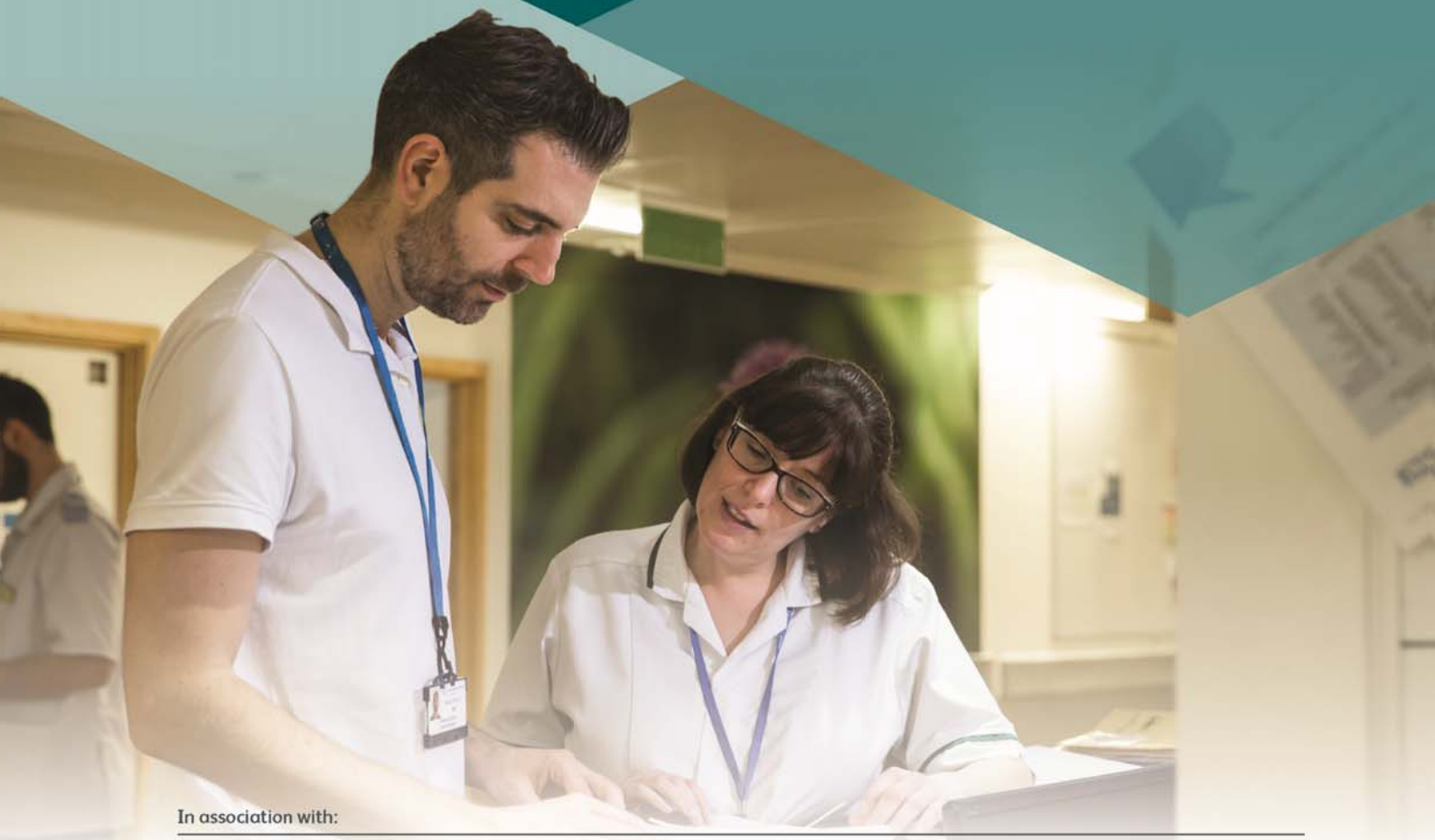
Royal College of Physicians | National Lung Cancer Audit

National Lung Cancer Audit Annual report 2017

(for the audit period 2016)

Published January 2018



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Citation for this document: Royal College of Physicians. *National Lung Cancer Audit annual report 2017 (for the audit period 2016).* London: Royal College of Physicians, 2018.

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ISBN 978-1-86016-702-7
eISBN 978-1-86016-703-4

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Registered Charity No 210508

Document purpose	To disseminate results on the quality of care of lung cancer care for patients diagnosed in the period between 1 January and 31 December 2016
Title	*National Lung Cancer Audit annual report 2017 (for the audit period 2016)*, January 2018
Author	Royal College of Physicians, Care Quality Improvement Department
Publication date	January 2018
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 13th annual report on the clinical component (process of care) of the National Lung Cancer Audit. It publishes national and named team results on the quality of lung cancer care for patients diagnosed between 1 January and 31 December 2016. It covers many processes of care across the entire patient pathway.
Related publications	NICE Quality standard for lung cancer in adults, 2012: **www.nice.org.uk/guidance/qs17** National Lung Cancer Audit annual report 2016: **www.rcplondon.ac.uk/projects/outputs/nlca-annual-report-2016**
Contact	**nlca@rcplondon.ac.uk**

Commissioned by:

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Acknowledgements

Thank you to all the lung cancer teams that have contributed data to the audit; without your considerable efforts, this report would not be possible.

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Wales Cancer Network
We would like to recognise the hard work of all our multidisciplinary team data clerks in ensuring that the data are as complete as possible, and Suzanne Jenkins and Gareth Popham from the Wales Cancer Network.

Contents

Foreword

It is an honour and a privilege to introduce the 13th annual report of the National Lung Cancer Audit (NLCA), which is my first as the senior clinical lead.

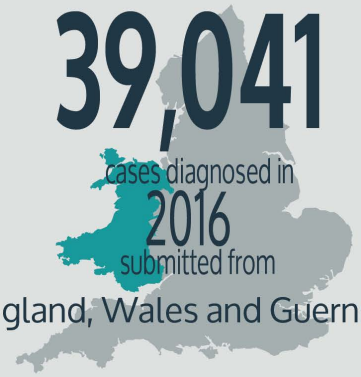
The most striking message in the report is the overwhelming support given to the audit by the lung cancer teams across England, Wales and Guernsey. Participation continues to be outstanding, with teams collectively contributing data on over 39,000 patients diagnosed in 2016. However, in addition to the core audit, the vast majority of organisations in both England and Wales took part in our organisational audit; around half of English organisations contributed to our spotlight audit on curative treatment, and all the relevant units in England took part in the surgical outcomes audit. Furthermore, nearly 150 lung cancer specialists attended our two national quality improvement (QI) workshops in London and Leeds, with many committing to local improvement projects. Finally, we have been delighted by the quick response to a call for volunteers from the regional cancer networks to sit on our 'users group', convened to help the audit plan its direction and discuss new ideas, which demonstrate the high level of engagement and ongoing commitment to its value.

We continue to see the number of lung cancer cases rise year on year, most likely because of diagnosis in older and frailer patients who would previously not have been captured by the audit. After a decade-long push for higher rates of surgery, it is pleasing to see a further rise in this outcome. Improvements in the delivery of radiotherapy mean that some patients who would previously have been ineligible for surgery can now receive potentially curative radiotherapy treatment instead. For the first time, we have been able to use our linkage with the Radiotherapy Dataset (RTDS) to combine the rates of curative surgery and radiotherapy in early-stage disease in patients with PS 0–2 to report an overall curative-intent treatment rate. We hope that a similar push for higher rates of curative treatment will drive this beyond the current 81% in the years to come.

For most of our other audit measures, national performance has been similar to previous years, but persisting variation across different individual organisations offers the opportunity to improve the care of, and outcomes for, lung cancer patients. This year, we shine a light on variation by using a new methodology designed to make variation clearer, and linked to identification of statistical outliers for whom focused QI work will be needed.

Dr Paul Beckett
Senior clinical lead, National Lung Cancer Audit

NATIONAL LUNG CANCER AUDIT
ANNUAL REPORT 2017



72% of patients had a **pathological diagnosis**

17% of patients with NSCLC had a **surgical operation**

58% of patients received **anti-cancer treatment**

81% of patients with stage 1/2 NSCLC and PS 0-2 had a **curative-intent treatment**

37% of patients **survived for at least 1 year**

- We delivered two National workshops on Quality Improvement
- We have refined our methodology to identify outliers
- We have produced quarterly data completeness reports
- We have produced a mid-year report for more regular feedback

135 providers took part in our ORGANISATIONAL AUDIT

73 providers took part in our SPOTLIGHT AUDIT

28 surgical centres took part in our CLINICAL OUTCOMES AUDIT

See our full report at
nlcaudit.co.uk

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Introduction

Background to the audit

The NLCA has been collecting data since 2005 and has become an exemplar of national cancer audit; it currently forms part of the National Clinical Audit and Patient Outcomes Programme (NCAPOP) commissioned by the Healthcare Quality Improvement Partnership (HQIP). NLCA data have been widely disseminated through abstracts at national and international meetings and in peer-reviewed publications. The data have also been used to underpin National Institute for Health and Care Excellence (NICE) guidelines, to inform research protocols and to guide national service developments. Most importantly, local data have been used as a driver for local service improvement projects.

The NLCA is delivered in partnership with a number of key stakeholders. The University of Nottingham provides the analysis for England, Wales and Guernsey. Clinical leadership is provided by lung cancer experts recruited through the Care Quality Improvement Department at the RCP. The NLCA executive group is constituted by the Society for Cardiothoracic Surgery (SCTS), the Roy Castle Lung Cancer Foundation (representing lung cancer patients), Wales Cancer Network Lung Cancer Group, the National Lung Cancer Forum for Nurses and the British Thoracic Oncology Group.

Data collection

The report covers patients with a diagnosis of cancer who have been classified with code C34 of the 10th edition of the World Health Organization International Classification of Disease (ICD-10). The National Mesothelioma Audit is funded by Mesothelioma UK (further details at **www.rcplondon.ac.uk/meso2016**).

NHS hospitals in England submit the details for all lung cancer patients, including patients undergoing lung cancer surgery, via the Cancer Outcomes and Services Dataset (COSD) to the NLCA via the National Cancer Registration and Analysis Service (NCRAS). The data are linked to other datasets, including Hospital Episode Statistics (HES), the National Radiotherapy Dataset (RTDS), the Systemic Anti-Cancer Dataset (SACT), pathology reports and death certificate data. For 2016 data, all lung cancer multidisciplinary teams (MDTs) were contacted by the NCRAS and offered the opportunity to validate their data. Those that took up the offer received spreadsheets of patient-identifiable data on the cases that the registry believed should be allocated to that trust. The data included cases for which there had been no COSD data submitted, but the NCRAS had already received pathology data, Patient Administration Systems (PAS) or death data. When the NCRAS received the updated data back from trusts, it updated the source data before supplying to the NLCA for analysis. Data were sent in three different periods: Q1&2, Q3 and Q4. On average across the periods, 122 trusts (86.5%) requested the data and 96 trusts (68.3%) returned the validated data.

Patients in the NLCA analysis are grouped into cohorts according to the trust first seen, since this is the best current indicator of the decision-making MDT. The COSD field ‘place first seen’ can be used to sort patients into cohorts, but problems arise when this is not completed, or when different providers in a complex pathway record different results. The NLCA and NCRAS team developed an algorithm that assists with the allocation of all patients by using all the data available to the NCRAS team, prioritising trusts that are non-surgical and non-tertiary. If a trust took part in the validation process, then the information that they provided will be taken as the ‘place first seen’. If the information is not available, the algorithm will then look at details and dates in the pathway to determine case allocation to trusts where a patient was ‘first seen’. The algorithm is available online at **www.nlcaudit.co.uk**.

Recording the activity of tertiary trusts in England has always been problematic for the NLCA. Some tertiary trusts provide specialist treatment only, and others also provide some complex diagnostics, and are therefore only rarely the ‘place first seen’. These trusts do provide a very important treatment service for patients in their local area, but also on a regional and national basis. More information on the NLCA’s approach to tertiary trust data is available at **www.nlcaudit.co.uk**.

In Wales, data are collected through the Cancer Network Information System Cymru (CANISC) and a pseudo-anonymised extract of patient-level data is submitted to the NLCA for analysis. The report also includes data from Guernsey, which has a separate funding agreement to participate in the audit directly with the RCP. The data are collected and submitted to the NLCA analysis team.

Lung cancer quality performance indicators (QPIs) have been implemented across NHS Scotland, meaning that Scottish lung cancer audit data are not directly comparable with data collected in England and Wales, and are therefore not included in this publication. National lung cancer reports for Scotland can be accessed via the Information Services Division (ISD) Scotland (**www.isdscotland.org/Health-Topics/Quality-Indicators/Cancer-QPI/**) and regional audit reports can be accessed via the web pages for the three regional cancer networks. The cancer networks in Scotland will continue to progress work at a national level to explore the possibility of contributing to a UK-wide audit going forward, making use of datasets where possible to ensure meaningful and directly comparable analysis.

Methodology

This year we have introduced a new methodology to identify trusts whose performance is statistically significantly below the average. For our key measures, rather than reporting odds ratios and confidence intervals (which can be difficult to understand), we report an adjusted percentage, which places each organisation into one of four groups, and have provided a graphic such as the one below to indicate how many organisations fall into the four key groups:

- Good practice (statistically significantly better than the overall result at the 95% level)
- Not significant (not statistically significantly different from the overall result)
- Alert (statistically significantly worse than the overall result at the 95% level)
- Alarm (statistically significantly worse than the overall result at the 99.8% level)

This adjusted percentage is more meaningful to both clinicians and the public, and the results are illustrated graphically using funnel plots in our online spreadsheet (**www.nlcaudit.co.uk**). In this report, we present the numbers of alert- and alarm-level outliers only. Full details of outliers can be found in our online spreadsheet. Further details can be found at **www.nlcaudit.co.uk/support**.

Standards and guidelines

National guidelines produced by NICE underpin the approach to management of patients with lung cancer in England. NICE has produced a set of 15 quality standards (QSs), intended to describe what a high-quality lung cancer service should deliver. The NICE guidance and QSs are currently undergoing an update, with a new publication scheduled for early 2019.

Annually, the NLCA develops a set of key indicators by which results will be benchmarked and reported on in the audit results. These indicators reflect NICE guidelines and QSs and have a broad clinical consensus. Our standards are developed to encourage healthcare professionals to review the findings of this report and to understand why the differences exist.

In August 2017, the new commissioning guidance for the whole lung cancer pathway was launched in England alongside quality indicators and an optimal clinical care pathway. The NLCA team is working to align our long-standing indicators with the new measures found in this guidance (**www.roycastle.org/how-we-help/lung-cancer-information/information-for-healthcare-professionals/commissioning-guidance**).

In England, the NLCA annual data are submitted to the Care Quality Commission (CQC) inspection process following publication of the data in this report.

Key findings

The NLCA collects a large amount of data from a variety of sources and can report on a wide range of process and outcome measures. This year, we have not produced provider-level data tables in this report. Instead, these can be viewed and downloaded from our website at **www.nlcaudit.co.uk/trusts**.

Number of cases

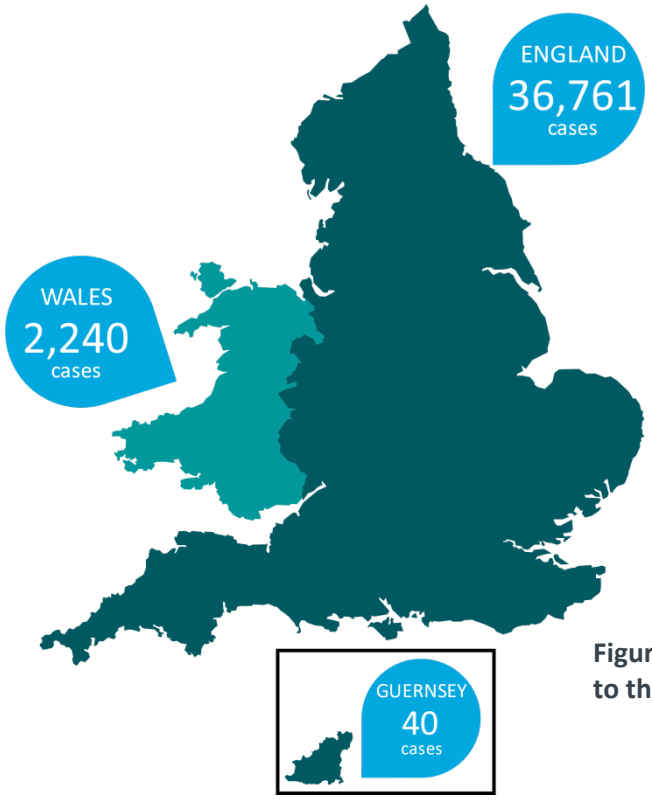


Figure 1: Number of patient records submitted to the NLCA – England, Wales and Guernsey

Case ascertainment

This measure has been a key feature of the NLCA since the audit began. To ensure that no cases were 'cherry-picked', case ascertainment was measured by comparing the number of cases submitted each year with the expected numbers based on historic data from the cancer registries. However, in England, providers can no longer 'choose' which cases to submit, as the NLCA now uses processed cancer registration data linked to a number of other data sources. This has facilitated the inclusion of cases that were not previously known to MDTs and has led to several thousand extra patients being included per year.[1] As a result, the case ascertainment rate is now de facto 100%, at least for English trusts. We have therefore decided to drop this rate as a key performance indicator, although we will continue to report the actual number of annual cases both by organisation and nationally.

[1] Khakwani A, Jack RH, Vernon S *et al*. Apples and pears? A comparison of two sources of National Lung Cancer Audit data in England. *ERJ Open Res* 2017;3:00003-2017. **https://doi.org/10.1183/23120541.00003-2017**

Demographics of lung cancer

NLCA Annual Report 2017 (2016 cohort)

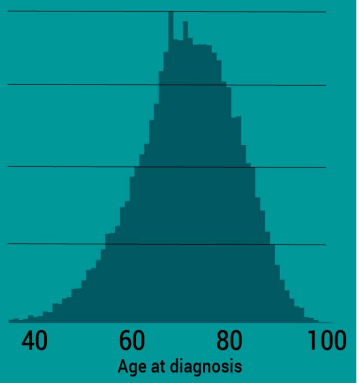
MORE LUNG CANCER CASES DIAGNOSED IN PATIENTS OVER 70

CHANGE IN % OF LUNG CANCER DIAGNOSES BY AGE GROUP

BETWEEN 2007 AND 2015

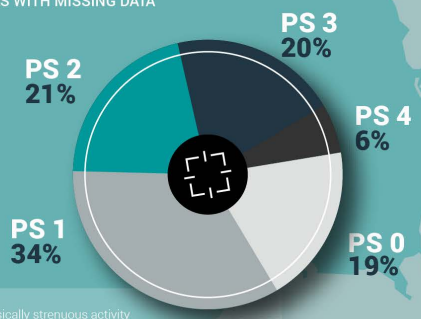
LUNG CANCER IS MAINLY A DISEASE OF OLDER PEOPLE

NUMBER OF CASES BY AGE AT DIAGNOSIS



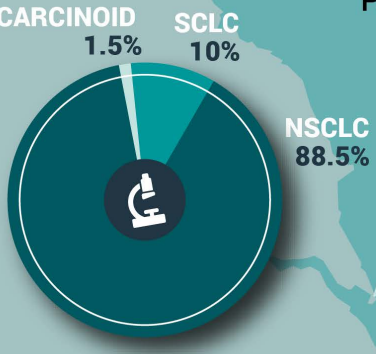
PERFORMANCE STATUS DISTRIBUTION

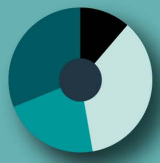
EXCLUDES CASES WITH MISSING DATA



PS 0: Fully active
PS 1: Restricted in physically strenuous activity
PS 3: Ambulatory and capable of all selfcarebut unable to carry out work
PS 3: Capable of only limited selfcare
PS 4: Completely disabled

PATHOLOGICAL SUBTYPES





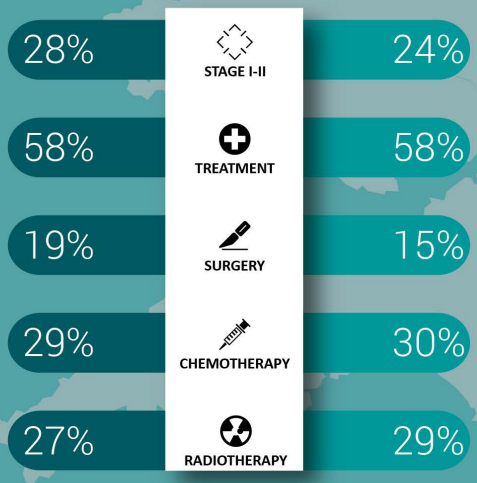
ADENOCARCINOMA 36%
NOT PATHOLOGICALLY CONFIRMED 31%
SQUAMOUS 22%
OTHER 11%

COMPARISON OF MALES AND FEMALES

FEMALES MORE LIKELY TO PRESENT WITH EARLY STAGE DISEASE AND TO HAVE SURGICAL TREATMENT

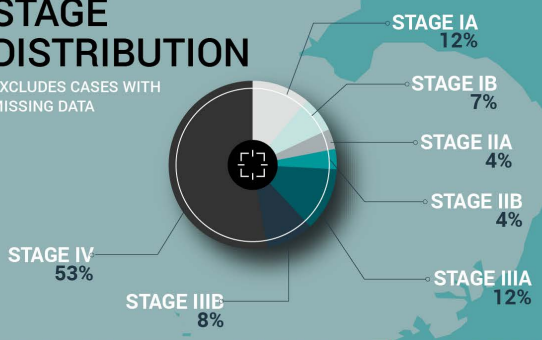
FEMALE
18,204 CASES
MEDIAN AGE 72YRS

MALE
20,837 CASES
MEDIAN AGE 73YRS



STAGE DISTRIBUTION

EXCLUDES CASES WITH MISSING DATA



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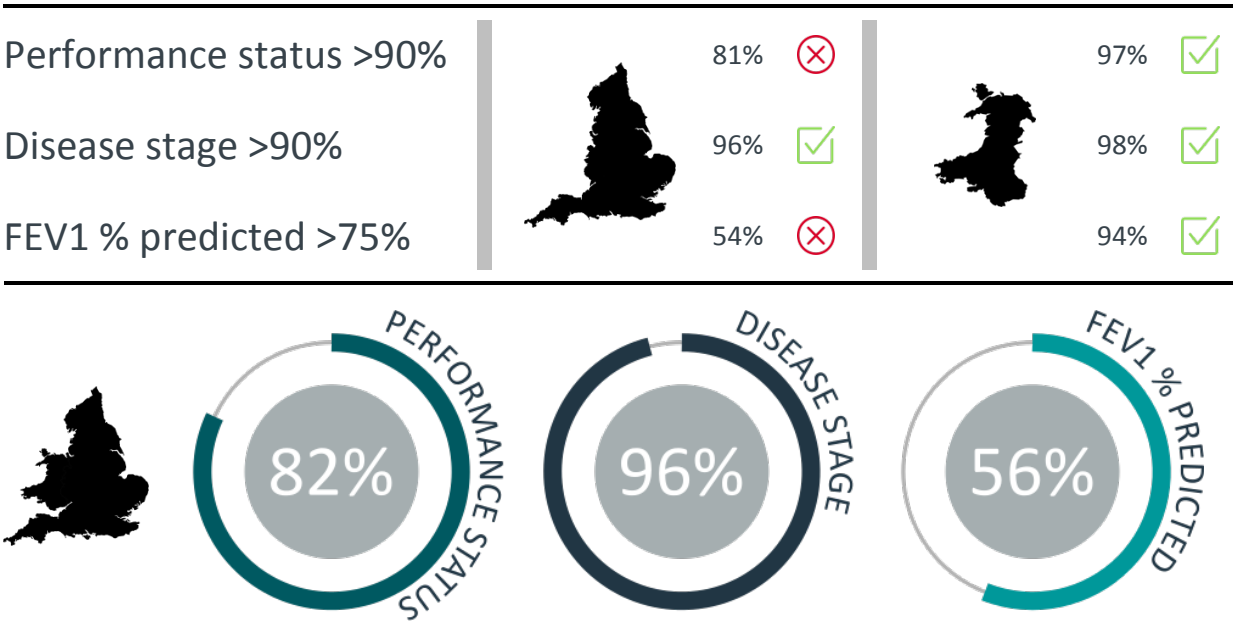
Data for this project is based on patient-level-information collected by the NHS, as part of the care and support of patients. The data is collated, maintained and quality-assured by the National Cancer Registration and Analysis Service, which is part of Public Health England (PHE).

Data completeness rates

It is important to maintain or improve the quality of data submitted to the NLCA, including detailed clinical data, to allow the most accurate risk adjustment to be carried out. Performance status (PS) describes a patient's level of functioning in terms of their ability to care for themselves, daily activity and physical ability. Stage refers to the extent of the cancer, such as how large the tumour is and whether it has spread. FEV1 is a measurement of lung capacity to determine how healthy a patient's lungs are.



Commentary

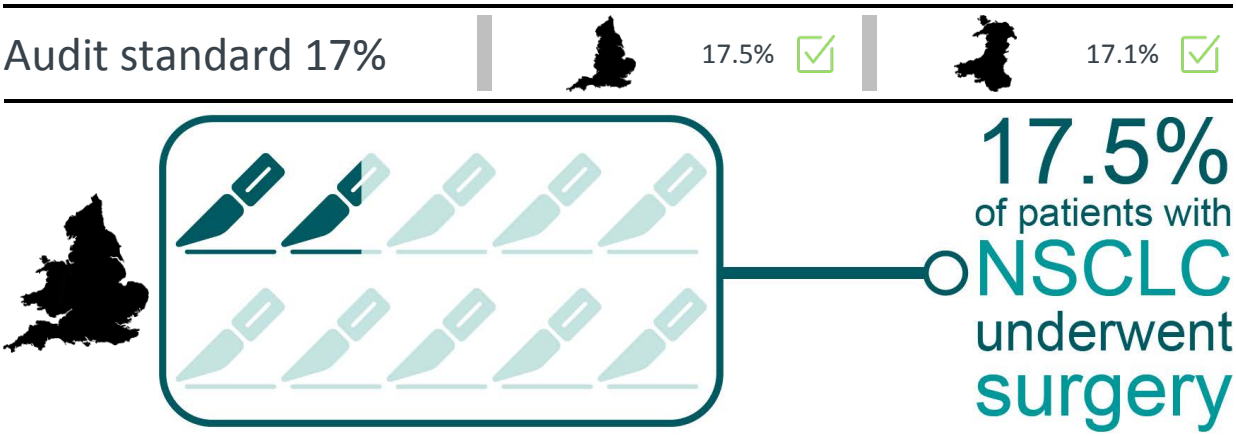
Data completeness in Wales is of a very high standard, with the recommended benchmarks being exceeded. In England, data completeness has improved from last year, particularly with regards to PS, which has increased from 75% in the 2016 audit to 81%. However, this still remains lower than the recommended data completeness level of more than 90% for PS. Staging data completeness is excellent and is the highest ever achieved in the NLCA. This reflects good practice from MDTs, but also work done by NCRAS to obtain missing staging data from primary sources.

Recommendations

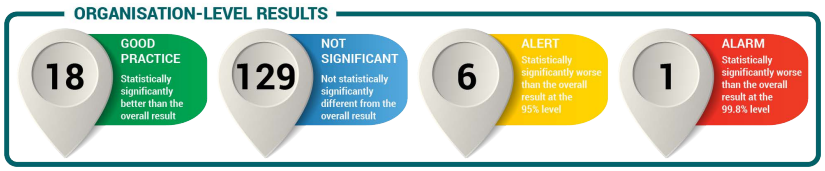
- Both performance status (PS) and stage should be recorded in at least 90% of cases.
- For patients with stage I–II and PS 0–1, data completeness for FEV1 and FEV1% should exceed 75%.
- All lung cancer MDTs should appoint a 'clinical data lead' with protected time to allow promotion of data quality, governance and QI.
- Data submitted should undergo clinical validation and assessment for data completeness. Data completeness can also be assessed by logging onto the NLCA CancerStats portal (**www.ncin.org.uk/cancer_information_tools**). Particular attention should be focused on completing the 'trust first seen' and PS fields.

Surgery rates in all non-small-cell lung cancer (NSCLC)

Surgery remains the preferred treatment for early-stage lung cancer, and historically patients in the UK have been less likely to undergo surgery than patients in other countries, although the numbers have increased slowly over the past 10 years, rising from around 9% in 2006 to 17% now. Disease stage, PS and lung function measurements are crucial in determining whether to offer a patient a surgical operation. Survival after surgery is high (98% at 30 days), suggesting that there is scope to further increase the resection rate. Last year, we set an audit standard of surgery for 17% of patients with histologically confirmed or presumed NSCLC.



Results for individual organisations can be obtained from **www.nlcaudit.co.uk**. In summary:



Commentary

This is an encouraging result, with a small increase in the overall proportion of patients undergoing surgery compared with 16.7% in the 2016 annual report. 18 organisations were identified as having a significantly better surgical resection rate than the national average, suggesting good practice. However, variation persists between organisations that is not explained by casemix adjustment. Adjusted surgical resection rates varied from 4.8 to 40.1%, and 60 organisations failed to meet the audit standard of 17%. Seven organisations have been notified of their outlier status.

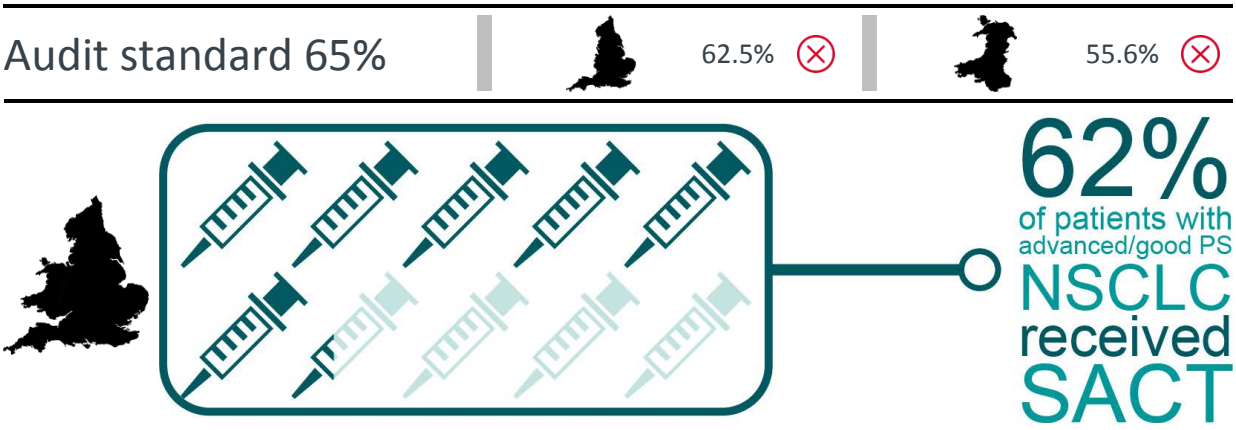
In acknowledgement of the important role of radiotherapy in patients with early-stage disease, the NLCA will be placing more emphasis on radical treatment rates (consisting of surgery and/or curative-intent radiotherapy) in patients with stage I and II disease with PS 0–2.

Recommendations

- MDTs with lower-than-expected surgical resection rates for NSCLC should perform detailed case-note review to determine why each resectable patient with good performance status did not receive an operation.
- With the introduction of the 8th version of the TNM (Tumour Node Metastasis) staging system, MDTs should be aware that the staging manual states that if there is uncertainty over stage, then the lower stage should be adopted for clinical decision-making.
- Low surgical rates in some organisations may be due to their surgical cases being allocated to a tertiary surgical trust. A key priority for these trusts will be to ensure that their data reflect their workload.

Systemic anticancer treatment rates in NSCLC (stage IIIB/IV and PS 0–1)

Clinical trials have demonstrated that patients with advanced and incurable NSCLC can benefit from palliative chemotherapy, delivered to improve quality of life and to extend survival. Since this measure was first introduced, there have been significant developments in the treatment options available to patients, such that the term 'chemotherapy' should now be replaced by the term 'systemic anticancer treatment' (SACT). Last year, we set an audit standard of SACT for 65% of patients with advanced NSCLC and good PS.



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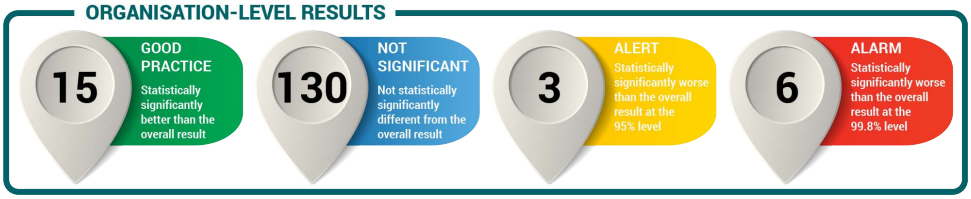


Commentary

Overall, 62% of patients with good PS and advanced NSCLC received SACT (England 62.5%, Wales 55.6%). This has dropped slightly from last year (64%). For England, across individual organisations (excluding tertiary trusts), the casemix-adjusted results varied from 25.7% to 100%, with 85 organisations failing to achieve the standard. Nine organisations have been identified as outliers.

We identified other interesting findings from the data. For patients in England where SACT drugs were reported, the chemotherapy combinations of gemcitabine/carboplatin (20.6%), pemetrexed/carboplatin (20.2%) and pemetrexed/cisplatin (18.2%) were most commonly used. Biologic (tyrosine kinase inhibitor) treatments targeting EGFR (epidermal growth factor receptor) mutations (gefitinib, erlotinib, osimertinib, afatinib) were used in 8.2% of patients, and therapies targeting ALK (anaplastic lymphoma kinase) mutations (crizotinib, ceritinib) were used in 1.2%. Pembrolizumab immunotherapy was used in 3.2% of patients, despite not becoming available on the NHS until the end of 2016.

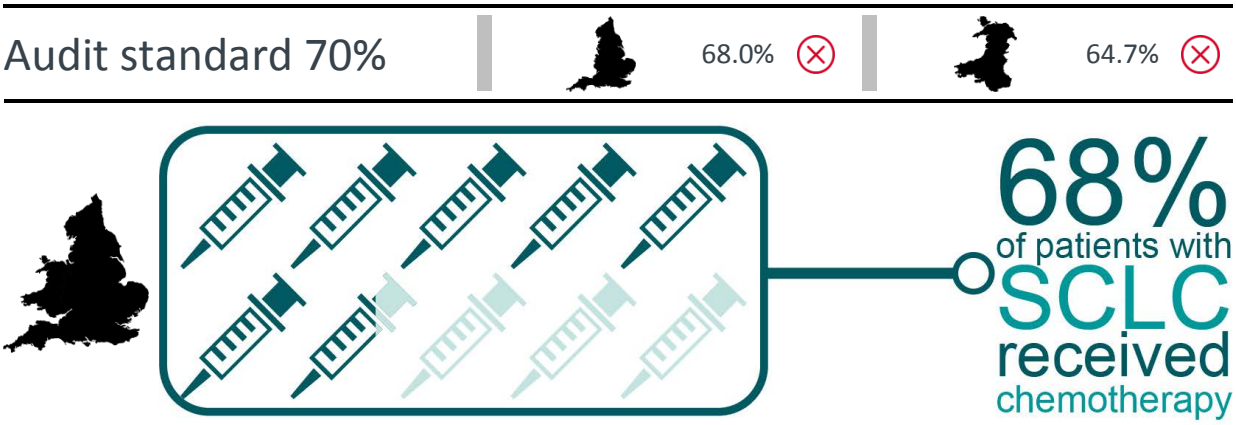
Recommendations

- MDTs with lower-than-expected systemic anticancer treatment rates for good PS (0–1) stage IIIB/IV NSCLC (<65% after casemix adjustment) should perform detailed case-note review to determine why each advanced NSCLC patient with good PS did not receive systemic therapy.

- MDTs should review their approach to groups such as older patients and patients with comorbidities, to ensure that it is in line with best practice.

Chemotherapy rates in SCLC

Small-cell lung cancer (SCLC) is a particularly aggressive cancer, which is nearly always advanced at the time of diagnosis, so the role of surgery is often not appropriate. These tumours are, however, very sensitive to chemotherapy (and radiotherapy), and this can improve survival and quality of life. Patients may deteriorate quickly in the time between presentation and treatment, and so it is particularly important that the pathway is expeditious. Last year, we set an audit standard that at least 70% of SCLC patients should receive chemotherapy



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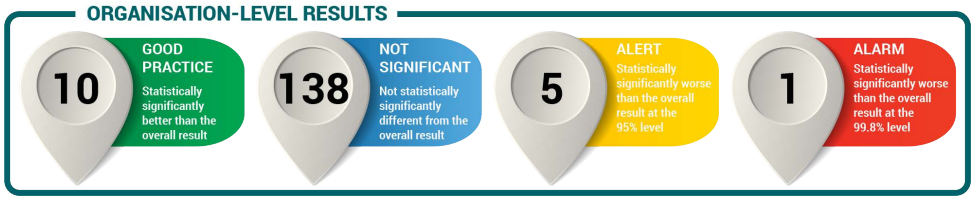


Commentary

Overall, 68% of SCLC patients received chemotherapy (England 68%, Wales 64.7%), which is just slightly lower than last year (69%). Across individual organisations (excluding tertiary trusts) the results, adjusted for casemix, varied from 27.9% to 100%, with six organisations identified as outliers.

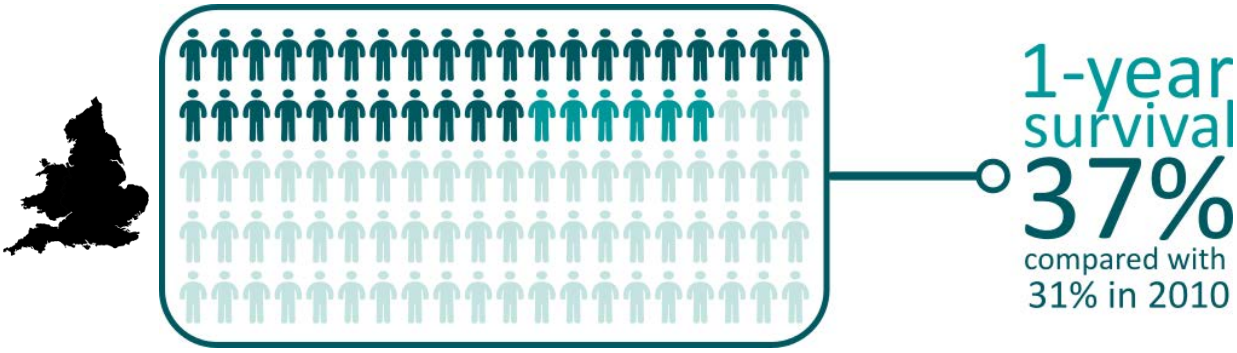
The vast majority of patients with SCLC present with metastatic disease, making timely use of palliative chemotherapy the most appropriate measure. However, 30% of patients present with stage I–III disease, where multi-modality therapy is recommended as optimal treatment. Of patients in England with stage I–III SCLC and PS 0–2, 38.8% received curative-intent treatment with chemotherapy and radical radiotherapy or occasionally surgery, with a further 3.5% receiving radical radiotherapy or surgery alone; prophylactic cranial irradiation was delivered in 37.8% of patients receiving radical radiotherapy. The remaining 37.8% of patients received palliative chemotherapy or radiotherapy, or no active treatment. Across all SCLC cases diagnosed in England, 11.2% of these patients received curative-intent treatment.

Recommendation

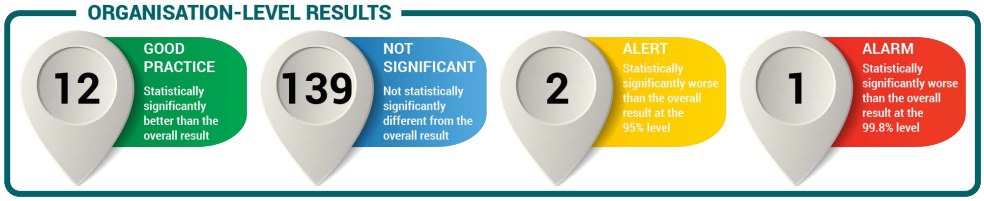
- MDTs with lower-than-expected chemotherapy rates for SCLC (<70% or low odds ratio after casemix adjustment) should perform detailed case-note review to determine why each SCLC patient did not receive chemotherapy.

One-year survival rates

The aim of treatment for lung cancer patients is to provide a cure for as many as possible, as well as to maintain quality of life in survivors and those who will still die of the disease. We do not set a target for survival; rather, we expect that attention to individual components will deliver improvements. Due to the timelines of analysis of patients diagnosed in 2016, our analysis of 1-year survival only includes patients diagnosed in January–September 2016.



Results for individual organisations can be obtained from **www.nlcaudit.co.uk**. In summary:



Commentary

The overall 1-year survival for patients with lung cancer across all stages in England and Wales is considerably improved from 2010; however, it is relatively unchanged from the 2016 report, when it was 38%.

1-year survival for NSCLC patients with stage I disease was 81.7%, for stage II it was 64.1% and for stage III disease, 42.5%. Despite advances in the care of patients with advanced disease, the 1-year survival for patients with stage IV disease was 15.5%, emphasising the importance of early diagnosis.

There remains unacceptable variation in casemix-adjusted survival between trusts, with the range in adjusted 1-year survival varying from 26.3% to 64.4%. Three organisations have been notified of their outlier status.

NEW MEASURE: Curative-intent treatment rate for stage I–II NSCLC, PS 0–2

Last year, the NLCA set a curative-intent treatment rate of 70%, based on the mean for 2015. This rate can only be calculated for England, as it relies on data included in the RTDS and combines receipt of surgery and radical radiotherapy in stage I–II NSCLC. This year, to align with new commissioning guidance, we report the curative-intent treatment for stage I–II and PS 0–2 cases.

Commentary

Overall, 80.4% of patients received curative-intent treatment in 2016 (surgery 60.6%, stereotactic ablative radiotherapy (SABR) 11.5% and other radical radiotherapy 9.8%; percentages include some patients who received radical radiotherapy after surgery). Across individual organisations (excluding tertiary trusts), the rate of this curative treatment varied from 54.5% to 100%.

While at first glance this seems an encouragingly high result, it does mean that, for England, one in five patients with good PS and early-stage disease do not receive treatment with curative intent; across organisations, there are 13 trusts where one in three patients with good PS and early-stage NSCLC do not receive curative-intent treatment.

Where radical radiotherapy was used, the most common SABR prescription was 55 Gy/5#/1.5 weeks (35.7%) and the most common fractionation for other radical radiotherapy was hypofractionated 55 Gy/20#/4 weeks (36.4%); both standard fractionated 60–66 Gy/30–33#/6–6.5 weeks and CHART (continuous hyperfractionated accelerated radiotherapy) were used in just 3% of cases.

From the data, we also identified some baseline curative-intent multi-modality treatment findings for patients with stage IIIA NSCLC and PS 0–2. 15.9% of patients received surgery with adjuvant or neoadjuvant chemotherapy, and 14.7% received radical radiotherapy with either sequential or concurrent chemotherapy, meaning that 30.6% of patients received multi-modality treatment. Surgery (10.3%) or radical radiotherapy (9.7%) without chemotherapy was delivered to a further 20%, with 50% of patients receiving palliative treatment or best supportive care.

Recommendations

- MDTs with lower-than-expected curative-intent treatment rates for stage I–II PS 0–2 NSCLC (<80% or lower) should perform detailed case-note reviews to determine why each patient did not receive either surgery or radical radiotherapy, including whether a second opinion was offered to borderline-fit patients.

- MDTs should consider whether their approach to groups such as older patients and patients with comorbidities is in line with best practice.

Case study: Victoria Bannon, cancer data and performance manager St Helens Hospital

Following the launch of the 2016 annual report, St Helens and Knowsley Teaching Hospitals NHS Trust worked closely with the NCRAS data improvement team to understand why the quality of their data had been much lower than expected. This included a patient-level review of all cases by the lead clinician for lung cancer, and the data manager. This resulted in the identification of several patients who should not have been included in the NLCA, which negatively impacted on the data quality and performance measures for the trust. Through the investigations, the trust also found patients who should have been included in the COSD data submissions, and was able to put additional steps in place to ensure that all cases were picked up going forward.

In order for future annual reports to include accurate data, the trust felt that all trusts should be provided with the opportunity to further validate cases identified from the other data sources used by the NCRAS. Following on from this, Victoria Bannon and her team received the data for the 2017 NLCA annual report at regular intervals throughout the year. The cases were again validated by the lead clinician and data manager, and feedback was submitted to the NCRAS. As the trust was piloting this new process, a telephone discussion with a member of the NCRAS team followed the submission to agree on cases to be included and removed.

The details of patients who the trust felt should not have been included or were missing from the NLCA data fell into three categories: not lung cancer, patients diagnosed at another trust, and patients diagnosed with 'unknown primary'. It is acknowledged that, in any future rounds of validation, not all amendments or exclusions would be accepted or removed if NCRAS had further information that confirmed lung cancer.

Steps implemented following the data improvement work include:

- enabling the NCRAS remote access to the Cancer Management Systems
- cross-referencing PAS submissions to COSD to ensure that all cases are captured and queries are raised regarding any identified as non-lung cancers
- monthly clearance of the suspected/diagnosed report on Somerset Cancer Register
- reinvention of the monthly list that runs from the pathology system; the frequency increased to weekly and all cases were automatically added to the next MDT meeting by the coordinator unless advised otherwise by the clinical team
- monthly validation with the lead clinician looking at all cases 4 months prior to enable them to only review the patient once.

These improvements and the validation process have provided an assurance mechanism for the trust with regards to the performance for the measures being included in the annual reports. The trust has requested clearly defined submission dates for future validation work so they can plan their work accordingly.

Additional measures

The table below lists some of the other measures that we have audited against standards set last year. These measures cover access to a lung CNS (cancer nurse specialist), pathological confirmation of the lung cancer diagnosis, use of PET-CT (positron emission tomography – computerised tomography) scanning and speed of chemotherapy delivery for SCLC.

Proportion of patients seen by lung CNS **>90%**	71% ✗	70% ✗	86% ✗
Proportion of patients where lung CNS present for diagnosis **>80%**	58% ✗	58% ✗	Not measured
Proportion of patients with pathological confirmation of lung cancer **>80%**	72% ✗	72% ✗	70% ✗
Proportion of patients where the pathology code is NSCLC-NOS **<15%**	9% ✓	9% ✓	4% ✓
Proportion of SCLC patients receiving chemotherapy within 2 weeks of pathological diagnosis **>80%**	34% ✗	33% ✗	40% ✗

Commentary

Lung CNS: Overall, 71% of patients were recorded to have been seen by a lung CNS (England 70%, Wales 86%, Guernsey 32.5%), with 58% having a lung CNS present at diagnosis (England only). This has greatly improved for many trusts in England compared with last year, when only 57% of patients were recorded as being seen by a lung CNS; however, it is still lower than for the 2015 annual report (84% seen and 65% at diagnosis).

Pathology: Overall, 72% of patients had their lung cancer confirmed pathologically, which remains stable compared with last year. Across individual organisations, results varied from 55.9 to 100%. Overall, for patients with pathological confirmation, just 9% of NSCLC cases were classified as not otherwise specified (NOS), achieving the target of <15% and showing continued improvement compared with last year. Across individual organisations, this varied widely from 0% to 35.6%, with 16 organisations not achieving the <15% target. Pathological confirmation and specification are important because oncologic treatments are increasingly determined by histologic subtyping and molecular analysis.

SCLC: Overall, 34% of SCLC patients received their chemotherapy within 14 days of pathological diagnosis (England 33%, Wales 40%), with wide variation across organisations. This figure has remained stable compared with last year.

Organisational audit results

The first NLCA organisational audit was performed in 2014, and highlighted significant variation in service provision and workload of lung cancer specialists. The second organisational audit commenced in June 2017, with the aim of reassessing the provision of lung cancer services. An electronic survey was sent to all lung cancer leads to provide a snapshot of lung cancer services in June 2017.

The key results are summarised below:

- 86% of providers (85% for England; 92% for Wales) participated in the second organisational audit.
- The number of providers with a separate diagnostic MDT meeting increased from 29% to 43%.
- One-third of providers discuss more than 30 patients per MDT meeting list.
- The provision of on-site endobronchial ultrasound (EBUS) has increased from 44% to 67% in 3 years.
- Access to on-site pulmonary rehabilitation (81% to 67%) and smoking cessation services (86% to 67%) has decreased in 3 years.

Table 1 below summarises the number of providers that meet the recommendations set out in the new commissioning guidance for the whole lung cancer pathway

	Recommendations met in 2017	Number (%)
1	One WTE respiratory physician (10 PAs) per 200 new diagnoses per year	79 (59%)
2	Radiologist with 1/3 of their job plan devoted to thoracic imaging	108(81%)
3	Medical oncologist with 1/3 of their job plan devoted to lung cancer	78 (59%)
4	Clinical oncologist with 1/3 of their job plan devoted to lung cancer	91 (68%)
5	One WTE lung CNS per 80 new diagnoses per year	25 (19%)

PAs = programmed activities; WTE = whole-time equivalent

Key recommendations

We make four specific recommendations to address the national variation in lung cancer services. We plan to repeat the organisational audit in 2019, using these recommendations as the benchmark.

1 All patients should have local access to smoking cessation and pulmonary rehabilitation services.
2 All core MDT members should have dedicated time to attend a weekly MDT meeting, discussing no more than 30 patients in 2 hours.
3 All MDTs should ensure adequate specialist time commitment, as specified in the national commissioning guidance, with particular focus on lung CNSs.
4 All providers without a separate diagnostic MDT should implement this within the next 12 months as specified in the new commissioning guidance.

Commentary on the results

Commentary for England

David R Baldwin, chair, Clinical Expert Group for Lung Cancer and Mesothelioma, NHS England:

Published papers and reports on the NLCA have repeatedly demonstrated important variations in practice and have helped individual trusts to address these. This real-life evidence has also shaped one of the priorities in the commissioning guidance for lung cancer in England, which was recognised this August by NHS England and sent to Cancer Alliances for implementation.

In this latest report from the NLCA, variation is still present, even at the network level and after casemix adjustment. We know that in particular, performance status (PS) and stage have a huge effect on survival and on treatment both offered and received. It is important that these data are collected, as we also know that missing these data tends to be associated with poorer outcomes. It is very encouraging that 80% of records for England have both PS and stage recorded, but the range by network is 62–88%. Those trusts with lower values should prioritise data collection.

At presentation to secondary care, 44% of patients had a PS of 0 or 1 (rising to 53% if missing data are excluded). This is encouraging, as these patients are usually suitable for active treatment. If we can improve this proportion further, we may see better treatment rates and outcomes. The range by network, however, is 36–50%, even wider for individual trusts, surely mandating an investigation into why this is the case. If there are reversible causes, such as delays in the pathway from symptom recognition, presentation to primary care and prompt referral and investigation, these should be addressed. The National Optimal Lung Cancer Pathway can help here.

Stage at presentation was well recorded, with only 4.5% of records missing stage; unfortunately, 50% had stage IV lung cancer and this is one of our biggest challenges. Early cross-sectional imaging, either as part of a risk-stratified protocol in symptomatic people or as part of a screening programme, is the only realistic solution; a decision on national CT screening is still awaited.

During the lifetime of the NLCA, we have seen considerable improvement in treatment rates and outcomes, although this report shows that, even after casemix adjustment, there is considerable variation in many key areas – including access to lung CNSs (incredibly important to patients and associated with higher treatment rates), surgical resection rates and active treatment rates. Treatment with curative intent for patients with NSCLC stage I or II and PS 0–2 varied from 70% to 88% by network, and chemotherapy rates in SCLC varied from 57% to 75%. Patients may rightly ask why the differences remain. The 2011 NICE guidance recommends that patients with SCLC are assessed by a thoracic oncologist within 1 week of a decision to treat. This report suggests that there is some way to go in speeding up treatment for this rapidly progressive disease, as no network treated more than 50% of patients within 2 weeks of diagnosis.

Fourteen trusts achieved an adjusted 1-year survival higher than two standard deviations from the mean. This is good news, but again emphasises the need for all trusts to strive to achieve better outcomes. Is this situation of still unacceptable variation going to continue or are we, the ‘lung cancer community’, going to tackle it? Although there will always be some variation, which is inevitable as progress is made, I believe that committed, enthusiastic clinicians working in a supportive environment can make a huge difference. The commissioning guidance recommends that all MDTs have committed experts in the same numbers as in the better resourced trusts, and if this cannot be provided within your trust, it is sourced elsewhere and still provided in the local area. This will be a challenge to clinical teams, but will help the majority of patients to have access to the best care. The NLCA has provided the evidence; it is up to us to use it to improve outcomes for our patients.

Commentary for Wales

Gareth Collier, clinical lead, lung cancer audit in Wales, and Ian Williamson, chair, Lung Cancer Group, Wales Cancer Network

Lung cancer is the leading cause of cancer death in Wales, and improving lung cancer outcomes was selected as a national priority in 2015. Some of these projects are only now being implemented, so the benefits of this work will not yet be fully apparent in this year's audit.

The method of data submission from Welsh MDTs has not changed in a decade; however, the quality appears to be good, with high levels of data completeness. For example, 95% of patients had both stage and performance status recorded, 94.3% had a CT thorax, and 93.9% of stage I and II PS 0–1 patients had an FEV1 recorded.

Despite the apparently high levels of data completeness submitted to the NLCA, there continues to be some discrepancy between this and the data collected by the Welsh Cancer Intelligence and Surveillance Unit; for example, their latest publication reports unknown stage as 14% for the 2015 patient cohort. This discrepancy will be investigated, as a possible explanation is that not all lung cancer cases are managed by lung cancer teams. Plans to upgrade data collection and allow linkage with other datasets such as SACT, RTDS and registry data are in progress, which will lead to improvement in the quality and quantity of data in the next few years.

Pathological confirmation remains at 69.6%, with the NOS rate falling from 6.7% to 3.8%, which is well below the 15% standard set last year. The percentage of patients assessed by a lung CNS remains high at 86%, but represents a slight fall since 2015 (90.6%), due to some difficulty in recruiting to more rural areas in Wales. The high level of lung CNS support in the face of increased patient numbers with increased complexity reflects the hard work and commitment of our nurse specialists.

The proportion of NSCLC patients having surgery in Wales, having increased steadily since 2010, appears to have fallen slightly to 17.1% from a peak of 18.3% in 2015. The proportion of patients receiving chemotherapy for SCLC has also reduced to 64.7% from 73.4% and, for patients with NSCLC stage IIIB/IV PS 0–1, has reduced to 55.6% from 62.2% since 2015.

As previous reports from the NCLA have shown, there continues to be variation in the investigation, treatment and survival of patients between MDTs in Wales, even with adjustment for age, performance status, stage and socio-economic status; for example, the percentage of patients receiving a bronchoscopy varies from 12.9% to 53.7%. For the first time this year, we have seen significant changes in certain clinical outcomes at MDT level when adjusted for these confounding variables, and we intend to review these in further detail in order to obtain a better understanding as to whether any changes to service delivery are required to meet the needs of the local population.

The NLCA outlier policy will support our Peer Review Programme in identifying areas of possible concern and areas of good practice. The current audit identifies four MDTs as having metrics of good practice, and a further two MDTs with a metric that triggered one alert and one alarm. The data triggering these alerts will be subject to further validation and the MDTs will be supported through our peer review process to develop and agree any action plans required with the Wales Cancer Network. Health boards are encouraged to review their data and work with the network on quality improvement.

The Wales Thoracic Oncology Group has been recently established with the goal of addressing early diagnosis, audit, pathway improvement and therapies. Specific subgroups have been established to look at these individual workstreams, with the intention of standardising care across Wales, reducing variation between MDTs and improving clinical outcomes and overall survival.

European perspective on the NLCA

In 2008, Anna Rich was awarded the first Royal College of Physicians Research Fellowship, and began work in this role on lung cancer epidemiology at Nottingham University. Anna describes how this early work led to her involvement in a Europe Respiratory Taskforce and how the NLCA is one of the best examples in Europe of a national patient-centred dataset specific to lung cancer.

In 2010, as my period of research came to a close, and having presented my results at national and international conferences, I was invited to speak at a meeting in Berlin. Several leading members of the European Respiratory Society (ERS) Thoracic Oncology assembly were present and they were impressed with the sheer size of the NLCA dataset, 66,000 patients at that time, and the level of clinical detail that it contained. This meeting was the springboard for an ERS task force entitled 'European Initiative for Quality Management in Lung Cancer Care'. I was fortunate to be nominated as a co-chair for this group, and have been involved with two subsequent task forces. Over the past 7 years, I have helped to establish a network of 38 national representatives, specialists in lung cancer care from all disciplines although primarily respiratory physicians, representing countries across Europe, from Iceland to Turkey, and Portugal to Estonia. We have performed a number of surveys at national and local levels (350 individual centres/hospitals), trying to quantify healthcare infrastructure, the lung cancer pathway, and delivery of care across these 38 countries. In 2015, I conducted a survey looking at data collection for lung cancer across Europe. The results demonstrate a wide variation in current practice, from paper records with no survival analysis to large national datasets producing annual reports.

The NLCA is one of the best examples in Europe of a national patient-centred dataset specific to lung cancer. Several large European countries are unable to collect data at the national level, for example Spain, Italy and Switzerland. Other countries have a national dataset, but data completeness is low, below 70%; for example France, Greece, Moldova, Portugal, Romania, Serbia and Turkey. Many countries have electronic national data collection, but this is usually a cancer registry, which lacks the level of clinical detail that is vital for meaningful analyses. For example, in 2015 performance status was recorded in only 17 countries, smoking status in 15, comorbidity in 10 and socio-economic status in eight. Not only does the NLCA have more than 10 years of high-level data collection, but it has recently been linked with the SACT dataset and RTDS. This creates the opportunity to extract detailed clinical information about the patient pathway, and to link aspects of that with their outcomes, be that treatment related or overall survival, which will be incredibly powerful in terms of health service research.

Anna Rich, respiratory consultant, Nottingham University Hospitals NHS Trust

Patient story

Kathryn was diagnosed with lung cancer in January 2015. She has worked in the NHS as a physiotherapist and later as an executive director for nearly 30 years. She now holds a university professorship at Swansea University and has continued with the role of independent director with the FAW (Football Association of Wales).

I had gone for my usual weekend 10 km training run the day I went to accident and emergency. Later that day, one side of my face drooped, which of course prompted me to seek medical help; I thought it was a transient ischaemic attack / a mini-stroke, as the symptoms resolved completely. I had a series of scans and investigations and was diagnosed with stage IV lung cancer with brain and bone metastases. I had no obvious symptoms of lung cancer, no chest symptoms at all. The news was a complete shock. I have never smoked, have always been very fit, eaten well and have been a long-distance and marathon runner all my life. My diagnosis led to some hurtful conversations and people would comment 'well I never knew you smoked', even though I never have been a smoker. I think it is easy to be naïve to the risk of lung cancer.

After genomic sequencing confirmed that I had the spontaneous EGFR exon 19 deletion mutation, this enabled me to begin targeted drug therapy; in February 2015, I was put on afatinib. I responded really well to treatment and went into remission within a few months. I remained on afatinib until March 2017, when I started on osimertinib. I have found this an easier drug with fewer side effects; I credit my previous health and fitness in hugely supporting my ability to cope with treatment and tolerate the drugs. As new drugs are developed, we hope to see the side effects and toxicities lessen.

Having worked my whole career in the NHS as both a clinician and a director, I do feel informed and I am comfortable asking questions and I understand the clinical 'jargon'. For others, the system maybe more intimidating and they may sometimes find asking questions difficult or uncomfortable, but I feel there has been a shift towards doctors welcoming patient questions and discussion.

The lung cancer nurse specialists are an absolutely crucial guide to the pathway and the ones I have encountered myself have been really wonderful. Credit should be given to the whole team and I would also like to commend my oncologist. I can always contact him and no question is too silly or irrelevant, and he has gone above and beyond to care for his patients.

After I was diagnosed, I was asked to be the chairperson of the Lung Cancer Initiative Prehabilitation and Optimisation Programme Board, which is funded by the Welsh Government's Cancer Improvement Group. The aim of this programme is to improve survival rates and care for people with lung cancer; using representatives from across the MDT, we aim to increase the number of patients who are in the optimal state of health before they start treatment, both curative and palliative. I am pleased to be leading this programme to help make a difference to the care given to all patients.

NLCA additional work programme activities

The NLCA has a number of additional workstreams, outlined below, to maximise use of the data to support clinical teams with improving care for patients.

Quality improvement

In 2017, the NLCA team hosted two successful workshops in London and Leeds to introduce quality improvement tools and techniques to lung cancer teams. Approximately 65 delegates attended each workshop and teams heard from the UK Lung Cancer Coalition on their strategy for achieving 25% 5-year survival by 2025, as well as the key features of the new National Optimal Lung Cancer Pathway (part of the new commissioning guidance) and an update on work to improve earlier diagnosis.

Delegates worked in teams to take part in process mapping and root cause analysis exercises; this was followed by a more detailed look into organisational dynamics and plan–do–study–act (PDSA) cycles. Local teams were invited to present and share their own improvement projects.

Alongside this, the NLCA clinical leads visited six cancer networks in 2017, presenting data and sharing improvement examples.

Spotlight audit: reviewing variation in patients offered surgery

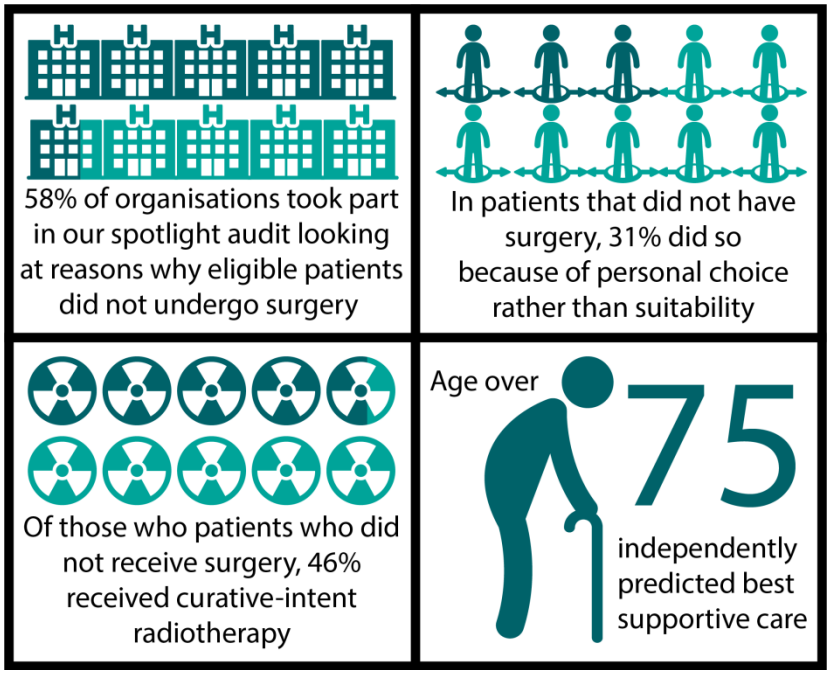
Data from patients first diagnosed in 2015 demonstrated that the proportion of patients with early-stage disease undergoing surgery was 58%. In August 2017, the NLCA ran its first quality improvement spotlight audit for all trusts in England to understand why this radical treatment rate was low and whether national guidelines for assessment of early-stage lung cancer were being adhered to. Here we share our initial findings.

Results

Of the 142 trusts in England, 82 took part in the spotlight audit. 2,163 patient records were included and we received datasets on 891 (41%) patients. After excluding 19 patients who underwent surgery and had incomplete records, 775 patient data were analysed. 516 (67%) patients were stage I and 255 (33%) stage II and in 57 cases the stage was missing. Of the 775 patients, 358 (46 %) received SABR or radical radiotherapy (including CHART). 354 (46 %) patients received best supportive care only, despite having early stage disease and good performance status. As expected, age over 75 independently predicted best supportive care rather than anticancer treatment, even after other factors associated with age (such as co-morbidity and PS) are taken into account.

Of the 755 patients not receiving surgery, 17 patients (2%) had a second surgical opinion, 14% had a cardiopulmonary exercise test, 34% had an echocardiogram and 11% had a V/Q scan. Very few patients had thoracoscore assessed (15 patients), a shuttle walk test (52 patients) or a formal cardiac risk assessed (four patients).

An analysis comparing survival in patients undergoing SABR, conventional radical radiotherapy and best supportive care was also carried out. The 1-year survival for patients having best supportive care only was 37%, for SABR it was 67%, for radical radiotherapy it was 45% and for those undergoing palliative radiotherapy, 27% of patients were alive at 1 year. Survival was adjusted for age, PS, stage, deprivation index and comorbidity index (ACE-27). Importantly, this showed that SABR and radical radiotherapy both improved survival compared with best supportive care in these patients.



Commentary

While the final response rate was low at 41%, to our knowledge this study of 755 patients is the largest to date to examine patients with operable disease who did not undergo surgery. It is reassuring that approximately half of this cohort did undergo SABR or other radical radiotherapy. A novel finding is that 31% of these patients did not have surgery owing to patient choice and, of these, 66% preferred SABR or other radical radiotherapy, while the remainder elected for no treatment. We plan to link these data with the organisational audit and lung CNS data to further understand factors behind patient choice.

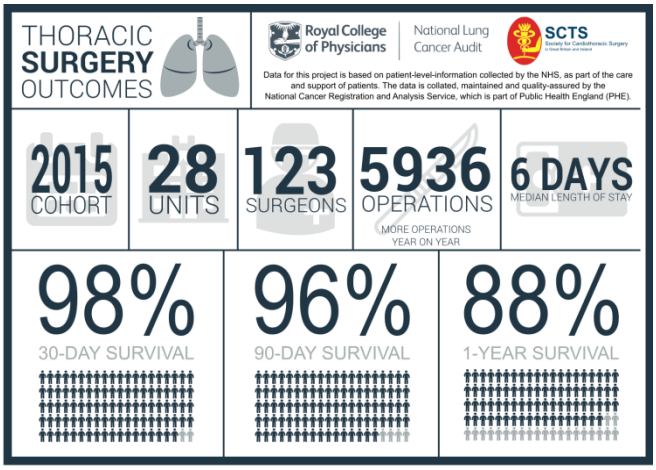
The audit has also identified that guidelines for radical treatment are poorly adhered to, with few patients having a second surgical opinion and detailed physiological testing. This may reflect the necessity to achieve treatment timelines or lack of knowledge of the guidance. We hope that these data will highlight to MDTs that, when radical radiotherapy or SABR is not an option, more patients could be undergoing further detailed assessment before excluding surgery.

Figure 2: Word cloud of free-text responses from the spotlight audit

Lung Cancer Clinical Outcomes Publication 2017

The Lung Cancer Clinical Outcomes (LCCOP) workstream looks at patients undergoing curative lung cancer surgery in the NHS in England.

This, the fourth year of reporting, sees some important improvements to this project.



Survival outcomes have been expanded to include adjusted survival at 1 year after surgery. It is likely that many factors – and not just the quality of surgical care – contribute, but we believe that long-term outcomes are important to patients, and therefore should be published.

We continue to report 30- and 90-day survival rates, and this year we have added the resection rates of MDTs to the LCCOP reports for surgical teams. Higher resection rates have been associated with better population-based survival, and we think that a balanced assessment of surgical quality includes the resection rates that a team achieves.

Knowing more about the kind of surgery performed, and not just the results achieved, and its variation may help teams to improve. Last year we added length of stay data, and this year we included information on outcomes after open, thoracoscopic (camera-based or keyhole) and robotic lobectomy, which is the commonest lung cancer operation.

Survival remains high, and we see consistent results across the country, with no alarm-level perioperative outliers again this year. The quality of NHS lung cancer surgery is high. In developing LCCOP, we try to report the data that matter to patients and families, but also which will help surgical teams to further improve their outcomes.

The data for this work are available on NHS Choices, My NHS and SCTS.org.

Key recommendations and plans for 2018 onwards

2018 audit measures

The NLCA has worked with key stakeholders to set the new audit standards for 2018, with alignment to the new commissioning guidance. We will choose the measures against which we will report outlier status based on discussion and feedback.

Audit measure	New standard
Valid performance status (PS) and stage	***≥90%***
Patients with stage I–II and PS 0–1, completeness for FEV1 and FEV1%	***>75%***
Proportion of patients seen by lung CNS	***≥90%***
Proportion of patients where lung CNS present for diagnosis	***≥80%***
Proportion of patients with pathological confirmation of lung cancer for stage I–II and PS 0–1	***≥90%***
Proportion of patients with pathological confirmation of lung cancer with PS 0–2	***≥80%***
Proportion of patients where the pathology code is NSCLC-NOS	***<15%***
Proportion of patients receiving PET-CTscan before surgery or radical radiotherapy	***≥90%***
Proportion of patients receiving anticancer treatment	***>60%***
Proportion of patients with PS 0–1 having anticancer treatment	***>80%***
Proportion of patients with NSCLC undergoing surgery	***>17%***
Proportion of NSCLC stage IIIB/IV and PS 0–1 who get systemic anticancer treatment	***>65%***
Proportion of SCLC patients receiving chemotherapy	***>70%***
Proportion of patients receiving chemotherapy for SCLC starting treatment within 2 weeks of pathological diagnosis	***≥80%***
Proportion of patients with stage I–II NSCLC and PS 0–2 receiving treatment with curative intent	***>80%***

Plans for 2018 onwards

Quality improvement

Starting this year, the NLCA has produced bespoke reports for lung cancer teams to share the headline results and identify key areas for improvement. Mid-year reports will be available for trusts in England.

Following the successful workshops in 2017, the NCLA team plans to develop virtual collaboratives to bring together lung cancer teams to share examples of improvement and provide peer-to-peer support. The NLCA will aim to host webinars as well as sharing QI tools and materials.

The NLCA clinical leads will continue to visit cancer networks; however, the focus will shift towards supporting those organisations identified in this year's results as outliers.

The second quality improvement spotlight audit will launch in mid-2018 for trusts in England, and will focus on molecular testing in patients with advanced disease.

Lung Cancer Clinical Outcomes Publication

The NLCA will continue to deliver the LCCOP workstream for surgical operations performed in England in partnership with SCTS. The fifth annual report (for the 2016 cohort) will launch at the end of 2018.

National Mesothelioma Audit (funded by Mesothelioma UK)

In March 2018, the NLCA team will publish the third National Mesothelioma Audit report.

Glossary

ALK	Anaplastic lymphoma kinase mutations
Anticancer treatment (active treatment)	a term used to define treatments for lung cancer that have an effect on the tumour itself, not just on symptoms. In lung cancer patients, these are most often surgery, SACT, radiotherapy or a combination of these
Biologic treatment	medicines used in the treatment of cancer, often directed against a specific molecular target in the cancer
Bronchoscopy	a procedure for examining the airways by inserting an instrument (bronchoscope) into the trachea and lungs via the nose or mouth. This enables a small piece of lung tissue to be removed for pathological diagnosis (***bronchial biopsy***)
Casemix adjustment	a statistical method of comparing quality of care between organisations that takes into account important and measurable patient characteristics, for example age, sex, disease stage, social deprivation and general health
CHART	continuous hyperfractionated accelerated radiotherapy: a radiotherapy regimen that involves giving many small doses of radiation in a short period of time
Comorbidity	medical condition(s) or disease process(es) that are additional to the disease under investigation (in this case, lung cancer). In the NLCA, this is recorded when a comorbidity restricts the type of treatment that can be given for lung cancer
COSD	the Cancer Outcomes and Services Dataset (COSD) is the national standard for reporting on cancer in the NHS in England. Trusts submit a data file to the National Cancer Registration and Analysis Service (NCRAS) every month
CT scan	the abbreviated term for computerised tomography. These tests produce detailed images of the body using X-ray images that are enhanced by a computer
EBUS	Endobronchial ultrasound, a minimally invasive method of diagnosing lung cancer similar to a bronchoscopy but allows for tissue samples to be removed with the same instrument
EGFR	epidermal growth factor receptor, a protein on the surface of cells
FEV1	a measurement of lung capacity used by doctors to determine how healthy a patient's lungs are, and can be measured as an absolute amount or as a percentage predicted
HES data	Hospital Episode Statistics. These include information relating to the patient, as well as clinical information about the diagnosis and dates of admission and discharge
Histologic subtyping	distinguishing between different subtypes of cancer at the cell level
Immunotherapy	systemic treatments that boost the immune system to fight cancer
Lobectomy	removal of one lobe of the lung. This is the commonest type of lung cancer operation
Mesothelioma	cancer of the lining of the lung (pleura), caused by exposure to asbestos
Molecular testing	identifying specific genetic abnormalities in a cancer to guide treatment
NCRAS	the National Cancer Registration and Analysis Service (NCRAS) is part of Public Health England and is responsible for all cancer registration in England
Non-small-cell lung cancer (NSCLC)	a group of types of lung cancer sharing certain characteristics, which makes up 85–90% of all lung cancers. Includes squamous carcinoma and adenocarcinoma
NOS	not otherwise specified. In the case of ***NSCLC*** histology, this implies that the pathological diagnosis has not been subclassified to a particular cell type, eg squamous carcinoma, adenocarcinoma

Organisational audit	a snapshot audit that looks at an organisation's staffing levels and the level of patient access to diagnostics and types of treatment
Outlier	a trust whose result for a certain measure lie either two (alert level) or three (alarm level) standard deviations from the mean, national, result
Pathological diagnosis	refers to a diagnosis of cancer based on pathological examination of a tissue (histology) or fluid (cytology), as opposed to a diagnosis based on clinical assessment or non-pathological investigation (eg ***CT scan***)
PAS data	Patient Administration System. This records the patient's interaction with a hospital, including appointment bookings and waiting time
Pathway	refers to the process of care that a patient experiences, from the point of diagnosis through to and following treatment
Performance status (PS)	a systematic method of recording the ability of an individual to undertake the tasks of normal daily life compared with that of a healthy person
PET-CT scan	a combined scan including a positron emission tomography (PET) scan and a ***CT scan*** to produce a three-dimensional image of the body
Pulmonary rehabilitation	a physical exercise programme, offered to patients with chronic lung disease, designed to improve a patient's breathlessness
Radiotherapy	the treatment of cancer using radiation, which is most often delivered by X-ray beams (external beam radiotherapy) but can be given internally (brachytherapy)
Radical treatment	***radical treatment rate*** refers to the proportion of patients who have had treatment with the intent to cure the patient of lung cancer
Resectability	in the consideration of surgical treatment of a lung cancer, refers to the ability of the tumour to be removed, taking into account its location and stage
Systemic anticancer therapy (SACT)	treatments for cancer given by mouth or injection, including chemotherapy, immunotherapy and biologic therapy
Stereotactic ablative body radiotherapy (SABR)	a modern radiotherapy delivery technique, designed to maximise the dose to the tumour and minimise side effects
Small-cell lung cancer (SCLC)	a subtype of lung cancer making up around 10–15% of all lung cancers. See also ***non-small-cell lung cancer***
Smoking cessation services	services offered by the NHS to help aid individuals to quit smoking. These include advisory sessions (group or one-on-one), nicotine replacement products and medication
Spotlight audit	an audit that focuses on a smaller cohort of patients to understand a specific issue in treatment or care
Squamous carcinoma	a subtype of non-small-cell lung cancer
Surgical resection	an operation to remove abnormal tissues or organs
TNM	Tumour Node Metastasis – an international standard system for describing the extent (stage) of a cancer
Tyrosine kinase inhibitors (TKIs)	targeted biologic treatments for cancer
Tertiary centres	hospitals that specialise in diagnosis and treatment of specific conditions, often handling very complex cases. Other hospitals may refer patients to these centres for specialist treatment

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