Radiology Workload and Follow-up Considerations

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Outline

• Startup phase
• Ongoing phase
• Comments
Startup Phase

- Assess institutional support
- Create a plan
- Hire personnel
- Set up the electronic medical record (EMR)
- Meet radiologic qualifications
- Make final preparations
Assess Institutional Support

- Radiology chairperson
- Primary care
- Lung cancer specialists
- Hospital /clinic administration
Create a Plan

- Create interdisciplinary team
- Create or choose SDM materials
- Create system for patient flow & follow-up
- Create a business plan
- Obtain institutional support
Hire Personnel

• Program coordinator (0.5-1.0 FTE)
  – Review, schedule, phone, database

• Administrative assistant (0.5-1.0 FTE)
  – Help program coordinator

• Administrative director
  – Oversee LCS operations and budget

• Computer programmer
  – PACS, EMR, LCS databases
Set up EMR

- Assessing/documenting patient eligibility
- Documenting SDM and smoking cessation
- Ordering & scheduling screening and follow-up exams
Meet Radiologic Qualifications

- Obtain LCS training (includes Lung-RADS)*
- Set up CT screening protocol*
- Obtain ACR LCS Designation*
- Enroll ACR LCS Registry*
- Create CT LCS reporting template
- Purchase software and build LCS database

*www.acr.org/Quality-Safety/Resources/Lung-Imaging-Resources
Make Final Preparations

- Set up hospital/clinic billing system
- Prepare for questions about LCS program
- Announce LCS program to providers & public
Ongoing Phase

- Handle inquiries from patients/providers
- Review screening requests
- Schedule screening exams
- Interpret screening exams
- Communicate results to patients/providers
- Schedule and track follow-up exams
- Manage database
Handle Inquiries

• General information about LCS
• Patient-specific information about LCS
• Insurance coverage and costs to patients
Review Screening Requests

• Is patient eligible?
  – Age 55-77 years?
  – Asymptomatic?
  – Smoking history?
  – Significant co-morbidity?
  – No chest CT within last year?
  – SDM (willing and able)

• Is it all documented in EMR?
Schedule Screening Exams

- Contact patient
- Review eligibility & SDM
- Find acceptable time and date
- Ask safety questions (weight and mobility)
- Reminder call
Interpret Screening Exams

- Overall quality
- Lungs
- Mediastinum
- Upper abdomen
- Bones
- Lung-RADS
Detection of Lung Nodules on CT

• Asked 13 radiologists to find 5 mm nodules
• 40 chest CT scans (1.0 mm slices)
• Gaze tracking system
• Measured gaze volumes and detections

Detection of Lung Nodules on CT

- Detected nodules $\leq 3$ cm of gaze point
- Rad searched 27% of lungs in 3.3 min
- Within-search sensitivity 65% (47-82)%
- Overall sensitivity 49% (30-73)

Rubin et al. Radiology. 2015;274(1):276-86..
Chest CT Search Time

- Lung: 450 x 1 mm axial (13 min)
- Lung: 50 x 8 mm MIPS (2 min)
- Lung: 150 x 3 mm Cor & Sag (2 min)
- Mediastinum: 100 x 2.5 mm axial (1 min)
- Abdomen 100 x 2.5 mm axial (1 min)
- Bone: axial and sag (1 min)
- Total search (20 min)
Assessment of SmPNs

• Benign features?
• Size (average diameter)?
• Other features?
• Lung-RADS category?
<table>
<thead>
<tr>
<th>Category</th>
<th>Category Description</th>
<th>Findings</th>
<th>Management</th>
<th>Probability of Malignancy</th>
<th>Estimated Population Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incomplete</td>
<td>-</td>
<td>0 prior chest CT examination(s) being located for comparison</td>
<td>Additional lung cancer screening CT images and/or comparison to prior chest CT examinations is needed</td>
<td>n/a</td>
<td>1%</td>
</tr>
<tr>
<td>Negative</td>
<td>No nodules and definitely benign nodules</td>
<td>1 no lung nodules, nodules with specific calcifications: complete, central, popcorn, concentric rings and fast containing nodules</td>
<td>Continue annual screening with LDCT in 12 months</td>
<td>&lt;1%</td>
<td>30%</td>
</tr>
<tr>
<td>Bizarre Changes in Appearance or Behavior</td>
<td>Nodules with a very low likelihood of becoming a clinically active cancer due to size or lack of growth</td>
<td>solid nodules: &lt; 6 mm or &lt; 4 mm part solid nodules: &lt; 6 mm or 0 to 5 mm total diameter on baseline screening</td>
<td>non solid nodules (GGN): &lt; 20 mm OR ≥ 20 mm and unchanged or slowly growing category 3 or 4 nodules unchanged for ≥ 2 months</td>
<td>1%</td>
<td>5%</td>
</tr>
<tr>
<td>Probably Benign</td>
<td>Probably benign finding(s) - short term follow up suggested, includes nodules with a low likelihood of becoming a clinically active cancer</td>
<td>solid nodules: ≥ 6 to &lt; 8 mm at baseline OR new 8 mm to &lt; 6 mm part solid nodules: ≥ 6 mm total diameter with solid component ≥ 6 mm OR new ≥ 6 mm total diameter non solid nodules (GGN) ≥ 20 mm on baseline CT or new</td>
<td>0 month LDCT</td>
<td>1-2%</td>
<td>2%</td>
</tr>
<tr>
<td>Suspicious</td>
<td>Findings for which additional diagnostic testing and/or tissue sampling is recommended</td>
<td>solid nodules: 8 to &lt; 15 mm at baseline OR growing 8 mm OR new 8 to &lt; 8 mm part solid nodules: 2 mm with solid component ≥ 8 mm OR new ≥ 6 mm total diameter with a new or growing ≥ 4 mm solid component endobronchial nodule</td>
<td>3 month LDCT; PCT/CT may be used when there is a ≥ 8 mm solid component</td>
<td>1%-15%</td>
<td>2%</td>
</tr>
<tr>
<td>Other</td>
<td>Clinically Significant or Potentially Clinically Significant findings (not lung cancer)</td>
<td>solid nodules: ≥ 15 mm OR growing ≥ 8 mm part solid nodules: a solid component ≥ 8 mm OR a new or growing ≥ 4 mm solid component</td>
<td>chest CT with or without contrast, PCT/CT and/or tissue sampling depending on the probability of malignancy and comorbidities. PET/CT may be used when there is a ≥ 8 mm solid component</td>
<td>≥ 15%</td>
<td>2%</td>
</tr>
<tr>
<td>Prior Lung Cancer</td>
<td>Modifier for patients with a prior diagnosis of lung cancer who return to screening</td>
<td>modifier may be added to category 0-4 coding</td>
<td>As appropriate to the specific finding</td>
<td>n/a</td>
<td>10%</td>
</tr>
</tbody>
</table>

**IMPORTANT NOTES FOR USE:**
1) Negative screen: does not mean that an individual does not have lung cancer.
2) Size: nodules should be measured on lung windows and reported as the average diameter rounded to the nearest whole number; for round nodules only a single diameter measurement is necessary.
3) Size Thresholds: apply to nodules at first detection, and those grow and reach a higher size category.
4) Growth: an increase in size of ≥ 1.5 mm.
5) Exam Category: each exam should be coded 0-4 based on the nodules with the highest degree of suspicion.
6) Exam Modifiers: 1 and 2 modifiers may be added to the 0-4 category.
7) Lung Cancer Diagnosis: Once a patient is diagnosed with lung cancer, further management (including additional imaging such as PET/CT) may be performed for purposes of lung cancer staging; this is no longer screening.
8) Practice guidelines: a negative screen is defined as categories 1 and 2; a positive screen is defined as categories 3 and 4.
9) Category 4B Management: this is predicated on the probability of malignancy, based on patient evaluation, patient preferences, and risk of malignancy. Radiologists are encouraged to use the MacWilliam et al assessment tool when appropriate.
10) Category 4X: nodules with additional imaging findings that increase the suspicion of lung cancer, such as calcification, GGN that doubled in size in 1 year, enlarged lymph nodes etc
11) Nodules with features of an intrapulmonary lymph node should be managed by mean diameter and the 0-4 numerical category classification.
12) Nodules 3 and 4A nodules that are unchanged on interval CT should be coded as category 2, and individuals returned to screening in 12 months.
13) LDCT due date chest CT

*Link to MacWilliam Lung Cancer Risk Calculator*

*Modification Note: http://www.breast.org/lung-cancer-risk-calculator

*Disclaimer: http://www.upstate.edu/centers/calculator/radiology-pulmonary-nodule-malignancy-risk-breast-university-cancer-predictive-equation*
Communicate Results

- Radiology report (ACR Lung-RADS)
- Letters to patients for all exams within 3 days
- Calls to providers at time of positive screen
- Reminders for follow-up and annual screens
EXAMINATION: [CT CHEST SCREENING LUNG CANCER]

CLINICAL HISTORY: []

TECHNIQUE: [Noncontrast, low-dose chest CT (LDCT) per DHMC lung cancer screening protocol.]

COMPARISON: [None]
**FINDINGS:** Lung-RADS

Lung screening specific: None/pulmonary nodule (size, shape, attenuation, opacity, margin, location)/other.

Potentially significant incidental findings: None.

Other incidental findings: None/aorta/CAC/mass…/pulmonary fibrosis/other interstitial lung disease(UIP,ILD other).

**IMPRESSION:** [ ]

**RECOMMENDATION:** [ ]
Lung Cancer Risk Calculator

- Based on 2 high risk screening populations
- Calculates lung cancer risk at first screen
- Uses patient and nodule characteristics

Calculator: Solitary pulmonary nodule malignancy risk

Schedule and Track FU Exams

• Confirm order for FU exam
• Find acceptable time and date
• Report back to provider & radiologist
• Follow-up exam result
• Report back to provider
Manage Database

• Enter new patients into database
• Enter screening results
• Enter follow-up results
• Submit to ACR LCSR
• Query for follow-ups & annual screens
• Prepare for audits
Summary

• Radiology workload considerable and requires additional support

• Large component related to eligibility and SDM, communication & database

• Large component related to searching for nodules and reporting
Radiology Workload Reduction

• Centralize eligibility assessment and SDM
• Computer-aided detection
• Computer-aided diagnosis
• Automated structured reporting
References


<table>
<thead>
<tr>
<th>Phase (Milestone)</th>
<th>Description</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provider Brochure</td>
<td>Provider educational materials</td>
<td>Complete</td>
</tr>
<tr>
<td>Lung Cancer Screening Registry</td>
<td>DH patients who meet NLST criteria – IRB approval</td>
<td>In Progress</td>
</tr>
<tr>
<td>Patient Fact Sheet</td>
<td>Patient educational materials</td>
<td>Complete</td>
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<td>Patient educational materials</td>
<td>Complete</td>
</tr>
<tr>
<td>Option Grid</td>
<td>Shared Decision-Making Tool</td>
<td>In Progress</td>
</tr>
<tr>
<td>Clinical Pathway</td>
<td>Strategic pathway for patients who are eligible for lung cancer screening</td>
<td>In progress</td>
</tr>
<tr>
<td>Patient &amp; Provider education</td>
<td>Distribute Provider and Patient Materials encourage shared decision-making</td>
<td>In progress</td>
</tr>
<tr>
<td>Phase 1 Screening</td>
<td>Target DH-Lebanon Employees – 200 Screens</td>
<td>Pending</td>
</tr>
<tr>
<td>Phase 2 Screening</td>
<td>Target DH-Lebanon Providers – 200 Screens</td>
<td>Pending</td>
</tr>
<tr>
<td>Phase 3 Screening</td>
<td>Open to Public</td>
<td>Pending</td>
</tr>
<tr>
<td>Process &amp; Quality Evaluation</td>
<td></td>
<td>Pending</td>
</tr>
</tbody>
</table>
Nodule Detection

- Orientation
- Visual scanning
- Pattern recognition
- Decision making
