

# Education and Training in Low-Dose CT Lung Cancer Screening Across Europe: A Survey Study

## ELECTRONIC SUPPLEMENTARY MATERIAL

Supplementary Table 1

| Survey Item                                           | Response                                                                                                                                                                                     | Thematic Categories                 |
|-------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|
| <b>Item 7</b> – Additional responses (“Other” option) |                                                                                                                                                                                              |                                     |
|                                                       | LCS awareness, which affect both utility and resources availability)                                                                                                                         | Awareness and perceived needs       |
|                                                       | 0                                                                                                                                                                                            |                                     |
|                                                       | 0                                                                                                                                                                                            |                                     |
|                                                       | 0                                                                                                                                                                                            |                                     |
|                                                       | The lack of perceived need from the community of radiologists to be trained for LCS                                                                                                          | Awareness and perceived needs       |
|                                                       | Expand the training to other professionals, the lack of practical part integrated into the program                                                                                           | Training Structure and Availability |
|                                                       | The importance of LCS is not sufficiently promoted or incentivized, and there are no additional professional or financial motivations for young radiologists to pursue training in this area | Motivation and Incentives           |
|                                                       | People think that they don't need specific education for doing LCS                                                                                                                           | Awareness and perceived needs       |
|                                                       | Lack of visibility for the training program                                                                                                                                                  | Institutional and Political Support |
|                                                       | Lack of official support                                                                                                                                                                     | Institutional and Political Support |
|                                                       | Homogenise how to read the LDCTs (different software)                                                                                                                                        | Technical Issues                    |
|                                                       | Political will and pharmaceutical companies' support to implement LCS program development and consequently education                                                                         | Institutional and Political Support |
|                                                       | Not enough slots for the workshops (necessary if you have to speed up the process)                                                                                                           | Training Structure and Availability |
|                                                       | Radiology misconception of how current skills apply to LCS (e.g., excellent thoracic radiologists perform rather badly on the external quality assurance package before training)            | Awareness and perceived needs       |
|                                                       | 0                                                                                                                                                                                            |                                     |
|                                                       | 0                                                                                                                                                                                            |                                     |
|                                                       | Availability of courses                                                                                                                                                                      | Training Structure and Availability |
|                                                       | 0                                                                                                                                                                                            |                                     |
|                                                       | Quality assurance metrics perceptions                                                                                                                                                        | Others                              |
|                                                       | Financial motivation for recruitment                                                                                                                                                         | Motivation and Incentives           |
|                                                       | 0                                                                                                                                                                                            |                                     |

|                                                       |                                                                                                                                                  |                                                          |
|-------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|
|                                                       | Smoking cessation (indicating gaps in awareness among referring physicians about the importance of smoking cessation as a core component of LCS) | Others                                                   |
|                                                       | 0                                                                                                                                                |                                                          |
|                                                       | 0                                                                                                                                                |                                                          |
|                                                       | Lack of motivation                                                                                                                               | Motivation and Incentives                                |
| <b>Item 8 – Additional responses (“Other” option)</b> |                                                                                                                                                  |                                                          |
|                                                       | 0                                                                                                                                                |                                                          |
|                                                       | 0                                                                                                                                                |                                                          |
|                                                       | 0                                                                                                                                                |                                                          |
|                                                       | 0                                                                                                                                                |                                                          |
|                                                       | Using of AI tools                                                                                                                                | AI tools                                                 |
|                                                       | Nodule management after being identified on CT, benefits of LCS                                                                                  | Nodule management after CT and further clinical Workflow |
|                                                       | Optimal implementation of AI tools                                                                                                               | AI tools                                                 |
|                                                       | Smoking cessation program                                                                                                                        | Smoking Cessation                                        |
|                                                       | Workflow of the system (not yet well-established)                                                                                                | Nodule management after CT and further clinical Workflow |
|                                                       | Training in logistics and operational issues                                                                                                     | Organizational Aspects                                   |
|                                                       | 0                                                                                                                                                |                                                          |
|                                                       | Lung nodules MDT                                                                                                                                 | Nodule management after CT and further clinical Workflow |
|                                                       | 0                                                                                                                                                |                                                          |
|                                                       | Administrative Management                                                                                                                        | Organizational Aspects                                   |
|                                                       | Stricter adherence to guidelines                                                                                                                 | Nodule management after CT and further clinical Workflow |
|                                                       | 0                                                                                                                                                |                                                          |
|                                                       | Different communication skills for reaching minorities                                                                                           | Patient care                                             |
|                                                       | Financial aspects                                                                                                                                | Others                                                   |
|                                                       | Quality assurance metrics (all the processes, mainly radiology)                                                                                  | Others                                                   |
|                                                       | 0                                                                                                                                                |                                                          |
|                                                       | -                                                                                                                                                | -                                                        |
|                                                       | 0                                                                                                                                                |                                                          |
|                                                       | Smoking cessation                                                                                                                                | Smoking Cessation                                        |
|                                                       | Tobacco cessation counselling                                                                                                                    | Smoking Cessation                                        |
|                                                       | Primary prevention (smoking cessation)                                                                                                           | Smoking Cessation                                        |
| <b>Item 9 – Additional responses (“Other” option)</b> |                                                                                                                                                  |                                                          |

|  |                                                                                 |                                                                                 |
|--|---------------------------------------------------------------------------------|---------------------------------------------------------------------------------|
|  | 0                                                                               |                                                                                 |
|  | 0                                                                               |                                                                                 |
|  | 0                                                                               |                                                                                 |
|  | 0                                                                               |                                                                                 |
|  | 0                                                                               |                                                                                 |
|  | 0                                                                               |                                                                                 |
|  | Awareness and education regarding pharmacological support for smoking cessation | Awareness and education regarding pharmacological support for smoking cessation |
|  | Ability to promote LCS (importance of dissemination and media)                  | Ability to promote LCS                                                          |
|  | 0                                                                               |                                                                                 |
|  | 0                                                                               |                                                                                 |
|  | 0                                                                               |                                                                                 |
|  | 0                                                                               |                                                                                 |
|  | 0                                                                               |                                                                                 |
|  | Management, infrastructure and automation                                       | Management, infrastructure and automation                                       |
|  | Knowledge of epidemiological principles of the screening                        | Knowledge of epidemiological principles of the screening                        |
|  | 0                                                                               |                                                                                 |
|  | 0                                                                               |                                                                                 |
|  | 0                                                                               |                                                                                 |
|  | Dedicating time in the normal clinical workplan                                 | Others                                                                          |
|  | Smoking cessation                                                               | Awareness and education regarding pharmacological support for smoking cessation |
|  | -                                                                               | -                                                                               |
|  | 0                                                                               |                                                                                 |
|  | 0                                                                               |                                                                                 |
|  | Tobacco cessation counselling                                                   | Awareness and education regarding pharmacological support for smoking cessation |
|  | 0                                                                               |                                                                                 |

**Supplementary Table 2. Ratings of survey items related to training gaps, training areas to be strengthened, and competencies in lung cancer screening.**

Ratings were provided on a Likert scale from 0 (not important) to 5 (extremely important). Values represent the number of respondents selecting each rating.

*N/A indicates missing responses. Total N = 25 respondents.*

| Domain                             | Survey Item                                                              | 5  | 4  | 3 | 2 | 1 | 0  | N/A | Mean | SD  | Median | IQR       |
|------------------------------------|--------------------------------------------------------------------------|----|----|---|---|---|----|-----|------|-----|--------|-----------|
| Training gaps and barriers         | Lack of awareness of need of training                                    | 10 | 3  | 2 | 0 | 3 | 7  | -   | 2.8  | 2.2 | 4      | 0-5       |
| Training gaps and barriers         | Lack of time for training                                                | 5  | 5  | 3 | 3 | 0 | 9  | -   | 2.4  | 2   | 3      | 0-4       |
| Training gaps and barriers         | Limited access to training courses (e.g. money)                          | 3  | 1  | 5 | 1 | 2 | 13 | -   | 1.5  | 1.9 | 0      | 0-3       |
| Areas that need to be strengthened | Knowledge regarding inclusion criteria                                   | 9  | 6  | 3 | 2 | 1 | 3  | 1   | 3.5  | 1.7 | 4      | 2.25-5    |
| Areas that need to be strengthened | Awareness of potential harms                                             | 6  | 7  | 5 | 1 | 2 | 3  | 1   | 3.2  | 1.7 | 4      | 2.25-4.75 |
| Areas that need to be strengthened | Structured Radiology reporting                                           | 12 | 5  | 2 | 0 | 1 | 4  | 1   | 3.6  | 1.9 | 4.5    | 3-5       |
| Areas that need to be strengthened | Confident use of guidelines for nodule management                        | 14 | 3  | 2 | 1 | 1 | 3  | 1   | 3.8  | 1.8 | 5      | 3-5       |
| Areas that need to be strengthened | Management of incidental findings                                        | 13 | 10 | 1 | 0 | 0 | 0  | 1   | 4.5  | 0.6 | 5      | 4-5       |
| Areas that need to be strengthened | Basic knowledge of lung cancer biology                                   | 3  | 4  | 8 | 1 | 5 | 3  | 1   | 2.6  | 1.6 | 3      | 1-4       |
| Areas that need to be strengthened | Communication skills                                                     | 10 | 5  | 4 | 3 | 0 | 2  | 1   | 3.7  | 1.5 | 4      | 3-5       |
| Areas that need to be strengthened | Collaborative skills                                                     | 11 | 3  | 5 | 1 | 2 | 2  | 1   | 3.6  | 1.7 | 4      | 3-5       |
| LCS Competencies                   | Sub-specialization in thoracic radiology                                 | 14 | 3  | 6 | 1 | 0 | 0  | 1   | 4.3  | 1   | 5      | 3-5       |
| LCS Competencies                   | Technical knowledge to perform and interpret LDCT                        | 15 | 4  | 5 | 0 | 0 | 0  | 1   | 4.4  | 0.8 | 5      | 4-5       |
| LCS Competencies                   | Familiarity with and appropriate use of guidelines for nodule management | 17 | 6  | 1 | 0 | 0 | 0  | 1   | 4.7  | 0.6 | 5      | 4-5       |
| LCS Competencies                   | Ability to use structured reporting systems                              | 14 | 6  | 3 | 1 | 0 | 0  | 1   | 4.4  | 0.9 | 5      | 4-5       |
| LCS Competencies                   | Basic knowledge and application of AI-based tools                        | 16 | 4  | 4 | 0 | 0 | 0  | 1   | 4.5  | 0.8 | 5      | 4-5       |

|                         |                                                                           |    |   |   |   |   |   |   |     |     |     |        |
|-------------------------|---------------------------------------------------------------------------|----|---|---|---|---|---|---|-----|-----|-----|--------|
| <b>LCS Competencies</b> | Competence in managing incidental findings                                | 17 | 6 | 1 | 0 | 0 | 0 | 1 | 4.7 | 0.6 | 5   | 4-5    |
| <b>LCS Competencies</b> | Effective communication with participants                                 | 16 | 7 | 0 | 0 | 0 | 1 | 1 | 4.5 | 1.1 | 5   | 4-5    |
| <b>LCS Competencies</b> | Ability to engage and collaborate within a multidisciplinary team         | 12 | 6 | 5 | 0 | 0 | 1 | 1 | 4.1 | 1.2 | 4.5 | 3.25-5 |
| <b>LCS Competencies</b> | Availability of minimally invasive techniques for diagnosis and treatment | 10 | 4 | 6 | 1 | 2 | 1 | 1 | 3.7 | 1.5 | 4   | 3-5    |
| <b>LCS Competencies</b> | Indications for locoregional lymph node staging in non-metastatic NSCLC   | 8  | 4 | 7 | 2 | 2 | 1 | 1 | 3.5 | 1.5 | 3.5 | 3-5    |
| <b>LCS Competencies</b> | Organizational skills to manage workflows and coordinate LCS activities   | 15 | 5 | 3 | 1 | 0 | 0 | 1 | 4.4 | 0.9 | 5   | 4-5    |
| <b>LCS Competencies</b> | Data handling                                                             | 11 | 9 | 4 | 0 | 0 | 0 | 1 | 4.3 | 0.8 | 4   | 4-5    |

## Survey about training & education in lung cancer screening

### Part I: Overview of the current status of lung cancer screening (LCS) training in your country

#### **1. Are there any ongoing or planned LCS programs in your country?**

- Are these programs regional/pilot projects or nationwide programs?
- Duration?

#### **2. Which healthcare professionals are involved in your LCS program?**

*e.g. Primary Care Provider (GP, Pulmonologist), Radiologist, Radiographer, Thoracic Surgeon, Pathologist  
Program Coordinator, Tobacco Cessation Counsellor, Ambassador*

#### **3. Is there any ongoing training for healthcare professionals involved in LCS in your country?**

*If yes:*

- Which specialties is it targeted to?
- Is it mandatory?

*If no:*

- Are you aware of any plans to develop such training?

#### **4. If yes to question 3, How are training programs for healthcare professionals involved in LCS structured in your country?**

- Which educational resources are used (e.g., classroom training, online courses, practical simulations)?
- Are they offered in different formats (e.g., in-person, online, hybrid)?
- How long do these training programs last?
- Do they need to pass a final examination?

Feel free to share any relevant official websites or resources you refer to.

#### **5. Do healthcare professionals involved in LCS legally need any specific certification in your country?**

*If yes:*

- For which specialties?
- Who assesses these qualifications (e.g., national/EU authorities or professional societies)?
- Is the certification program iteratively repeated (e.g. yearly, every 3 years, other) to warrant consistency and update for the LCS practice?
- Does the certification program include a proof of activity (e.g. a minimum number of LDCT reporting per year) to support its longitudinal maintenance?

*If no: **Any other relevant and/or voluntary certification? (Same questions or official websites you refer to).***

## Part II: Personal view and experiences

**6. In your opinion, which specialties should be trained?**

**7. Have you identified any specific training gaps or barriers to the implementation of the training program? Rate on a scale from 0 (not important) to 5 (extremely important).**

- lack of awareness about the need for training
- lack of time for training
- limited access to training courses (time, money, etc)
- Other (Please specify...):

**8. In your opinion, which areas of training should be strengthened to enhance the development and effectiveness of LCS programs in your field? Rate on a scale from 0 (not important) to 5 (extremely important).**

- Knowledge regarding inclusion criteria
- Awareness of potential harms
- Structured radiology reporting
- Confident use of guidelines for nodule management
- Management of incidental findings
- Basic knowledge of lung cancer biology
- Communication skills (e.g., with patients, discussing results, shared decision-making)
- Collaborative skills (e.g., teamwork in a multidisciplinary setting)
- Other (Please specify...):

**9. In your opinion, how important are the following competencies and skills for the medical discipline primarily responsible for this task within an LCS program? Rate on a scale from 0 (not important) to 5 (extremely important).**

- Sub-specialization in thoracic radiology
- Technical knowledge to perform and interpret low-dose CT scans
- Familiarity with and appropriate use of guidelines for nodule management
- Ability to use structured reporting systems
- Basic knowledge and application of AI-based tools
- Competence in managing incidental findings
- Effective communication with patients (e.g., explaining risk, results, limitations)
- Ability to engage and collaborate within a multidisciplinary team
- Availability of minimally invasive techniques for diagnosis and treatment
- Indications for locoregional lymph node staging in patients with non-metastatic NSCLC

- Organizational skills to manage patient workflows and coordinate LCS activities
- Data handling and management skills (e.g., extracting relevant clinical information, etc)
- Other (Please specify...):

**10. Do you think that LCS-related education should be integrated into the residency curriculum?**

*If yes:*

- *For which specialties?*
- *When should this training be provided?*
- *And to what extent?*
- *Should residents be involved in Multidisciplinary Team discussions?*

**11. Do you have any additional suggestions or comments regarding the training and education in LCS?**