NATIONAL INSTITUTE FOR HEALTH AND CARE EXCELLENCE

Diagnostics Assessment Programme

Artificial Intelligence software for analysing chest X-ray images to identify suspected lung cancer

Final scope

November 2022

1. Introduction

The topic selection oversight panel identified software with artificial intelligence derived algorithms for analysing chest x-ray images as potentially suitable for early value assessment (EVA) by the Diagnostics Assessment Programme. NICE has published a medtech innovation briefing on artificial intelligence for analysing chest X-ray images in March 2022. The scope of this early value assessment will focus on the use of the software to assist in the identification of suspected lung cancer from chest X-ray images. The final scope was informed by a scope consultation and discussions at the assessment subgroup meeting held on 15 November 2022.

The software identified for this assessment uses algorithms that have been produced using artificial intelligence. The algorithms are fixed but updated periodically.

The purpose of this early value assessment evaluation is to identify evidence that is available on the technologies; assess the potential clinical and cost-effectiveness of artificial intelligence software for analysing chest X-ray images to identify suspected lung cancer; and identify evidence gaps to help direct data collection and further research. This evaluation will inform committee recommendations on the conditional use of these technologies in the NHS while further evidence is generated.

A glossary of terms is provided in appendix A.

2. Description of the technologies

This section describes the properties of the diagnostic technologies based on information provided to NICE by manufacturers and experts, and information available in the public domain. NICE has not carried out an independent evaluation of this description.

2.1. Purpose of the medical technologies

The chest X-ray is the most performed X-ray examination in the NHS in England. Chest X-rays are done because of signs and symptoms suggestive of lung cancer or because of another suspected condition or trauma. Demand for chest X-rays has increased and capacity to read and report them in the NHS is limited due to the number of radiologists and reporting radiographers. This has led to variable and sometimes lengthy report turnaround times, potentially impacting on timely patient management. Often the NHS outsources the reading and reporting of chest X-rays service to external companies.

Software is available that could be used to assist a healthcare professional's review and interpretation of chest X-ray images. The technologies may help identify images as normal or abnormal, highlight suspected abnormalities and provide results as heat maps or probability score. Identifying abnormal lung features suggestive of lung cancer on a chest X-ray may help to prioritise review of chest X-rays and speed up subsequent referral to CT scan. The technologies may also be used as a decision support tool to increase the accuracy of suspected lung cancer detection by consultant radiologists and reporting radiographers. This may help to find and treat lung cancer early.

Some of the abnormal features suggestive of lung cancer on a chest X-ray may include lung nodules, pleural effusion (excess fluid around the lung), collapsed lung or lung segments, destruction or erosion of bony structures such as the ribs, as well as masses or lymph nodes within the mediastinum. Other abnormalities may include calcification (thickening and stiffening of the thin, transparent, two-layered membrane that covers the lungs), consolidation (lung air sac and small airways fill with a dense material), fibrosis (the lungs become scarred and breathing becomes increasingly difficult), mediastinal widening (widening of the area between the lungs where the heart sits), and pneumoperitoneum (presence of air within the abdomen). Detecting some of these abnormalities may be challenging. According to the Healthcare Safety Investigation Branch (HSIB), about 20% of lung cancers will be missed on X-rays resulting in a delay in diagnosis and potentially affecting a patient's prognosis. For instance, lung nodules may be challenging to detect because of their small size, varying shape, and how close to other structures in the lung they are. Most lung nodules are benign and small, but some may grow and develop into lung cancer.

This scope is concerned with the use of software to read and report chest X-rays to speed up and improve the identification of people with suspected lung cancer. The detection of other conditions not suggestive of cancer such as tuberculosis and COVID-19 is outside the scope of this assessment.

2.2. Product properties

The chest X-ray imaging artificial intelligence (AI) technologies included in this scope are at least class IIa CE marked software platforms that are developed with deep learning algorithms to interpret radiology images. In addition, for inclusion in the scope, the technology needs to be radiological computer-assisted triage (CAST) software, computer aided detection (CADe) software or computer-aided diagnosis (CADx) software. CAST software is intended to aid prioritization and triage of medical images that are time sensitive. CADe and CADx software are technologies that can detect or diagnose an abnormality on the X-ray image. Table 1 shows the category for each included software

The technologies included assist health professional's review and reporting of chest X-rays. Some technologies allow images to be transferred from the hospital to the software platform, which is hosted in an NHS accredited secure data centre. The software analyses the chest DICOM (digital imaging and communications in medicine) image using proprietary algorithms. The image analysis may be sent directly back to the hospital to be viewed with hospital systems such as PACS (picture archiving and communication system) and some radiology information systems (RIS), using protocols such as DICOM and Health Level 7 (HL7). Some technologies may also allow uploading and viewing of images and analysis using a web interface. Version updates and periodic maintenance activities are needed for these technologies. This can be done remotely.

The following technologies are software for analysing chest X-ray images included in this scope.

2.2.1. AI-Rad Companion Chest X-ray (Siemens Healthineers)

AI-Rad Companion Chest X-ray is a class IIa CE marked post-processing image analysis software for posteroanterior (back to front) chest X-ray DICOM images in people aged at least 22 years. This is a CADx software as it is intended to be used as a diagnostic aid for assessment of the presence of prespecified radiographic findings by a radiologist or reporting radiographer. The technology characterises radiographic findings for a valid chest X-ray image in the lung and membrane between the lung and the chest wall. It works as a concurrent reader to support radiologists or reporting radiographers in differential diagnosis and clinical decision making. The technology is capable of characterising nodules, masses, granuloma, pneumothorax, consolidation, atelectasis, and pleural effusions. AI-Rad Companion Chest X-ray highlights the location of pneumothorax and pulmonary lesions in the findings report. The technology also generates

PACS-ready objects that summarise the radiographic findings that are then automatically routed to the PACS upon confirmation by the user.

2.2.2. Annalise CXR (annalise.ai)

Annalise CXR is a class IIb CE marked post-processing image analysis software intended to assist clinicians with interpretation of chest X-ray images, including the front to back, back to front and side view images. Annalise is both a computer-assisted triage (CAST) and computer aided detection (CADe) software. Annalise CXR's customisable user interface integrates into the hospital PACS and RIS. The display reports the confidence bar which shows the likelihood of the finding and the uncertainty. This technology is reported to identify 124 different radiological findings on chest X-rays. Findings include lung nodule, mass, hilar lymphadenopathy, pleural effusion, and pneumothorax. A subset of the findings are also accompanied by localisation – either highlighted areas of interest or laterality indicators overlaid onto the X-ray image. Reporting worklists can be prioritised based on clinical abnormalities, enabling triage of time-sensitive findings.

2.2.3. Auto Lung Nodule Detection (Samsung)

Auto Lung Nodule Detection is a class IIa CE marked post-processing image analysis software for back to front chest X-ray images of adults. The technology is intended to support clinicians in reviewing and reporting X-ray images to identify lung nodules. The Auto Lung Nodule Detection is computer-aided detection (CADe) software to identify and mark regions in relation to suspected pulmonary nodules from 10 to 30 mm in size. It produces suspected locations of the lung nodules on the X-ray image.

2.2.4. Chestlink (Oxipit)

Chest link is CE Class IIb marked post-processing image analysis software for chest X-ray images. Chestlink is both a computer-assisted triage (CAST) and computer aided detection (CADe) software. It detects 75 findings including mass, lobar collapse, abnormal rib, pleural effusion that may indicate lung cancer. It is an autonomous software technology that identifies and reports chest X-rays with no abnormalities without any intervention from the radiologist or reporting radiographer. The technology also sends preliminary reports on demand presenting results as heatmaps, priority label or pathology label to assist the radiologist or reporting radiographer review and reporting.

2.2.5. ChestView (GLEAMER)

ChestView (GLEAMER) is a class IIa CE marked post-processing image analysis software for chest X-ray images. ChestView is both a computer-

assisted triage (CAST) and computer aided detection (CADe) software. It detects pneumothorax, pleural effusion, alveolar syndrome, lung nodule, and mediastinal mass. The technology is intended to triage and prioritise interpretations of the X-ray images. It supports integration with RIS through HL7 capability. It integrates different IT infrastructures and communicates with the PACS to process appropriate examinations and display results in the user's usual environment.

2.2.6. Chest X-ray (Rayscape)

Chest X-ray previous known as CheXVision by XVision is a class IIa CE marked post-processing image analysis software for chest X-ray DICOM image data in people aged 16 and over. According to the company, the technology detects 17 radiological abnormalities such as lung opacity, atelectasis, cardiomegaly, consolidation, oedema, diaphragmatic dysfunction, emphysema, fracture, hilar/mediastinal disease, interstitial disease, lung lesion, pleural effusion, pleural other, pneumothorax, scoliosis, support devices, and tuberculosis. Chest X-ray is a computer aided detection (CADe) software. The output is displayed as a heat map representing the location and probability of the presence of the detected abnormality(s). The image output and report can be sent to the hospital PACS or RIS system. The technology can also be integrated via the AI marketplace, distribution platform, or as a stand-alone web-based system.

2.2.7. ClearRead Xray (Riveraintech)

ClearRead is a class IIa CE marked post-processing image analysis software for chest X-ray. It is a platform that is made up of four applications (Bone Suppress, Detect, Confirm and Compare). The technology is a computer aided detection (CADe) software. ClearRead Xray Bone Suppress increases the visibility of soft tissue in standard chest X-rays by suppressing the bone on the digital image without the need for two exposures, helping radiologists or reporting radiographers to detect 1 out of 6 previously missed nodules. ClearRead Xray Detect offers improved detection of 9-30mm nodules and detection of 1 in 2 previously missed lung nodules. According to the company ClearRead Xray Confirm is software that identifies and highlights lines and tubes on portable chest XR images while maintaining excellent image quality. ClearRead Compare provides a clear illustration of density changes between current and prior chest XR images.

2.2.8. InferRead DR Chest (Infervision)

InferRead DR Chest is a class IIa CE marked post-processing image analysis software for chest X-ray DICOM image data. The technology is a computer

aided detection (CADe) software. According to the company, the technology detects 16 radiological abnormalities including atelectasis, cardiomegaly, emphysema, fracture, nodules, pleural effusion, pneumothorax.

2.2.9. Lunit INSIGHT CXR (Lunit)

Lunit INSIGHT is a class IIa CE marked post-processing image analysis software for chest X-ray DICOM image data in people aged 14 and over. The technology is a computer aided detection (CADe) software. According to the company, the technology detects 10 radiological abnormalities such as atelectasis, calcification, cardiomegaly, consolidation, fibrosis, mediastinal widening, nodules, pleural effusion, pneumoperitoneum and pneumothorax, as well as tuberculosis screening support. The output is displayed as a heat map or contour, representing the location and probability of the presence of the detected abnormality(s), including abnormality label, and score reflecting the calculated probability of the nodule presence. It can also provide an automated diagnostic report. The image output and report can be sent to the hospital PACS or RIS system. The worklist can be prioritised based on abnormality scores, allowing triaging of urgent cases.

2.2.10. Milvue Suite (Milvue)

The Milvue Suite is a class IIa CE marked post-processing image analysis software for chest X-ray. The technology is both a computer-assisted triage (CAST) and computer aided detection (CADe) software. It provides triage (negative, doubt, positive) with tags in the worklist, detection with boxes on lesions, and possible pre-documented report in the RIS or the PACS. The Milvue Suite has not been designed for a specific screening of the lung cancer. It can also flag other chest diseases which might or not be associated with lung cancer.

2.2.11. qXR (Qure.ai)

qXR is a class IIa CE marked post-processing image analysis software for chest X-ray DICOM image data in people aged 6 and over. qXR can also analyse images stored in PNG and JPEG formats. The technology is a computer aided detection (CADe) software. It classifies images as normal or abnormal, and assigns clinically relevant labels (including the name, size and location of the abnormality). The company claims that the technology detects 30 types of abnormality. Qure.ai was awarded the Small Business Research Initiative funding under the NHS Cancer Programme - Innovation.

2.2.12. red dot (behold.ai)

Red dot is a class IIa CE marked post-processing image analysis software for frontal chest X-ray images data in people aged at least 18 years. The technology is both a computer-assisted triage (CAST) and computer aided detection (CADe) software. The technology classifies scans as normal or abnormal and suggests prioritisation for radiological clinical review of frontal chest X-ray images with features suggestive of lung cancer, abnormality, or pneumothorax.

It can also provide an authorised diagnostic report, sent to the hospital PACS or RIS system, of a subset of normal examinations (high confidence normal) that can be removed from the radiologist worklist. It is registered with the Care Quality Commission (CQC) for autonomous diagnosis. A condition of this registration is that all examinations auto reported as high confidence normal are reviewed by a human within 24 hours. For examinations that have been classified as suspected lung cancer, the software is intended to be used alongside radiologist or reporting radiographer review to aid decision making and improve diagnostic accuracy. Behold.ai is a Phase 4 NHSX AI in Health and Care Award winner. Phase 4 is intended to identify medium stage AI technologies that have market authorisation but insufficient evidence to merit large-scale commissioning or deployment.

2.2.13. SenseCare-Chest DR Pro (Sensetime)

SenseCare-Chest DR Pro is a class IIb CE marked post-processing image analysis software for chest X-ray DICOM image data. The technology is a computer aided detection (CADe) software. It allows integration in standard reading environment (PACS), RIS, CIS (Clinical Information System), stand-alone third-party application, and stand-alone web based. It helps radiologists or reporting radiographers screen out suspected cases of various diseases from chest X-ray images. It automatically provides the location and analysis of lesions. The targeted features include pneumonia, tuberculosis, pneumothorax, pleural effusion, cardiomegaly, rib fractures.

2.2.14. VUNO Med Chest X-ray (VUNO)

VUNO Med Chest X-ray is a class IIa CE marked post-processing image analysis software for chest X-ray DICOM image data. It allows integration in standard reading environment (PACS), via the AI marketplace, distribution platform, or as a stand-alone web-based system. The technology is a computer aided detection (CADe) software. It is a screening solution for five major lung diseases - nodule/mass, consolidation, interstitial opacity,

pneumothorax, and pleural effusion. This software provides information on the presence of the abnormalities, their names, abnormality scores, and locations.

Table 1: Summary of technology category

Product name	CAST	CADe/CADx
AI-Rad Companion Chest X-ray		✓
Annalise CXR*	✓	✓
Auto Lung Nodule Detection*		✓
Chest- Xray*		✓
Chestlink*	✓	✓
ChestView*	✓	✓
ClearRead*		✓
InferRead DR Chest		✓
Lunit INSIGHT CXR		✓
Milvue Suite	✓	✓
qXR*		✓
Red dot	✓	✓
SenseCare*		✓
Vuno Med Chest X-ray*		✓

*Information only from public domain

3. Target conditions

3.1. Lung cancer

Lung cancer is one of the most common types of cancer in the UK. It causes symptoms such as persistent cough, coughing up blood, and feeling short of breath. People in the early stages of the disease may not have symptoms and so lung cancer is often diagnosed late. In 2018, more than 65% of lung cancers were diagnosed at stage 3 or 4 (Cancer Research UK). The NHS Long Term Plan (section 3.52) sets out NHS's ambition to diagnose 75% of all cancers at an earlier stage, stages 1 or 2, by 2028.

Early lung cancer may be seen as a lung nodule, a small growth found inside the lung, on imaging such as chest X-ray. Other abnormal features suggestive

of lung cancer on a chest X-ray may include lung nodules, pleural effusion, collapsed lung or lung segments, destruction or erosion of bony structures such as the ribs, as well as masses or lymph nodes within the mediastinum or neck. A chest X-ray may be done because of signs and symptoms suggestive of lung cancer. It may also be done for reasons unrelated to lung cancer (incidental detection) for example because of trauma (this may mean younger people at low risk of lung cancer) or heart problems (this may mean people with risk factors similar to risk factors for lung cancer). While most lung nodules are benign, some are malignant so it is important to identify all nodules accurately and quickly to help diagnose lung cancer early.

3.2. Diagnostic and care pathway

3.2.1. Initial assessment in primary care

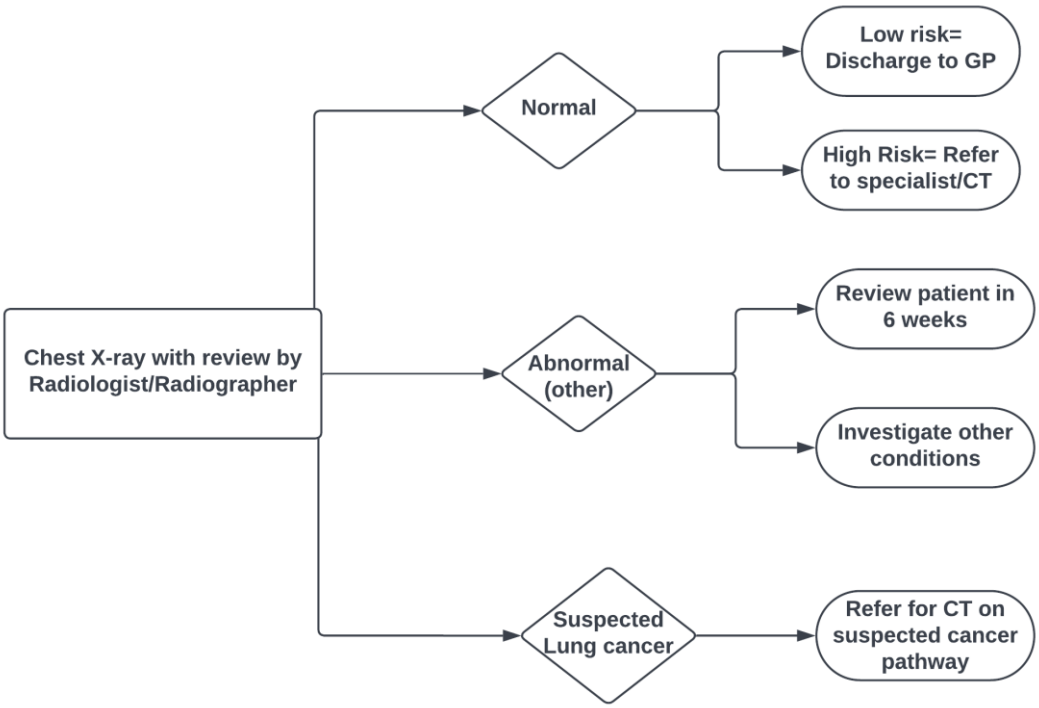
The NICE guideline on recognition and referral for suspected cancer recommends that people aged 40 and over are offered an urgent chest X-ray (within 2 weeks of referral) if they have 2 or more of the following unexplained symptoms, or if they have ever smoked and have 1 or more of the following unexplained symptoms:

- cough
- fatigue
- shortness of breath
- chest pain
- weight loss
- appetite loss.

An urgent chest X-ray should also be considered for people aged 40 or over if they have persistent or recurrent chest infection, finger clubbing, enlarged lymph nodes near the collarbone or in the neck, chest signs consistent with lung cancer or increased platelet count. Individuals aged at least 40 years and coughing blood (haemoptysis) are referred to the suspected cancer pathway without need for X-ray imaging.

If the chest X-ray findings suggest lung cancer, referral to secondary care should be made using a suspected cancer pathway referral for an appointment within 2 weeks, see Figure 1. In this scope, the term “normal” X-ray image refers to images without any clinically relevant lung abnormalities. High risk patients are those presenting with ongoing, unexplained symptoms. Experts have highlighted that some hospitals outsource the reading and/or reporting of X-rays to external companies.

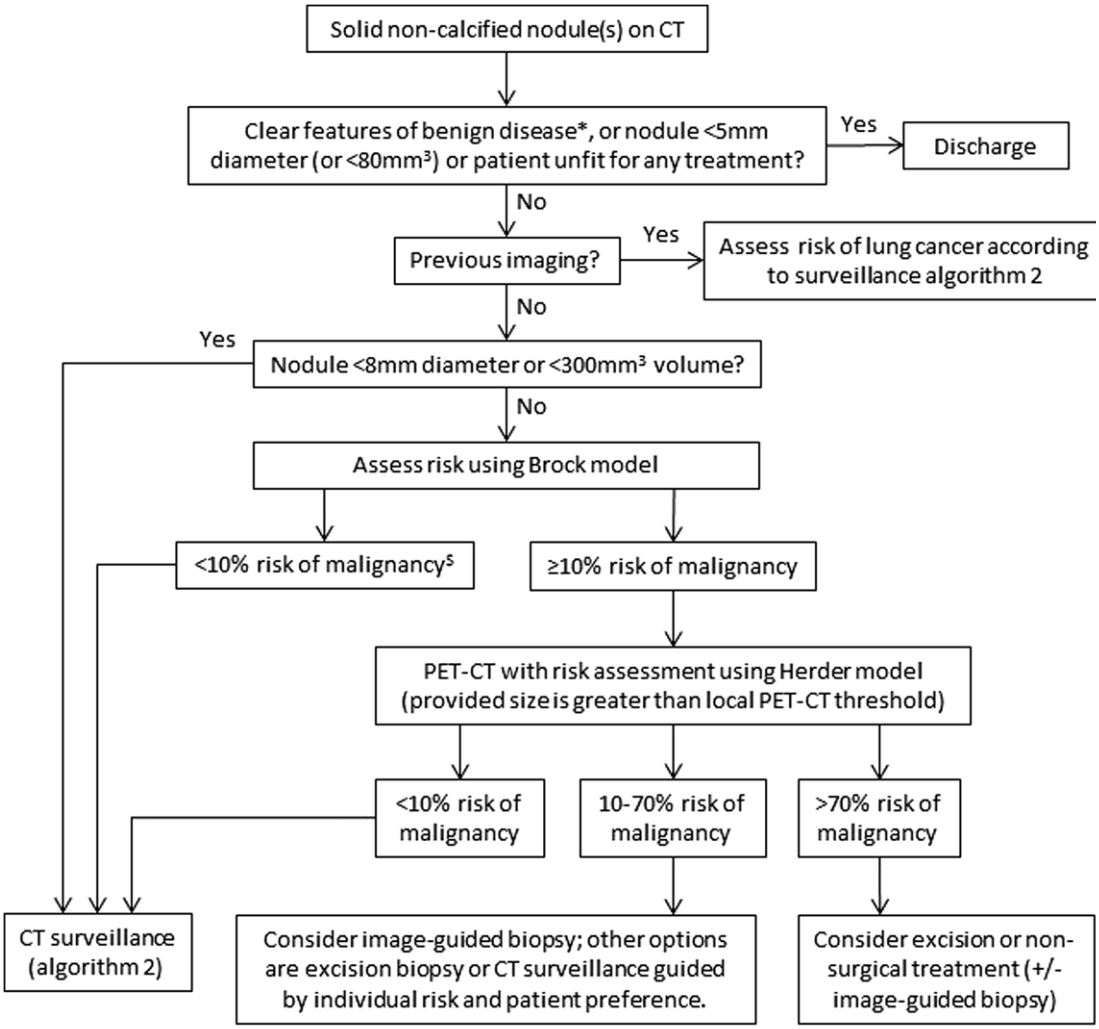
Figure 1: Chest X-ray pathway for people referred from primary care



3.2.2. Diagnosis and staging in secondary care

People with suspected lung cancer should be offered a contrast-enhanced chest CT scan to further the diagnosis and stage the disease (NICE guideline on diagnosis and management of lung cancer). NICE is developing diagnostics guidance on AI software for automated detection and analysis of lung nodules from CT scan images. The investigation of lung nodules identified on CT follows the British Thoracic Society (BTS) guidelines for the investigation and management of pulmonary nodules, see Figure 2. The UK national screening committee recommend targeted screening for lung cancer by low dose CT for people aged 55 to 74 identified as being at high risk of lung cancer.

Figure 2: Initial assessment of solid lung nodules in secondary care



The National Optimal Lung Cancer Pathway (NOLCP) aims to improve and streamline the pathway to help lung cancer patients get diagnosed more quickly and at an earlier stage, when treatment could be more effective. The NOLCP recommends changes and improvements in the whole lung pathway from prevention, early diagnosis, treatment and improving patient experience. NOLCP advocates for rapid imaging and reporting within 72 hours from abnormal chest X-ray to CT.

To guide the treatment of lung cancer, information about type and spread of the lung cancer (stage) are needed. The NICE guideline on diagnosis and management of lung cancer recommend choosing investigations that give the most information about diagnosis and staging with the least risk to the person. The type and sequence of investigations may vary but the investigations typically include a positron emission tomography-CT (PET-CT) scan and an image-guided biopsy. Other methods that may be used include MRI,

endobronchial ultrasound-guided transbronchial needle aspiration (EBUS-TBNA) and endoscopic ultrasound-guided fine-needle aspiration (EUS-FNA).

3.2.3. Treatment for lung cancer

After diagnosis, treatment for lung cancer is based on several factors, such as overall health, the type, size, position, and stage of cancer. The treatment may include surgery, chemotherapy, radiotherapy, immunotherapy or other targeted therapy drugs or a combination of these (NICE guideline on diagnosis and management of lung cancer).

3.3. Patient issues and preferences

Incidental nodule finding or other findings suggestive of lung cancer may cause anxiety and worry especially if it is not clear whether the nodule is malignant. Most patients are happy to have all tests performed quickly, even on the same day as a 'one-stop shop'. Immediate results would turn a passive period of waiting into something seemingly more proactive and less uncertain. Early diagnosis would be beneficial because of earlier treatment and potential for improved patient outcomes but false positives test results could lead to harms from unnecessary investigations. Where treatment is not possible such as for people with limited life-expectancy or with multiple co-morbidities, the finding of nodules or other abnormalities and the diagnosis of lung cancer could cause unnecessary anxiety. People may want to discuss in advance of the X-ray imaging what might happen if a potential lung nodule or other abnormality is found.

4. Comparator

The comparator for this assessment is chest X-ray image review by an appropriate radiology specialist (radiologist or reporting radiographer) without the assistance from AI-derived software.

The reference standard for test accuracy will be determined by the outcome. For instance, review of the images by at least one radiology expert could be used when considering accuracy to detect abnormalities. A multi-disciplinary team or a biopsy confirmation of cancer should be used when considering accuracy to detect lung cancer.

5. Scope of the assessment

Table 2 Scope of the assessment

Decision question	• Does the use of software with artificial intelligence (AI) derived algorithms for analysing chest X-ray images for suspected lung cancer have the potential to be clinically and cost-effective to the NHS? • What evidence is available to support the value proposition outlined in the scope (1. identification of lung cancer, 2. triage and prioritisation to improve workflow) and where are the evidence gaps?
Populations	Adults who have a chest X-ray request from primary care because of: - Symptoms suggestive of lung cancer (symptomatic population) - Reasons unrelated to suspicion of lung cancer (incidental population) Where data permits, subgroups will be considered based on: • Ethnicity • Age • Sex • Socio-economic status
Interventions	AI-derived software-assisted chest X-ray review by a radiologist or reporting radiographer using any of the following software/platforms: • AI-Rad Companion Chest X-ray (Siemens Healthineers) • Annalise CXR (annalise.ai) • Auto Lung Nodule Detection (Samsung) • ChestLink Radiology Automation (Oxipit) • ChestView (GLEAMER) • Chest X-ray (Rayscape) • ClearRead Xray – Detect (Riverain Technologies) • InferRead DR Chest (Infervision) • Lunit INSIGHT CXR (Lunit) • Milvue Suite (Milvue) • qXR (Qure.ai) • red dot (behold.ai) • SenseCare-Chest DR Pro (SenseTime)

	• VUNO Med-Chest X-Ray (VUNO)
Comparator	Chest X-ray image review by an appropriate radiology specialist (radiologist or reporting radiographer) without the assistance from AI-derived software.
Healthcare setting	Secondary care
Outcomes	Intermediate measures for consideration may include: • Accuracy to detect lung cancer • Accuracy to detect nodules • Accuracy to detect abnormalities • Concordance between intervention and comparator • Turnaround time (time from start of image review to radiology report) • Technical failure rate • Impact of software output on clinical decision-making • Impact of false positives on the workflow • Number of people referred for a CT scan • Number of people referred for follow-up X-ray • Number of people identified as 'normal'/discharged • Number of cancers missed/detected • Stage of cancer at detection • Time to X-ray report • Time to CT scan • Time to diagnosis • Ease of use/acceptability of the software by clinicians
	Clinical outcomes for consideration may include: • Morbidity • Mortality
	Patient-reported outcomes for consideration may include: • Health-related quality of life
	Costs will be considered from an NHS and Personal Social Services perspective. Costs for consideration may include: • Cost of software • Cost of staff time to read and report X-ray • Cost of staff training • Cost of further diagnostic tests • Cost of treatment (including costs of any adverse events)

6. Other issues for consideration

Diversity in the technology included

Although the technologies included are all based on AI, there are differences in the X-ray image view needed, the abnormalities identified by the technologies, how results are presented and how images are prioritised. The technologies might also differ on populations indicated for use such as those with signs and symptoms of lung cancer or people that have a chest X-ray for other reasons.

Ongoing studies

Evidence searches identified one ongoing UK study to assess the Impact of an Artificial Intelligence (AI) System on Chest X-ray Reporting.

Software updates

The lung nodule software may have periodic updates and upgraded versions with new functionality may become available. These updates may have an impact on the accuracy to detect abnormalities. This means that evidence based on earlier versions of the software may not accurately reflect the effectiveness of the current versions. Evidence on older versions should be examined to see if it is relevant to the decision question.

7. Potential equality issues

NICE is committed to promoting equality of opportunity, eliminating unlawful discrimination and fostering good relations between people with particular protected characteristics and others.

People with lung cancer are protected under the Equality Act 2010 from the point of diagnosis. Incidence for lung cancer in the UK are highest in people aged 85 to 89 (Cancer Research UK 2016-2018). Lung cancer is more common in men than in women. But over time, the lung cancer rate in men has become lower, whereas the rate in women has increased. There are differences in the rates of lung cancer between ethnic groups. In men, lung cancer is most common in white men and men of Bangladeshi family background. In women, lung cancer is most common in white women. The incidence and mortality of lung cancer are higher in deprived communities. Lung cancer also disproportionately affects those that may not frequently engage with health services.

8. Authors

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Appendix A Glossary of terms

Atelectasis
The complete or partial collapse of the lung. It occurs when the tiny air sacs (alveoli) within the lung become deflated or possibly filled with alveolar fluid.

Calcification
Thickening and stiffening of the pleura (the thin, transparent, two-layered membrane that covers the lungs) that occurs because of pleural inflammation.

Cardiomegaly
Enlarged heart seen on any imaging test, including a chest X-ray.

Consolidation
When the tiny air sacs (alveoli) and small airways of the lungs fill with dense material, the lung is said to be consolidated. Consolidation does not always mean there is infection, and the small airways may fill with pus (as in pneumonia), fluid (pulmonary oedema), blood (pulmonary haemorrhage), or cells (cancer).

DICOM
The Digital Imaging and Communications in Medicine (DICOM) is the standard for the communication and management of medical imaging information and related data.

Fibrosis
Condition in which the lungs become scarred and breathing becomes increasingly difficult.

Granuloma
A small cluster of white blood cells and other tissue that forms as a response to persistent inflammation. This is often non-cancerous.

HL7
Health Level 7 is an old but widely deployed standard for the cross-system exchange of messages. In radiology, those messages support processes including procedure requesting, result / report transmission and patient demographic management.

Lung nodule
Small growth found inside the lung. This is mostly from small clumps of cells in the lungs.

Mediastinal widening
Mediastinal widening on chest X-ray is defined as width of more than 8cm on front to back view (a chest X-ray taken with the chest against the film plate and the X-ray machine behind the patient). It can be commonly due to lymph node enlargement, vascular causes, neoplasia, and rarely due to gastrointestinal causes such as achalasia or hernia.

PACS
The picture archiving and communications system (PACS) system electronically stores images and reports.

Pneumoperitoneum
Presence of air within the peritoneal cavity (abdomen).

Pneumothorax
A collapsed lung resulting from air leaks into the space between the lung and chest wall.

Reporting radiographers
Reporting radiographers are registered diagnostic radiographers who have completed accredited postgraduate education to report chest X-rays.

RIS
Radiology Information System is an application which manages the booking, scheduling and communications for patient appointments and procedures within a medical imaging facility. It may also be used by radiologists and radiographers to dictate and store the diagnostic report for those procedures.