

Does triage of chest X-rays with artificial intelligence shorten the time to lung cancer diagnosis: a randomised controlled trial

Submission date 07/03/2023	Recruitment status No longer recruiting	<input checked="" type="checkbox"/> Prospectively registered <input checked="" type="checkbox"/> Protocol
Registration date 21/03/2023	Overall study status Ongoing	<input type="checkbox"/> Statistical analysis plan <input type="checkbox"/> Results
Last Edited 28/02/2025	Condition category Cancer	<input type="checkbox"/> Individual participant data <input checked="" type="checkbox"/> Record updated in last year

Plain English summary of protocol

Background and study aims

Diagnosing lung cancer early saves lives. Nearly three quarters of lung cancers are diagnosed late, at stage 3 or 4. One promising way to shorten the time to diagnose of lung cancer is to give patients their test results more quickly and proceed to the next step. Chest X-ray (CXR) and computed tomography (CT) scans are usually the first tests to suggest a diagnosis of lung cancer. Waiting for the results of a test is an anxious time for patients. If lung cancer is suspected, patients are often referred for a CT scan which may cause further anxiety. Usually, patients and their GPs do not receive these results straight away, and there can be longer delays due to the number of CXRs performed and imaging workforce shortages.

Immediate reporting allows patients to receive the result of the X-ray at the time of the test. If their X-ray is suspicious or unclear, patients are then offered a CT scan on the same day. CXRs for patients referred from primary care will be included, with help from the AI available for all patients. The study will test if AI helps identify CXRs from patients who will benefit most from same day CT, triaging for an immediate review and report at eight clinical sites over a 12 month period.

Who can participate?

This study requires all patients 18 years and over who have been referred by their GP for an AP or PA chest x-ray at the trial participating centres.

What does the study involve?

Patients will attend for their x-ray as normal and will receive the usual standard of care and referral pathways for each of the trial centres. Patients will not be asked to participate in any additional tests or assessments for the study. The AI will be randomised to intervention and non-intervention days and will highlight any possible abnormalities on chest x-rays. On non-intervention days the AI will be available later on, when being reviewed by radiologists. If a patient has an x-ray on an intervention day they may be asked to wait whilst the AI and radiographer check their results, and may be referred for a CT scan that same day, if possible.

What are the possible benefits and risks of participating?

Immediate reporting of GP chest X-rays has the potential to improve the patient experience by eliminating the wait for results, often an anxious time for patients. It may also streamline the diagnosis of lung cancer by performing additional radiology investigations (e.g. CT scan) at a single visit. This could reduce the time to diagnosis and minimise the number of patient attendances to hospital. It could also reduce the number of unnecessary urgent referrals to respiratory medicine, thus reducing patient anxiety. Given the nature of the study, we do not envisage any elevation to the harms or to the risk of harm for patients.

Where is the study run from?

Nottingham University Hospitals NHS Trust (UK)

When is the study starting and how long is it expected to run for?

February 2022 to September 2025

Who is funding the study?

1. Clatterbridge Cancer Charity (UK)
2. NHS England (UK)

Who is the main contact?

Prof David Baldwin, David.baldwin12@nhs.net

Contact information

Type(s)

Scientific

Contact name

Prof David Baldwin

ORCID ID

<https://orcid.org/0000-0001-8410-7160>

Contact details

Respiratory Medicine
Nottingham University Hospitals NHS Trust
City Campus
Nottingham
United Kingdom
NG5 1PB
+44 115 9691169 ex 79473
David.baldwin12@nhs.net

Additional identifiers

EudraCT/CTIS number

Nil known

IRAS number

317009

ClinicalTrials.gov number

Nil known

Secondary identifying numbers

CPMS 54991, SBRIC01P3039, IRAS 317009

Study information

Scientific Title

Impact of immediate AI enabled patient triage to chest CT on the lung cancer pathway

Acronym

LungIMPACT

Study objectives

Implementation of the AI will lead to a change in the timing of the CT scan for people with suspicious chest x-rays (CXR) and therefore to a change in the timing of the diagnosis of lung cancer.

Ethics approval required

Old ethics approval format

Ethics approval(s)

Approved 21/02/2023, East of England - Cambridge East Research Ethics Committee (The Old Chapel, Royal Standard Place, Nottingham, NG1 6FS, UK; +44 207104818; cambridgeeast.rec@hra.nhs.uk), ref: 23/EE/0014

Study design

Interventional randomized controlled trial

Primary study design

Interventional

Secondary study design

Randomised controlled trial

Study setting(s)

Hospital

Study type(s)

Diagnostic

Participant information sheet

See study outputs table

Health condition(s) or problem(s) studied

Lung cancer

Interventions

This is a prospective, multi-centre healthcare service delivery study with the primary objective of assessing the effectiveness of AI immediate read and worklist prioritisation for immediate review on the time to diagnosis of lung cancer and the time to CT chest following abnormal CXR. The study will be conducted over a 12-month period at eight NHS Trusts in England. qXR, a class IIa CE certified deep learning algorithm already in routine clinical use in some NHS Trusts, will be used in this study. All patients in the study will have their CXRs read by qXR. The only difference is the timing of the information from the AI. The process adopted in radiology departments is that the patient attends for a CXR and it is performed by a radiographer. The radiographer may, at their discretion flag abnormalities that may require further action and this may result in a CT scan being done, sometimes on the same day as is a preferred option in the NOLCP. Where there is no flag, the CXR is later reported by a radiologist or reporting radiographer. This study is testing whether having an AI immediate flag influences that process and shortens time to diagnosis.

AI clinical decision support will be available to the reporting practitioner (consultant radiologist, specialist registrar or reporting radiographer) for all CXRs. The intervention is the timing of the CXR alert from the AI, on intervention (worklist prioritisation for immediate report) and non-intervention (routine reporting time) days. On intervention days, an active notification will be sent to the worklist for any 'qXR-suspected-abnormal cases, so these can be prioritised for immediate reporting. Pre-allocation to intervention (qXR AI-immediate read and worklist prioritisation for immediate CXR review) and routine care (normal reporting with qXR read available) will occur using random sampling (Monday – Friday when routine imaging is performed). All patients over 18 years will have qXR decision support available. Patients will receive routine care, no additional diagnostic tests will be performed. Data will be collected from existing routine clinical data sources. All imaging (CXR or CT) will be performed as part of routine care, and no additional radiation exposure will be required. The reporting practitioner will have the AI decision support information for all cases and all days, the intervention is only the timing of the AI information (immediate reporting or with usual reporting). The reporting practitioner can choose to accept the alert and refer the patient for CT chest and/or referral onto the lung cancer pathway where appropriate. Patients who are referred for CT will follow the current CT and post-CT pathways of the participating clinical sites, which may include placing them on a cancer pathway. On non-notification days, the AI tool information will be available at the time the CXRs are reporting by the reporting practitioner. The PACS will have both the original image and qXR secondary capture showing the AI attention point.

Intervention Type

Other

Primary outcome measure

1. Time from chest X-ray to lung cancer diagnosis in days from the cancer waiting time database
2. Time from chest X-ray to CT (when performed) in days from the radiology information system

Secondary outcome measures

1. Time to first respiratory cancer outpatient appointment in days from the cancer waiting time database
2. Time to treatment start for lung cancer patients in days from the cancer waiting time database
3. Agreement between AI (qXR) and human readers for normal/abnormal interpretation of chest X-ray as an agree/disagree decision with discordance review by a thoracic radiologist where required
4. Number of urgent lung cancer referrals from the cancer waiting time database
5. The incidence of lung cancer from the cancer waiting time database

6. The stage of lung cancer diagnosis from the cancer waiting time database
7. Cost-effectiveness of AI support at the time of CXR acquisition and prioritisation for immediate review of CXRs; to be measured by difference in costs per patient diagnosed, per percentage increase in early-stage diagnosis and potentially per QALY subject to the availability of health utilities in the published studies

Overall study start date

01/02/2022

Completion date

30/09/2025

Eligibility

Key inclusion criteria

1. Chest X-ray referred from primary care
2. Age ≥ 18 years
3. Anteroposterior (AP) or Posteroanterior (PA) view

Participant type(s)

Patient

Age group

Adult

Lower age limit

18 Years

Sex

Both

Target number of participants

Planned Sample Size: 150,000; UK Sample Size: 150,000

Key exclusion criteria

1. Age < 18 years
2. CXR referral not from primary care
3. Lateral X-ray view of the chest

Date of first enrolment

01/08/2023

Date of final enrolment

31/12/2024

Locations

Countries of recruitment

England

United Kingdom

Study participating centre

Nottingham University Hospitals NHS Trust

Queens Medical Centre

Derby Road

Nottingham

United Kingdom

NG7 2UH

Study participating centre

United Lincolnshire Hospitals NHS Trust

Lincoln County Hospital

Greetwell Road

Lincoln

United Kingdom

LN2 5QY

Study participating centre

Mid Yorkshire Hospitals NHS Trust

Pinderfields Hospital

Aberford Road

Wakefield

United Kingdom

WF1 4DG

Study participating centre

University Hospitals of Leicester NHS Trust

Leicester Royal Infirmary

Infirmary Square

Leicester

United Kingdom

LE1 5WW

Study participating centre

University Hospitals Birmingham NHS Foundation Trust

Queen Elizabeth Hospital

Mindelsohn Way

Edgbaston

Birmingham
United Kingdom
B15 2GW

Study participating centre
East Suffolk and North Essex NHS Foundation Trust
Colchester Dist General Hospital
Turner Road
Colchester
United Kingdom
CO4 5JL

Study participating centre
University College London Hospitals NHS Foundation Trust
250 Euston Road
London
United Kingdom
NW1 2PG

Sponsor information

Organisation
Nottingham University Hospitals NHS Trust

Sponsor details
Research & Innovation
Queens Medical Centre
Derby Road
Nottingham
England
United Kingdom
NG7 2UH
+44 1159249924
nuhnt.researchsponsor@nhs.net

Sponsor type
Hospital/treatment centre

Website
<http://www.nuh.nhs.uk/>

ROR
<https://ror.org/05y3qh794>

Funder(s)

Funder type

Charity

Funder Name

Clatterbridge Cancer Charity

Funder Name

NHS England

Results and Publications

Publication and dissemination plan

Planned publication in a high-impact peer-reviewed journal

Intention to publish date

31/05/2025

Individual participant data (IPD) sharing plan

The datasets generated during and/or analysed during the current study are/will be available upon request from David Baldwin David.baldwin@nuh.nhs.uk - Fully anonymised clinical and outcome data will be available for 18 months after the end of the study and can be transferred digitally, upon request and with the correct data-sharing agreement.

IPD sharing plan summary

Data sharing statement to be made available at a later date

Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
Participant information sheet	version 1.4	18/02/2023	07/03/2023	No	Yes
Protocol file	version 1.3	08/02/2023	20/03/2023	No	No
HRA research summary			26/07/2023	No	No