BTS Audit of Quality in Endobronchial Ultrasound Pilot Audit Report 2024
Audit period: 1 March 2024- 30 June 2024
Data collection period: 1 October 2024- 31 January 2025
Audit leads: Dr Emma O'Dowd, Dr Haval Balata, Professor Matt Evison

Number of participating institutions and records submitted:
Part 1: 1859 records from 28 hospitals

Audit Rationale and Background

The principal purpose of the BTS 2024 Quality of Endobronchial Ultrasound (EBUS) pilot audit was to test a new audit dataset in preparation for a national audit in 2026.

The 2022 National Lung Cancer GIRFT Report made a total of 33 recommendations to deliver optimal outcomes for patients with lung cancer divided across 5 categories. Endobronchial Ultrasound is a cornerstone of lung cancer staging and diagnostics and features heavily within the GIRFT report within two sections: 'Making a rapid and precise diagnosis' and 'Improving data & information'[1].

The deep-dive data analysis within the lung cancer GIRFT process identified '***very marked and apparently unwarranted variation***' in the use of EBUS. This included evidence that '….*when EBUS took place, the quality of the procedure being carried out was sometimes suboptimal and focused on diagnosis where full systematic staging was needed. A full staging EBUS requires considerably more time and technical expertise as it necessitates sampling of multiple nodes, many of which will be small. These variations risk impacting on the outcome for the patient and may alter the ability to offer curative-intent treatment.'*

The following GIRFT recommendations were made in relation to EBUS:

- EBUS for lung cancer should be available within five calendar days of request
- Collect, analyse and publish an agreed EBUS dataset aligned to agreed performance metrics and standards.
- National bodies should explore the opportunity to collect, analyse and publish these data in order to highlight outliers and encourage sharing of best practice.

There are established national and international quality standards and key performance metrics for EBUS that apply to lung cancer diagnosis and staging, as well as to broader EBUS performance across all indications, including benign respiratory diseases. Given the identification of variation in performance, there is a need for performance monitoring and quality improvement against an established framework of audit standards, as offered by a BTS national audit. This would also represent an unprecedented opportunity to evaluate and benchmark a common respiratory diagnostic that has transformed bronchoscopy in the UK over the last decade, but has not been subject to any quality assurance processes on a national scale.

The audit standards are drawn from the following national and international sources:

- ✓ **2021 National GIRFT report for Lung Cancer (1)**
- ✓ **NICE 2019 guidelines NG12: Lung cancer Diagnosis & Management (2)**
- ✓ **National endobronchial ultrasound service specification (England) (3)**
- ✓ **World Association for Bronchology & Interventional Pulmonology – Quality indicators in performance of EBUS bronchoscopy 2023 (4)**

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Key Messages from the Pilot Audit

- EBUS data collection at scale is feasible, with 28 hospitals submitting nearly 1,900 procedures.
- Diagnostic sensitivity for lung cancer was high at 91%, but only 84% of cases provided adequate tissue for biomarker testing.
- Timeliness standards were not achieved: no Trust met the 5-day referral-to-procedure target for staging or diagnostic EBUS.
- Systematic staging was performed in 80% overall but with wide variation (0–100%) between hospitals; only 39% of services met minimum sensitivity standards for staging.
- 20% of staging EBUS lymph node samples were inadequate, highlighting a major gap in quality against the <10% standard.
- Use of rapid on-site cytology evaluation (ROSE) was rare (4%), contributing to inadequate yield.
- Performance in non-lung cancer conditions was mixed: strong for sarcoidosis and metastatic cancer, but poor for tuberculosis and lymphoma.
- Variation between centres across almost all metrics suggests inequity of access to high-quality EBUS services.

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Summary of Audit Standards

The following table summarises the pilot audit data against the standards listed on page 1. Results highlighted in green meet the standards, while those in red do not.

EBUS type	Audit standard	Source (Page 1)	Target	Results From Pilot Audit
All EBUS procedures	Incidence of procedures requiring premature termination due to tolerance	3	≤5%	5%
Staging EBUS	Procedure performed within 5 calendar days of referral	1	>85%	20%
	PET-CT completed prior to staging EBUS	2	>95%	83%
	Recording of sonographic appearances of lymph nodes within procedural report	3, 4	>95%	71%
	Overall proportion of lymph nodes sampled that were classified as 'inadequate' (<10%)	4	<10%	20%
	Evidence of Systematic approach - examination of all accessible lymph node stations N3, N2, N1 in ACCP group B & C	4	>95%	80%
	Sensitivity of staging EBUS	3,4	>85%	81%
	Negative predictive value of staging EBUS	3,4	>85%	86%
	Adequacy of tissue for complete biomarker testing in NSCLC	3,4	>90%	92%
	Proportion of cases where a repeat procedure is needed due to non-diagnostic procedure or insufficient tissue	3,4	<10%	13%
Diagnostic EBUS – lung cancer	Procedure performed within 5 calendar days of referral	1	85%	24%
	Sensitivity of diagnostic EBUS for diagnosis of lung cancer	3,4	>90%	91%
	Adequacy of tissue for complete biomarker testing in NSCLC	3,4	>90%	84%
	Proportion of cases where a repeat procedure is needed due to non-diagnostic procedure or insufficient tissue	3,4	<10%	9%
Diagnostic EBUS - Other	Sensitivity of diagnostic EBUS for diagnosis of sarcoidosis	4	>80%	89%
	Sensitivity of diagnostic EBUS for diagnosis of tuberculosis	4	>80%	77%
	Sensitivity of diagnostic EBUS for diagnosis of lymphoma	4	>65%	44%
	Sensitivity of diagnostic EBUS for diagnosis of extra-thoracic cancer	4	>85%	93%

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Aims and Objectives

The pilot audit had the following aims:

1. To test the BTS EBUS audit dataset in preparation for a future BTS national audit.
2. To assess compliance with audit standards for EBUS as found on Page 1.
3. To describe patient demographics, procedural outcomes, and key quality metrics.

This report outlines the results of the 2024 pilot audit in preparation for a proposed national audit in 2026.

Methods

The Pilot Audit

Hospitals were invited to participate in the pilot audit and 30 hospitals were selected, of which 28 completed the audit. Data were collected on all consecutive EBUS procedures performed at a hospital between 01/03/2024 and 30/06/2024. Data collection was divided into 4 sections, which were collected for each individual EBUS procedure:

Section 1: Patient demographics

Section 2: EBUS procedure data (all procedures)

Section 3: Staging EBUS outcomes (only applicable to staging EBUS procedures)

Section 4: Diagnostic EBUS outcomes (only applicable to diagnostic EBUS procedures)

Audit Standards

The following standards were audited drawn from the sources mentioned on page 1:

All EBUS procedures • Incidence of procedures requiring premature termination due to tolerance (≤5%)
Staging EBUS in suspected / confirmed lung cancer • Procedure performed within 5 calendar days of referral (target >85%) • PET-CT completed prior to staging EBUS (target >95%) • Recording of sonographic appearances of lymph nodes within procedural report (target >95%) • Overall proportion of lymph nodes sampled that were classified as 'inadequate' (<10%) • Evidence of Systematic approach - examination of all accessible lymph node stations N3, N2, N1 (ACCP group B & C >95%) • Sensitivity of staging EBUS (stratified according to prevalence of nodal metastases – Table 1) • Negative predictive value of staging EBUS (stratified according to prevalence of nodal metastases – Table 1)

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- Adequacy of tissue for complete biomarker testing in Non-Small Cell Lung Cancer (NSCLC) (>90% of eligible cases)
- Proportion of cases where a repeat procedure is needed due to non-diagnostic procedure or insufficient tissue (10%) **not where a second procedure is appropriately required for diagnosis e.g. CT guided lung biopsy after negative staging EBUS. This should only be recorded if a repeat procedure if it was needed because the first EBUS procedure failed to achieve its goal.*

Prevalence of nodal metastases in population undergoing EBUS	Audit standard for staging EBUS sensitivity	Audit standard for staging EBUS Negative Predictive Value
>80%	**>90%**	**>80%**
60-80%	**>88%**	**>80%**
40-60%	**>85%**	**>85%**
20-40%	**>80%**	**>90%**
<20%	**>75%**	**>92%**

Table 1: Prevalence of Nodal Metastases in EBUS Population

Diagnostic EBUS in suspected / confirmed advanced stage lung cancer

- Procedure performed within 5 calendar days of referral (target >85%)
- Sensitivity of diagnostic EBUS for diagnosis of lung cancer (>90%)
- Adequacy of tissue for complete biomarker testing in NSCLC (>90% of eligible cases)
- Proportion of cases where a repeat procedure is needed due to non-diagnostic procedure or insufficient tissue (10%)

Diagnostic EBUS (other)

- Sensitivity of diagnostic EBUS for diagnosis of sarcoidosis (>80%)
- Sensitivity of diagnostic EBUS for diagnosis of tuberculosis (>80%)
- Sensitivity of diagnostic EBUS for diagnosis of lymphoma (>65%)
- Sensitivity of diagnostic EBUS for diagnosis of extra-thoracic cancer (>85%)

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Participating sites

The following 28 hospitals participated in the pilot audit:

Institution	Trust
Antrim Area Hospital	Northern Health and Social Care Trust
Arrowe Park Hospital	Wirral University Teaching Hospital NHS Foundation Trust
Basildon University Hospital	Mid and South Essex NHS Foundations Trust
Bedford Hospital	Bedfordshire Hospitals NHS Foundation Trust
Blackpool Victoria Hospital	Blackpool Teaching Hospitals NHS Foundation Trust
Broomfield Hospital	Mid Essex Hospital Services NHS Trust
Castle Hill Hospital	Hull University Teaching Hospitals NHS Trust
Churchill Hospital	Oxford University Hospitals NHS Foundation Trust
Croydon University Hospital	Croydon Health Services NHS Trust
Derriford Hospital	University Hospitals Plymouth NHS Trust
Fairfield General Hospital	Northern Care Alliance NHS Foundation Trust
James Paget University Hospital	James Paget University Hospitals NHS Foundation Trust
Kent and Canterbury Hospital	East Kent Hospitals University NHS Foundation Trust
Liverpool Heart and Chest Hospital	Liverpool Heart and Chest Hospital NHS Foundation Trust
Manchester Royal Infirmary	Central Manchester University Hospitals NHS Foundation Trust
North Manchester General Hospital	Manchester University NHS Foundation Trust
Nottingham City Hospital	Nottingham University Hospitals NHS Trust
Princess Alexandra Hospital	The Princess Alexandra Hospital NHS Trust
Queen Elizabeth Hospital	The Queen Elizabeth Hospital King's Lynn NHS Foundation Trust
Queen Elizabeth Hospital - Birmingham	University Hospitals Birmingham NHS Foundation Trust
Royal Albert Edward Infirmary	Wrightington, Wigan and Leigh Teaching Hospitals NHS Foundation Trust
Royal Cornwall Hospital	Royal Cornwall Hospitals NHS Trust
Royal Preston Hospital	Lancashire Teaching Hospitals NHS Foundation Trust
Royal Stoke University Hospital	University Hospitals of North Midlands NHS Trust
Royal United Hospital	Royal United Hospitals Bath NHS Foundation Trust
The County Hospital	Wye Valley NHS Trust
Whiston Hospital	Mersey and West Lancashire Teaching Hospitals NHS Trust
Wythenshawe Hospital	Manchester University NHS Foundation Trust

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Table 2: Hospitals Participating in Pilot Audit

Findings

The following represents the main findings of the pilot audit, examining data on procedure numbers, patient demographics, indications, delivery method and performance against the audit standards. Data were collected from 28 hospitals from the period 01/03/2024 to 30/06/2024.

Procedure numbers and patient demographics

The number of consecutive EBUS procedures performed/records committed by the hospitals over the timeframe ranged from 7 to 186.

In total, records on 1859 procedures were submitted. Of these,1064 related to male patients (57%) and 795 to female patients (43%). Median age was 68 years (interquartile range (IQR) 59-75).

Clinical indication

Table 3 represents the clinical indication for EBUS reported by the clinicians for each record submitted.

Indication	Number	Percentage (%)
Diagnostic EBUS in suspected Lung cancer	577	31
Staging EBUS in suspected / confirmed lung cancer	614	33
Diagnostic EBUS – Isolated mediastinal / hilar lymphadenopathy (IMHL)	443	24
Diagnostic EBUS – Suspected metastases from an extra-thoracic cancer	139	7
Diagnostic EBUS – Other	73	4
Other (please specify)*	13	1

* Other- additional samples for NGS in lung cancer patients, suspected sarcoidosis

Table 3: Indication for EBUS

Method of delivery and available support

Examining the results regarding EBUS delivery and available support, the following was found. Almost all procedures (96%) used physician-led sedation. The majority (86%) of TBNA procedures were performed using 21G or 22G needle but only 4% of procedures had rapid on-site evaluation (ROSE) cytopathology available at the time of the procedure.

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Audit standards and results:

1. All EBUS procedures:

The audit standards for all EBUS procedures are presented in Table 4.

Standard	Audit Target	Audit Result Overall (N= 1859)	Number Of Hospitals Achieving Target
Incidence of procedures requiring premature termination due to tolerance	≤ 5%	5%	14/28 (50%)

Table 4: Audit Standards for All EBUS Procedures

The audit standard for incidence of procedures requiring premature termination is ≤5%, which was met throughout the dataset as the overall audit result had a 5% early termination rate (Table 4). However, technically only 50% of hospitals met this ≤5% premature termination rate individually, with hospitals exceeding this rate ranging from 6%-15% of total cases requiring early termination.

2. Staging EBUS In Suspected / Confirmed Lung Cancer

Data on staging EBUS were submitted by 26 of 28 hospitals. The number of staging EBUS procedures submitted per hospital ranged from 1 to 83. One way of categorising patient scans based on CT scan appearances, is by using the American College of Chest Physicians (ACCP)[4] radiographic group descriptions. This is divided into 4 groups, as detailed in Table 5.

Group	Description	Definition (By Chest CT Scan)
A	Mediastinal infiltration	Tumour mass within the mediastinum such that discrete lymph nodes cannot be distinguished or measured
B	Enlarged discrete mediastinal nodes	Discrete mediastinal nodes ≥ 1 cm in short-axis diameter on a transverse CT image
C	Clinical stage II or central stage I tumour	Normal mediastinal nodes (< 1 cm) but enlarged N1 nodes (≥ 1 cm) or a central tumour (within proximal one-third of the hemithorax)
D	Peripheral clinical stage I tumour	Normal mediastinal and N1 nodes (< 1 cm) and a peripheral tumour (within outer two-thirds of hemithorax)

Table 5: ACCP Radiographic Group Description

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Figure 1 summarises the proportion of procedures that were performed by ACCP category. Almost two-thirds (64%) of procedures were in the Group B and C category.

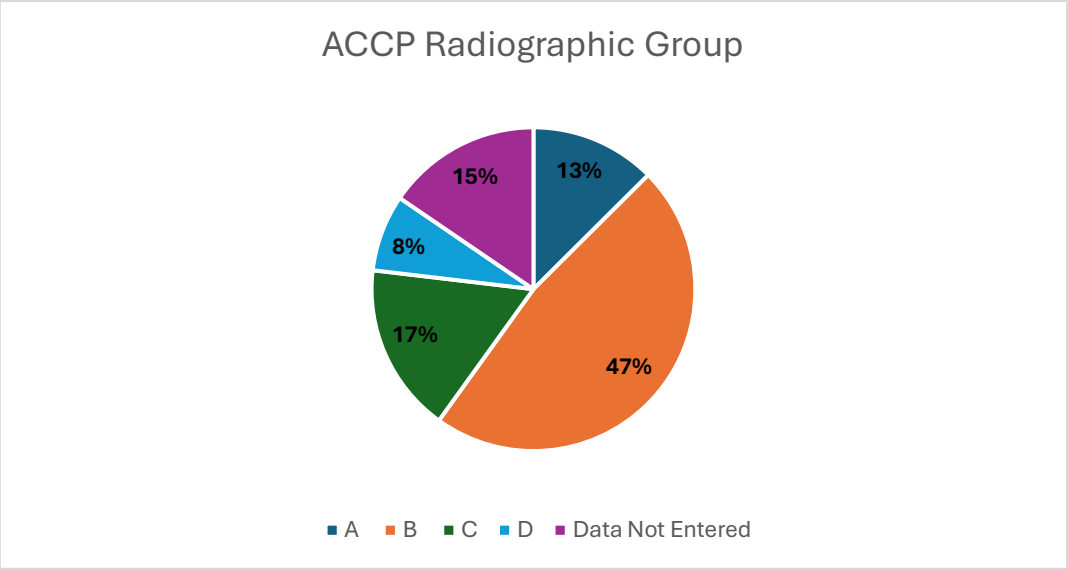

Figure 1: Proportion of Procedures by ACCP Radiographic Group

There are also two systematic nodal staging techniques that can be used to stage the mediastinum in lung cancer, alongside a more targeted staging approach. The majority (60%) used the systematic staging technique recommended by ESTS/ERS[5]. and only 6% employed targeted staging. The different approaches employed are summarised below in Table 6.

Staging/Sampling Technique Used During EBUS	**Number (N= 614)**	**Proportion**
Systematic staging procedure examining all accessible N3, N2 and N1 lymph node stations & sampling of any lymph node >5mm (ESTS/ERS recommendations)	371	60%
Systematic staging procedure examining all accessible N3, N2 and N1 lymph node stations & sampling of any lymph node abnormal on CT, PET, USS (NICE recommendations)	122	20%
Targeted staging where only lymph nodes abnormal on CT/PET examined & sampled	36	6%
EBUS report does not provide this information	85	14%

Table 6: Staging technique Used During EBUS Procedure

In relation to time from referral to staging EBUS, the median was 11 days (IQR 9-15 days) and no hospital met the audit target of > 85% (Table 7).

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Standard	Audit target	Audit result overall (N= 614)	Number of hospitals achieving the target
Procedure performed within 5 calendar days of referral	>85%	20%	0/26 (0%)
PET-CT completed prior to staging EBUS	> 95%	83%	9/26 (35%)
Recording of sonographic appearances of lymph nodes within procedural report	> 95%	71%	10/26 (38%)
Evidence of Systematic approach - examination of all accessible lymph node stations N3, N2, N1	ACCP group B & C > 95%	80%	14/ 26 (54%)
Overall proportion of lymph nodes sampled that were classified as 'inadequate'	< 10%	20%	N/A

Table 7: Audit standards For Staging EBUS Procedures

Examining PET scans performed before EBUS, although overall the PET target was not met, there was wide variability between different hospitals- range 20%- 100% (Figure 2).

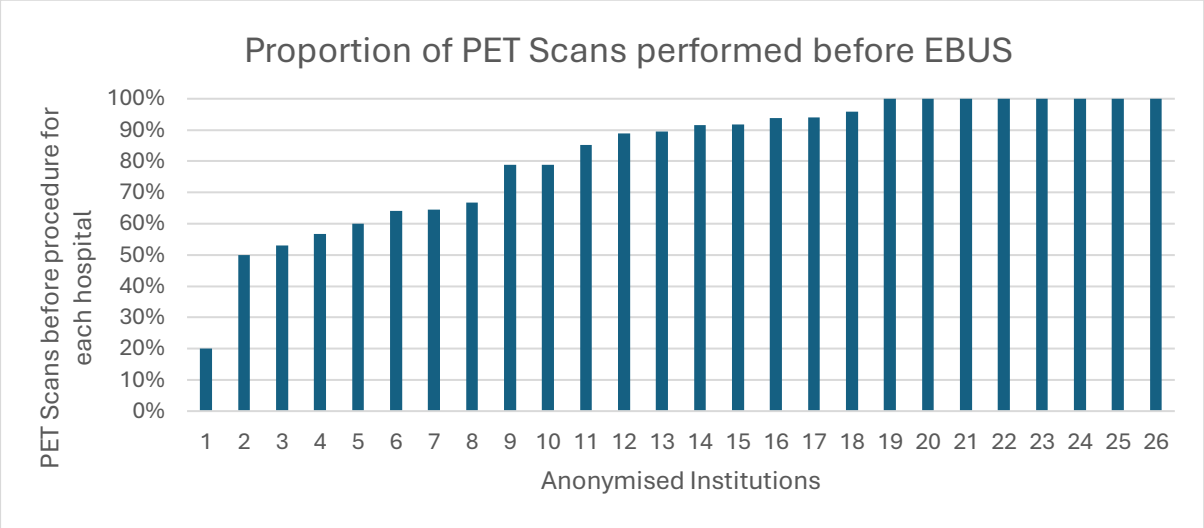

Figure 2: Proportion of PET Scans Performed Before EBUS Procedure

It is recommended that a systematic approach is documented and used for staging EBUS, but this was very variable between hospitals (range 0%- 100%) and overall this audit standard was not met (Table 7 and Figure 3).

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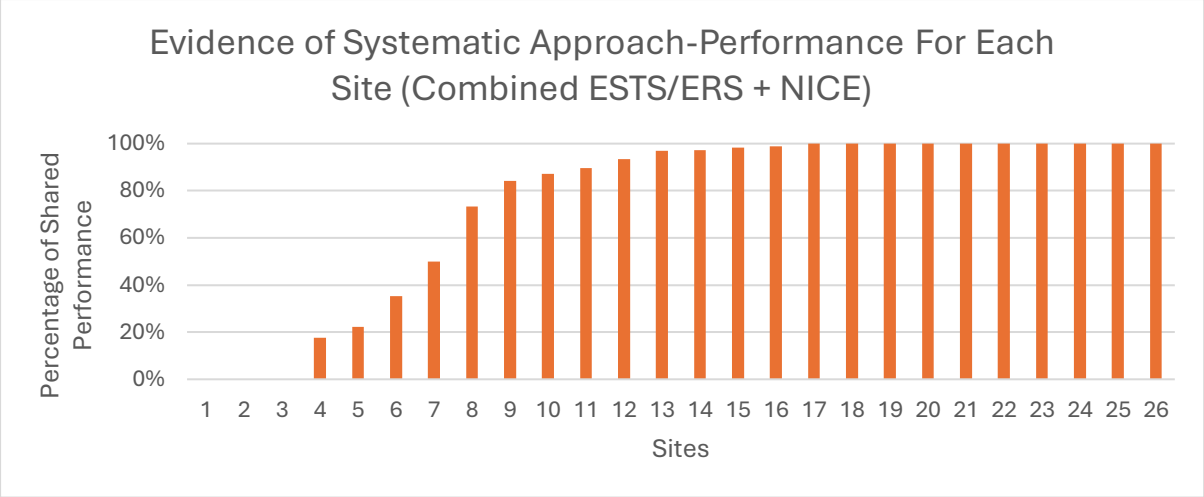

Figure 3: Evidence of Systematic Staging Performed by Site

The final nodal staging according to the EBUS pathology result was collected (Figure 4) and this was compared to the final confirmed nodal staging for each patient (Figure 5). Where verification method was recorded, method of confirmation of this nodal staging was either minimum of 3 months clinicoradiological follow-up (41%) or intraoperative nodal staging (17%). For 22% of records however a final confirmation of nodal status was not available (Figure 6).

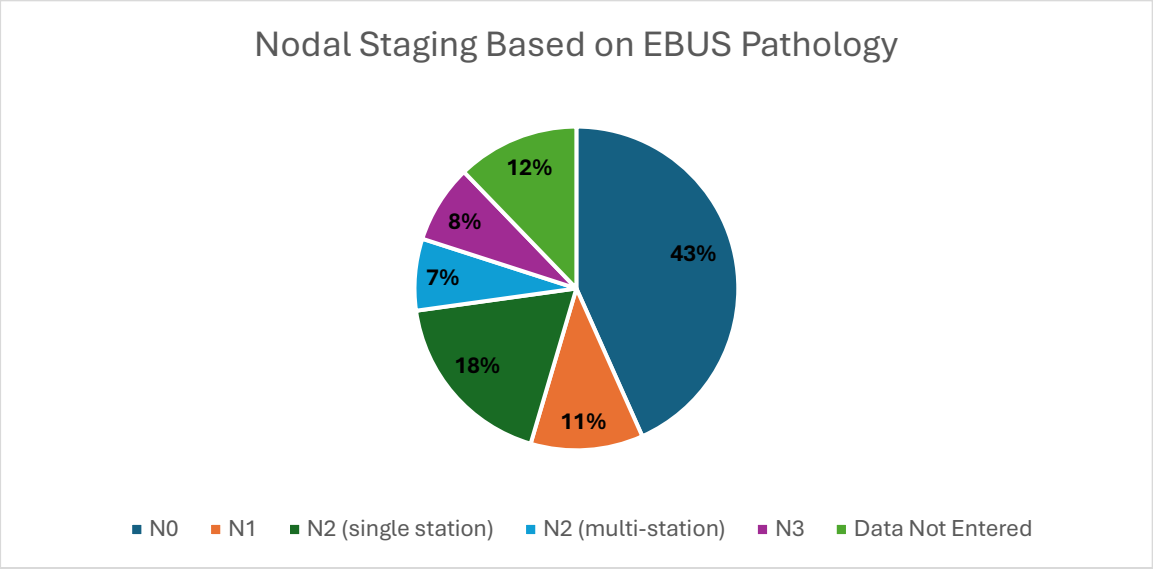

Figure 4: Nodal Staging Based on EBUS Result

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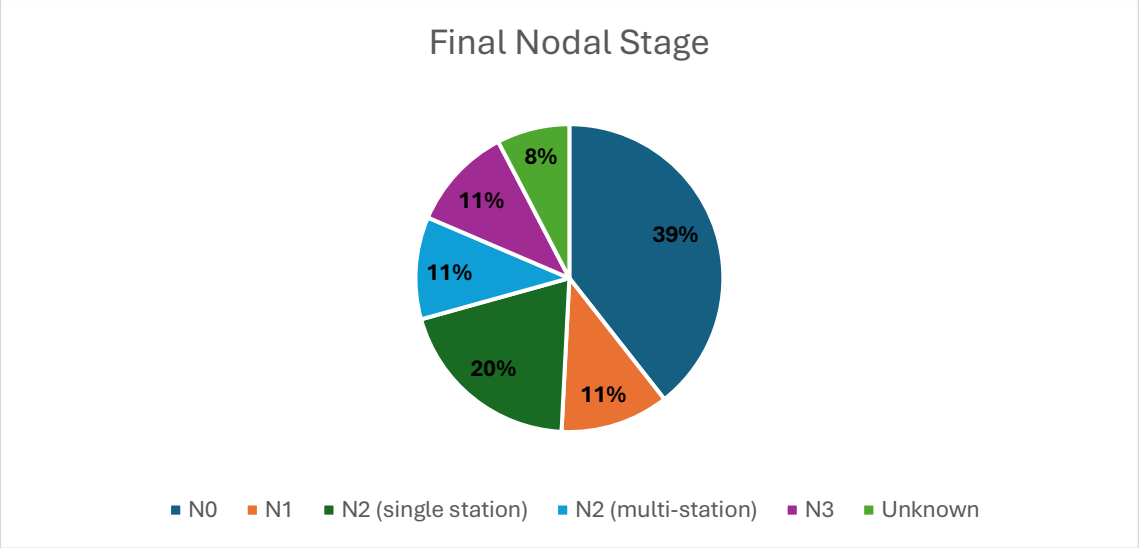

Figure 5: Final Confirmed Nodal Staging

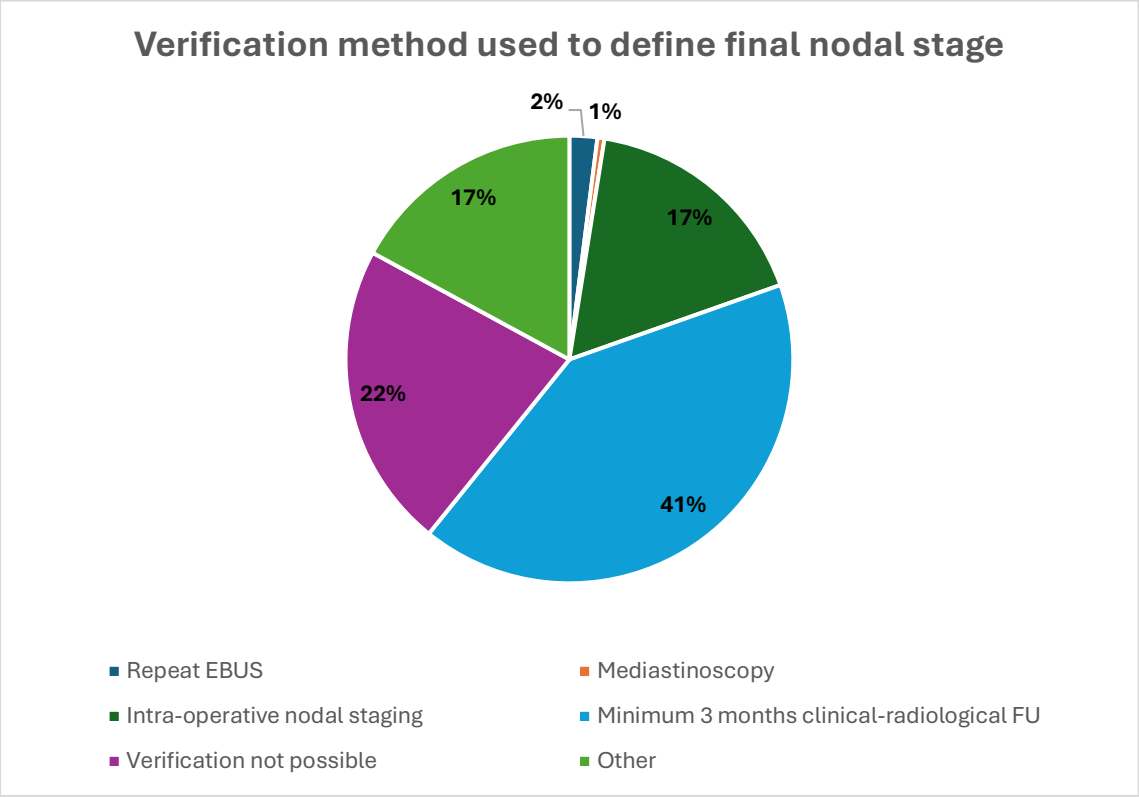

Figure 6: Verification Method for Final Nodal Staging

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Sensitivity and Negative Predictive Value (NPV) of Staging EBUS

The minimum standard for sensitivity and NPV is determined by the prevalence of nodal metastases in the population undergoing EBUS. Eight hospitals were excluded as the number of submissions were below 10, questioning the accuracy of the results. This ranged from 24% to 100% across the centres submitting staging EBUS data.

Sensitivity of Staging EBUS

- Across the pilot audit the sensitivity of staging EBUS was 81% (with a prevalence of nodal metastases of 53% and a minimum standard of 85%)
- 7/18 (39%) of EBUS services achieved the minimum standard for sensitivity on staging EBUS

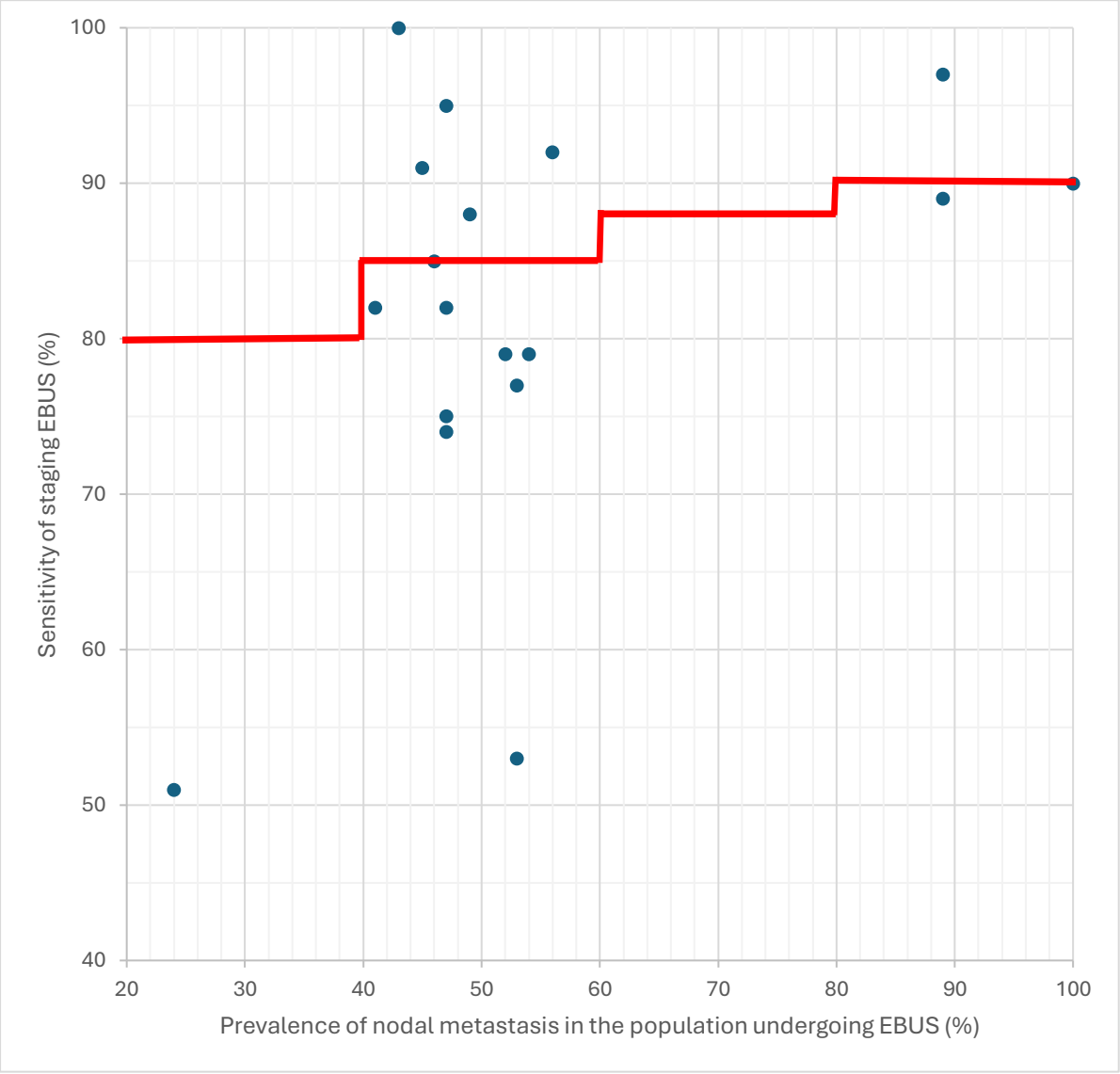

Figure 7: Sensitivity of Staging EBUS

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Negative Predictive Value Of Staging EBUS

- Across the pilot audit the NPV of staging EBUS was 86% (with a prevalence of nodal metastases of 53% and a minimum standard of 85%)
- 10/18 (56%) of EBUS services achieved the minimum standard for NPV on staging EBUS

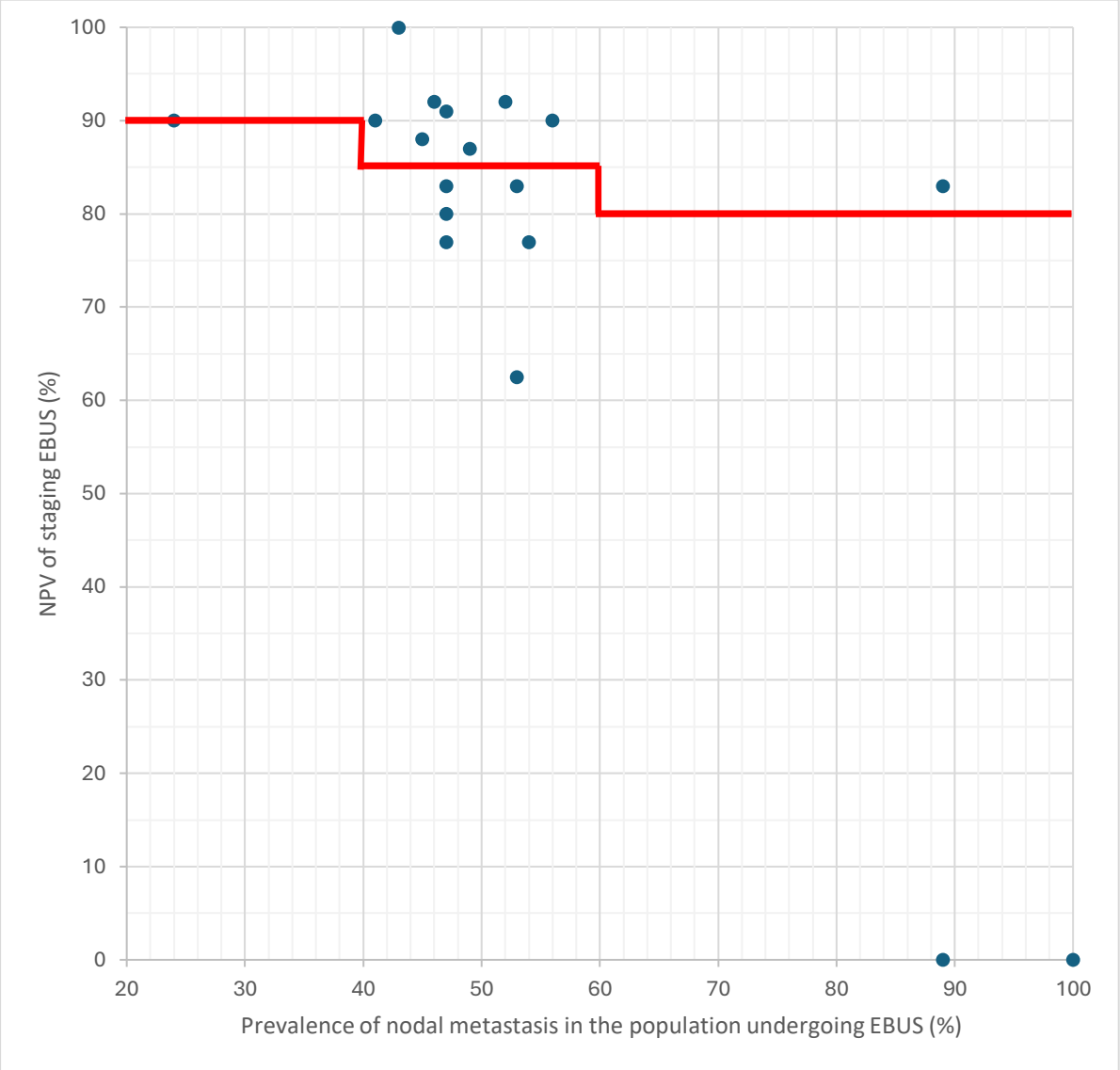

Figure 8: Negative Predictive Value Of Staging EBUS

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3. Diagnostic EBUS In Suspected / Confirmed Advanced Stage Lung Cancer

There were data on 577 procedures that were performed for suspected or confirmed lung cancer, but in only 455 (79%) was lung cancer the final diagnosis. Table 8 provides an overview of the lung cancer diagnoses from EBUS, stratified by histological subtype.

Lung Cancer	EBUS Positive Diagnosis (N= 413)	Final Diagnosis (N= 455)	Proportion Diagnosed Via EBUS
Non-Small Cell Lung Cancer – Adenocarcinoma	175	198	88%
Non-Small Cell Lung Cancer – Squamous Cell Carcinoma	102	116	88%
Non-Small Cell Lung Cancer – Not Otherwise Specified (NOS)/ other	42	43	98%
Small cell lung cancer	88	91	97%
Bronchopulmonary carcinoid tumour/ neuroendocrine	6	7	86%

Table 8: Lung Cancer Diagnosis According to Histological Subtype

Table 9 summarises the key audit standards for diagnostic EBUS in suspected/ confirmed lung cancer. No hospital achieved the target of > 85% of EBUS procedures performed within 5 calendar days of referral. Overall, the sensitivity of EBUS for lung cancer diagnosis exceeded the audit target of 91%, but only 84% of cases had sufficient tissue to enable full biomarker testing to take place. Despite this, only 9% overall required a repeat procedure, which was in line with the audit target of <= 10%.

Standard	Audit Target	Audit Result Overall	Number Of Hospitals Achieving the Target
Procedure performed within 5 calendar days of referral (N= 577)	>85%	24%	0/28 (0%)
Sensitivity of diagnostic EBUS for diagnosis of lung cancer (N=455)	> 90%	91%	23/28 (82%)
Adequacy of tissue for complete biomarker testing in NSCLC (N= 455)	> 90% of eligible cases	84%	13/28 (46%)
Proportion of cases where a repeat procedure is needed due to non-diagnostic procedure or insufficient tissue (N= 455)	<=10%	9%	13/28 (46%)

Table 9: Audit Standards For Diagnostic EBUS In Suspected/ Confirmed Lung Cancer

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4. Diagnostic EBUS (Other)

Table 10 summarises the results overall for the audit standards regarding the sensitivity of diagnostic EBUS for non-lung cancer causes. Due to small numbers for some of the diagnoses, this is not provided by hospital.

Standard	Audit target	Audit result overall
Sensitivity of diagnostic EBUS for diagnosis of sarcoidosis (N= 243)	>80%	89%
Sensitivity of diagnostic EBUS for diagnosis of tuberculosis (N= 44)	> 80%	77%
Sensitivity of diagnostic EBUS for diagnosis of lymphoma (N= 36)	> 65%	44%
Sensitivity of diagnostic EBUS for diagnosis of extra-thoracic cancer (N= 87)	> 85%	93%

Table 10: Audit Standards for Diagnostic EBUS (Other)

Audit standards were met for diagnosis of sarcoidosis and extra-thoracic malignancy, but not for tuberculosis and lymphoma.

Conclusions

This pilot audit confirms that national quality assurance for EBUS is both feasible and necessary. The dataset captured almost 1,900 procedures across 28 hospitals, providing the first UK-wide benchmarking of this service.

The audit identified clear strengths, including universal documentation of indication and high diagnostic sensitivity for lung cancer. However, important shortcomings were observed: timeliness standards were not met at any centre, one in five lymph node samples for staging EBUS were inadequate, and systematic staging was inconsistently performed or documented. Sensitivity and NPV standards for staging EBUS were achieved by fewer than half of services.

Marked variation between centres highlights inequities in access to high-quality EBUS. Limited use of ROSE, under-documentation of staging approaches, and insufficient adequacy for biomarker testing further indicate gaps in practice. Diagnostic performance for non-lung cancer conditions also reflected known limitations, with poor sensitivity for tuberculosis and lymphoma.

The findings underline the need for a full national BTS audit in 2026 to benchmark services, identify outliers, and promote best practice. Improving timeliness, tissue adequacy, systematic staging, and equity of provision will be critical to ensure that all patients benefit equally from high-quality EBUS.

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