# Lung Biopsy Management in the era of Personalised Molecular Medicine
## - MSc Biomedical Science (online) Project

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# About Me

- BSc (Hons) Biomedical Science, Abertay University - July 2016

- Trainee Specialist Biomedical Scientist, Department of Pathology, Ninewells - July 2016

- Specialist Diploma; Cellular Pathology, Specialist Biomedical Scientist – May 2018

- MSc Biomedical Science (online), University of Greenwich – July 2021

- Senior Biomedical Scientist, Department of Pathology, Ninewells – November 2021

# UK Lung Cancer Statistics
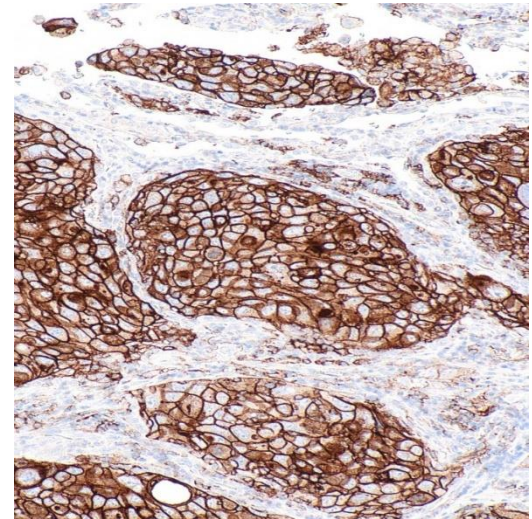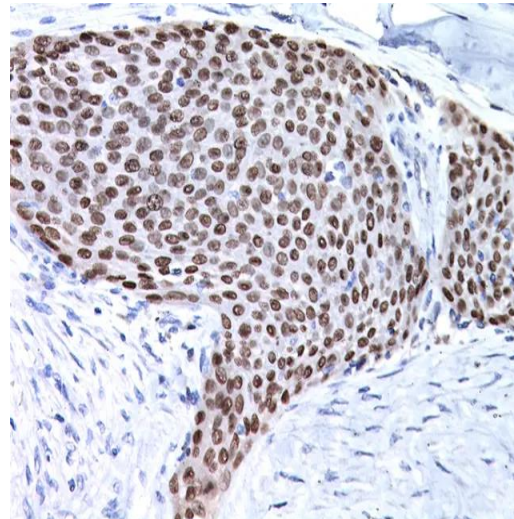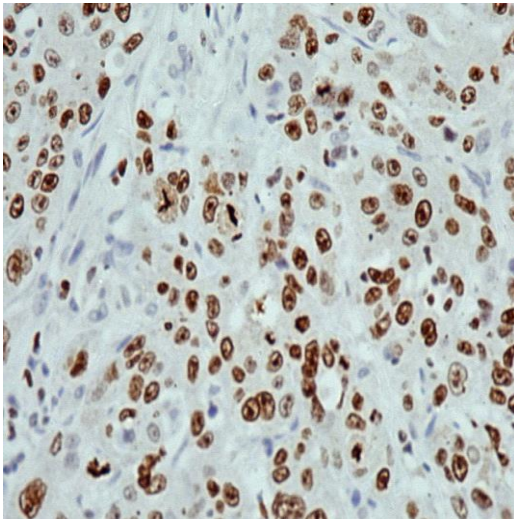
**Third** most common type of cancer

**Most** common cause of cancer death (24.6% in Scotland)

**EARLY** diagnosis: 57% survival rate (5 years)

**LATE** diagnosis: 3% survival rate (5 years)

# Background

• Ability to identify pulmonary predictive biomarkers that classify lung tumours

• The presence or absence of these biomarkers allows suitable, targeted treatments to be identified
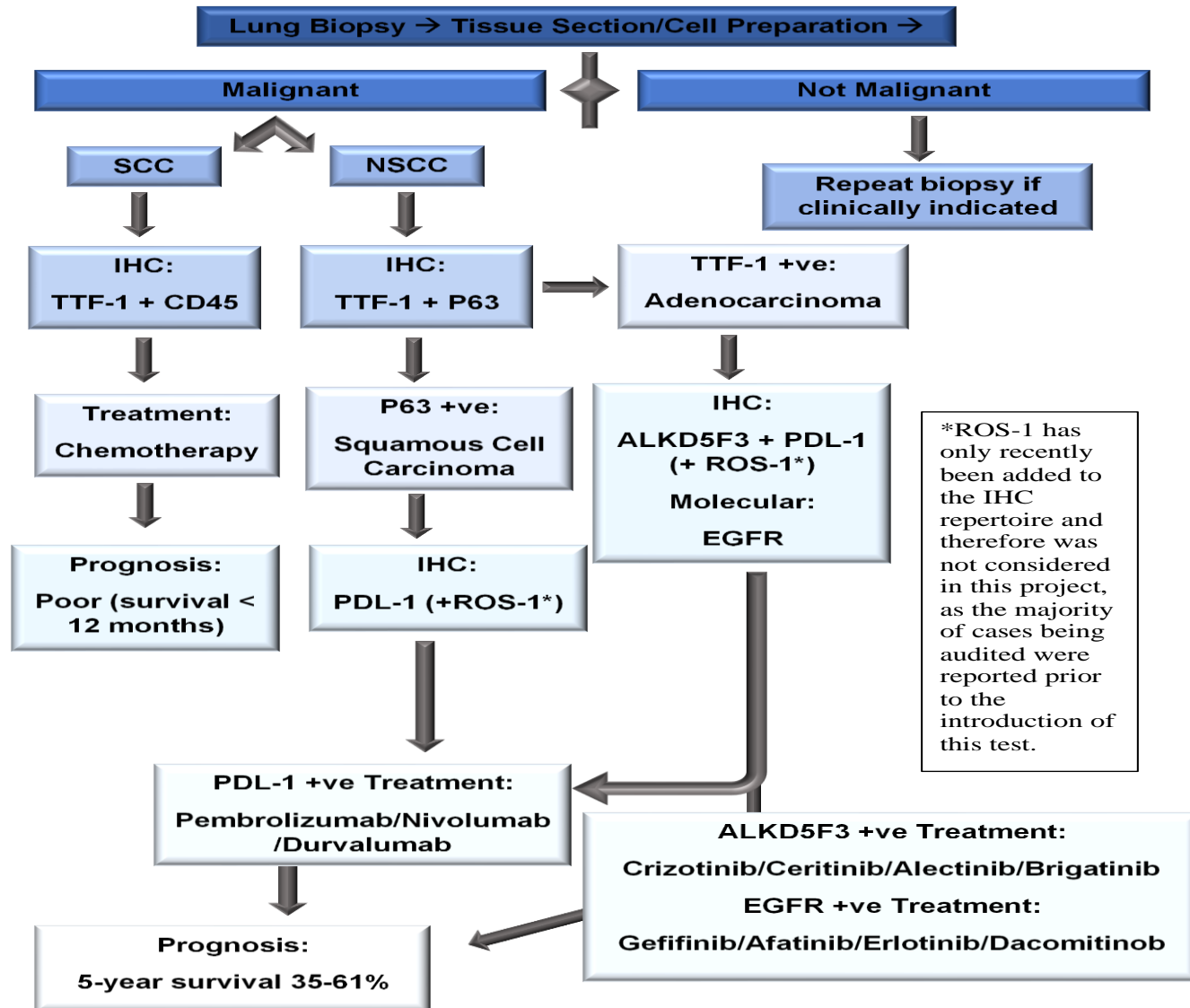
# Background

• Efficient management of lung biopsies is essential to be able to conduct all necessary tests

• Quick TAT is critical in lung cancer diagnosis in order to optimise clinical outcome

**GMCA** GREATER MANCHESTER COMBINED AUTHORITY

"Approximately 100 lives per year can be saved by shortening TAT"

# Lung Sample Testing Protocols

**Testing Protocol**



Lung Biopsy → Tissue Section/Cell Preparation →

**Malignant** / **Not Malignant**

- SCC
- NSCC
- Repeat biopsy if clinically indicated

IHC: TTF-1 + CD45

IHC: TTF-1 + P63 → TTF-1 +ve: Adenocarcinoma

Treatment: Chemotherapy

P63 +ve: Squamous Cell Carcinoma

IHC: ALKD5F3 + PDL-1 (+ ROS-1*) Molecular: EGFR

Prognosis: Poor (survival < 12 months)

IHC: PDL-1 (+ROS-1*)

*ROS-1 has only recently been added to the IHC repertoire and therefore was not considered in this project, as the majority of cases being audited were reported prior to the introduction of this test.

PDL-1 +ve Treatment: Pembrolizumab/Nivolumab/Durvalumab

ALKD5F3 +ve Treatment: Crizotinib/Ceritinib/Alectinib/Brigatinib

EGFR +ve Treatment: Gefifinib/Afatinib/Erlotinib/Dacomitinob

Prognosis: 5-year survival 35-61%

(Urga and Mino-Kenudson, 2018c)

# Lung Cancer Types

**Non-Small Cell Carcinoma**

**80-85%**

**Prognosis: Optimistic**

**Small Cell Carcinoma**

**15-20%**

**Prognosis: Poor**

# Aim of Project

Establish the effectiveness of the current laboratory processes carried out on histological and cytological lung samples

Develop a plan to adapt these processes in order to improve turnaround time and, ultimately, clinical outcome

# Materials & Methods

- **Process Mapping:**
  - **Current processes for lung samples – histology, cytology, immunohistochemistry**
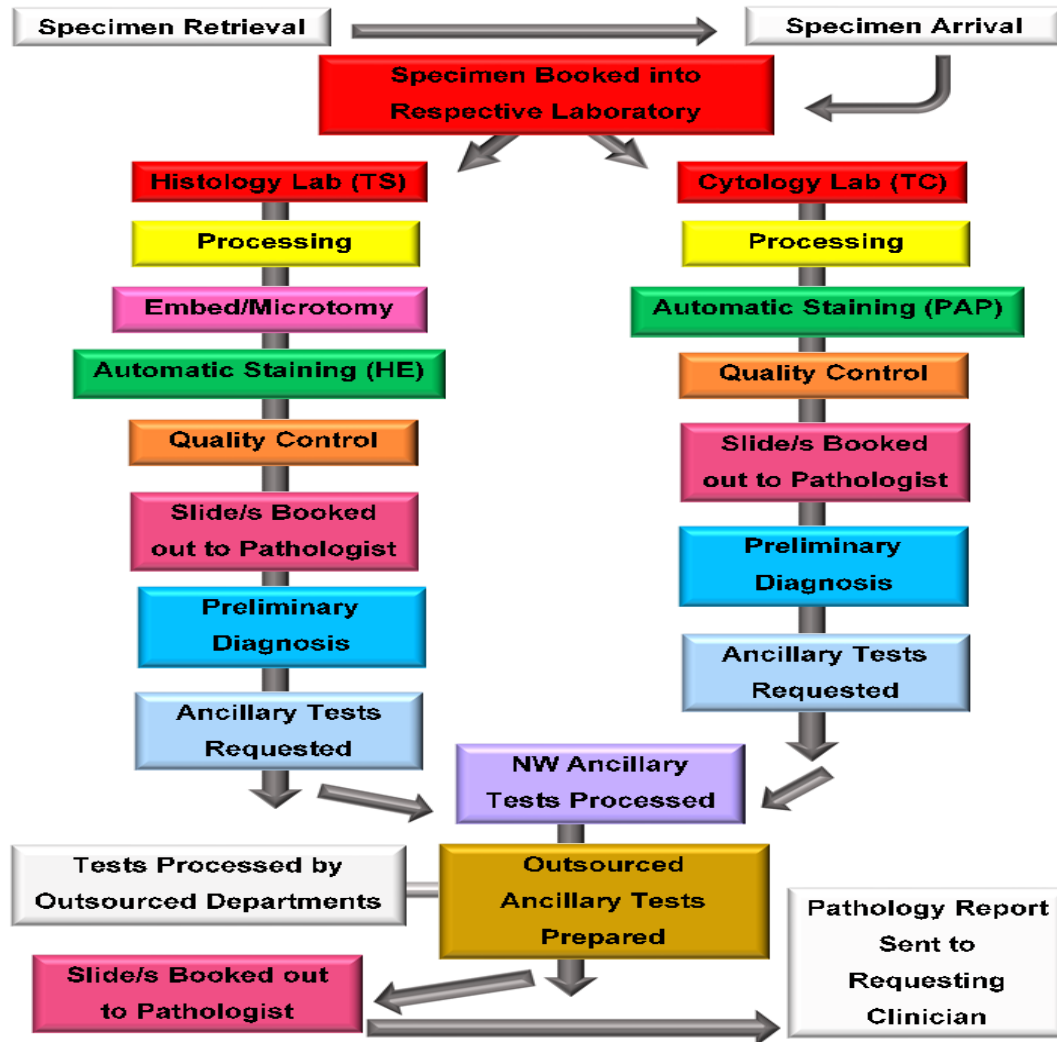
- **Lung Cancer Audit:**
  - **2018 & 2019 NSCC & SCC diagnoses with both histology & cytology samples**

- **Improvement Plan**
  - **Improved process map developed, based on map analysis and audit results**

# Results – Process Mapping

# Results - Audit

| Year | No. of Cases |
|------|--------------|
| 2018 | 54 |
| 2019 | 47 |
| **TOTAL** | **101** |

## 1. Diagnostic/Tissue Management
## 2. Specimen Journey
## 3. Ancillary Test Requesting

# Results - Audit

## Key Findings
## 1. Diagnostic/Tissue Management

98% of cases preliminarily diagnosed via HE diagnostic slide (histology sample)

8% of cases ran out of tissue from one sample and relied on the other to complete pathology report

2% of cases ran out of tissue from both samples, resulting in a repeat biopsy

# Results - Audit

## Key Findings
## 2. Specimen Journey

**Tissue Biopsy (Histology only)**

36% of these samples were booked in before 1pm that day

72% of samples were booked in to the lab on the day they were taken from the patient

**Tissue Biopsy & Cell Sample (Histology and Cytology)**

42% of cases were booked out to different pathologists

44% of cases were booked out to the pathologist on different days

35% of cases were booked out on the same day but sent to different pathologists

# Results - Audit

## Key Findings
## 3. Ancillary Test Requesting

67% of ancillary test requests were submitted before 4pm on the same day the diagnostic slide was booked out to the pathologist

Delayed TAT was identified in 63% of cases

66% of these were due to;

- Sample taken on a Friday/before bank holiday

- Ancillary test request submitted on a Friday/before bank holiday

This means that 34% of cases with delayed TAT, were delayed for a reason unrelated to the weekend/bank holiday/lab operating hours

# Results - Improvement Plan

**Separate specimen receptions/lab numbers for histology & cytology samples →**
**Combine booking-in for histology and cytology samples**

**HE (histology) and PAP (cytology) used for diagnostic tests →**
**Reserve cytology sample for molecular genetics/IHC**

**All (histology) lung biopsies processed overnight on 8-hour processing cycle →**
**Introduce 2-hour rapid processing cycle for histology lung biopsy**

**Batched IHC work with 2 staining runs per day →**
**Introduce continuous workflow system in IHC**

**PDL-1 slides sent to Aberdeen for staining & reporting →**
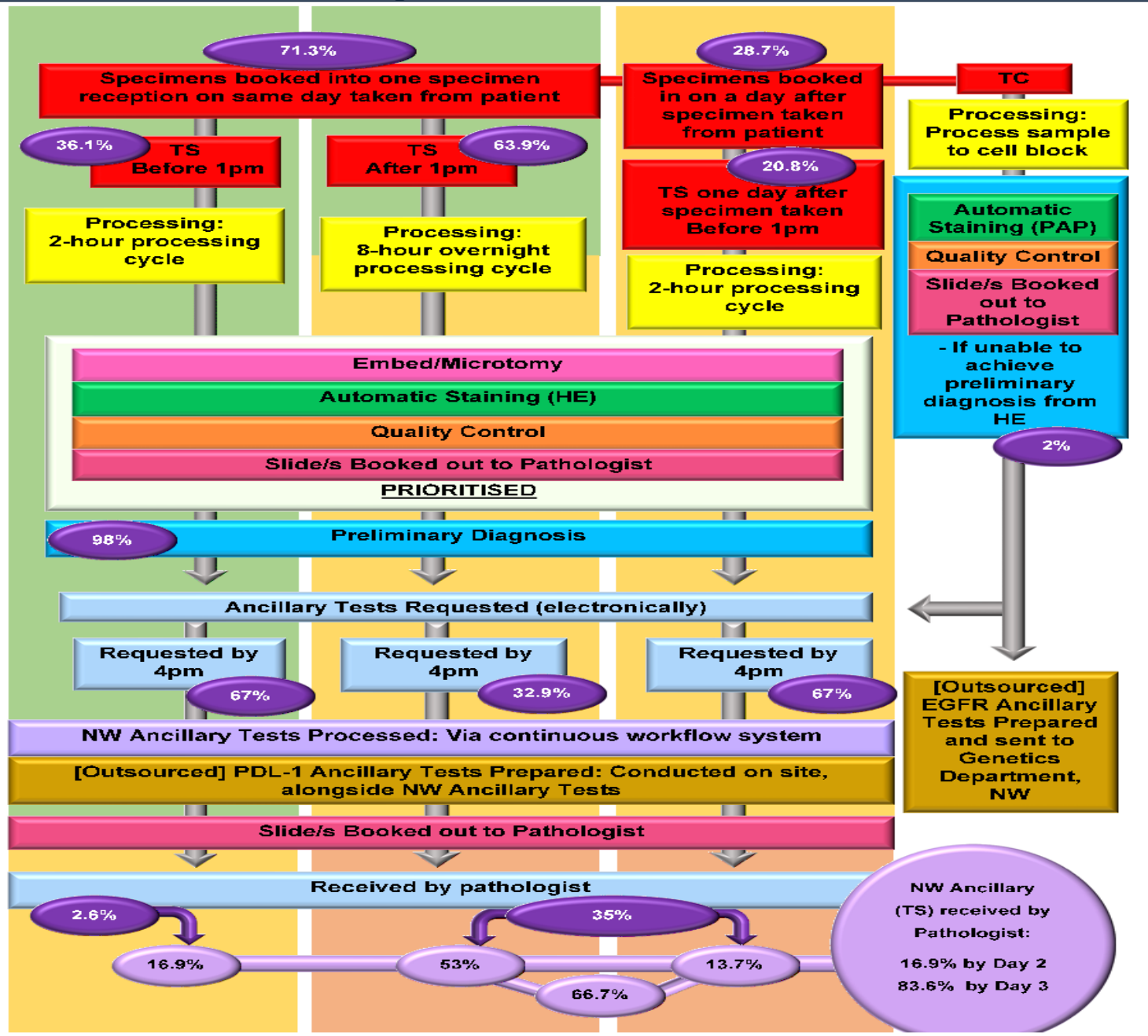**Conduct PDL-1 testing & reporting on-site**

# Results - Improvement Plan

# Results - Improvement Plan

## Ancillary tests:

- **14.3%** increase in cases sent to Pathologist on Day 2 (one day after sample  taken from patient)

- **31.7%** increase in cases sent to Pathologist on Day 3 (two days after sample taken from patient)

**Laboratory Journey Completed by Day 3:**
**Current: 37.6%**
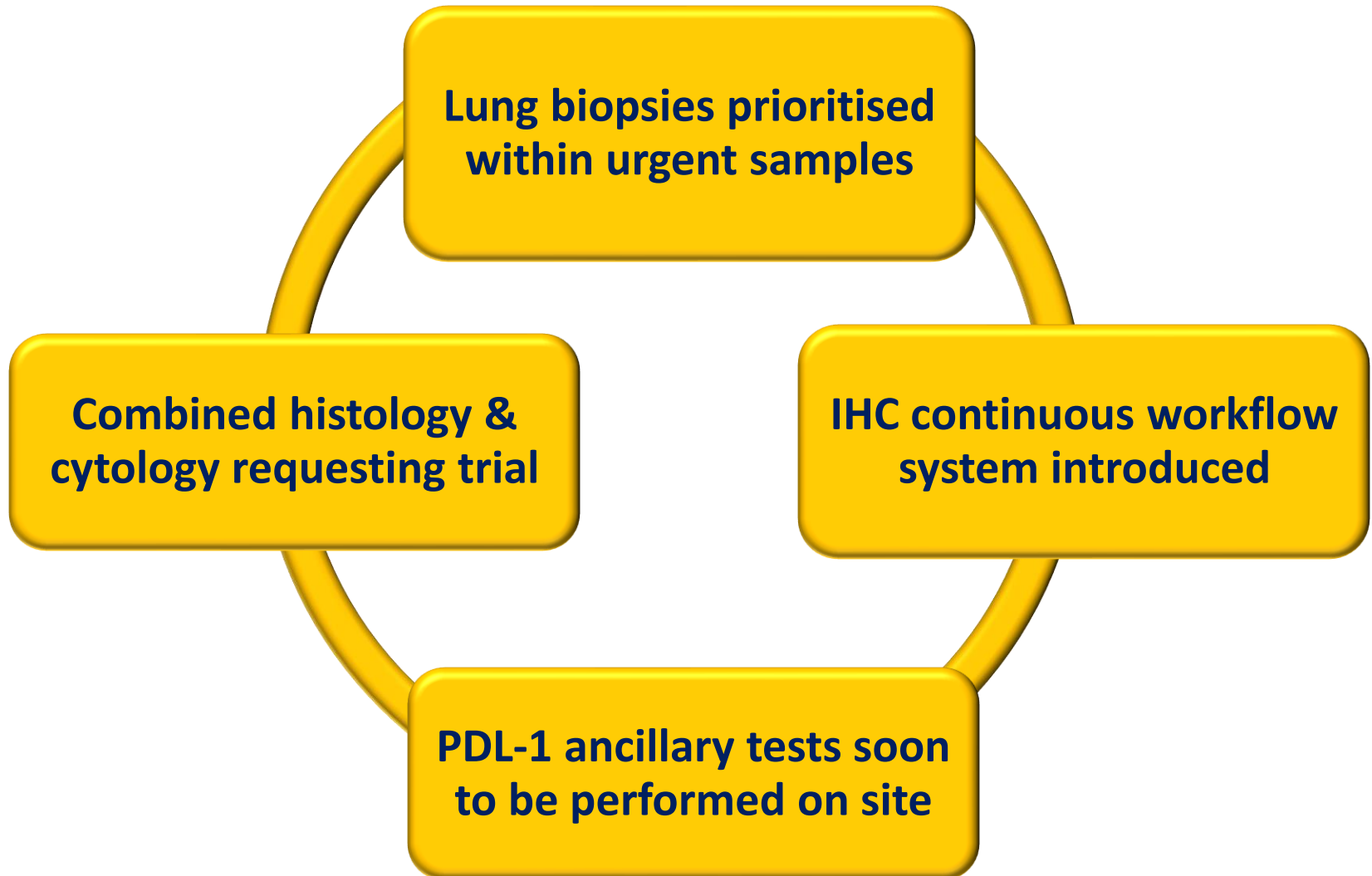**Improved: 83.6%**

**Predicted Total Improvement:**
**122%**

# Conclusions

- Improved TAT for lung biopsies **is** possible

- Reserve one sample (e.g. cytology sample) for ancillary testing;
  - ➢ Save time
  - ➢ Save resources
  - ➢ Reduce risk of running out of material

- Future proofing

# Lung Biopsy Management – One Year On

Lung biopsies prioritised within urgent samples

IHC continuous workflow system introduced

PDL-1 ancillary tests soon to be performed on site

Combined histology & cytology requesting trial

# Future Work

- Further investigation into (unexplained) delayed TAT

- Continue with combined histology/cytology specimen reception trial

- Explore/validate rapid processing cycle

- Standardise lung sample procedures across Scotland

# Acknowledgements

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*Dick Quibell, Mathematics Tutor, University of Greenwich, London*

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# Thank you for listening

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