
Capturing Data Elements and the Role of Imaging Informatics

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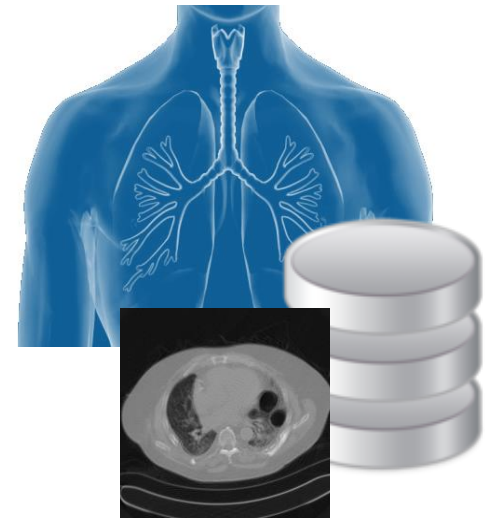
Disclosures

- 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
3. Motivate structured reporting for lung cancer assessment: Radiation Dose SR, LungRADS
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 (CTDIvol) of ≤ 3.0 mGy for standard size patients (5' 7", 155 pounds) with reductions in CTDIvol for smaller patients and increases in CTDIvol 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

Data Type	Minimum Required Data Elements
Facility	Identifier
Radiologist (reading)	National Provider Identifier (NPI)
Patient	Identifier
Ordering Practitioner	National Provider Identifier (NPI)
CT scanner	Manufacturer, Model
Indication	Lung cancer LDCT screening – absence of signs or symptoms of lung cancer
System	Lung nodule identification, classification and reporting system
Smoking history	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.
Effective radiation dose	CT Dose Index (CTDIvol).
Screening	Screen date Initial screen or subsequent screen



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



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

ABOUT LUNG CANCER & SCREENING

WHAT IS LUNG CANCER SCREENING

BENEFITS AND HARMS OF SCREENING

COMPARED TO OTHER TESTS

CAUSES OF LUNG CANCER

PACK YEAR CALCULATOR

REDUCING RISK OF LUNG CANCER

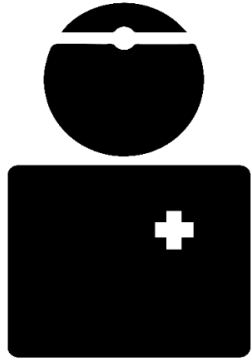
CALCULATE MY LUNG CANCER RISK

Things you should know about lung cancer screening

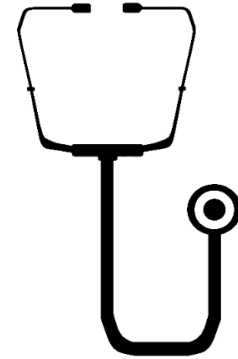
Q1. WHAT IS LUNG CANCER CT SCREENING?

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.

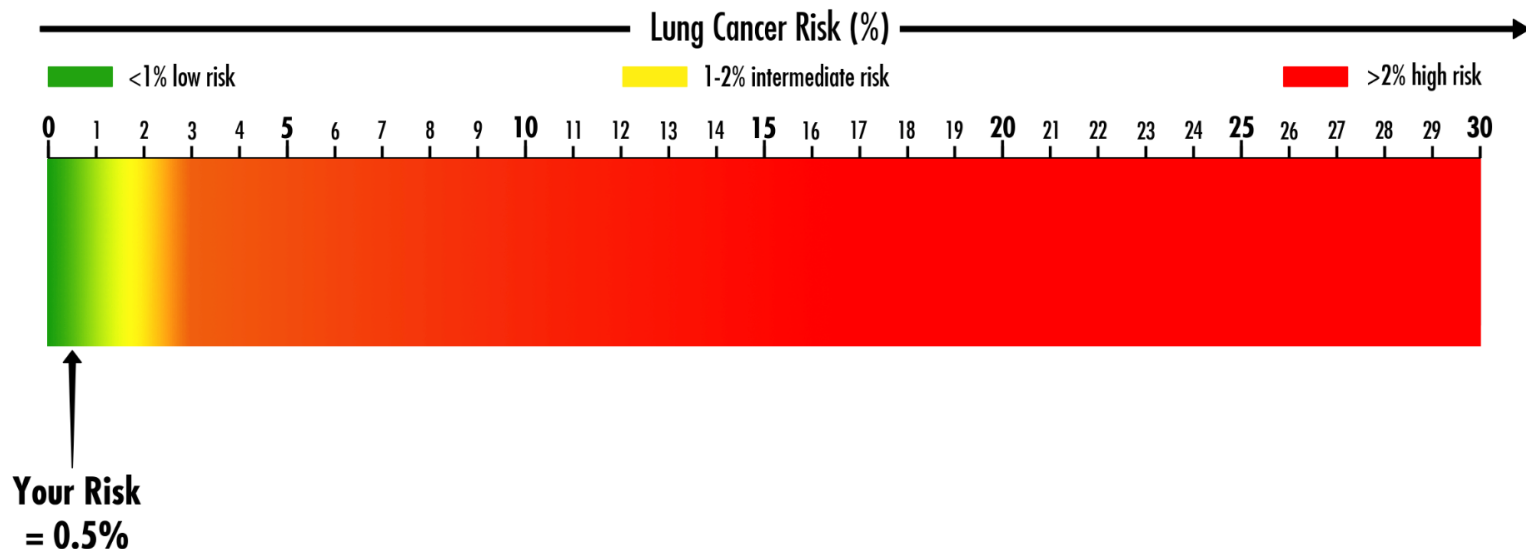




Given your age and smoking history,
you are **not eligible** for screening
according to the US Preventive Services
Task Force criteria.



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.



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

Structured Reporting

D Clunie, AAPM 2013

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

Patient Name:			Exam no:		
Accession Number:			Discovery CT750 HD		
Patient ID:			Discovery CT750 HD		
Exam Description: CT HALS/THORAX/ABDOMEN					
Dose Report					
Series	Type	Scan Range (mm)	CTDIvol (mGy)	DLP (mGy-cm)	Phantom cm
1	Scout	-	-	-	-
2	Helical	\$15.750-1650.250	5.10	373.00	Body 32
5	Helical	\$188.000-1105.000	5.10	182.72	Body 32
Total Exam DLP:				555.72	

	NL	Rel with	VT	Concept Name	VM	Req
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	NL	Rel with Parent	VT	Concept Name	VM	Req Type
1			CONTAINER	EV (113811, DCM, "CT Accumulated Dose Data")	1	M
2	>	CONTAINS	NUM	EV (113812, DCM, "Total Number of Irradiation Events")	1	M
3	>	CONTAINS	NUM	EV (113813, DCM, "CT Dose Length Product Total")	1	M
4	>	CONTAINS	NUM	EV (113814, DCM, "CT Effective Dose Total")	1	U

NEMA Radiation Dose CT Template



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Structured Reporting

EXAM: CT LUNG LOW DOSE WO 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.

CTDIvol (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.

Lung Cancer Screening Report

- Exam description / radiation dose
- Indeterminate or suspicious nodules (Category 3-4B)
 - Location, longest/shortest diameter, consistency, margin, evolution
- Benign appearing/non-actionable (Category 2)
 - Location, size, consistency, evolution
- Lung parenchyma
- Other anatomic regions
- Conclusions / recommendations



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

UCLA LUNG QUESTIONNAIRE

Directions: This survey gives your doctor information about conditions that may affect your lung health or risk of cancer. Please answer questions by darkening the appropriate circles with a blue/black ink pen and print clearly in UPPERCASE letters.

Date: -- --- MM-DD-YYYY

Patient Identifier (3.5" x 3.5")

A. DEMOGRAPHIC INFORMATION

Age years old Weight lbs Height ft in

Sex ☐ Male ☐ Female

Race ☐ White ☐ Black / African American ☐ Unknown / Prefer not to Answer
☐ Asian ☐ Native Hawaiian / Pacific Islander
☐ American Indian / Alaska Native ☐ More than one race

Ethnicity ☐ Non-Hispanic or Latino ☐ Hispanic or Latino ☐ Unknown / Prefer not to Answer

Education ☐ Less than high school graduate ☐ College graduate ☐ Unknown / Prefer not to Answer
☐ High school graduate or GED ☐ Some college or technical school
☐ Some training after high school ☐ Postgraduate

B. SIGNS OR SYMPTOMS Please indicate whether you NOW or have experienced any of the following in the last 2 months:

☐ Blood in sputum ☐ Loss of appetite
☐ Chest pain ☐ New or changing cough
☐ Fatigue or weakness ☐ Shortness of breath
☐ Fevers/Chills ☐ Wheezing
☐ Headache ☐ Unexpected weight loss greater than 10 pounds
☐ Hoarseness / Change in voice ☐ I have NO SIGNS OR SYMPTOMS

C. CIGARETTE SMOKING HISTORY

1. Describe your present cigarette smoking status. ☐ Never smoker (less than 100 cigarettes in my life)
☐ Prior smoker (quit more than 1 month ago)
☐ Current smoker (at least 1 cigarette daily)

2. Is there now or has there ever been a smoker in your household? ☐ NO ☐ YES ☐ UNKNOWN

If you indicated that you currently or previously smoked cigarettes, please answer the following. Otherwise, skip to D.

3. At what age did you regularly start smoking cigarettes (smoking at least once a day)? years old

4. For how many years have/did you smoke regularly (at least 1 cigarette daily)? years

5. Over the entire time that you have smoked, what is the average number of cigarettes you smoke/did smoke per day? cigarettes/day

6. Over the entire time that you have smoked, what is the highest number of cigarettes you smoke/did smoke per day? cigarettes/day

7. If you no longer smoke, at what age did you quit smoking? years old

D. PARTICIPATION IN THE UCLA LUNG REGISTRY

May we contact you about joining the UCLA Lung Registry, a project to collect information on individuals seen as patients at UCLA who are either at risk of lung cancer, or have the diagnosis of lung cancer? ☐ NO ☐ YES

Form Version 2014-05

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Quality Improvement Metrics

Screen Results	Total	Lung-RADS 1	Lung-RADS 2	Lung-RADS 3	Lung-RADS 4A	Lung-RADS 4B Imaging only	Lung-RADS 4B Biopsy ± Imaging	Variance FU imaging	Variance Biopsy
USPSTF Eligible Screenees									
Expanded Eligibility Screenees									
Total Screens Performed									
Screen-detected Lung Cancers									
Interval lung cancers									

- 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



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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