



National Lung Cancer Audit: Lung Cancer Clinical Outcome Publication 2017 (2015 data)

Analysis methods

Overall aim

The National Lung Cancer Audit has analysed five outcome measures for the 2015 data as below

- Number of operations for lung cancer
- Surgical unit based 30 day survival
- Surgical unit based 90 day survival
- Surgical unit based 1 year survival
- Median length of stay per surgical unit

Case-mix adjustment has been completed this year. We have adjusted our analyses for age, sex, performance status, co-morbidity, stage, lung function, laterality and socioeconomic status.

Collection and validation of Data

Data for surgical resections carried out at the 28 surgical units between 1 January and 31 December 2015 were extracted by Karen Linklater, National Cancer Registration and Analysis Service (NCRAS), from the cancer registry data. The data included all patients from England, as well as c139 patients from Wales, the Isle of Man, and the Channel Islands that underwent resections at the units. The cases for each unit were sent out securely by Sharon Almond, NCRAS to the units for validation. The units were given six weeks to validate the data, amend as required and include any additional resections they had carried out in 2015.



Reasons from Trusts for deletion:	Records
Duplicate surgery	488
Private patient	63
Surgery for metastases	34
No surgery performed or was abandoned	25
Surgery for diagnosis only or pre or post 2015	19
Not lung cancer or an unwanted morphology	20
No surgeon recorded	15
Palliative only	8
Patient not found at Trust	9
No reason given by the Trust	4
Total	685

Reasons added records not sent to the Trusts:	Records
Surgery missing or miscoded in incoming data	32
Duplicate of case already sent	28
For deletion as not malignant on Encore	19
Not registered on Encore	10
Procedure registered from a Trust not in the audit	9
Data miscoded in incoming COSD data	6
Operation not in required range	5
Data should have been sent and will be in future	5
Procedure for metastases	4
Diagnosis date and operation pre or post 2015	3
Sarcoma on Encore	3
No surgeon recorded	1
No NHS number recorded	1
Total	126

Upon return, the data were amalgamated, cleaned and quality assured. As well as hospital trusts excluding patients, the dataset was examined for other data cleaning issues. Other exclusion reasons were invalid or inconsistent identifier, surgery and diagnosis were in 2014, no valid surgery recorded, and records were duplicated. Where patients had multiple operations recorded (either on the same or different days) these were all included, identified by the same patient identifier.

An anonymised data extract was then produced containing all required data items and transferred to the analysis team at the University of Nottingham. From NCRAS, Karen Linklater, Eleanor Fitzgerald and Ruth Jack were involved in the extract.



Statistical analysis

The data were analysed in the Division of Epidemiology and Public Health at the University of Nottingham by Dr Aamir Khakwani and Prof Richard Hubbard. After a review of the available methods a decision was taken to follow the methodology suggested by Prof Spiegelhalter (Cambridge University)¹, with refinements made by Prof Eva Morris (University of Leeds). We are grateful to Prof Morris for the specific advice relating to this work.

There is no well-established risk adjustment model available for assessing the risks of lung cancer surgery. For this reason we have taken a standard approach by adjusting for likely important confounders. This is the same approach as would be used in the initial devising of a standardized risk adjustment model.

The dataset provided 5,939 observations for 5,846 patients with proven or presumed non-small cell lung cancer (NSCLC), carcinoids and small-cell lung cancer (SCLC) who underwent surgical resection between 1 January 2015 and 31 December 2015 in 28 surgical trusts in England.

Surgical operations were identified with the Office of Populations Census and Surveys Classification of Interventions and Procedures version 4 (OPCS-4) codes for each patient indicating thoracic surgical procedure with curative intent. The surgical procedures were categorised as 1) pneumonectomy, 2) lobectomy, including sleeve and bilobectomy, 3) sub-lobar resections, comprising segment and wedges, 4) complex resection and others. We excluded 3 observations for patients with multiple observations that had the date of death before date of surgery. The final cohort analysed consisted of 5,936 resection for 5,843 patients.

The proportion of patients alive at 30 days, 90 days and one year were calculated for each unit and compared to the average proportion of deaths for England as a whole. We then used multivariable logistic regression to control of the effects of age, sex, performance status, stage, laterality, co-morbidity (HES derived Charlson score), FEV 1 % and socioeconomic status. The findings are displayed graphically in our report using a combination of funnel plots and caterpillar plots with 2 & 3 standard deviations or 95% & 99.8% confidence intervals to allow identification of alert and alarm outliers.

¹ Spiegelhalter DJ. Funnel plots for comparing institutional performance. *Statist Med* 2005;24:1185-1202.



The analysed data were sent to units by the NLCA for one final check before submission to NHS Choices.

During local validation, 141 clinicians were identified as performing lung cancer surgery. The data was checked on return, and cross referenced to the online GMC register (www.gmc-uk.org).

6 duplicate entries were identified and merged.

A further 11 clinicians who had been identified as performing lung cancer surgery actually held specialist accreditation in another specialty on the GMC register, but not in cardiothoracic surgery. One further clinician was known to practice only cardiac surgery. These 13 clinicians had been credited with 17 cases in total (median 1 case per clinician), representing 0.3% of all the resections reported in LCCOP. 5 of these 13 clinicians were identified within one trust.

These appeared to be data entry errors which were not identified during local data validation, and this was confirmed by the local audit leads who responded to an email query.

These clinicians were removed, leaving 123 surgeons in the final report. The 17 cases originally attached to their names remain associated with the units involved, but not with an individual surgeon.

Summary

The NLCA has used standard statistical methods, in keeping with advice provided in the HQIP COP manual, to compare mortality between surgical units in England. Surgical units identified as a negative outlier at the alert (p value <0.025) and alarm ($p < 0.001$) will be notified.