Equity Issues with Lung Cancer Screening
Prevent Cancer - Quantitative Imaging Workshop
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Director, Lung Cancer Screening Program
No Disclosures
Equity Issues with Lung Cancer Screening: Today’s Focus

• Discuss UIC’s lung cancer screening program and how it relates to health disparities.

• Identify components of a successful screening program for minority and underserved populations.

• Discuss screening eligibility and how it may need to be altered for programs that serve primarily minority populations.
Lung Cancer Screening and Health Disparities
Lung Cancer and Health Disparities

Smoking
• Rates are highest among:
  ◦ Race/Ethnicity: American Indians and Alaskan Natives 26.1%, White 19.4%, Black/African Americans 18.3%, Hispanics 18%
  ◦ Education Status: no diploma 27.1%, high school 21.7%, some college 20%, college degree 9.1%
  ◦ Poverty Status: Below poverty level 26%, at or above poverty level 14%
• Cigarette advertising is targeted at minorities
• Minorities are least likely to be screened for smoking by primary care providers and receive smoking cessation resources

Lung Cancer
• Black/African Americans (AA):
  ◦ AA men have the highest incidence and mortality of lung cancer
  ◦ More likely to smoke longer in years but less cigarettes per day
  ◦ More likely to smoke menthol (more addictive)
  ◦ More likely to be diagnosed at a late stage
Social Determinants of Health
Interplay Between Host, Agent, And Environment

Health Care
Housing
Food
Built Environment
Community
Domestic Violence & Crime
Pollution
Employment
Education
Governance
Economic Stability
UIC’s Lung Cancer Screening Program
Lung Cancer Mortality and UIC’s Service Area

- 24 community areas in the West and South-side of Chicago
- 495 bed hospital, 22 outpatient clinics, and a network of 15 FQHCs (Mile Square)
History of Lung Cancer Screening Program at UIC

CMS Approves Coverage for Lung Cancer Screening

2013 - 2014
$99 Lung Screening

2/2015

2015 - 2018

Lung Cancer Screening Program Using USPSTF Guidelines:
Age 55-80, smoking history of ≥30 yrs, current smokers or quit within the past 15 years

(Grade B Recommendation)
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(Grade B Recommendation)

4

750+
Lung Screening Models
Decentralized vs Centralized

**DECENTRALIZED**
- Shared Decision Making Visit by referring provider
- Order written
- LDCT performed
- Results to referring provider & called or mailed to patient
- Smoking Cessation resources provided
- Patient recalled for f/u by radiology or referring provider
- Referring provider responsible for critical findings

**CENTRALIZED**
- Referring provider notified
  - Not Eligible
  - Eligible
    - Shared Decision Making Visit
    - LDCT performed with someday in-person visit
    - Screening Center responsible for critical findings
- Eligibility Determined (call)
- Patient referred for screening
- Screening Center responsible recall and f/u
Current UIC’s Lung Cancer Screening Workflow

Provider (MD, APN, PA) Identified patient, meets criteria

Lung Cancer Screening Clinic does Shared Decision Making Visit, Smoking Cessation, Orders Scan

Radiology Completes Screening Questionnaire

LDCT Scan Performed

LungRADS 1 & 2 (Annual LDCT)

Results to Referring Provider who Follows up with Pt

LungRADS 3 (6 month LDCT)

Reviewed in Multidisciplinary Thoracic Tumor Board Conference

LungRADS 4

Follow up: PET, Biopsy, Surgery, Med or Rad Oncology

Provider does Shared Decision Making Visit, Smoking Cessation, Orders Scan

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Physician Engagement – A Key to Lung Cancer Screening

1. Get Physicians/APNs/PA/RNs involved early, listen to them
2. Give them the Big Picture
3. Support with Structure and Resources
4. Listen and Communicate
5. Continue to Evolve the Process
6. Keep them Informed of the Process and Outcomes
UIC
From Patient to Community Engagement
Low-Dose Lung Screen Order Embedded with Criteria, Template

Lung Cancer Shared Decision Making Visit:

Smoking Status ____Current _____Former. If former quit_________(year)

Smoked ________cigarettes/day x ______years. ______pack-year history

Discussed current USPSTF (or CMS) guidelines and eligibility for annual lung cancer screening with low-dose CT. Discussed risks/benefits including false positives, over-diagnosis, possible need for further testing, radiation exposure. Counseled on importance of smoking cessation and adherence to annual lung cancer screening until patient no longer meets criteria, co-morbidities prevent a patient from being screened, or by patient choice. Pt is asymptomatic of lung cancer and willing to undergo further testing and treatment if lung cancer is detected.

Template made for EMR note
Quality Improvement Project to Improve Knowledge and Lung Cancer Screening in Primary Care Clinics

Interventions:

- Faculty meetings, lecture series, Grand Rounds
- Lung Cancer Screening “Champion” at resident and attending level
- Placing Lung Cancer Screening information flyers/resources in clinics
- Reminder emails
- Lung cancer navigators in Mile Square Clinics (UI Health’s FQHC clinics)
Successful Learning by Primary Care Providers: Pre- and Post- Educational Interventions
Successful Learning by Primary Care Providers: Pre- and Post- Educational Interventions

Of 147 Internal Medicine or combined residents, 53 completed a pre-intervention survey and 26 completed a post-intervention survey. The percentage of correct responses by pre and post-intervention are shown above.

Increases in Screening

After discussing the survey results and educating Internal Medicine residents, the average number of screens ordered through GMC clinic increased from 6.8 per month [May 2016 to September 2016] to 10.6 per month [October 2016 to April 2017].

LDCT orders from other primary care clinics at UIC stayed stable throughout this timeframe.
Results of UIC Lung Cancer Screening Program
UIC’s LDCT Screening Cohort

**Race/Ethnicity**
- Black or African American: 69%
- White: 19%
- Hispanic or Latino: 11%
- Asian: 1%

**Smoking Status**
- Current: 72%
- Former: 28%

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Outcomes From a Minority-Based Lung Cancer Screening Program vs the National Lung Screening Trial

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Outcomes From a Minority-Based Lung Cancer Screening Program vs the National Lung Screening Trial

Table 1. Baseline Demographic Factors and Smoking Status of Participants Included in the UIC’s Lung Cancer Screening Program and the LDCT Arm of the National Lung Screening Trial

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>UIC (n = 500)</th>
<th>NLST (n = 26,722)*</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, mean (SD)</td>
<td>62.8 (5.69)</td>
<td>61.4 (5.03)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>262 (52.4%)</td>
<td>15,770 (59.0%)</td>
<td>.01</td>
</tr>
<tr>
<td>Female</td>
<td>238 (47.6%)</td>
<td>10,952 (41.0%)</td>
<td></td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>144 (28.8%)</td>
<td>24,289 (90.9%)</td>
<td></td>
</tr>
<tr>
<td>African American</td>
<td>348 (69.6%)</td>
<td>11,955 (4.5%)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Asian</td>
<td>7 (1.4%)</td>
<td>559 (2.1%)</td>
<td></td>
</tr>
<tr>
<td>Other/&gt;1</td>
<td>1 (0.2%)</td>
<td>516 (1.9%)</td>
<td></td>
</tr>
<tr>
<td>Missing</td>
<td>0</td>
<td>163 (0.6%)</td>
<td></td>
</tr>
</tbody>
</table>

Abbreviations: LDCT, low-dose computed tomography; NLST, National Lung Screening Trial; UIC, University of Illinois at Chicago.

* Table adapted from Aberle et al., adjusted with UIC results and data provided from the NLST data set at the National Cancer Institute.
# Outcomes From a Minority-Based Lung Cancer Screening Program vs the National Lung Screening Trial

<table>
<thead>
<tr>
<th>Lung-RADS Classification&lt;sup&gt;a,b&lt;/sup&gt;</th>
<th>UIC, No. (%)&lt;sup&gt;c&lt;/sup&gt;</th>
<th>UIC With Cancer, No./No. (%)</th>
<th>NLST, No. (%)&lt;sup&gt;d&lt;/sup&gt;</th>
<th>NLST With Cancer, No./No. (%)&lt;sup&gt;d&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>136 (27.2)</td>
<td>0/136</td>
<td>14,709 (55.6)</td>
<td>15/14,709 (0.1)</td>
</tr>
<tr>
<td>2</td>
<td>241 (48.2)</td>
<td>0/241</td>
<td>8,145 (30.8)</td>
<td>29/8,145 (0.4)</td>
</tr>
<tr>
<td>3</td>
<td>77 (15.4)</td>
<td>0/77</td>
<td>1,697 (6.4)</td>
<td>21/1,697 (1.2)</td>
</tr>
<tr>
<td>3, 4A&lt;sup&gt;e&lt;/sup&gt;</td>
<td>0</td>
<td>0/0</td>
<td>97 (0.4)</td>
<td>0/97</td>
</tr>
<tr>
<td>3, 4A, 4B&lt;sup&gt;e&lt;/sup&gt;</td>
<td>0</td>
<td>0/0</td>
<td>193 (0.7)</td>
<td>22/193 (11.4)</td>
</tr>
<tr>
<td>4A</td>
<td>33 (6.6)</td>
<td>4/33 (12.1)</td>
<td>1,107 (4.2)</td>
<td>78/1,107 (7.0)</td>
</tr>
<tr>
<td>4B</td>
<td>10 (2.0)</td>
<td>6/10 (60.0)</td>
<td>358 (1.4)</td>
<td>124/358 (34.6)</td>
</tr>
<tr>
<td>4X</td>
<td>3 (0.6)</td>
<td>3/3 (100)</td>
<td>149 (0.6)</td>
<td>3/149 (2.0)</td>
</tr>
<tr>
<td>All</td>
<td>500 (100)</td>
<td>13/500 (2.6)</td>
<td>26,455 (100)</td>
<td>292/26,455 (1.1)</td>
</tr>
</tbody>
</table>

**Table 2. Lung-RADS Classification From the UIC Cohort and the LDCT Arm of the NLST<sup>a,b</sup>**

**Abbreviations:** LDCT, low-dose computed tomography; NLST, National Lung Screening Trial; UIC, University of Illinois at Chicago.

- <sup>a</sup> Adapted from Pinsky et al<sup>4</sup> to compare NLST and UIC data.
- <sup>b</sup> Lung-RADS category descriptor: 0 (incomplete scan), 1 (negative: no nodules and definitely benign nodules), 2 (benign-appearing nodules with low likelihood of becoming cancer owing to size or lack of growth), 3 (probably benign and short-term follow-up is suggested), 4 (suspicious; additional diagnostic testing and/or tissue sampling is recommended; subcategories 4A, 4B, and 4X denote additional features increasing the degree of suspicion of malignancy).
- <sup>c</sup> The distributions of Lung-RADS categories were significantly different between UIC and NLST cohorts (P < .001).
- <sup>d</sup> Percentages may not sum to 100 due to rounding.
- <sup>e</sup> These classifications were consistent with more than 1 Lung-RADS category in the NLST.
Outcomes From a Minority-Based Lung Cancer Screening Program vs the National Lung Screening Trial

Discussion Points:

• Consistent with the goal of screening, both cohorts had greater than 50% of lung cancer cases detected at an early (stage I) curable stage (UIC [7 of 13] and NLST [155 of 266]).

• The magnitude of the disparity in lung cancer mortality between African American and white individuals has been widening.

• Screening that is skewed toward the white population could paradoxically increase racial disparities in lung cancer outcomes.

• These real-world differences are in accordance with a secondary analysis from NLST that showed that reduction in lung cancer mortality was greatest among African American participants.

• Refining risk-based guidelines would improve the beneficial results of LDCT screening.
Meeting the Goal of Early Detection: Results of UIC’s Lung Cancer Screening Program (N = 500)
Downstream Revenue
Downstream Revenue Attributable to Lung Cancer Screening Program Serving a Minority Predominant Population

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Lung Health Program, University of Illinois at Chicago, Chicago IL, United States

Background

The National Lung Screening Trial (NLST) showed a 20% decrease in mortality from lung cancer in the patients screened with low-dose CT when compared to chest radiography. The NLST also demonstrated a 6.7% reduction in mortality from any cause in the LDCT group, due to incident findings such as pneumothorax, malignant disease, etc. As a result of the study, the US Preventative Service Task Force recommended annual lung cancer screenings with LDCT for patients who meet the following criteria:

- Age 55-80
- 30 pack-year smoking history
- Current smoker or has quit within the past 15 years

The goal of incorporating such screening programs into health systems is to identify causes of lung cancer at early stages of development and thereby reduce mortality. University of Illinois Health System (UI) implemented a lung cancer screening program following these criteria and this study will evaluate patients screened from 2015-2017.

This study will seek to provide an estimate of the downstream revenue of the Lung Cancer Screening Program within UI Health. Downstream revenue is defined as revenue captured after a patient uses one hospital service and then subsequently uses others. It is used to evaluate the economic impact of a new procedure or program within a hospital system. Downstream revenue from this program would capture the revenue from screening as well as any required follow-up - the cost would include additional LDCTs, chemotherapy, surgical procedures, radiation, etc.

This study is unique in assessing the financial value of a screening program that serves a specific population. Thirty-eight percent of patients within the program receive insurance through Medicaid/Medicare Managed Care and 40% have Medicare as their insurance provider. Approximately 75% of patients screened are African American/Hispanic.

Methods

In performing this analysis, we will first identify all patients included in the screening program. All patients receive an initial LDCT to screen for the presence of malignancy. Results of the LDCT can be classified according to Lung Imaging Reporting and Data System (Lung-RADS). Results are placed in categories 1, 2, 3, 4a, 4b, and 4c, representing findings that are increasingly suspicious for lung cancer. Based on the category different follow-up protocols are advocated.

Compass® was queried using the UMR hit & scan database provided by Mary Pasquinelli. UMR Lung Nodule Screening Program Director, for the LDCT program between FY13 and FY17. Downstream patient activity was queried in Compass® by UMR and by each individual screening date through September 2017. All downstream cases were then filtered using the diagnosis code field to include only those cases related to LDCT. Using the filtered downstream cases, Compass® was queried to gather cost and operating margin data.

Results

- The downstream revenue for screened patients in the LDCT program resulted in a net revenue of approximately $315,000. This is approximately $775,000 in net revenue.
- There were a total of 21 identified screening cases in this time span which accounted for a downstream revenue of approximately $370,000. The Medicare Managed Care payer represented 34% of the payer mix. The Medicare payer represented 19% of the payer mix.
- There were a total of 647 outpatient cases which resulted in an operating margin of 34.8%.
- Of the patients screened, 53 patients were diagnosed with cancer. All subsequent diagnostic work and treatment after the initial screening of these patients was billed and the net revenue was $315,000. This equates to approximately $5,800 per patient in downstream revenue of this subset patients.

Discussion

The downstream revenue attributable to the lung cancer screening program at UI Health is approximately $775,000. The overall net revenue for the screening program is approximately $315,000 from 2015-2017. The screening program has detected 10 cancer cases, of which seven were early stage cancers. In consideration of the mortality benefit of this program and the higher risk population it serves, further research would evaluate the financial value of its positive downstream revenue of $775,000 demonstrates that a lung cancer screening program is viable in a low socioeconomic environment. Its screening program as a whole contributes to expand. It is notable that the LDCT used for screening may incidentally detect additional health problems, and this could provide additional downstream revenue attributable to the screening. Further research could evaluate the financial value of this screening program as it continues to expand in coming years. It is possible that the LDCT used for screening may incidentally detect additional health problems, and this could provide additional downstream revenue attributable to lung cancer screening. This could be an area of further investigation.

References


Targeted Lung Cancer Screening- Current and Future Phases
<table>
<thead>
<tr>
<th><strong>2019: APN Led Lung Screening Clinic</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary Care Provider (MD, APN, PA)</strong></td>
</tr>
<tr>
<td>Identified patient, meets criteria</td>
</tr>
<tr>
<td><strong>Lung Cancer Screening Clinic</strong></td>
</tr>
<tr>
<td>does Shared Decision Making Visit, Smoking Cessation, Orders Scan</td>
</tr>
<tr>
<td><strong>Radiology</strong></td>
</tr>
<tr>
<td>Completes Screening Questionnaire</td>
</tr>
<tr>
<td><strong>LDCT scan performed and is seen by APN</strong></td>
</tr>
<tr>
<td>same day for results and counseling</td>
</tr>
<tr>
<td><strong>LungRADS 1 &amp; 2 (Annual LDCT)</strong></td>
</tr>
<tr>
<td><strong>LungRADS 3 (6 month LDCT)</strong></td>
</tr>
<tr>
<td><strong>LDCT screening clinic tracks patients and provides follow up scans</strong></td>
</tr>
<tr>
<td><strong>LungRADS 4</strong></td>
</tr>
<tr>
<td><strong>Reviewed in Multidisciplinary Thoracic Tumor Board Conference</strong></td>
</tr>
<tr>
<td><strong>Follow up: PET, Biopsy, Surgery, Med or Rad Oncology</strong></td>
</tr>
</tbody>
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2019: APN Led Lung Screening Clinic

- Consistent messaging to patients
- Patients see their screen – nodules, emphysema, coronary calcification: teachable moment
- In depth smoking cessation counseling, provide follow up and resources
- Screen for head and neck cancers– same high-risk population
- Assist with overcoming barriers to care and follow up - lung navigator
- Streamlines patient tracking and follow-up LDCT process
- Partnership with lung cancer researchers – obtain bio-samples for biomarker research

Goal of program: Save lives from tobacco related diseases and reduce health disparities
Conclusions and Future Directions

• Lung cancer screening with low-dose CT scan can be successfully accomplished in minority and underserved communities.

• High risk communities may benefit most by lung screening and help to decrease health disparities.

• New model of APN led lung screening clinic can improve outcomes

• We are examining our patients diagnosed with lung cancer to determine best available models for establishing screening eligibility criteria.

• Eligibility criteria for screening may need to be tailored to specific communities that are being screened.
Contact Information

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