BTS Guideline for pulmonary nodules

On behalf of the BTS pulmonary nodules Guideline Development Group

Draft for Public Consultation

October 2026

Membership of group:

Dr Arjun Nair and Prof Neal Navani (co-chairs)

Dr Ahsan Akram
Dr Haval Balata
Dr Emily Bartlett
Dr Rachel Benamore
Prof Ashley Groves
Dr Alex Haragan
Dr Stephen Harrow
Mr Paul Holland
Dr Stephen Harrow
Dr Carolyn Horst
Dr Ahmad Lodhi
Ms Lavinia Magee
Dr Fraser Millar
Dr Sindhu Naidu
Dr Sushiladevi Natarajan
Dr Emma O'Dowd
Mr Douglas West
Dr Kay Por Yip
Dr Kirstie Opstad (Methodologist, BTS representative)

Contact:

British Thoracic Society, 17 Doughty St, London WC1N 2PL

kirstie.opstad@brit-thoracic.org.uk

13,574 words

Draft For Public Consultation October 2026

CONTENTS

SUMMARY OF RECOMMENDATIONS AND GOOD PRACTICE POINTS

Appendix 1 Clinical Pathways

Algorithm 1 Solid nodule diagnostic pathway

Algorithm 2 Solid nodule follow-up pathway

Algorithm 3 New solid nodule follow-up pathway

Algorithm 4 Ground glass-nodule (GGN) pathway

Algorithm 5 Part-solid nodule pathway

1. INTRODUCTION

1.1 Aim of the guideline

1.2 Intended users of the guideline and target patient populations

1.3 Scope of the guideline

1.4 Areas not covered by the guideline

1.5 Limitations of the guideline

1.6 Members of the guideline development group

1.7 Acknowledgements

2. METHODOLOGY

2.1 Establishment of guideline development group

2.2 Methodology

2.3 Summary of key questions, outcomes and literature search

2.4 Literature review

2.5 External sourcing of evidence

2.6 Systematic review of the evidence

2.7 GRADE analysis of the evidence

2.8 Development of recommendations

2.9 Diagnostic test accuracy reviews

2.10 Drafting the guideline

2.11 Review of the guideline

2.12 Declarations of interests

2.13 Stakeholders

3. PULMONARY NODULES

3.1 Background

3.2 Investigative approach following low dose computed tomography (LDCT) screening or incidental detection

3.3 Likelihood of lung cancer following a previous history of non-lung cancer

3.4 Solid nodules – Baseline diagnostic approach

Draft For Public Consultation October 2026

3.5 Solid nodules – Surveillance
3.6 Solid nodules – New nodules
3.7 Sub-solid nodules – Baseline diagnostic approach
3.8 Sub-solid nodules – Surveillance
3.9 Pulmonary nodule biopsy for diagnosing lung cancer
3.10 Pre-treatment biopsy versus no pre-treatment biopsy
3.11 FDG PET-CT staging

4. EVALUATION, MEASUREMENT AND FOLLOW-UP CONSIDERATIONS
4.1 Technical considerations for pulmonary nodule evaluation
4.2 Considerations for nodule measurement and description
4.3 Pulmonary nodule follow**-up considerations**

5. ALGORITHM CONSIDERATIONS
5.1 Algorithm 1 Solid nodule diagnostic pathway
5.2 Algorithm 2 Solid nodule follow-up pathway
5.3 Algorithm 3 New solid nodule follow-up pathway
5.4 Algorithm 4 Ground-glass nodule (GGN) pathway
5.5 Algorithm 5 Part-solid nodule pathway

REFERENCES

Appendix 2 Example scenarios where nodule follow-up intervals require modification
Appendix 3 Guideline Development Group (GDG) members
Appendix 4 Clinical Questions
Appendix 5 Stakeholders

Draft For Public Consultation October 2026

GLOSSARY AND ABBREVIATIONS

AAH	Atypical adenomatous hyperplasia
AI	Artificial intelligence
AIS	Adenocarcinoma in situ
CI	Confidence interval
CT	Computed tomography
EBUS	Endobronchial ultrasound
FDG PET-CT	Fluorodeoxyglucose positron emission tomography computed tomography
GDG	Guideline development group
GGN	Ground-glass pulmonary nodules
GPP	Good practice point
GRADE	Grading of Recommendations, Assessment, Development and Evaluation
IAC	Invasive adenocarcinoma
IASLC	International Association for the Study of Lung Cancer
IPLN	Intrapulmonary lymph node
IQR	Interquartile range
LCS	Lung cancer screening
LDCT	Low dose computed tomography
MDT	Mass doubling time
MetaDTA	Diagnostic test accuracy meta-analysis
MIA	Minimally invasive adenocarcinoma
NICE	National Institute for Health and Care Excellence
PET-CT	Positron emission tomography computed tomography
PFN	Perifissural nodule
PICO	Population, Intervention, Comparator, Outcome
PSN	Part-solid pulmonary nodule
SSN	Sub-solid pulmonary nodule
UKLS	UK Lung Screen model
USS/CT	Ultrasound/computed tomography
VA	Veterans Affairs Model
VDT	Volume doubling time

Draft For Public Consultation October 2026

SUMMARY OF RECOMMENDATIONS AND GOOD PRACTICE POINTS

Investigative approach following low dose computed tomography (LDCT) screening or incidental detection

Recommendation

- For adults with pulmonary nodules identified on a CT scan, the investigation and management should not differ whether detected on low dose computed tomography (LDCT) for lung cancer screening or CT scan done for other reasons. (**Conditional**)

Likelihood of lung cancer following a previous history of non-lung cancer

Recommendation

- For adults with a pulmonary nodule identified on a CT scan, information about a previous history of non-lung cancer should be sought as there may be an increased risk of nodule malignancy. (**Conditional**)

Solid nodules – Baseline diagnostic approach

Recommendations

- The Solid nodule diagnostic pathway (Algorithm 1), incorporating different solid nodule characteristics, should be used for determining lung cancer in solid pulmonary nodules. (**Conditional** – by consensus)
- An FDG PET-CT (fluorodeoxyglucose positron emission tomography computed tomography) scan should be offered for determining lung cancer risk in solid pulmonary nodules ≥ 8 mm. (**Conditional**)

Solid nodules – Surveillance

Recommendations

- Comparison to the earliest available CT should be performed at each evaluation of solid pulmonary nodules.
- For adults with solid pulmonary nodules, a volume doubling time (VDT) of less than 600 days should be considered suggestive of lung cancer. (**Conditional**)
- The Solid nodule follow-up pathway (Algorithm 2), incorporating solid pulmonary nodule changes at follow-up, should be used for determining lung cancer in progressing solid pulmonary nodules. (**Conditional** – by consensus)
- For new solid nodules, please use the New nodule follow-up pathway (Algorithm 3). (**Conditional** – by consensus)

Good Practice Points

- ✓ Volumetry should be used when available and reliable, in preference to diameter, to calculate nodule size.
- ✓ A volume change of > 25% between interval CTs can be considered highly specific for detecting growth in a solid pulmonary nodule.
- ✓ In the absence of available or reliable volumetry, ≥ 2mm increase in diameter can be considered clear evidence of growth.

Draft For Public Consultation October 2026

Sub-solid nodules – Baseline diagnostic approach

Recommendations

- For adults with sub-solid pulmonary nodules, maximal nodule diameter, increased CT density, spiculation, size of solid component, presence of air bronchogram and presence of bubble-like lucency can all be considered when determining lung cancer risk. (**Conditional**)
- For adults with ground-glass pulmonary nodules (GGN), the Ground-glass nodule pathway (Algorithm 4) should be used for determining lung cancer in GGN. (**Conditional** – by consensus)
- For adults with sub-solid pulmonary nodules with a solid component, the Part-solid nodule pathway (Algorithm 5) should be used for determining lung cancer risk. (**Conditional** – by consensus)

Good Practice Points

- ✓ Sub-solid pulmonary nodules should be reviewed on both mediastinal and lung windows to determine if the nodule is of increased density.
- ✓ Diameter rather than volumetry should be used to determine the size of sub-solid pulmonary nodules.
- ✓ The maximum diameter of the solid component should be measured on lung windows and a lung kernel.

Sub-solid nodules – Surveillance

Recommendations

- For adults with pure ground-glass pulmonary nodules (GGN), the Ground-glass nodule pathway (Algorithm 4) should be used for determining lung cancer in progressing GGN. (**Conditional** – by consensus)
- For adults with sub-solid pulmonary nodules with a solid component, the Part-solid nodule pathway (Algorithm 5) should be used for determining lung cancer in progressing part-solid pulmonary nodules. (**Conditional** – by consensus)

Good Practice Points

- ✓ Comparison to the earliest available CT should be performed at each evaluation of sub-solid pulmonary nodule.
- ✓ The following changes on interval CT scans may be suggestive of invasive lung cancer in sub-solid pulmonary nodules: increase in the maximal diameter of the solid component, distortion of fissure, development of air bronchograms, development of bubble-like lucency, increased CT density.

Pulmonary nodule biopsy for diagnosing lung cancer

Recommendation

- For adults with a suspected malignant pulmonary nodule, bronchoscopic (**Conditional**), percutaneous (**Strong**), or surgical (**Conditional**) biopsy can be considered for diagnosing lung cancer

Good Practice Points

- ✓ Modality for tissue acquisition should consider patient choice, nodule location and number, need for mediastinal staging, wait times, and available services.
- ✓ All patients should be able to access robotic-assisted bronchoscopy, endobronchial ultrasound (EBUS), percutaneous ultrasound / computed tomography (USS/CT) guided and surgical biopsy.

Draft For Public Consultation October 2026

Pre-treatment biopsy versus no pre-treatment biopsy

Recommendation

- A pre-treatment biopsy should be offered, where feasible, to patients who are suitable for curative-intent treatment. (**Conditional**)

FDG PET-CT staging

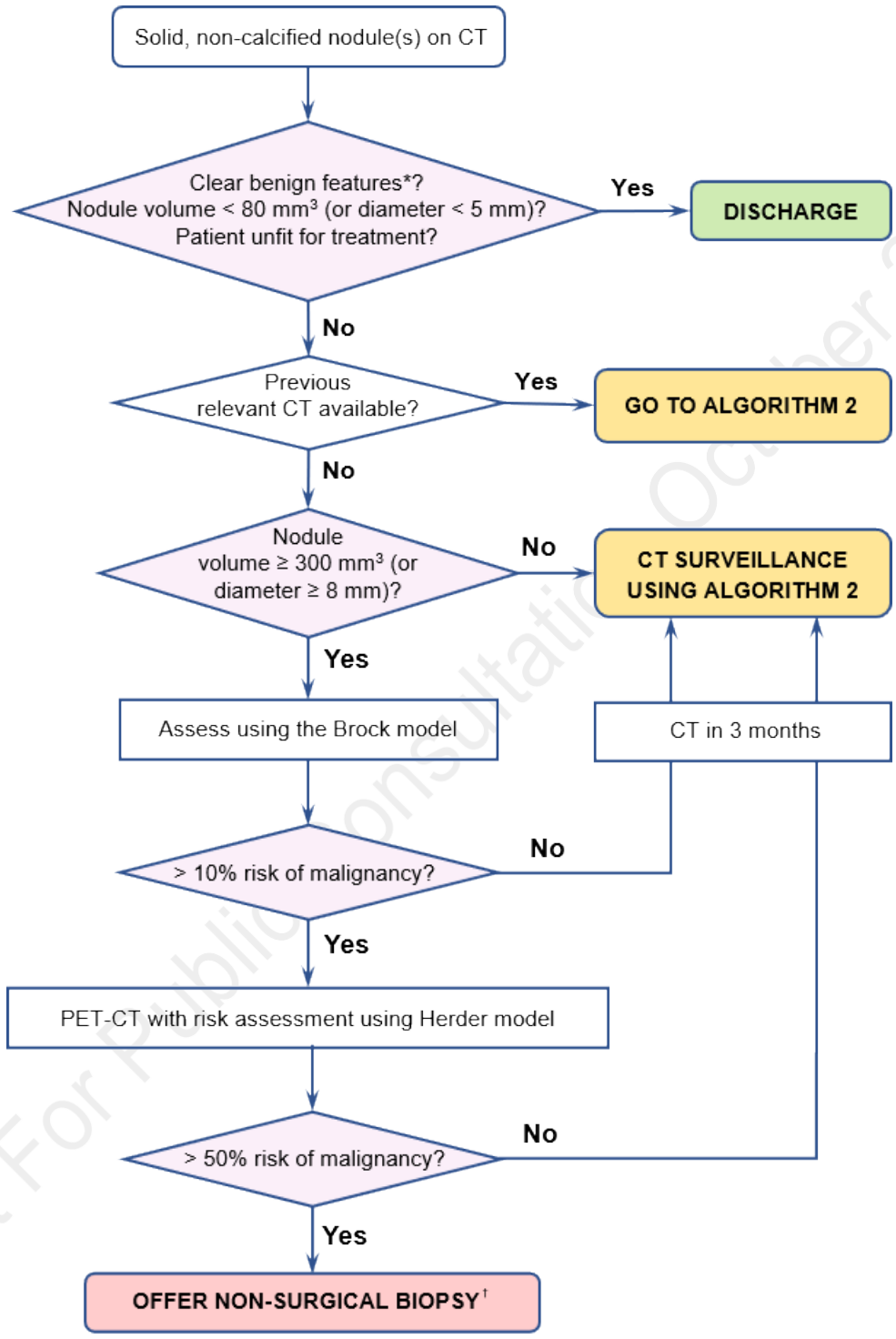
Recommendations

- For patients with solid pulmonary nodules being considered for treatment with curative intent, FDG PET-CT staging should be offered to detect occult nodal disease or metastases. (**Conditional**)
- Solid pulmonary nodules of ≥ 8 mm diameter should be offered FDG PET-CT staging (depending on PET-CT manufacturers' resolution specifications). (**Conditional** – by consensus)
- Sub-solid pulmonary nodules with a solid component ≥ 10 mm diameter should be offered FDG PET-CT staging. (**Conditional** – by consensus)

Draft For Public Consultation October 2026

Appendix 1 Clinical pathways

Algorithm 1 Solid nodule diagnostic pathway



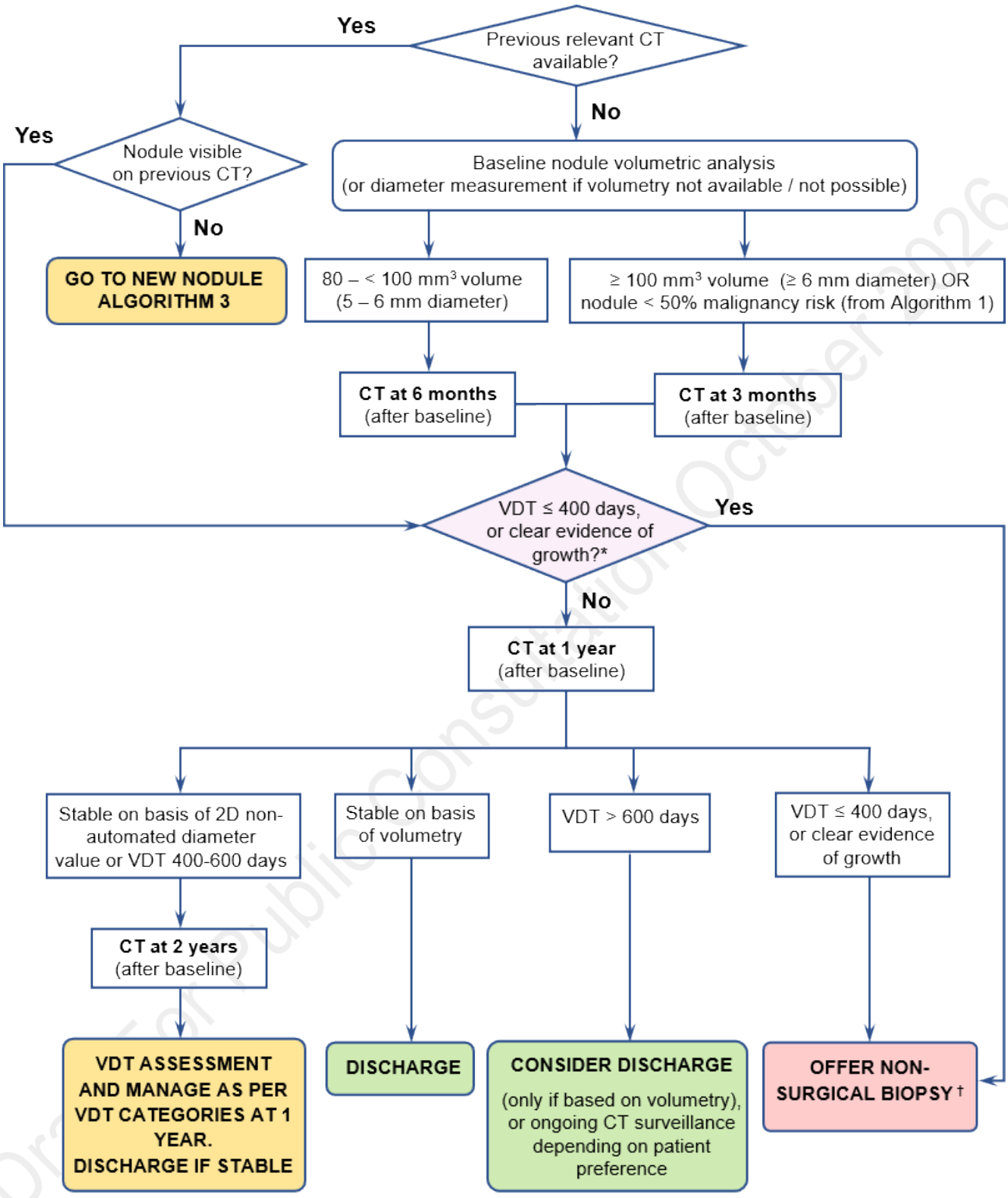
* e.g., hamartoma, typical benign intrapulmonary lymph node

† Consider definitive management without biopsy if nodule is < 2 cm and risk of malignancy is > 85%

CT – computed tomography; FDG-PET-CT – fluorodeoxyglucose positron emission tomography computed tomography; PET-CT – positron emission tomography computed tomography.

Draft For Public Consultation October 2026

Algorithm 2 Solid nodule follow-up pathway



Draft for Public Consultation October 2026

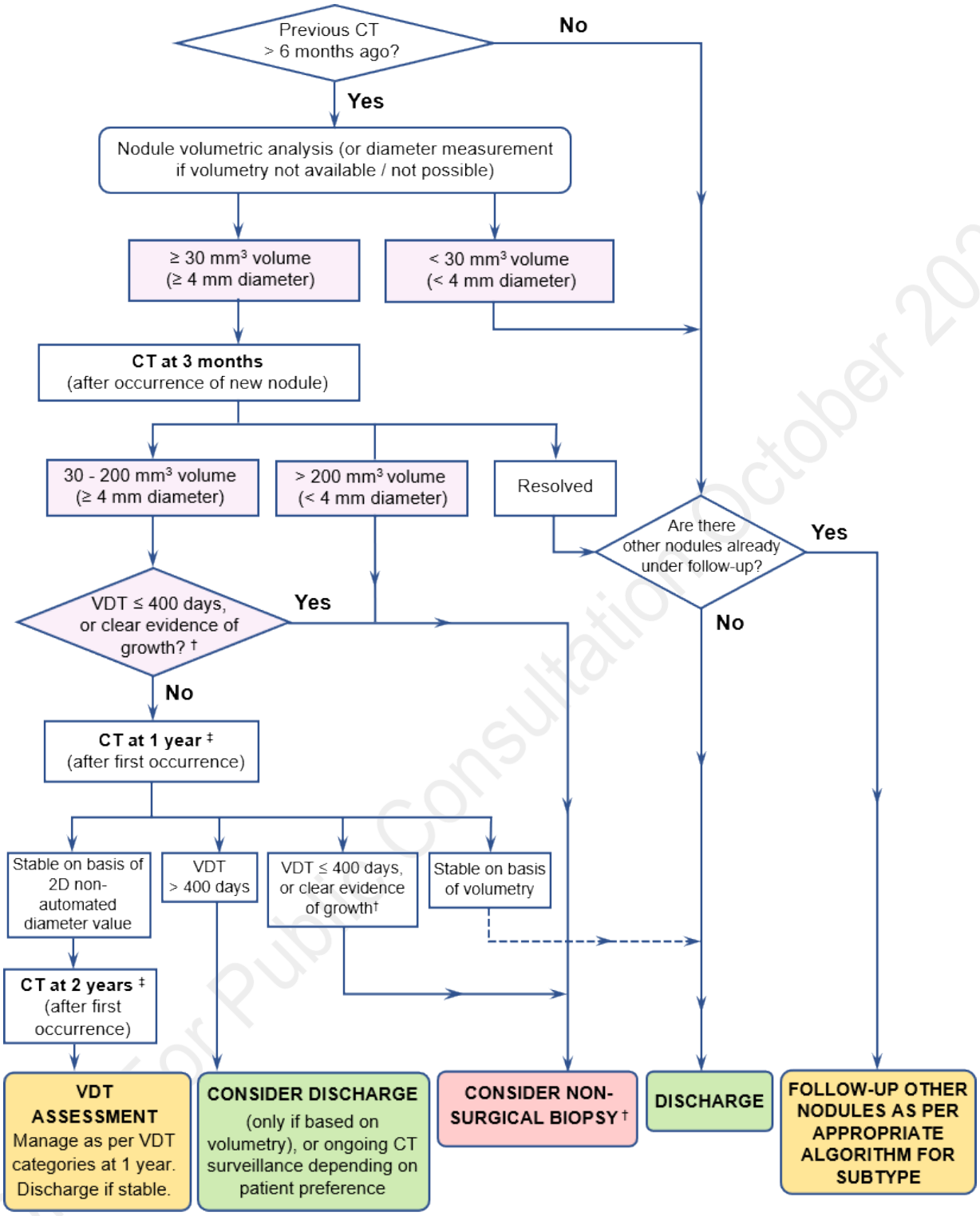
* ≥ 25% increase in volume, or ≥ 2mm in diameter

† Consider further CT surveillance if nodule is < 200 mm³

Brock and Herder models not to be used for nodule discrimination after baseline scan.

CT – computed tomography; VDT – volume doubling time

Algorithm 3 New solid nodule follow-up pathway*



* Nodule must be confirmed to be truly new. If nodule is newly detected but visible in retrospect, please follow Algorithm 2.

† ≥ 25% increase in volume, or ≥ 2mm in diameter.

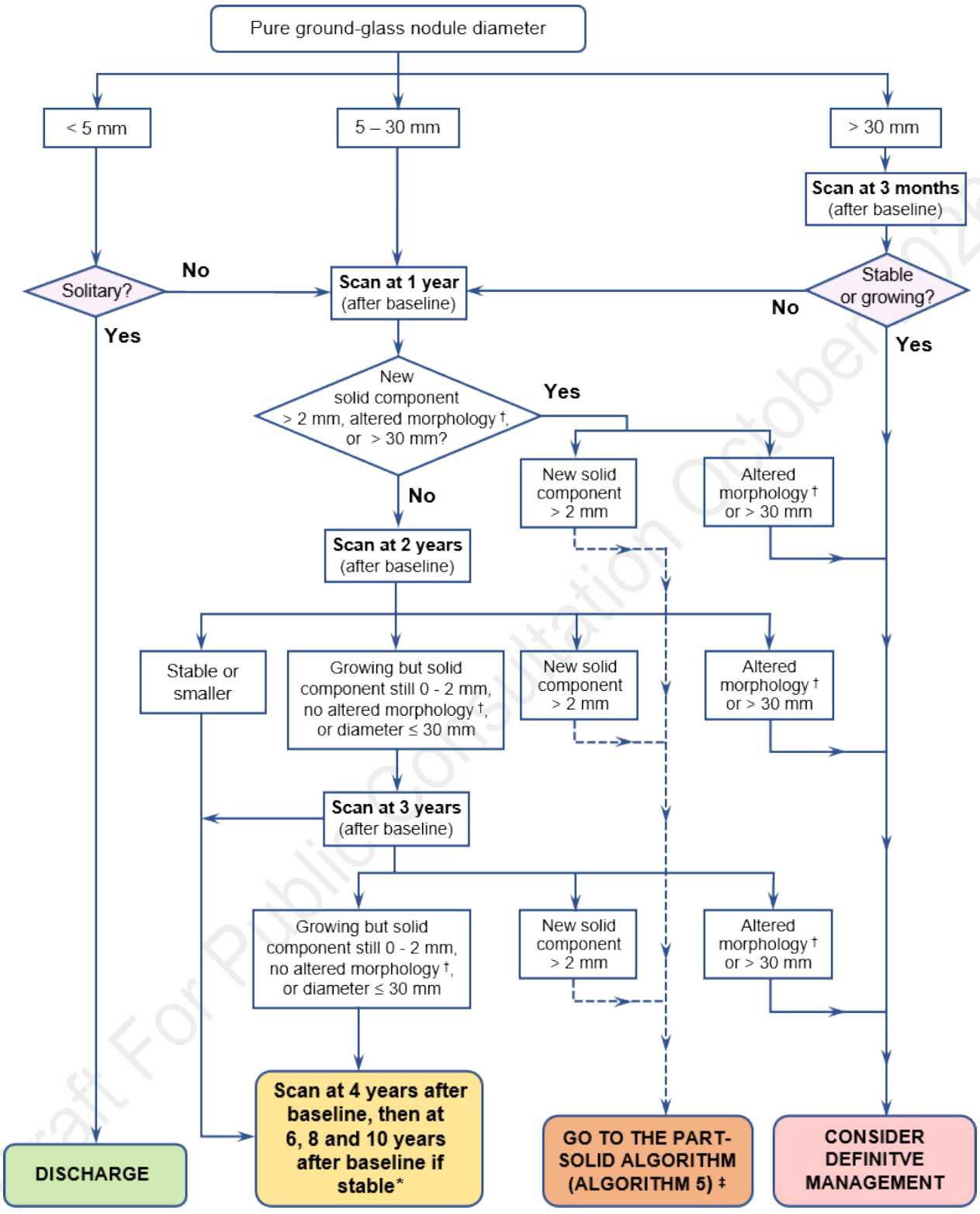
‡ If the new nodule was discovered on follow-up CTs performed for other nodules it is acceptable to modify the surveillance timepoints in this Algorithm and Algorithm 2 to ensure that both the nodule(s) originally under surveillance and the new nodule have sufficient time to permit reliable growth assessment. Please see *Section 5.3 Algorithm 3 New solid nodule follow-up pathway* and examples in Appendix 2.

Brock and Herder models not to be used for nodule discrimination for new nodules.

CT – computed tomography; VDT – volume doubling time

Draft for Public Consultation October 2026

Algorithm 4 Ground-glass nodule (GGN) pathway



* Length of follow-up:

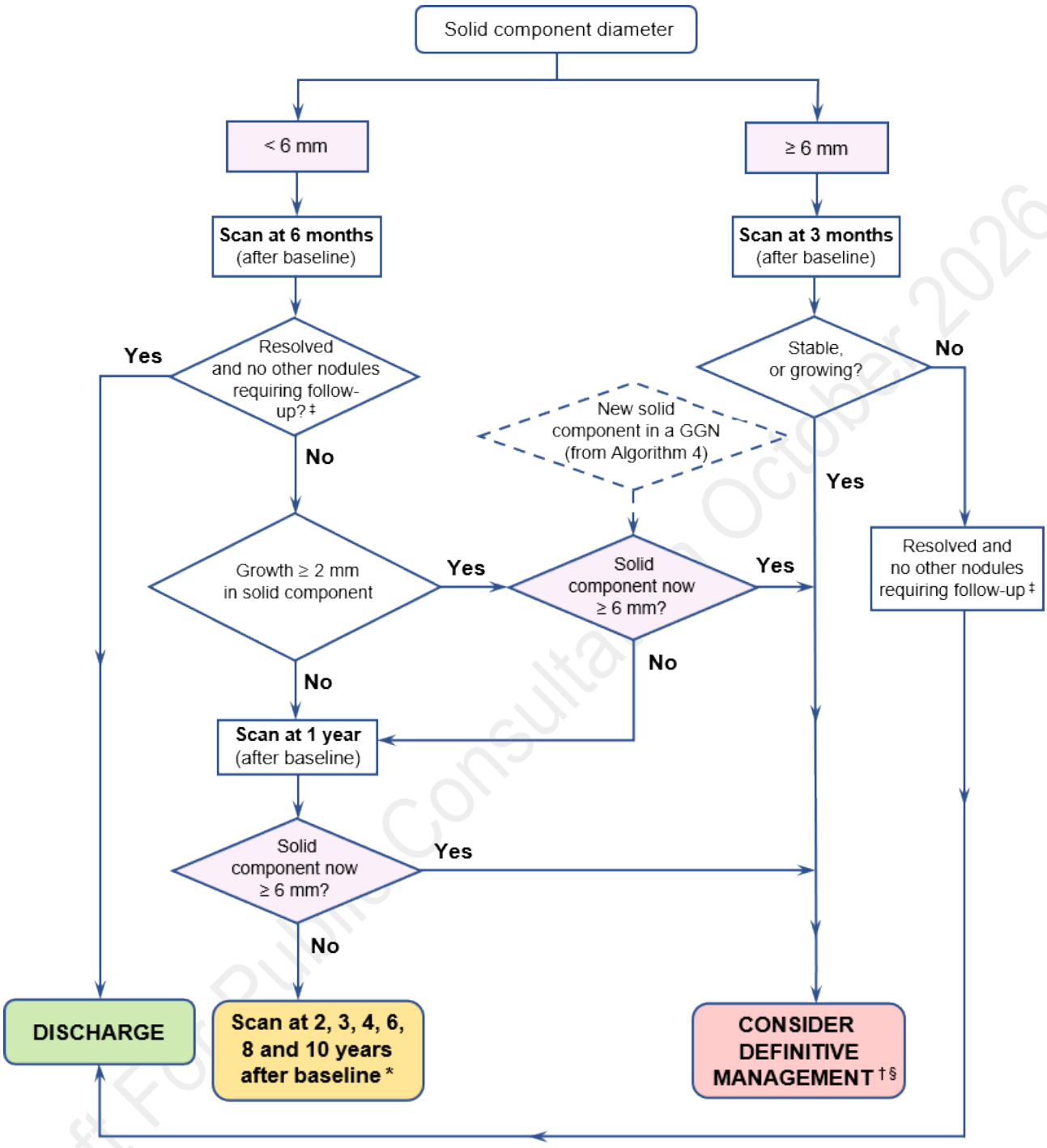
- After 10 years of follow-up, consider CT every 5 years if patient remains suitable for definitive management.
- At any point at or after 4 years, if changes in the lesion occur, manage as per the steps for a scan at 2 years from baseline.

† Altered morphology: air bronchograms, bubble-like lucency, increased CT density, distortion of fissure.

‡ Definitive management should be a shared decision-making process taking into account patient choice, age, co-morbidities, and fitness for treatment.

Draft For Public Consultation October 2026

Algorithm 5 Part-solid nodule pathway



* Length of follow-up:

- After 10 years of follow-up, consider CT every 5 years if patient remains suitable for definitive management.
- At any point at or after 4 years, if changes in the lesion occur, manage as per the steps for a scan at 2 years from baseline.

† PET-CT not required for further nodule characterisation or staging if solid component < 10 mm.

‡ If multiple GGNs and still persistent – see Ground-glass nodule pathway (Algorithm 4)

§ Definitive management should be a shared decision-making process taking into account patient choice, age, and co-morbidities.

CT – computed tomography; GGN – ground-glass nodule; VDT – volume doubling time

Draft For Public Consultation October 2026

1. INTRODUCTION

1.1 Aim of the guideline

The British Thoracic Society (BTS) published its previous guideline on pulmonary nodules in 2015, which was widely adopted and provided a robust framework for clinical practice.[1] Since that time, several important developments have occurred. These include the implementation of lung cancer screening in England, advances in imaging technology, and significant progress in biopsy techniques and surgical approaches. The current guideline is not an update of previous recommendations; it represents a new process, underpinned by de novo systematic reviews, meta-analyses, and algorithm development conducted in accordance with the GRADE Working Group framework.

The aim of this guideline is therefore to provide evidence-based, pragmatic recommendations for the investigation and management of patients with pulmonary nodules within the UK healthcare setting, reflecting contemporary evidence, evolving technologies, and the realities of clinical practice. Guidance should be interpreted in the context of suitability for treatment, co-morbidities, competing causes of mortality and patient preferences.

1.2 Intended users of the guideline and target patient populations

The guideline will be of interest to UK based clinicians diagnosing lung cancer and managing adults with pulmonary nodules, including respiratory physicians, respiratory trainees, thoracic radiologists, thoracic surgeons, clinical oncologists, lung cancer nurse specialists, pathologists, positron emission tomography–computed tomography (PET-CT) specialists, pathologists, radiographers, other allied health professional and patients and carers. Guideline group members were selected to offer a broad geographical coverage of the United Kingdom and to include specialists with backgrounds in respiratory medicine, thoracic surgery, oncology, pathology, radiology and nursing.

1.3 Scope of the guideline

The guideline will focus on accurately diagnosing cancerous and non-cancerous pulmonary nodules (solid or sub-solid) in adults 18 years-old or older. For those that are cancerous, and represent early lung cancer, the guideline will determine appropriate further investigation to optimise patient outcomes.

Specifically, the guideline will determine:

i) If the route of detection (CT screening versus incidental detection) influences the likelihood of a pulmonary nodule being lung cancer.

ii) If a previous history of cancer influences the likelihood of a pulmonary nodule being a primary lung cancer.

iii) The best imaging test(s) for detecting cancer in pulmonary nodules (solid and sub-solid).

iv) The best imaging assessment method(s) for identifying nodule morphological change(s) when using CT surveillance to predict lung cancer (solid and sub-solid).

v) The diagnostic accuracy of different biopsy methods (surgical and non-surgical) for diagnosing lung cancer in pulmonary nodules.

vi) If non-surgical biopsy improves clinical outcomes in those with pulmonary nodules being considered for treatment with curative intent; and

vii) If PET-CT is required for all nodules being considered for treatment for lung cancer with curative intent.

1.4 Areas not covered by the guideline

The management of pulmonary nodules in patients with known extra-thoracic malignancy is not specifically addressed. In this setting, the probability of metastatic disease, a second primary lung cancer, or benign pathology varies substantially according to tumour type, stage, treatment history and clinical trajectory; management should therefore be individualised through multidisciplinary review.

Draft For Public Consultation October 2026

Artificial intelligence-based malignancy prediction software is also not incorporated into these recommendations. Although these tools are promising, the evidence base remains heterogeneous and is still maturing. In particular, published datasets often classify nodules incompletely, with limited separation of solid, part-solid and ground-glass nodules, making it difficult to define how AI outputs should be incorporated into management algorithms across specific nodule subtypes.

1.5 Limitations of the guideline

Healthcare providers need to use clinical judgement, knowledge and expertise when deciding whether it is appropriate to apply recommendations for the management of patients. The recommendations cited here are a guide and may not be appropriate for use in all situations. The guidance provided does not override the responsibility of healthcare professionals to make decisions appropriate to the circumstances of each patient, in consultation with the patient and/or their guardian or carer.

1.6 Members of the guideline development group

The guideline development group (GDG) was chaired by two respiratory consultants and a consultant radiologist – Professor Mat Callister, Professor Neal Navani and Dr Arjun Nair. Professor Callister stepped down from the group in March 2024, with Professor Navani taking over the co-chair role. The GDG had a wide membership and included colleagues from respiratory medicine, oncology, radiology, pathology and nursing. A full list of group members can be seen in Appendix 3.

1.7 Acknowledgements

The GDG would like to thank Professor Mat Callister who co-chaired the group until March 2024. Professor Callister put considerable effort into developing the scope, developing the clinical questions and screening the abstracts in the first literature review. The GDG would also like to thank Professor Anand Devaraj who was a member of the group until December 2025.

2. METHODOLOGY

2.1 Establishment of guideline development group

The GDG was convened in February 2022, with the first meeting taking place in October 2022. Five additional trainee group members were recruited in June 2024. The full GDG met eight times during the development of the guideline and kept in close contact by teleconference and email throughout the process.

2.2 Methodology

This BTS guideline uses GRADE methodology in the guideline development process. Full details are provided in the BTS Guideline production manual (https://www.brit-thoracic.org.uk/quality-improvement/guidelines/) and in the detailed training materials produced for the group.

2.3 Summary of key questions, outcomes and literature search

Clinical questions were defined from the scope of the guideline formulated into PICO-type (population, intervention, comparator, and outcome) framework diagnostic accuracy, intervention or prognostic review formats. A full list of clinical questions for each section of the guideline is provided in Appendix 4.

Patient centred outcomes were agreed by the group for each question.

The PICO framework formed the basis of the literature search. Searches were completed by BTS Head Office. Systematic electronic database searches were conducted to identify all papers that may be relevant to the guideline. For each question, the following databases were searched in Search 1: Cochrane Database of Systematic Reviews (CDSR), Cochrane Central Register of Controlled Trials (CENTRAL), EMBASE and MEDLINE; and in Search 2: EMBASE and MEDLINE. The search strategy is available for review in Online Supplementary Appendix 10 (not included in the main guideline document).

Draft For Public Consultation October 2026

2.4 Literature review

Literature searches were conducted as shown in Table 1:

Table 1: Literature search details

Search	Search date(s)	Dates covered by search	Abstracts
Search 1	23 - 26 May 2023	1990 onwards	12201
Search 2	21 - 24 March 2025	May 2023 onwards	2647
Additional	28 March 2025	1990 onwards	3553

Letters, conference papers and news articles were removed and criteria for initial screening of the abstracts were:

- Does the study type match the study type criteria in the clinical question protocols?
- Does the population match the clinical question population(s)?
- Is the abstract in English?

The remaining abstracts were screened by Professor Mat Callister and Dr Arjun Nair (Search 1), Professor Neal Navani and Dr Arjun Nair (Search 2) and Dr Kirstie Opstad (Additional Search). Potentially relevant abstracts were allocated to the relevant clinical questions. Abstracts were not rejected based on the journal of publication, authorship, or country of origin.

GDG members were allocated to work on individual questions in small groups. Each abstract was read and at least two members agreed whether the abstract was 'potentially relevant' or 'not relevant' to the clinical question of interest. Abstracts were excluded if they were deemed 'not relevant' to the clinical question.

Full papers were obtained for all abstracts assigned as 'potentially relevant'. Each full paper was reviewed to assess if it addressed:

i) The clinical question population
ii) The index test and reference standard (for diagnostic accuracy questions), the intervention and comparator (for intervention questions), or the exposure and referent (for prognostic questions)
iii) The study type(s) defined in the clinical question protocol; and
iv) The clinical question outcome(s)

Each full paper fulfilling the above criteria, and agreed by at least two members of the GDG, was 'accepted' for meta-analysis and subsequent critical appraisal.

In circumstances where there was little, or no supporting evidence that fulfilled the above criteria, the full paper inclusion strategy was widened to include evidence which partially addressed the clinical question.

The second literature search (Search 2) was undertaken in March 2025 to capture additional published evidence while the guideline was in development prior to finalising the draft document. Due to the lack of relevant evidence from Search 1 to adequately address all clinical questions, an additional literature search was also undertaken in March 2025 to widen the search, and source further abstracts not retrieved in Searches 1 and 2. All additional abstracts were reviewed and allocated to the clinical questions as above. The full list of abstracts has been retained and is kept in an archive.

2.5 External sourcing of evidence

For clinical questions where data were still lacking after Searches 1, 2 and 'Additional', PubMed and ChatGPT (GPT-5) were used to try and source other relevant publications. Despite using this approach, only one additional publication was relevant to the evidence reviews (Clinical Question 8, Reference 12 (Online Supplementary Appendix 8, not included in the main guideline document)).

Draft for Public Consultation October 2026

2.6 Systematic review of the evidence

Each 'accepted' full paper underwent a systematic review. Data were extracted and meta-analyses were performed for each clinical question on an outcome-by-outcome basis for intervention reviews, or an index test basis for diagnostic accuracy reviews. If meta-analysis was not possible, e.g. if there was insufficient evidence to perform a meta-analysis, if data could not be extracted to input into a meta-analysis, or data across studies had been published in different formats, all relevant supporting data were tabulated where possible.

All full papers contributing towards a meta-analysis underwent critical appraisal. For all non-meta-analysed data included in an evidence review, contributing papers also underwent critical appraisal where possible.

Meta-analyses and risk of bias assessments (critical appraisal) were performed in Review Manager 5.3 and agreed by at least two members of the GDG. Diagnostic accuracy meta-analyses involved an additional step which was performed by BTS Head Office using the MetaDTA app.[2,3] Papers no longer deemed relevant were removed from the systematic review, with the decision to 'exclude' a paper solely based on it not fulfilling the clinical question criteria.

2.7 GRADE analysis of the evidence

Having generated evidence profiles for each of the clinical questions, GDG question groups assessed the quality of the evidence using the Grading of Recommendations, Assessment, Development and Evaluation (GRADE) methodology.[4]

Where GRADE analysis was not possible, but GDG members felt the evidence was important to be included in the Evidence Statements, these have been listed as (**Ungraded**). Definitions of the Evidence statement (GRADE) scores are shown in Table 2.

Each clinical question was reviewed by the full GDG during the regular meetings and consensus was reached in relation to the evidence summary.

Table 2: Evidence statement (GRADE) score definitions

GRADE	Definition
High ⨁⨁⨁⨁	High confidence that the true effect is close to the estimated effect
Moderate ⨁⨁⨁◯	Moderate confidence that the true effect is close to the estimated effect
Low ⨁⨁◯◯	Low confidence that the true effect is close to the estimated effect
Very Low ⨁◯◯◯	Very low confidence that the true effect is close to the estimated effect
Ungraded	GRADE analysis not possible, but evidence deemed important by the GDG

2.8 Development of recommendations

The GDG proceeded to decide on the direction and strength of recommendations considering the quality of the evidence, the balance of desirable and undesirable outcomes and the values and preferences of patients and others. GRADE specifies two categories of strength for a recommendation, as shown in Table 3.

From the outset, it was acknowledged that there would be little high-quality evidence for some of the clinical questions identified. In this instance, low grade evidence was considered, along with expert opinion via consensus at the meetings.

Draft For Public Consultation October 2026

Table 3: Explanation of the terminology used in BTS recommendations

Strength	Benefits and risks	Implications
Strong Recommended, so "offer"	Benefits appear to outweigh the risks (or vice versa) for the majority of the target group	Most service users would want to, or should receive this intervention
Conditional Suggested, so "consider"	Risks and benefits are more closely balanced, or there is more uncertainty in likely service users' values and preferences	Service users should be supported to arrive at a decision based on their values and preferences

Good practice points (GPPs) were developed by consensus in areas where there was no quality evidence, but the GDG felt that some guidance, based on the clinical experience of the GDG, might be helpful to the reader. These are indicated as shown below.

✓ Advised best practice based on the clinical experience of the guideline development group

In some instances where evidence was limited, but GDG members felt that it was important to include a recommendation rather than a GPP, recommendations were agreed by consensus and categorised as (**Conditional** – by consensus), based on the same criteria detailed in Table 3.

Cost-effectiveness was not considered in detail as in-depth economic analysis of recommendations falls outside of the scope of the BTS guideline production process. However, the GDG were asked to be mindful of any potential economic barriers to the implementation of recommendations and GPPs.

Research recommendations were also identified and listed in Online Supplementary Appendix 11 (not included in the main guideline document).

2.9 Diagnostic test accuracy reviews

Diagnostic test accuracy reviews evaluate how good, or bad, a diagnostic test is for diagnosing a disease and have been used for several clinical question reviews within the guideline. Test accuracies are usually reported as sensitivity and specificity and commonly labelled as 'Very high', 'High', 'Moderate' or 'Low', but currently there is no standard definition of what each level is. Hence, for the purposes of this guideline the definitions in Table 4 have been used (cut-offs not validated). It is important when considering implementation of the recommendations to consider the prevalence of the condition within the clinical setting. This will affect the positive and negative predictive values of a test, i.e. the proportion of patients with a positive or negative test who are correctly diagnosed.

Table 4: Guideline definitions of 'Very high', 'High', 'Moderate' and 'Low' sensitivity/specificity

Level	Pooled estimate sensitivity / specificity
Very high	90% to 100%
High	>80% to 90%
Moderate	65% to 80%
Low	<65%

2.10 Drafting the guideline

The guideline group corresponded regularly by email and meetings of the full group were also held in the period between December 2025 and August 2026. A revised draft guideline document was circulated to all stakeholders for consultation in October 2026 followed by a period of online public consultation. The BTS SOCC reviewed the draft guideline in June 2026 and October 2026.

Draft For Public Consultation October 2026

2.11 Review of the guideline

The guideline will be reviewed five years after the date of publication.

2.12 Declarations of interests

BTS Declarations of Interest forms have been completed by all members for each year they were part of the GDG. Details of these forms can be obtained from BTS Head Office. “Declarations of Interests” was a standing item at each GDG meeting.

2.13 Stakeholders

Stakeholders were identified at the start of the process. All stakeholder organisations were notified when the guideline was available for public consultation, and a list is published in Appendix 5.

3. PULMONARY NODULES

3.1 Background

A pulmonary nodule is defined as a focal opacity within the lung measuring less than 3 cm in diameter on computed tomography (CT). Pulmonary nodules are classified into three radiological subtypes: (1) solid nodules, which completely obscure the underlying lung parenchyma; (2) pure ground-glass nodules, through which the underlying lung architecture remains visible; and (3) part-solid nodules, which contain both ground-glass and solid components. Accurate distinction between these subtypes is essential, as they can differ significantly in their probability of malignancy, natural history, prognosis, and optimal management strategies. For example, persistent part-solid nodules are frequently malignant but may exhibit indolent behaviour, necessitating prolonged surveillance rather than immediate intervention.

While lung cancer remains the leading cause of cancer-related mortality worldwide, randomised controlled trials of low-dose CT (LDCT) screening have demonstrated a significant reduction in lung cancer–specific mortality. Lung cancer screening (LCS) is now being implemented across England, with full national roll-out anticipated by 2030. As a consequence, the detection of pulmonary nodules has increased substantially. Nodules are identified in a significant proportion (15-20%) of screening scans, and as of July 2026, over 1.2 million LDCT scans have been performed in England, with approximately 198,000 individuals undergoing nodule surveillance through the screening programme. In parallel, the widespread use of CT imaging for other clinical indications—such as suspected pulmonary embolism or coronary artery disease—has further increased the incidental detection of pulmonary nodules.

The management of pulmonary nodules is a complex clinical challenge that extends beyond distinguishing benign from malignant disease. High-quality care requires balancing early cancer diagnosis with the avoidance of harm. This includes minimising false-positive findings from screening programmes, reducing unnecessary follow-up imaging, optimising diagnostic yield from biopsy procedures, limiting overdiagnosis, preventing stage progression during surveillance, and avoiding unnecessary surgical resection of benign lesions.

This guideline therefore aimed to provide evidence-based, pragmatic recommendations for the investigation and management of patients with pulmonary nodules within the UK healthcare setting, reflecting contemporary evidence, evolving technologies, and the realities of clinical practice. Guidance should be interpreted in the context of suitability for treatment, co-morbidities, competing causes of mortality and patient preferences.

3.2 Investigative approach following low dose computed tomography (LDCT) screening or incidental detection

Pulmonary nodules are common incidental findings on computed tomography (CT) scans performed for other clinically indicated reasons. These incidentally detected nodules have been the main source of pulmonary nodules requiring follow up in accordance with previous BTS guidelines. More recently, lung cancer screening has become a significant source of pulmonary nodules requiring follow up. This question focused on whether incidentally detected and screen detected pulmonary nodules differed in their risk for malignancy and therefore whether they required different follow up guidelines.

Draft For Public Consultation October 2026

Question 1: In adults, is there a difference in the likelihood of diagnosing lung cancer in pulmonary nodules detected by low dose computed tomography (CT) screening compared to those detected on CT scans done for other reasons?

The findings of this question are summarised in Tables 5 and 6.

Table 5: Evidence summary of the likelihood of diagnosing lung cancer in pulmonary nodules detected by LCDT screening versus incidental detection

Clinical Outcome	Summary of evidence review (LDCT versus incidental)
Actionable pulmonary nodules after pulmonary nodule detection	Greater following LCDT screening detection (25 [16, 38] % versus 12 [5,31] % respectively, median [IQR], $p < 0.01$*)
Lung cancer after actionable pulmonary nodule detection	No difference (6 [4,10] % versus 6 [3, 10] % respectively, median [IQR], $p = 0.58$*)

* Mann-Whitney U Test

IQR – interquartile range

Table 6: Evidence summary of the likelihood of diagnosing lung cancer in pulmonary nodules detected by LDCT screening, with or without previous CT imaging, versus incidental detection

Comparison	Summary of evidence review (lung cancer detection)
LDCT with previous CT imaging versus LDCT without previous CT imaging	No difference (5 [3,12] % versus 6 [4,8] % respectively, median [IQR], $p = 0.52$*)
LDCT with previous CT imaging versus incidental detection	No difference (6 [4, 8] % versus 6 [3,10] % respectively, median [IQR], $p = 0.51$*)
LDCT without previous CT imaging versus incidental detection	No difference (5 [3, 12] % versus 6 [3,10] % respectively, median [IQR], $p = 0.96$†)

* Unpaired t-test

† Mann-Whitney U Test

IQR – interquartile range

Evidence statements

- An actionable pulmonary nodule is more likely to be identified on screening low-dose computed tomography (LDCT) than on a CT scan performed for another reason. (**Ungraded**)
- The likelihood that a pulmonary nodule is diagnosed as lung cancer is similar whether it is detected through low-dose computed tomography (LDCT) screening or incidentally on a CT scan performed for another reason. (**Ungraded**)

Recommendation

- For adults with pulmonary nodules identified on a CT scan, the investigation and management should not differ whether detected on low dose computed tomography (LDCT) for lung cancer screening or CT scan done for other reasons. (**Conditional**)

Issues with the data

Only one paper directly compared the lung cancer incidence in incidentally detected versus screen detected pulmonary nodules. However, this study had to be excluded from analysis as data reporting was incomplete. Therefore, the analysis is limited to single arm studies only and the data were not suitable for meta-analysis.

Draft for Public Consultation October 2026

Point of ongoing contention

As lung cancer screening programmes internationally mature and publish new data this topic will be open to further review.

The full Evidence Review is available in Online Supplementary Appendix 1 (not included in the main guideline document).

3.3 Likelihood of lung cancer following a previous history of non-lung cancer

Patients with a prior history of non-lung cancer frequently undergo thoracic imaging as part of follow-up care, leading to detection of incidental pulmonary nodules. Pulmonary nodules in these patients may represent benign disease, primary lung cancer, or metastatic recurrence of the previous malignancy. It remains uncertain whether a previous history of non-lung cancer increases the likelihood of diagnosing primary lung cancer in a pulmonary nodule, and whether this should influence interpretation or follow-up imaging strategies.

Question 2: In adults with pulmonary nodules, is there a difference in the likelihood of diagnosing lung cancer between patients with or without a previous history of non-lung cancer?

The findings of this question are summarised in Table 7.

Table 7: Evidence summary of the likelihood of diagnosing lung cancer between patients with or without a previous history of non-lung cancer

Clinical Outcome	Summary of evidence review ("with" versus "without" a previous history)
Lung cancer	Greater with a previous history of non-lung cancer (31 [18,48] % versus 5 [2,11] % of subjects respectively, median [IQR], $p < 0.001$* (single arm studies)

* Mann-Whitney U Test

IQR – interquartile range

Evidence statement

- A previous history of non-lung cancer appears to increase the likelihood of diagnosing lung cancer in a pulmonary nodule (**Very low**)

Recommendation

- For adults with a pulmonary nodule identified on a CT scan, information about a previous history of non-lung cancer should be sought as there may be an increased risk of nodule malignancy. (**Conditional**)

Issues with the data

The available evidence was limited and largely derived from small observational studies, with only two comparative studies suitable for meta-analysis. Many studies lacked pathological confirmation of malignancy or combined multiple histological subtypes without clear reporting, limiting interpretation of the data. In several studies it was also difficult to determine whether pulmonary nodules represented primary lung cancer or metastatic disease from a previous malignancy.

Point of ongoing contention

Key areas of ongoing uncertainty include the extent to which a previous history of non-lung cancer independently increases the likelihood of pulmonary nodule being a primary lung cancer. Despite this, extra-thoracic cancer is included in the Herder model which has been used effectively in the 2015 BTS Guidelines for the investigation and management of pulmonary nodules [1] and has been externally validated.

The full Evidence Review is available in Online Supplementary Appendix 2 (not included in the main guideline document).

Draft For Public Consultation October 2025

3.4 Solid nodules – Baseline diagnostic approach

Solid pulmonary nodules identified at baseline (prevalence) imaging may represent a range of pathologies, from benign to malignant, and therefore not all solid pulmonary nodules require immediate invasive diagnostic procedures. Solid pulmonary nodules, when compared with part-solid or pure ground-glass nodules, are known to have different malignancy risk profiles and underlying pathologies and therefore require different diagnostic and surveillance methods when identified at baseline imaging. Question 3 aimed to interrogate the baseline data on these types of nodules to inform downstream decision making (immediate intervention versus surveillance versus discharge from follow up).

Question 3: What is the diagnostic accuracy of imaging tests, and the optimal strategy for image utilisation for diagnosing lung cancer in a solid pulmonary nodule?

The findings of this question are shown in Tables 8 and 9.

Table 8: Evidence review summary for the diagnostic accuracy of imaging tests for diagnosing lung cancer in solid pulmonary nodules

Imaging test	**n**	**Cut-off**	**Sensitivity** [95% CI]	**Specificity** [95% CI]
Nodule diameter	5	> 8 mm	0.86 [0.71, 0.94]	0.55 [0.31, 0.78]
Nodule volume	1	> 2.17 cm^3	0.62 [0.50, 0.72]	0.64 [0.52, 0.75]
Upper lobe location	5	-	0.59 [0.50, 0.68]	0.74 [0.57, 0.85]
Spiculation	8	-	0.56 [0.44, 0.67]	0.74 [0.57, 0.85]
FDG-avidity	9	-	0.84 [0.76, 0.89]	0.76 [0.66, 0.83]
Brock score	1	>13.4%	0.75 [0.69, 0.80]	0.52 [0.41, 0.62]
Herder score	1	>70%	0.74 [0.68, 0.80]	0.64 [0.53, 0.73]
Mayo score	1	>29.6%	0.69 [0.63, 0.75]	0.68 [0.57, 0.77]
VA	-	-	-	-
UKLS	-	-	-	-

CI – confidence intervals; n – number of datasets

Evidence statements

- Solid pulmonary nodule diameter greater than 8 mm appears to have a high sensitivity and low specificity for diagnosing lung cancer. (**Low**)
- Solid nodule upper lobe location appears to have a low sensitivity and low specificity for diagnosing lung cancer. (**Low**)
- Solid nodule spiculation appears to have a low sensitivity and a moderate specificity for diagnosing lung cancer. (**Very low**)
- Solid nodule FDG-avidity appears to have a high sensitivity and moderate specificity for diagnosing lung cancer. (**Low**)

Recommendations

- The Solid nodule diagnostic pathway (Algorithm 1), incorporating different solid nodule characteristics, should be used for determining lung cancer in solid pulmonary nodules. (**Conditional** – by consensus)
- An FDG PET-CT (fluorodeoxyglucose positron emission tomography computed tomography) scan should be offered for determining lung cancer risk in solid pulmonary nodules ≥ 8 mm. (**Conditional**)

Draft For Public Consultation October 2026

Issues with the Data

The evidence base for Question 3 had several important limitations. Data on solid pulmonary nodules identified at baseline imaging are heterogeneous, with no standardised approach to reporting diameter, volume or other imaging characteristics. This assessment was further limited by the fact that studies often report solid and part-solid nodule characteristics together, without separating these distinct nodule groups. Much of the relevant literature focussed on de novo risk scores, tools which combine multiple clinical and imaging biomarkers (often presented as AI-generated algorithms) to predict underlying malignancy, but these could not be included due to heterogeneity of the components used to create the scores, and limitations around the clinical reproducibility of these risk scores. Certain metrics specified in the question had insufficient data to be assessed. In addition, some clinically relevant information could not be incorporated due to restrictions related to question definition, extraction methodology, or meta-analysis requirements. As such, a consensus view on solid pulmonary nodule management was taken, to allow for practical management of solid nodules identified at baseline imaging.

Due to a relatively limited sample of data meeting the criteria for inclusion in the meta-analysis, a consensus statement on how to manage solid pulmonary nodules has been agreed (see Algorithm 1 Solid nodule diagnostic pathway). This algorithm represents a practical approach to management of these nodules, while acknowledging the results from the meta-analysis.

The full Evidence Review is available in Online Supplementary Appendix 3 (not included in the main guideline document).

3.5 Solid nodules – Surveillance

The assessment of interval change in solid pulmonary nodules is a key component of establishing the risk of malignancy and potential for a subsequent lung cancer diagnosis, in patients with a low initial probability of malignancy. In these patients, immediate invasive investigation may not be appropriate or feasible, and serial computed tomography (CT) surveillance is an established modality to help distinguish benign from malignant nodules. Several strategies have been proposed to define significant growth, and therefore the potential of a cancer diagnosis, including changes in diameter, volume, and volume doubling time (VDT). Accurate assessment of growth patterns is clinically important to avoid delaying cancer diagnosis, while minimising unnecessary imaging, procedures, and patient anxiety associated with benign nodules. This question evaluates the diagnostic accuracy of CT-based strategies used to detect interval change suggestive of malignancy.

Question 4: In adults with solid pulmonary nodules, what is the diagnostic accuracy of strategies used to detect change between interval computed tomography (CT) scans for diagnosing lung cancer?

The findings of this review are summarised in Table 9.

Table 9: Evidence review summary for the diagnostic accuracy of imaging test changes between CT scans for diagnosing lung cancer in solid pulmonary nodules

Imaging strategy	**n**	**Cut-off**	**Sensitivity** [95% CI]	**Specificity** [95% CI]
Visual analysis	-	-	-	-
Diameter change	1	> 1.5 mm	0.55 [0.23, 0.83]	1.00 [0.96, 1.00]
Volume doubling time (VDT)	4	< 400 days	0.76 [0.59, 0.87]	0.94 [0.79, 0.98]
Volume doubling time (VDT)	5	< 600 days	0.87 [0.72, 0.94]	0.84 [0.64, 0.93]
Mass doubling time (MDT)	-	-	-	-
Volume change	2	> 25 %	0.62 [0.31, 0.86]	0.81 [0.47, 0.91]

CI – confidence intervals; n – number of datasets

Draft for Public Consultation October 2025

Evidence Statements

- A volume doubling time of <400 days appears to have a moderate sensitivity and a very high specificity for detecting change between interval computed tomography (CT) scans for diagnosing lung cancer in solid pulmonary nodules. (**Very low**)
- A volume doubling time of <600 days appears to have a high sensitivity and a high specificity for detecting change between interval computed tomography (CT) scans for diagnosing lung cancer in solid pulmonary nodules. (**Low**)
- A volume change of > 25% between interval computed tomography (CT) scans may have a low sensitivity and a high specificity for detecting change between interval computed tomography (CT) scans for diagnosing lung cancer in solid pulmonary nodules. (**Low**)
- There was insufficient evidence to support the use of visual analysis, diameter change, or mass doubling time (MDT) to detect change between interval computed tomography (CT) scans for diagnosing lung cancer in solid pulmonary nodules. (**Very low**)
- There was insufficient evidence to consider peri-cystic lesion and consolidated solid pulmonary nodule subgroups.

Recommendations

- ➢ Comparison to the earliest available CT should be performed at each evaluation of solid pulmonary nodules.
- ➢ For adults with solid pulmonary nodules, a volume doubling time (VDT) of less than 600 days should be considered suggestive of lung cancer. (**Conditional**)
- ➢ The Solid nodule follow-up pathway (Algorithm 2), incorporating solid pulmonary nodule changes at follow-up, should be used for determining lung cancer in progressing solid pulmonary nodules. (**Conditional** – by consensus)
- ➢ For new solid nodules, please use the New nodule follow-up pathway (Algorithm 3). (**Conditional** – by consensus)

Good Practice Points

- ✓ Volumetry should be used when available and reliable, in preference to diameter, to calculate nodule size.
- ✓ A volume change of > 25% between interval CTs can be considered highly specific for detecting growth in a solid pulmonary nodule.
- ✓ In the absence of available or reliable volumetry, ≥ 2mm increase in diameter can be considered clear evidence of growth.

Issues with the data

The evidence base for Question 4 had several important limitations. Studies evaluating combined diagnostic imaging approaches, such as positron emission tomography (PET) metrics alongside growth assessment, were outside the scope of the review question. Similarly, de novo risk scores that combine multiple clinical and imaging biomarkers, often presented as AI-generated algorithms, were common in the literature but could not be included because of heterogeneity in score components and concerns regarding clinical reproducibility. Several prespecified metrics also lacked sufficient data for assessment, including mass doubling time and peri-cystic lesions. In addition, some clinically relevant information could not be incorporated because of constraints related to the question definition, extraction methodology, or meta-analysis requirements. There was further heterogeneity across studies in how growth was defined and measured, including variation in thresholds for changes in diameter, volume, and volume doubling time (VDT). Finally, this question did not specifically evaluate the impact of different surveillance intervals (for example, 3- versus 12-month CT follow-up) or the optimal duration of surveillance required to confirm benignity.

Draft For Public Consultation October 2026

Insufficient evidence was available to assess visual analysis, diameter change, mass doubling time, peri-cystic lesions, and consolidation. Evidence was limited as some studies did not report solid and sub-solid nodules separately. More standardised reporting of solid nodule growth is needed, including the use of accepted VDT thresholds.

The full Evidence Review is available in Online Supplementary Appendix 4 (not included in the main guideline document).

3.6 Solid nodules – New nodules

New solid pulmonary nodules identified at follow-up were not considered as one of the clinical questions. However, please refer to Section 5.3 Algorithm 3 New solid nodule follow-up pathway and Algorithm 3 New solid nodule follow-up pathway (developed by clinical consensus) for information.

3.7 Sub-solid nodules – Baseline diagnostic approach

CT is the cornerstone imaging modality for assessment of sub-solid pulmonary nodules (SSNs), while PET-CT may be considered in selected cases. SSNs may represent benign pathology, such as focal infection or fibrosis, or lesions within the adenocarcinoma spectrum ranging from pre-invasive abnormalities to invasive adenocarcinoma. Persistent SSNs are more likely to be malignant than solid nodules, although many demonstrate indolent behaviour and favourable outcomes, contributing to uncertainty regarding optimal investigation and management strategies, including surveillance and intervention.[5,6]

Question 5: What is the diagnostic accuracy of imaging tests, and the optimal strategy for image utilisation for diagnosing lung cancer in a sub-solid pulmonary nodule?

The overall findings for this question are summarised in Tables 10 and 11.

Table 10: Evidence review summary for the diagnostic accuracy of imaging tests for diagnosing lung cancer in sub-solid pulmonary nodules

Imaging test	**n**	**Sensitivity** [95% CI]	**Specificity** [95% CI]
Nodule diameter	-	-	-
Nodule volume	-	-	-
Upper lobe location	12	0.63 [0.61, 0.65]	0.43 [0.35, 0.51]
Spiculation	22	0.28 [0.18, 0.39]	0.91 [0.86, 0.94]
FDG-avidity	-	-	-
Air bronchogram	12	0.27 [0.18, 0.40]	0.88 [0.79, 0.94]
Bubble-like lucency	19	0.25 [0.19, 0.31]	0.89 [0.85, 0.91]
Clear lung/tumour interface	6	0.76 [0.52, 0.90]	0.25 [0.15, 0.38]
CT density	-	-	-
Size of solid component	-	-	-
Brock score	2	0.82 ± 0.00*	0.55 ± 0.02*
Mayo score	1	0.72	0.76
VA	-	-	-
UKLS	-	-	-

* Not meta-analysed (mean ± SD)

CI – confidence intervals; n – number of datasets

Draft For Public Consultation October 2026

Table 11: Evidence summary of imaging tests for diagnosing lung cancer in malignant (IAC + MIA) versus benign (AIS + AHH) sub-solid pulmonary nodules

Imaging test	**Evidence summary of malignant nodules versus benign nodules** (95% CI)
Nodule diameter (maximal)	Malignant nodules 4.0 (3.2 to 4.8) mm greater
Nodule volume	Malignant nodules 0.9 (0.4 to 1.4) cm^3 greater
FDG-avidity	Malignant nodules 2.8 (2.5 to 3.1) g/mL greater*
CT density	Malignant nodules 104.1 (81.4 to 126.8) HU greater
Size of solid component	Malignant nodules 3.3 (3.0 to 3.5) mm greater

* Based on 1 study; CI – confidence intervals

Part solid nodule (PSN) and ground-glass nodule (GGN) subgroups

Part-solid nodules (PSN) and ground-glass nodules (GGN) were considered as separate subgroups. Unfortunately, there was insufficient separation of the PSN and GGN subgroups in the literature for all subgroup analyses. However, where GGN data were available, GGN subgroup analyses were considered, and the results are summarised in Tables 12 and 13.

Ground-glass Nodules

Table 12: Evidence review summary for the diagnostic accuracy of imaging tests for diagnosing lung cancer in ground-glass sub-solid pulmonary nodules (GGN)

Imaging test	**n**	**Sensitivity** [95% CI]	**Specificity** [95% CI]
Nodule diameter	-	-	-
Nodule volume	-	-	-
Upper lobe location	6	0.65 [0.60, 0.70]	0.41 [0.27, 0.60]
Spiculation	8	0.17 [0.07, 0.36]	0.95 [0.87, 0.98]
FDG-avidity	-	-	-
Air bronchogram	4	0.38 [0.20, 0.61]	0.84 [0.64, 0.93]
Bubble-like lucency	7	0.23 [0.13, 0.37]	0.90 [0.78, 0.95]
Clear lung/tumour interface	-	-	-
CT density	-	-	-
Brock score	-	-	-
Mayo score	-	-	-
VA	-	-	-
UKLS	-	-	-

CI – confidence intervals; n – number of datasets

Draft For Public Consultation October 2026

Table 13: Evidence summary of imaging tests for diagnosing lung cancer in malignant (IAC + MIA) versus benign (AIS + AHH) ground-glass sub-solid pulmonary nodules (GGN)

Imaging test	**Evidence summary of malignant nodules versus benign nodules** (95% CI)
Nodule diameter (maximal)	Malignant nodules 3.6 (2.4 to 4.8) mm greater
Nodule volume	No evidence
FDG-avidity	No evidence
CT density	Malignant nodules 54.6 (42.6, 66.6) HU greater

* Based on 2 studies

Evidence statements

- Malignant sub-solid pulmonary nodules appear to have a greater maximal nodule diameter than benign sub-solid pulmonary nodules. (**Very low**)
- There was insufficient evidence to determine if pulmonary nodule volume can be used for determining lung cancer in sub-solid pulmonary nodules.
- Upper lobe location appears to have a low sensitivity and a low specificity for diagnosing lung cancer in sub-solid pulmonary nodules. (**Moderate**)
- Upper lobe location appears to have a moderate sensitivity and a low specificity for diagnosing lung cancer in ground-glass pulmonary nodules. (**Low**)
- Spiculation appears to have a low sensitivity and a very high specificity for diagnosing lung cancer in sub-solid pulmonary nodules. (**Very low**)
- Spiculation appears to have a low sensitivity and a very high specificity for diagnosing lung cancer in ground-glass pulmonary nodules. (**Low**)
- There was insufficient evidence to determine if FDG-avidity can be used for determining lung cancer in sub-solid pulmonary nodules.
- The presence of air bronchogram appears to have a low sensitivity and a high specificity for diagnosing lung cancer in sub-solid pulmonary nodules. (**Very low**)
- The presence of air bronchogram appears to have a low sensitivity and a high specificity for diagnosing lung cancer in ground-glass pulmonary nodules. (**Moderate**)
- The presence of bubble-like lucency appears to have a low sensitivity and a high specificity for diagnosing lung cancer in sub-solid pulmonary nodules. (**Low**)
- The presence of bubble-like lucency appears to have a low sensitivity and a very high specificity for diagnosing lung cancer in ground-glass pulmonary nodules. (**Low**)
- The presence of a clear lung/tumour interface appears to have a moderate sensitivity and a low specificity for diagnosing lung cancer in sub-solid pulmonary nodules. (**Very low**)
- Malignant sub-solid pulmonary nodules appear to have a greater CT density than benign sub-solid pulmonary nodules. (**Very low**)
- Malignant sub-solid pulmonary nodules appear to have a greater size of solid component than benign sub-solid pulmonary nodules. (**Very low**)
- There was insufficient evidence to determine the diagnostic accuracy of risk calculator models (Brock, Herder, Mayo, VA and UKLS) for diagnosing lung cancer in sub-solid nodules.

Draft For Public Consultation October 2026

Recommendations

- For adults with sub-solid pulmonary nodules, maximal nodule diameter, increased CT density, spiculation, size of solid component, presence of air bronchogram and presence of bubble-like lucency can all be considered when determining lung cancer risk. (**Conditional**)
- For adults with ground glass pulmonary nodules (GGN), the Ground glass nodule pathway (Algorithm 4) should be used for determining lung cancer in GGN. (**Conditional** – by consensus)
- For adults with sub-solid pulmonary nodules with a solid component, the Part-solid nodule pathway (Algorithm 5) should be used for determining lung cancer risk. (**Conditional** – by consensus)

Good Practice Points

- ✓ Sub-solid pulmonary nodules should be reviewed on both mediastinal and lung windows to determine if the nodule is of increased density.
- ✓ Diameter rather than volumetry should be used to determine the size of sub-solid pulmonary nodules.
- ✓ The maximum diameter of the solid component should be measured on lung windows and a lung kernel.

Issues with the Data

The available literature was dominated by studies of adenocarcinoma-spectrum lesions, with limited evidence directly comparing all benign SSNs with invasive lung cancer. Consistent with the International Association for the Study of Lung Cancer/American Thoracic Society/European Respiratory Society (IASLC/ATS/ERS) classification framework [7], invasive adenocarcinoma (IAC) and minimally invasive adenocarcinoma (MIA) sub-solid pulmonary nodules were classified as malignant lesions; whereas adenocarcinoma in situ (AIS) and atypical adenomatous hyperplasia (AAH) were considered benign pre-invasive lesions. Consequently, a substantial number of studies were excluded due to inconsistent lesion classification, including the grouping of AIS (and AAH) with the malignant cohorts, the classification of MIA as a pre-invasive lesion, or insufficient reporting of adenocarcinoma subtype stratification. This classification framework is pivotal for guiding clinical decision-making and optimising patient management. In addition, analyses were limited to surgically resected specimens because of the recognised limitations of biopsy sampling in accurately identifying invasive components within adenocarcinoma-spectrum lesions.

Key areas of ongoing uncertainty include whether imaging-defined malignant SSNs represent clinically significant invasive lung cancer requiring intervention, the optimal classification of adenocarcinoma-spectrum lesions in diagnostic accuracy studies, and the relative value of imaging biomarkers compared with clinical risk prediction models for guiding management decisions.

The full Evidence Review is available in Online Supplementary Appendix 5 (not included in the main guideline document).

3.8 Sub-solid nodules – Surveillance

When the likelihood of invasive malignant tumour is felt to be low, CT surveillance of sub-solid nodules is favoured. Timely identification of CT features, such as growth or changes in nodule morphology, which may indicate progression to an invasive tumour, can help guide further intervention and prognosis.

Question 6: In adults with sub-solid pulmonary nodules, what is the diagnostic accuracy of strategies used to detect change between interval computed tomography (CT) scans for diagnosing lung cancer?

The findings of this question are summarised in Tables 14 and 15.

Draft For Public Consultation October 2026

Table 14: Evidence review summary for the diagnostic accuracy of imaging test changes between CT scans for diagnosing lung cancer in sub-solid pulmonary nodules

Imaging strategy	**n**	**Cut-off**	**Sensitivity** [95% CI]	**Specificity** [95% CI]
Visual analysis	-	-	-	-
Diameter change	4	-	0.63 [0.37, 0.83]	0.39 [0.22, 0.61]
Volume doubling time (VDT)	-	-	-	-
Mass doubling time (MDT)	2	≤ 400 days	0.76 [0.34, 0.94]	0.43 [0.14, 0.81]
Volume change	2	< 25 %	0.62 [0.31, 0.86]	0.81 [0.47, 0.91]

CI – confidence intervals; n – number of datasets

Table 15: Evidence summary of imaging test changes between CT scans for diagnosing lung cancer in malignant (IAC + MIA) versus benign (AIS + AHH) sub-solid pulmonary nodules

Imaging strategy	**Evidence summary of imaging test changes between CT scans** (CI)
Diameter change at ≤ 2-year follow-up	Malignant nodules 1.5 (-0.5 to 3.5) mm greater Benign nodules 0.7 (-0.8 to 2.2) mm greater
Diameter change at > 2-year follow-up	Malignant nodules 2.5 (1.0 to 4.0) mm greater Benign nodules 0.8 (-2.2 to 3.8) mm greater*

* Based on 2 studies

AHH – atypical adenomatous hyperplasia; AIS – adenocarcinoma in situ; CI – confidence intervals; IAC – invasive adenocarcinoma; MIA – minimally invasive adenocarcinoma

Evidence Statements

- There was insufficient evidence to support the use of visual analysis to detect change between interval computed tomography (CT) scans for diagnosing lung cancer in sub-solid pulmonary nodules.
- Diameter change may have a low sensitivity and low specificity for detecting change between interval computed tomography (CT) scans for diagnosing lung cancer in sub-solid pulmonary nodules. (**Very low**)
- A diameter change of ≥ 2 mm between interval CT scans may indicate lung cancer in a sub-solid pulmonary nodule. (**Very low**)
- There was insufficient evidence to support the use of volume doubling time (VDT) to detect change between interval computed tomography (CT) scans for diagnosing lung cancer in sub-solid pulmonary nodules.
- A mass doubling time (MDT) of ≤ 400 days may have a moderate sensitivity and a low specificity for detecting change between interval computed tomography (CT) scans for diagnosing lung cancer in sub-solid pulmonary nodules. (**Very low**)
- Volume change may have a low sensitivity and a low specificity for detecting change between interval computed tomography (CT) scans for diagnosing lung cancer in sub-solid pulmonary nodules. (**Very low**)
- There was insufficient evidence to consider ground-glass nodule (GGN) and part solid nodule (PSN) subgroups.

Recommendations

➢ For adults with pure ground glass pulmonary nodules (GGN), the Ground glass nodule pathway (Algorithm 4) should be used for determining lung cancer in progressing GGN. (**Conditional** – by consensus)

Draft For Public Consultation October 2026

- For adults with sub-solid pulmonary nodules with a solid component, the Part-solid nodule pathway (Algorithm 5) should be used for determining lung cancer in progressing part-solid pulmonary nodules. (**Conditional** – by consensus)

Good Practice Points

- ✓ Comparison to the earliest available CT should be performed at each evaluation of sub-solid pulmonary nodule.
- ✓ The following changes on interval CT scans may be suggestive of invasive lung cancer in sub-solid pulmonary nodules: increase in the maximal diameter of the solid component, distortion of fissure, development of air bronchograms, development of bubble-like lucency, increased CT density.

Issues with the data

Data analysis was hindered by limited sample size and inconsistent classification. Although several studies reported longitudinal changes or stability in SSNs, the small number of resected nodules in most studies (usually < 50 resected nodules) precluded meaningful analysis. In most studies, longitudinal stability was equated with benignity, and therefore nodules remained unresected, although notable exceptions to this were identified.[8] Inconsistent adenocarcinoma spectrum classification (similar to Question 4, Section 3.5 Baseline diagnostic approach – sub-solid nodules) confounded the analysis of those studies reporting resected nodules. Some studies reported only resected adenocarcinoma spectrum lesions, excluding other causes of SSNs including fibrosis and inflammation, thus introducing an inherent bias.

There is ongoing uncertainty regarding the likelihood of invasive tumour in growing pure ground-glass nodules, particularly regarding risk of overdiagnosis and overtreatment of such lesions. The lack of published data reporting longitudinal change in benign resected non-adenocarcinoma spectrum lesions adds to this uncertainty.

The full Evidence Review is available in Online Supplementary Appendix 6 (not included in the main guideline document).

3.9 Pulmonary nodule biopsy for diagnosing lung cancer

The decision to biopsy a pulmonary nodule is often complex. Deciding which modality to choose is based on both patient and nodule characteristics. There are several modalities available to clinicians to obtain a diagnostic biopsy, and these can be broadly categorised into:

i) Bronchoscopic biopsy (flexible bronchoscopy, navigational bronchoscopy or robotic assisted bronchoscopy)

ii) Percutaneous biopsy (USS or CT guided biopsy); and

iii) Surgical biopsy.

This question aimed to address the diagnostic accuracy of using biopsy to diagnose lung cancer in a pulmonary nodule.

Question 7: In adults with pulmonary nodules, what is the diagnostic accuracy of biopsy of a pulmonary nodule for diagnosing lung cancer?

The findings of this review are summarised in Table 16.

Draft For Public Consultation October 2020

Table 16: Evidence review summary for the diagnostic accuracy of biopsy for diagnosing lung cancer in pulmonary nodules

Biopsy type	**n**	**Sensitivity** [95% CI]	**Specificity** [95% CI]
All	36	0.93 [0.90, 0.95]	1.00 [0.99, 1.00]
Bronchoscopic	10	0.91 [0.80, 0.96]	1.00 [0.77, 1.00]
Percutaneous	23	0.93 [0.89, 0.95]	1.00 [0.96, 1.00]
Surgical	3	0.98 [0.78, 1.00]	0.98 [0.74, 1.00]

CI – confidence intervals; n – number of datasets

Evidence statements

- Biopsy appears to have a very high sensitivity and very high specificity for diagnosing lung cancer in pulmonary nodules. (**Moderate**)
- Percutaneous biopsy appears to have a very high sensitivity and very high specificity for diagnosing lung cancer in pulmonary nodules (**High**) with a small interquartile range.
- Bronchoscopic biopsy appears to have a very high sensitivity and very high specificity for diagnosing lung cancer in pulmonary nodules (**Low**) with a moderate interquartile range.
- Surgical biopsy appears to have a very high sensitivity and very high specificity for diagnosing lung cancer in pulmonary nodules. (**Low**)
- There was insufficient evidence to consider solid and sub-solid nodule subgroups.

Recommendation

➢ For adults with a suspected malignant pulmonary nodule, bronchoscopic (**Conditional**), percutaneous (**Strong**), or surgical (**Conditional**) biopsy can be considered for diagnosing lung cancer

Good Practice Points

✓ Modality for tissue acquisition should consider patient choice, nodule location and number, need for mediastinal staging, wait times, and available services.

✓ All patients should be able to access robotic-assisted bronchoscopy, endobronchial ultrasound (EBUS), percutaneous ultrasound / computed tomography (USS/CT) guided and surgical biopsy.

Issues with the data

Publication bias is likely to impact the perceived accuracy of all three modalities, with a predominance of studies reporting percutaneous biopsies and a relatively low number of studies reporting bronchoscopic biopsies. The high accuracy reported with bronchoscopic biopsy was mainly in studies utilising advanced bronchoscopic techniques such as robotic assisted bronchoscopy. There were also very few randomised studies assessing diagnostic accuracy and yield of different pulmonary nodule biopsy modalities. Evidence for this question mostly relied on observational real-world data.

The evidence base in this area is likely to change rapidly over the coming years, due to the increasing adoption of advanced bronchoscopic techniques such as robotic assisted bronchoscopy.

The full Evidence Review is available in Online Supplementary Appendix 7 (not included in the main guideline document).

3.10 Pre-treatment biopsy versus no pre-treatment biopsy

In patients with pulmonary nodules considered at high risk of malignancy, treatment with curative intent may include surgical resection, stereotactic ablative radiotherapy, or other definitive therapies. While histological

Draft for Public Consultation October 2026

confirmation through pre-treatment biopsy is often recommended, biopsy procedures can carry risks associated with morbidity or may be technically not feasible. In some patients with a high clinical and radiological probability of lung cancer, treatment may proceed without tissue confirmation. This question examines whether obtaining a pre-treatment biopsy influences clinical outcomes compared with proceeding directly to curative-intent treatment without biopsy, balancing diagnostic certainty, treatment delay, procedural risk, and overtreatment.

Question 8: In adults with pulmonary nodules being considered for treatment for lung cancer with curative intent, does pre-treatment biopsy provide the same clinical outcomes as no biopsy?

The findings are summarised in Table 17.

Table 17: Evidence summary of the effect on clinical outcomes following pre-treatment biopsy or no pre-treatment biopsy

Clinical outcome	**Evidence summary of pre-treatment biopsy versus no pre-treatment biopsy** (95% CI)
Benign resection	Greater with no pre-treatment (67/1000 (19 to 245) versus 371/1000 respectively)*
Mortality	No difference (short-term 0 [0, 0] % versus 0.7 [0, 0.9] % respectively, median [IQR], $p = 0.16^{\dagger}$; longer-term (80 months) 166/1000 (59 to 466) versus 113/1000 respectively*)
Morbidity	Greater following pre-treatment biopsy (29 [16, 39] versus 7 [7, 13] % respectively, median [IQR], $p = 0.004$)‡
Quality of life	No evidence
Recurrence	Greater following pre-treatment biopsy (336/1000 (246 to 462) versus 85/1000 respectively)*

* Reported per 1000 patients (based on 2 studies)

† Unpaired t-test, with pre-treatment biopsy group n = 2, without pre-treatment biopsy group n = 5

‡ Unpaired t-test, primarily pneumothorax following percutaneous biopsy

CI – confidence interval; IQR – interquartile range; n – number of datasets

Evidence statements

- Pre-treatment biopsy may reduce the incidence of benign resection in adults with pulmonary nodules being considered for treatment for lung cancer with curative intent when compared with no pre-treatment biopsy. (**Very low**)
- Pre-treatment biopsy appears to have no effect on short-term mortality (up to 30-days post-treatment) in adults with pulmonary nodules being considered for treatment for lung cancer with curative intent when compared with no pre-treatment biopsy. (**Ungraded**)
- Pre-treatment biopsy appears to have no effect on longer-term mortality (up to 80 months post-treatment) in adults with pulmonary nodules when compared with no pre-treatment biopsy. (**Very low**)
- There was insufficient evidence to consider solid and sub-solid pulmonary nodule subgroups separately.

Recommendation

➢ A pre-treatment biopsy should be offered, where feasible, to patients who are suitable for curative-intent treatment. (**Conditional**)

Issues with the data

The available evidence base was limited, with relatively few studies directly comparing outcomes between patients undergoing pre-treatment biopsy and those treated without prior tissue confirmation. There was also

Draft for Public Consultation October 2026

substantial methodological variation between studies, including differences in patient selection, biopsy techniques, definitions of clinical/procedural outcomes, and thresholds for malignancy risk. In particular, several studies reported mixed cohorts with both intraoperative biopsies and percutaneous biopsies [9] or defined non-biopsy cohorts as those with previous failed attempts [10,11] which led to their exclusion. No randomised controlled trials were identified. Analysis was therefore based on a small number of eligible studies which raises possibility of publication bias and limits the certainty of conclusions that can be drawn from the evidence. There were no studies looking at quality of life outcomes in this cohort and therefore no conclusions could be made regarding this.

There are ongoing considerations regarding the balance between avoiding unnecessary biopsy-related complications and minimising the risk of overtreating benign disease. The data currently available for analysis could not definitively answer the posed question and therefore expert clinical opinion was used where necessary whilst waiting for more published data on this topic.

Newer interventional procedures, such as robotic assisted bronchoscopy, allow for tissue confirmation of malignancy in nodules which were previously inaccessible. This may increase the evidence base for treating smaller biopsy confirmed cancers and will be an area for review once these data are published.

The full Evidence Review is available in Online Supplementary Appendix 8 (not included in the main guideline document).

3.11 FDG PET-CT staging

Current guidance suggests that people with lung cancer who are being considered for treatment with curative intent are offered positron emission tomography computed tomography (PET-CT) to stage their disease and identify nodal and distant metastases. The value of PET-CT in adults with pulmonary nodules has been debated, particularly in adults with small solid nodules and sub-solid nodules, where there is reduced risk of metastasis and PET-CT may have limited spatial resolution. Furthermore, lung cancer screening has led to increased identification of individuals with pulmonary nodules and higher demand for radiological investigations including PET-CT. This question aimed to address if fluorodeoxyglucose (FDG) PET-CT staging improves clinical outcomes in adults with pulmonary nodules being considered for treatment with curative intent.

Question 9: In adults with pulmonary nodules being considered for treatment with curative intent, does FDG positron emission tomography computed tomography (PET-CT) staging provide the same clinical outcomes as no PET-CT staging?

The findings of this review are summarised in Tables 18 and 19.

Table 18: Evidence summary of the incidence of occult nodal or distant metastases after definitive treatment with or without pre-treatment FDG-PET-CT staging

Nodule type	**Evidence summary of nodal or distant metastases following FDG-PET-CT staging or no FDG-PET-CT staging** (95% CI)
All	No difference (174/1000 versus 139/1000 (87 to 224) respectively*; and 6 [4, 13] % versus 8 [0, 31] % respectively, median [IQR], $p = 0.20^{\dagger}$)
Solid	May be greater with no FDG-PET-CT staging (13 [7, 14] % versus 22 [12, 31] % respectively, median [IQR], $p = 0.06^{\dagger}$)
Sub-solid	No difference (0 [0, 5] % versus 0 [0, 1] % respectively, median [IQR], $p = 0.25^{\dagger}$)

* Reported per 1000 patients (based on 2 studies)

† Unpaired t-test

CI – confidence interval; IQR – interquartile range

Draft For Public Consultation October 2025

Table 19: Evidence summary of the incidence of occult nodal or distant metastases in solid versus sub-solid nodules after definitive treatment with or without pre-treatment FDG-PET-CT staging

Staging type	**Evidence summary of nodal or distant metastases in solid versus sub-solid nodules following FDG-PET-CT staging or no FDG-PET-CT staging** (95% CI)
FDG-PET-CT	Greater in solid nodules (13 [7, 14] % versus 0 [0, 5]% respectively, median [IQR], $p = 0.001^{\dagger}$)
No FDG-PET-CT	May be greater in solid nodules (22 [12, 31] % versus 0 [0, 1] % respectively, median [IQR], $p = 0.08^{\ddagger}$)

* Reported per 1000 patients (based on 2 studies)

† Unpaired t-test

‡ Unpaired t-test, small study numbers (n = 2 for both groups)

CI – confidence interval; IQR – interquartile range

Evidence statements

- FDG PET-CT staging detects unexpected nodal/metastatic disease in patients with solid pulmonary nodules. (**Ungraded**)
- The incidence of nodal/metastatic disease appears to be greater in patients with solid pulmonary nodules when compared with sub-solid pulmonary nodules. (**Ungraded**)
- There was insufficient evidence to consider sub-centimetre nodules.

Recommendations

- For patients with solid pulmonary nodules being considered for treatment with curative intent, FDG PET-CT staging should be offered to detect occult nodal disease or metastases. (**Conditional**)
- Solid pulmonary nodules of ≥ 8 mm diameter should be offered FDG PET-CT staging (depending on PET-CT manufacturers' resolution specifications). (**Conditional** – by consensus)
- Sub-solid pulmonary nodules with a solid component ≥ 10 mm diameter should be offered FDG PET-CT staging. (**Conditional** – by consensus)

Issues with the data

The review question aimed to compare outcomes between individuals who did and did not have PET-CT, however, most studies offered PET-CT to all individuals. Several studies defined their outcome by a positive PET-CT scan instead of biopsy-proven metastatic disease. Studies provided limited data on pulmonary nodule size or pooled participants into broad groups, such as grouping all participants with a solid component of 3 cm or smaller. The optimal size threshold at which PET-CT is less likely to be beneficial remains contentious.

The full Evidence Review is available in Online Supplementary Appendix 9 (not included in the main guideline document).

4. EVALUATION, MEASUREMENT AND FOLLOW-UP CONSIDERATIONS

4.1 Technical considerations for pulmonary nodule evaluation

The diagnostic accuracy of different CT acquisition and reconstruction parameters, and variation in the evaluation of nodule characteristics was not evaluated in this review. As such, it is suggested that good practice for the evaluation of pulmonary nodules follow those from multiple international recommendations [12-16] and include:

- Multidetector CT systems with at least 16 detector rows, but 64-detector or wider configurations are preferred for volumetric analysis;

Draft For Public Consultation October 2026

- Whole-thorax acquisition should be performed in a single breath-hold at full inspiration
- Radiation exposure should be minimised, targeting a CTDI vol ≤3 mGy with automated exposure control and weight-adapted tube voltages between 80 – 120 kVp.
- Thin-section reconstruction (minimum 1.5 mm, but ≤ 1 mm preferred) with 50 % overlap, mandatory for volumetric assessment
- Soft- to medium-frequency reconstruction kernel to avoid edge-enhancement artefacts that can impair volumetric accuracy
- Iterative reconstruction, including deep-learning–based techniques, preferred to filtered back projection at all dose levels
- Review of images using both standard lung (width 1500 HU, level − 600 HU) and mediastinal (width 400 HU, level m40 HU) window settings with axial and coronal multiplanar reformats
- Review of maximum-intensity projection (MIP) reconstructions for nodule detection, and thin-section reconstructions for nodule characterisation
- Maintaining protocol consistency (including scanner, reconstruction kernel, radiation dose, and software) is critical for reliable serial assessment.

4.2 Considerations for nodule measurement and description

The technical aspects of methods for measuring pulmonary nodules were not evaluated. In line with consensus recommendations for best practice, this guideline recognises that volumetric analysis (both semi-automated and fully automated) is more accurate, repeatable and reproducible than diameter for the measurement of solid nodules when available and reliable, as both maximum and mean diameter measurements overestimate the true size of a nodule (Figure 1). However, the incremental benefit of volume of the diameter is probably less apparent for larger nodules (Figure 2).

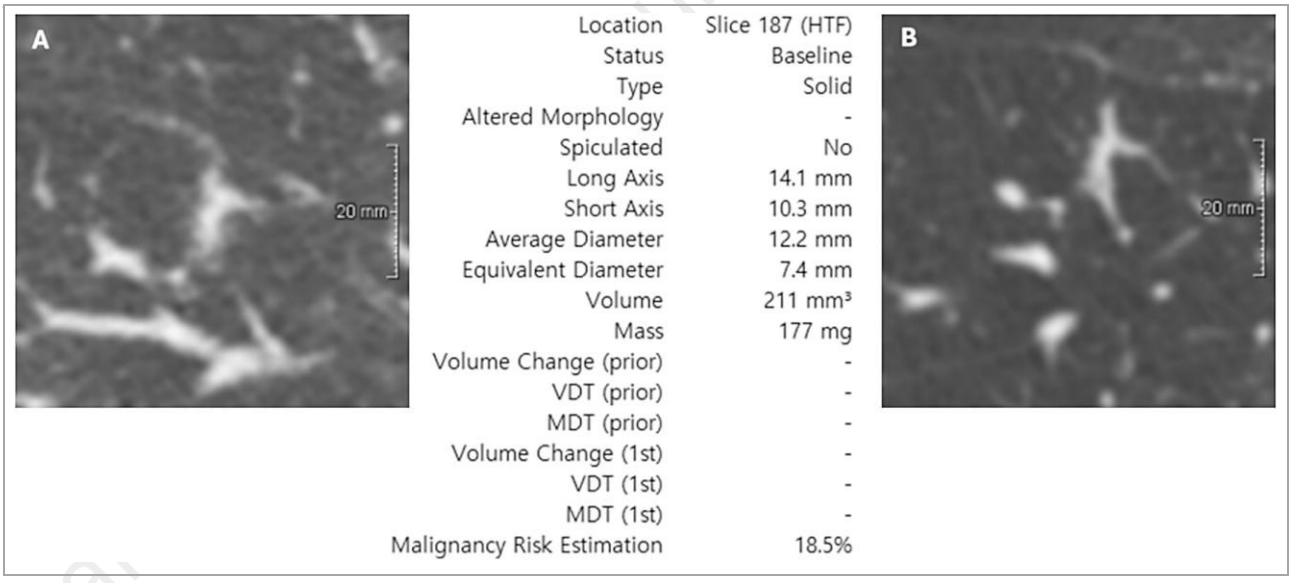


Figure 1: Female lung cancer screening participant in her 60s with an irregular 14 x 10 mm nodule in the right lower lobe (A, on a background of mild emphysema. Using the maximum diameter of 14 mm, the probability of malignancy is overestimated at 14.4%; using the average diameter of 12 mm would still overestimate the probability of malignancy at 10.9% using the Brock score. Reliance on diameter here would have instigated further workup with FDG PET-CT. Reliable volumetric segmentation shows the nodule to only be 211 mm³, and therefore the nodule was followed up for 1 year, where it has demonstrated shrinkage to 100 mm³ (B).

Simple tools for modifying the segmentation of a nodule to ensure the segmentation accurately reflects the entire volume of the nodule are available in some volumetric software: their use is neither recommended or discouraged, but it is suggested that where there is doubt in the veracity of volumetric segmentation, and/ or the user has limited experience with the use of segmentation modification tools, the use of diameter as a

Draft for consultation October 2026

convenient and reproducible metric may be more pragmatic and desirable (see the Solid Nodule Follow-up Pathway, Algorithm 2) (Figure 3).

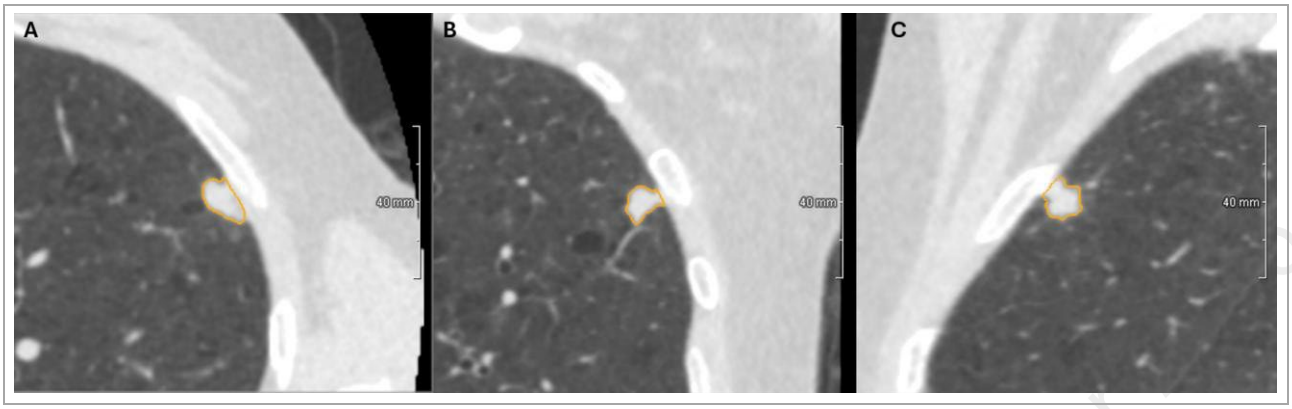


Figure 2: Female lung cancer screening participant in her 60s with a 16 mm, reliably segmented 617 mm³ subpleural non-spiculated left upper lobe solid nodule in (A) axial, (B) coronal and (C) sagittal planes, on a background of mild centrilobular emphysema, giving this nodule of a Brock score of 33.9%. This nodule would be recommended for immediate workup even if volumetric analysis had not been available or possible and diameter alone was used to measure its size.

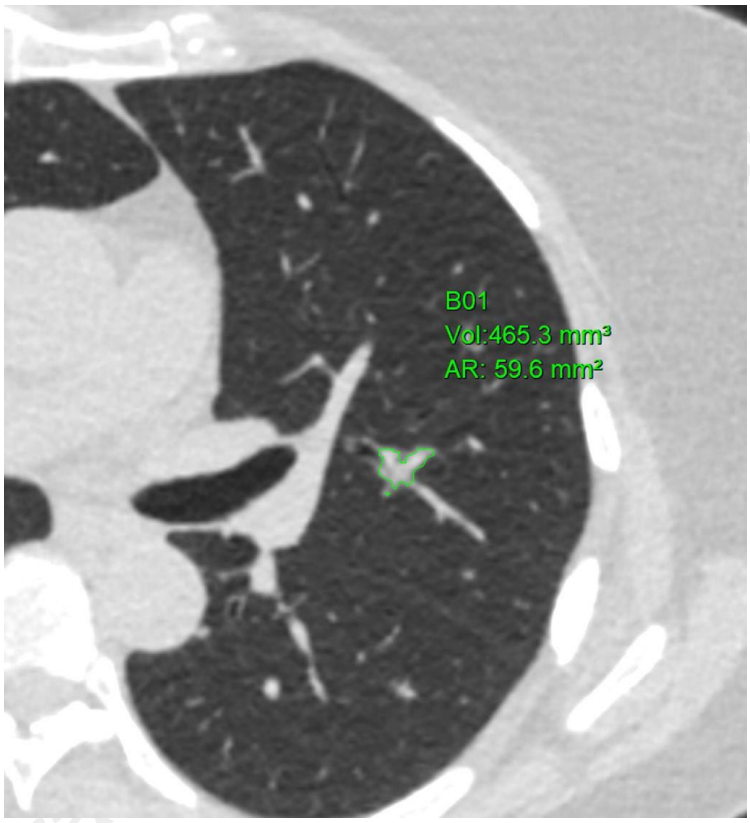


Figure 3: Male lung cancer screening participant in his 60s with a juxtavascular left upper lobe nodule that is unreliably segmented.

The use of volumetric analysis for ground-glass nodules or part-solid nodules (including the solid component of part-solid nodules) is not recommended as the variability of volumetry in this subgroup of nodules, and incremental benefits (if any) over diameter measurement, still require validation.

The diameter thresholds recommended in this guideline are maximum diameter measurements, as the evidence reviewed largely reported maximum diameters (although there was huge heterogeneity). As per the Fleischner Society recommendations [12] on measuring pulmonary nodules, it is good practice to measure pulmonary nodules on standard lung windows, using a lung kernel.

Draft for Consultation October 2020

Radiologists should use their clinical discretion to dismiss overtly inflammatory nodules, especially ground-glass nodules (Figure 4). For new nodules, it is emphasised that only discrete nodules considered non-inflammatory should be designated for follow-up.



Figure 4: Male lung cancer screening participant in his 60s with clustered nodules (arrows) in the right lower lobe, that are considered inflammatory and do not require follow-up.

There is no consensus definition of significant shrinkage in pulmonary nodules. Nodules that decrease in size but persist should remain under imaging surveillance until resolution or until the reporting radiologist considers further follow-up unnecessary.

4.3 Pulmonary nodule follow-up considerations

When considering follow-up of pulmonary nodules, it is recommended that imaging surveillance is always interpreted within the broader clinical context. Decisions should take account of patient preferences, anxiety, competing health priorities, co-morbidities, and fitness for further investigation and treatment. Where a patient would not be suitable for, or would not wish to undergo, treatment, the value of prolonged surveillance should be discussed carefully.

5. ALGORITHM CONSIDERATION

5.1 Algorithm 1 Solid nodule diagnostic pathway

Several key elements of this algorithm deserve attention. Morphological characterisation of solid nodules is paramount. Nodules with clear benign features such as popcorn calcification together with low density in a pulmonary hamartoma do not require follow-up. Caution should be exercised when determining whether there is fat density in nodules (to characterise it as benign) on images with increased noise, particularly those reconstructed on CT protocols with very low radiation doses.

Perifissural and juxtapleural nodules with benign features [17] are a reliable radiological correlate of benign intrapulmonary lymph nodes (IPLNs) and do not require follow-up. In the absence of an internationally agreed consensus definition, IPLNs are defined incorporating the latest evidence (Box 1).[18-21]

Draft For Public Consultation October 2026

Box 1: Radiological characteristics of benign intrapulmonary lymph nodes (IPLNs) (Figure 5)

Well-defined

Polygonal, triangular or lentiform in at least 2 orthogonal views

Up to 10 mm in maximum diameter

Located on or within 10 mm of a pleural surface (i.e. juxtapleural)

Have fine linear extensions

Not in contact with a branch of a pulmonary artery

Located in the middle lobe, lingula or lower lobes

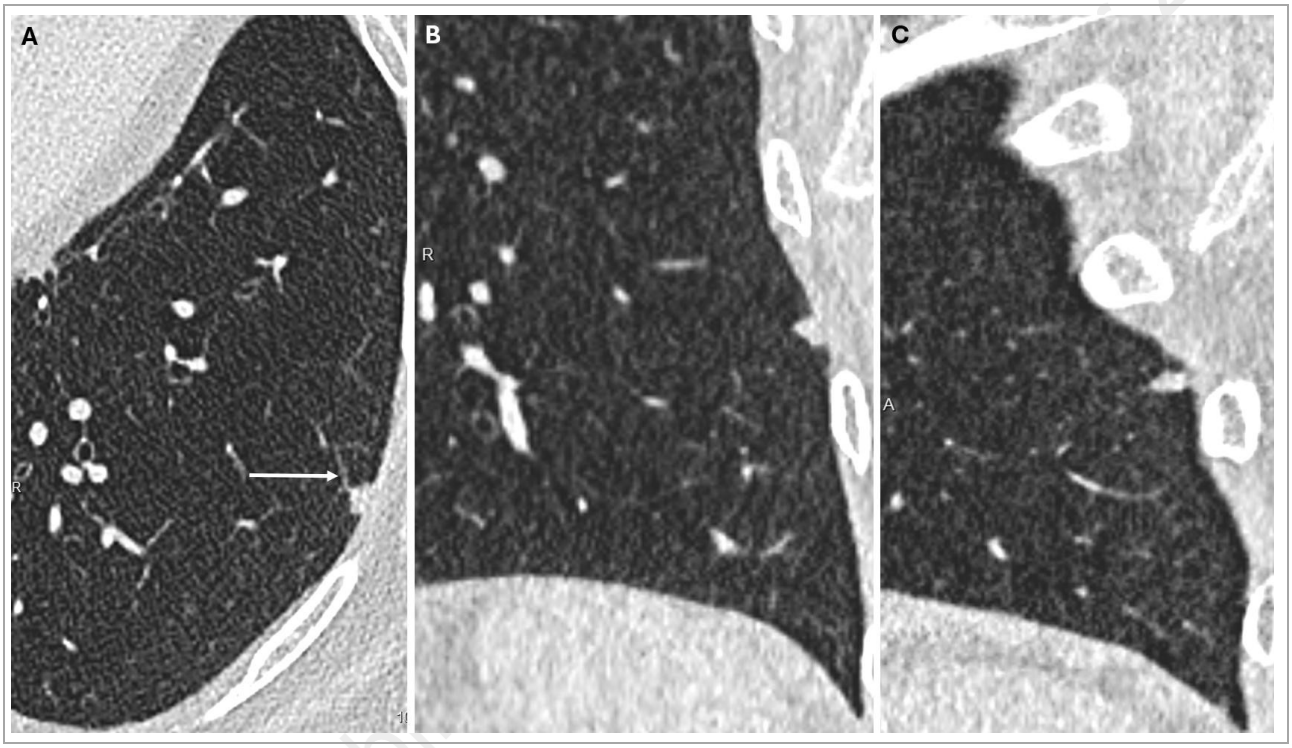


Figure 5: Male in his 70s with an 8 mm subpleural left lower lobe non-calcified well-defined solid nodule on low-dose CT that appears ovoid on the axial reconstructions (A), where it is contact with a branch of a pulmonary vein (arrow) but not an artery, and quite flat on the coronal (B) and sagittal (C) reconstructions. This is consistent with a benign intrapulmonary lymph node.

A low threshold for follow-up should be exercised when juxtapleural nodules are in the upper lobes [20], are not fully ovoid (Figure 6), are adjacent to the termination of a pulmonary artery branch (a feature never seen in isolation with IPLNs (Figure 7) [22]), an active or previous history of cancer and those larger than 10 mm.

The importance of searching for, and reviewing, any previous CT imaging is reinforced, as a lower size threshold for follow-up is used for truly new nodules (Algorithm 3 New solid nodule follow-up pathway) while nodules that were already present require assessment of growth (Algorithm 2 Solid nodule follow-up pathway).

An 80 mm^3 cut-off has been retained, rather than the 100 mm^3 cut-off proposed in other guidelines [23-25] for two reasons. On the one hand, it accommodates limitations in volumetry repeatability- that is, the degree to which the volumetry result will vary under the same conditions. The 95% confidence limits for relative difference in measured nodule volume between scans done minutes apart is reported as $\pm$ 25% with all conditions kept the same (scanner, acquisition parameters, volumetry software) [19], although it has been suggested this threshold could be lower, between -16% to +15%, for smaller nodules (mean 81 mm^3, range 28–170 mm^3) in one study [26]. Importantly, this repeatability may vary even more widely with different software packages [25] and therefore is important to acknowledge (Figure 8).

Draft for Public Consultation 2026

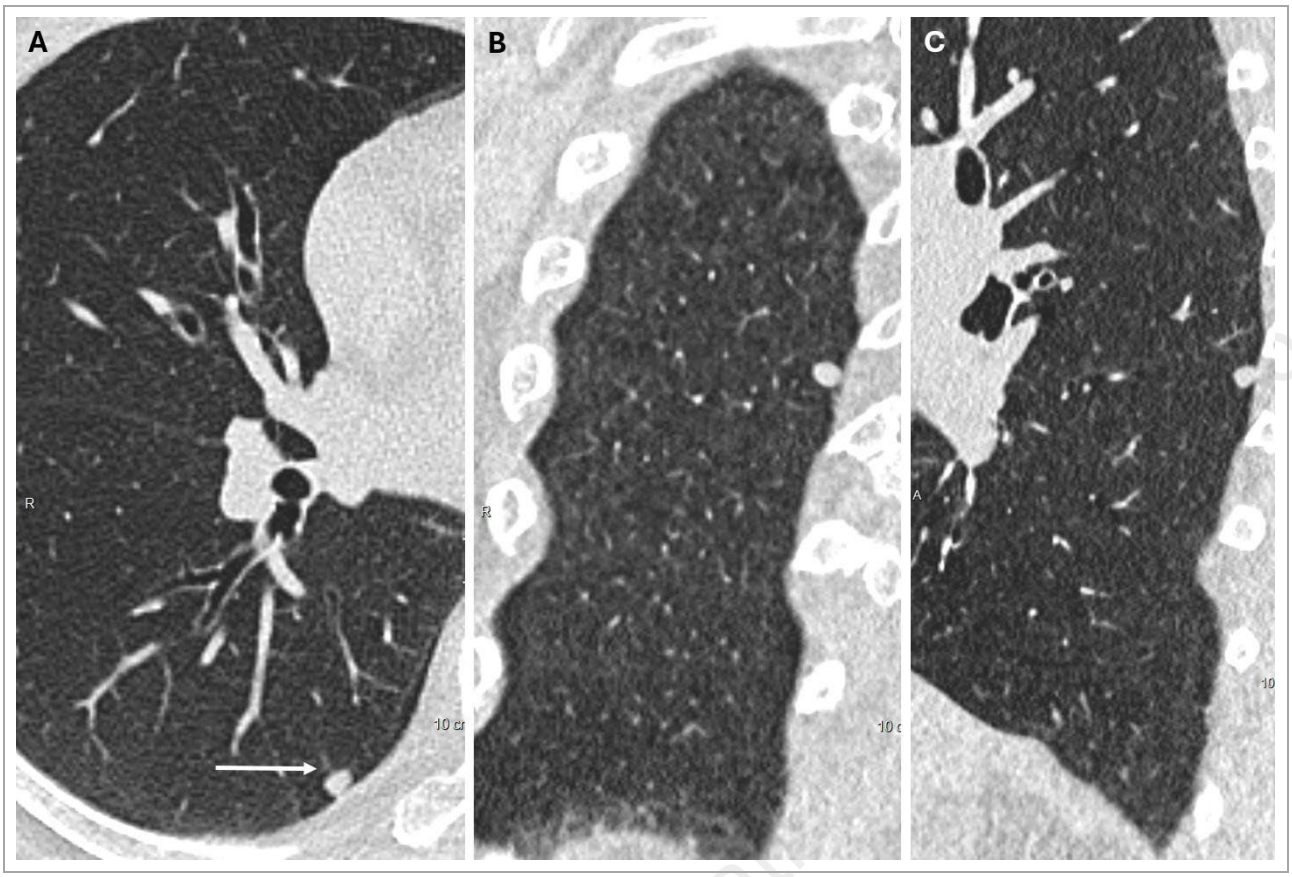


Figure 6: Woman in her 60s with a 7 mm subpleural non-calcified well-defined solid nodule on low-dose CT that appears ovoid on the axial (A) and coronal (B) reconstructions (A), and in contact with a branch of a pulmonary vein (arrow in A) but not an artery. It appears more rounded at its anterior border, and slightly more convex at its inferior border, on the sagittal (C) reconstruction. This would be classified as atypical for an intrapulmonary lymph node.

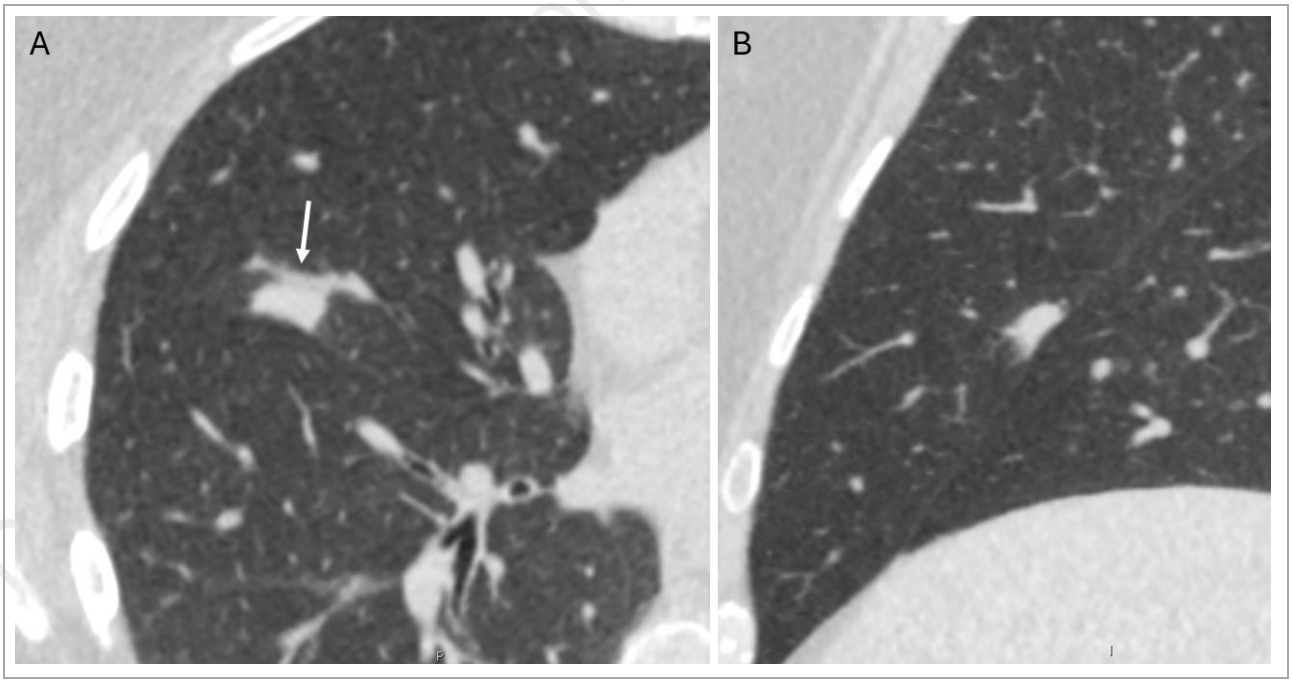


Figure 7: woman in her 60s with a 14mm perifissural ovoid nodule slightly distorting the fissure on both axial (a) and sagittal (b) views. Although perfissural and ovoid, it is irregular and in contact with a branch of the pulmonary artery (arrow), which are not typical of intrapulmonary lymph nodes. Further work-up revealed the nodule to be a T1b lung papillary adenocarcinoma.

1059

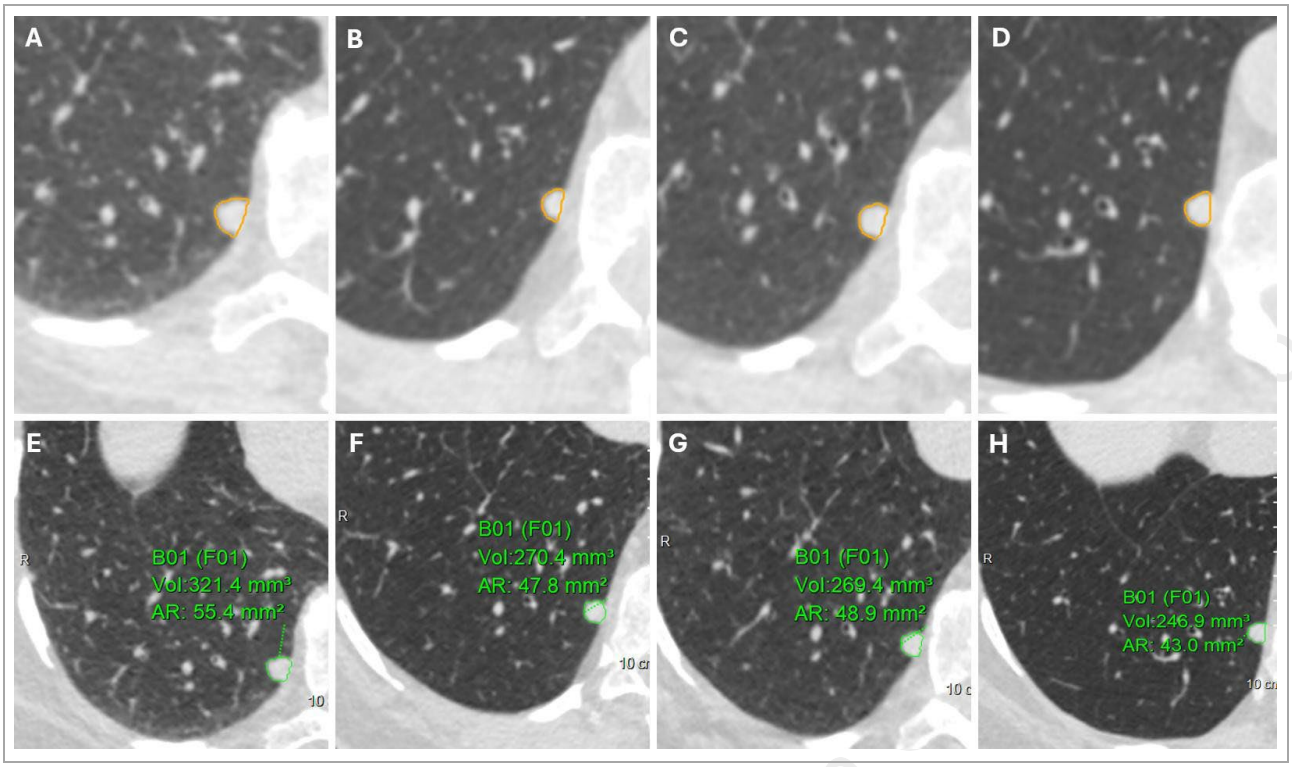


Figure 8: Female lung cancer screening participant in her 60s with a medial right lower lobe subpleural non-calcified solid nodule measuring 10 mm, 335 mm³ at baseline, with a Brock score of 6.8% (A). As such this nodule was followed up at 3 months, where its volume was 251 mm³, a 25% difference which is still within interscan variation (B). At 1 year, this nodule was stable at 296 mm³ (C) and the patient was discharged to the next screening round 2 years later, where the nodule remained stable at 263 mm³ (D). On a different software, the absolute values of the nodule volume at the different time points are 321 mm³ (E), 270 mm³ (F), 269 mm³ (G), and 247 mm³ (H); thus, while the absolute volumes differ by a small degree between these particular software packages, the relative changes in volume, and stability, are consistent despite the software used. However, different software packages can vary more widely and therefore volumetry should be performed on the same software package for the duration of follow-up.

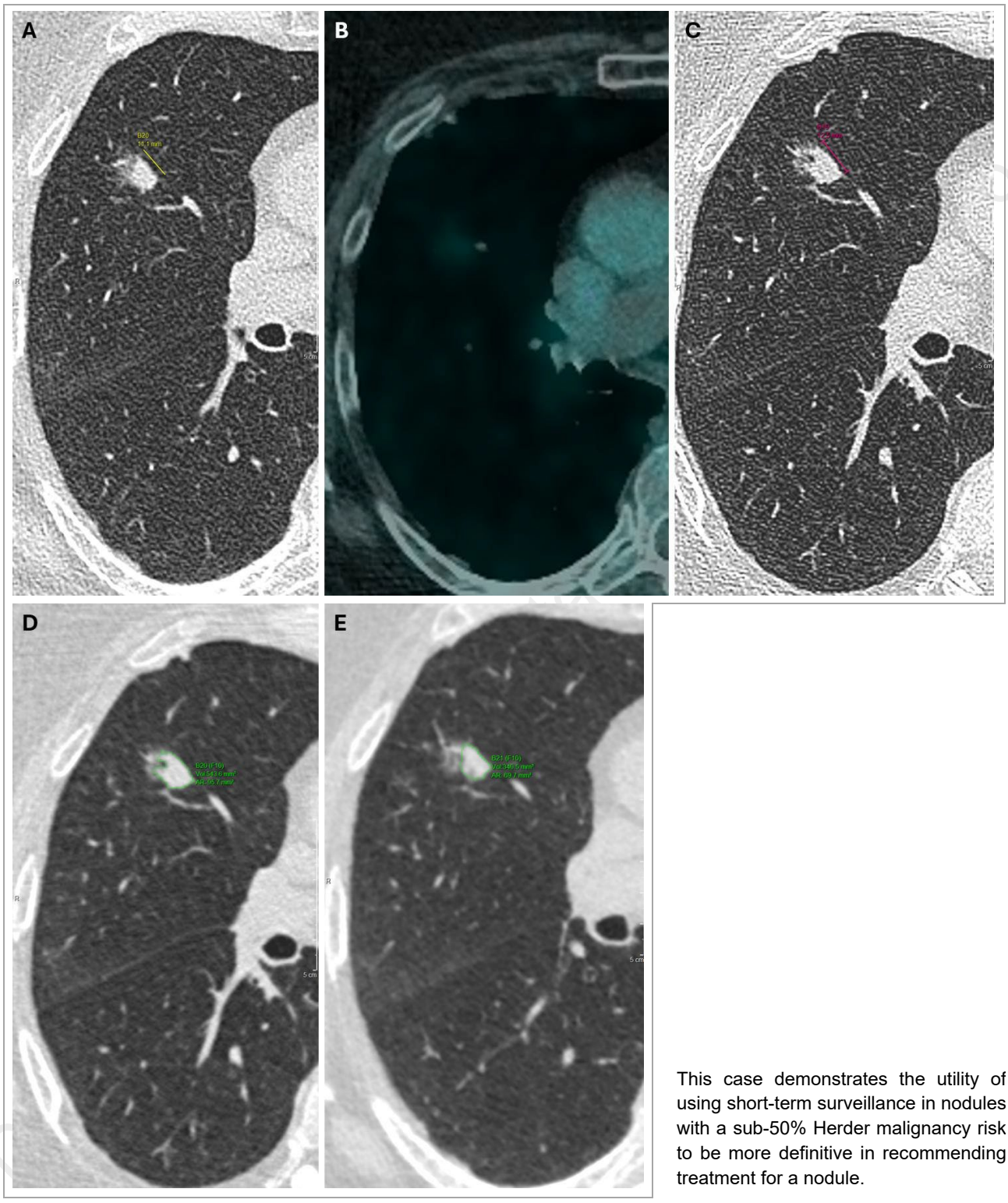
On the other hand, it is acknowledged that the chances of identifying malignancy in nodules 80 to < 100 mm^3 is low, and therefore an 80 mm^3 threshold could be viewed as increasing the proportion of nodules requiring follow-up. The only study which compared the likelihood of malignancy in nodules using both thresholds in a single lung cancer screening population found that, compared to a 100 mm^3 threshold, the 80 mm^3 threshold increased sensitivity for lung cancer detection by 1.7% (rising from 85.1% to 86.8%) at the expense of a 7.4% decrease in specificity; four additional cancers were detected by including the 427 additional participants at the lower threshold [27]; in other words, 107 additional patients needed follow-up to diagnose one additional cancer. As sensitivity is prioritised at the outset of this algorithm, the lower threshold has been chosen but concede that, as always, extrapolating data from a high-risk population to all nodules is difficult and this threshold will thus require further validation.

Another key change is the removal of the intermediate-risk category (Herder risk 10–70%). The 2015 BTS Guideline recommended considering nodule sampling, surveillance, or surgical excision for patients in this category.[1] Several factors support revising this approach. Advances in robotic-assisted bronchoscopy now permit sampling of many nodules that were previously inaccessible to CT-guided percutaneous biopsy. Raising the threshold for biopsy helps maintain an adequate prevalence of malignancy in the biopsied cohort, thereby preserving the diagnostic yield of invasive sampling techniques. Biopsy is no longer an option for very low-risk nodules, as it was under the 2015 BTS Guideline.[1] For those nodules with a Herder score of < 50%, a surveillance scan in 3 months is recommended (Figure 9). However, biopsy may still be appropriate below this threshold, depending on patient preferences and multidisciplinary team discussion.

A further implication of removing the intermediate nodule risk category is that there is no longer a defined risk threshold above which patients with solid nodules could proceed directly to treatment without tissue confirmation. In the absence of prior imaging demonstrating growth, and based on the evidence reviewed above, the GDG agreed that histological confirmation should generally be obtained before treatment with

Draft for Public Consultation

curative intent, particularly lobectomy or stereotactic radiotherapy. However, when the Herder score is very high (≥ 85%) and the nodule is < 2 cm, the multidisciplinary team may consider definitive treatment (28), with sub-lobar resection generally preferred for nodules of this size.



This case demonstrates the utility of using short-term surveillance in nodules with a sub-50% Herder malignancy risk to be more definitive in recommending treatment for a nodule.

Figure 9: Female lung cancer screening participant in her 60s, with an 11 mm spiculated nodule in the right upper lobe in contact with the horizontal fissure and suspicious for pleural invasion. It had a Brock score of 21% (8 other nodules and emphysema not shown) (A). This was referred for FDG PET-CT, but the nodule only had an SUV max of 1.5 compared to a mediastinal blood pool activity SUV max of 2.9 i.e., faint activity (B), giving it a Herder score of 33%. The patient was not suitable for image-guided biopsy and therefore 3-month CT follow-up was recommended. At 3 months, the nodule had grown by 2 mm to 13 mm (C), but the volumetric analysis demonstrates the growth was much greater, from 341 mm³ (D) to 544 mm³ (E), giving it a volume doubling time of 154 days and providing impetus for treatment. The patient underwent a wide local excision resection with a pathological T2a N0 PI1 (extending into the visceral pleura of the horizontal fissure).

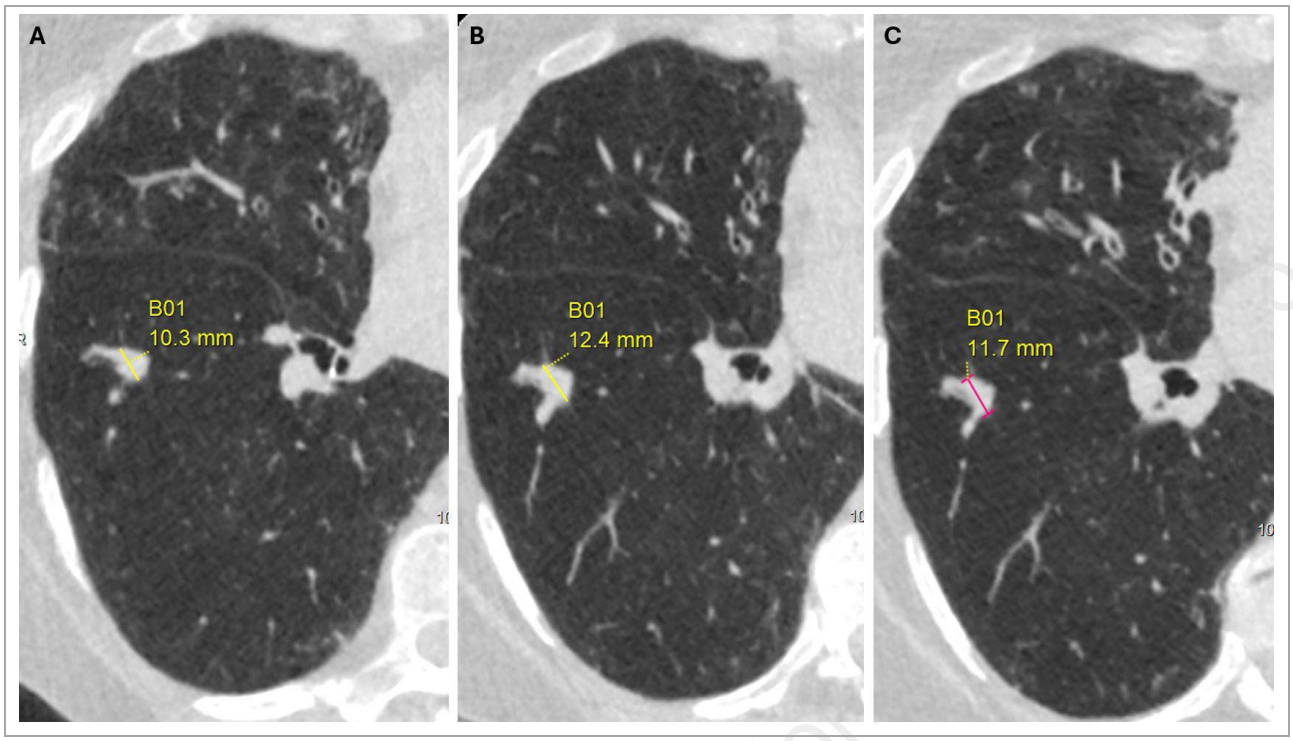


Figure 10: Female lung cancer screening participant in her 70s with a right lower lobe juxtavascular 10 mm solid nodule (A) that is unreliably segmented and therefore managed using diameter. At 1 year, the nodule has apparently grown to 12 mm, giving it a volume doubling time of 492 days (B), and so it was followed for a further year, where it remained stable at 12 mm (C), allowing discharge to the next screening round.

5.2 Algorithm 2 Solid nodule follow-up pathway

The follow-up period for nodules 80-100 mm^3 (with a corresponding maximum diameter of 5-6 mm) has been extended from 3 months to 6 months to allow for more accurate growth assessment that a longer interval permits. The rationale underpinning this is that, even for cancers with fast growth rates (e.g. a mean of 207 days in a recent meta-analysis [28], nodules at this size will only just reach or still be below the size for further investigation at 6 months.

The recommendation made in the 2015 BTS Guidelines for the investigation and management of pulmonary nodules [1] to discharge a volumetrically stable solid nodule after one year, while those managed based on diameter require a minimum of 2-year stability [29] has been retained. However, while reviewing evidence for Question 4, it could not be identified what, if any, proportion of nodules that are volumetrically stable at one year subsequently grow, and further research is required in this area. It is emphasised that in practical terms, if a nodule is initially assessed with reliable volumetry but on follow-up CT studies volumetry is either unreliable or unavailable and diameter is then used as the sizing method, diameter must then become the default sizing method for that nodule. In practical terms, “discharging” a nodule from follow-up in a lung screening context means discharging the lung cancer screening participant to the next screening round if they are still eligible for, and attend, screening.

In the surveillance of solid nodules, volume doubling time (VDT) continues to play an important role and should be calculated with reference to the earliest identification of the nodule. VDT may provide an important balance between the risk of stage progression associated with prolonged surveillance and the avoidance of overtreatment of indolent disease. Our meta-analysis demonstrated minimal difference in sensitivity and specificity between VDT thresholds of 400 and 600 days, while a previous meta-analysis reported a median VDT of 207 days for malignant nodules.[28] Given the trade-offs in sensitivity and specificity between these 400- and 600- day VDT thresholds, we have retained CT surveillance for nodules in this category. Discharge of patients with nodules demonstrating a VDT > 600 days should only occur where reliable volumetric assessment is available; otherwise, a further CT scan in another 12 months is recommended.

Draft for Public Consultation

5.3 Algorithm 3 New solid nodule follow-up pathway

In answering Question 3 it was evident that, while approximately 55% of new nodules resolve on subsequent imaging, persistent new solid nodules carry a higher cancer risk than baseline nodules of equivalent size and therefore warrant lower management thresholds.[31-33]

For new solid nodules detected on follow-up CT, routine follow-up for nodules <30 mm³ is not currently recommended, as malignancy risk is low. In the NELSON trial, the risk of malignancy was 0.5% for nodules < 27 mm³, increasing to 3.1% for nodules measuring 27–206 mm³ and 16.9% for nodules ≥ 206 mm³.[31] These findings have subsequently been validated in a different screening cohort, which reported malignancy risks of 1.7%, 2.2% and 11.0% for nodules < 30 mm³, 30–200 mm³ and > 200 mm³, respectively. [33]

For new solid nodules measuring 30–200 mm³, 3-month CT follow-up is recommended to determine persistence, and then follow-up as per Algorithm 2 Solid nodule follow-up pathway for assessment for nodules ≥ 200 mm³. For persistent nodules, volumetric growth assessment should be undertaken, with a volume doubling time (VDT) < 400 days considered indicative of a substantially increased risk of malignancy and warranting expedited investigation.

Dedicated surveillance of new nodules (of any type) that occur within 6 months of the last CT is not currently recommended. The limited available evidence suggests that the malignancy risk of such nodules is very low (approximately 0.6%), despite occurring in around 8% of individuals undergoing short-interval surveillance.[33] This risk is comparable to that of small baseline nodules for which further follow-up is not routinely recommended. In the absence of evidence demonstrating clinical benefit, additional dedicated surveillance of newly detected nodules arising during short-interval follow-up CT is not currently justified. In practice, many of these new nodules will be opportunistically evaluated at further follow-up performed for the original nodule(s) that instigated the 3- or 6-month follow-up CT. The GDG expressed concern that even a 6-month cut-off could lead to excessive CT surveillance of new nodules developing within this short interval. However, given the absence of evidence quantifying the relative risk versus benefits on alternative intervals, the group could not currently justify adopting an alternative threshold, such as 12 months.

In contrast, it is recommended that new subsolid nodules are managed using the same approach as baseline subsolid nodules. As highlighted by Zhong et al., current evidence from NELSON does not support lower intervention thresholds for incident subsolid nodules [34], as their behaviour and malignancy risk appear comparable to those detected at baseline [35]. Management should therefore continue to be based on overall nodule size, the presence and size of any solid component, and interval change in morphology.

Finally, follow-up of new nodules that are confidently classified as benign intrapulmonary lymph nodes is not recommended. New fissure-attached nodules are uncommon, accounting for approximately 6.5% of incident nodules in the NELSON study.[36] Although around 4% of all new nodules demonstrated typical or atypical perifissural nodule (PFN) morphology, none of these proved malignant. However, caution in dismissing such nodules should be exercised in patients with a history of malignancy that may manifest with pulmonary metastases.

Of course, in the presence of previous imaging, the nodule must first be determined to be truly new. The GDG recommends future research should focus on whether it is more beneficial to use the higher size thresholds in the baseline solid algorithm (Algorithm 1) rather than the new solid algorithm (Algorithm 3), when the interval since the prior CT is long (for example, 5 or 10 years).

The approach to new nodule management is summarised in Algorithm 3 New solid nodule follow-up pathway and examples of scenarios where follow-up intervals may need to be adapted are provided in Appendix 2.

5.4 Algorithm 4 Ground-glass nodule (GGN) pathway

3-month CT follow-up for GGNs measuring 5-30 mm in maximum diameter is not recommended, reasoning that the rate of change in these nodules that would herald development of an invasive adenocarcinoma is too slow to manifest in a 3-month period. In contrast, 3-month CT follow-up for GGNs > 30 mm and definitive management consideration at 3 months if they persist is recommended given that lung cancers manifesting as GGNs of this size are considered T1a lung cancers in current lung cancer staging [37] and diagnosing these at the earliest opportunity is desirable. At the same time, it is recognised that measurement variability inevitably implies that there may be some variation in management (follow-up versus definitive management) for

Draft for Public Consultation October 2026

persistent GGNs that are just under or over this 30 mm threshold (see example in Figure 11). In such cases, using the lower measurement is recommended, applying the principle of benefit of doubt inherent to lung cancer management [38,39] and prioritising specificity for invasive lung cancer diagnosis.

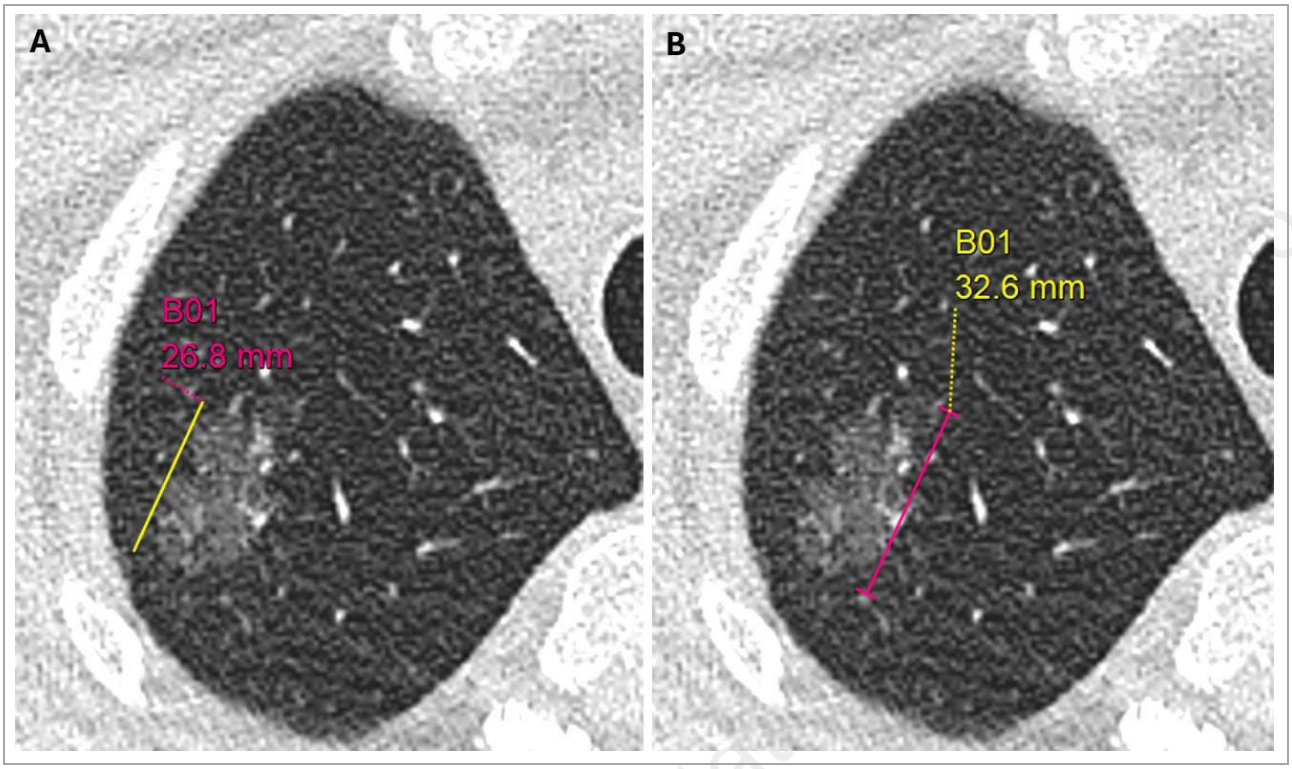


Figure 11: Lung cancer screening participant in their 70s with an apical right upper lobe ground-glass nodule with no solid component or altered morphology, measured at 27 mm by one radiologist (A) and 33 mm by another radiologist (B). The measurement variability arises because of difficulty delineating the border of such lesions.

A distinction is also made between solitary (Figure 12) and multiple GGNs, because data from both screening [40] and incidental [41] subsolid nodules (i.e. GGNs and PSNs) indicates that having more than one subsolid nodule is associated with an increased lung cancer incidence and a lower probability of lung cancer-free survival.

In pure ground-glass nodules, unequivocal altered morphology or growth beyond 30 mm should prompt consideration of definitive management (Figure 13). Several morphologic features associated with invasive lung cancer were investigated and found that bubble-like lucency and air bronchograms are the most specific features heralding invasion; accordingly, “altered morphology” in this context means the unequivocal development of these features. Because of heterogeneity in the published data for Questions 5 and 6, an algorithm could not be synthesised that could prescribe exactly how to quantify these non-size bases features, or in what order to prioritise them particularly in the absence of a solid component (Figure 13). Therefore, management decisions in the absence of developing an unequivocal new solid component should be based only on unequivocal morphologic change.

The appearance of a solid component should prompt reclassification as a PSN and transitions management of a nodule to the PSN algorithm (Part-solid nodule pathway) (Figure 14), with the size and growth of the solid component (the most robustly validated imaging predictor of invasiveness and prognosis) prioritised over other, non-size-based, morphologic descriptors in guiding management.

Draft for Public Consultation

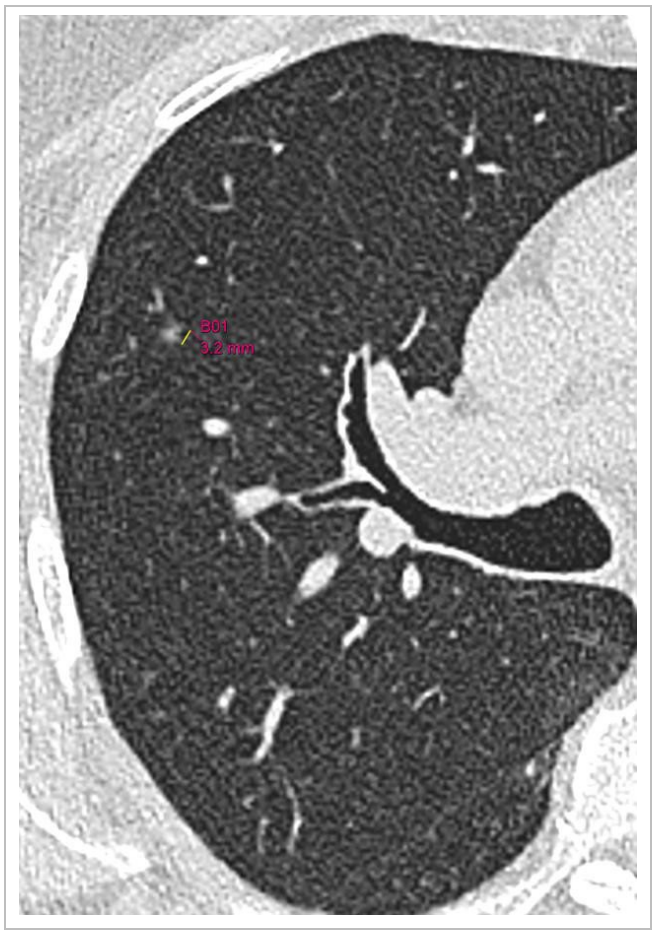


Figure 12: Male lung cancer screening participant in his 60s with a solitary 3 mm right upper lobe ground-glass nodule, requiring no follow-up.

1183



Figure 13: Male lung cancer screening participant in his 60s, with a 37 mm ground-glass mass in the left upper lobe demonstrating bubble-like lucency suspicious for invasive pulmonary adenocarcinoma, despite the absence of a solid component.

1184

Publication October 2026

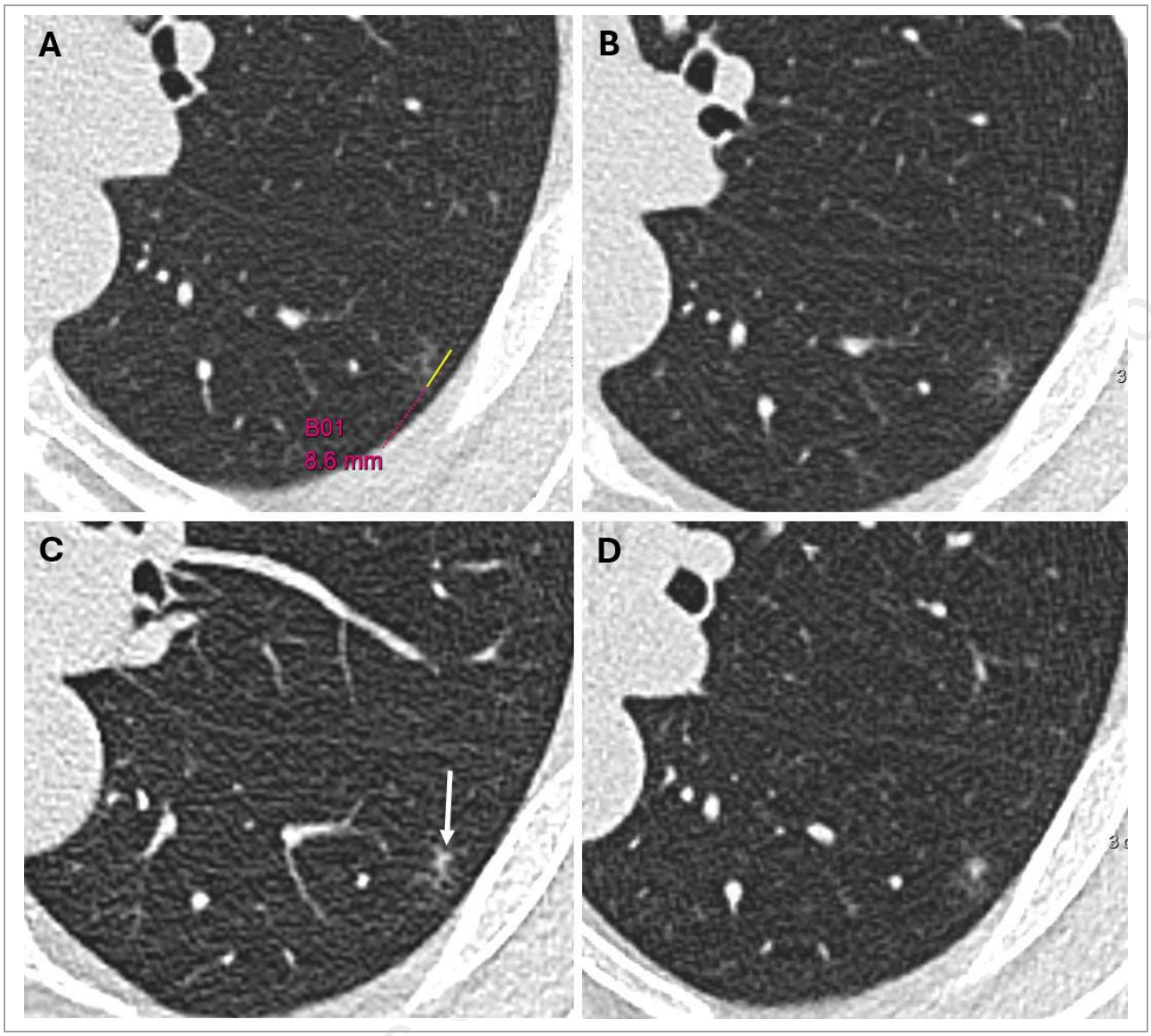


Figure 14: Male lung cancer screening participant in his 60s with a 9 mm ground-glass nodule in the apical left lower lobe at baseline (A), that remained stable at 1 year (B) but then developed a 3 mm solid component 2 years from baseline (C). Less than 6 mm, further annual surveillance CT was planned, whether nodule remains stable (D). As the new solid component was < 6 mm, further surveillance in another year, rather than immediate intervention, was planned, where the nodule remained stable in size, density and morphology (D).

Defining the duration of follow-up is an essential component of both the optimal strategy for image utilisation and for detecting change in subsolid nodules. Most persistent subsolid nodules that ultimately demonstrate growth do so within the first three years of surveillance. In one series, all growing lesions exhibited detectable growth within three years of initial observation [42], supporting follow-up at 1, 2 and 4 years to encompass this higher-risk period. However, long-term stability does not eliminate the possibility of subsequent progression. After five years of stability, further growth has been reported in approximately 5–13% of GGNs during extended follow-up, although the clinical impact appears limited.[43,44] In the largest recent series, only 3.8% of nodules demonstrated stage progression and just 0.9% progressed to T1a/T1b disease, with no metastatic events observed. It has been suggested that CT surveillance could be extended to 5-year intervals after an initial 5 years of stability.[42] Given the desire to detect progression before stage upshifting occurs, continued surveillance to 10 years appears reasonable, particularly as simulation modelling has demonstrated minimal differences in outcomes when follow-up intervals are extended from 1 to 3 years for stable ground-glass nodules.[45] To pragmatically align with current biennial lung cancer screening recommendations, we have recommended further scanning at 2-year intervals (i.e. 6, 8 and 10 years from baseline) after 4 years initial follow-up and stability.

5.5 Algorithm 5 Part-solid nodule pathway

Management of part-solid nodules (PSNs) is primarily determined by the size and behaviour of the solid component. The guideline group found insufficient evidence to support recommendations based on changes in any single subsolid nodule parameter for the diagnosis of malignancy. However, in keeping with the Good Practice Points (GPPs), interval changes in additional radiological features may suggest invasive malignancy in subsolid nodules, including fissural distortion, development of air bronchograms, emergence of bubble-like lucencies, and increasing CT attenuation.

For PSNs, the threshold for intervention was set at a solid component diameter of 6 mm (Figures 15 and 16). This approach aims to support conservative management where appropriate and aligns with the IASLC (International Association for the Study of Lung Cancer) definition of cT1a disease.[37] It also approximates the lower limit at which biopsy techniques may achieve acceptable diagnostic reliability. The guideline group recognised that pathological staging frequently exceeds clinical staging in PSNs because imaging may underestimate the extent of the invasive solid component. Adoption of a 6 mm threshold is therefore likely to ensure that many lesions remain within the pT1a category at treatment.

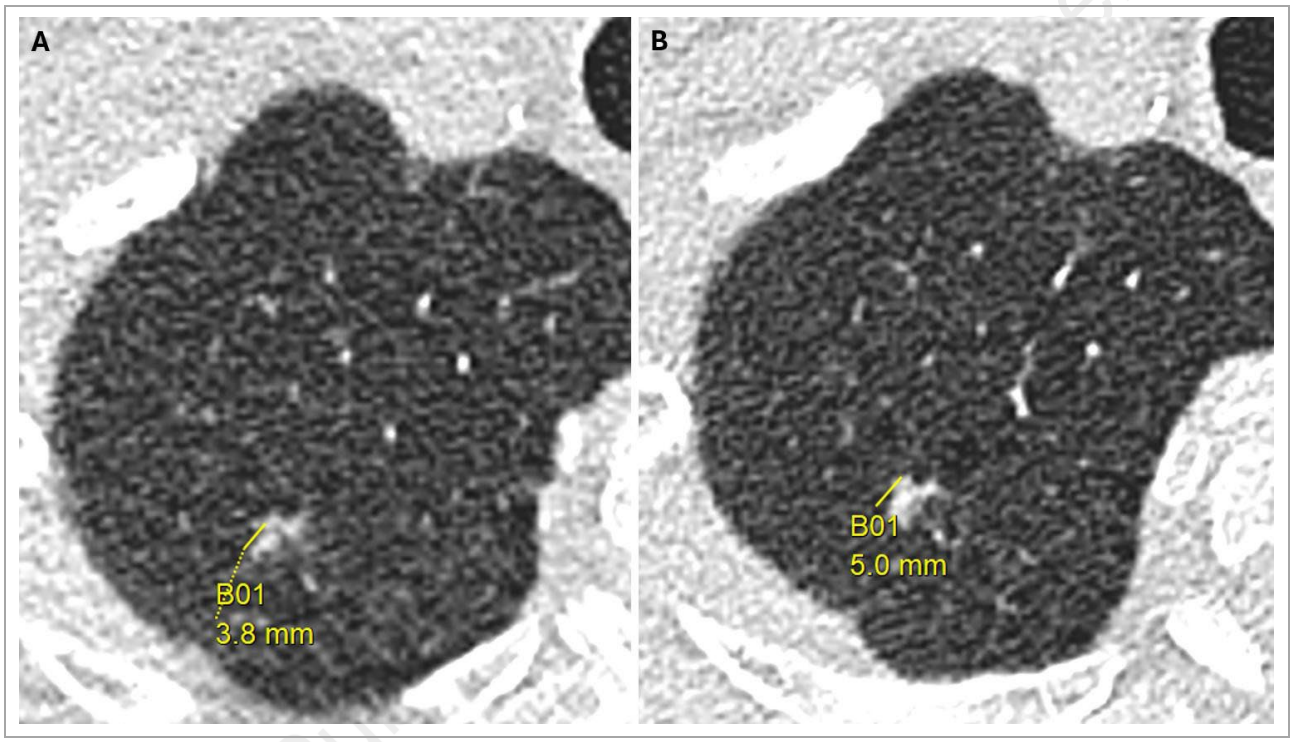


Figure 15: Male lung cancer screening participant in his 60s with a 9 mm part-solid nodule in the right apex, demonstrating a 4 mm solid component at baseline (A). The solid component slowly increased to 5 mm after 3 years of annual follow-up (B); as the solid component increase was less than 2 mm, and the overall solid component remains under 6 mm, the nodule remains under further surveillance.

Another important change is that PET-CT is no longer routinely recommended for either nodule discrimination or staging in PSNs where the solid component measures < 10 mm. This reflects both the high likelihood of malignancy in enlarging PSNs and their relatively low propensity for metastatic spread. This recommendation differs from current NICE (National Institute for Health and Care Excellence) guidance, although the NICE guideline did not specifically address the management of PSNs.

While some guidelines and studies have proposed managing predominantly solid nodules (e.g. those with a ≥ 90% solid component) as solid nodules [24,46], there is currently insufficient evidence to support this approach. In particular, some slow-growing part-solid nodules may present with a predominant solid component at initial detection despite following the biological behaviour of subsolid lesions. Classifying such nodules as solid could result in erroneous discharge after one- or two-year stability and no planned long-term surveillance, potentially missing the delayed growth patterns characteristic of subsolid adenocarcinoma-spectrum lesions.

Draft For Public Consultation October 2026

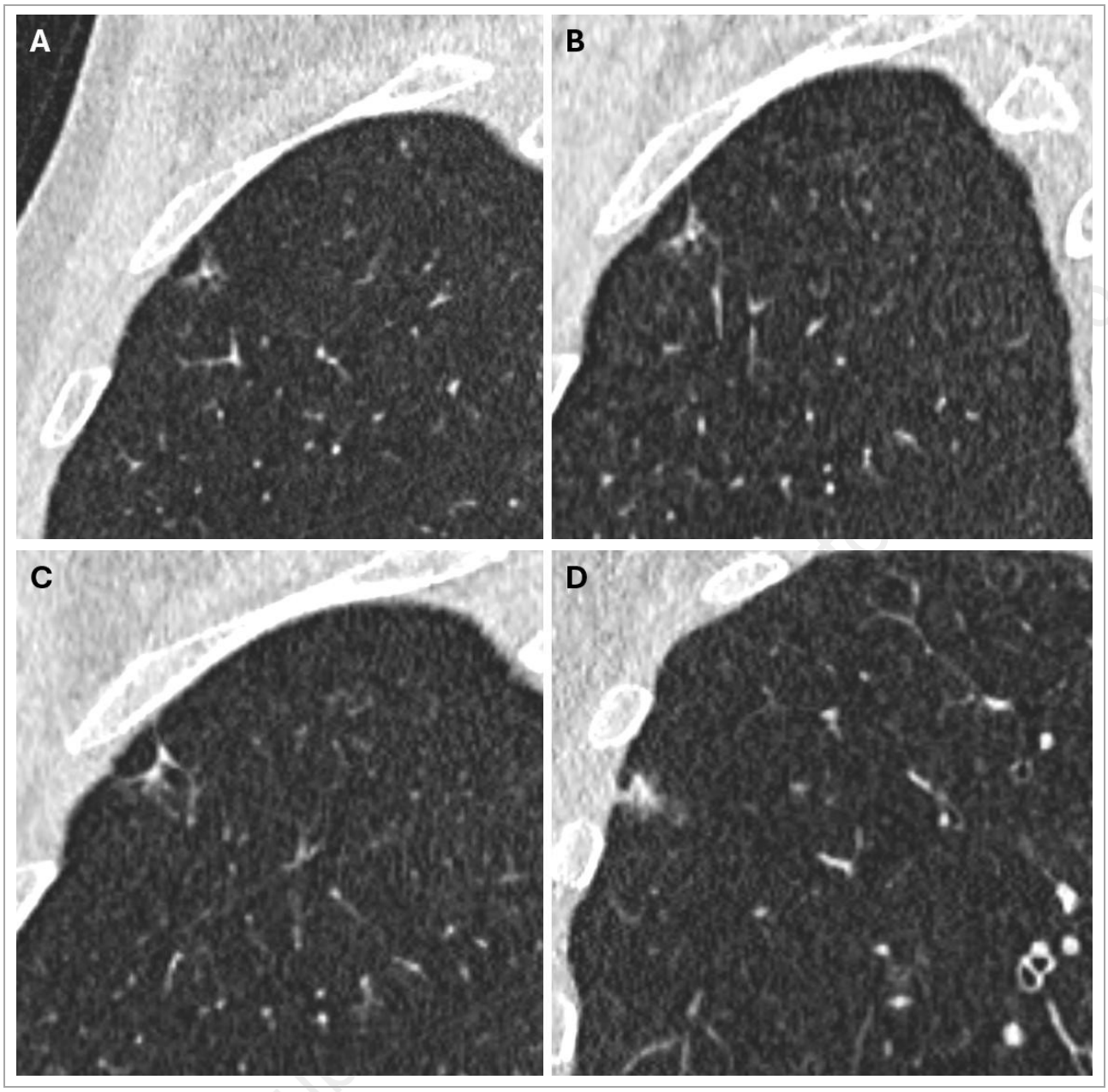


Figure 16: Sagittal reconstructions from the low-dose CT of a male lung cancer screening participant in his 60s with a part-solid nodule, measuring 12 mm overall, associated with some air bronchograms, but a solid component of only 2 mm at baseline (A). This remained stable over 1 year (B), but the solid component then increased to just under 6 mm after 2 years from baseline (C). Further annual CT 3 years from baseline revealed an unequivocal growing solid component, now 8 mm (D), consistent with an invasive adenocarcinoma.

Draft For Public Comment

REFERENCES

1. Callister ME, Baldwin DR, Akram AR, Barnard S, Cane P, Draffan J, et al. British Thoracic Society guidelines for the investigation and management of pulmonary nodules. *Thorax*. 2015;70 Suppl 2:ii1–ii54.
2. Freeman SC, Kerby CR, Patel A, Cooper NJ, Quinn T, Sutton AJ. Development of an interactive web-based tool to conduct and interrogate meta-analysis of diagnostic test accuracy studies: MetaDTA. *BMC Med Res Methodol*. 2019;19:81.
3. Patel A, Cooper N, Freeman S, Sutton A. Graphical enhancements to summary receiver operating characteristic plots to facilitate the analysis and reporting of meta-analysis of diagnostic test accuracy data. *Res Synth Methods*. 2021;12:34–44.
4. Guyatt GH, Oxman AD, Vist GE, Kunz R, Falck-Ytter Y, Alonso-Coello P, et al. GRADE: an emerging consensus on rating quality of evidence and strength of recommendations. *BMJ*. 2008;336:924–6.
5. Wu H, Fu F, Ye T, Hu H, Yu Q, Zhang H, et al. Active Surveillance of multifocal ground-glass opacities: Results of a prospective multicenter trial (ECTOP1021). *J Thorac Oncol*. 2026;21:150–9.
6. Balbi M, Sabia F, Ledda RE, Rolli L, Milanese G, Ruggirello M, et al. Surveillance of subsolid nodules avoids unnecessary resections in lung cancer screening: long-term results of the prospective BioMILD trial. *ERJ Open Res*. 2024;10:00167-2024.
7. Travis WD, Brambilla E, Noguchi M, Nicholson AG, Geisinger KR, Yatabe Y, et al. International association for the study of lung cancer/American Thoracic Society/European Respiratory Society international multidisciplinary classification of lung adenocarcinoma. *J Thorac Oncol*. 2011;6:244–85.
8. Bak SH, Lee HY, Kim JH, Um SW, Kwon OJ, Han J, et al. Quantitative CT Scanning Analysis of Pure Ground-Glass Opacity Nodules Predicts Further CT Scanning Change. Chest. 2016;149(1):180–91.
9. Kaaki S, Kidane B, Srinathan S, Tan L, Buduhan G. Is tissue still the issue? Lobectomy for suspicious lung nodules without confirmation of malignancy. *J Surg Oncol*. 2018;117:977–84.
10. Sihoe AD, Hiranandani R, Wong H, Yeung ES. Operating on a suspicious lung mass without a preoperative tissue diagnosis: pros and cons. *Eur J Cardiothorac Surg*. 2013;44:231–7.
11. Yu W, Ma H, Yu G, Xia P, An Z, Yu L, et al. Non-diagnostic electromagnetic navigation bronchoscopy biopsy: Predictive factors and final diagnoses. *Oncol Lett*. 2023;25:166.
12. Bankier AA, MacMahon H, Goo JM, Rubin GD, Schaefer-Prokop CM, Naidich DP. Recommendations for measuring pulmonary nodules at CT: A statement from the Fleischner Society. *Radiology*. 2017;285:584–600.
13. MacMahon H, Naidich DP, Goo JM, Lee KS, Leung ANC, Mayo JR, et al. Guidelines for management of incidental pulmonary nodules detected on CT images: From the Fleischner Society 2017. *Radiology*. 2017;284:228–43.
14. Baldwin DR, O'Dowd EL, Tietzova I, Kerpel-Fronius A, Heuvelmans MA, Snoeckx A, et al. Developing a pan-European technical standard for a comprehensive high-quality lung cancer computed tomography screening programme: an ERS technical standard. *Eur Respir J*. 2023;61:2300128.
15. Kauczor HU, Baird AM, Blum TG, Bonomo L, Bostantzoglou C, Burghuber O, et al. ESR/ERS statement paper on lung cancer screening. *Eur Radiol*. 2020;30(6):3277–94.
16. Christensen J, Prosper AE, Wu CC, Chung J, Lee E, Elicker B, et al. ACR Lung-RADS v2022: Assessment categories and management recommendations. *J Am Coll Radiol*. 2024;21:473–88.
17. Goo JM. Juxtapleural (Perifissural) Nodules: Does location mean a benign lesion? *Radiology*. 2018;288: 876–7.
18. Ahn MI, Gleeson TG, Chan IH, McWilliams AM, Macdonald SL, Lam S, et al. Perifissural nodules seen at CT screening for lung cancer. Radiology. 2010;254(3):949–56.
19. de Hoop BvG, B.;Gietema, H.;Prokop, M. Pulmonary perifissural nodules on CT scans: Rapid growth is not a predictor of malignancy. *Radiology*. 2012;265:611–6.

Draft For Public Consultation October 2026

20. Schreuder A, Van Ginneken B, Scholten ET, Jacobs C, Prokop M, Sverzellati N, et al. Classification of CT pulmonary opacities as perifissural nodules: Reader variability. *Radiology*. 2018;288:867–75.

21. Schreuder A, Jacobs C, Scholten ET, van Ginneken B, Schaefer-Prokop CM, Prokop M. Typical CT Features of intrapulmonary lymph nodes: A review. *Radiology Cardiothoracic Imaging*. 2020;2:e190159.

22. Barnett J, Pulzato I, Wilson R, Padley S, Nicholson AG, Devaraj A. Perinodular vascularity distinguishes benign intrapulmonary lymph nodes from lung cancer on computed tomography. *J Thorac Imaging*. 2019;34:326–8.

23. Oudkerk M, Devaraj A, Vliegenthart R, Henzler T, Prosch H, Heussel CP, et al. European position statement on lung cancer screening. *Lancet Oncol*. 2017;18:e754–e66.

24. Snoeckx A, Silva M, Prosch H, Biederer J, Frauenfelder T, Gleeson F, et al. Lung cancer screening with low-dose CT: definition of positive, indeterminate, and negative screen results. A nodule management recommendation from the European Society of Thoracic Imaging. Eur Radiol. 2026;36(1):135–47.

25. Soo E, Edey AJ, Mak SM, Moser J, Mohammadi S, Rodrigues T, et al. Impact of choice of volumetry software and nodule management guidelines on recall rates in lung cancer screening. *Eur J Radiol*. 2019;120:108646.

26. Bartlett EC, Kemp SV, Rawal B, Devaraj A. Defining growth in small pulmonary nodules using volumetry: results from a "coffee-break" CT study and implications for current nodule management guidelines. *Eur Radiol*. 2022;32:1912–20.

27. Creamer AW, Horst C, Prendecki R, Verghese P, Bhamani A, Hall H, et al. Performance of volume and diameter thresholds in malignancy prediction of solid nodules in lung cancer screening. *Thorax*. 2025;80: 624–31.

28. Fontaine-Delaruelle C, Souquet PJ, Gamondes D, Pradat E, De Leusse A, Ferretti GR, et al. Negative predictive value of transthoracic core-needle biopsy: A multicenter study. *Chest*. 2015;148:472–80.

29. Jiang B, Han D, van der Aalst CM, Lancaster HL, Vonder M, Gratama JC, et al. Lung cancer volume doubling time by computed tomography: A systematic review and meta-analysis. *Eur J Cancer*. 2024;212: 114339.

30. Revel MP, Bissery A, Bienvenu M, Aycard L, Lefort C, Frija G. Are two-dimensional CT measurements of small noncalcified pulmonary nodules reliable? *Radiology*. 2004;231:453–8.

31. Walter JE, Heuvelmans MA, de Jong PA, Vliegenthart R, van Ooijen PMA, Peters RB, et al. Occurrence and lung cancer probability of new solid nodules at incidence screening with low-dose CT: analysis of data from the randomised, controlled NELSON trial. *Lancet Oncol*. 2016;17:907–16.

32. Walter JE, Heuvelmans MA, Bock GH, Yousaf-Khan U, Groen HJM, Aalst CMV, et al. Characteristics of new solid nodules detected in incidence screening rounds of low-dose CT lung cancer screening: the NELSON study. *Thorax*. 2018;73:741–7.

33. Creamer AW, Horst C, Verghese P, Prendecki R, Bhamani A, Hall H, et al. Incidence rate and malignancy risk in new nodules in a lung cancer screening programme. *Eur Radiol*. 2025;35:7156–66.

34. Zhong D, Sidorenkov G, Jacobs C, de Jong PA, Gietema HA, Stadhouders R, et al. Lung nodule management in low-dose CT screening for lung cancer: Lessons from the NELSON Trial. *Radiology*. 2024;313:e240535.

35. Walter JE, Heuvelmans MA, Yousaf-Khan U, Dorrius MD, Thunnissen E, Schermann A, et al. New subsolid pulmonary nodules in lung cancer screening: The NELSON Trial. *J Thorac Oncol*. 2018;13:1410–4.

36. Han D, Heuvelmans MA, van der Aalst CM, van Smoorenburg LH, Dorrius MD, Rook M, et al. New fissure-attached nodules in lung cancer screening: A brief report from the NELSON study. *J Thorac Oncol*. 2019;10:125-129

37. Travis WD, Asamura H, Bankier AA, Beasley MB, Detterbeck F, Flieder DB, et al. The IASLC Lung Cancer Staging Project: Proposals for coding T categories for subsolid nodules and assessment of tumor size in

Draft For Public Consultation October 2026

part-solid tumors in the forthcoming eighth edition of the TNM Classification of Lung Cancer. *J Thorac Oncol*. 2016;11:1204–23.

38. Edge SB, Byrd DR, Compton CC, Fritz AG, Greene FL, Trotti A, editors. AJCC Cancer Staging Manual, Seventh Edition. Springer; 2010. Available at: <https://www.facs.org/media/j30havyf/ajcc_7thed_ cancer_ staging_manual.pdf> [Accessed 20 October 2026]
39. Brierley J, Giuliani M, O'Sullivan B, Rous B, Van Eycken E, editors. TNM Classification of Malignant Tumours, Ninth Edition. John Wiley & Sons Ltd; 2025 Available at <https://media.wiley.com/product_data/ excerpt/58/13942168/1394216858-1.pdf> [Accessed 20 October 2026]
40. Silva M, Prokop M, Jacobs C, Capretti G, Sverzellati N, Ciompi F, et al. Long-Term Active Surveillance of screening detected subsolid nodules is a safe strategy to reduce overtreatment. *J Thorac Oncol*. 2018; 13:1454–63.
41. Schreuder A, Prokop M, Scholten ET, Mets OM, Chung K, Mohamed Hoesein FAA, et al. CT-detected subsolid nodules: A predictor of lung cancer development at another location? *Cancers*. 2021;13:2812.
42. Kobayashi Y, Fukui T, Ito S, Usami N, Hatooka S, Yatabe Y, et al. How long should small lung lesions of ground-glass opacity be followed? *J Thorac Oncol*. 2013;8:309–14.
43. Lee HW, Jin KN, Lee JK, Kim DK, Chung HS, Heo EY, et al. Long-term follow-up of ground-glass nodules after 5 years of stability. *J Thorac Oncol*. 2019;14:1370–7.
44. Lee JH, Lim WH, Park CM. Growth and clinical impact of subsolid lung nodules ≥ 6 mm during long-term follow-up after five years of stability. *Korean J Radiol*. 2024;25:1093–9.
45. Hammer MM, Palazzo LL, Eckel AL, Barbosa EM, Jr., Kong CY. A decision analysis of follow-up and treatment algorithms for nonsolid pulmonary nodules. *Radiology*. 2019;290:506–13.
46. Yip R, Henschke CI, Xu DM, Li K, Jirapatnakul A, Yankelevitz DF. Lung cancers manifesting as part-solid nodules in the national lung screening trial. *AJR Am J Roentgenol*. 2017;208:1011–21.

Draft For Public Consultation October 2026

Appendix 2 Example scenarios where nodule follow-up intervals require modification

Scenario 1: Delayed follow-up

An Indeterminate solid nodule, reliable volume of 135 mm^3 is detected on a baseline scan performed on 15 January 2025.

Follow-up for this nodule is planned on 15 April 2025, 3 months from baseline (Algorithm 2).

However, the participant does not attend follow-up at 3 months and only attends on 15 October 2025 (9 months from baseline). The nodule measures 140 cubic mm^3 (3.7% difference from baseline, within the 25% allowed for inter-scan variation) and so is considered stable at 9 months.

If the patient had attended in April 2025 and the nodule had been stable, the next follow-up timepoint for this nodule should have been January 2026, i.e. 1 year from baseline. However, as they have attended their follow-up 9 months from baseline, they have not yet had a minimum of 1 year follow-up for volumetric stability, while January 2026 would only be in another 3 months and so be too short an interval. It is sensible in this case to perform the next follow-up CT in April 2026, i.e. 6 months from the first follow-up scan and 15 months from the baseline scan, to allow a longer and more reliable assessment of VDT.

Scenario 2: New nodule on a follow-up scan

Indeterminate solid nodule (nodule 1), reliable volume of 85 mm^3 on a baseline scan performed on 1 June 2024. A follow-up CT in 6 months is planned (Algorithm 2).

On the 6-month follow-up CT for this nodule on 01 December 2024, the nodule measures 90 mm^3 (5.9% difference from baseline, within the 25% allowed for inter-scan variation) but there is a new 43 mm^3 solid nodule (nodule 2) in another lobe. A further follow-up CT on 01 March 2025 is thus performed (3 months from the occurrence of the new nodule, as per Algorithm 3, and 9 months from the baseline scan).

On 1 March 2025, nodule 1 remains stable at 88 mm^3, and nodule 2 persists but is stable at 47 mm^3.

The next scan for nodule 1 should be on 01 June 2025 (1 year from baseline, Algorithm 2), but this would only be 3 months from the most recent CT.

The next scan for nodule 2 should be on 01 December 2025 (1 year from first occurrence, Algorithm 3).

As Nodule 1 has already been stable for 9 months, while the new nodule 2 has only had 3 months of follow-up, it makes sense to perform the next CT on 01 December 2025, 1 year from first occurrence of the new nodule and 18 months from baseline. If both nodules are then stable, no further follow-up CT is required.

Draft For Public Consultation October 2026

Appendix 3 Guideline Development Group (GDG) members

Name	Role/Location
Dr Arjun Nair, co-chair	Consultant Radiologist University College London Hospitals NHS Foundation Trust
Prof Neal Navani, co-chair	Consultant Respiratory Physician University College London Hospitals NHS Foundation Trust
Dr Ahsan Akram	Consultant Respiratory Physician Royal Infirmary of Edinburgh, Edinburgh
Dr Haval Balata	Consultant Respiratory Physician Wythenshawe Hospital, Manchester
Dr Emily Bartlett	Consultant Radiologist Royal Brompton & Harefield NHS Foundation Trust, London
Dr Rachel Benamore	Consultant Radiologist Oxford University Hospitals NHS Trust, Oxford
Prof Ashley Groves	Nuclear Medicine Physician/Radiologist University College London
Dr Alex Haragan	Consultant Pathologist Liverpool Lung Cancer Unit, Liverpool
Dr Stephen Harrow	Consultant Clinical Oncologist NHS Lothian, Edinburgh
Mr Paul Holland	Radiographer Nottingham University Hospitals NHS Trust
Dr Stephen Harrow	Consultant Clinical Oncologist NHS Lothian, Edinburgh
Dr Carolyn Horst	Academic Clinical Fellow University College London Hospitals NHS Foundation Trust
Dr Ahmad Lodhi	Radiology Registrar Manchester University NHS Foundation Trust
Ms Lavinia Magee	Lung Cancer Nurse Specialist Royal Papworth Hospital, Cambridge
Dr Fraser Millar	Consultant Respiratory Physician Royal Infirmary of Edinburgh, Edinburgh
Dr Sindhu Naidu	Respiratory Registrar/Research Fellow Rayne Institute, London
Dr Sushiladevi Natarajan	Respiratory Registrar The Royal London Hospital, London
Dr Emma O'Dowd	Consultant Respiratory Physician Nottingham City Hospital, Nottingham
Mr Douglas West	Consultant Thoracic Surgeon Bristol Royal Infirmary, Bristol
Dr Kay Por Yip	Respiratory Registrar University of Birmingham, Birmingham

Draft For Public Consultation October 2026

Appendix 4 Clinical Questions

Q1 In adults, is there a difference in the likelihood of diagnosing lung cancer in pulmonary nodules detected by low dose computed tomography (CT) screening compared to those detected on CT scans done for other reasons?

Q2 In adults with pulmonary nodules, is there a difference in the likelihood of diagnosing lung cancer between patients with or without a previous history of non-lung cancer?

Q3 What is the diagnostic accuracy of imaging tests, and the optimal strategy for image utilisation for diagnosing lung cancer in a solid pulmonary nodule?

Q4 In adults with solid pulmonary nodules, what is the diagnostic accuracy of strategies used to detect change between interval computed tomography (CT) scans for diagnosing lung cancer?

Q5 What is the diagnostic accuracy of imaging tests, and the optimal strategy for image utilisation for diagnosing lung cancer in a sub-solid pulmonary nodule?

Q6 In adults with sub-solid pulmonary nodules, what is the diagnostic accuracy of strategies used to detect change between interval computed tomography (CT) scans for diagnosing lung cancer?

Q7 In adults with pulmonary nodules, what is the diagnostic accuracy of biopsy of a pulmonary nodule for diagnosing lung cancer?

Q8 In adults with pulmonary nodules being considered for treatment for lung cancer with curative intent, does pre-treatment biopsy provide the same clinical outcomes as no biopsy?

Q9 In adults with pulmonary nodules being considered for treatment with curative intent, does FDG positron emission tomography computed tomography (PET-CT) staging provide the same clinical outcomes as no PET-CT staging?

Draft For Public Consultation October 2026

Appendix 4 Stakeholders

Royal College of Radiologists

British Society of Thoracic Imaging

Royal College of Physicians

British Nuclear Medicine Society

British Thoracic Oncology Group

Society for Cardiothoracic Surgery

British Thoracic Oncology Group

Lung Cancer Nursing UK

Draft For Public Consultation October 2026