CANADIAN PARTNERSHIP AGAINST CANCER | PARTENARIAT CANADIEN CONTRE LE CANCER

Companion Implementation Resource: Lung Cancer Screening

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Pan-Canadian Lung Cancer Screening Network

Introduction

Lung cancer is the most common cause of cancer death in Canada, and the most commonly diagnosed cancer, accounting for 14% of all cancers. (1) While the lung cancer mortality rate has been declining for the past several decades, smoking remains the most important risk factor for lung cancer (1) and primary and secondary prevention strategies are needed to reduce the burden of lung cancer.

The National Lung Screening Trial (NLST), a randomized controlled trial in the United States, was the first trial to demonstrate a mortality reduction with low-dose computed tomography (LDCT) screening in a high-risk population. The study was published in 2011 and reported a 20% relative reduction in mortality from lung cancer with low-dose CT screening. (2) The eligible population were individuals between the ages of 55-74 who were current smokers or former smokers who had quit smoking within the last 15 years, with at least a 30 pack-year smoking history (defined as the product of the average number of cigarette packs smoked daily and the number of years of smoking).

Lung Cancer Screening Guidelines

The Canadian Task Force on Preventive Health Care (CTFPHC) released lung cancer screening guidelines in March 2016, recommending lung cancer screening with LCDT for a high-risk population. (3)

The CTFPHC guidelines state:

- For adults aged 55-74 years with at least a 30 pack-year smoking history and who currently smoke or quit less than 15 years ago, annual screening with LDCT is recommended up to three consecutive times. However, screening should only be carried out in health care settings with expertise in early diagnosis and treatment of lung cancer. *Weak recommendation; low quality evidence.*
- For all other adults, regardless of age, smoking history or other risk factors, screening for lung cancer with LDCT is not recommended. *Strong recommendation; very low quality evidence.*
- Screening for lung cancer with chest x-ray, with or without sputum cytology, is not recommended. *Strong recommendation; low quality evidence.*

The strength of the CTFPHC recommendations is based on the quality of the evidence, degree of uncertainty about the benefits and harms, and variability in patient values and preferences using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) system. A weak recommendation indicates that the benefits probably outweigh the harms and while many may opt for the intervention, many may not. (3)

Background and Purpose

The Canadian Partnership Against Cancer (the Partnership) established the Pan-Canadian Lung Cancer Screening Network (PLCSN) in 2012. The PLCSN works with provinces and territories to support the Partnership's mandate to reduce the number of cancer cases, lessen the likelihood of Canadians dying from cancer and enhance the quality of life of those living with cancer. The PLCSN exists as a national forum to support Canadian initiatives that inform discussions and decisions around lung cancer screening, leverage expertise, and make evidence-based recommendations to the cancer control

system. The objectives of the PLCSN include sharing and facilitating the use of best practices to enhance the benefits and reduce the harms of screening and maintaining up-to-date knowledge of current lung cancer screening initiatives both nationally and internationally.

The purpose of this document is to increase the reach of the work that the PLCSN has done on lung cancer screening to date, and to act as a resource for jurisdictions considering the implementation of a lung cancer screening program. This document highlights key messages from three reports previously developed by the PLCSN: the 5-Year Questions Report, the National Data Working Group Report and the National Lung Cancer Screening Quality Indicators Report.[1]

Methods

The 5-Year Questions Report, the National Data Working Group Report and the National Lung Cancer Screening Quality Indicators Report were each developed by separate PLCSN working groups.

The 5-Year Questions Working Group was convened in August 2016 to explore key lung cancer screening-related questions that the PLCSN identified as important to have answered in five years. The working group met four times during the fall of 2016 to develop five high-level questions.

The purpose of the National Data Working Group was to provide an opportunity for the PLCSN to review the options for management of lung cancer screening data. The working group was convened in August 2016 and met four times from August 2016 through January 2017 to discuss the options for the management of lung cancer screening data and develop recommendations.

The Lung Cancer Screening Quality Indicators Working Group was formed in October 2015 to define a core set of national-level quality indicators for organized lung cancer screening with low-dose computed tomography (LDCT). Each indicator, definition and calculation was chosen based on a review of the literature and by consensus of the working group.

Resource #1: 5-Year Questions Report

In order to allow comparisons between approaches to inform future lung cancer screening delivery, the 5-Year Questions Working Group developed questions that the PLCSN identified as important to have answered in five years. These questions were developed by identifying focus areas along the lung cancer screening pathway as articulated in the Lung Cancer Screening Framework for Canada document developed by PLCSN in 2014. (4)

The selected 5-year questions are intended to be flexible in their interpretation to allow for comparisons across programs that may vary considerably in structure and process. Ideally, several indicators will be used to evaluate each question upon program implementation.

[1] If you are interested in receiving a copy of a PLCSN working group report, please contact screening@partnershipagainstcancer.ca.

The questions described below were developed by the working group to highlight some of the most important considerations for the successful implementation and operation of lung cancer screening programs where evidence is equivocal at this time, and where programs have an opportunity to contribute "real world" experience. These questions will allow for comparison across jurisdictions and may be used to inform future lung cancer screening delivery in Canada.

Table 1: 5-Year Questions

Question	Focus Area	Interpretation
1. Which recruitment methods optimize enrollment?	Recruitment and enrollment	Optimal recruitment method is the approach that successfully enrolls the appropriate high-risk population. The success of recruitment methods will vary between programs, and these differences will be used to inform the answer to this question.
2. What is the most effective risk assessment approach?	Eligibility and risk assessment	It is expected that some programs will use a risk assessment model to determine eligibility for lung cancer screening. Variability in the parameters and cut-off points will allow programs to be compared to determine the most effective assessment approach.
3. What is the most effective approach for smoking cessation programs for lung cancer screening participants?	Smoking cessation	The integration of prevention into screening programs has shown many benefits. It will be important for lung cancer screening programs to include a smoking cessation component for participants. The effectiveness of smoking cessation approaches can be evaluated through quality indicators and qualitative measures.
4. What is the optimal nodule approach?	Diagnosis	Clearly defined nodule management approaches will help to avoid inappropriate referrals, repeated CTs and unnecessary interventions. Nodule management approaches are expected to vary across programs, creating a natural experiment to determine the optimal approach.
5. What is the impact of lung cancer screening on projected/predicted lung cancer mortality?	Outcome evaluation	The ultimate goal of lung cancer screening is to reduce lung cancer mortality in the screened population. As data accumulates, programs will be able to calculate decreases in lung cancer mortality.

Resource #2: National Data Working Group Report

The National Data Working Group reviewed three options for a national-level lung cancer screening database, including the advantages, limitations, and characteristics of the three database options.

Table 2: Options for the management of lung cancer screening data

Type of Database	Description
National Record-Level Database	Provincial and territorial screening programs report record-level screening data to one central database. Analysis is done at the national level. Provinces and territories maintain ownership of their data.
National Aggregate Database	Provinces and territories collect record-level screening data and analyze it to report aggregate data for further analysis at the national level. Record-level data are not available at the National level. Provinces and territories maintain ownership of their data.
Virtual National Database (Federated model)	Each jurisdiction manages its own database but provides virtual access to data through a central access point for the purpose of analysis. Software allows all provincial and territories databases to be virtually queried as one database. The system takes into consideration the need to protect the privacy and security of the data. Analysis can be done within the system or information can be downloaded to build a dataset.

The three database options were compared on five high-level domains: database structure, data quality, data submission, governance, and resources.

The National Data Working Group's aim was to review the options for the management of national lung cancer screening data. The Working Group was also tasked with identifying the preferred option or options that could be most readily implemented as lung cancer screening activities begin across Canada. However, the recommendations will need to be further scoped before a preferred choice for a national-level lung cancer screening database is confirmed.

Table 3: National Data Working Group Recommendations

***Recommendation #1**:* Regardless of the option selected, the Programs will retain access to, and control over, the use of their data.
Recommendation #2: Standardization or harmonization of data definitions across provinces/territories and commitment to high quality databases are necessary to support an organized national lung cancer screening program, regardless of the database type.
Recommendation #3: Prior to selecting the database type to support a national lung cancer screening program, local IT resources and requirements, human resources capacity and database compatibility should be determined across the network. • An environmental scan and additional consultation with database experts would be needed.
***Recommendation #4**:* A better understanding of data to be collected, indicators and expected utilization of the information are required before final assessment of database options can be done.

Resource #3: National Lung Cancer Screening Quality Indicators Report

Ten national-level quality indicators for organized lung cancer screening with low-dose computed tomography (LDCT) were developed by the Lung Cancer Screening Quality Indicators Working Group.

Coming to consensus on a set of national quality indicators prior to program implementation may facilitate more consistent and comparable data collection and analysis across Canada. It is anticipated that, as new evidence emerges, these indicators may need to be revised and updated, new indicators added, and indicator targets set.

Table 4: Lung Cancer Screening Quality Indicators

Indicator	Definition	Calculation
1. Early reassessment rate	Percentage of LDCT screens which recommend any additional test or referral other than the next routinely scheduled annual or biennial screen	Number of LDCT screening tests within measurement time frame for which an additional test or referral other than the next routinely scheduled annual or biennial LDCT screening test is recommended / Number of LDCT screening tests performed within measurement time frame x 100
2. Invasive procedure rate	Percentage of participants screened who undergo an invasive procedure as a result of a positive screen	Number of participants who undergo an invasive procedure / Number of participants screened x 100
3. Positive predictive value	The positive predictive value is defined as the proportion of screening participants with screens requiring early reassessment who are diagnosed with lung cancer after diagnostic work up	Number of participants with screen-detected cancers / Number of participants with screens which recommend any additional test or referral other than the next routinely scheduled annual or biennial screen x 100
4. 30 day mortality following an invasive diagnostic procedure	Percentage of participants who die within 30 days of an invasive diagnostic procedure for a positive screen (i.e. early reassessment)	Number of participants who die within 30 days following an invasive diagnostic procedure / Number of participants who underwent an invasive diagnostic procedure x 100
5. Non-malignant surgical biopsy/resection rate	Number of surgical lung biopsies/resections with a non-malignant result per 1,000 screens	Number of surgical biopsies with non-malignant diagnosis / Total number of screens x 1,000
6. Cancer detection rate in the screening program	Number of invasive cancers detected per 1,000 screens	Number of invasive cancers detected in screening program / Number of screens on an annual basis x 1,000
7. Cancer detection rate of those biopsied or resected in screening program	Lung cancer detection rate out of those biopsied or resected in a screening program	Number of invasive cancer detected / Number of biopsy/surgical procedures x 1,000
8. 30 day mortality rate after	30 day mortality rate after surgical procedure	Number of screening participants who underwent a surgical procedure who

surgical procedure		$\frac{\text{died within 30 days of the procedure}}{\text{Number of screening participants who underwent a surgical procedure}} \times 100$
9. Resection rate	The proportion of all screening participants diagnosed with stage I or II screen-detected lung cancer who undergo a surgical resection	$\frac{\text{Number of screening participants with a TNM stage I or II screen-detected lung cancer who underwent a surgical resection}}{\text{Number of screening participants with TNM stage I or II screen-detected lung cancer}} \times 100$
10. Proportion of screen-detected cancers by stage	The distribution by stage of all screen-detected cancers	$\frac{\text{Number of stage I, II, III or IV screen-detected lung cancers}}{\text{Total number of screen-detected lung cancers}} \times 100$

Future Directions

The PLCSN has had the opportunity, in advance of widespread lung cancer screening initiatives, to develop resources to pro-actively support Canadian jurisdictions prepare for the future implementation of lung cancer screening programs. From 2015 to 2017, the PLCSN convened three working groups to address key topics in lung cancer screening: 5-year goals for lung cancer screening programs, management of lung cancer screening data, and lung cancer screening quality indicators.

The 5-year questions described in this resource highlight important considerations that should be addressed during the planning and development stage of lung cancer screening programs. The National Data Working Group outlined three options for a national-level lung cancer screening database, including the advantages, limitations, and characteristics of the three database options, and developed recommendations to guide future thinking on this topic. The lung cancer screening quality indicators report describes 10 expert-vetted national lung cancer screening quality indicators that have been developed and defined in detail. Next steps will involve the measurement and reporting of these 10 indicators and, once there is sufficient data to review over time, national targets could be set.

Together, these three resources contribute to existing knowledge on lung cancer screening, serve as a resource for pilot planning and evaluation, and can be used to inform the development of provincial/territorial screening programs.

References

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4. Canadian Partnership Against Cancer. Lung Cancer Screening Framework for Canada. Canadian Partnership Against Cancer, 2014.