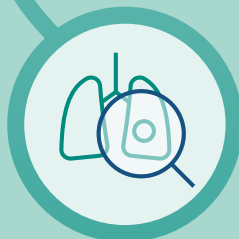


# Enhancing the earlier detection of lung cancer:

## effective management of incidental pulmonary nodules

November  
2024



**LUNG CANCER  
POLICY NETWORK**

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# Contents

Acknowledgements	3
Executive summary	4
<b>1 Managing incidental pulmonary nodules: a core component of detecting lung cancer earlier</b>	<b>8</b>
<b>2 Approaches to enhancing the incidental detection of lung cancer</b>	<b>11</b>
Optimising the incidental detection of pulmonary nodules	13
Optimising the tracking of incidental pulmonary nodules	18
Optimising the follow-up of incidental pulmonary nodules	26
<b>3 Action to integrate IPN management into early detection programmes</b>	<b>31</b>
Summary of recommendations to optimise IPN management	32
References	34
Appendix	38

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# Executive summary

**Earlier detection is essential to reduce the high number of deaths caused by lung cancer, and targeted screening alone will not fully realise this ambition.**

Lung cancer incidence is rising and mortality rates remain high due to 70% of lung cancers being diagnosed at a late stage, when five-year survival rates can be as low as 10%.<sup>1-5</sup> Detecting lung cancer earlier is a key factor in improving survival, as early-stage diagnoses can have five-year survival rates of over 70%.<sup>3,5</sup> An important strategy to improve earlier detection relies on low-dose computed tomography (LDCT) screening programmes with specific eligibility criteria.<sup>6</sup> While vital, these screening programmes alone are not enough to tackle the magnitude of current lung cancer incidence and mortality, and may not yet be feasible in many healthcare settings.<sup>7</sup>

**Incidental pulmonary nodule (IPN) management offers a crucial route to detecting lung cancer earlier, outside of targeted screening.** IPNs are lesions that are detected incidentally, outside of a screening programme. They are largely benign, but ~1.5% indicate lung cancer – which could translate to an additional 63,000 lung cancer diagnoses within two years of detection in the US alone.<sup>8-10</sup> The appropriate management of people with IPNs offers a route to detect lung cancer earlier among those who are not eligible for LDCT screening; in some populations, almost half of lung cancers occur in those ineligible for screening.<sup>11,12</sup>

**To fully utilise the opportunity presented by optimal IPN management, there is a need to implement pathways that support the detection, tracking and follow-up of IPNs.** While care provision varies greatly across healthcare settings, proactively detecting, tracking and following-up individuals with IPNs can help to realise the potential impact of IPN detection on the overall earlier detection of lung cancer.<sup>13</sup> Pathways can be adapted to the local health system and implemented alongside existing prevention activities and early detection programmes such as LDCT screening, or on their own where these programmes are not currently established under current guidelines.

**Policymakers should implement a combination of the following recommendations, based on their health system infrastructure and the resources available, to optimally manage care of individuals with IPNs and detect lung cancer earlier.**



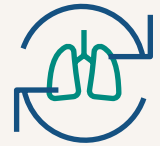
# Recommendations to **optimise the incidental detection of pulmonary nodules**

- **Create and implement a nodule management pathway** that reflects the needs of the local population to facilitate the earlier detection of lung cancer.
- **Develop tailored guidance on IPN management** so appropriate follow-up procedures are integrated into the existing health system.
- **Educate healthcare professionals** about existing IPN guidelines and their use across the health system.
- **Equip healthcare professionals with tools** (such as traditional and AI-enhanced risk models) **to accurately assess IPN risk** and minimise overdiagnosis and overmedicalisation.
- **Standardise templates for IPN radiology reporting** to encourage adherence to guidelines and ensure individuals receive appropriate follow-up care.
- **Ensure healthcare professionals collect comprehensive patient data** to optimise the effectiveness of traditional risk models.
- **Conduct ongoing research on the use and suitability of AI and novel diagnostics**, assessing their capacity to improve IPN detection and risk stratification in practice, and reduce radiologist workload.



# Recommendations to **optimise the tracking of incidental pulmonary nodules**

- **Create, implement and integrate standardised templates for radiology reporting** to ensure nodules are correctly integrated into the IPN management pathway.
- **Provide a patient navigator** to facilitate patient education and adherence to follow-up recommendations, and to improve patient wellbeing.
- **Implement tracking systems** for IPN management to ensure people receive appropriate follow-up care.
- **Implement integrated interdepartmental communication systems** to improve the tracking of IPNs among healthcare professionals.
- **Create and distribute patient-facing materials about IPNs** and their cancer risk, in a range of formats and languages, to provide accessible and tailored information to people with IPNs.
- **Set up a nodule registry** to provide an epidemiological oversight of nodule prevalence, and to guide future prevention and detection strategies for lung cancer.



# Recommendations to **optimise the follow-up of incidental pulmonary nodules**

- **Integrate IPN management into the health system** – as a standalone programme or integrated with existing programmes for LDCT screening – to increase the coverage of earlier detection strategies for lung cancer and to facilitate detection among people who are not eligible for screening.
- **Implement a dedicated nodule clinic** to provide multidisciplinary care and to alleviate pressures on other hospital departments.
- **Provide multidisciplinary care** for people with IPNs to increase the earlier diagnosis of lung cancer and improve patient wellbeing.
- **Implement processes**, including adherence to quality assurance standards for CT scanners, **to facilitate accurate comparison across follow-up imaging** and hence robust assessment of nodule change.

# 1 Managing incidental pulmonary nodules: a core component of detecting lung cancer earlier

**Earlier detection is increasingly recognised as essential to reducing the number of deaths caused by lung cancer.** In recent years, a growing number of countries have committed to implementing screening programmes for lung cancer using low-dose computed tomography (LDCT).<sup>14</sup> Evidence shows these programmes are successfully shifting the detection of lung cancer to an earlier stage, thereby reducing mortality.<sup>15</sup>

**Screening programmes for lung cancer are currently targeted towards people deemed at high risk of developing the disease but, as understanding of risk factors improves, a broader approach may be needed.** LDCT screening takes a targeted approach, in that it is only available to people who meet certain eligibility criteria, usually linked to their age and smoking history.<sup>15</sup> However, smoking is not the only risk factor for lung cancer; the disease has a complex risk profile that varies greatly across the world, including:<sup>16,17</sup>

- exposure to outdoor and indoor air pollution
- second-hand tobacco smoke
- genetic predisposition
- socioeconomic position
- occupational exposures
- family history.

There is also a growing number of cases of lung cancer occurring in people who have never smoked.<sup>16,18</sup> In some populations almost half of lung cancers occur among people who are ineligible for screening.<sup>11,12</sup> Consequently, even if smoking rates decrease and LDCT screening is widely implemented, this is unlikely to be sufficient to fully reduce mortality rates for lung cancer across the population.<sup>19</sup>



### **The need for earlier detection of lung cancer**

In 2022, there were 2.4 million new lung cancer diagnoses and 1.8 million deaths due to the disease.<sup>1</sup> Lung cancer causes more than twice as many deaths as the next most common cancer, and costs the global economy over \$3.8 trillion annually.<sup>1</sup> As the number of lung cancer diagnoses is predicted to rise to 4.1 million by 2045,<sup>2</sup> there is an urgent need to address this issue.

The high mortality rate of lung cancer can be attributed to the late stage of diagnosis: 70% of lung cancers are diagnosed at stages III and IV, when the five-year survival rate can be as low as 10%.<sup>3-5</sup> However, the five-year survival rate for lung cancer diagnosed at stage I is over 70%.<sup>3 20</sup>

**There is considerable opportunity to improve the detection and management of incidental pulmonary nodules (IPNs) as a route to support the earlier detection of lung cancer.** Pulmonary nodules are lesions of the lung that can be a sign of lung cancer (*Box 1*). ‘Incidental’ pulmonary nodules (or IPNs) are found outside of targeted lung cancer screening – such as during emergency scans, chest imaging, or imaging of other areas such as the abdominal, thoracic or head and neck regions – for reasons other than suspicion of lung cancer.<sup>21</sup> Approximately 3.6 billion diagnostic imaging examinations are performed annually around the world, including 300 million computed tomography (CT) scans.<sup>22 23</sup> Currently, only 29–36% of people who have IPNs of note recorded in their radiology reports receive appropriate follow-up care.<sup>24 25</sup> With the number of CT scans predicted to rise by 4% per year,<sup>22</sup> it is more important than ever to optimally care for individuals with IPNs to ensure the earlier detection of lung cancer.

#### **Box 1. What are pulmonary nodules?**

Pulmonary (or lung) nodules are lesions that are up to 30mm in diameter and are estimated to be present in 13–42% of the adult population.<sup>8 9</sup> They are detected via CT scans and X-rays.<sup>8</sup> Most nodules are benign and present no risk, but ~1.5% are malignant and are indicative of lung cancer.<sup>8</sup> In the US, this rate could translate to an additional 63,000 lung cancer diagnoses within two years of detection.<sup>10</sup>

**Optimal IPN management is key to a more comprehensive approach to detecting lung cancer earlier, but it has yet to be implemented widely.**

There are some existing examples of successful programmes for IPN management – for example, IPN clinics – but formal guidance for IPN management is often not fully integrated into care pathways.<sup>26-29</sup>

Commonly cited barriers to the widespread adoption of IPN management pathways include:<sup>30</sup>

- limited education on nodule risk and reporting
- inconsistent guidelines to govern nodule management
- inconsistent communication systems between stakeholders
- limitations in workforce and technical capacity.

To maximise this opportunity for earlier detection, we need formal pathways that support detecting, tracking and following up individuals with IPNs. This will ensure any detected nodule that shows suspicion of lung cancer is effectively managed and monitored over time. These pathways can be adopted alongside prevention activities and other early detection strategies such as LDCT screening, or on their own where these programmes are not currently established.<sup>6</sup>



Appropriate IPN management is another way that lung cancers can be found early, especially for people who are not eligible for screening.

**Andrea Borondy Kitts, Rescue Lung Society<sup>31</sup>**

## 2

# Approaches to enhancing the incidental detection of lung cancer



Optimal IPN management should be explored as much as possible, because our primary aim is to cure lung cancer.

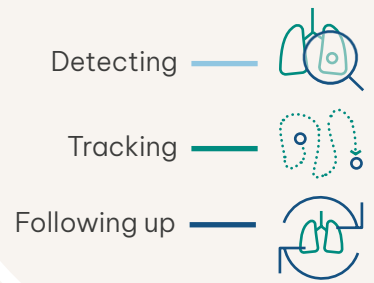
Giorgio Scagliotti, University of Turin<sup>28</sup>

**IPN identification and follow-up can supplement LDCT screening programmes, but it can also be used in systems where LDCT screening has not yet been implemented.** Locations without an LDCT screening programme in place can still provide patients with high-quality follow-up care through the proactive management of IPNs.<sup>7,11</sup> This will allow for a dedicated route for the earlier detection of lung cancer, and it can be a precursor to building a screening programme.

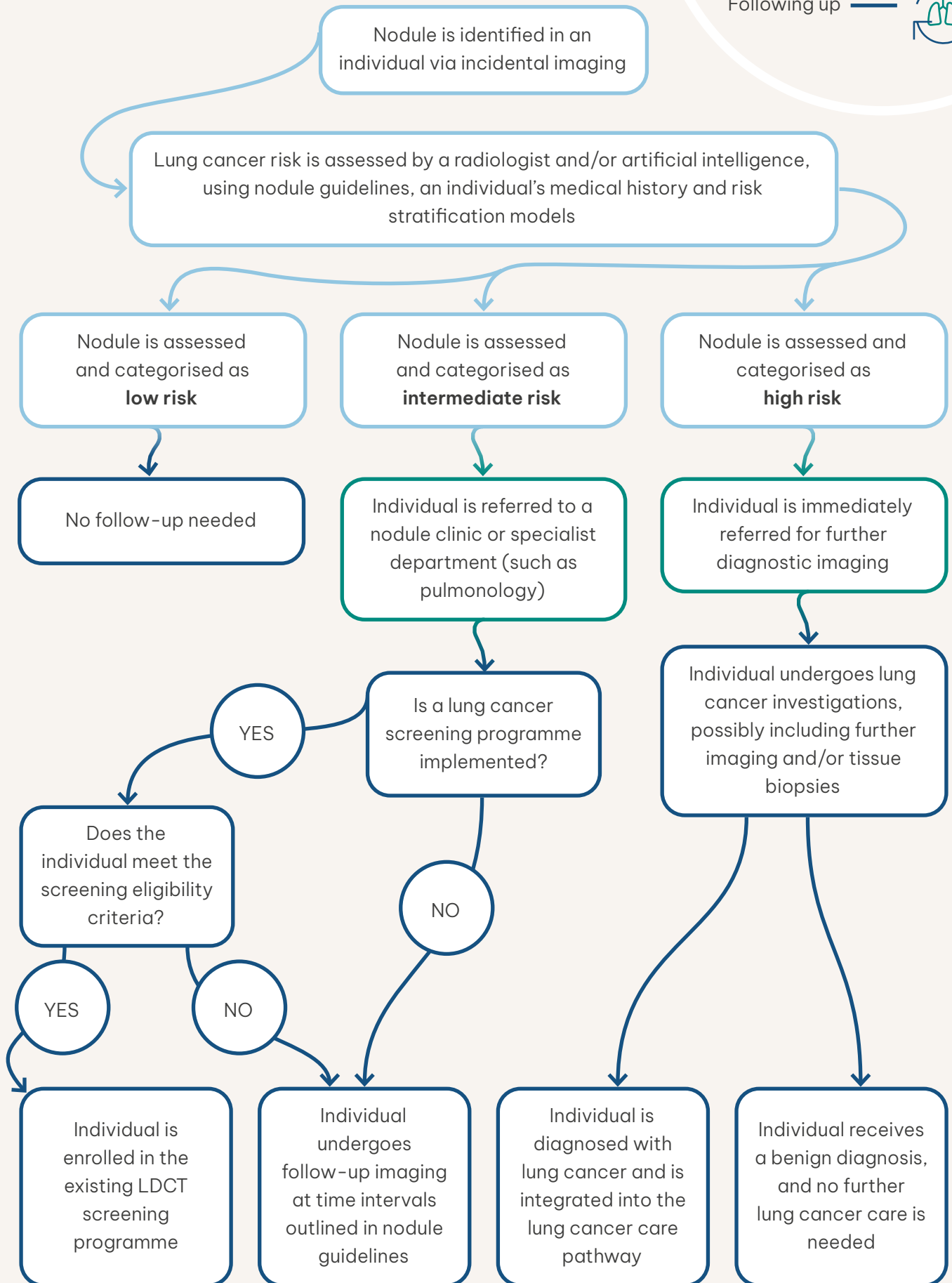


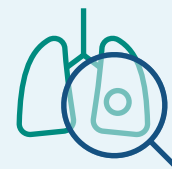
It doesn't matter what your programme format is, as long as you're staying true to the goals of detecting, tracking, following up and managing nodules for the early detection of lung cancer.

Ella Kazerooni, University of Michigan<sup>13</sup>



**Figure 1. An optimised IPN management pathway**





# Optimising the incidental detection of pulmonary nodules

**Improved education around the use of nodule guidelines, the adaptation of radiology reporting practices, and the use of a variety of risk-stratification tools could lead to the improved management of individuals with suspicious IPNs, resulting in an increase in the earlier detection of lung cancer.**

Detecting and accurately classifying nodules is the first step towards optimal IPN management. However, there is significant variability in practice, with guideline-adherent IPN management only occurring for up to 54% of individuals, though in many settings this can be lower.<sup>32</sup> Poor detection and classification of nodules can lead to early-stage lung cancer going undetected until a person is symptomatic, by which time the cancer is likely to have progressed to a more advanced stage.<sup>3-5 33</sup>

## Improve adherence to existing guidelines for nodule management

**Improving awareness and use of nodule management guidelines among healthcare professionals is key to ensuring all individuals with IPNs are appropriately identified.** Several internationally recognised guidelines (*Box 2*) have been created to provide consistency in how a nodule is assessed for its risk of lung cancer and how it is followed up in practice – whether it was detected incidentally or through a screening programme. Their use and uptake in practice, however, remains low.<sup>34-36</sup> It may not be clear to different healthcare professionals how they should use the guidelines. Educating non-thoracic clinicians who could encounter individuals with IPNs (such as primary care providers and emergency department providers) about existing guidelines may help to increase their use and improve the quality of care.<sup>36</sup>

### **Box 2. Existing guidelines for pulmonary nodule management**

The Fleischner Society and the British Thoracic Society, along with a number of other organisations, have published guidelines for the management of pulmonary nodules either within or outside of an LDCT screening programme.<sup>8 21 37-39</sup> There is slight variance between the guidelines, reflecting different types of health systems and practices. However, the guidelines outline the size, structure and growth rate of a nodule, along with the personal risk factors that should be considered to assess overall risk. They also provide instruction on appropriate follow-up care such as timescales for follow-up imaging.

**Although guidelines exist, there is a need for further guidance that is tailored to local populations and health systems.** There are various guidelines available for nodule management, but they are not necessarily applicable in all settings, especially for people with higher-risk nodules.<sup>13</sup> Therefore, it is important that policymakers use the established guidelines as a basis for location-specific guidance (*Case study 1*), which can be used to create an IPN management pathway appropriate to the local context and population.



You can't apply all guidelines to all situations, policymakers should adapt them to local populations.

Stephen Lam, BC Cancer; University of British Columbia<sup>13</sup>

### Case study 1

#### Tailoring nodule management guidelines to localised health systems in England and Wales

The British Thoracic Society published a set of guideline recommendations for the management of both incidental and screening-detected nodules in 2015.<sup>8</sup>

Prior to publication, stakeholder input suggested that the guidelines should include a practical description of an incidental nodule programme. In response to this, an example of a dedicated nodule programme was created and included in the guidelines. It aims to facilitate the implementation of nodule management guidelines by giving an example of service design that is specific to the National Health Service in England and Wales. Since the publication of these guidelines, nodule programmes have been implemented across both health systems.<sup>8,13</sup>



The difference in populations means we do have to have different guidance.

David Baldwin, Nottingham University Hospitals; University of Nottingham<sup>13</sup>

**Adapting practices to ensure radiology reports are used to accurately document individuals with IPNs is also key to improving their management.**

Radiology reports, the document a radiologist completes that summarises all findings from a CT scan, are part of the initial phase of identifying a nodule of interest. These reports are thus crucial to ensuring a person with an IPN is accurately detected. However, use of existing guidelines for nodule management is currently low due to limited integration into the radiology report template.<sup>40</sup> Adapting these templates to ensure individuals with IPNs are appropriately documented can increase the likelihood of a person receiving the recommended follow-up care.<sup>36 41 42</sup> Report templates could be adjusted to include a tailored version of nodule management guidelines and a description of how risk has been stratified.<sup>36</sup>

**Ensure appropriate and timely risk stratification through the integration of clinically validated artificial intelligence and other diagnostic tools**

**Accurate risk stratification of nodules is key to detecting lung cancer earlier.**

An analysis of the Danish Lung Cancer Registry and the Danish Health Data Authority found that 4.3% of people with stage IV lung cancer had a nodule that could have been detected on previous CT scans.<sup>33</sup> If the cancerous nodule had been identified at this time, using correct risk stratification, it may have been possible to diagnose the lung cancer at an earlier stage.

**At the same time, it is important that risk stratification approaches do not lead to overdiagnosis and subject people to unnecessary interventions.**

This is a particular issue for individuals with medium-risk IPNs, which are more difficult to classify than low- and high-risk nodules, and often require further investigation.<sup>43</sup> In a number of cases, people will undergo procedures (such as biopsies) that find the IPN to be benign.<sup>44-46</sup> These interventions require additional resources and can cause people emotional stress, as can the idea of a potential cancer diagnosis.<sup>47</sup> Implementing appropriate processes for risk stratification can help to ensure people with medium-risk IPNs are more accurately classified, minimising their discomfort and reducing capacity demands on the health system.

**Artificial intelligence (AI)-based tools for risk stratification may aid radiologists in making a more rapid risk assessment.**

There are a variety of risk stratification tools available for nodules. To provide an estimate of malignancy, these tools consider factors such as nodule size, shape and growth rate, along with patient characteristics such as age, sex, family medical history and a history of emphysema.<sup>48 49</sup> While traditional risk

calculators seldom outperform an experienced radiologist's estimation of risk, clinically validated AI tools that analyse scans and radiologist reports (using established risk models) can match experienced radiologists' accuracy in risk assessment.<sup>50 51</sup> Moreover, the AI software can continuously assess scans, producing a far greater output than any radiologist.<sup>27</sup> AI tools can also be used to assess IPNs detected via X-ray; these scans are done at greater volumes than CT scans but with a lower image quality, so nodules are harder to assess for risk.<sup>52</sup> Using AI tools in this way can assess a high number of X-ray scans and identify nodules that should receive further investigation, including CT imaging at a higher resolution, to enable more accurate assessment of risk to inform onward testing and care.<sup>53</sup> This offers a route to earlier detection that supports radiologists without adding significant pressure to radiology workflows.

**As AI-based tools continue to evolve, it is crucial to carefully assess potential risks around data bias and large-scale feasibility.** Tools include deep learning algorithms (DLAs) – which use previous CT data to develop pattern recognition models – and novel diagnostic modalities such as biomarkers, liquid biopsies and molecular signatures.<sup>27 54</sup> While DLAs promise more accurate risk stratification with fewer false positives, there are concerns about their performance in real-world applications.<sup>55</sup> This is partly due to the limited data these tools are trained on, which may not accurately reflect a more diverse population. Other concerns centre around 'black box' algorithms, where the type and amount of data used is not disclosed, leading to issues with trust and transparency.<sup>56</sup> While novel diagnostic modalities offer promising non-invasive tools for risk stratification, they are still in their infancy and have had few studies looking at large-scale feasibility.<sup>27 57 58</sup>

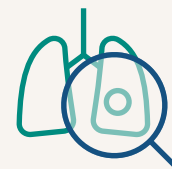
**Health systems should be prepared to adapt to emerging technologies while understanding their limitations.** More research should be conducted on the large-scale feasibility of DLAs and novel diagnostics, considering the amount and variation of data used to create and verify the tools. When using existing risk models, healthcare professionals should work to collect comprehensive patient data to optimise the effectiveness of traditional risk models.



AI is extremely important because it saves a lot of time and human resources, which allows for more nodules to be detected and more cancers diagnosed.

Luis Raez, Memorial Cancer Institute<sup>27</sup>





## Recommendations to optimise the incidental detection of pulmonary nodules:

- **Create and implement a nodule management pathway** that reflects the needs of the local population to facilitate the earlier detection of lung cancer.
- **Develop tailored guidance on IPN management** so appropriate follow-up procedures are integrated into the existing health system.
- **Educate healthcare professionals** about existing IPN guidelines and their use across the health system.
- **Equip healthcare professionals with tools** (such as traditional and AI-enhanced risk models) **to accurately assess IPN risk** and minimise overdiagnosis and overmedicalisation.
- **Standardise templates for IPN radiology reporting** to encourage adherence to guidelines and ensure individuals receive appropriate follow-up care.
- **Ensure healthcare professionals collect comprehensive patient data** to optimise the effectiveness of traditional risk models.
- **Conduct ongoing research on the use and suitability of AI and novel diagnostics**, assessing their capacity to improve IPN detection and risk stratification in practice, and reduce radiologist workload.



# Optimising the tracking of incidental pulmonary nodules

**The use of tracking systems, along with improved interdepartmental and patient-facing communication, can help to ensure all individuals with suspicious IPNs receive appropriate follow-up care.** It is imperative that any individual with an IPN be tracked through the IPN management pathway to ensure they receive follow-up care appropriate to their level of risk. Tracking processes should be adapted to the existing health system and workflow.

## Ensure appropriate tracking through accurate information systems and records

**Using tracking systems can ensure that all individuals with IPNs are appropriately managed.** Tracking systems (*Box 3*) relieve people with IPNs of the responsibility of organising their own follow-up care as well as making tracking more streamlined and efficient for healthcare professionals (*Case study 2*). In a study in Mississippi, for example, 4% of lung cancer cases were diagnosed following prompts from tracking software;<sup>59</sup> these cases may have been missed or delayed without the software, potentially leading to worse outcomes.

### Box 3. What do automated IPN tracking systems do?

Tracking systems can help healthcare professionals by reducing their workload, tracing 'lost' patients and ensuring they receive appropriate follow-up care.<sup>61</sup>

Automated IPN tracking systems perform a variety of tasks, including:<sup>59</sup>

- automatically detecting people with IPNs who have been identified as needing follow-up care in radiology reports
- documenting communications between different healthcare departments, and between healthcare professionals and patients
- calculating follow-up timelines
- recording follow-up and timeliness of testing
- providing appointment reminders and alerts about missed scans for both people with IPNs and healthcare professionals.
- consolidating previous imaging.

**To be effective, tracking systems require comprehensive patient information.**

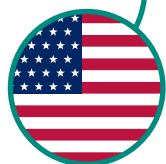
Up-to-date information is essential, as missing or incorrect patient data can hamper communication and increase time to follow-up.<sup>60</sup> For example, radiologists may not have sufficient, relevant information to suggest appropriate next steps for IPN management.<sup>30</sup> However, records are not always complete, particularly for underserved population groups who may have limited interactions with the health system.<sup>26 60</sup>

**Case study 2**

**Using an automated tracking registry to optimise timely follow-up of nodules in Minneapolis**

The Minneapolis Veterans Administration Medical Center implemented an automated tracking registry to test its impact on IPN tracking failure (where individuals receive significantly delayed or no follow-up care).<sup>62</sup> The system automatically enters any individual with an IPN into a registry if a lung nodule code is used in a radiology report. The tracking system then sends alerts to clinical staff at set intervals (as determined by nodule management guidelines), indicating that follow-up surveillance is required.

Implementation of the tracking registry reduced tracking failure by 64%.<sup>62</sup>



**We can't make a good programme for early detection without navigator software.**

**Francisco Sarmiento, Real Hospital Português<sup>29</sup>**

**Implementing nodule registries alongside an IPN management pathway can help improve care and inform future service provision.**

A lung nodule registry gathers data on individuals with IPNs, tracks rates of follow-up, highlights areas for system improvement, enables epidemiology insights and collates information that can be used to inform future research (*Case study 3*).<sup>63-65</sup> The use of such registries in practice is just beginning, but similar registries for other cancers have helped to improve access to care, change clinical practice and provide data insights for future research.<sup>66</sup>

### Case study 3



#### Implementing a lung nodule registry in Denmark

The Danish Lung Nodule Registry is being established as a complement to the existing Danish Lung Cancer Registry. It is hoped the expansion of the registry will provide a comprehensive picture of the number of individuals with IPNs nationwide and insights on the epidemiology of identified nodules. These data will be used to inform the implementation of targeted strategies for the earlier detection of lung cancer in Denmark.<sup>63</sup>

It is hoped that the registry will be a resource to guide further research in novel diagnostics and public health strategies to reduce the incidence of lung cancer.<sup>64</sup>



We want to have more systematic registration; a nodule registry allows us to monitor what happens with these nodules, because at the moment we have very little information about outcomes.

Torben Riis Rasmussen, Aarhus University<sup>64</sup>

### Improve integration and communication between different parts of the health system

**Systems should be established to facilitate communication between different healthcare departments to ensure people with IPNs are appropriately tracked and cared for.** A variety of medical specialists may initially identify people with IPNs; however, follow-up and management should be handed over to a specialist clinician or team. This means communication between healthcare professionals, facilitated by integrated health records, is essential to ensuring individuals receive appropriate follow-up care that adheres to guidelines. Healthcare professionals frequently cite insufficient communication with other healthcare staff as a primary reason for missed opportunities to follow up individuals with suspicious IPNs.<sup>40</sup> Outside of

nodule clinics, primary care providers typically oversee ongoing monitoring of individuals with suspicious IPNs, but they may be unsure of how to effectively communicate with tertiary care centres due to not knowing the initial reasons for imaging.<sup>67 68</sup> Dedicated communication systems that use reciprocal reporting can minimise errors, help to avoid interdisciplinary communication breakdown, increase timely follow-up, and improve uptake and completeness of radiology reports. In one health system, use of these communication systems increased follow-up rates by 33%.<sup>67</sup>

**Using standardised nomenclature and a structured radiology report is also key to improving communication between healthcare professionals and reducing delays in follow-up care.** Embedding standardised templates into the existing radiologist workflows can improve rates of appropriate follow-up care and reduce time spent documenting IPNs (*Case study 4*).<sup>42 69</sup> This should make the templates easier for radiologists to adopt, while increasing the number of individuals with IPNs who receive appropriate follow-up care. In Minnesota, IPN follow-up increased by 35% after the implementation of a structured template for radiology reporting that includes six key nodule descriptors.<sup>70</sup> Using standardised nomenclature has also been shown to increase follow-up rates.<sup>67 71</sup>

#### Case study 4

##### Implementing a standardised template for radiology reporting in Germany

In Hannover, Germany, a standardised template for radiology reporting is in the early phases of adoption, with the aim of ensuring individuals with IPNs are identified appropriately. The template has a simple list of pre-set data tags for nodule management that the radiologist must select when completing the report. Any radiology report that includes the data tags for suspicious nodules is then referred for discussion by a multidisciplinary tumour board.<sup>69</sup>



In our radiology department, we standardised the CT report and we have built a pathway into the nodule management programme.

Francisco Sarmiento, Real Hospital Português<sup>29</sup>

## Improve communication between healthcare professionals and people with IPNs

**Healthcare professionals should ensure they communicate clearly with their patients about the risk of cancer associated with IPNs, as this can reduce distress and contribute to better outcomes.** Research shows that a quarter of people with IPNs experience distress due to misconceptions about cancer risk, uncertainty about a potential diagnosis, feelings of losing control over medical decisions, and fear of cancer.<sup>47</sup> In one study, 77% of people with IPNs reported not receiving adequate information on cancer risk from their clinician,<sup>47</sup> while some clinicians admitted to withholding this information in an attempt to reduce their patients' worry.<sup>72</sup> Clinicians can mitigate patients' distress and improve their adherence to recommended follow-up actions by emphasizing that IPNs are a common finding, discussing the patient's CT scans and nodule size, and sharing information about cancer risk.<sup>47</sup>

**People with IPNs from groups who are already underserved by the health system may require additional and tailored communication to mitigate exacerbating inequalities in care.** Evidence shows that people from lower socioeconomic groups often receive suboptimal care, and this is reflected in the management of individuals with IPNs.<sup>73 74</sup> In the US, White people receive more and higher-quality information on IPNs than other ethnic groups.<sup>30 73</sup> This could be due to many reasons, including:<sup>73</sup>

- implicit bias on the part of healthcare providers towards certain population groups
- care information being provided in English, making it less accessible to people with different primary languages.

These factors can all complicate ongoing care and result in poorer outcomes.<sup>74 75</sup> It is important to ensure that individuals are provided with information about IPNs and their cancer risk in a range of accessible formats and languages.<sup>60</sup>



By addressing language and health literacy, and by facilitating access to treatment and social services, navigators help reduce disparities in care for people from traditionally under-represented groups.

**Andrea Borondy Kitts, Rescue Lung Society<sup>31</sup>**

**Patient navigators\* can guide people with IPNs through the management pathway to ensure they remain engaged and supported throughout their care.** The role of a patient navigator includes coordinating and monitoring follow-up care, serving as a consistent point of contact for people with IPNs, offering emotional support and providing tailored information.<sup>76 77</sup> By addressing language and health literacy barriers, navigators help reduce disparities in care for people from traditionally under-represented groups.<sup>31 78 79</sup> The use of a navigator not only improves adherence to recommendations (among both people with IPNs and healthcare professionals) (*Case study 5*) and increases follow-up rates, but also enhances patient wellbeing and education.<sup>76 77 79</sup>

### Case study 5

#### Implementing a patient navigator as part of an integrated nodule clinic in the US

The Pulmonary Nodule and Lung Cancer Screening Clinic (PNLCSC) at Massachusetts General Hospital was created to assess individuals with suspicious nodules using a multidisciplinary approach. The clinic is staffed by a range of experts from radiology, medical oncology, radiation oncology, surgical oncology and pulmonology, as well as nurse practitioners, patient navigators and tobacco cessation specialists.<sup>76</sup>

An analysis of the programme has cited the provision of a patient navigator as a key reason the clinic experienced high rates (95%) of patient adherence to follow-up care recommendations.<sup>76</sup>



It has been essential for our programme to have a navigator because follow-up is guided by them.

**Lucia Viola, Fundación Neumológica Colombiana;  
Luis Carlos Sarmiento Angulo Cancer Treatment  
and Research Center<sup>13</sup>**

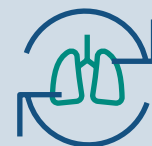
\* Also known as a nurse navigator or a nodule navigator.



## Recommendations to optimise the tracking of incidental pulmonary nodules:

- **Create, implement and integrate standardised templates for radiology reporting** to ensure nodules are correctly integrated into the IPN management pathway.
- **Provide a patient navigator** to facilitate patient education and adherence to follow-up recommendations, and to improve patient wellbeing.
- **Implement tracking systems** for IPN management to ensure people receive appropriate follow-up care.
- **Implement integrated interdepartmental communication systems** to improve the tracking of IPNs among healthcare professionals.
- **Create and distribute patient-facing materials about IPNs** and their cancer risk, in a range of formats and languages, to provide accessible and tailored information to people with IPNs.
- **Set up a nodule registry** to provide an epidemiological oversight of nodule prevalence, and to guide future prevention and detection strategies for lung cancer.





# Optimising the follow-up of incidental pulmonary nodules

## **Access to multidisciplinary care and consistent follow-up imaging**

**facilitates the appropriate management of people with IPNs.** Once nodules have been appropriately found and tracked, it is vital that they are followed up. Appropriate follow-up care facilitates the earlier diagnosis of lung cancer and also improves patient wellbeing and the quality of care decisions.

## **Ensure consistency across follow-up imaging**

**Appropriate IPN follow-up involves comparing scans over time to assess growth, so it is vital that images are of highest quality and can be compared consistently across different CT scanners.** Existing guidelines on CT scanner calibration aim to minimise inconsistency in imaging as part of standard quality assurance processes. However, some variation can occur between different scanner models. Even the same CT scanner may vary in the quality of the images it provides over time, underscoring the importance of adherence to quality control measures. One of the biggest indicators of cancer is how a nodule grows and changes, so most nodule management guidelines recommend that individuals with IPNs are observed and followed up within set timescales.<sup>40 821</sup> Where an individual receives follow-up scans over a period of time, potential differences between scans (whether using the same CT scanner or a different model) could increase the risk of false positives or missed cancerous nodules.<sup>80</sup> CT scanners should be calibrated at manufacturer-recommended intervals to ensure nodule growth can be accurately assessed, thus increasing the likelihood that all individuals with IPNs receive appropriate follow-up care.<sup>80</sup> One method of facilitating comparison across different images is through the use of a phantom (a physical model that replicates the body; see *Case study 6*), which can help to assess whether any of the observed changes in nodule size are caused by variance in imaging parameters rather than indicative of malignancy.<sup>81</sup>

### Case study 6

#### Approaches to ensuring high-quality imaging using CT scanners

The safe and effective use of CT scans can be supported by clear guidelines and reference protocols to guide CT use, formalised nomenclature and defined calibration methods for the scanners.

- The Alliance for Quality Computer Tomography (AQCT) have published a range of resources aiming to enhance the quality of CT practice, including: teaching slide sets, reference protocols, and a lexicon assisting CT-scan users in understanding the different nomenclature used across manufacturers.<sup>82</sup>
- The American College of Radiology (ACR) and American Association of Physicists in Medicine (AAPM) jointly developed a technical standard as a tool to assist CT practitioners with monitoring the performance of CT equipment on an ongoing basis. The standard recommends monitoring be done yearly as a minimum, as well as after any repair or service that might alter the performance of the equipment, image quality or radiation exposure for patients or healthcare professionals.<sup>83</sup>
- A study into the use of phantoms demonstrated that a commonplace object can be used as a reference to accurately assess imaging precision for small lung nodules.<sup>81</sup> This indicates that assessing consistency across CT scanners is feasible and that could be carried out to facilitate better comparisons across follow-up images. Using phantom data can help to measure differences in imaging parameters, as well as providing an overall picture of the variation in CT scanner models. This can inform future nodule imaging assessment and, potentially, future guidance.<sup>84</sup>

## Provide individuals with access to comprehensive and multidisciplinary nodule care

**Multidisciplinary care is central to the effective follow-up of IPNs and contributes to better treatment outcomes.** People with IPNs should be managed by a multidisciplinary team that includes pulmonologists, patient navigators, oncologists, radiologists, smoking cessation specialists and thoracic surgeons.<sup>82</sup> This broad expertise can help to evaluate individuals with IPNs and determine their appropriate management.<sup>21 82</sup> Multidisciplinary care has been shown to increase the number of early-stage diagnoses, improve adherence to guideline recommendations and reduce unnecessary biopsies.<sup>76</sup> The IPN management pathway requires an effective multidisciplinary team\* to ensure high-quality care is provided.



An expert multidisciplinary team can ensure the safe and responsible monitoring, longitudinal nodule management and activation of timely diagnostic workup and access to the right treatment with the right specialists.

**Joelle Fathi, GO2 for Lung Cancer<sup>60</sup>**

**Dedicated nodule clinics offer centralised, multidisciplinary care for people with IPNs.** These clinics facilitate timely follow-up care and help alleviate workforce pressures by managing people with IPNs outside of pulmonology or radiology departments, thus increasing capacity for follow-up (*Case study 7*). Staffed by dedicated teams with specialised knowledge of IPNs, nodule clinics oversee all aspects of IPN management.<sup>78</sup> Nodule clinics can be complementary to lung cancer screening (*Case study 8*) as some people with IPNs can be enrolled in an existing screening programme, based on their availability and eligibility criteria, and thus may be moved into a programme of periodic screening.<sup>27</sup>

\* An effective multidisciplinary team adheres to the following principles: patient-centred care, shared decision-making processes, whole-health-system representation, understanding of the location-specific health system, and special considerations for high-risk populations.<sup>83</sup>

### Case study 7



#### **Assessing the impact of a pulmonary nodule programme in the Mississippi Delta**

The Detecting Lung Cancer Early (DELUGE) study, a large-scale prospective study that ran between 2015 and 2021, compared the outcomes of over 22,000 participants who had pulmonary nodules detected incidentally. It intended to compare and assess the impact of a lung nodule management programme, LDCT screening and a multidisciplinary thoracic oncology team on the earlier detection of lung cancer.<sup>11</sup>

The study found that managing IPNs through a lung nodule programme diagnosed as many early-stage lung cancers as screening (60% vs. 61%) and more than multidisciplinary care (44%). Only 54% of participants diagnosed with lung cancer qualified for LDCT screening as per the 2021 eligibility criteria of the United States Preventive Services Taskforce, demonstrating that nodule management is a vital component of earlier detection strategies. The study also found that a lung nodule programme was able to detect 20% of early-stage lung cancers that would otherwise have been missed even if LDCT screening had 100% uptake, as they occurred among individuals who would not have met the narrower eligibility criteria for screening.<sup>11</sup>

### Case study 8



#### **Implementing an IPN programme alongside lung cancer screening in Brazil**

At the Real Hospital Português in Brazil, an IPN programme has been implemented alongside an LDCT screening programme in the form of a nodule clinic. The nodule clinic uses software to identify actionable nodules in radiology reports. A patient navigator, assisted by navigator software, then contacts people with IPNs to enrol them in the programme. The nodules of interest are then reviewed by a multidisciplinary tumour board, which provides follow-up recommendations.<sup>29</sup>

Since its inception in 2023, 21% of people in the programme have been diagnosed with lung cancer. Almost 75% of the people diagnosed with lung cancer were ineligible for lung cancer screening, demonstrating the importance of a nodule clinic as a complement to screening, to enhance earlier detection opportunities.<sup>29</sup>

A key success of the programme has been using a multidisciplinary team that includes a patient navigator and integrating the programme into the existing health system infrastructure. The IPN programme has access to electronic health records to allow radiology reports to be automatically reviewed by a multidisciplinary tumour board.<sup>29</sup>



## Recommendations to optimise the follow-up of incidental pulmonary nodules:

- **Integrate IPN management into the health system** – as a standalone programme or integrated with existing programmes for LDCT screening – to increase the coverage of earlier detection strategies for lung cancer and to facilitate detection among people who are not eligible for screening.
- **Implement a dedicated nodule clinic** to provide multidisciplinary care and to alleviate pressures on other hospital departments.
- **Provide multidisciplinary care** for people with IPNs to increase the earlier diagnosis of lung cancer and improve patient wellbeing.
- **Implement processes**, including adherence to quality assurance standards for CT scanners, **to facilitate accurate comparison across follow-up imaging** and hence robust assessment of nodule change.

### 3

## Action to integrate management of incidental pulmonary nodules into early detection programmes



Our vision is to make small changes to the way we work in order to have a big effect on the system.

Jens Vogel Claussen, Hannover Medical School<sup>69</sup>

The opportunity for improving the management of individuals with IPNs should be better recognised in policy, with guidance on how to establish or optimise robust nodule management processes, and should be better utilised by integrating these processes into existing lung cancer care pathways, in accordance with local contexts.

**Comprehensive and coordinated lung nodule programmes provide a clear pathway to detecting lung cancer earlier, improving patient wellbeing and reducing mortality.** Standardised protocols, guideline recommendations and patient referral pathways are needed at an organisational, regional and national level to maximise the impact of nodule follow-up as an early detection strategy for lung cancer. Providing a comprehensive nodule management pathway that integrates the detection, tracking and follow-up of nodules significantly improves follow-up rates and leads to earlier diagnosis compared with locations without stratified nodule management.<sup>11</sup>



We need to strongly advise policymakers that the IPN route is a complementary piece of the earlier detection strategy, especially for those outside of traditionally high-risk groups.

Giorgio Scagliotti, University of Turin<sup>28</sup>

# Summary of recommendations to optimise IPN management

Optimising the management of individuals with IPNs can be achieved in a range of health systems and settings by applying the principles of detecting, tracking and following-up lung nodules.

The following recommendations highlight opportunities at each stage of the nodule pathway to ensure IPN management has a tangible impact on the earlier detection of lung cancer:

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## Recommendations to optimise the incidental detection of pulmonary nodules:

- **Create and implement a nodule management pathway** that reflects the needs of the local population to facilitate the earlier detection of lung cancer.
- **Develop tailored guidance on IPN management** so appropriate follow-up procedures are integrated into the existing health system.
- **Educate healthcare professionals** about existing IPN guidelines and their use across the health system.
- **Equip healthcare professionals with tools** (such as traditional and AI-enhanced risk models) **to accurately assess IPN risk** and minimise overdiagnosis and overmedicalisation.
- **Standardise templates for IPN radiology reporting** to encourage adherence to guidelines and ensure individuals receive appropriate follow-up care.
- **Ensure healthcare professionals collect comprehensive patient data** to optimise the effectiveness of traditional risk models.
- **Conduct ongoing research on the use and suitability of AI and novel diagnostics**, assessing their capacity to improve IPN detection and risk stratification in practice, and reduce radiologist workload.



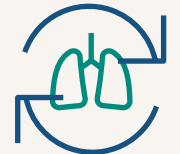




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- **Provide multidisciplinary care** for people with IPNs to increase the earlier diagnosis of lung cancer and improve patient wellbeing.
- **Implement processes**, including adherence to quality assurance standards for CT scanners, **to facilitate accurate comparison across follow-up imaging** and hence robust assessment of nodule change.

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# Appendix: Network members

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