



Royal College
of Physicians



Society for Cardiothoracic Surgery
in Great Britain and Ireland

National Lung Cancer Audit

Lung cancer clinical outcomes publication

(for the 2018 audit period)

Published July 2021



In association with:



Public Health
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HQIP

Healthcare Quality
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NLCA Lung cancer clinical outcomes publication for the 2018 audit period

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The Society for Cardiothoracic Surgery in Great Britain and Ireland

This report was commissioned by the Society for Cardiothoracic Surgery in Great Britain and Ireland (SCTS). SCTS was founded in 1934. A self-funding organisation, it is the representative body for thoracic and cardiac surgery in the UK and Ireland. The SCTS has pioneered the collection and publication of surgical outcomes data. It has maintained and published a registry of thoracic surgery since 1980, through a network of audit leads in each thoracic surgical trust across Britain and Ireland. The SCTS currently contributes to national audits in children's and adult heart surgery, and lung cancer surgery.

National Lung Cancer Audit

The National Lung Cancer Audit (NLCA) is commissioned by HQIP. The NLCA is a programme of work that aims to improve the quality of care, services and clinical outcomes for patients with lung cancer in England and Wales. To find out more about the NLCA visit www.rcplondon.ac.uk/projects/national-lung-cancer-audit. HQIP commissioned the work to produce the LCCOP data, published separately here: nlca.azurewebsites.net/LCCOP ; the production of this report was separately commissioned and funded.

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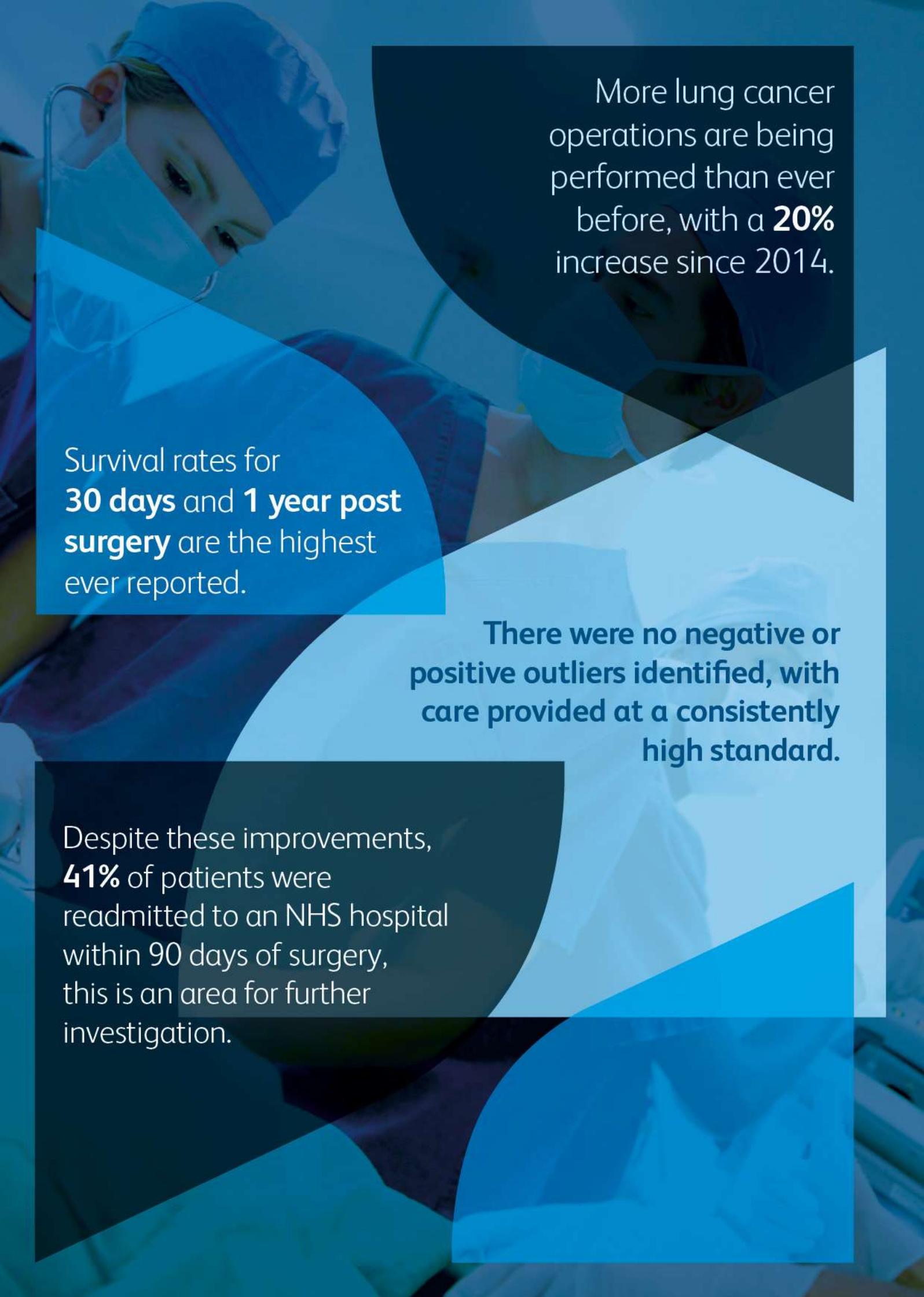
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More lung cancer operations are being performed than ever before, with a **20%** increase since 2014.

Survival rates for **30 days** and **1 year post surgery** are the highest ever reported.

There were no negative or positive outliers identified, with care provided at a consistently high standard.

Despite these improvements, **41%** of patients were readmitted to an NHS hospital within 90 days of surgery, this is an area for further investigation.

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1. Executive summary

This audit report forms the seventh lung cancer clinical outcomes publication (LCCOP). Data from 27 surgical trusts in England performing thoracic surgery between 1 January and 31 December 2018 have been analysed, following local clinical validation.

Key findings include:

- > The number of lung cancer operations increased by 3.1%, from 6,684 in 2017 to 6,894 in 2018. There has been a 20% increase in resections since 2014, with year-on-year increases in every year of the LCCOP project so far.
- > Survival at 30 days and at 1 year is high, at 98.46% and 89.6% respectively. These are the highest survival rates ever recorded in LCCOP at both 30 days and 1 year. This is of course good news. However, it reduces the ability to differentiate between trusts in the future based on survival outcomes alone. Development of other outcome measures is therefore a priority.
- > No trusts were identified as outliers for patient survival, at either 30 days or 1 year after surgery. All trusts were within the 99.8% confidence intervals expected.
- > Surgical trusts are becoming larger, with a median of 243 cases performed per trust in 2018, compared to 235 in 2017. Although three trusts still performed fewer than the recommended 150 cases per year, a quarter of trusts performed 300 or more cases.
- > More lung cancer patients are receiving surgery with curative intent. 18% of all patients diagnosed with lung cancer underwent surgery in 2018. However, this varies across the country, with trust resection rates ranging from 12.9% to 32.3%. There is scope to provide a more uniform service to patients across the country in the future.
- > An increase in the number of patients undergoing minimally invasive surgery accounts for the increase in activity in recent years. Open surgery activity has fallen slightly. The growth in activity has been in fit patients (with performance status 0 or 1).
- > The morbidity of surgery is falling and open surgery is becoming less common. 60% of all operations were completed using minimally invasive surgery techniques and patients spent a median of 5 days in hospital. 2.6% of all resections were completed with robotic assistance. Only 3.5% of lung cancer resections required a pneumonectomy.
- > Despite the improvements documented above, 41% of patients were readmitted to an NHS hospital within 90 days of surgery, suggesting a burden of morbidity that persists beyond hospital discharge. Innovations to prepare for discharge and reduce readmission should be considered by all trusts.
- > The audit period reported here did not include patients that were diagnosed or treated during the COVID-19 pandemic, which we will cover in future reports.

2. Recommendations

Recommendation	Result (page in the report)	Standard	Key audience
1 Surgical trusts with resection rates in stage I/II and PS 0–2 patients below 55% should review their processes for surgical selection and data collection, taking into account local radical radiotherapy rates.	In 2018, 62% of lung cancer patients in stage I and II and with WHO performance status 0–2 underwent lung resection as part of their treatment (page 13).	Target standard proposed by NLCA/SCTS (2021)	Surgical leads for lung cancer, MDTs, cancer managers and commissioners of lung cancer surgery.
2 Surgical trusts with pneumonectomy rates above 5% should carry out a review of these cases to determine if alternative surgical approaches could be considered.	The proportion of patients undergoing pneumonectomy continues to fall. In 2018, pneumonectomies comprised 3.5% of all resections (page 11).	Target standard proposed by NLCA/SCTS (2021)	Surgical leads for lung cancer, MDTs and commissioners of lung cancer surgery.
3 Surgical trusts whose minimally invasive surgery (MIS) rate for stage I and II lobectomy is less than 45% should review their data and consider steps to increase their MIS rate.	References 4 and 5 (page 20).	Target standard proposed by NLCA/SCTS (2021)	Surgical leads for lung cancer and commissioners of lung cancer surgery.
4 All surgical trusts should share good practice examples through SCTS initiatives, including the BORS meeting and the GIRFT cardiothoracic programme.	All	N/A	Surgical leads for lung cancer and commissioners of lung cancer surgery.
5 Readmission rates are generally high across all trusts. All surgical trusts should carry out a review into rates of and reasons for readmission to hospital after surgery on a subset of their patients, to determine whether processes need to be modified to reduce these.	41% of patients were admitted to an NHS hospital within 90 days of their lung cancer surgery (page 14).	N/A	Surgical lead for lung cancer, MDTs, cancer managers and commissioners of lung cancer surgery.

PS = performance status; SCTS = Society for Cardiothoracic Surgery; BORS = Board of representatives; GIRFT = Getting It Right First Time; MDTs = multi-disciplinary teams
 Further surgical recommendations can be found in the NLCA quality improvement toolkit (page 5): https://nlcastorage.blob.core.windows.net/misc/AR_2019_QIToolkit.pdf

3. Introduction

The lung cancer clinical outcomes publication (LCCOP) publishes quality measures for lung cancer surgery using national clinical audit and administrative data. The aims of publishing these results are to:

- > reassure patients that the quality of clinical care is high
- > assist patients in having informed conversations with their healthcare team about treatment options, including surgery
- > provide information to individuals, teams and organisations to allow them to monitor and improve the quality of the clinical care that they provide
- > inform the commissioning of NHS lung cancer services.

This is the seventh report on the activity of thoracic surgery teams and their contribution to lung cancer care. The data relate to patients diagnosed with lung cancer who underwent surgery between 1 January and 31 December 2018. Small-cell lung cancers are excluded due to the significantly reduced survival rates expected in this disease.

4. Methods

Patients undergoing lung resection for primary lung cancer within the NHS in England are included. Operations for small-cell lung cancer (SCLC) are not included. Diagnostic or staging operations and resections for metastatic disease are also excluded.

This work uses data that have been provided by patients and collected by the NHS as part of their care and support. The data are collated, maintained and quality assured by the National Cancer Registration and Analysis Service (NCRAS), which is part of Public Health England (PHE). Access to the data was facilitated by the PHE Office for Data Release.¹ Validation of local data, and collection of data on surgical approach, have been performed in collaboration with the Society for Cardiothoracic Surgery (SCTS) and their network of local audit leads in every NHS thoracic surgery trust in England.

Lung cancer operations are extracted from the NCRAS data and sent to local SCTS audit leads within each surgical trust for local validation. The records are cross-referenced to Hospital Episode Statistics (HES) data to obtain some comorbidity and other data. Named consultants are cross-referenced against the General Medical Council Specialist Register.

Once the local data validation window has closed, it is not possible to revise or update the data submitted by trusts.

HQIP's *Clinical outcomes publications: Technical manual* was used to guide the development of LCCOP. The full methodology report can be accessed at www.hqip.org.uk/resource/clinical-outcomes-publication-technical-manual.

¹ See www.ndrs.nhs.uk

Case-mix adjustment and outlier notification

Survival outcomes at 30 days and 1 year are adjusted using comorbidity and demographic data from HES and NCRAS. They are presented as odds ratios relative to pooled national data. Trusts with odds ratios beyond the 99.8% (alarm) level after this adjustment are notified and identified as outliers in the LCCOP report. Positive outliers are also identified as examples of good practice.

Negative outlier trusts are required to complete and submit a response and action plan, in line with the NLCA and SCTS policy for the 2021 management of outliers within LCCOP policy.² No outliers were identified for the 2018 data cohort.

5. Results

Local validation and data completeness

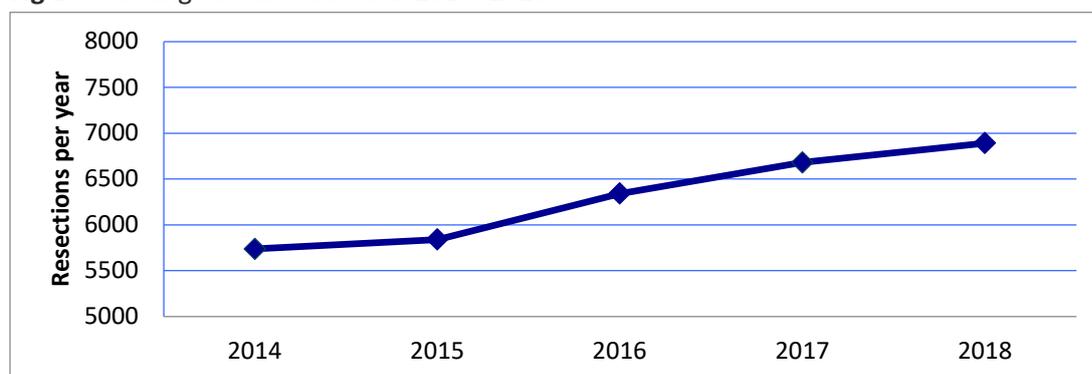
This year, all trusts completed the clinical validation process within the allocated time. We are aware that the data from Newcastle Upon Tyne Hospitals were incomplete.

Data completeness for surgical approach has improved, with only 5.7% unrecorded compared with 14.6% in our last report.

National activity

In 2018, 6,894 lung cancer resections were performed, an increase of 3.1% since last year and 20% since 2014 (Fig 1). This is in line with the trend of increasing activity seen in LCCOP since its inception.

Fig 1 Total lung cancer resections 2014–2018



Resections for SCLC have been excluded since 2016.

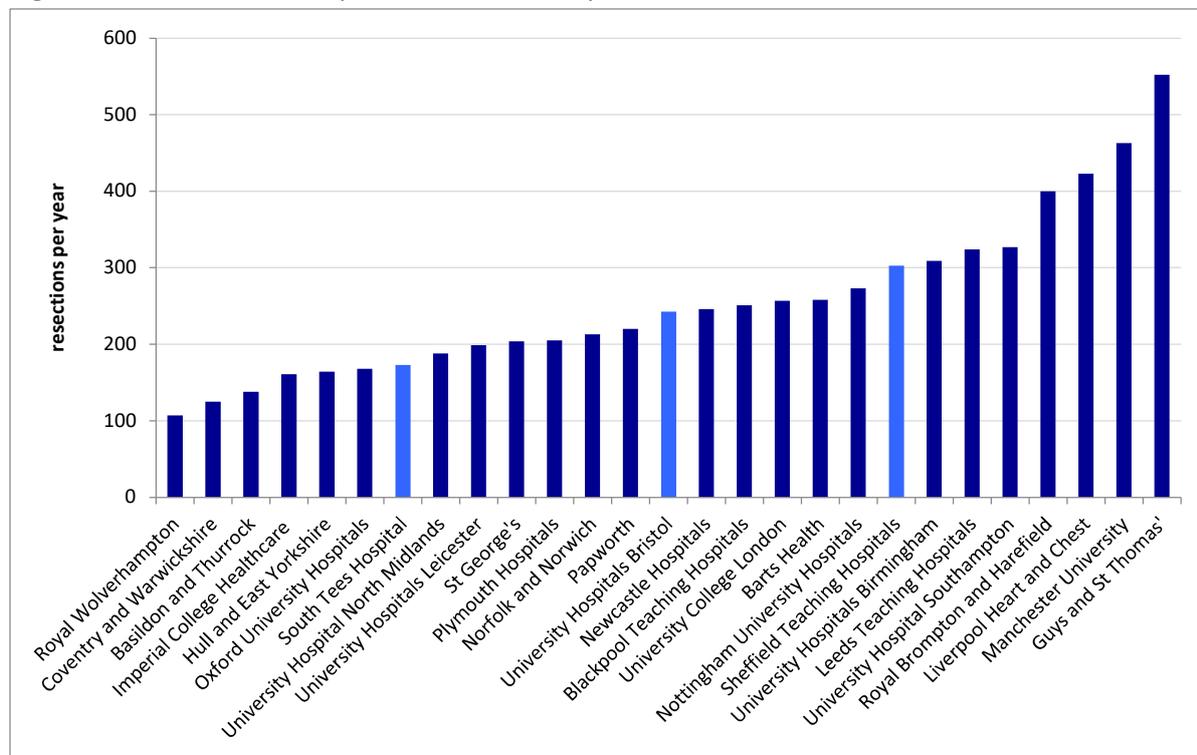
Trust-level activity

The number of provider trusts remained stable at 27. This stability, combined with rising activity, led to a slight increase in the number of operations per trust. The median number of resections per year is now 243 (interquartile range (IQR) 180, 306) per trust, up from 203 (IQR

² See www.rcplondon.ac.uk/projects/outputs/background-data-collection-and-governance

166, 278) in 2016. The smallest trust performed 107 resections. Only three trusts remain under the NHS England commissioning guidance threshold of 150 cases per year, half the 2017 figure.

Fig 2 Number of resections performed in 2018 by trust

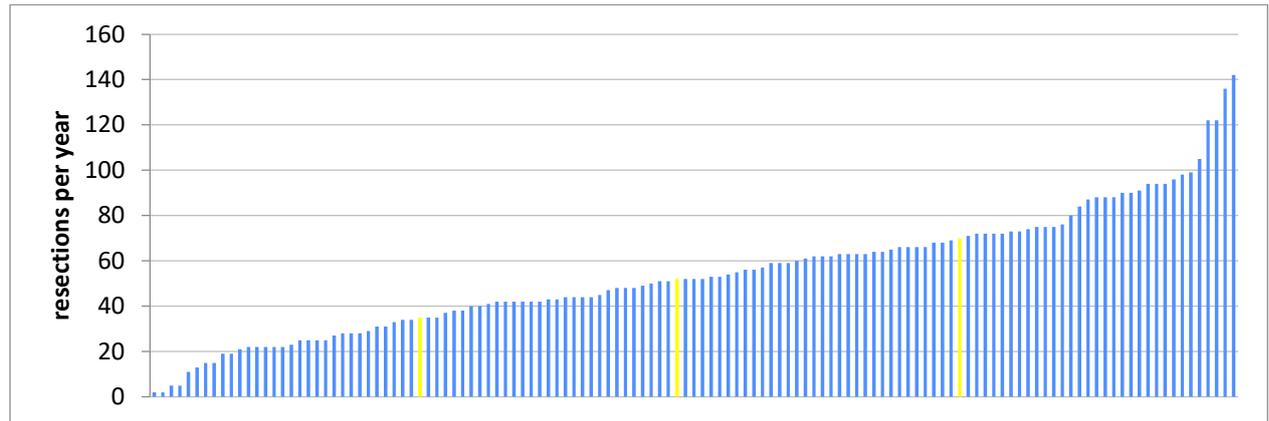


Trusts closest to the 1st, 2nd and 3rd quartiles are marked in light blue for reference.

Surgeon-level activity

Overall, 128 surgeons performed lung cancer resections in 2018 (Fig 3). The median number of cases operated on by individual surgeons was 52 (IQR 35, 70), a 13% increase in the median individual surgeon case volume over the past 2 years. The rise in overall activity and the reduction of mixed job plans which included both cardiac and thoracic practice might both be factors here.

Fig 3 Individual clinician case volumes (cases per year) 2018



The data points closest to the 1st, 2nd and 3rd quartiles are marked in yellow.

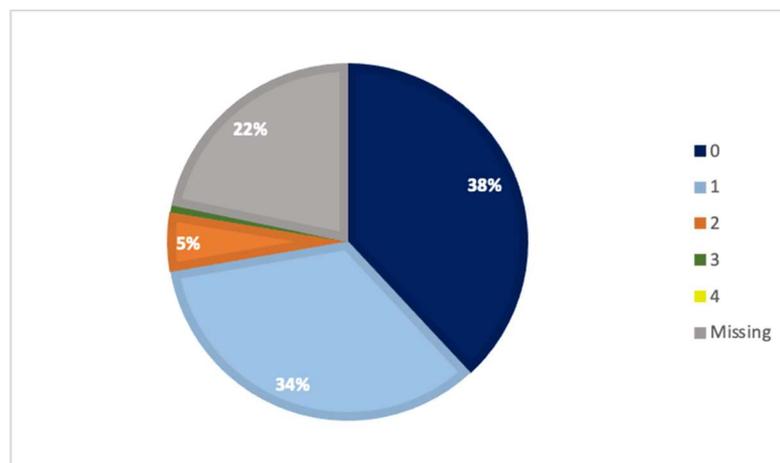
Note that consultants with very small numbers of resections may only have been in post for part of the year in question.

Demographic data

More men than women are diagnosed with lung cancer,¹ but an increasing majority of the patients who undergo lung cancer surgery are women; 53.3% in 2018.

Where WHO performance status (PS) was recorded, over 90% of patients had a PS of 0 or 1, meaning that they were able to carry out light work or more before their surgery (Fig 4).

Fig 4 World Health Organization performance status of patients undergoing lung cancer surgery in 2018



A total of 464 resections for pulmonary carcinoid tumours took place, 7% of all operations performed. The remaining 93% of activity comprised resection of non-small cell lung cancers. LCCOP does not collect data on the resection of small cell lung cancers.

The nature of lung cancer surgery

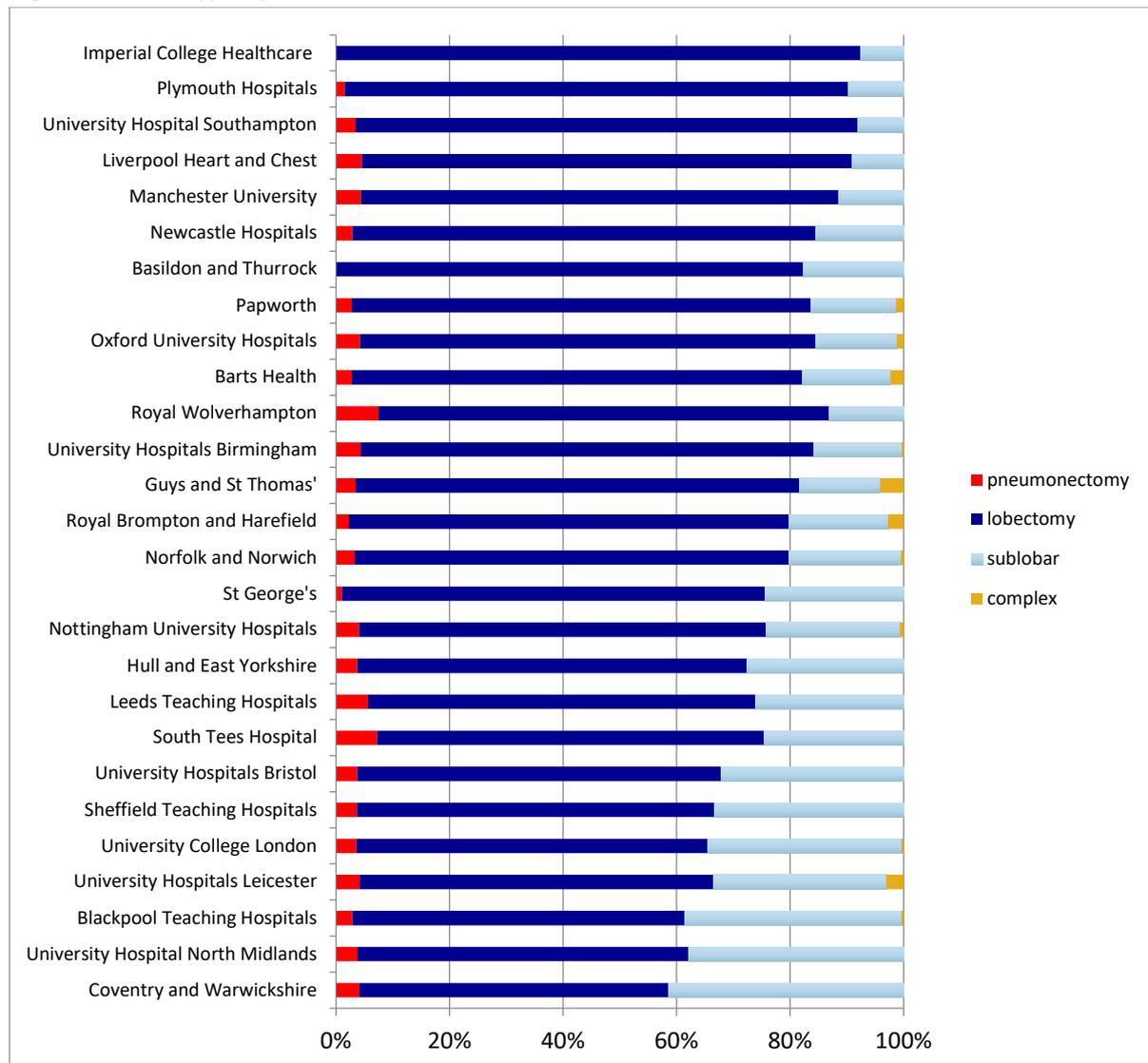
Lobectomy or bilobectomy operations made up 77% of the lung resections performed, as recommended for fit patients by NICE (Fig 5). The next largest group were sublobar resections, which accounted for 20% of cases. Overall, 98.6% of patients were alive at 30 days after both lobectomy and sublobar resections. We have not analysed comorbidity differences between

NLCA Lung cancer clinical outcomes publication for the 2018 audit period

lobar and sublobar resection groups, but current NICE guidance suggests that sublobar resection is usually reserved for less fit patients.²

Pneumonectomy involves removal of the whole lung. It is associated with poorer survival as documented in the survival outcomes section below, but it can be the only method for resecting large or central tumours. The proportion of patients undergoing pneumonectomy continues to fall. In 2018 pneumonectomies comprised 3.5% of all resections. In 2013 this figure was 5.8% and historically it has been far higher.³

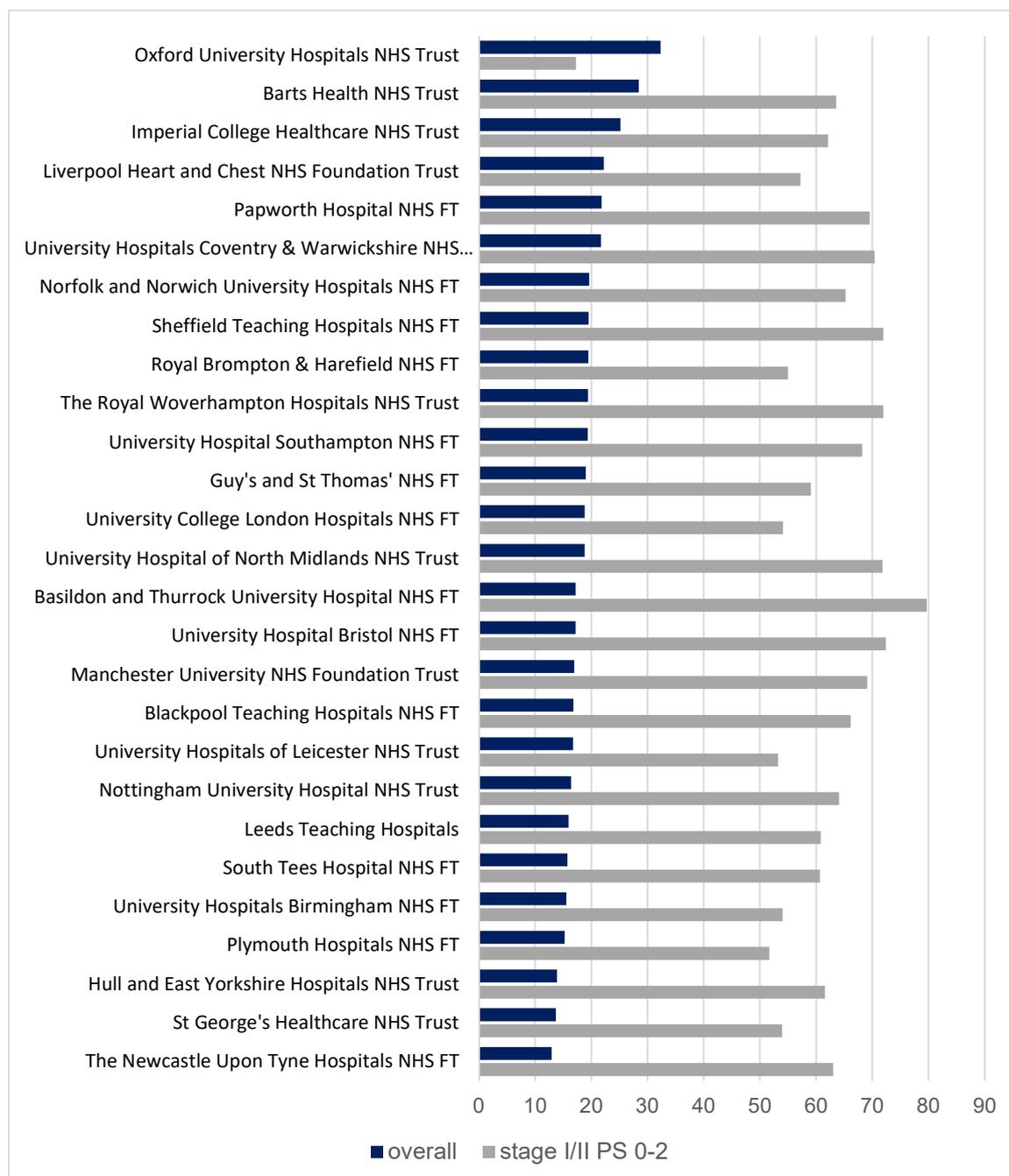
Fig 5 Resection type by trust



Data ordered by proportion of patients receiving lobectomy/bilobectomy.

Resection rates

Fig 6 Resection rates by trust: both overall and in patients with stage I–II/performance status 0–2



*We are aware of some data issues at Newcastle and Oxford which may make their resection rate data inaccurate this year.

** Papworth Hospital, Royal Brompton and Harefield, and St George's cover tertiary level MDTs. The resection rates for these MDT's and surgical trusts should be interpreted with caution due to non-geographical referral patterns.

We report on two resection rates. One is specific to patients with stage I or II lung cancer in patients with performance status 0, 1 or 2. The other is the overall resection rate. The decision to undergo lung cancer resection is individual to each patient. This will include both individual patient preference and clinical factors which are not included here, such as cardiovascular comorbidities. However, most patients in this stage and performance status group will be

appropriate for surgery based on current NICE guidance, while in the overall rate there are patients (for example the majority of those with stage IV disease) who would not normally be treated surgically.

In 2018, 62% of lung cancer patients in stage I and II and with performance status 0–2 underwent lung resection as part of their treatment. This equated to 18% of all patients diagnosed with non-small lung cancer or carcinoid tumours in England. There continues to be variation in both early stage/fit and overall resection rates across the country (Fig 6). Differences in the access to and organisation of diagnostic and assessment services before surgery, and regional differences in comorbidity, are likely to affect this metric. However, surgical resources, assessment and organisation will also play a part.

Outcomes: survival at 30 days and 1 year after surgery

Of 6,894 patients undergoing a lung resection, 6,560 were alive at 30 days; an overall survival proportion of 98.46%. By 1-year, overall survival was 89.6%. These are the highest survival proportions reported at both 30 days and 1 year since data began being collected for LCCOP.

Variation has reduced between trusts. This year, no negative or positive survival outliers were identified at either 30 days or 1 year after surgery after adjusting for comorbidity and demographic factors.

Pneumonectomy is still associated with inferior unadjusted survival, with 94.2% surviving 30 days from surgery. Lobectomy and sublobar resections both have a 98.6% 30-day survival (Table 1).

This difference persists at 1 year, with 76.8% of pneumonectomy patients still alive compared with 90.5% of lobectomy and 89.2% of sublobar resection patients. Reducing rates of pneumonectomy further when technically appropriate could improve survival rates in this subgroup.

Table 1

Survival by type of resection	Number performed	30-day survival (%)	90-day survival (%)	1-year survival (%)
Bilobectomy / lobectomy / sleeve resection	5,175	98.6	97.0	90.5
Wedge and multiple wedge resection / segmental resection	1,385	98.6	97.0	89.2
Carinal resection / lung resection with resection of chest wall	56	98.2	87.5	64.3
Pneumonectomy	241	94.2	87.1	76.8
Other resections	37	97.3	91.9	83.8

Outcomes: length of stay

The median length of stay was 5 days during this audit period (IQR 4, 8). Three years ago, in our 2017 report (for the 2015 audit period), this metric was 6 days. This equates to a saving of over 6,800 bed days per year. Increasing day of surgery admissions, minimally invasive surgery rates

and use of enhanced recovery protocols probably all contribute to this reduction. Variation between trusts has reduced slightly.

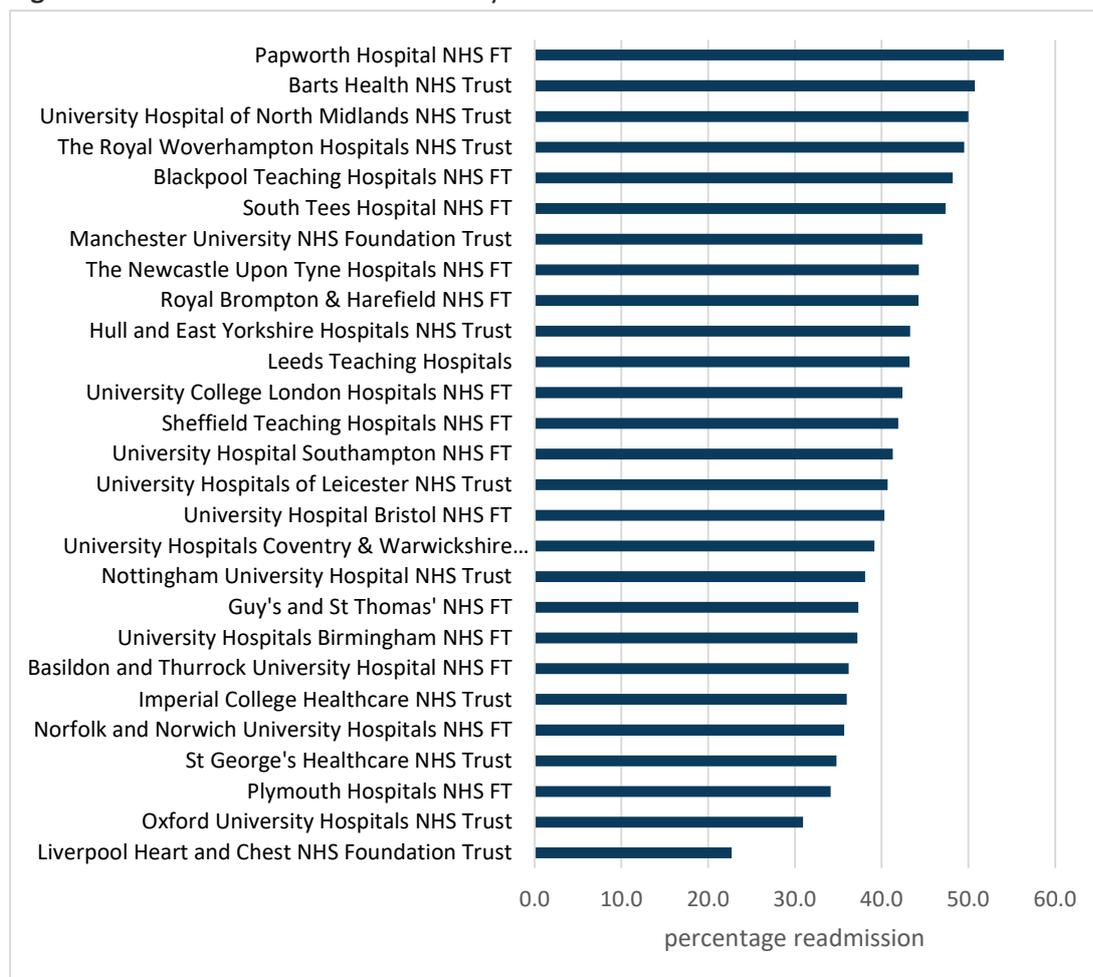
Outcomes: readmission to hospital

A total of 41% of patients were admitted to an NHS hospital within 90 days of their lung cancer surgery. This figure includes planned and unplanned admissions. It includes all causes of admission, both related and unrelated to lung cancer treatment. This rate has been stable over the past 3 years.

Readmission varies by a factor of two between the highest and lowest readmitting trusts (range 22.7% to 54.1%) (Fig 7). The causes are likely multifactorial and not simply related to surgical provision, but good discharge planning and post-discharge support may reduce readmissions.

The length of hospital stay after surgery does not correlate with subsequent readmission at trust level (Pearson coefficient 0.04) in unadjusted data.

Fig 7 All-cause readmission within 90 days

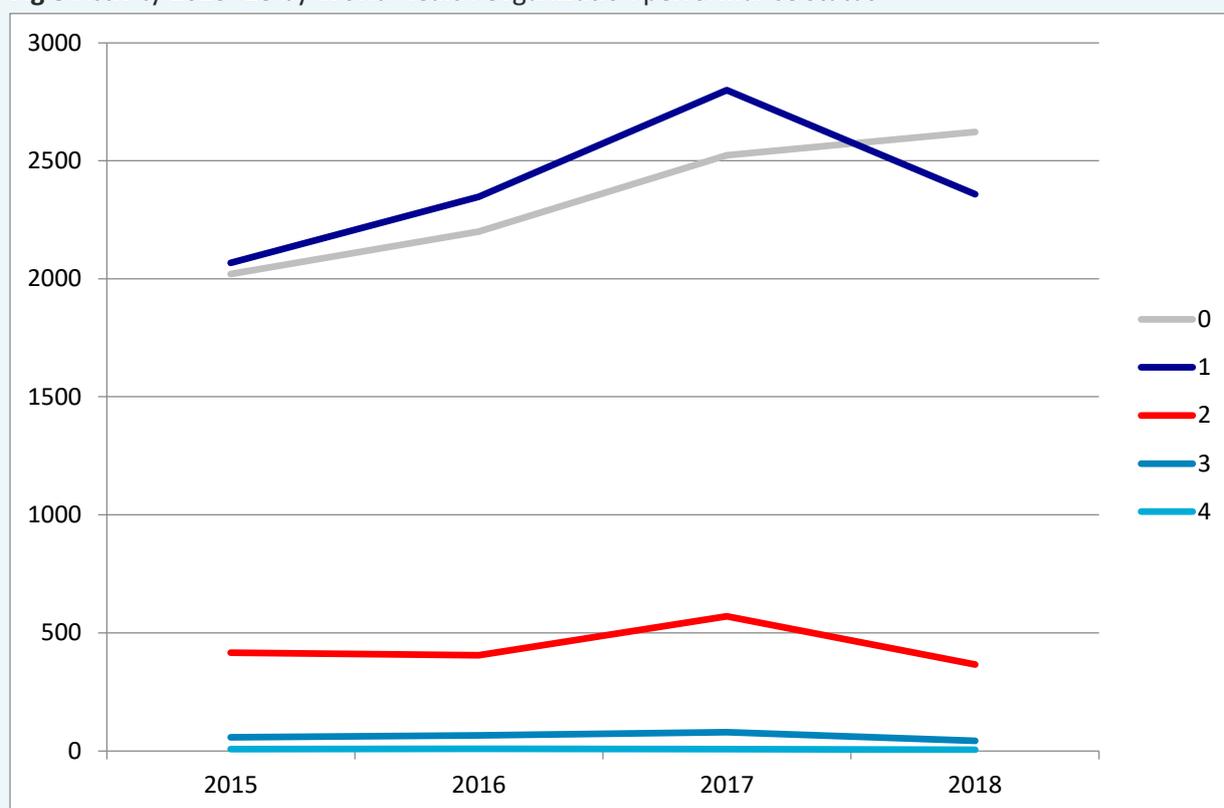


Focus point: increasing resection rates

Every LCCOP report has shown an increase in activity and this year is no different. Data from the SCTS show that this trend has existed for over a decade.³ A total of 5,936 resections were performed in 2015 compared with 6,894 in 2018, a 16% increase in 3 years. We have looked at some of the data behind this overall trend.

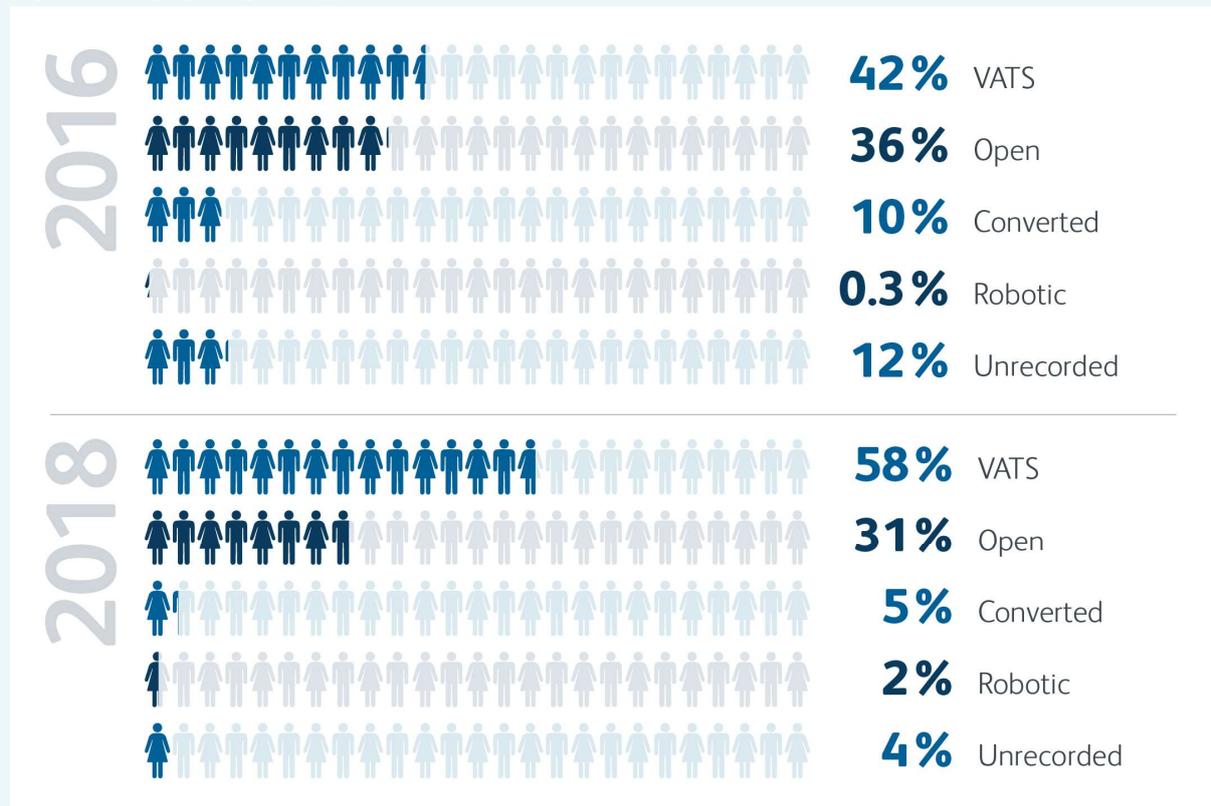
The growth in activity from 2015 to 2018 has been in fitter patients (Fig 8). 92% of patients having surgery in 2018 had a performance status of 0 or 1. Compared with 2015, 30% more patients with PS 0 and 14% more with PS 1 had surgery. Activity in patients with PS 2, defined as those unable to do any work but ambulant at least half of the day, slightly reduced. This suggests that the recent increase in activity has not been due to a general relaxation of the fitness criteria for surgery.

Fig 8 Activity 2015–18 by World Health Organization performance status



The overall growth in activity seen in recent years was accounted for by an increase in minimal access operations (Fig 9). These grew by 55% between 2016–18, while open surgery activity actually fell by 13% over the same period.

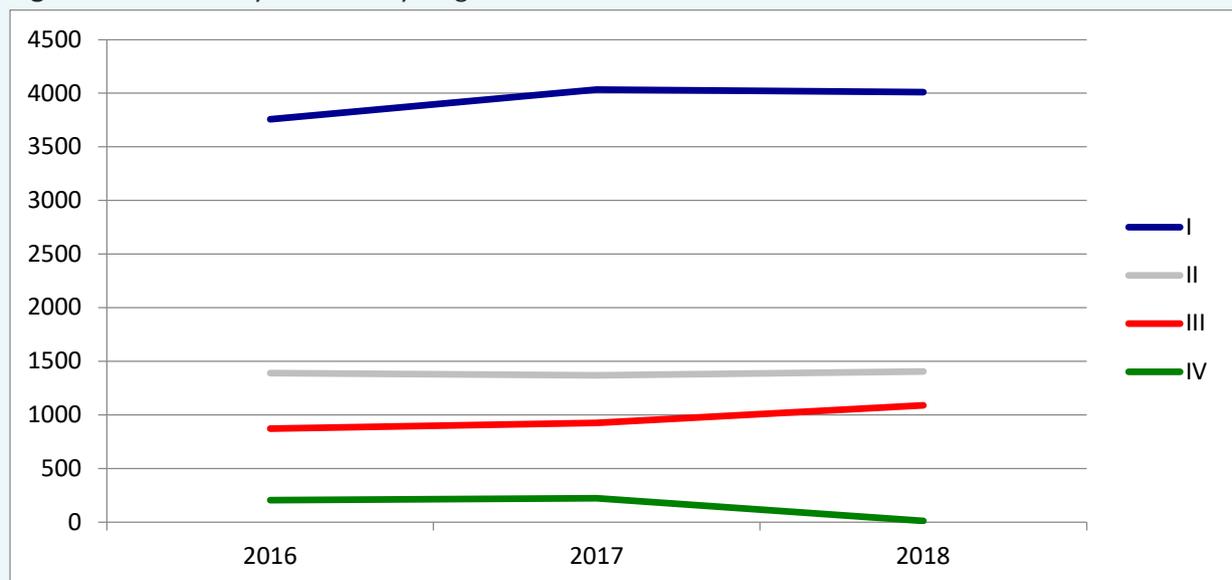
Fig 9 Activity by surgical approach 2016–18



VATS = video assisted thoracic surgery

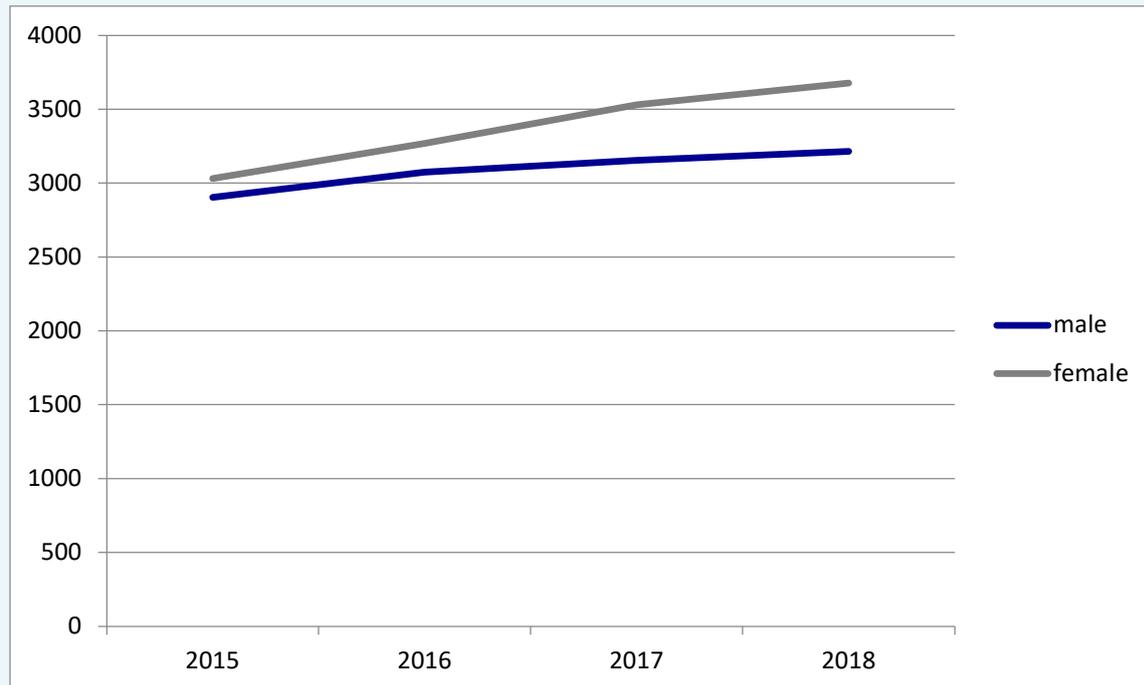
Changes in stage distribution over time are more complex (Fig 10). The largest growth in volume was in stage I patients, with 252 extra cases in 2018 compared with 2015, a 6.7% rise. However, the fastest rate of growth was in the smaller stage III patient group, with 217 extra cases, representing a 24.8% increase in activity over the same period.

Fig 10 Annual activity 2016–18 by stage



Activity has grown faster in women (21% increase since 2015) than in men (11%) (Fig 11).

Fig 11 Increasing activity by gender 2015–18



Focus point: minimally invasive surgery for lung cancer

Minimally invasive surgery (MIS) approaches, particularly video-assisted thoracic surgery (known as VATS or thoracoscopic surgery) are now the predominant approach for lung cancer surgery. Of the 6,303 operations with an approach recorded, 55.8% (3,515) were completed via VATS or a robotic approach, a slight increase from 53.4% in the preceding year.

Randomised trials in the UK and Denmark have now shown shorter lengths of stay, reduced perioperative complications and improved quality of life with VATS lobectomy in early disease.^{4,5}

MIS approaches were commonest for sublobar resections (segmentectomy and wedge resections) with 80% of all procedures completed this way, and lowest for pneumonectomy, where 83.5% were both planned and completed as open operations (Fig 12).

VATS approaches are by far the most popular minimal access technique. However, robotic-assisted operations, while still rare, are growing rapidly. A total of 171 cases were completed robotically in 2018, up from 57 cases in 2016. Seven trusts, 26% of all providers, reported performing some robotic-assisted cases (Fig 13). 2.5% of all lung cancer surgery was performed with robotic assistance in 2018.

In MIS, slightly over one procedure in 20 is converted to an open procedure during the operation. The risk is slightly higher in lobectomy operations (5.8%) than in sublobar resections (4.0%), some of which are technically more straightforward wedge resection operations. Over half of the 30 MIS pneumonectomies attempted were converted to an open approach during surgery, a far higher conversion rate. The possibility of conversion to open surgery should be shared with patients during the consent process.

Fig 12 Surgical approaches used by type of resection

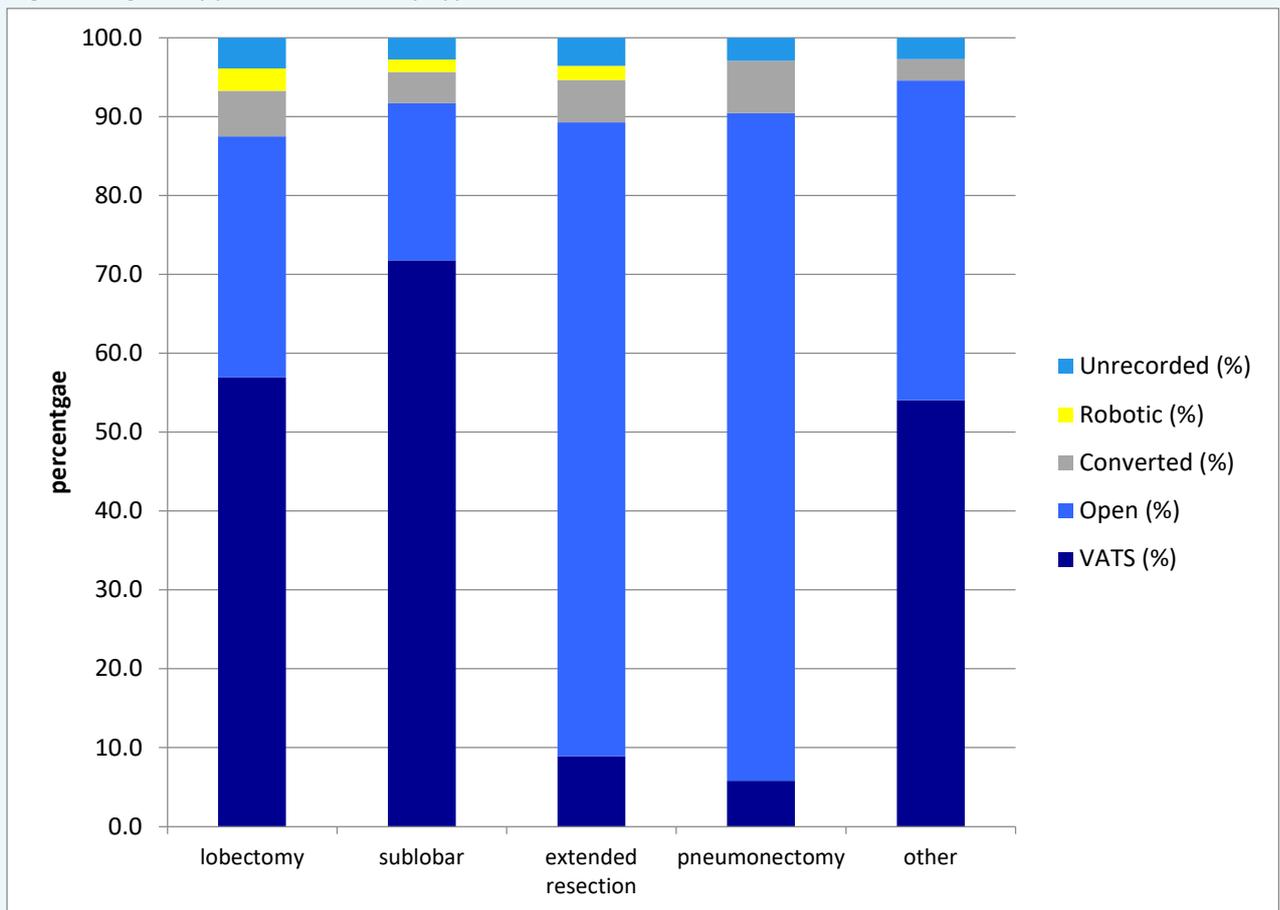
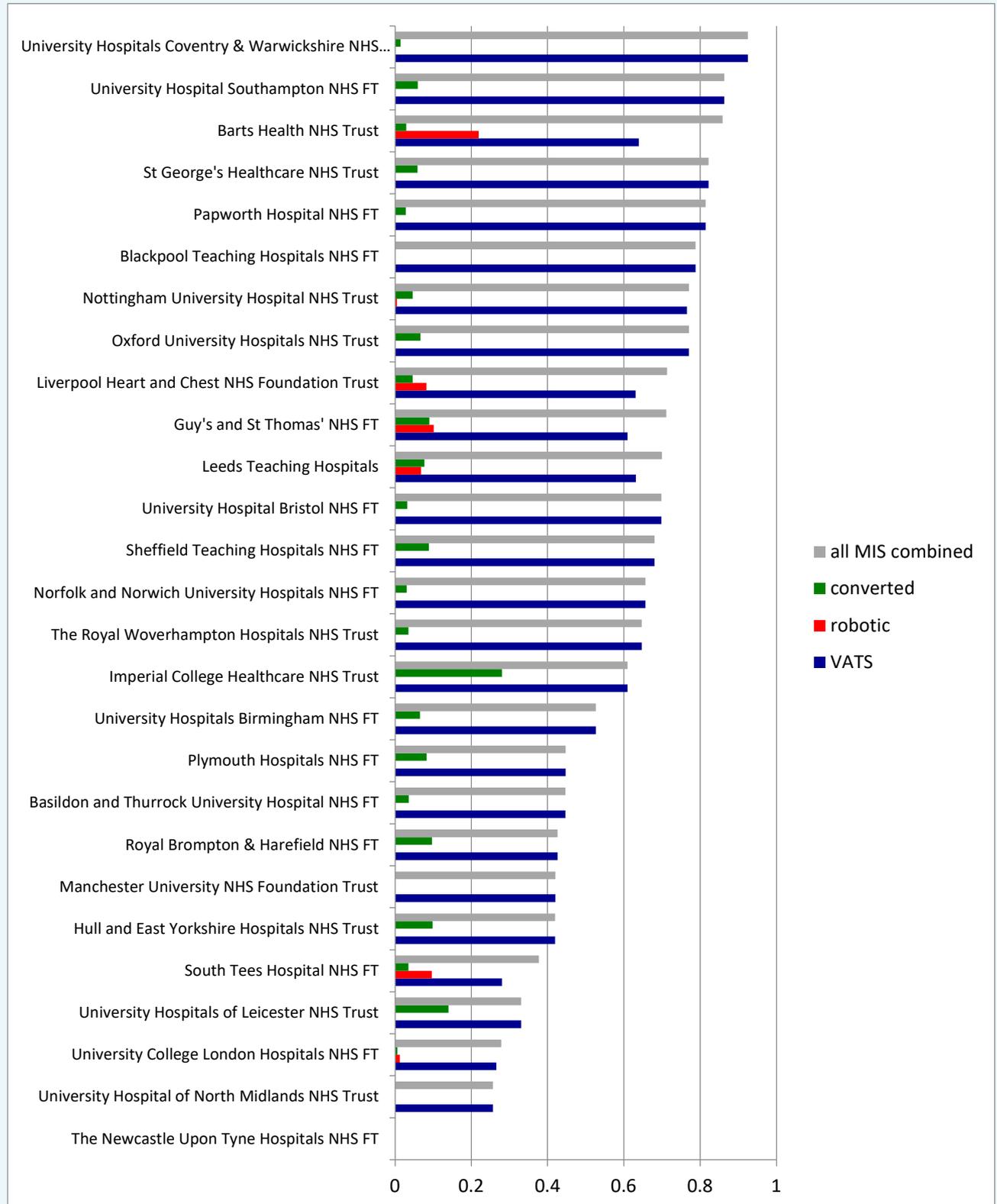


Fig 13 Lobectomy: use of minimally invasive surgery approaches and conversions by trust



Data ordered by overall MIS proportion for lobectomy.

*Newcastle Upon Tyne Hospitals did not submit data on surgical approach.

6. References

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7. Document purpose

Document purpose	To disseminate results on the outcomes of lung cancer surgery for patients who had operations between 1 January and 31 December 2018
Title	Lung cancer clinical outcomes publication 2021 (for the 2018 audit period)
Author	Royal College of Physicians and the Society for Cardiothoracic Surgery in Great Britain and Ireland
Publication date	July 2021
Target audience	NHS staff in lung cancer multidisciplinary teams; hospital managers and chief executives; commissioners; lung cancer researchers; lung cancer patients, their families and their carers.
Description	This is the seventh lung cancer clinical outcomes publication on individual activity of surgeons or their specific contribution to lung care. The data relate to patients diagnosed with lung cancer (excluding small-cell cancers) who underwent surgery during the period between 1 January and 31 December 2018.
Related publications	National Lung Cancer Audit annual reports: www.rcp.ac.uk/NLCA
Contact	nlca@rcp.ac.uk

8. Acknowledgements

Thank you to all surgical trusts that have contributed to this audit; without your considerable efforts, this report would not be possible. We are extremely grateful to our colleagues at Public Health England for their support in the collection and quality assurance of data. We also acknowledge our data analysts and the collaboration between the Society of Cardiothoracic Surgery and the National Lung Cancer Audit in producing this work.

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