Ontario Lung Screening Program

Radiology Quality Assurance Program Manual

SEPTEMBER 2024

For any questions, please contact
cancerscreening@ontariohealth.ca

Ontario Health
Cancer Care Ontario

Table of Contents

1.0 Introduction

Ontario Lung Screening Program

In 2017, Ontario Health (Cancer Care Ontario) launched an initiative to pilot organized lung cancer screening using low dose computed tomography (LDCT) for people at high risk for lung cancer. The goal of the pilot was to determine how best to implement organized lung cancer screening programs that optimize outcomes and processes for patients at high risk. The organized screening pathway consists of five main phases: recruitment, risk assessment, screening, diagnosis, and treatment. The pilot transitioned to the Ontario Lung Screening Program (OLSP) in April 2021. Hospitals that participated in the pilot continue to provide screening as part of the OLSP. Provincial program expansion is currently underway.

Defining and Measuring Quality in Radiology

The Radiology Quality Assurance (QA) Program was developed to ensure LDCT is performed and interpreted according to consistent 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., radiologists, medical radiation technologists), equipment, and facilities. The program also outlines assurance processes to ensure that quality requirements have been fulfilled.

The importance of setting quality requirements in Radiology

There is increasing focus provincially to enhance the quality and safety of all diagnostic imaging in Ontario. Ontario Health's Cancer Imaging Program works to improve quality for cancer imaging through priority initiatives, taking a patient-centred approach to improve patient outcomes and optimize system resources.

The Radiology QA Program aims to build on existing efforts and set a foundation that defines quality for imaging performed to screen for lung cancer. It has been developed to align with broader diagnostic imaging quality initiatives, including Ontario Health's province-wide peer review recommendations for diagnostic imaging (Health Quality Ontario).

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

2.0 Radiology QA Program Review

The Radiology QA Program supports the definition, implementation, and adoption of requirements to ensure LDCTs are performed and interpreted according to quality standards. This is achieved by establishing quality standards, processes, and clear accountability expected across all sites.

Guiding Principles

The Radiology QA Program is based on the following four components essential for effective quality management: quality defined, quality assurance, quality reporting and quality improvement.

Components of the Radiology QA Program

(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 QA Expert Panel, convened by Ontario Health (Cancer Care Ontario), reviewed existing evidence and standards 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 LDCTs 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. Sections 4.1 to 5.2 outline the requirements that must be met for equipment, facilities, and personnel (QA Facility Leads, radiologists, medical radiation technologists (MRTs) as well as residents and fellows).

(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 are 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 is responsible for ensuring that quality requirements have been fulfilled at their respective site.

The Ontario Health Radiology QA Lead is responsible for verifying that 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 section 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 improvement opportunities at the site level. For more information on quality reporting, see section 6.0 Assuring Quality.

(d) Quality Improvement

The Radiology QA Program for the OLSP aims to support and foster a culture of continuous quality improvement for sites that do not meet radiology quality assurance requirements. For information, see section 6.0 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 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 and 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 randomized control trials, 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. 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
- Ontario Health (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 Radiology Requirements

Radiologists

Degrees and Certifications

Radiologists performing or interpreting LDCT examinations for the 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 by the Royal College of Physicians and Surgeons of Canada in Diagnostic Radiology or international equivalent and have a certificate of registration to practice in Ontario.

Minimum Volumes Interpreted

Setting a standard for minimum 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

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

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

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 lung screening CT exams over the previous 12 months.

Exceptions to this requirement are to be considered (e.g., sabbatical, maternity leave) by the Ontario Health Radiology QA 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. 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. CPD specific to lung cancer screening is recommended.

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

Radiology QA Facility Lead Qualifications

Radiology QA Facility Leads are key individuals who will monitor and oversee quality at the OLSP sites. All Radiology QA Facility Leads are practicing radiologists that are accountable to their local facility as per current accountability and legislative requirements, and responsible to the Ontario Health Radiology QA Lead to foster accountability and support quality assurance at their respective sites. 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.

Training for OLSP

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.

Within 12 months prior to participating in the OLSP, radiologists must successfully complete the Canadian Association of Radiologists (CAR)/Canadian Society of Thoracic Radiology (CSTR) Course, QUEST: Introduction to Lung Cancer Screening. Exceptions to this requirement are to be considered on a case-by-case basis (e.g., radiologists with prior experience through participation in national and international lung cancer screening clinical trials and/or prior participation as faculty in the OLSP Radiology Continuing Professional Development (CPD) Workshop development and workshops).

Additionally, supplementary specialized content provided by Ontario Health (i.e., through a webinar or recording) will need to be completed. This webinar will provide an overview of the key components of the Radiology QA Program and use of the standardized OLSP LDCT Lung Cancer Screening Reporting Template.

Source: Expert panel consensus decision with guidance from Canadian Association of Radiologists, 2017.

Double Read of Positive Cases

Radiologists participating in the OLSP must have their first 15 positive LDCT lung cancer screening interpretations (Lung-RADS® 3 or 4) double-read by a peer-matched site radiologist, to ensure quality assurance of radiological interpretation. Any discrepancies that remain unresolved as per the facility's existing peer review process should be brought to the Ontario Health Radiology QA Lead for

adjudication. Opportunities to improve reporting quality at a facility level will be provided through monthly and quarterly facility-level reports, as outlined in section 6.0.

Source: Expert panel consensus decision with guidance from Health Quality Ontario, 2016 and Canadian Association of Radiologists, 2012.

Report Requirements

Report Completeness

The interpretation of the 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 providers to act on radiologists' assessments.

Radiologists participating in the OLSP must complete all required fields of the Ontario Health OLSP Lung Cancer Screening Reporting Template for OLSP participants.

Source: Expert panel consensus decision.

Report Turnaround Time

Timely access to screening results is essential for high-quality care. As per the OLSP policies, all scan results should be communicated to participants within 14 days. Note, the provincial benchmark for report turnaround time (time from radiologist review of results to signing the report of the procedure) is 5 days for adult CT.

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

Use of CAD Software

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, 2017.

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).

All participating sites should have a peer review or peer learning process in place and OLSP LDCT cases should be incorporated into this process.

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 Ontario Health Radiology QA Lead for resolution.

Source: Expert panel consensus decision with guidance from Canadian Association of Radiologists, 2012 and 2022, and Ontario Health (Health Quality Ontario), 2023.

4.2 Personnel Requirements

Radiology Residents and Fellows

Degrees/Certifications

Residents and fellows performing or interpreting LDCT scans for OLSP must meet qualifications and licensing requirements outlined by The College of Physicians and Surgeons of Ontario.

Source: Expert panel consensus decision.

Supervision

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.

Training Recommendation

Residents and fellows performing or interpreting LDCT scans for the OLSP are encouraged to complete the CAR/CSTR Course, QUEST: Introduction to Lung Cancer Screening during their training.

Source: Expert panel consensus decision.

Medical Radiation Technologists

Degrees/Certifications

All Medical Radiation Technologists (MRTs) performing LDCT scans for the OLSP must meet qualifications outlined in College of Medical Radiation and Imaging Technologists 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 College of Medical Radiation and Imaging Technologists of Ontario.

Source: College of Medical Radiation and Imaging Technologists of Ontario.

Continuing Education

Participating in continuing education provides medical professionals with opportunities to improve healthcare practice (Forsetlung, 2009). All MRTs performing LDCT scans for the OLSP must meet requirements for continuing education, as outlined by the College of Medical Radiation and Imaging Technologists of Ontario.

Source: College of Medical Radiation and Imaging Technologists of Ontario, 2020.

4.3 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 LDCT Ontario Lung Cancer Screening Protocol (adapted from The American Association of Physicists in Medicine (AAPM)) (Appendix C).

Source: American Association of Physicists in Medicine, 2019.

PACS: Storage of Images

Storage and retrieval of digital images is an integral component of a screening program as it ensures 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. LDCT Ontario 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 to remain safe and effective.

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

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

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.

4.4 Facility Requirements

Administration of the 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 Ontario Health Radiology QA Lead as required.

Source: Expert panel consensus decision.

Protocol Compliance

The LDCT Ontario 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 comply with the Ontario Health 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 programs.

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

5.0 Assuring Quality

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

How quality is assessed

Personnel, equipment, and facility requirements are assessed for adherence through either site sign-off, indicator review, or audit completion (Appendix E). The Ontario Health Radiology QA Lead is 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 Leads 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 Ontario Health for verification by the Ontario Health Radiology QA Lead. See Appendix E for more information on requirements that are measured through site sign-off. The corresponding assessment form and requirement check frequency is also presented.

Audit

Audit(s) may be conducted to evaluate requirements that cannot currently be measured through indicators or site sign-off, e.g., report completeness.

Indicators

Indicators are measures of quality that are used with facility-provided data to measure and track performance. For the OLSP, indicators are used to signal issues related to image quality and interpretation. Radiology quality assurance indicators and other indicators that pertain to radiology are collected and reported at a facility level. See section on Facility-level Reports below for an overview of indicators that pertain to radiology.

Requirement verification

Assessment forms, audit results, and indicators are reviewed by the Ontario Health Radiology QA Lead to ensure that requirements have been fulfilled and to identify opportunities for follow-up.

Reporting quality achievement 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 is 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 that requirements have been met or opportunities for quality improvement have been identified. Sites are actively engaged when issues or opportunities for quality improvement have been identified. For more information on Radiology Quality Issues Management Process, see section 7.0 Radiology QA Governance Model and Radiology Quality Issues Management Process.

Facility-level Reports

Facility-level reports will include indicators that pertain to radiology outcomes, as well as radiology quality assurance (e.g., CT wait times), as outlined in the OLSP Reporting Plan. All sites participating in the OLSP will receive regular reports to support identification of opportunities to improve quality at a facility level. Facility-level reports are issued monthly and quarterly. Radiology QA Indicators that are included in Facility-level reports include:

- Proportion of LDCT scans stratified by Lung-RADS® score (0, 1, 2, 3, 4A, 4B, or 4X).
- Proportion of LDCT scans with actionable incidental findings detected.

Additional Radiology QA indicators will be included on an ad-hoc bases or annual basis, and could include:

- CT wait time from recruitment to the date the LDCT is performed.
- Lung cancer detection rate.

6.0 Radiology QA Governance Model and Radiology Quality Issues Management Process

To ensure successful implementation and oversight, the Radiology QA Program works in collaboration with multiple stakeholder groups across the OLSP and is aligned with Ontario Health's (Cancer Care Ontario's) Performance and Issues Management Guidelines. An overview is provided in the following section.

Radiology QA Governance Model

The Radiology QA Program is integrated across multiple stakeholder groups at the provincial and site level to ensure successful implementation and oversight. Defining quality is an on-going activity and will proceed with expert clinical guidance and in consultation with stakeholders as new evidence is developed.

The Ontario Health Radiology Quality Assurance Lead will provide program oversite by reviewing and verifying that sites have fulfilled requirements, and support quality improvement efforts by following-up with sites when issues or opportunities for quality improvement have been identified.

The network of Radiology QA Facility Leads across OLSP sites can provide further support when additional engagement is required to discuss issues or opportunities for quality improvement. At the site level, the Radiology QA Facility Lead will provide oversight for the Radiology QA Program for OLSP by monitoring and overseeing quality, fostering accountability, and supporting quality assurance activities.

Radiology Quality Issues Management Process

The Radiology Quality Issues Management Process aligns with Ontario Health's (Cancer Care Ontario's) Performance and Issues Management Guidelines. This process is in place 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 this process.

Requirement Verification by Ontario Health Radiology Quality Lead

The Ontario Health Radiology Quality Lead is responsible for verifying that sites have met requirements by. The Ontario Health Radiology Quality Lead will review indicators, audit results, and assessment form(s). Sites will receive and provide confirmation they have fulfilled requirements or issues and opportunities for quality improvement have been identified.

Issue Identification

The Ontario Health Radiology Quality Lead, will initiate an appropriate follow-up which may include:

- Providing confirmation to sites that requirements have been fulfilled.
- Engaging with site leadership to discuss issues or opportunities for quality improvement.
- Engaging with Radiology QA Facility Leads and site leadership to discuss issues or opportunities for quality improvement that require further consultation.

Further Engagement

If the Ontario Health Radiology Quality Lead, determines that the issue or opportunity for quality improvement requires further consultation, a meeting will be scheduled with key site leadership and Radiology QA Facility Leads. 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.

7.0 References

American Association of Physicists in Medicine 2019. Lung Cancer Screening CT Protocols.

Canadian Association of Radiologists 2012. The CAR Guide to Peer Review Systems.

Canadian Association of Radiologists 2022. CAR Peer Learning Guide.

Canadian Association of Radiologists 2017. CAR CT lung cancer screening draft membership.

Cancer Care Ontario 2012. Cancer Imaging Program, Cancer Imaging Program, Cancer Care Ontario Strategic Directions.

D Buchanan, L Peirson 2016. Quality Assurance Standards in Lung Radiology: A Rapid Review.

EA Kazerooni, MR Armstrong, JK Amorosa, D Hernandez, LA Liebscher, H Nath, MF McNitt-Gray, EJ 2015. ACR CT accreditation program and the lung cancer screening program designation.

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

Health Canada 2006. Guidance for Records Related to Clinical Trials.

Health Quality Ontario 2016. Peer Review: A Diagnostic Imaging Quality Initiative for Ontario.

International Early Lung Cancer Action Program, 2017. I. International Early Lung Cancer Action Program: update on lung cancer screening and the management of CT screen-detected findings.

JT Norweck, JA Seibert, KP Andriole, DA Clunie, BH Curran, MJ Flynn, E Krupinski, RP Lieto, DJ Peck, TA Mian, M Wyatt 2013. ACR–AAPM–SIIM Technical Standard for Electronic Practice of Medical Imaging, J Digit Imaging, 26(1): 38-52.

L Forsetlung, A Bjørndal, A Rashidian, G Jamtvedt, MA O'Brien, FM Wolf, D Davis, J Odgaard-Jensen, AD Oxman 2009. Continuing education meetings and workshops for health professionals, Cochrane Database Syst Rev, (2):CD003030.

Stern, PA Wilcox 2015. ACR CT accreditation program and the lung cancer screening program designation, J Am Coll Radiol, 12(1): 38-42.

The College of Medical Radiation and Imaging Technologists of Ontario. Practice Essentials.

The College of Medical Radiation and Imaging Technologists of Ontario 2020. Quality Assurance Program.

The College of Physicians and Surgeons of Ontario 2020. Independent Health Facilities Clinical Practice Parameters and Facility Standards: Magnetic Resonance Imaging & Computed Tomography.

The Royal College of Radiologists 2019. Picture archiving and communication systems (PACS) and guidelines on diagnostic display devices: Third edition.

Appendix A - Radiology QA Expert Panel Membership

Table 1: 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. 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

Table 2: Study Selection Criteria

Parameter	In Scope/Include	Out of Scope/Exclude
Interventions of Interest	• CT scans • Thoracic CT scans • Lung screening LDCT scans	• CT scans for specific areas of the body other than the chest and lungs • Contrast agents • Cardiac imaging • Mammography
Quality Assurance Domains	• Facilities • Equipment Personnel	• Radiologist report content standards
Professionals of Interest	• Medical Radiation Technologist (MRTs) • Radiologists • Radiology Residents • Radiology Fellows	• Medical Physicists
Type of Documents	• Standards • Guidelines	• Publication of primary research • Position papers
Publication Characteristics	• Publishes • Grey Literature	
Timeframe	• 2006 to present	• Before 2006
Jurisdiction	• Canada, United States, United Kingdom, Europe, Australia, and New Zealand	• Any other locations
Population for Screening	• Adults	• Pediatrics
Language of Publication	• English	• Any language other than English

Appendix C - LDCT Lung Cancer Screening Protocol Example

Clinical Indication

Lung Cancer Screening for People at High Risk

Protocol Code

Lung Cancer Screening for People at High Risk

Contrast

None

CT Technique Without IV Contrast

Small Patient - CTDI 1.46 mGy

kV	mA ASiR 40%	Scan type Rotation time	Scan Thickness (mm)	Scan mode	Speed (mm)	Recon Thickness (mm)	Algo
100	60	0.5	1.25mm	0.984:1	39.37	1.25 Axial 2 Cor Sag Lung 7x3 ax min	LUNG & STD

Medium Patient - CTDI 2.31 mGy

kV	mA ASiR 40%	Scan type Rotation time	Scan Thickness (mm)	Scan mode	Speed (mm)	Recon Thickness (mm)	Algo
120	60	0.5	1.25mm	0.984:1	39.37	1.25 Axial 2 Cor Sag Lung 7x3 ax min	LUNG & STD

Large Patient - CTDI 3.08 mGy

kV	mA	Scan type Rotation time	Scan Thickness (mm)	Scan mode	Speed (mm)	Recon Thickness (mm)	Algo
120	80	0.5	1.25mm	0.984:1	39.97	1.25 Axial 2 Cor Sag Lung 7x3 ax min	LUNG & STD

Comments

- Scan thickness should be ≤ 1.5mm
- 1.25mm Axial in both STD and LUNG recons
- 2mm Coronal and Sagittal MPR in LUNG
- 7x3mm Axial MIP LUNG recons
- If available, dose reduction techniques should be used whenever possible.
- Low dose cancer screening, maximum CTDI is 3 mGy

CT scanner settings and protocols are not standardized and therefore some parameters may be slightly different based on the machines 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:

Table 3: Quality Control of CT equipment

Frequency	**Quality Control Measure**
Daily	1) Water CT Number and Standard Deviation 2) Artifact Evaluation
Monthly	1) Visual Checklist 2) Acquisition Display Monitor Quality Control
Annually	1) Review of Clinical Protocols 2) Scout Prescription and Alignment Light Accuracy 3) Image Thickness 4) Radiation Beam Width 5) Low Contrast Performance 6) Spatial Resolution 7) CT Number Accuracy 8) Artifact Evaluation 9) CT Number Uniformity 10) Dosimetry 11) Gray Level Performance of CT Acquisition Display Monitors

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, it is recommended to use the National QMP Registry. The QMP must meet the following minimum criteria:

Table 4: Minimum Criteria for Qualified Medical Physicists

Qualifications	**Medical Physicist**
Initial	**Board Certified** • Certified in Radiological Physics or Diagnostic Radiological Physics by the American Board of Radiology, OR • Certified in Diagnostic Imaging Physics by the American Board of Medical physics, OR • Certified in Diagnostic Radiology Physics by the Canadian College of Physics in Medicine OR **Not Board Certified in Required Subspecialty** • Graduate degree in medical physics, radiologic physics, physics, or other relevant physical science of engineering discipline from an accredited institution, AND • Formal coursework in the biological science with at least one course in biology or radiation biology, and one course in anatomy, physiology, or similar topics related to the practice of medical physics • Three years of documented experience in a clinical CT environment OR **Grandfathered** Conducted surveys of at least three CT units between January 1st, 2007 and January 1st, 2010.

Qualifications	Medical Physicist
Continuing Experience	Upon renewal, two CT unit surveys in prior 24 months
Continuing Education	Upon renewal, fifteen CEU/CME (1/2 Category 1) in prior 36 months (must include credits pertinent to the accredited modality).

Appendix E - Radiology requirement assessment overview

	Requirement Assessor		Requirement Check Frequency			Method for Ensuring Adherance to Requirements				
	OLSP Facility	Ontario Health (Cancer Care Ontario)	One-time	Monthly	Annual	New Radiologist Assessment Form	Initial Assessment Form	Annual Assessment Form	Indicators	Audit
Radiologist requirements										
Degrees/Certification	•		•			•	•			
Minimum Volumes Interpreted	•		•			•	•			
Training	•		•			•	•			
Continuing Medical Education	•				•			•		
Continuing Experience	•				•			•		
Peer Review	•				•			•		
Double Read of Positive Cases	•				•			•		
Report Completeness		•			•					•
Report Turnaround Time		•		•					•	
CAD Software	•				•			•		
Facility Lead requirement										
Initial Qualifications	•		•				•			
Resident/Fellow requirements										
Degrees/Certifications	•				•		•			
Supervision	•				•			•		
MRT requirements										
Degrees/Certifications	•		•				•			
Continuing Education	•				•			•		
Equipment requirements										
CT Equipment Specification	•				•		•	•		
PACS: Storage of Images	•		•				•			
Safety: Radiation Dose	•				•			•		
Installation and Shielding	•		•				•			
QC Testing	•				•		•	•		
Facility requirements										
Protocol Compliance	•				•		•	•		
Administer OLSP Radiology QA Program	•				•		•	•		
Quality Control Testing Program					•		•	•		

Need this information in an accessible format? 1-877-280-8538, TTY 1-800-855-0511, info@ontariohealth.ca.
Document disponible en français en contactant info@ontariohealth.ca