

# Radiology Quality Assurance Program Manual Ontario Lung Screening Program

**October 2019 (updated March 2021)**

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## Contents

1.0 Introduction.....	3		
2.0 Radiology QA Program Overview .....	4		
Guiding principles.....	4		
3.0 Radiology QA Program Development	6		
Radiology QA Expert Panel .....	6		
Data abstraction .....	7		
Quality assessment.....	7		
4.1 Radiologist Requirements.....	8		
Degrees/certifications.....	8		
Minimum volumes interpreted.....	8		
Training – Radiology CPD Workshop	9		
Report turnaround time .....	10		
Peer review .....	10		
Double read of positive cases.....	11		
Continuing experience.....	11		
Continuing medical education .....	12		
Use of CAD software.....	12		
4.2 Radiology QA Facility Lead			
Requirements .....	13		
Initial qualifications.....	13		
4.3 Resident and Fellow Requirements	14		
Degrees/certifications.....	14		
Supervision.....	14		
4.4 Medical Radiation Technologist			
Requirements .....	15		
Degrees/certifications.....	15		
Continuing education.....	15		
4.5 Equipment Requirements .....	16		
CT equipment specification.....	16		
PACS: storage of images.....	16		
Safety: radiation dose .....	16		
Installation and shielding .....	17		
Quality control testing .....	17		
4.6 Facility Requirements.....	18		
Administer Radiology QA Program..	18		
Protocol compliance .....	18		
Quality control testing program .....	18		
5.1 Resident and Fellow			
Recommendation.....	19		
Training – Radiology CPD Workshop			
.....	19		
5.2 Equipment Recommendation.....	20		
Workstations .....	20		
6.0 Assuring Quality.....	21		
		How quality will be assessed .....	21
		How quality will be reported to sites.	22
		7.0 Radiology QA Governance Model and	
		Radiology Quality Issues Management	
		Process .....	25
		Radiology QA Governance Model .....	25
		Radiology Quality Issues Management	
		Process .....	27
		8.0 References .....	29
		Appendix A – Radiology QA Expert Panel	
		Membership.....	30
		Appendix B – Study Selection Criteria.	32
		Appendix C - LDCT Lung Cancer	
		Screening Protocol .....	33
		Appendix D – Quality Control Testing	
		Program .....	35

## 1.0 Introduction

### **Ontario Lung Screening Program**

In 2016, Ontario Health (Cancer Care Ontario) (OH-CCO) launched an initiative to pilot organized lung cancer screening, using low-dose computed tomography (LDCT), for people at high risk for lung cancer. The Ontario Lung Screening Program () will support the implementation and evaluation of organized lung cancer screening at three hospital sites across Ontario in order to inform recommendations for a potential provincial program.

### **Defining and measuring quality in radiology**

The Radiology Quality Assurance (QA) Program for was developed to ensure LDCT is performed and interpreted according to quality standards at various sites. The program sets quality standards by defining requirements that must be met by each site. Requirements are defined for personnel (e.g., radiologist, medical radiation technologist), equipment, and the facility. The program also outlines assurance processes to ensure that quality requirements have been fulfilled.

### **Why setting quality requirements in radiology is important**

There is increasing focus provincially to enhance the quality and safety of all diagnostic imaging in Ontario; Health Quality Ontario is leading this work by developing a set of recommendations to inform provincial standards for diagnostic imaging (Health Quality Ontario, 2016). Ontario Health's Cancer Care Ontario's Cancer Imaging Program works to improve quality for cancer imaging through priority initiatives to enhance the patient journey (Cancer Care Ontario, 2012).

The Radiology QA Program for aims to build on existing efforts and set a foundation that defines quality for lung cancer diagnostic imaging. The Radiology QA Program for has been developed to align with broader diagnostic imaging quality initiatives, including mammography and provincial quality management programs (QMPs).

As provincial recommendations are established for quality diagnostic imaging, the Radiology QA Program for will contribute insights that can inform a conceptual framework for a provincial quality assurance program. Additionally, this work has the potential to be applied to other areas of clinical practice beyond diagnostic imaging.

## 2.0 Radiology QA Program Overview

The Radiology QA Program for will support the definition, implementation and adoption of requirements to ensure LDCT is performed and interpreted according to quality standards across sites by establishing quality standards, processes, and clear accountability required to ensure that quality is achieved.

### Guiding principles

The Radiology QA Program for is based on the Quality Management Partnership's Quality Management Program (QMP) framework (Quality Management Partnership, 2015). The QMP framework aims to guide the development of provincial QMPs and has been applied to colonoscopy, mammography, and pathology programs. The QMP framework outlines components essential for effective quality management. These include quality defined, quality assurance, quality reporting and quality improvement.

### Components of the Radiology QA Program for

#### a) Quality defined

Defining quality involves establishing the requirements to provide a foundation for quality assurance processes.

Requirements are minimum acceptable levels of quality based on best available evidence.

The Radiology Quality Assurance (QA) Expert Panel, convened by Ontario Health (Cancer Care Ontario), reviewed existing evidence related to quality standards for radiology and LDCT and defined a set of mandatory requirements for personnel, equipment, and facilities to ensure consistent, high quality LDCT across sites offering lung cancer screening. For more information on the expert panel and the approach used for the evidence review, see **3.0 Radiology QA Program Development**. Section **4.1 to 4.6** outlines the requirements that must be met for equipment, facilities, and personnel (Radiology Quality Assurance (QA) Facility Leads, radiologists, medical radiation technologists (MRTs) as well as residents and fellows) during the . Existing standards are leveraged where they exist.

The Radiology QA Expert Panel also developed a set of recommendations for equipment as well as residents and fellows that are encouraged in order to enhance consistency and quality for LDCT scanning across sites offering lung cancer screening. For more information on these recommendations, see section **5.1 to 5.2**.

#### **b) Quality assurance**

Quality assurance processes establish clear accountability to ensure that quality is achieved. These processes provide a consistent way to assess quality and monitor adherence to requirements across facilities. Quality requirements will be assessed at specific intervals, either one-time, monthly, or annually through site sign-off using assessment forms, indicators, and audit(s). The Radiology QA Facility Lead will be responsible for ensuring quality requirements have been fulfilled at their respective site.

The OH-CCO Radiology Quality Lead will be responsible for verifying radiology quality assurance requirements have been met and providing appropriate follow-up when opportunities for quality improvement are identified. For information on quality assurance processes, see **6.0 Assuring Quality**.

#### **c) Quality reporting**

A key component of the Radiology QA Program for OLSP is to provide sites with ongoing progress reports to support quality and quality improvement opportunities at the site level. For more information on quality reporting, see **6.0 Assuring Quality**.

#### **d) Quality improvement**

The Radiology QA Program for OLSP will support and foster a culture of continuous quality improvement for sites that do not meet radiology quality assurance requirements. To support the implementation of requirements across the sites, a program governance model and a issues management process has been developed. For information, see section **7.0 Radiology QA Governance Model and Radiology Quality Issues Management Process**.

## 3.0 Radiology QA Program Development

### Radiology QA Expert Panel

An expert panel was convened by Ontario Health (Cancer Care Ontario) to develop the Radiology QA Program for OLSP through a Call for Participation in 2016. The panel selected represented a cross-section of experts in diagnostic imaging and included radiologists, MRTs, diagnostic imaging administrators, and medical physicists with demonstrated commitment to quality assurance, patient focused care, and public accountability. The panel was co-chaired by two radiologists. Ontario Health (Cancer Care Ontario) staff provided secretariat support. For a list of members included in the expert panel, see **Appendix A**.

The Radiology QA Expert Panel was mandated to develop an evidence-based radiology quality assurance program for LDCT lung cancer screening. Panel activities included review of evidence and relevant jurisdictional, professional association or government agency guidance to inform requirement recommendations for LDCT lung cancer screening. The expert panel met monthly between August 2016 and January 2017.

### Information sources and literature search

A literature review was conducted to support the expert panel by the Evidence and Program Integration Team within the Program Design Unit at Ontario Health (Cancer Care Ontario). A rapid review was conducted to identify current radiology quality assurance standards for personnel, equipment, and facilities related to LDCT lung cancer screening (Buchanan, 2016).

Three sources were used to inform the evidence review: PubMed, consultation with expert panel members to identify relevant publications, and a targeted website search to identify standards published from clinical practice guideline databases, guideline development groups, professional associations and government agencies.

### Literature selection

Publications were included if they met study selection criteria, as outlined in **Appendix B**. A single reviewer screened each citation and subsequent full-text article. The literature search was supplemented by searching the reference list of included studies.

During the targeted website search, 9 keywords were entered into the search box where available and the first 5 pages of results were reviewed for relevant titles. If a search box was not available, the website directory was navigated for links that could include relevant guideline/standards publications. Publications from all searches were combined in Distiller, a web-based systematic review software program (Buchanan, 2016).

### **Data abstraction**

Standards were abstracted from all included publications for each category of personnel, equipment and facility. Radiology standards from each publication were extracted by one reviewer (Buchanan, 2016).

### **Quality assessment**

The evidence product was a summary of the literature, and did not include formal critical appraisal of the included

publications. However, each publication was categorized based on the level of evidence supporting each standard (ranging from no references to peer-reviewed RCT, systematic review or meta-analysis). The level of evidence assigned to each standard ranged from only one supporting publication to several classified at that level (Buchanan, 2016).

### **Result of literature search**

Of the 51 publications included in the standards review, 6 were identified from the PubMed search, 26 were identified from the targeted website search and 19 were included from expert identification. The findings were organized into three categories and included: (1) personnel (36 publications), (2) equipment (28 publications) and (3) facilities (24 publications) (Buchanan, 2016).

### **Expert panel review and endorsement**

The findings of the literature search were presented to the Radiology QA Expert Panel monthly. Among the sources which contributed to the evidence base include:

- The American College of Radiology

- The College of Physicians and Surgeons of Ontario
- The Canadian Association of Radiologists
- Health Quality Ontario

Over the course of several meetings, the expert panel reviewed the evidence, discussed, and established a set of

radiology quality requirements for LDCT lung cancer screening. The expert panel also established and endorsed processes to ensure quality is achieved.

## 4.1 Radiologist Requirements

### Degrees/certifications

Radiologists performing or interpreting LDCT examinations for OLSP must meet the qualifications stated by The College of Physicians and Surgeons of Ontario.

Prior to participating in the OLSP, radiologists must:

- be certified in Diagnostic Radiology with The Royal College of Physicians and Surgeons of Canada and have a certificate of registration to practice in Ontario, **OR**
- have a Restricted Certificate of Registration to practice independently

**Source:** The College of Physicians and Surgeons of Ontario, 2015

### Minimum volumes interpreted

Setting a standard for minimum computed tomography (CT) volumes interpreted ensures that competencies are maintained and that radiologists are thoroughly acquainted with the many morphologic and pathophysiologic manifestations and artifacts demonstrated on CT.



Prior to participating in the OLSP, radiologists must interpret at least:

- 300 chest CT exams over the previous 36 months, AND
- 100 chest CT exams over the previous 12 months

### **Training – OLSP Radiology CPD Workshop**

Training helps ensure consistent and standardized reporting for LDCT lung cancer screening. Radiologists interpreting LDCT scans for the OLSP must meet training requirements designed to prepare them to read for the program.

Prior to participating in the OLSP, radiologists must have successfully completed the OLSP Radiology CPD Workshop within 12 months prior to reading for the program. Exceptions will be considered by the OH-CCO Radiology Quality Lead on a case by case basis. Exceptions to this requirement are to be considered (e.g., radiologists with prior experience through

Exceptions to this requirement are to be considered (e.g., sabbatical, maternity leave) by the CCO Radiology Quality Lead on a case by case basis.

**Source:** Expert panel consensus decision with guidance from Kazerooni, 2015

participation in national and international lung cancer screening clinical trials and/or participation as faculty in OH-CCO OLSP Radiology CPD Workshop development and workshops, and/or radiologists who have successfully taken the “Lung Cancer Screening – from Science to Practice” course by the American College of Radiology (ACR).

**Source:** Expert panel consensus decision with guidance from Canadian Association of Radiologists, 2016

### **Report completeness**

The interpretation of LDCT scan and the clarity of the lung cancer screening report are essential for high quality care. Report completeness ensures all critical information is provided to equip referring physicians to act on radiologists' assessment.

**Source:** Expert panel consensus decision

Radiologists participating in the OLSP must complete all required fields of the OH-CCO Lung Cancer Screening Reporting Template for OLSP participants

### **Report turnaround time**

Timely access to screening results is essential for high-quality care.

As per the OLSP policies, all scan results will be communicated to participants within 14 days. Scan interpretations are required to be completed in a timeframe allowing for all QA processes (double-read, peer

review as needed) to occur within this time.

**Source:** Expert panel consensus decision with guidance from OH-CCO - Access to Care; Provincial Wait Times Benchmark for CT, OLSP LDCT Policy, OLSP Results Communication Policy

### **Peer review**

Peer review, as defined by the Canadian Association of Radiologists, is a process of self-regulation by a profession or a process of evaluation involving qualified individuals within the relevant field (Health Quality Ontario, 2016). Peer review aims to improve overall standards by defining unperceived discrepancies between

peers and providing opportunities for supportive education (Canadian Association of Radiologists, 2012).

A minimum of 5% of all OLSP LDCT cases per year must be peer reviewed by a peer-matched site radiologist who is currently participating in the OLSP.

A four point system (e.g., aligned with the ACR RADPEER™ scoring system) is recommended. Any discrepancies that remain unresolved as per the facility's existing peer review process should be brought to the OH-CCO Radiology Quality Lead for adjudication.

**Source:** Expert panel consensus decision with guidance from Canadian Association of Radiologists, 2016, and Health Quality Ontario, 2016

### **Double read of positive cases**

Double reading positive lung cancer screening cases ensures quality assurance of radiological interpretation.

Radiologists participating in the OLSP must have their first 15 positive LDCT lung cancer screening interpretations (Lung-RADS™ [Version 1.1] 3 or 4) double-read by a peer-matched site radiologist. All Lung-RADS™ (Version 1.1) 4A must be double read by a peer-matched site radiologist. Any discrepancies that remain unresolved as per the facility's existing peer review process should be brought to the OH-CCO Radiology Quality Lead for adjudication.

**Source:** Expert panel consensus decision with guidance from Health

Quality Ontario, 2016 and Canadian Association of Radiologists, 2012

### **Continuing experience**

Continuing experience ensures that competencies are being maintained and that radiologists are thoroughly acquainted with the many morphologic and pathophysiologic manifestations and artifacts demonstrated on CT.

Radiologists participating in the OLSP must interpret at least:

- 300 chest CT exams over the previous 36 months, **AND**
- 100 chest CT exams over the previous 12 months.

Exceptions to this requirement are to be considered (e.g., sabbatical, maternity leave) by the OH-CCO Radiology Quality Lead on a case by case basis.



**Source:** Expert panel consensus decision with guidance from Kazerooni, 2015

### **Continuing medical education**

Continuing medical education is an important aspect in maintaining competency.

Computer aided detection (CAD) software can be used to decrease observational oversights and assist the radiologist in reading LDCT lung cancer screening scans.

If CAD software is being used, it must be used according to the manufacturer specifications to ensure appropriate quality. Radiologists should verify CT images and CAD segmentation quality (e.g., for motion artifacts). **Source:** International Early Lung Cancer Action Program, 2016

Radiologists participating in the OLSP must complete continuing professional development (CPD) programs relevant to their practice, as per The Royal College of Physicians and Surgeons of Canada requirements for maintenance of certification. CPDs specific to lung cancer screening are recommended

**Source:** The College of Physicians & Surgeons of Ontario, 2015

### **Use of CAD software**

## 4.2 Radiology QA Facility Lead Requirements

### Initial qualifications

Radiology QA Facility Leads are key individuals who will monitor and oversee quality at the pilot sites. All Radiology QA Facility Leads are practicing radiologists that will be accountable to their local facility as per current accountability and legislative requirements, and responsible to the OH-CCO Radiology Quality Lead to foster accountability, and support quality assurance at their respective site. The Radiology QA Facility Lead for the OLSP must meet all requirements of a radiologist participating in the OLSP, as outlined in section 4.1.

**Source:** Expert panel consensus decision

## 4.3 Resident and Fellow Requirements

### Degrees/certifications

Residents and fellows performing or interpreting LDCT scans for OLSP must meet qualifications outlined in The College of Physicians and Surgeons of Ontario<sup>1</sup>.

Residents and fellows participating in the OLSP must fulfill the licensing requirements of The College of Physicians and Surgeons of Ontario.

**Source:** Expert panel consensus decision

### Supervision

Residents and fellows performing or interpreting LDCT scans for the OLSP must meet supervisory requirements.

Residents and fellows participating in the OLSP must have on site supervision by a radiologist who meets all the requirements outlined in section 4.1. Residents and fellows must review each case with the Radiology QA Facility Lead or delegate who meets all radiologist standards as outlined in section 4.1.

**Source:** Expert panel consensus decision

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<sup>1</sup> The College of Physicians and Surgeons of Ontario. Registration requirements, <http://www.cpso.on.ca/Registering-to-Practise-Medicine-in-Ontario/Registration-Requirements>

## 4.4 Medical Radiation Technologist Requirements

### Degrees/certifications

All MRTs performing LDCT scans for the OLSP must meet qualifications outlined in The College of Medical Radiation Technologists of Ontario and The College of Physicians and Surgeons of Ontario.

Prior to participating in the OLSP an MRT must undergo CT training as prescribed by their facility and meet the educational competencies as outlined by The College of Medical Radiation Technologists of Ontario.

**Source:** The College of Medical Radiation Technologists of Ontario, 2011 and College of Physicians and Surgeons of Ontario, 2015

### Continuing education

Participating in continuing education provides medical professionals with opportunities to improve healthcare practice (Forsetlund, 2009). All MRTs performing LDCT scans for

the OLSP must meet requirements for continuing education, as outlined in The College of Medical Radiation Technologists of Ontario. To continue to participate in the OLSP, MRTs must meet the continuing education requirements as prescribed by The College of Medical Radiation Technologists of Ontario

**Source:** The College of Medical Radiation Technologists of Ontario

## 4.5 Equipment Requirements

### **CT equipment specification**

CT equipment used in the OLSP must meet a certain standard to ensure optimal image acquisition.

CT equipment used for the OLSP must be capable of meeting the requirements of the OH-CCO LDCT Lung Cancer Screening Protocol (adapted from The American Association of Physicists in Medicine (AAPM)) (**Appendix C**).

**Source:** American Association of Physicists in Medicine, 2016

### **PACS: storage of images**

Storage and retrieval of digital images is an integral component of a

screening program as it ensure that new scans can be compared to previous scans for changes in nodule growth and appearance. Minimum retention periods allow for image retrieval, quality control, and training.

Images for the OLSP, must be available for retrieval for quality control, training, image display and manipulation and must be stored for a minimum of 25 years.

**Source:** Health Canada, 2006; The Royal College of Radiologists, 2012

### **Safety: radiation dose**

Continual efforts should be in place to ensure that the radiation dose from

medical imaging procedures is appropriate, given the diagnostic task. Strategies and recommendations to manage and minimize the radiation dose related to CT scanning should be followed. Radiation dose to screening participants must be appropriately minimized while still providing diagnostic quality examinations. OH-CCO LDCT Lung Cancer Screening Protocol must be pre-programmed into the scanner. Whenever possible, auto-exposure techniques should be employed

**Source:** The College of Physicians and Surgeons of Ontario, 2015 and Canadian Association of Radiologists, 2016



### **Installation and shielding**

Practices and procedures to minimize radiation dose to operators and participants during CT installation and subsequent operation must be in place. CT equipment used in LDCT lung cancer screening, must adhere to installation and shielding requirements as outlined in the Healing Arts Radiation Protection (HARP) Act. Installation and shielding for CT equipment used for OLSP must meet HARP standards.

**Source:** Healing Arts Radiation Protection Act, R.S.O. 1990, c. H.2

### **Quality control testing**

CT equipment used in LDCT lung cancer screening, must be properly maintained through regular quality control testing in order to remain safe and effective.

The CT equipment being used for the OLSP must undergo quality control testing as per facility standards. Please see **4.6** for facility requirements regarding quality control testing program.

**Source:** The College of Physicians and Surgeons of Ontario, 2015

## 4.6 Facility Requirements

### **Administer OLSP Radiology QA Program**

Facilities participating in the OLSP must administer the Radiology QA Program for OLSP to ensure that quality is achieved. The Radiology QA Facility Lead must, in conjunction with any existing internal diagnostic imaging quality assurance body, administer the Radiology QA Program at their respective site by monitoring all requirements as indicated, and escalate to the OH-CCO Radiology Quality Lead as required.

**Source:** Expert panel consensus decision

### **Protocol compliance**

The OH-CCO LDCT Lung Cancer Screening Protocol ensures that all participants in the OLSP are scanned safely and appropriately. The facility's LDCT Lung Cancer Screening protocol must be in compliance with the OH-CCO Lung Cancer Screening Technical protocol and is to be used for every OLSP patient. Acceptance testing should be conducted to determine baseline parameters and develop pass/fail criteria for future annual evaluations. It is recommended that the evaluation should be done by a Qualified Medical Physicist (QMP) or their delegate, given that written justification exists to show competence

of the delegate by the QMP. The LDCT lung cancer screening protocol should be evaluated annually as per the pass/fail criteria developed during acceptance testing.

**Source:** Expert panel consensus decision with guidance from Norweck, 2015

### **Quality control testing program**

Facilities participating in the OLSP must have a comprehensive CT equipment quality control program to ensure proper functioning and maintenance of equipment. The facility must have a comprehensive quality control testing program, including processes to resolve issues detected

during testing for the CT equipment being used for the OLSP. It is recommended that facility standards align with The College of Physicians and Surgeons of Ontario/American

College of Radiology. Please see Appendix D for the details for these quality control programmes.

**Source:** The College of Physicians and Surgeons of Ontario, 2015

## 5.1 Resident and Fellow Recommendation

**Source:** Expert panel consensus decision

### Training – OLSP Radiology CPD Workshop

Lung CT Screening Reporting and Data System (Lung-RADS™ - Version 1.1) is a quality assurance tool designed to standardize lung cancer screening LDCT reporting. Residents and fellows performing or interpreting LDCT scans for the OLSP are encouraged to participate in the OLSP Radiology CPD Workshop during their training. Residents and fellows participating in the OLSP are encouraged to take the OLSP Radiology CPD Workshop course during their training



## 5.2 Equipment Recommendation

### Workstations

The consistent presentation of images on workstations is essential for electronic imaging operations (Norweck, 2013). It is encouraged that primary and secondary workstations being used for the OLSP meet the recommendations as outlined in document: [ACR–AAPM–SIIM Technical Standard for Electronic Practice of Medical Imaging](#). It is specifically encouraged that primary displays (those used for diagnosing)

are calibrated to the Grayscale Standard Display Function (GSDF) within +/- 10% AND luminance ratio > 250 (> 350 preferred)

**Source:** Expert panel consensus decision with guidance from Norweck, 2013

## 6.0 Assuring Quality

The following section describes how adherence to requirements will be assessed to support quality assurance activities.

### How quality will be assessed

Personnel, equipment, and facility requirements will be assessed for adherence through either site sign-off, indicator review, or audit completion (**Table 1**). The OH-CCO Radiology Quality Lead will be responsible for reviewing and verifying that sites have met requirements and provide follow-up for any quality concerns.

### Site sign-off

The Radiology QA Facility Leads are responsible for monitoring and overseeing quality at sites, fostering accountability, and supporting quality assurance activities. The Radiology QA Facility Lead will support quality assurance activities by documenting and providing record that sites have fulfilled requirements through site sign-off of initial, annual, and new radiologist assessment form(s). The completed assessment form(s) must be submitted by the sites to Cancer Care Ontario for verification by the OH-CCO Radiology Quality Lead. See **Table 1** for more information on requirements that will be measured through site sign-off. The corresponding assessment form and requirement check frequency is also presented.

### Audit

Audit(s) will be conducted to evaluate requirements that cannot currently be measured through indicators or site sign-off. The requirement for report completeness will be assessed annually through audit. See **Table 1** for more information.

### **Indicators**

Indicators are quantitative measures that will be used to determine whether requirement for report turnaround time has been met. Radiology quality assurance indicators (report turnaround time) along with other indicators that pertain to radiology (e.g., CT wait time) will be collected. See **Table 1** for more information on requirement check frequency for report turnaround time. See Facility-level Report for an overview of other indicators that pertain to radiology that will be collected during evaluation.

### **Requirement verification**

The OH-CCO Radiology Quality Lead will be responsible for reviewing and verifying that sites have met requirements because they have quality assurance experience in the field of radiology. Assessment forms, audit results, and indicators will be reviewed by the OH-CCO Radiology Quality Lead to ensure that requirements have been fulfilled and identify opportunities for follow-up.

### **How quality will be reported to sites**

A key component of the Radiology QA Program for OLSP is regular reporting back to sites to support quality assurance activities. The following section describes how quality achievement will be reported back to sites.

### **Radiology requirement assessment update**

Upon review of indicators, audit results, or assessment form(s), sites will receive confirmation from Ontario Health (Cancer Care Ontario) that requirements have been met or opportunities for quality improvement have been identified. Sites will be actively engaged when issues or opportunities for quality improvement have been identified. For more information on Radiology Quality Issues Management Process, see **7.0 Rad QA Governance and Radiology Quality Issues Management Process**.

### **Facility-level report**

Facility-level reports will report facility level indicators that pertain to radiology outcomes (e.g., CT wait time) as well as radiology quality assurance indicators (results communication wait time). All sites participating in the OLSP will receive regular reports to support identification of opportunity to improve quality at a facility level. Facility-level reports will be issued monthly and quarterly. Indicators that will be included in Facility-level reports include:



- Results Communication Wait Time Indicator (wait time from LDCT scan completed to radiology report verification)
- Proportion of LDCT scans with each Lung-RADS™ (Version 1.1) score (0, 1, 2, 3, 4a, 4b, or 4x)
- Proportion of LDCT scans with actionable incidental findings detected
- CT wait time from imaging order received date to the date the procedure is performed

**Table 1. Radiology requirement assessment overview**

	Requirement Assessor		Requirement Check Frequency			Method for Ensuring Adherence to Requirements				
	Pilot Facility	Cancer Care Ontario	One-time	Monthly	Annual	New Radiologist Assessment Form	Initial Assessment Form	Annual Assessment Form	Indicators	Audit
<b>Radiologist requirements</b>										
Degrees/certification	•		•			•	•			
Minimum volumes interpreted	•		•			•	•			
Training - HR LCSP Radiology CPD Workshop	•		•			•	•			
Continuing medical education	•				•			•		
Continuing experience	•				•			•		
Peer review	•				•			•		
Double read of positive cases	•				•			•		
Report completeness		•			•					•
Report turnaround time		•		•					•	
CAD software	•				•			•		
<b>Facility Lead requirement</b>										
Initial qualifications	•		•				•			
<b>Resident/Fellow requirements</b>										
Degrees/certifications	•				•			•		
Supervision	•				•			•		
<b>MRT requirements</b>										
Degrees/certifications	•		•				•			
Continuing education	•				•			•		
<b>Equipment requirements</b>										
CT equipment specification	•				•		•	•		
PACS: storage of images	•		•				•			
Safety: radiation dose	•				•			•		
Installation and shielding	•		•				•			
Quality control testing	•				•		•	•		
<b>Facility requirements</b>										
Protocol compliance	•				•		•	•		
Administer HR LCSP Radiology QA Program	•				•		•	•		
Quality control testing program	•				•		•	•		

Note: The Ontario Lung Screening Program (OLSP) was previously known as the High Risk Lung Cancer Screening Pilot (HR LCSP).



## 7.0 Radiology QA Governance Model and Radiology Quality Issues Management Process

To support the implementation of the Radiology QA Program, a governance model and issues management has been developed. An overview is provided in the following section.

### **Radiology QA Governance Model**

The governance model is designed to enhance overall performance of Radiology QA Program by strengthening stakeholder accountability and promoting collaboration.

The Radiology QA Facility Lead will provide oversight for the Radiology QA Program for OLSP by monitoring and overseeing quality at the local level, fostering accountability, and supporting quality assurance activities.

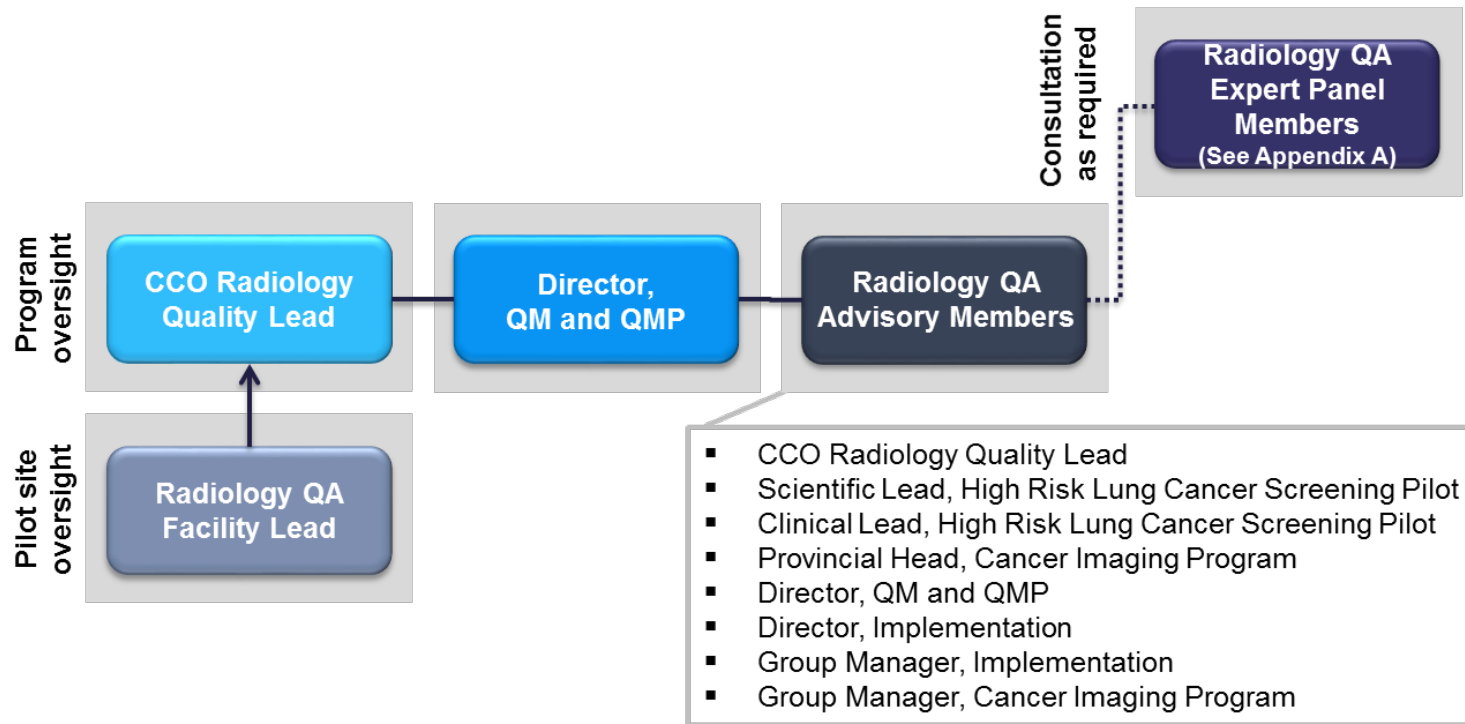
The OH-CCO Radiology Quality Lead will provide program oversight by reviewing and verifying that sites have fulfilled requirements. In consultation with the Director, Quality Management (QM) and Quality Management Partnership (QMP), the OH-CCO Radiology Quality Lead will follow-up with sites when issues or opportunities for quality improvement have been identified and support quality improvement efforts.

The Radiology Quality Assurance (QA) Advisory Group is a network of Ontario Health (Cancer Care Ontario) leads that

can provide further support when further engagement is required to discuss issues or opportunities for quality improvement.

Defining quality will be an on-going activity and will proceed with expert clinical guidance and in consultation with stakeholders as new evidence is developed. The Radiology QA Expert Panel may be consulted as new evidence emerges for radiology quality in LDCT lung cancer screening. The governance model is detailed in **Figure 1 - Radiology QA Governance Model**.

**Figure 1. Radiology QA Governance Model**



Note: The Ontario Lung Screening Program (OLSP) was previously known as the High Risk Lung Cancer Screening Pilot (HR LCSP).

## **Radiology Quality Issues Management Process**

The Radiology Quality Issues Management Process has been developed to support appropriate follow-up and collaboration among stakeholders when issues or opportunities for quality improvement have been identified following requirement verification. The following section provides an overview of the Radiology Quality Issues Management Process. For an overview, see **Figure 2 - Radiology Quality Issues Management Process**.

### **Requirement verification by OH-CCO Radiology Quality Lead**

The OH-CCO Radiology Quality Lead will be responsible for verifying that sites have met requirements because they have quality assurance experience in the field of radiology. The OH-CCO Radiology Quality Lead will review indicators, audit results, and assessment form(s), and provide confirmation that sites have fulfilled requirements or identify issues or opportunities for quality improvement.

### **Issue identification**

The OH-CCO Radiology Quality Lead, in consultation with the Director, QM & QMP, will initiate appropriate follow-up which may include:

- Provide confirmation to sites that requirements have been fulfilled;
- Engage with site leadership to discuss issues or opportunities for quality improvement;
- Engage with Radiology QA Advisory members and site leadership to discuss issues or opportunities for quality improvement that require further consultation.

### **Further engagement**

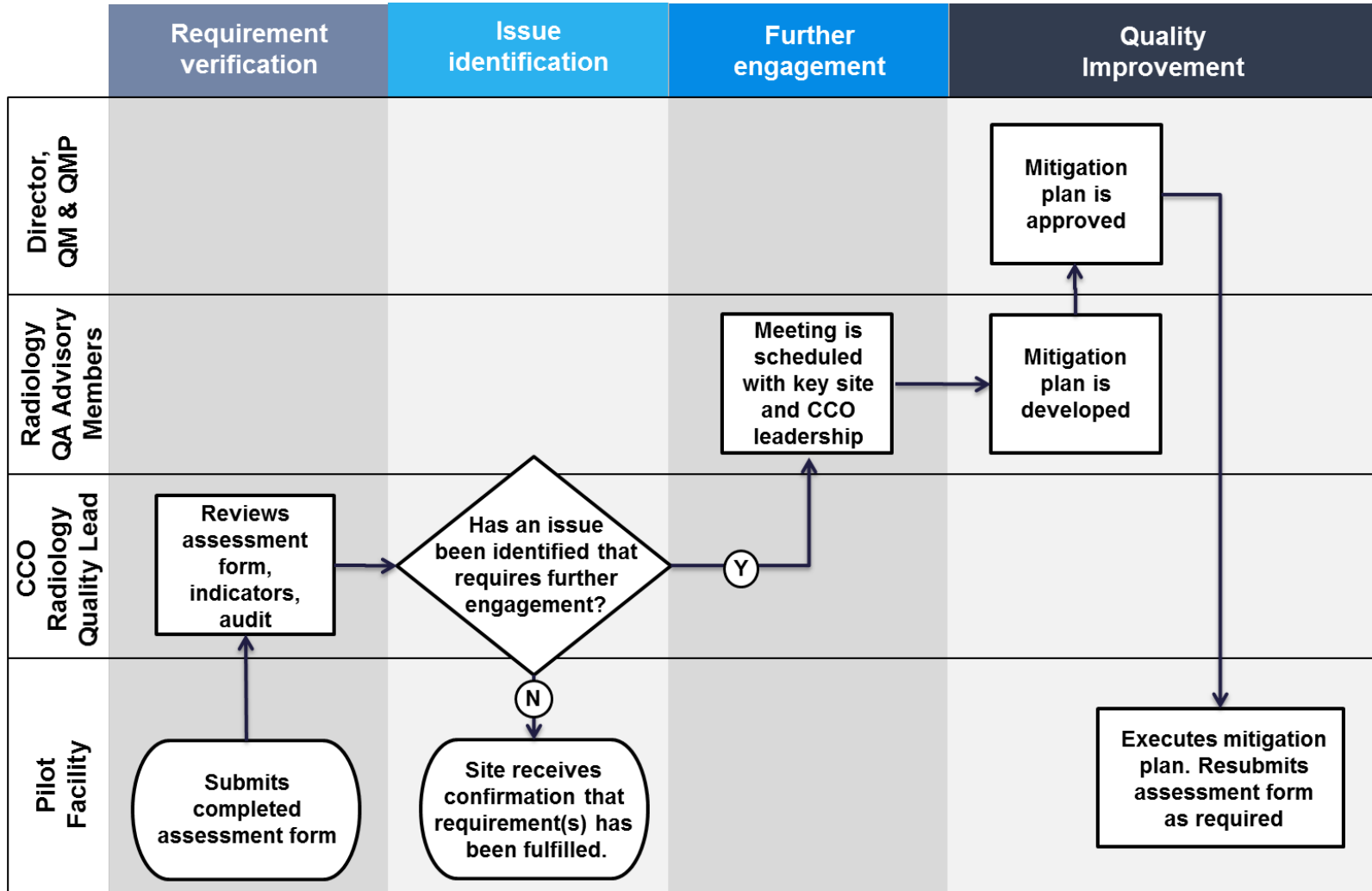
If the OH-CCO Radiology Quality Lead, in consultation with the Director QM & QMP, determines that the issue or opportunity for quality improvement requires further consultation, a meeting will be scheduled with key site leadership and Radiology QA Advisory members. This engagement serves one or more of the following purposes:

- Discuss the cause(s) of the issue and review any action plans underway;
- Offer assistance in addressing the issue; and
- Develop a mitigation plan

### **Quality improvement**

Following development and implementation of a mitigation plan, sites may be required to re-submit the appropriate assessment form to provide a record that requirement(s) have been fulfilled.

Figure 2. Radiology Quality Issues Management Process



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## Appendix A – Radiology QA Expert Panel Membership

Name	Role
Dr. Julian Dobranowski	Co-chair, Radiology QA Expert Panel Provincial Head, Cancer Imaging
Dr. Heidi Schmidt	Co-chair, Radiology QA Expert Panel Radiology Quality Lead, Ontario Lung Screening Program
Dr. Martin Tammemagi	Scientific Lead, Ontario Lung Screening Program
Dr. Anastasia Oikonomou	Radiologist
Dr. Lisa Thain	Radiologist
Dr. Carole Dennie	Radiologist
Dr. Mark Landis	Radiologist
Dr. Narinder Paul	Radiologist
Dolores Cook	MRT/Administrator
Kathy Mills	MRT/Administrator
Jerry Plastino	MRT/Administrator
Jeff Frimeth	Medical Physicist
Nicholas Shkumat	Medical Physicist

## Appendix B – Study Selection Criteria

	In Scope / Include	Out of Scope / Exclude
Interventions of Interest	<ul style="list-style-type: none"> <li>• CT scans</li> <li>• Thoracic CT scans</li> <li>• Lung screening LDCT scans</li> </ul>	<ul style="list-style-type: none"> <li>• CT scans for specific areas of the body other than the chest and lungs</li> <li>• Contrast agents</li> <li>• Cardiac imaging</li> <li>• Mammography</li> </ul>
Quality Assurance Domains	<ul style="list-style-type: none"> <li>• Facilities</li> <li>• Equipment Personnel</li> </ul>	<ul style="list-style-type: none"> <li>• Radiologist report content standards</li> </ul>
Professionals of Interest	<ul style="list-style-type: none"> <li>• Medical Radiation Technologist (MRTs)</li> <li>• Radiologists</li> <li>• Radiology Residents</li> <li>• Radiology Fellows</li> </ul>	<ul style="list-style-type: none"> <li>• Medical Physicists</li> </ul>
Type of Documents	<ul style="list-style-type: none"> <li>• Standards</li> <li>• Guidelines</li> </ul>	<ul style="list-style-type: none"> <li>• Publication of primary research</li> <li>• Position papers</li> </ul>
Publication Characteristics	<ul style="list-style-type: none"> <li>• Publishes</li> <li>• Grey Literature</li> </ul>	
Timeframe	<ul style="list-style-type: none"> <li>• 2006 to present</li> </ul>	<ul style="list-style-type: none"> <li>• Before 2006</li> </ul>
Jurisdiction	<ul style="list-style-type: none"> <li>• Canada, United States, United Kingdom, Europe, Australia, and New Zealand</li> </ul>	<ul style="list-style-type: none"> <li>• Any other locations</li> </ul>
Population for Screening	<ul style="list-style-type: none"> <li>• Adults</li> </ul>	<ul style="list-style-type: none"> <li>• Pediatrics</li> </ul>
Language of Publication	<ul style="list-style-type: none"> <li>• English</li> </ul>	<ul style="list-style-type: none"> <li>• Any language other than English</li> </ul>



## Appendix C - LDCT Lung Cancer Screening Protocol

<b>Clinical Indication</b>	Lung Cancer Screening for People at High Risk							
<b>Protocol Code</b>	Lung Cancer Screening for people at High Risk							
<b>Contrast</b>	None							
<b>CT Technique Without IV Contrast</b>	<b>Small Patient - CTDI 1.46 mGy</b>							
	kV	mA ASiR 40%	Scan type Rotation time	Scan Thickness (mm)	Scan mode	Speed (mm)	Recon Thickness (mm)	Algo
	100	60	0.5	1.5mm	0.984:1	39.37	1.25 Axial 2 Cor sag Lung 7X3 ax mip	LUNG & STD

<b>Medium Patient – CTDI 2.31 mGy</b>							
kV	mA ASiR 40%	Scan type Rotation time	Scan Thickness (mm)	Scan mode	Interval (mm)	Recon Thickness (mm)	Algo
120	60	0.5	1.5 mm	0.984:1	39.37	1.25 Axial 2 Cor sag Lung 7X3 ax mip	LUNG & STD
<b>Large Patient – CTDI 3.08 mGy</b>							
kV	mA	Scan type Rotation time	Scan Thickness (mm)	Scan mode	Speed (mm)	Recon Thickness (mm)	Algo
120	80	0.5	1.5 mm	0.984:1	39.37	1.25 Axial 2 Cor sag Lung 7X3 ax mip	LUNG & STD
<b>Comment</b>	Scan thickness should be $\leq 1.5$ mm. Typically 1.0 mm 1.5mm Axial in both Std and Lung recons 2mm Cor and Sag MPR in Lung 7 x 3 mm Axial MIP Lung recons If available, dose reduction techniques should be used whenever possible <b>Low dose lung cancer screening, maximum CTDI is 3 mGy</b>						

CT scanner setting and protocols are not standardized and therefore some parameters may be slightly different based on the machine(s) used at facilities.

## Appendix D – Quality Control Testing Program

As per CPSO’s IHF Clinical Practice Parameters and Facility Standards: MRI & CT, facilities should perform daily, monthly, and annual quality control testing of the CT machine according to the American College of Radiology (ACR), outlined below:

<b>Daily</b>	<ul style="list-style-type: none"> <li>a) Water CT Number and Standard Deviation</li> <li>b) Artifact Evaluation</li> </ul>
<b>Monthly</b>	<ul style="list-style-type: none"> <li>a) Visual Checklist</li> <li>b) Acquisition Display Monitor QC</li> </ul>
<b>Annually</b>	<ul style="list-style-type: none"> <li>a) Review of Clinical Protocols</li> <li>b) Scout Prescription and Alignment Light Accuracy</li> <li>c) Image Thickness</li> <li>d) Table Travel Accuracy</li> <li>e) Radiation Beam Width</li> <li>f) Low-Contrast Performance</li> <li>g) Spatial Resolution</li> <li>h) CT Number Accuracy</li> <li>i) Artifact Evaluation</li> <li>j) CT Number Uniformity</li> <li>k) Dosimetry</li> <li>l) Gray Level Performance of CT Acquisition Display Monitors</li> </ul>

ACR also indicates that a Qualified Medical Physicist (QMP) be both involved in developing the quality control program, and perform the annual testing. The National QMP Registry acts as a central location to confirm the qualifications of board certified medical

physicists. If you wish to seek out a QMP, then we suggest using the search engine in the following link: <http://qmp.crcpd.org/>. The QMP must meet the following minimum criteria:

Qualifications	Medical Physicist
Initial	<p style="text-align: center;"><b><u>Board Certified</u></b></p> <p>Certified in Diagnostic Radiological Physics or Radiological Physics by the American Board of Radiology; in Diagnostic Imaging Physics by the American Board of Medical Physics; or in Diagnostic Radiology Physics by the Canadian College of Physics in Medicine</p> <p style="text-align: center;"><b>OR</b></p> <p style="text-align: center;"><b><u>Not Board Certified in Required Subspecialty</u></b></p> <ul style="list-style-type: none"> <li>• Graduate degree in medical physics, radiologic physics, physics, or other relevant physical science or engineering discipline from an accredited institution, and</li> <li>• Formal coursework in the biological science with at least             <ul style="list-style-type: none"> <li>- 1 course in biology or radiation biology and</li> <li>- 1 course in anatomy, physiology, or similar topics related to the practice of medical physics</li> </ul> </li> <li>• 3 years of documented experience in a clinical CT environment</li> </ul>



	<p style="text-align: center;"><b>OR</b></p> <p style="text-align: center;"><b><u>Grandfathered</u></b></p> <p>Conducted surveys of at least 3 CT units between January 1, 2007 and January 1, 2010</p>
<b>Continuing Experience</b>	Upon renewal, 2 CT unit surveys in prior 24 months
<b>Continuing Education</b>	Upon renewal, 15 CEU/CME (1/2 Cat 1) in prior 36 months (must include credits pertinent to the accredited modality)

