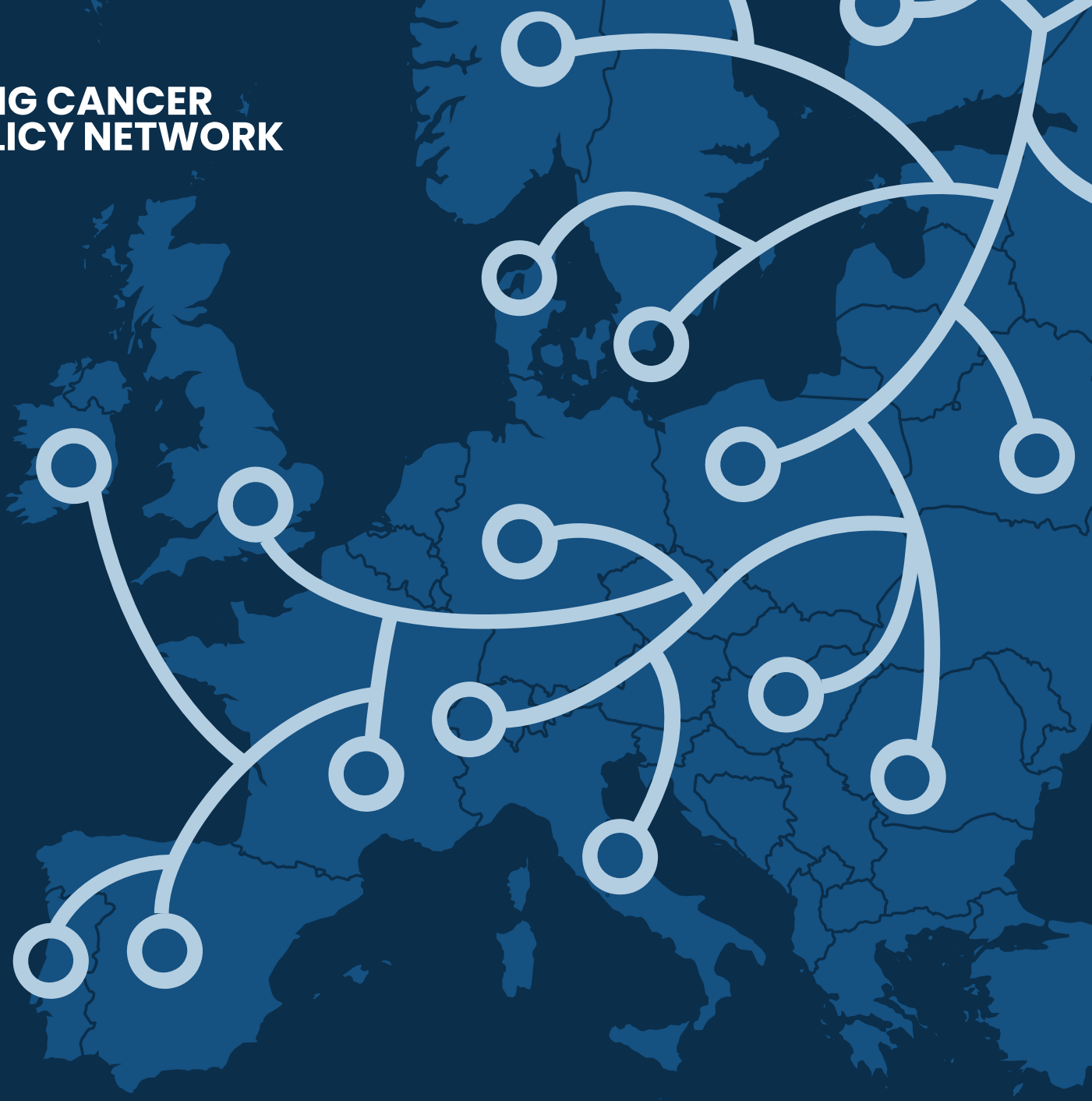
LUNG CANCER POLICY NETWORK



Advancing lung cancer screening: learning from implementation in Europe

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We thank the following experts for sharing their perspectives with us:

Antun Aboud, Project Manager, Croatian National Lung Cancer Screening Program, Department of Respiratory Diseases, University Hospital Centre Zagreb, Croatia

Professor David Baldwin, Consultant Respiratory Physician; Honorary Professor of Medicine, Nottingham University Hospitals; University of Nottingham, UK

Dr Joanna Bidzińska, Assistant Professor, Medical University of Gdańsk; Radiographers Team Coordinator, Department of Radiology; Former Project Coordinator, Nationwide Programme of Early Lung Cancer Detection – Northern Macroregion, University Clinical Centre in Gdańsk, Poland

Anne Clement, Global Marketing Director, GE HealthCare, France

Professor Joanna Chorostowska-Wynimko, Head of the Department of Genetics and Clinical Immunology, National Institute of Tuberculosis and Lung Disease, Poland

Dr Hans-Ulrich Kauczor, Medical Director, Department of Diagnostic and Interventional Radiology, University Hospital Heidelberg, Germany

Associate Professor Kristina Krpina, Pulmonology Coordinator, Croatian National Lung Cancer Screening Program, Department of Respiratory Diseases, University Hospital Centre Zagreb, Croatia

Professor Tanel Laisaar, Head of Lung Clinic, Associate Professor of Thoracic Surgery, Tartu University Hospital, Estonia

Michaela Regan, Policy and Member Engagement Lead, Lung Cancer Europe, France

Professor Oluf Dimitri Røe, Specialist in Medical and Radiation Oncology, Norwegian University of Science and Technology; Aalborg University Hospital, Norway

Dr Sebastian Schmidt, Head of Medical Affairs Computed Tomography, Siemens Healthineers, Germany

Professor Edyta Szurowska, Head of Radiology Departments at University Clinical Centre and Medical University of Gdańsk; National Consultant for Radiology and Diagnostic Imaging; Vice President of the Polish Medical Society of Radiology

About this report

In 2022, the Lung Cancer Policy Network published its inaugural report, Lung cancer screening: learning from implementation. The report – developed in collaboration with experts – provided a blueprint for implementing low-dose computed tomography screening by collating evidence and case studies from countries that had established or piloted programmes. It demonstrated how health systems could translate the strong evidence base for screening into practice.

This second-phase report takes stock of rapid policy and implementation shifts across Europe and suggests clear, actionable priorities.

How to use this report

This report is designed to support policymakers, healthcare professionals and advocates working to implement lung cancer screening.

The **executive summary** outlines key messages and priorities.

The **implementation sections** provide practical lessons and examples from across Europe.

The **recommendations** highlight actionable steps to guide policy and programme design.

Contents

Executive summary

Detecting lung cancer earlier is crucial to reducing deaths. In Europe, lung cancer remains the leading cause of cancer deaths, driven largely by late diagnosis rather than a lack of effective treatment.[1] Low-dose computed tomography (LDCT) screening offers a proven solution with robust evidence showing that targeted LDCT screening can detect lung cancer earlier, shift diagnosis to more treatable stages and consequently reduce mortality among people at highest risk.[2–8] The debate has moved beyond assessing scientific validity; the central challenge now facing Europe is how to implement targeted lung cancer screening programmes that are high-quality, equitable, scalable and sustainable.

The European policy and implementation landscape for lung cancer screening has evolved rapidly in recent years, signalling political momentum and a growing focus on delivery. Lung cancer screening is now recognised in Europe's Beating Cancer Plan, European Union (EU) Council recommendations and the fifth edition of the European Code Against Cancer, and supported by other EU-funded initiatives.[9–12] Several countries have launched national programmes or are moving from pilots to scale-up, while others are actively exploring implementation.[13]

Translating this momentum into effective delivery requires getting three things right. Policy alignment and governance are essential: policymakers can only act when evidence, system readiness and political conditions converge, and European-level standards play a critical role in helping national leaders justify investment. Sustainable funding is equally important: upfront costs should be framed as strategic, time-limited enablers of long-term system efficiency – evidence from Croatia shows that even preliminary economic analyses can be sufficient to secure government approval. And because health systems across Europe differ substantially in structure and capacity, successful implementation depends on flexibility and adaptability rather than a single prescribed model.

LDCT screening is not a single diagnostic test but a complex health service, and four key lessons have emerged from the European implementation experience. Eligibility criteria must be tailored to reach people at highest risk: while age and smoking status are widely used, multivariable risk models better identify high-risk individuals, improve screening efficiency and reduce selection disparities. Targeted outreach is essential to boost participation and reduce inequalities: the most effective programmes combine systematic population-based invitations with outreach tailored to underserved groups. Lung cancer screening should be integrated with broader

public health initiatives: embedding smoking cessation support systematically within screening pathways maximises health impact and cost-effectiveness. Screening must also be fully integrated into health systems to be sustainable – requiring robust nodule management protocols, interoperable digital infrastructure, national quality assurance frameworks and parallel investment in downstream diagnostic and treatment capacity, because earlier detection only delivers its full benefit when the system can act on what it finds.

Europe has the evidence, the political momentum and the practical experience to accelerate screening implementation. The priority is execution: translating commitment into coordinated, systemwide screening programmes that are high quality, equitable, scalable and sustainable.

Four key lessons from lung cancer screening implementation

Lesson 1

Tailor eligibility criteria for screening to reach people at highest risk of lung cancer

Lesson 2

Develop targeted outreach to address potential barriers to participation in lung cancer screening

Lesson 3

Amplify the impact of lung cancer screening by integrating it into other public health initiatives

Lesson 4

Ensure the full integration of lung cancer screening into health systems

From political momentum to screening delivery in Europe

Lung cancer kills more people than any other cancer in Europe, and the majority of these deaths are driven not by a lack of effective treatment, but by diagnoses that come too late. Lung cancer is responsible for around 20% of cancer-related deaths.[1 14] In 2022, tracheal, bronchus and lung cancers killed over 375,000 people in Europe – one life lost every 84 seconds.[15] Most people with lung cancer will receive their diagnosis at a late stage, when the likelihood of surviving for five years or more is just 7–18%, compared with over 80% for people whose disease is detected at stage I.[14 16]

The scientific case for low-dose computed tomography (LDCT) screening is well established; the central challenge now is how to implement screening programmes effectively and at scale. Randomised trials, pilots and national programmes demonstrate that LDCT screening can detect lung cancer earlier, shift diagnosis to more treatable stages and improve outcomes among people at highest risk.[2-8 17]

Political momentum for lung cancer screening has grown significantly at the European and global level, but it has not translated into equally rapid adoption of screening programmes across Member States. Europe's Beating Cancer Plan and the 2022 update of the European Union (EU) Council Recommendation on cancer screening have strengthened the policy case for organised LDCT screening for high-risk populations, with subsequent guidance providing greater clarity for implementation.[9 10 18 19] This direction was further reinforced in 2025, when the European Code Against Cancer explicitly recommended participation in organised lung cancer screening programmes for eligible people.[12] A range of European and international initiatives are also investing in research, digital infrastructure and cross-border collaboration related to lung cancer screening, facilitating the exchange of best practice and addressing implementation barriers (*Box 1*).[11]

Professional and patient organisations are also contributing to this momentum. The European Lung Cancer Screening Alliance brings together clinicians, researchers, patient representatives and policymakers to promote collaboration and support implementation.[20] Patient organisations, including Lung Cancer Europe, are working to define shared expectations for lung cancer care through initiatives such as the Lung Cancer Europe Charter.[21] These efforts are helping translate policy commitment into practical delivery, and tackle the long-standing stigma that has so often led to lung cancer being under-prioritised in policy.

Box 1

Key European and international initiatives advancing LDCT screening

- EU4Health and Horizon Europe are funding research, digital infrastructure and cross-border collaboration.
- The Strengthening the screening of Lung Cancer in Europe (SOLACE) project is facilitating the exchange of best practice and addressing implementation barriers.[11]
- The European Commission Initiative on Lung Cancer is expected to develop evidence-based recommendations and a voluntary European quality assurance framework for lung cancer screening and care.[22]
- The European Respiratory Society also developed technical standards to support the implementation of screening.[23]
- The World Health Organization (WHO) lung health resolution, the Lancet Commission on Lung Health and the International Agency for Research on Cancer handbook on lung cancer screening all emphasise the growing importance of prevention and earlier detection as central components of lung health strategies.[24-26]

Despite this progress, implementation remains uneven across Europe. Many countries are testing feasibility through pilot studies, while others are moving toward broader integration; in countries where programmes are more mature, attention is turning to optimisation (*Figure 1*).[13 27 28] National cancer control plans in Europe are increasingly aligning with this direction by identifying lung cancer screening as a strategic priority.[13] However, only six countries in Europe have formally committed to implementing screening, with four others in the roll-out stage (*Figure 2*).[13] As programmes evolve, the strategic debate is changing. The key question is no longer whether LDCT screening should be available, but how to implement programmes that are high-quality, equitable, scalable and cost-effective.

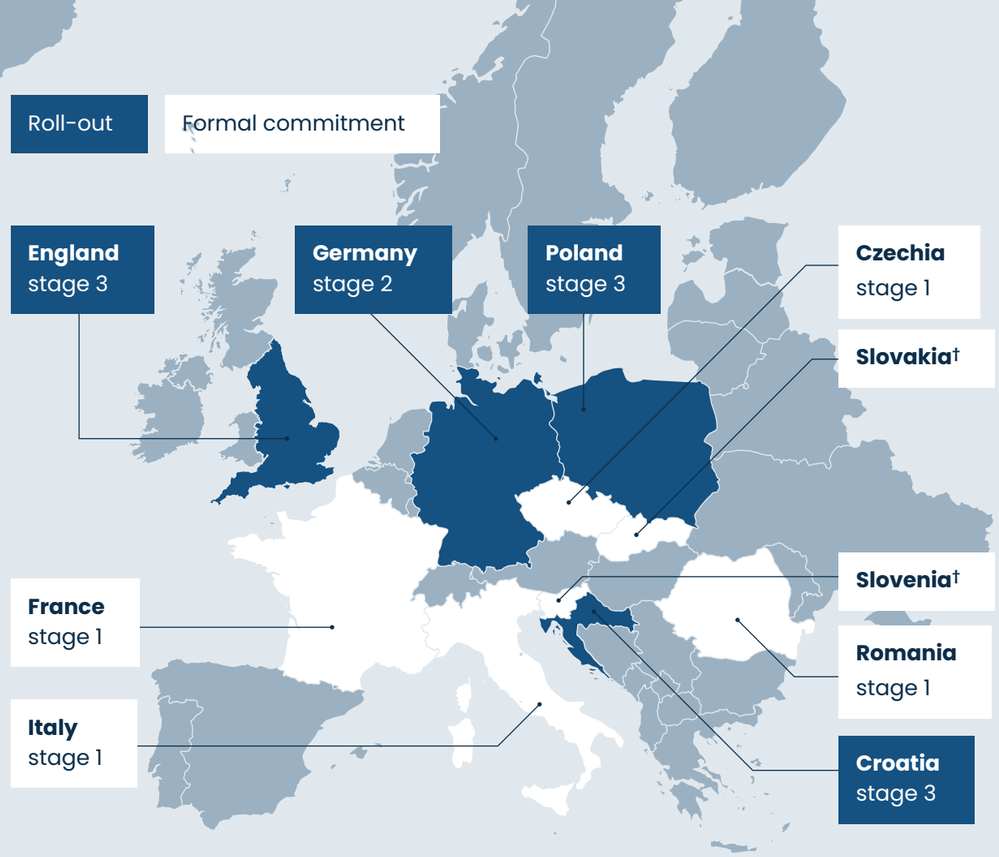
'We are dealing with the deadliest cancer in Europe – and one where early detection can make a real difference. So the pace of implementation needs to accelerate.'

PROFESSOR OLUF DIMITRI RØE

Figure 1. Stages of lung cancer screening implementation

Stage 1: **preparation and pilot programmes**	Stage 2: **scaling and integration**	Stage 3: **optimisation and innovation**
Countries are testing feasibility through regional pilots, and building evidence on participation, logistics, workforce capacity and IT systems.	National programmes are implemented, embedding screening within cancer pathways, establishing sustainable financing, and linking programmes with primary care and smoking cessation services.	Maturing programmes are refining eligibility, strengthening quality assurance, improving equity in uptake, and deploying digital tools and AI to enhance accuracy and efficiency.

Figure 2. The status of national screening programmes for lung cancer in Europe[13]



	Croatia	England	Germany	Poland
Health system funding structure	Social health insurance Centralised health system	Publicly funded (tax-based National Health Service) Centralised health system	Statutory health insurance or substitutive private health insurance Decentralised health system	Social health insurance Centralised health system
Eligibility criteria	**Age:** 50–75 years People who currently smoke or stopped smoking within the past 15 years with the equivalent of 30 years smoking a pack a day[29]	**Age:** 55–74 years People who currently smoke or previously smoked Risk score above a selected threshold using LLPv2 (≥2.5% risk) and PLCOm2012 (≥1.51% risk)[30] *	**Age:** 50–75 years People who currently smoke or stopped smoking within the past 10 years, with at least 25 years of tobacco use and the equivalent of minimum 15 years smoking a pack a day[31]	**Age:** 55–74 years *Age threshold is lowered to 50 years if additional risk factors are present*[32] People who smoked within the past 15 years with the equivalent of 20 years smoking a pack a day
Lung cancer cases diagnosed at an early stage (I or II) through screening programme	46.5%[8]	75.7%[7]	N/A – programme initiated in 2026	Only regional data available
Proportion of eligible people invited who attended screening	86%[33]	89.6%[34]	N/A – programme initiated in 2026	Only regional data available

* These percentages represent the estimated chance of developing lung cancer. For more information on risk models see: Lung Cancer Policy Network. 2023. Selected risk prediction models used in lung cancer screening.

† Pilot programmes planned.

The building blocks of effective implementation

Implementing lung cancer screening in European health systems requires policy alignment, sustainable funding, and the flexibility to adapt to differing national contexts. In practice, this means embedding lung cancer screening into national cancer priorities, providing sustainable funding, and ensuring adequate workforce and system capacity. Approaches vary due to differing health system structures in Europe, from centralised tax-funded models to decentralised or insurance-based systems. But regardless of health system structure, LDCT screening must be integrated into the whole pathway to be effective, equitable and scalable.

Clear policy alignment and effective governance

Policymakers can only prioritise lung cancer screening when they have the evidence, system readiness and political conditions to act. Securing these conditions is the central challenge of implementation, and European-level initiatives and recommendations, such as the European Code Against Cancer (*Box 2*), play an important role by providing shared standards that help national leaders justify investment. Evidence from established programmes can further strengthen policymakers' confidence by demonstrating feasibility and impact.

Box 2

Recommendation for lung cancer screening in the fifth edition of the European Code Against Cancer

The European Code Against Cancer recommends implementing sustainable, organised programmes with LDCT screening, where participants are ideally screened every year, with integrated smoking cessation interventions offered to people with an increased risk of lung cancer (based on criteria of age, smoking status and/or locally validated multivariable risk models).[12]

Readiness varies widely across Europe, shaped by differences in radiology capacity, IT systems, administrative coordination and political culture. In more complex systems – Germany's decentralised model being a clear example – policymakers must align multiple authorities, insurers and clinical disciplines, making decision-making slower and more resource-intensive.[35] In Belgium, each region is responsible for organising and implementing screening programmes; this has led to varying implementation timelines for other screening programmes.[36]

Sustainable funding streams

'Political support alone is not enough. Without sustained funding and a coordinating body, programmes cannot be implemented effectively.'

PROFESSOR TANEL LAISAAR

Proactively articulating cost-effectiveness can accelerate political and financial support and position lung cancer screening as a smart, forward-looking investment in population health. Financial commitment plays a central role in the transition of lung cancer screening from pilot initiatives to national programmes. While screening requires upfront investment in programme design, workforce development, diagnostic capacity and follow-up pathways, these costs should be framed as strategic, time-limited enablers of long-term system efficiency.[37] Targeted investment in CT capacity, radiology staffing and reimbursement mechanisms can unlock faster implementation and create a more resilient diagnostic infrastructure overall. In many settings, however, cautious attitudes toward long-term financial commitments delay implementation.[27] Evidence from existing programmes reinforces this opportunity: in Croatia, preliminary economic analyses – undertaken before the completion of comprehensive studies – were sufficient to secure government approval and reimbursement, based on the expectation that screening would generate long-term savings by shifting diagnoses to earlier, more treatable stages.[28]

Flexibility and adaptability

Because health systems across Europe differ substantially in structure, capacity and population needs, effective implementation depends on tailoring programmes to context. The successful implementation of diverse screening programme models indicates that flexibility, rather than a single prescribed model, is effective. Scale-up depends on tailoring programmes to national and local contexts, including health system capacity, population needs and geographical factors.[27 38] Countries differ in their pace of adoption: some require extended pilot phases to test feasibility, while others may move more quickly when supported by strong evidence and political alignment. In all cases, implementation must account for population diversity, ensuring access for high-risk groups.

Lessons from the implementation of lung cancer screening programmes

Tailor eligibility criteria for screening to reach people at highest risk of lung cancer

Context

Lung cancer screening programmes are more effective and equitable because of their specific eligibility requirements. Unlike population-wide screening programmes, lung cancer screening targets people at higher risk.[39] This makes it more efficient than screening for other cancers, as fewer people need to be screened to prevent one death.[40] Targeting people at high risk maximises the benefit of screening while minimising the harms, and enhances health equity by targeting those who need it most.[41-43]

Eligibility criteria should be based on risk factors and tailored to the local context. Smoking remains the dominant risk factor in Europe, with studies estimating that tobacco smoking is responsible for more than 80% of lung cancer cases in women and more than 90% in men.[44] In 2024, the European region had the highest average prevalence of tobacco smoking globally (23.5%).[45] However, tobacco use is not the only risk factor for lung cancer.[41] Air pollution, residential radon and second-hand smoke are major risk factors too.[46] In the EU, 97% of people living in urban areas are exposed to ambient air pollution levels that surpass recommendations from the World Health Organization.[46] Family history of lung cancer also raises risk, particularly in women and in people aged 50 and younger.[47 48]

'It is essential to accurately select the high-risk population for lung cancer screening. This is one vital element that improves efficiency and overall impact.'

PROFESSOR DAVID BALDWIN

What have we learnt from Europe?

While many national programmes and pilot initiatives define eligibility using age and smoking status, these criteria could miss other people with a high risk of lung cancer. Historically, only age and smoking status have been used to assess risk.[41] Both Germany and Croatia use these criteria, which are simple and feasible in clinical practice.[13] However, using these categorical thresholds can be restrictive, potentially excluding some people with higher risk while including some with lower risk, and collecting accurate smoking status can be challenging.[18 49-51]

Risk prediction models incorporate multiple risk factors and can therefore improve screening efficiency, but their use varies widely. Risk prediction models can better identify people at highest risk, increasing cancer detection without screening more people.[52] And they can also reduce selection disparities.[49] The European Respiratory Society technical standards recommend using risk models over smoking status and age alone.[23] Despite this, uptake in Europe is not consistent, driven in part by concerns about complexity and feasibility in clinical practice.[18 53] Some experts argue that risk model questionnaires are relatively simple to implement and, importantly, they mitigate the well-recognised limitations of self-reported smoking status, which is often inconsistent and incomplete.[27 50 54] In England, the use of two risk models has proven effective: nearly half of participants were classified as high risk, and over 90% of individuals identified as high risk proceeded to LDCT screening.[7] And high lung cancer detection rates in the Norwegian pilot programme have been attributed to using risk models for selection.[55]

European pilots and national programmes have created a valuable testing ground for eligibility criteria, generating real-world insights that can lead to more refined, risk-based approaches as implementation expands. Although risk models perform better than categorical criteria, in practice, many programmes have begun with traditional, easily operationalised criteria (typically age and smoking history) and progressively incorporated multivariable risk models, additional risk factors or expanding criteria (such as age range) as programmes mature. This iterative approach is reflected in the fifth edition of the European Code Against Cancer, which supports both traditional criteria and locally validated risk models.[12] Pilots and national programmes play a critical role in testing and optimising these approaches. National experiences are already informing this evolution: Croatia is actively reassessing its age and smoking thresholds to improve reach, while in Poland there is growing recognition that factors such as respiratory disease, socioeconomic position, passive smoking and air pollution may further refine risk stratification.[28 56] These existing programmes are generating the evidence needed to inform thresholds; promote equity and feasibility; and enable more sophisticated, data-driven eligibility models as screening expands.

‘Criteria should be continuously evaluated and refined as new evidence and real-world data become available.’

PROFESSOR EDYTA SZUROWSKA

Evidence from Europe shows that effective eligibility criteria depend on strong data infrastructure capable of accurately identifying and inviting high-risk people. A major lesson across countries is that the inconsistent recording of smoking status and other risk factors in routine health records limits the ability to systematically reach eligible populations.[50 57] These experiences highlight the value of strengthening data systems – linking primary care records, cancer registries and population databases – to enable more proactive, precise and scalable identification of eligible people. Enhanced data collection supports continuous optimisation, allowing programmes to track participation, detection rates and equity in real time.[49] Some countries already illustrate what is possible when robust infrastructure is in place: Norway’s long-standing linkage between population studies and national cancer registries provides detailed, longitudinal information on smoking and health outcomes, offering a powerful foundation for evidence-informed eligibility design, targeted outreach and ongoing evaluation.[18]

How future European screening programmes can apply these lessons

Ensure that eligibility criteria reflect local population risk profiles to improve equity in recruitment.

Design pilots and national programmes to generate real-world evidence comparing traditional and risk-based eligibility approaches to inform calibration of thresholds, participation and equity impacts.

Measure cancer detection rates according to sociodemographic variables, with a clear policy to implement change where efficiency can be improved.

Strengthen routine data capture by linking records across primary care, registries and population databases to enable proactive identification, systematic invitations and continuous monitoring of programme performance and equity.

Develop targeted outreach to address potential barriers to participation in lung cancer screening

Context

Achieving high participation among people at greatest risk of lung cancer is critical for screening to reduce mortality, yet the groups most likely to benefit are often the least likely to engage. In Europe, people from lower socioeconomic backgrounds face a greater risk of developing lung cancer and are more likely to be diagnosed at later stages: a study from Italy found that people with a low socioeconomic position had a 70–80% higher risk of receiving a delayed diagnosis compared with those with a high socioeconomic position.[58 59 60] Despite this, people of lower socioeconomic position are less likely to participate in screening programmes.[7 51 61] The same pattern holds for women in many European countries, where smoking rates are high but screening engagement is lower.[62 63] Stigma associated with smoking, limited awareness of screening, a nihilistic view of lung cancer treatment, and logistical barriers – including travel, time off work and care commitments – all compound this challenge.[63-65] Without deliberate design to reach these groups, screening programmes risk reinforcing the very inequalities they are intended to address, and recruitment approaches must therefore be tailored to the organisational structure, resources and cultural context of each country's health system.

What have we learnt from Europe?

'General practitioners are essential to recruitment, but they need the right incentives, training and support to play that role effectively.'

PROFESSOR HANS-ULRICH KAUCZOR

Recruiting screening participants through trusted healthcare professionals can improve uptake. Several countries have successfully leveraged connections between populations and healthcare professionals to encourage participation in lung cancer screening (*Case study 1*). In Croatia, every citizen has a primary care physician (PCP), and over 90% of the population visit their PCP at least once a year. Positioning PCPs as the first point of contact has helped ensure equitable access to lung cancer screening

Case study 1
Estonia's primary care-led lung cancer screening

Targeted outreach in Estonia shows the central role of primary care physicians (PCPs) in achieving high participation in lung cancer screening. By embedding invitations within primary care, the pilot programme achieved participation rates close to 80% without relying on large-scale public campaigns.[54 66]

Eligible people were systematically identified and contacted by their PCP. This ensured that invitations reached people at highest risk.[66] Web-based training and on-site visits by screening coordinators helped educate PCPs and nurses about the programme.[54]

The high uptake in Estonia reflects the strong trust between PCPs and their patients. Well-established relationships in primary care strengthen the impact of personalised invitations and follow-up, help address hesitancy and support informed participation.[66 67]

across regions and population groups, with consistently high participation and minimal disparities.[28 29] Similarly, in Czechia, recruitment strategies have relied on active engagement from healthcare professionals – including pulmonologists, oncologists and PCPs – who offer lung cancer screening to high-risk people during routine care.[68] This clinician-led approach is particularly effective in reaching groups at elevated risk, including people living with chronic obstructive pulmonary disease (COPD), highlighting the value of embedding screening within existing care pathways and targeting those most likely to benefit.[68] These examples also highlight the importance of sustained investment in PCP education and engagement, as limited awareness of screening pathways is an implementation challenge in some countries and can constrain uptake even where programmes are available.

Systematic, population-based enrolment approaches enable programmes to monitor uptake and provide coverage of the eligible population. Evidence from countries such as Estonia and England shows that direct invitations, including letters and telephone outreach, significantly increased participation rates.[7 29 66] Centralised

approaches encourage equity and scalability: in Norway, pilot studies have shown that electronic invitation systems reach eligible populations efficiently, and the country's IT system can accommodate the expansion of this pilot to a national-level programme.[18]

'High participation is not accidental. It depends on tailored outreach, consistent follow-up and understanding how to reach the target population.'

DR JOANNA BIDZIŃSKA

Case study 2

Community-based outreach and mobile screening in Poland

Poland demonstrates how community-based outreach and mobile screening can effectively reach high-risk populations, particularly in rural and underserved areas.

By partnering with trusted local networks – including parish communities and women's groups – screening programmes engaged people in familiar, credible settings. Religious leaders and local groups helped spread awareness, for example by announcing upcoming mobile screening unit visits during religious services and regular meetings.[38]

Mobile screening units helped overcome structural barriers such as distance, travel costs and low awareness, bringing services directly into communities and linking with primary care and specialist follow-up pathways.[69]

The programme also showed that tailored outreach combined with consistent follow-up improves participation rates. Targeted campaigns – particularly those aimed at women – successfully increased uptake.[38]

Community-based outreach, mobile screening models and tailored communication significantly improve access to screening, especially for underserved groups. Working with local organisations, workplaces and community leaders helps build trust and raise awareness among people who are less engaged with formal healthcare (*Case study 2*).[38] Ambassador programmes, in which community members promote screening, further support engagement among marginalised ethnic groups and socially deprived populations.[70] Mobile units reduce geographical and logistical barriers by bringing screening directly into communities.[49 70] Because community-only recruitment can skew toward more affluent participants, these approaches work best when combined with systematic invitations targeted to the eligible population.[71] Tailored communication – such as the female-focused materials used in the SOLACE project and by Women Against Lung Cancer in Europe – and consistent follow-up also boost participation.[38 72 73] Clear, accessible information delivered through both digital and paper-based channels supports informed decision-making and helps reduce inequalities in screening uptake.[39 74]

How future European screening programmes can apply these lessons

Engage PCPs and relevant specialists early as entry points for screening, for example, by integrating screening offers into routine care, to establish understanding and awareness of the programme.

Allocate dedicated resources for training and awareness among healthcare professionals to maximise referral of high-risk populations and ensure equitable access.

Use systematic, centralised invitation approaches (such as letters, calls, electronic systems) alongside clinician-led recruitment to maximise coverage, monitor uptake and support scalable national implementation.

Complement population-based and clinician-led recruitment with targeted community outreach, mobile screening and tailored, inclusive communication strategies to build trust, address practical barriers and improve participation among underserved communities.

Amplify the impact of lung cancer screening by integrating it into other public health initiatives

Context

Smoking cessation is a core public health priority in Europe, with clear opportunities to embed it in lung cancer screening. Including smoking cessation programmes as part of lung cancer screening services is recognised as an essential strategy for maximising cessation rates, clinical benefit and cost-effectiveness.[75-79] Evidence shows that people who stop smoking achieve better outcomes following diagnosis, reduce their risk of dying from lung cancer, and are less likely to develop other non-communicable diseases.[76 80 81] In Europe, smoking cessation support is often hindered by barriers such as limited awareness of resources, stigma associated with smoking, and practical challenges including transportation and financial constraints.[77] Yet the screening pathway offers a moment of heightened health awareness that existing tobacco control efforts rarely reach. In Europe, the implementation of tobacco control policies, such as the WHO Framework Convention on Tobacco Control, is uneven; integrating cessation into lung cancer screening directly addresses this gap by reaching a priority population at exactly the right moment.[82 83]

What have we learnt from Europe?

Smoking cessation is widely seen as integral to lung cancer screening, but its implementation varies considerably. Some initiatives in Europe have adopted a structured smoking cessation model: all people who smoke are automatically enrolled (or strongly encouraged to enrol) in a protocolised, evidence-based intervention; other initiatives rely on informal advice or referral.[77] There is broad consensus that cessation support should be systematically incorporated rather than offered as an optional add-on.[41 77] And European guidance recommends that all people who smoke receive advice and be actively referred to support services.[12]

Across Europe, the extent and intensity of cessation support varies considerably depending on how services are organised, resourced and delivered. Smoking cessation services may include face-to-face behavioural counselling, or advice provided via apps, videos, SMS messages and pharmacotherapy.[77] In England, all people who smoke and who engage in lung cancer screening, receive brief advice on cessation and are referred to cessation services on an opt-out basis.[30] When these services were provided with mobile screening, 30% of participants stopped smoking within a year.[84] Other approaches rely on referral to existing national or specialist services; in Czechia and Ireland, referrals are made to tobacco addiction centres, pharmacy-based counselling or national quit programmes.[85] [86] The incorporation of pharmacotherapy into programmes is variable, and a survey of 16 cessation programmes in the EU found that 12 did not provide free medication.[77] Timing also varies; some programmes initiate cessation support during the screening pathway, while others begin before screening or incorporate relapse-prevention elements for people who have recently quit smoking.[77] As implementation expands, systematic evaluation across different models will be essential to identify the most effective and scalable approaches.[41]

How future European screening programmes can apply these lessons

Ensure that lung cancer screening programmes systematically provide smoking cessation advice and active referral to support services for people who currently smoke, rather than offering cessation as an optional add-on.

Design smoking cessation support to be adaptable in terms of timing and mode of delivery, and evaluate systematically to identify the most effective and scalable models.

Ensure the full integration of lung cancer screening into health systems

Context

To be effective, lung cancer screening must be embedded in existing pathways and tailored to national health system structures. This means integrating screening within existing governance frameworks, information systems, funding mechanisms and workforce structures.[87 88] European health system structures vary substantially and shape how screening programmes are designed and delivered.[89] Tax-funded national health systems are typically more centralised and support coordinated, population-based screening approaches.[7 57 90] In contrast, social health insurance systems involve multiple payers and providers, which can complicate standardisation and national roll-out.[91 92]

What have we learnt from Europe?

PATHWAYS AND PROTOCOLS

The effective implementation of lung cancer screening in Europe and the management of incidental findings require full integration into care pathways. Screening requires a distinct, structured approach to image interpretation, with dedicated protocols for nodule management (the clinical process of evaluating, monitoring and treating abnormal spots found in the lungs) and incidental findings (including COPD, lung disease and other cancer types) to support consistent clinical decision-making, minimise harm and reduce unnecessary burden on health systems.[93 94] Clear nodule management pathways are essential to ensure that suspicious findings are identified and managed promptly while avoiding unnecessary follow-up.[94] European guidance, including recommendations from the European Society of Thoracic Imaging, supports this standardisation.[94] In Croatia, there is an ongoing effort to embed clear next-step guidance for incidental findings in programme reports.[28] Similarly, in England, the programme has been optimised to include standardised pathways for the management of clinically significant incidental findings; this protocol is tailored to the UK health system and provides clarity to support consistent implementation.[7]

INFRASTRUCTURE AND DIGITAL SUPPORT

Building the necessary system infrastructure is a prerequisite for effectively implementing and scaling up lung cancer screening programmes. Across Europe, a key constraint is limited radiology capacity, including shortages of trained radiologists and radiographers, alongside uneven access to CT scanners.[95] These workforce and infrastructure gaps risk creating bottlenecks along the screening pathway, from image acquisition to diagnosis and treatment. Similarly, access to CT infrastructure varies widely between countries, reinforcing the importance of national-level capacity assessments and targeted investment to support sustainable programme delivery.[95]

Digital infrastructure and national coordination systems are also critical enablers of integrated screening. Centralised IT platforms that connect primary care, screening services and specialist care facilitate national coordination, such as in the Croatian programme (*Case study 3*).[28] In Poland, a dedicated digital platform has supported the coordination of mobile screening units, primary care and specialist centres, streamlining pathways and enabling efficient follow-up – this was particularly important in enabling an efficient personalised approach and visit scheduling.[38] These systems also create opportunities to link screening data with cancer registries and hospital records, which supports the monitoring of outcomes and programme performance. However, challenges remain in many settings, including incomplete interoperability (sharing data), limited automation of data flows, and the absence of central bodies responsible for quality assurance and oversight.[56] England's screening programme also illustrates this evolving landscape, with plans underway to introduce a fully integrated, participant-level IT system to support end-to-end programme delivery.[7]

AI and computer-aided detection tools are increasingly being explored to support system capacity and efficiency. These technologies have the potential to reduce radiologist workload by helping triage scans and improving consistency in reporting.[49 96] In Germany, use of AI is mandatory (*Case study 4*). In Croatia, AI is used as a first reader – with radiologists providing secondary confirmation – improving speed and efficiency.[28] However, wider implementation in Europe is constrained by the need for integration with existing clinical systems and sustainable reimbursement models.[94] While AI shows significant promise, it is not yet a substitute for workforce capacity and should be seen as a complementary tool within a broader system strategy.

'Without digital connectivity, running a screening programme at this scale would be extremely difficult.'

PROFESSOR KRISTINA KRPINA

Case study 3

A digitally enabled approach to lung cancer screening in Croatia

Croatia's programme leverages strong primary care and the Central Health Information System of the Republic of Croatia (CEZIH), the national digital health platform connecting all levels of care.[97]

CEZIH links participating radiology and pulmonology centres with over 2,000 PCPs, allowing PCPs to enrol participants, book CT appointments instantly and refer participants directly to specialists when cancer is detected.[28 29 97]

Structured radiology reporting, aligned with guidelines from the International Early Lung Cancer Action Program, ensures consistent CT interpretation, with results uploaded immediately and accessible to PCPs.[28 97] All clinical data sit in a single digital database, giving healthcare professionals a full view of the pathway.[28]

This end-to-end digital model, with real-time data access, streamlines enrolment, accelerates information sharing, and strengthens monitory and quality control.[28] Fully reimbursed and digitally integrated, Croatia's approach ensures uniform, standardised screening at scale – offering a model that other health systems could adapt.[97]

'As screening expands, it increases demand along the care pathway – and health systems need to plan for that from the outset.'

MICHAELA REGAN

Case study 4
Germany's AI-supported screening programme for lung cancer

Germany's national screening programme for lung cancer, which launched in April 2026, mandates AI-assisted detection as part of its quality assurance framework. Under requirements set by the Federal Joint Committee, any scan with findings requiring follow-up must undergo double reading – a standard intended to reduce people being incorrectly diagnosed with lung cancer and experiencing associated anxiety.[98]

The programme uses AI-supported software as a formal second reader of screening scans, after the radiologist's first assessment.[35] Scans where the radiologist and software agree that no clinically relevant findings are present are closed without further review. Where potential abnormalities are identified, cases are escalated to a second specialist radiologist, who uses the same software.[35] Decisions are reached by consensus between the two readers, with only higher-risk cases referred to multidisciplinary review. This enables efficient, guideline-concordant double reading without reliance on unsustainable workforce models.[35]

Strengthening system infrastructure for lung cancer requires a whole-system approach – one that extends beyond screening alone to encompass workforce, technology, digital coordination and downstream care capacity. Across Europe, a key constraint is limited radiology capacity, including shortages of trained radiologists and radiographers, alongside uneven access to CT scanners. These workforce and infrastructure gaps risk creating bottlenecks along the screening pathway, from image acquisition to diagnosis and treatment. Access to CT infrastructure varies widely between countries, reinforcing the importance of national-level capacity assessments and targeted investment to support sustainable programme delivery. Experience from England shows that screening programmes can place additional pressure on surgical and oncology services, particularly as more cancers are detected at a stage where curative treatment is possible.[7] As programmes expand, this requires parallel investment in treatment capacity and workforce to ensure that the benefits of earlier detection can be fully realised. The investment case is strong: in the Netherlands, monthly treatment costs are over twice as high for stage IV as for stage IA, and modelling in Spain suggests the resulting stage shift can offset up to 70% of screening costs over time.[99] [100]

Case study 5

A standard protocol and quality assurance in England

England has developed a standard protocol of service and quality indicators to ensure the screening programme provides a high-quality service.[101 102]

The programme is also guided by 15 national quality standards that cover areas such as data management and smoking cessation, which together form a comprehensive quality assurance (QA) framework for training and clinical delivery.[102] Each standard aligns with a part of the programme and cross-references the national protocol, outlining the objective, metric and assurance mechanisms required at both local and national levels.[102]

The standard protocol sets out four clinical roles to ensure effective care delivery and clinical governance of the programme.[102] The clinical director works with the responsible assessor, radiologist and clinician to implement and monitor the 15 quality standards.[102] The clinical director reports quarterly to NHS England, with an annual summary incorporating additional review metrics.[102]

Having one agreed protocol and QA standard was essential for starting implementation and ensuring consistency across screening sites.[27] This shared framework enabled iterative improvements as teams identified gaps, clarified procedures and aligned practices across regions.[27] While adherence to the protocol is mandatory, sites may propose innovations for national review; this flexibility supports continuous improvement while preserving programme consistency.[7]

A clear national protocol with built-in flexibility can support rapid, consistent implementation while enabling local learning and continuous improvement.

Alongside investment in capacity, establishing robust national quality assurance (QA) and monitoring frameworks is essential to ensure the effectiveness and consistency of lung cancer screening programmes (*Case study 5*).[95] In Poland, structured QA mechanisms have been implemented, including the use of specialised tests to verify screening image quality, as well as internal audits and targeted retraining

for radiologists and PCPs, demonstrating a proactive approach to maintaining quality across settings.[38] In contrast, Estonia lacks a central body to oversee screening programmes, with existing registries focused primarily on data collection rather than quality improvement, underscoring the importance of national coordination.[54]

How future European screening programmes can apply these lessons

Embed screening programmes fully in existing health systems, with clear links between primary care, screening services, and secondary and tertiary care to ensure timely follow-up, referral and treatment of detected findings.

Implement evidence-based protocols for nodule surveillance and incidental findings management, aligned with European guidance and embedded in reporting systems to ensure consistent, proportionate follow-up.

Underpin national implementation with coordinated workforce and infrastructure planning across radiology, respiratory medicine, surgery and oncology, alongside investment in CT scanner availability to prevent bottlenecks along the screening pathway.

Invest in diagnostic and curative treatment capacity to coincide with the expansion of screening, to ensure that earlier detection translates into timely and effective care.

Connect centralised, interoperable IT platforms to primary care, screening services and specialist care to support enrolment, scheduling, reporting, follow-up and linkage with cancer registries and health records.

Support screening programmes with national QA frameworks, with clear accountability for audit, performance monitoring, protocol adherence and targeted retraining to ensure consistent quality across settings.

Adopt AI and computer-aided detection tools as complementary supports to increase efficiency and consistency in image interpretation, while recognising that they do not replace the need for sufficient workforce capacity or downstream care infrastructure.

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Appendix
Lung Cancer Policy Network members

Mariusz Adamek, Medical University of Silesia
Ogechukwu Akabuike, Move Against Cancer Africa
Humaid Al Shamsi, Burjeel Cancer Institute
Zhandos Amankulov, Kazakh Institute of Oncology and Radiology
Aziz Ayed, Massachusetts Institute of Technology Jameel Clinic
Chunxue Bai, Zhongshan Hospital, Fudan University
Anne-Marie Baird, Lung Cancer Europe
David Baldwin, Nottingham University Hospitals NHS Trust
Angela Barry, GO2 for Lung Cancer
Joanna Bidzińska, Medical University of Gdańsk
Torsten Gerriet Blum, Lungenklinik Heckeshorn
Andrea Borondy Kitts, Rescue Lung Society
Mark Brooke, Lung Foundation Australia
William Brown, ASPIRE for Lung Cancer
Joanna Chorostowska-Wynimko, National Institute of Tuberculosis and Lung Diseases
Lynsey Conway, UK Lung Cancer Coalition; ALK Positive Lung Cancer UK
Sébastien Couraud, Lyon Sud Hospital
Sue Crengle, University of Otago
Péter Czanyo, Fundación Pacientes de Cáncer de Pulmón
Caleb Egwuenu, Move Against Cancer Africa
Helena Esteves, Oncoguia
Joelle Fathi, GO2 for Lung Cancer
Andrea Ferris, LUNGevity
John Field, University of Liverpool
Jesme Fox, Roy Castle Lung Cancer Foundation
Michelle Futrell, LUNGevity
Pilar Garrido, University of Alcalá
David Gilligan, UK Lung Cancer Coalition
Peter Glazier, Lung Cancer Canada
Tiffany Gowen, American College of Radiology
Catharine Grimes, Bristol Myers Squibb Foundation
Vitali Grozman, Karolinska Institutet
Maria Isabelle Grueso, Pfizer
Helen Haggart, Johnson & Johnson
Ebba Hallersjö Hult, Vision Zero Cancer
Michael Hartevelt, MSD
Merel Hennink, Global Lung Cancer Coalition
Ronald Henry, Men's Health Network; Global Action on Men's Health
Claudia Henschke, Mount Sinai Hospital
Fred Hirsch, Mount Sinai Hospital
Luciana Holtz, Oncoguia
Hidehito Horinouchi, National Cancer Center Hospital
Gopal Iyer, University of Wisconsin
Dragana Jovanovic, Akta Medica and Melliora Clinic
Rabiga Kadyrbayeva, Kazakh Institute of Oncology and Radiology
Hans-Ulrich Kauczor, University Hospital Heidelberg
Ella Kazerooni, University of Michigan
Karen Kelly, International Association for the Study of Lung Cancer
Anna Kerpel-Fronius, Országos Korányi Pulmonológiai Intézet
Yeon Wook Kim, Seoul National University
Jennifer King, International Association for the Study of Lung Cancer
Vladimír Koblížek, Charles University
Gillianne Lai, National Cancer Centre Singapore
David CL Lam, University of Hong Kong
Stephen Lam, University of British Columbia
David LeDuc, AstraZeneca
Olivier Leleu, Centre Hospitalier d'Abbeville
Judy Li, ASPIRE for Lung Cancer
Sewanti Limaye, Sir H. N. Reliance Foundation Hospital & Research Centre
Herbert Loong, Chinese University of Hong Kong
Ante Marušić, University Hospital Centre Zagreb
Allona McCloy, MSD
Olivia McDermid, Amgen
Tracy McDowell, AstraZeneca
Jessica Moffatt, Lung Health Foundation
Debra Montague, ALK Positive Lung Cancer UK; Lung Cancer Europe
Luis Montuenga, University of Navarra

Florian Cyril Mashanga, Feliciana Mshanga Memorial Cancer Foundation

Linda Murakami, Amgen

Andrea Nurko, American Lung Cancer Screening Initiative

Emma O'Dowd, Nottingham University Hospitals NHS Trust

Gbemi Ojole, Move Against Cancer Africa

Allison Osterman, International Association for the Study of Lung Cancer

Zulfiquer Otty, Townsville University Hospital; James Cook University

Matthijs Oudkerk, University of Groningen

Kate Parker, Te Whatu Ora, Health New Zealand

Ugo Pastorino, Istituto Nazionale dei Tumori

Korina Pateli-Bell, FairLife Lung Cancer Care

Merilyn Penn, Cancer Australia

Pham Cam Phuong, Bach Mai Hospital; Vietnam National University

Michaela Regan, Lung Cancer Europe

Marie Pierre-Revel, Cochin Hospital

Lauren Pretorius, Campaigning for Cancer

Morten Quist, University Hospital of Copenhagen

Luis Raez, Memorial Cancer Institute

Nicole Rankin, University of Melbourne

Jacqui Real, Cancer Australia

Hilary Robbins, International Agency for Research on Cancer

Oluf Dimitri Røe, Aalborg University Hospital

Witold Rzyman, Medical University of Gdańsk

Anand Sachithanandan, Lung Cancer Network Malaysia

Ricardo Sales dos Santos, Hospital Israelita Albert Einstein

Miroslav Samaržija, University of Zagreb

Giorgio Scagliotti, University of Turin

Sebastian Schmidt, Siemens Healthineers

Victoria Schneider, Siemens Healthineers

Luis Seijo, University of Navarra

Dorith Shaham, Hadassah Medical Center

Abhishek Shankar, All India Institute of Medical Sciences

Sanjeev Sharma, Lung Connect India Foundation

Shani Shilo, The Israeli Lung Cancer Foundation

Ambar Shrivastava, Lung Connect India Foundation

Annemiek Snoeckx, Antwerp University Hospital

Yuanlin Song, Zhongshan Hospital; Fudan University

Kostas Syrigos, Hellenic Association of Lung Cancer

Edyta Szurowska, Medical University of Gdańsk

Jennifer Thompson, Men's Health Network

Katy Tong, Cancerinformation.com.hk

Maëlle-Marie Troadec, Massachusetts Institute of Technology Jameel Clinic

Sonia Upujan, Lilly

Stefania Vallone, Women Against Lung Cancer in Europe

Jan van Meerbeeck, Antwerp University and University Hospital

Giulia Veronesi, Vita-Salute San Raffaele University

Lucia Viola, Fundación Neumológica Colombiana; Luis Carlos Sarmiento Angulo Cancer Treatment and Research Center

Murry Wynes, International Association for the Study of Lung Cancer

Dawei Yang, Zhongshan Hospital; Fudan University

Pan-Chyr Yang, National Taiwan University

David Yankelevitz, Mount Sinai Hospital

Ignacio Zervino, Fundación Pacientes de Cáncer de Pulmón

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