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A framework to support the implementation of LDCT lung cancer screening

Research methodology

Version 1

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**LUNG CANCER
POLICY NETWORK**

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About this document

The Lung Cancer Policy Network was established in 2021 with the aim of encouraging policymakers around the world to make improving survival from lung cancer a policy priority. One of the Network’s first objectives is to accelerate the implementation of targeted low-dose computed tomography (LDCT) lung cancer screening around the world.

As one step towards achieving this goal, the Network developed a framework to support the implementation of LDCT lung cancer screening in different countries. This document outlines the research methodology designed to inform the development of this tool.

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1 Background

1.1 LDCT lung cancer screening

Early detection, with screening at its core, is essential to reduce mortality from lung cancer, which currently causes more deaths than any other cancer worldwide.^{1 2} Based on current evidence, low-dose computed tomography (LDCT) is the only approach that has been proven to be an effective and safe tool to screen for lung cancer.

Evidence from multiple randomised controlled trials and several meta-analyses has shown that screening with LDCT can reduce mortality from lung cancer by up to one quarter in high-risk individuals.^{3 4} The publication of the European NELSON trial showed that LDCT screening in people who currently smoke or used to smoke heavily can deliver a significant stage shift to earlier diagnosis in lung cancer.⁵ It can deliver a significant stage shift to earlier diagnosis among people who currently smoke or used to smoke.⁶⁻⁸ When optimised, LDCT screening does not lead to a high proportion of false-positive results or subsequent unnecessary procedures or treatments.^{7 9 10}

In light of this evidence, several countries have ongoing national or regional organised screening programmes, and there is also an expanding body of research on the implementation of LDCT screening around the world. To date, this research supports the findings of clinical trials and confirms the impact of this screening on stage distribution and mortality.¹¹⁻¹³ To find out more, please visit the Network's [interactive map](#) of lung cancer screening implementation.

Implementing large-scale screening programmes is a complex task that requires careful assessment of local infrastructure, technical capacity, workforce, governance, data flows and existing care pathways. In addition, a thorough understanding of local lung cancer epidemiology and broad engagement from all relevant stakeholders are necessary. A careful assessment of readiness for the implementation of such programmes can improve the chances of a successful roll-out and effective long-term implementation.

1.2 Health system readiness for LDCT screening

System readiness refers to the ability of a health system to rapidly and sustainably adapt policies, processes and infrastructure to support the integration of new components of care.¹⁴ Understanding readiness requires a systems approach that considers the roles and collective interplay of all pillars of a health system to effectively integrate a new intervention or programme.¹⁵⁻¹⁷

Health system readiness refers to the ability of a health system to rapidly and sustainably adapt policies, processes and infrastructure to support the integration of new components of care.¹⁴ Understanding readiness requires a systems approach that factors in the roles of all facets of the health system and their collective interplay when considering the integration of the proposed intervention or programme.¹⁵⁻¹⁷ For example, for a health system to be ready to introduce organised lung cancer screening, it must have a sufficiently sized and adequately trained workforce, appropriate healthcare infrastructure, and suitable governance frameworks to coordinate the programme.⁶ Assessing health system readiness is therefore a necessary first step when planning the implementation of LDCT screening programmes.

With this in mind, the Network developed a bespoke framework to assess implementation of low-dose CT lung cancer screening. This framework aims to support those involved in the planning and delivery of implementation activities. It should help these people make informed planning decisions, leading to more effective prioritisation of resources and improved efficiency and impact of screening on the health of populations. It should also help them put in place the necessary measures to address any system deficiencies that may hamper the introduction and long-term implementation of a screening programme.¹⁸

1.3 The implementation framework

The framework consists of a series of **metrics*** organised into six domains to help users take a structured approach to:

- assessing how 'ready' a given health system is to implement LDCT screening
- determining whether key requirements for implementation are being met
- identifying what measures may be needed to address any identified gaps.

The framework also signposts users to technical guidance and other resources that may help support best-practice implementation.

The framework was developed iteratively, in close consultation with Network members. This approach is illustrated in the [Appendix](#) and described in more detail in the subsequent sections.

* A metric is a standard of measurement that can be used to help break down and evaluate each theme within the framework; metrics are largely designed to stimulate quantitative data collection.

2 Scoping research to develop the initial framework structure

In 2021, scoping research identified literature on the implementation of LDCT screening, providing the necessary information to populate the Network's global [interactive map](#).¹⁹⁻³⁶ Findings from the full interactive map methodology were also used to inform the content of the Network's inaugural report, [Lung cancer screening: learning from implementation](#), published in 2022.

Further scoping research on the existing guidance and frameworks for LDCT screening implementation (*Box 1*) supplemented this earlier work, contributing to an initial draft of the framework. Through this research, the Network also developed a preliminary list of questions, which were grouped into six domains and formed the initial structure of the draft framework (*Box 2*).

Box 1. Resources consulted during the scoping research phase

The organisations consulted for drafting the framework include, among others:

- American Thoracic Society and American Lung Association¹⁹
- Canadian Partnership Against Cancer^{20 37 38}
- Cancer Australia²⁴
- Cancer Council Australia³⁹
- Global Lung Cancer Coalition⁴⁰
- Lung Cancer Europe⁴¹⁻⁴⁴
- UK Lung Cancer Coalition⁴⁵⁻⁴⁷
- World Health Organization.⁴⁸⁻⁵⁰

Box 2. Summary of domains included in the initial draft framework

1. Establishing a legal or governance framework
2. Workforce and technical capacity planning
3. Financial planning
4. Eligibility and recruitment
5. LDCT screening delivery
6. Data monitoring and evaluation
7. Integration into the lung cancer care pathway

Rationale behind countries selected to test the framework

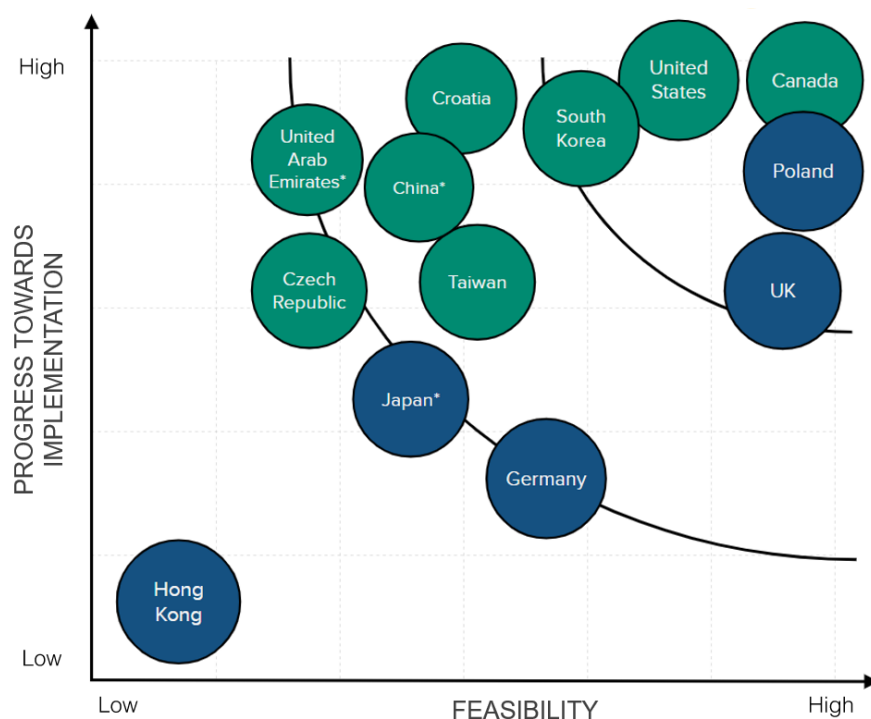
The framework was tested through application to five countries where organised LDCT screening was at a more advanced stage of implementation. The identification and mapping of countries that were further along the pathway of implementation were based on the following criteria:

- **Feasibility:** The findings of the scoping research had to show that comprehensive application of the framework in this country would be possible. Considerations included the extent to which literature was widely available and the number of key stakeholders.
- **Progress around implementation:** Countries that had advanced further along the implementation pathway were deemed to provide a more comprehensive evidence base from which to develop, test and adapt metrics.

A summary of this mapping is presented in *Figure 1*. Following a consultation with the Network Advisory Committee about the proposed options, the decision was made to focus on Canada, Poland, South Korea, the UK and the US. The reasoning was that this group of countries would provide a wide range of health systems and approaches to implementation, helping ensure that the resulting framework would apply to a global audience.

A summary of the rationale behind the selection of each country is provided in *Table 1*.

Figure 1. Summary of countries considered for testing the Network’s framework



Green: has implemented national or regional organised LDCT screening programmes

Blue: has not yet implemented national or regional organised LDCT screening programmes

***Clarification:** China has implemented a national organised screening programme in some provinces,²² while the Emirate of Abu Dhabi has introduced a regional organised programme.⁵¹ Japan has implemented a national organised screening programme using chest X-ray but is still conducting implementation research on LDCT screening.^{52 53} For further information, please see the Network’s [interactive map](#) of LDCT screening implementation.

Table 1. Countries selected for application of the framework

Country	Programme start	Overview of current status around implementation
Canada	2021/22	<p>In 2016, the Canadian Task Force on Preventive Health Care updated its guidelines to support LDCT screening.⁵⁴ The funding and implementation of screening programmes in Canada remain the responsibility of each province's or territory's public health system. Regional organised programmes are ongoing in Ontario, British Columbia and Alberta (since April 2021, May 2022 and September 2022, respectively), and numerous provinces are undertaking pilots or have committed to implementing programmes.³⁸ There are currently no organised screening activities in the Northwest Territories, Yukon or Nunavut.</p> <p>Note: Based on advice from Network members, the decision was made to apply the framework to a select few individual provinces that have implemented organised screening, rather than to the country as a whole. We looked at British Columbia and Ontario primarily, with additional information coming from research into the programmes in Québec and Alberta.</p>
Poland	N/A	<p>The National Pilot Program of Early Lung Cancer Detection (Ogólnopolski Program Wczesnego Wykrywania Raka Płuca, WWRP) officially began in 2020.⁵⁵ It is a centrally administered national pilot programme co-financed by the Ministry of Health and the European Social Fund. It is hoped that the WWRP, which is currently being rolled out in a phased approach by six leading institutions, will transition to a national programme when the first term of the pilot ends in 2023. A brief overview published by the Network is available online.</p>
South Korea	2019	<p>In 2019, following the results of the nationwide Korean Lung Cancer Screening (K-LUCAS) pilot study,⁵⁶ the Korean National Cancer Screening Programme was expanded to include lung cancer screening via LDCT.⁵⁷ More information is available on the Network's interactive map.</p>
UK	N/A	<p>Since 2016, the UK has been piloting LDCT screening via Targeted Lung Health Checks (TLHCs).⁵⁸ In 2019, a protocol was published by NHS England for expansion of the national pilot programme of TLHCs, which is expected to expand to 43 locations across England by 2024/25.⁵⁹ In September 2022, the UK National Screening Committee updated its recommendations on LDCT screening. It is anticipated that the national TLHC pilot programme will transition to a national programme.</p> <p>Note: Although Scotland is currently piloting LDCT screening,⁶⁰ to the best of our knowledge, there are no implementation studies in Northern Ireland or Wales. As a result, the chosen approach was to focus on the TLHC pilot programme in England.</p>
US	2015	<p>Following the landmark National Lung Screening Trial (NLST), the US Preventive Services Task Force issued national guidelines for LDCT screening in 2013.⁶¹ Organised screening was introduced in 2015. However, there is significant variation both between and within individual states in terms of how implementation is approached. The Network has published a brief overview online.</p> <p>Note: The approach was similar to that in Canada, focusing on a select number of individual programmes within the US rather than evaluating the country as a whole. These were the ChristianaCare Program (Delaware, Maryland and Pennsylvania) and the Lahey Hospital and Medical Center programme (Massachusetts).</p>

3 Testing the initial framework in five countries

The process of testing the initial framework in each country involved gathering information via a structured review of peer-reviewed and grey literature (*described below*). The review informed the selection of stakeholders to interview (see section 3.2), with the interviews designed to address any gaps within the framework that desk research could not fill.

The findings from this testing phase also enabled an assessment of whether the framework metrics were sufficiently comprehensive to account for differences between health systems, and whether they were applicable globally.

3.1 Literature reviews

Literature reviews were conducted to capture lung cancer epidemiology, guidelines, position statements, protocols and other relevant peer-reviewed commentary relating to implementation in each country (Canada, Poland, South Korea, the UK and the US). Taking place alongside these reviews were structured environmental scans of grey literature to identify screening programme evaluations, expert commentary, reports, news articles and relevant web resources that may describe or signpost the Network to implementation research around LDCT screening in each country.

The literature review was intended neither to gather evidence about the science behind lung cancer screening itself nor to provide a systematic analysis of clinical trial results. Although the search terms (*detailed below*) led to the inclusion of numerous scientific papers about the outcomes of LDCT in clinical trials, only the commentary from these studies on the implementation of LDCT screening in practice was included.

3.1.1 Peer-reviewed literature search strategy

The proposed period for this literature review was 2010–22. This date range took into account the fact that a lot of valuable planning occurred prior to 2015, when the US guidelines were updated to recommend organised screening.⁶¹ Numerous implementation studies were also underway at this time.

The literature review used the following search engines:

- [PubMed](#)
- [Bielefeld Academic Search Engine](#) (BASE)
- [Google Scholar](#)

The search terms that were used for the literature review are detailed in *Table 2*. However, the search approach was flexible, with the option to refine these terms if, for example, some yielded more results than others or the literature uncovered other commonly used terms.

Searches of the peer-reviewed literature were not limited to documents in the English language but used appropriate Medical Subject Headings (MeSH). A record was kept of any alterations to the search strategy for individual countries – for example, to adapt to local terminology – to ensure consistency across countries.

Table 2. Search terms to be used in the search of peer-reviewed literature

Combinations: First row alone then subsequently search in combination one line at a time.[†]

Date: January 2010 – present

ALWAYS include	“Lung cancer screening”	AND [country name]	e.g. “UK” or “United Kingdom”
1. AND	“Low-dose computed tomography”	OR “low-dose”	OR LDCT
OR	“computed tomography”	OR CT	OR CTLS
2. AND	diagnos*	OR “Early detection”	OR “organi*ed screening”
3. AND	implement*	OR evaluat*	OR regulat*
OR	“implementation trial”	OR feasibility	OR demonstration
4. AND	pilot	OR project	OR program*
5. AND	governance	OR approval	OR oversight
6. AND	prevent*	OR awareness	OR “smoking cessation”

[†] Punctuation and asterisks to be observed.

3.1.2 Grey literature search

The above search strategy was also applied to identify relevant grey literature sources, but there was the option to simplify it for these purposes. Although the search was conducted in English, identifying key policy documents published in the local language and translating core content where needed helped ensure that important regional developments were covered. The search looked for evaluations, expert commentary, reports, guidelines, position papers and policy briefings, as well as relevant web pages.

The aim was to cover a wide range of sources, which are listed below:

Google Alerts and social media

The Network Secretariat scanned social media (i.e. Twitter) daily for relevant news articles, reports and other grey literature on lung cancer screening using hashtags such as ‘#lungcancer’, ‘#lungcancerscreening’, ‘#LCSM’ and ‘#LDCT’. These daily scans were expanded using identified organisations and trending hashtags. Using the search terms from *Table 2* in Google search also helped identify grey literature, with the first 100 results being screened for relevance. Some searches needed minor amendments to the search terms if they returned fewer results, e.g. searching for ‘country’ and ‘lung cancer screening’ in the language of that country.

Professional societies and research organisations

The literature review included grey literature from government websites as well as third-party organisations. The websites and newsletters of key stakeholders in lung cancer and lung cancer screening were also scanned regularly for announcements or new publications.

Conference proceedings

Research presented at recent cancer research conferences and webinars was scanned. In addition, proceedings, posters and abstracts were reviewed for announcements of new studies/programmes and notifications of results and updates being published at events.

3.1.3 Use and storage of literature

All sources of information cited in the literature review were saved in PDF format, and the PDF highlighter tool was used to identify the specific areas of text that included the relevant information. This was an important step for the Network Secretariat's internal quality assurance process as we undertake independent reference checks of all of the research undertaken.

3.2 Stakeholder engagement

Stakeholder mapping

The literature review also aimed to provide some insight into the spheres of influence that surround perspectives on lung cancer screening, as well as the connections among stakeholders in each country. A stakeholder map of individuals who may be suitable to interview was developed for each country. Network members were also invited to suggest experts who could address any gaps in the stakeholder mapping.

Stakeholders include patient organisations; professional societies in oncology, pulmonology and radiology; research institutes; and relevant public health bodies. Certain stakeholders were a priority to engage; they included representatives of the categories of personnel/organisations likely to be involved in the delivery of a screening programme (*Box 3*). The feasibility and appropriateness of including key decision-makers from government agencies in the interviews were also assessed.

Box 3. Categories of stakeholders approached for interview

- Patient advocates/organisations
- Respiratory medicine specialists (pulmonologists)
- Radiologists
- Thoracic surgeons
- Medical oncologists
- Family physicians (general practitioners)
- Primary care and specialist nurses (in cancer or respiratory health)
- Public health specialists/epidemiologists
- Smoking cessation specialists
- Screening programme coordinators and/or non-clinical personnel (e.g. patient navigators)

Country expert interviews

Findings from the literature review also informed the development of a discussion guide for expert interviews. The discussion guide was structured around the initial domains of the framework and tailored to each stakeholder's expertise to focus the discussion on areas of the framework that required further input.

Up to 10 semi-structured interviews were scheduled with stakeholders in each country.

The aims of these interviews were to:

- validate the findings of desk research
- address gaps in the framework
- understand expert opinions on key topics around implementation
- identify additional literature that desk research did not capture.

The interviews were approximately 45 minutes long and took place using videoconference technology (e.g. Zoom). They were conducted by two researchers – one responsible for leading the interview and the other acting as an observer and note-taker. All interviewees consented to the interview in writing and gave consent at the start of the interview for it to be recorded for transcription purposes. The recordings will be securely stored for two years before being deleted, in compliance with HPP policy.

4 Refining the framework and developing an online toolkit

Findings from both the literature review and interviews with country experts were used to refine the framework. The Network reviewed iterative drafts of the framework to find consensus on the final wording and content.

The finalised framework was developed into an interactive online toolkit, housed in a dedicated section of the Network website. The toolkit provides practical guidance around how to address important components for LDCT screening implementation with the aim of helping other countries support implementation locally.

It also contains a library of external resources to support implementation, such as guidelines, protocols/checklists, infographics, case studies, webinars and an ‘expert perspectives’ video series on key topics in implementation (*Appendix*). The toolkit launched in March 2023.

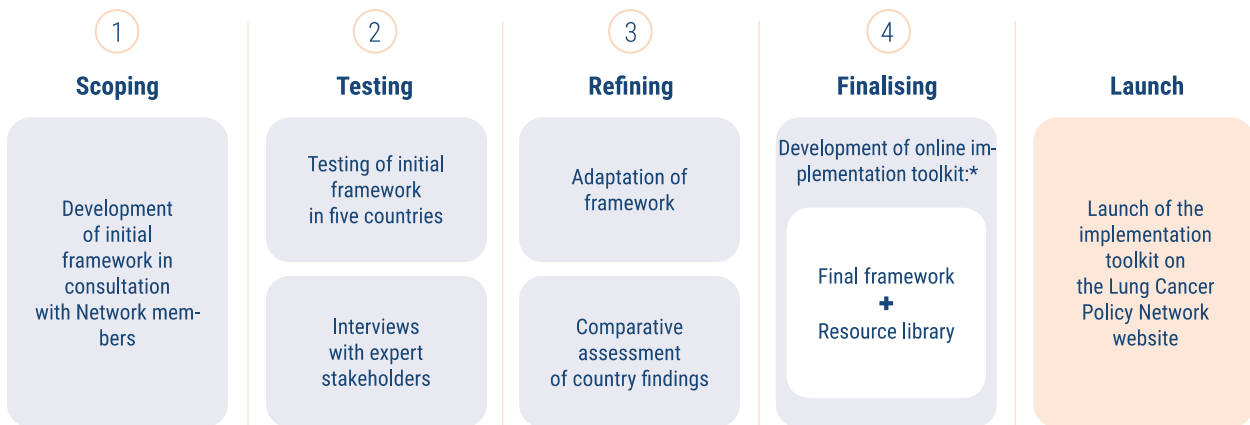
The Network will also publish a series of policy briefs comparing the findings from different countries, which will include case studies of how implementation has been optimised in each country. The finalised framework will be reviewed on an annual basis.

For more information about the project or the Lung Cancer Policy Network more broadly, please visit the [website](#) or contact the Network Secretariat at secretariat@lungcancerpolicynetwork.com

Appendix

Research methodology

A framework to support the implementation of LDCT lung cancer screening



* Comprises a suite of materials hosted on the Network's website including the framework template, library of resources, supporting figures and templates

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