Capturing Data Elements and the Role of Imaging Informatics

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Disclosures

• None
Overview

• Lung cancer screening is relatively nascent with unanswered questions related to appropriate eligibility criteria and screening algorithm

• Implementation of a data registry is critical to collect information about patients for reimbursement and quality improvement
Objectives

1. Understand the requirements put forth by the Centers for Medicare & Medicaid Services (CMS) for lung cancer screening reimbursement
2. Discuss the ACR Lung Cancer Screening registry and required data elements
4. Illustrate an example screening data collection workflow implemented at UCLA
CMS Statement

Radiology imaging facility eligibility criteria:

• Performs LDCT with volumetric CT dose index (CTDvol) of ≤ 3.0 mGy for standard size patients (5’ 7”, 155 pounds) with reductions in CTDvol for smaller patients and increases in CTDvol for larger patients;

• Utilizes a standardized lung nodule identification, classification and reporting system;

• Makes available smoking cessation interventions for current smokers; and

• Collects and submits data to a CMS-approved registry for each LDCT lung cancer screening performed.
## CMS Statement

<table>
<thead>
<tr>
<th>Data Type</th>
<th>Minimum Required Data Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facility</td>
<td>Identifier</td>
</tr>
<tr>
<td>Radiologist (reading)</td>
<td>National Provider Identifier (NPI)</td>
</tr>
<tr>
<td>Patient</td>
<td>Identifier</td>
</tr>
<tr>
<td>Ordering Practitioner</td>
<td>National Provider Identifier (NPI)</td>
</tr>
<tr>
<td>CT scanner</td>
<td>Manufacturer, Model</td>
</tr>
<tr>
<td>Indication</td>
<td>Lung cancer LDCT screening – absence of signs or symptoms of lung cancer</td>
</tr>
<tr>
<td>System</td>
<td>Lung nodule identification, classification and reporting system</td>
</tr>
<tr>
<td>Smoking history</td>
<td>Current status (current, former, never). If former smoker, years since quitting. Pack-years as reported by the ordering practitioner. For current smokers, smoking cessation interventions available.</td>
</tr>
<tr>
<td>Effective radiation dose</td>
<td>CT Dose Index (CTDlvol).</td>
</tr>
<tr>
<td>Screening</td>
<td>Screen date</td>
</tr>
<tr>
<td></td>
<td>Initial screen or subsequent screen</td>
</tr>
</tbody>
</table>
ACR Lung Cancer Screening Registry

• First lung cancer screening registry approved by CMS
• Launching in 2015, accepting site registrations
• Participant responsibilities
  • Furnish data for a twelve (12) month period
  • Provide data for all eligible patients and exams to ACR
  • Submit follow-up information
  • Data from Medicare patients will be sent to CMS for validation
  • Format to be specified by the ACR
  • A Facility Administrator should be identified
  • Plans for ensuring data quality and security must be in place

http://www.acr.org/Quality-Safety/National-Radiology-Data-Registry/Lung-Cancer-Screening-Registry
LCSR: Key Data Elements

- Facility
  - Facility ID, Medicare NPI
- Patient information
  - SSN, Medicare ID, birthdate
- Patient demographics
  - Sex
- Smoking history
  - Current status, number of packs-year, years since quit
- Shared decision making
  http://www.shouldiscreen.com/

- Clinical information at time of exam
  - Height/weight
- Study data
  - Radiologist NPI, Ordering NPI, exam date, signs or symptoms, indication,
- Follow-up
- Additional risk factors (optional)
  - Education, occupational exposures, family history
LUNG CANCER SCREENING

Things you should know about lung cancer screening

Q1. WHAT IS LUNG CANCER CT SCREENING?

Lung cancer screening uses low-dose computed tomography (LDCT) i.e. a CT scan with a low dose of radiation, to find lung nodules, some of which may be cancer. People who take part in screening can lower their chances of dying from lung cancer.

http://www.shouldiscreen.com/
Given your age and smoking history, you are **not eligible** for screening according to the US Preventive Services Task Force criteria.

The chance of you developing lung cancer in the next 6 years is 0.5%. Talk to your doctor about the option to screen or not to screen as s/he will understand your situation best.

Your Risk = 0.5%
LCSR: Exam Elements

• CT scanner
  • Manufacturer
  • Model
• Radiation exposure
  • CTDIvol (mGy)
  • DLP (mGy*cm)
    • Tube current-time (mAs)
    • Tube voltage (kV)
    • Scanning time (s)
    • Scanning volume (cm)
  • Pitch
  • Reconstructed image width (mm)

• Additional elements
  • CT exam result by Lung-RADS category
  • Reason for recall (if Lung-RADS category 0)
  • Other clinically significant or potentially significant abnormalities
    • Other findings
      • Other interstitial lung disease
      • Prior history of lung cancer
      • Years since prior diagnosis of lung cancer

* Optional elements
Structured Reporting

**Radiation Dose Structured Report**

- Accumulated dose data
  - CT dose length product
- Acquisition parameters
  - Exposure time, scanning length, collimation width, pitch factor, number of x-ray sources
- X-ray source parameters
  - KVP, maximum x-ray tube current, exposure time per rotation
- CT dose
  - Mean CTDIvol

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### NEMA Radiation Dose CT Template

<table>
<thead>
<tr>
<th>Series</th>
<th>Type</th>
<th>Scan Range (mm)</th>
<th>CTDIvol (mGy)</th>
<th>DLP (mGy-cm)</th>
<th>Phantom cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Scout</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>Helical</td>
<td>157.50–1650.250</td>
<td>5.10</td>
<td>373.00</td>
<td>Body 32</td>
</tr>
<tr>
<td>5</td>
<td>Helical</td>
<td>188.000–1105.000</td>
<td>5.10</td>
<td>182.72</td>
<td>Body 32</td>
</tr>
</tbody>
</table>

**Total Exam DLP**: 555.72
EXAM: CT LUNG LOW DOSE W/O CONTRAST
COMPARE: Prior chest CT angiogram dated ______
HISTORY: Baseline lung screen. 62-year-old male former smoker of 50 pack-years.
TECHNIQUE: A low dose helical CT CHEST was performed on a Siemens definition AS multi-detector scanner. The chest was studied in helical mode with prospective reconstructions of 1 and 3 mm slice thickness at dFOV = 34 cm. Coronal and sagittal MIPS were reconstructed from the axial images.
NOTE: This study was performed for the specific purposes of lung cancer screening and is not an alternative to diagnostic chest CT.
RADIATION DOSE: 1 Volumetric series was performed for this exam.
CTDlvol (CT dose Index-volume) = 2.5 mG
DLP (Dose Length Product) = 80 mG cm

FINDINGS:
Indeterminate or Suspicious Lung Nodules (Category 3-4B): None
Indeterminate/Non-actionable Nodules (Category 2): Present
Two small nodules in RLL. These were not visible previously due to lung collapse. Representative locations:
Solid nodule less than 4 mm in subpleural right lower lobe (2-263)
Solid micronodule in subpleural RLL (2-249)
Benign nodules (Category 1): Scattered calcified granulomas in right upper, right middle, and both lower lobes.

LUNG PARENCHYMA
Emphysema: Trace centrilobular emphysema, upper lobe predominant
Airways disease: Mild bronchial wall thickening and ectasia of medium-sized airways, particularly in the lower lobes
Fibrosis: Surgical microstaple line juxtadiaphragmatic right base with linear, band like scarring in right middle lobe

OTHER ANATOMIC REGIONS
Lymph Nodes: Small calcified and noncalcified prevascular, right paratracheal, right hilar and interlobar lymph nodes
Pleura: Minor right pleural thickening
Cardiac: Heart size normal. Pericardium normal. No significant coronary artery calcifications.
OTHER FINDINGS: None

IMPRESSION:
1. Lung Cancer Screening: LungRADS Category 2, Benign appearing (non-actionable) nodule(s).
These types of nodules are commonly observed and require no immediate action. Current recommendations for eligible high risk individuals (criteria below) are routine annual screening with low dose CT.
2. Post inflammatory/infarct scarring in RML.
Standardized Assessment

Lung-RADS Categories

• Incomplete — Category 0
  • Additional imaging needed

• Negative/Benign — Categories 1 & 2
  • Continue annual screening

• Probably benign — Category 3
  • 6 month LDCT

• Suspicious — Categories 4A/B
  • 4A: 3 month LDCT; PET/CT when ≥ 8 mm solid component exists
  • 4B: Chest CT w/wo contrast, PET/CT and/or biopsy
Implementation Tools

- Vendors now have commercial software solutions to facilitate reporting and tracking
  - ACR screening registry compliance
  - Lung-RADS compliance
  - Ability to track recall/follow-up exams
  - Support for entering pathology information
  - Support for Radiation Dose Structured Report
  - Integration with computer aided detection tools
Data Collection at UCLA

- **Patient Questionnaire**
  - Paper-based Scantron
  - Demographics, signs or symptoms, smoking history, environmental factors, cancer and family history
  - Shortened questionnaires to be given during follow-up exams

- **Lung Screening Registry**
  - Capture Lung-RADS categories and findings
  - Track individual nodules longitudinally

- **Archive raw imaging from scanner**
  - To evaluate reconstruction quality

- **Investigating software tracking solutions**
# Quality Improvement Metrics

- Breakdown of Lung-RADS score
  - # of diagnostic tests performed
  - # of complications
- Histology vs. screening result
  - Type of 1st line treatment vs. lung cancer stage
  - Long term outcomes

<table>
<thead>
<tr>
<th>Screen Results</th>
<th>Total</th>
<th>Lung-RADS 1</th>
<th>Lung-RADS 2</th>
<th>Lung-RADS 3</th>
<th>Lung-RADS 4A</th>
<th>Lung-RADS 4B Imaging only</th>
<th>Lung-RADS 4B Biopsy ± Imaging</th>
<th>Variance FU imaging</th>
<th>Variance Biopsy</th>
</tr>
</thead>
<tbody>
<tr>
<td>USPSTF Eligible Screenees</td>
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<td>Expanded Eligibility Screenees</td>
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<tr>
<td>Total Screens Performed</td>
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<tr>
<td>Screen-detected Lung Cancers</td>
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<tr>
<td>Interval lung cancers</td>
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Summary

• Lung cancer screening programs need to collect data on all enrolled patients related to the quality of the program
• Routine review of the data collected should be performed
  • Consistency of Lung-RADS assessments
  • Quality of the generated images
• Open questions regarding screening
  • Appropriateness of eligibility criteria, dose/reconstruction quality, risk stratification
  • Need for consistent, centralized reporting

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