
Baseline section; Page 2; Version 3.2 (23 Oct 2019)

Unique patient identifier

Date of operation dd / mm / yyyy

Initial registry data

Pre-operative thyroid details

Main indication for thyroid surgery
- ○ Completion thyroidectomy for cancer
- ○ Thyrotoxicosis
- ○ Compressive symptoms
- ○ Quality of life
- ○ Recurrent cyst
- ○ Biopsy result
- ○ Recurrent cancer
- ○ Thyroglossal cyst
- ○ Clinically worrying lesion

Thyroid status at presentation
○ Euthyroid ○ Hyperthyroid ○ Hypothyroid

Goitre type
- ○ Cervical
- ○ Retroclavicular
- ○ Upper border AA
- ○ Below AA

Sternal split / thoracotomy required
○ No ○ Yes

Pre-operative voice change
○ No ○ Yes

Pre-op laryngoscopy
○ No ○ Yes

Re-operation
○ No ○ Yes

Same side as previous operation
○ No ○ Yes

Number of previous operations
○ One ○ Two ○ Three ○ Four

FNAC
○ No ○ Yes

FNAC result
- ○ Thy1 - non-diagnostic
- ○ Thy2 - non-neoplastic
- ○ Thy3 - follicular lesions / neoplasia cannot be excluded
- ○ Thy4 - abnormal; suspicious of malignancy
- ○ Thy5 - malignant

Thy 3 sub-categorization
- ○ Thy3a
- ○ Thy 3f
- ○ Not recorded

Core biopsy
- ○ Not done
- ○ Unsatisfactory
- ○ Non-neoplastic
- ○ Atypical
- ○ Suggestive of follicular neoplasm
- ○ Suspicious of malignancy
- ○ Malignant

MEN
○ No ○ Yes

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Form T

The British Association of Endocrine & Thyroid Surgeons
UK Registry of Endocrine & Thyroid Surgery: Thyroid surgery
Baseline section; Page 3; Version 3.2 (23 Oct 2019)

Unique patient identifier

Date of operation dd / mm / yyyy

Thyroid surgery procedure

Grade of principal surgeon	○ Consultant ○ Registrar (year 4+) ○ Registrar (year 1-3) ○ BST ○ Staff grade ○ Fellow ○ Other
Grade of assistant surgeon	○ Consultant ○ None ○ Registrar (year 4+) ○ Registrar (year 1-3) ○ BST ○ Staff grade ○ Fellow ○ Other
Side of thyroid procedure	○ None ☐ Left ☐ Right
Side of nodal procedure	○ None ☐ Left ☐ Right
Previous contralateral lobectomy	○ No ○ Yes
Isthmusectomy alone	○ No ○ Yes
Thyroid procedure (left)	○ Lobectomy ○ Sub / near total lobectomy ○ Isthmusectomy ○ Biopsy ○ Other
Thyroid node dissection (left)	☐ I ☐ II ☐ III ☐ IV ☐ V ☐ VI ☐ VII ○ Biopsy only
Thyroid procedure (right)	○ Lobectomy ○ Sub / near total lobectomy ○ Isthmusectomy ○ Biopsy ○ Other
Thyroid node dissection (right)	☐ I ☐ II ☐ III ☐ IV ☐ V ☐ VI ☐ VII ○ Biopsy only
Recurrent laryngeal nerve sacrificed	○ No ○ Yes
Thymectomy	○ No ○ Yes

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Appendix

Form T

The British Association of Endocrine & Thyroid Surgeons
UK Registry of Endocrine & Thyroid Surgery: Thyroid surgery
Baseline section; Page 4; Version 3.2 (23 Oct 2019)

Unique patient identifier

Date of operation dd / mm / yyyy

Thyroid surgery procedure continued …

Nerve monitoring used ○ No ○ Yes

Nerve monitoring method ○ Continuous ○ Intermittent

Monitor
○ Medtronic NM
○ Magstim ○ Inomed ○ Dr Langer ○ Other

Other monitor details

ET tube with integrated electrodes ○ No ○ Yes

Energy source used
☐ Monopolar diathermy
☐ Bipolar diathermy ☐ Other

Other energy source used
○ Bipolar scissors
○ Enseal™ (Ethicon) ○ Sonicision™ (Medtronic)
○ Harmonic Scalpel™ ○ Thunderbeat™
○ Ligasure™ ○ Voyant™ (Applied)
○ Lotus™ ○ Other

Details of other energy source

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Form T

The British Association of Endocrine & Thyroid Surgeons
UK Registry of Endocrine & Thyroid Surgery: Thyroid surgery
Baseline section; Page 5; Version 3.2 (23 Oct 2019)

Unique patient identifier

Date of operation dd / mm / yyyy

Primary thyroid pathology

Thyroid pathology
- ○ Single pathology
- ○ Multiple pathologies

Primary thyroid pathology
- ○ Anaplastic cancer
- ○ Auto immune thyroiditis
- ○ C-cell hyperplasia
- ○ Colloid goitre
- ○ Colloid nodule
- ○ Follicular adenoma
- ○ Follicular thyroid cancer
- ○ Graves' disease
- ○ Lymphoma
- ○ Metastatic
- ○ Medullary thyroid cancer
- ○ Oncocytic adenoma
- ○ Oncocytic carcinoma
- ○ Papillary thyroid cancer
- ○ Simple cyst
- ○ Other cancer
- ○ Other

Details of other primary thyroid pathology

Type of PTC
- ○ Classical
- ○ Microcarcinoma
- ○ Follicular variant
- ○ Tall cell
- ○ Diffuse sclerosing

Invasive nature of cancer
- ○ Minimally invasive
- ○ Widely invasive

Details of other thyroid pathology
- ○ NIFTP
- ○ Other

Details of other thyroid cancer
- ○ Poorly differentiated carcinoma
- ○ Other unspecified cancers

Other details of other thyroid pathology

Thyroid malignancy resectable
- ○ No
- ○ Yes
- ○ Unknown

T
- ○ T0
- ○ T1a
- ○ T1b
- ○ T2
- ○ T3a
- ○ T3b
- ○ T4a
- ○ T4b
- ○ TX

N
- ○ N0
- ○ N1a
- ○ N1b
- ○ NX

M
- ○ M0
- ○ M1

Loco-regional residual tumour after resection
- ○ R0
- ○ R1
- ○ R2
- ○ Rx

Patient discussed at MDM before first operation
- ○ No
- ○ Yes

Patient discussed at MDM after first operation
- ○ No
- ○ Yes

Side of this malignancy
- ○ Left
- ○ Right
- ○ Bilateral

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Appendix

Form T

The British Association of Endocrine & Thyroid Surgeons
UK Registry of Endocrine & Thyroid Surgery: Thyroid surgery
Baseline section; Page 6; Version 3.2 (23 Oct 2019)

Unique patient identifier

Date of operation dd / mm / yyyy

Secondary thyroid pathology

Additional thyroid pathology

- ○ Anaplastic cancer
- ○ Auto immune thyroiditis
- ○ C-cell hyperplasia
- ○ Colloid goitre
- ○ Colloid nodule
- ○ Follicular adenoma
- ○ Follicular thyroid cancer
- ○ Graves' disease
- ○ Lymphoma
- ○ Metastatic
- ○ Medullary thyroid cancer
- ○ Oncocytic adenoma
- ○ Oncocytic carcinoma
- ○ Papillary thyroid cancer
- ○ Simple cyst
- ○ Other cancer
- ○ Other

Details of other additional thyroid pathology

Thyroid malignancy resectable ○ No ○ Yes ○ Unknown

T

- ○ T0
- ○ T1a
- ○ T1b
- ○ T2
- ○ T3a
- ○ T3b
- ○ T4a
- ○ T4b
- ○ TX

N ○ N0 ○ N1a ○ N1b ○ NX

M ○ M0 ○ M1

Side of this malignancy ○ Left ○ Right ○ Bilateral

Thyroid surgery discharge details

Re-operation for haemorrhage ○ No ○ Yes

Hypocalcaemia ○ No ○ Yes

Hypocalcaemia treatment given ○ No ○ Yes

Post-operative complications

- ○ None
- ☐ MI
- ☐ DVT / PE
- ☐ Respiratory
- ☐ CVA
- ☐ Other

Details of other complications

Tracheostomy

- ○ Not done
- ○ Yes - planned
- ○ Yes - unplanned

Patient survival ○ Discharged alive ○ Died in hospital

Date of discharge / death dd / mm / yyyy

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Form T

The British Association of Endocrine & Thyroid Surgeons
UK Registry of Endocrine & Thyroid Surgery: Thyroid surgery
Follow up section; Page 7; Version 3.2 (23 Oct 2019)

Unique patient identifier	
Date of follow up	dd / mm / yyyy

Thyroid follow up

Lost to follow up within 6 / 12 after surgery	○ No ○ Yes
Date of follow up	dd / mm / yyyy
Related re-admission	○ No ○ Yes
Date of related re-admission	dd / mm / yyyy
Voice change	○ No ○ Yes
Vocal cord check	○ Not done ○ Normal ○ Abnormal
Date of first post-operative vocal cord check	dd / mm / yyyy
Side of vocal cord abnormality	○ Left palsy alone ○ Right palsy alone ○ Bilateral palsy
Outcome of abnormal (cord palsy) vocal cord check at 6/12: left	○ Recovered ○ Persistent ○ Pre-existing
Outcome of abnormal (cord palsy) vocal cord check at 6/12: right	○ Recovered ○ Persistent ○ Pre-existing
Is the patient on T3 / T4	○ No ○ Yes
Is the patient taking calcium or Vitamin D to maintain normocalcaemia at 6 months	○ No ○ Yes
Database comments	
Follow up comments	

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Appendix

Form P

The British Association of Endocrine & Thyroid Surgeons
UK Registry of Endocrine & Thyroid Surgery: Parathyroid surgery
Baseline section; Page 1; Version 3.2 (23 Oct 2019)

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	○ Male ○ Female
Dual-operating case	○ No ○ Yes
Name of principal consultant surgeon	
Name of second consultant surgeon	

Initial registry data

Pre-operative parathyroid details

Pre-op cord check	○ No	○ Yes	
Nuclear medicine	○ Negative	○ Positive	○ Not done
Ultrasound	○ Negative	○ Positive	○ Not done
CT / MRI	○ Negative	○ Positive	○ Not done
4DCT	○ Negative	○ Positive	○ Not done
PET	○ Negative	○ Positive	○ Not done
Venous sampling	○ Negative	○ Positive	○ Not done
Methylene blue	○ Negative	○ Positive	○ Not done
Gamma probe	○ Negative	○ Positive	○ Not done
Hyperparathyroidism	○ Primary	○ Renal	
Primary hyperparathyroidism	○ Sporadic ○ MEN	○ Familial HPT ○ Carcinoma	
Renal hyperparathyroidism	☐ Normocalcaemic ☐ Hypercalcaemic	☐ Medical Rx alone ☐ Dialysis	☐ Post-transplant

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Form P

The British Association of Endocrine & Thyroid Surgeons
UK Registry of Endocrine & Thyroid Surgery: Parathyroid surgery
Baseline section; Page 2; Version 3.2 (23 Oct 2019)

Unique patient identifier

Date of operation dd / mm / yyyy

Parathyroid surgery procedure

Grade of principal surgeon
○ Consultant ○ BST ○ Other
○ Registrar (year 4+) ○ Staff grade
○ Registrar (year 1-3) ○ Fellow

Grade of assistant surgeon
○ None ○ Registrar (year 1-3) ○ Fellow
○ Consultant ○ BST ○ Other
○ Registrar (year 4+) ○ Staff grade

Re-operation ○ No ○ Yes

Number of previous operations ○ One ○ Two ○ Three ○ Four

Location of tumour ○ Eutopic ○ Ectopic neck ○ Ectopic chest

Supernumary ○ No ○ Yes

Number of glands removed ○ 0 ○ 1 ○ 2 ○ 3 ○ 3.5 ○ 4

Targeted approach ○ No ○ Yes

Converted to conventional ○ No ○ Yes

qPTH measured ○ No ○ Yes

Nerve monitoring used ○ No ○ Yes

Monitor
○ Medtronic NM ○ Inomed
○ Magstim ○ Dr Langer ○ Other

Other monitor details

Parathyroid surgery discharge details

Re-operation for haemorrhage ○ No ○ Yes

Hypocalcaemia ○ No ○ Yes

Hypocalcaemia treatment given ○ No ○ Yes

Post-operative complications
○ None ☐ DVT / PE ☐ CVA
☐ MI ☐ Respiratory ☐ Other

Details of other complications

Patient survival ○ Discharged alive ○ Died in hospital

Date of discharge / death dd / mm / yyyy

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Appendix

Form P

The British Association of Endocrine & Thyroid Surgeons
UK Registry of Endocrine & Thyroid Surgery: Parathyroid surgery
Follow up section; Page 3; Version 3.2 (23 Oct 2019)

Unique patient identifier	
Date of follow up	dd / mm / yyyy

Parathyroid follow up

Lost to follow up within 6 / 12 after surgery	○ No ○ Yes
Date of follow up	dd / mm / yyyy
Persisting hypercalcaemia	○ No ○ Yes
Related re-admission	○ No ○ Yes
Date of related re-admission	dd / mm / yyyy
Voice change	○ No ○ Yes
Vocal cord check	○ Not done ○ Normal ○ Abnormal
Date of first post-operative vocal cord check	dd / mm / yyyy
Side of vocal cord abnormality	○ Left palsy alone ○ Right palsy alone ○ Bilateral palsy
Outcome of abnormal (cord palsy) vocal cord check at 6/12: left	○ Recovered ○ Persistent ○ Pre-existing
Outcome of abnormal (cord palsy) vocal cord check at 6/12: right	○ Recovered ○ Persistent ○ Pre-existing
Is the patient taking calcium or vitamin D to maintain normocalcaemia at 6 months	○ No ○ Yes
Database comments	
Follow up comments	
Confirmed parathyroid histopathology	○ Adenoma ○ Hyperplasia ○ Cancer ○ Uncertain

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Form A

The British Association of Endocrine & Thyroid Surgeons
UK Registry of Endocrine & Thyroid Surgery: Adrenal surgery
Baseline section; Page 1; Version 3.2 (23 Oct 2019)

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	○ Male ○ Female
Dual-operating case	○ No ○ Yes
Name of principal consultant surgeon	
Name of second consultant surgeon	

Initial registry data

Pre-operative adrenal details

Indication for operation	○ Conn's ○ Phaeo ○ Carcinoma ○ Cushing's ○ Adenoma ○ Metastasis ○ Other
Details of other adrenal diagnosis	
Adrenal anatomy	○ Left ○ Bilateral ○ Right ○ Extra-adrenal
MEN	○ No ○ Yes
Malignant	○ No ○ Yes
Maximum diameter by radiology	mm

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Appendix

Form A

The British Association of Endocrine & Thyroid Surgeons
UK Registry of Endocrine & Thyroid Surgery: Adrenal surgery
Baseline section; Page 2; Version 3.2 (23 Oct 2019)

Unique patient identifier

Date of operation dd / mm / yyyy

Adrenal procedure

Grade of principal surgeon
- ○ Consultant
- ○ Registrar (year 4+)
- ○ Registrar (year 1-3)
- ○ BST
- ○ Staff grade
- ○ Fellow
- ○ Other

Grade of assistant surgeon
- ○ Consultant
- ○ None
- ○ Registrar (year 4+)
- ○ Registrar (year 1-3)
- ○ BST
- ○ Staff grade
- ○ Fellow
- ○ Other

Adrenal operation type
- ○ Open
- ○ Laparoscopic
- ○ Converted

Adrenal operation approach
- ○ Trans-peritoneal
- ○ Posterior

Energy source used
- ☐ Monopolar diathermy
- ☐ Bipolar diathermy
- ☐ Other

Other energy source used
- ○ Bipolar scissors
- ○ Enseal™ (Ethicon)
- ○ Harmonic Scalpel™
- ○ Ligasure™
- ○ Lotus™
- ○ Sonicision™ (Medtronic)
- ○ Thunderbeat™
- ○ Voyant™ (Applied)
- ○ Other

Details of other energy source

Adrenal surgery discharge details

Re-operation for haemorrhage
- ○ No
- ○ Yes

Post-operative complications
- ○ None
- ☐ MI
- ☐ DVT / PE
- ☐ Respiratory
- ☐ CVA
- ☐ Other

Details of other complications

Patient survival
- ○ Discharged alive
- ○ Died in hospital

Date of discharge / death dd / mm / yyyy

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Form A

The British Association of Endocrine & Thyroid Surgeons
UK Registry of Endocrine & Thyroid Surgery: Adrenal surgery
Follow up section; Page 3; Version 3.2 (23 Oct 2019)

Unique patient identifier	
Date of follow up	dd / mm / yyyy

Adrenal follow up

Lost to follow up within 6 / 12 after surgery	○ No ○ Yes
Date of follow up	dd / mm / yyyy
Related re-admission	○ No ○ Yes
Date of related re-admission	dd / mm / yyyy
Database comments	
Follow up comments	

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Appendix

Form N

The British Association of Endocrine & Thyroid Surgeons
UK Registry of Endocrine & Thyroid Surgery: Pancreas surgery
Baseline section; Page 1; Version 3.2 (23 Oct 2019)

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	○ Male ○ Female
Dual-operating case	○ No ○ Yes
Name of principal consultant surgeon	
Name of second consultant surgeon	

Initial registry data

Pre-operative pancreas details

Pancreas diagnosis	○ Insulinoma ○ VIPoma ○ Ppoma ○ Somatostatinoma ○ Glucagonoma ○ Other
Details of other pancreas diagnosis	
MEN	○ No ○ Yes

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Form N

The British Association of Endocrine & Thyroid Surgeons
UK Registry of Endocrine & Thyroid Surgery: Pancreas surgery
Baseline section; Page 2; Version 3.2 (23 Oct 2019)

Unique patient identifier

Date of operation dd / mm / yyyy

Pancreas procedure

Grade of principal surgeon
- ○ Consultant
- ○ Registrar (year 4+)
- ○ Registrar (year 1-3)
- ○ BST
- ○ Staff grade
- ○ Fellow
- ○ Other

Grade of assistant surgeon
- ○ Consultant
- ○ None
- ○ Registrar (year 4+)
- ○ Registrar (year 1-3)
- ○ BST
- ○ Staff grade
- ○ Fellow
- ○ Other

Pancreas operation type
- ○ Open
- ○ Laparoscopic
- ○ Converted

Pancreas procedure
- ○ Enucleation
- ○ Distal resection
- ○ Right-sided pancreatectomy
- ○ Total pancreatectomy
- ○ Other

Details of other pancreas procedure

Energy source used
- ☐ Monopolar diathermy
- ☐ Bipolar diathermy
- ☐ Other

Other energy source used
- ○ Bipolar scissors
- ○ Enseal™ (Ethicon)
- ○ Harmonic Scalpel™
- ○ Ligasure™
- ○ Lotus™
- ○ Sonicision™ (Medtronic)
- ○ Thunderbeat™
- ○ Voyant™ (Applied)
- ○ Other

Details of other energy source

Pancreas surgery discharge details

Re-operation for haemorrhage
- ○ No
- ○ Yes

Post-operative complications
- ○ None
- ☐ MI
- ☐ DVT / PE
- ☐ Respiratory
- ☐ CVA
- ☐ Other

Details of other complications

Fistula
- ○ No
- ○ Yes

Pancreatitis
- ○ No
- ○ Yes

Patient survival
- ○ Discharged alive
- ○ Died in hospital

Date of discharge / death dd / mm / yyyy

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Appendix

Form N

The British Association of Endocrine & Thyroid Surgeons
UK Registry of Endocrine & Thyroid Surgery: Pancreas surgery
Follow up section; Page 3; Version 3.2 (23 Oct 2019)

Unique patient identifier	
Date of follow up	dd / mm / yyyy

Adrenal follow up

Lost to follow up within 6 / 12 after surgery	○ No ○ Yes
Date of follow up	dd / mm / yyyy
Related re-admission	○ No ○ Yes
Date of related re-admission	dd / mm / yyyy
Database comments	
Follow up comments	

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