How a Lung Cancer Screening Program Can Help Reduce Health Disparities

Mary Pasquinelli, DNP, FNP-BC, APRN
University of Illinois Hospital and Health Science System (UI Health)
Pulmonary and Thoracic Medical Oncology
Director, Lung Cancer Screening Program

April 25, 2019
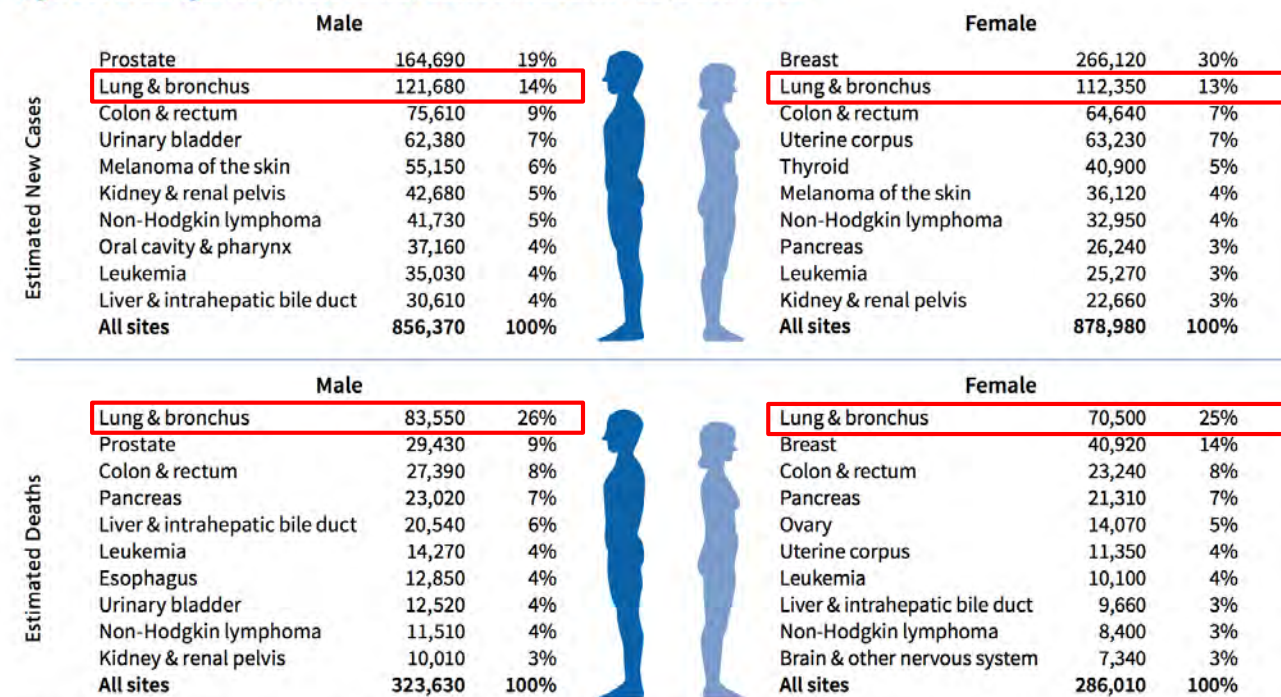Crystal City, VA

No Disclosures

Equity Issues with Lung Cancer Screening: Today's Focus

1. Discuss UI Health's lung cancer screening program and how it reduces health disparities.

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

3. Discuss how cancer screening programs can decrease health disparities

Lung Cancer Stats

Figure 3. Leading Sites of New Cancer Cases and Deaths – 2018 Estimates

Estimated New Cases

Male			Female		
Prostate	164,690	19%	Breast	266,120	30%
Lung & bronchus	121,680	14%	Lung & bronchus	112,350	13%
Colon & rectum	75,610	9%	Colon & rectum	64,640	7%
Urinary bladder	62,380	7%	Uterine corpus	63,230	7%
Melanoma of the skin	55,150	6%	Thyroid	40,900	5%
Kidney & renal pelvis	42,680	5%	Melanoma of the skin	36,120	4%
Non-Hodgkin lymphoma	41,730	5%	Non-Hodgkin lymphoma	32,950	4%
Oral cavity & pharynx	37,160	4%	Pancreas	26,240	3%
Leukemia	35,030	4%	Leukemia	25,270	3%
Liver & intrahepatic bile duct	30,610	4%	Kidney & renal pelvis	22,660	3%
All sites	**856,370**	**100%**	**All sites**	**878,980**	**100%**

Estimated Deaths

Male			Female		
Lung & bronchus	83,550	26%	Lung & bronchus	70,500	25%
Prostate	29,430	9%	Breast	40,920	14%
Colon & rectum	27,390	8%	Colon & rectum	23,240	8%
Pancreas	23,020	7%	Pancreas	21,310	7%
Liver & intrahepatic bile duct	20,540	6%	Ovary	14,070	5%
Leukemia	14,270	4%	Uterine corpus	11,350	4%
Esophagus	12,850	4%	Leukemia	10,100	4%
Urinary bladder	12,520	4%	Liver & intrahepatic bile duct	9,660	3%
Non-Hodgkin lymphoma	11,510	4%	Non-Hodgkin lymphoma	8,400	3%
Kidney & renal pelvis	10,010	3%	Brain & other nervous system	7,340	3%
All sites	**323,630**	**100%**	**All sites**	**286,010**	**100%**

Estimates are rounded to the nearest 10, and cases exclude basal cell and squamous cell skin cancers and in situ carcinoma except urinary bladder. Ranking is based on modeled projections and may differ from the most recent observed data.
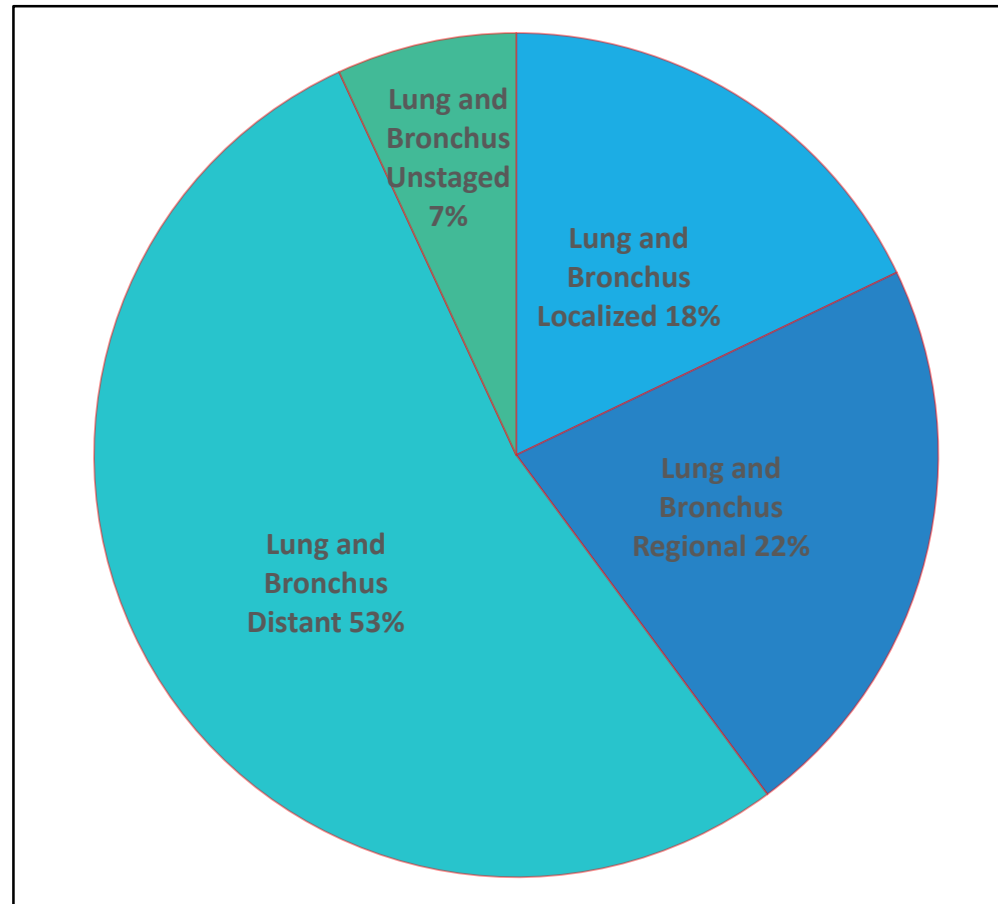
©2018, American Cancer Society, Inc., Surveillance Research

Lung Cancer Mortality

Estimated Cancer Deaths by Site in the United States, 2015
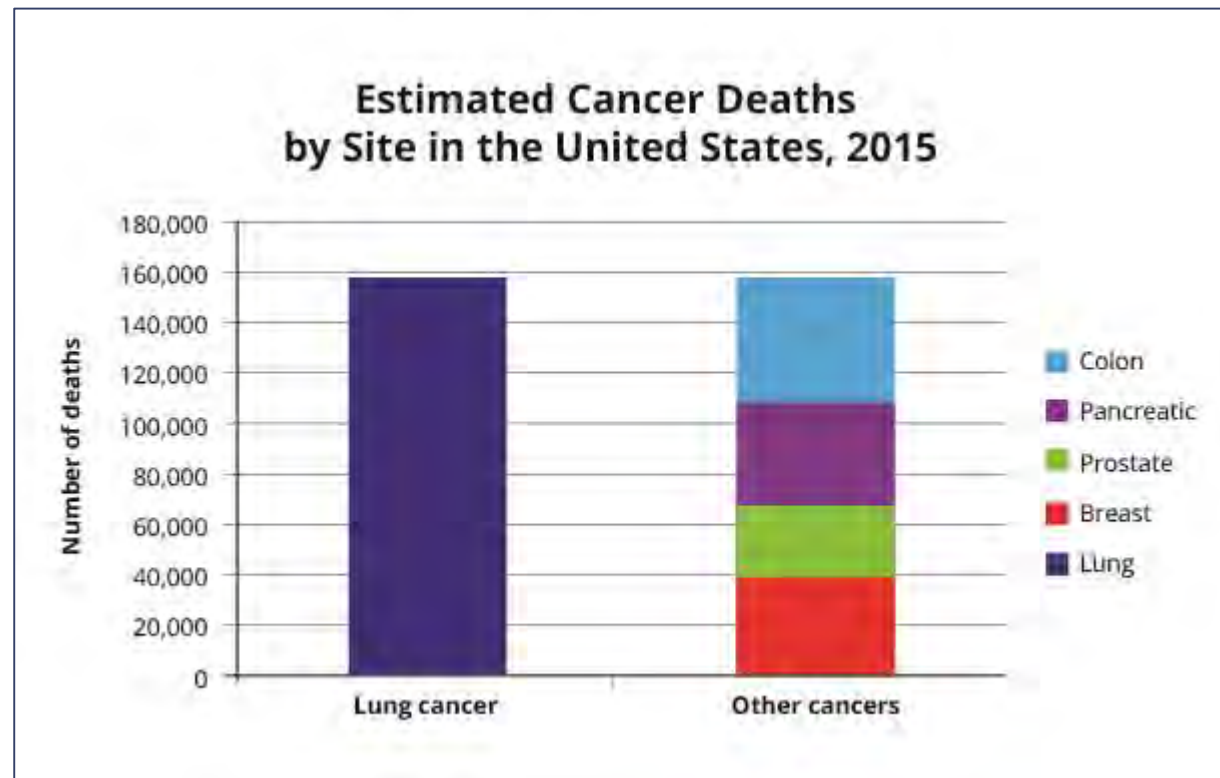
Lung Cancer Diagnosed by Stage in the U.S.

Lung Cancer 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

Your Zip Code is a better predictor of your health than your Genetic Code

What is Lung Cancer Screening?

National Lung Screening Trial Chest X-Ray vs. Low-dose CT

CHEST X-RAY

LOW-DOSE CT

VS
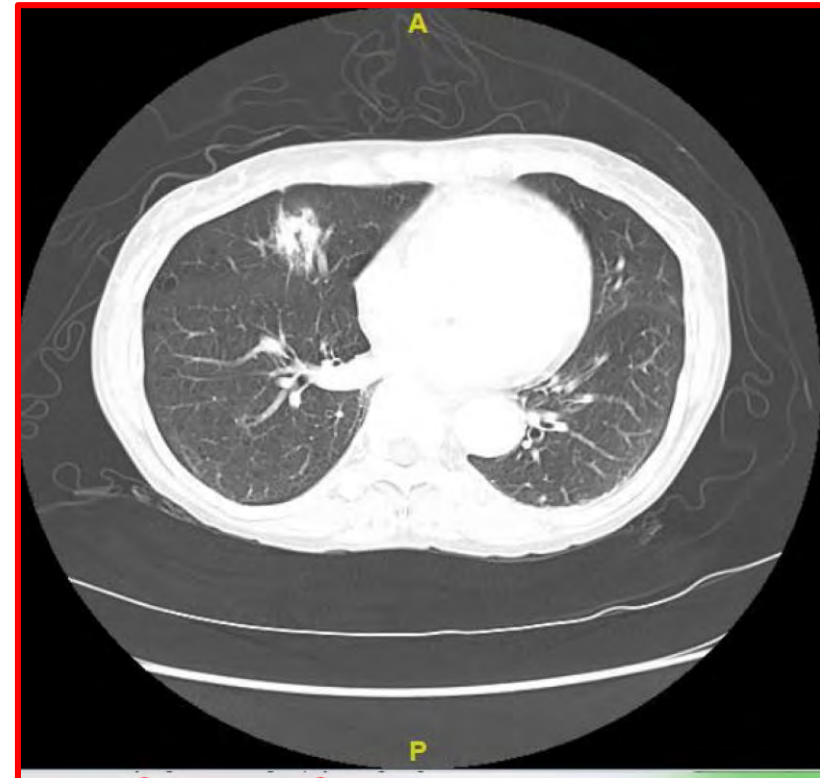
Landmark National Lung Screening Trial (NLST) Results Showed Lung Cancer Mortality Benefit - 2011

Results:

• 20 % decrease in lung cancer deaths in those who received Low-Dose CT vs. chest x-ray

• 6.7% decrease in all-cause mortality (deaths due to any factor, including lung cancer)

• 1.1% lung cancer detection rate

Population: 91% White, 4.5% African American, 1.8% Hispanic

Lung cancer case survival Kaplan Meier curve
CXR compared with matched group in PLCO and no difference

20% improvement in lung cancer survival
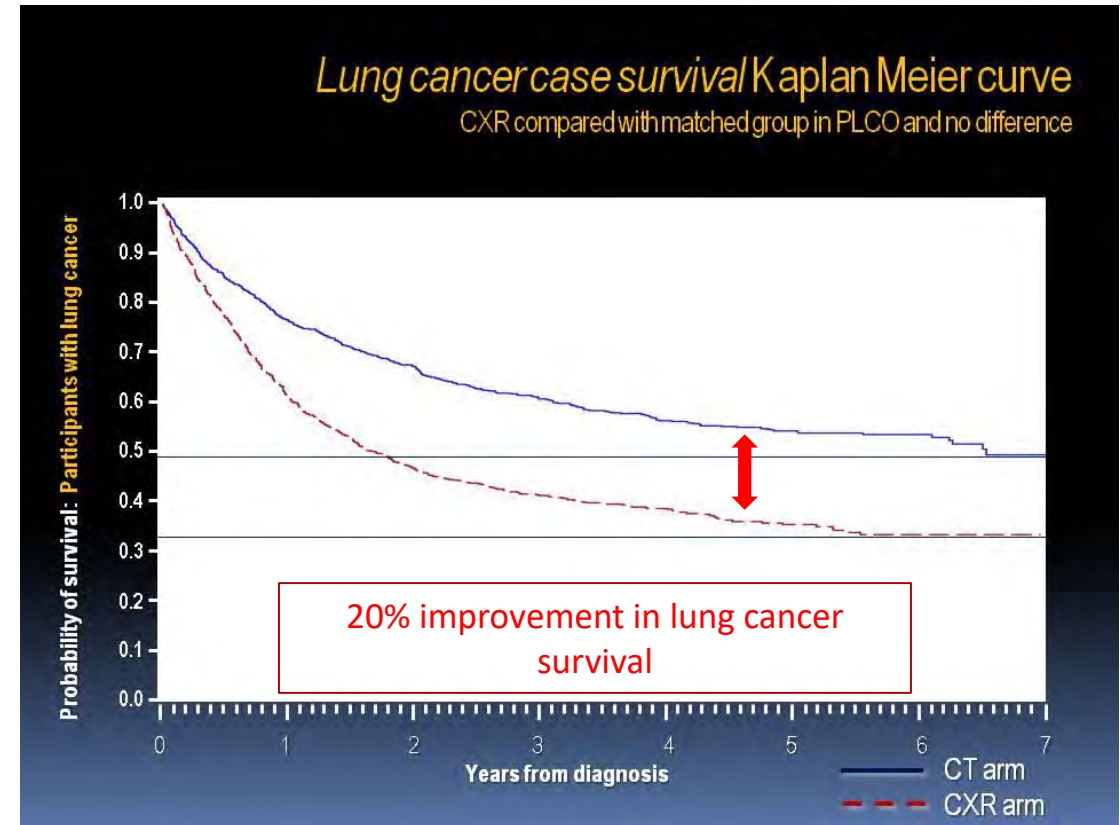
National Lung Screening Trial
Chest X-Ray vs. Low-dose CT

CHEST X-RAY
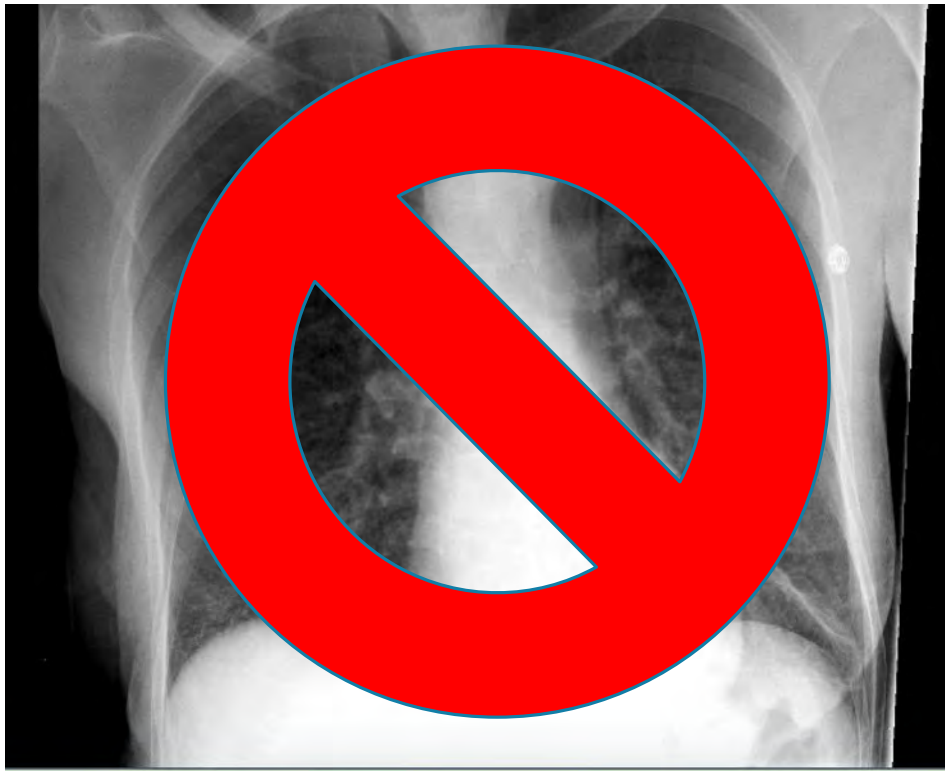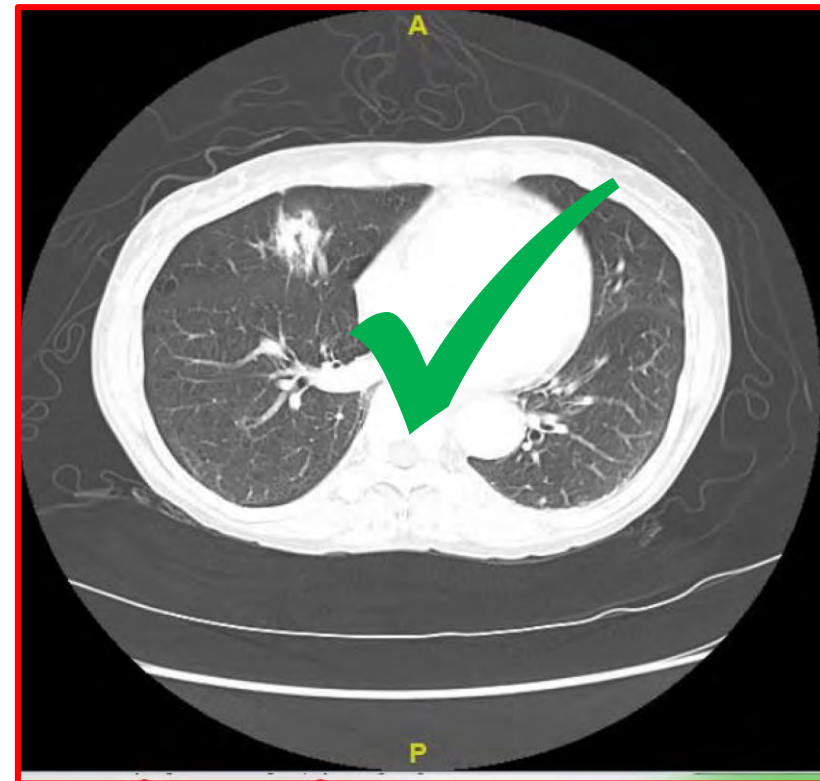
LOW-DOSE CT

VS

Lung Cancer Screening
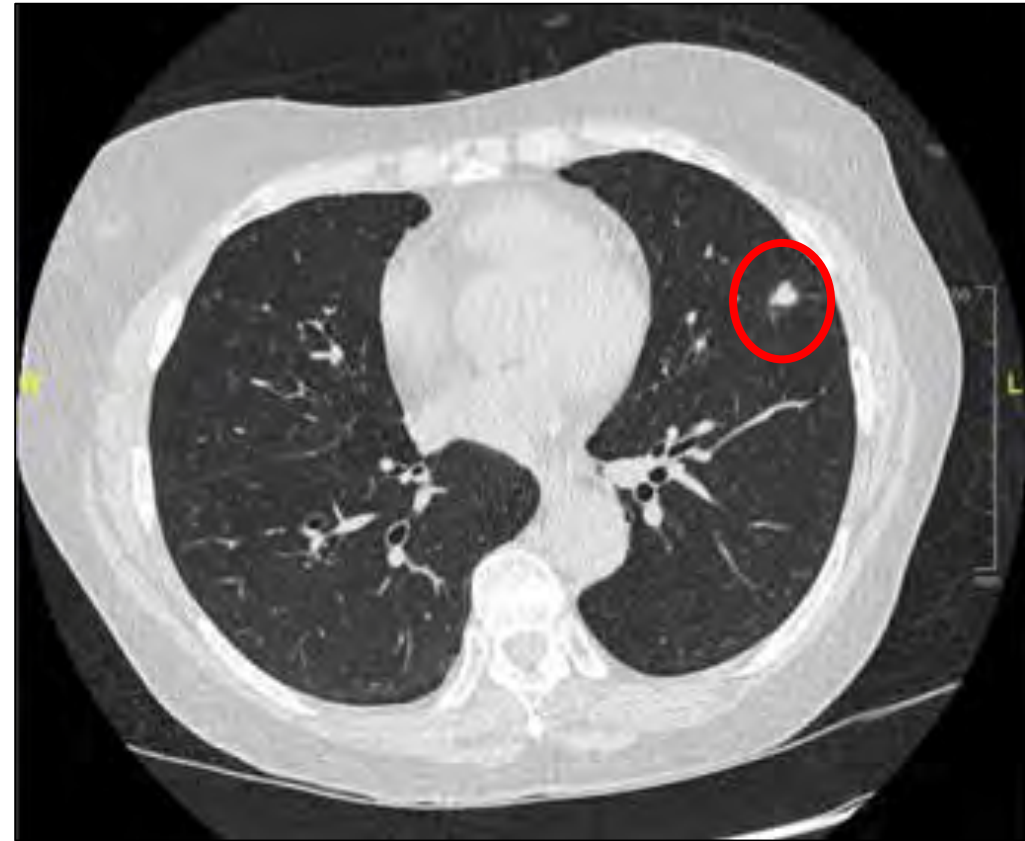
United States Preventative Services Task Force (USPSTF) Lung Screening Criteria

Annual Low-Dose CT for those at high risk:

1. Age 55-80 (age 55 to 77 for Medicare patients)

2. Current smoker or quit within past 15 years

3. Tobacco smoking history of ≥30 pack-years*

4. Asymptomatic of lung cancer

5. Able and willing to receive treatment

6. Shared decision making visit (with initial screen)

*30 pack-years = 1 pack of cigarettes per day x 30 years
USPSTF: lung cancer screening: Grade B

What is a Low-Dose CT Scan?

A low-dose CT scan continuously rotates in a spiral motion taking several 3-demensional x-rays of the lungs:

- Non-invasive: no IVs, injections, or medications

- Painless

- Lie on your back on the table, arms above the head

- No need to change out of regular clothing

- Take 1 deep breath and hold it (~10 seconds)

- Machine is completely open

- Approximately 5 x less radiation compared to regular CT

Number Needed To Screen Lower Than Other Commonly Accepted Cancer Screening Tests
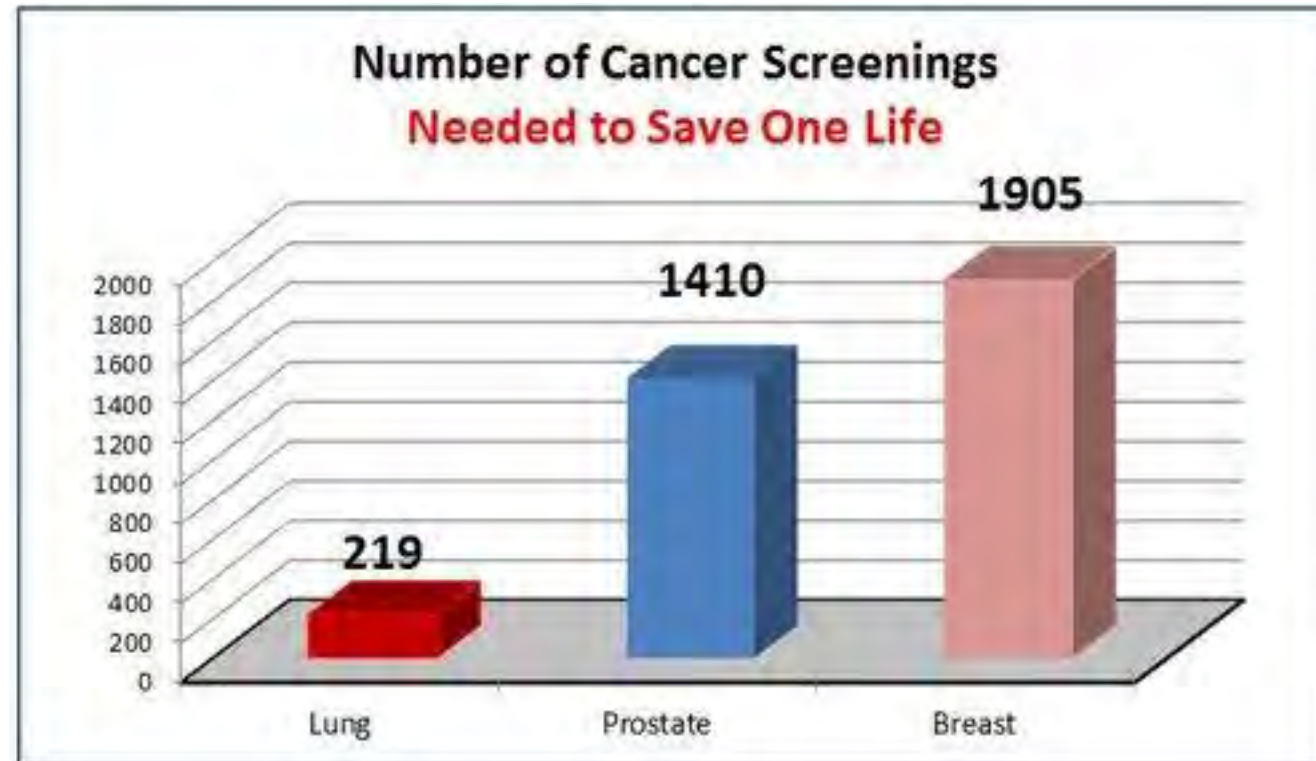
NLST: number needed to screen to prevent one **lung cancer** death of 320 and 219 to save one life overall.

UI Health's
Lung Cancer Screening Program

Disparities in Chicago

Racial & Ethnic Group Distribution

Poverty Distribution

Lung Cancer Mortality Rates

Chicago:
2.7 million

45% White
33% Black
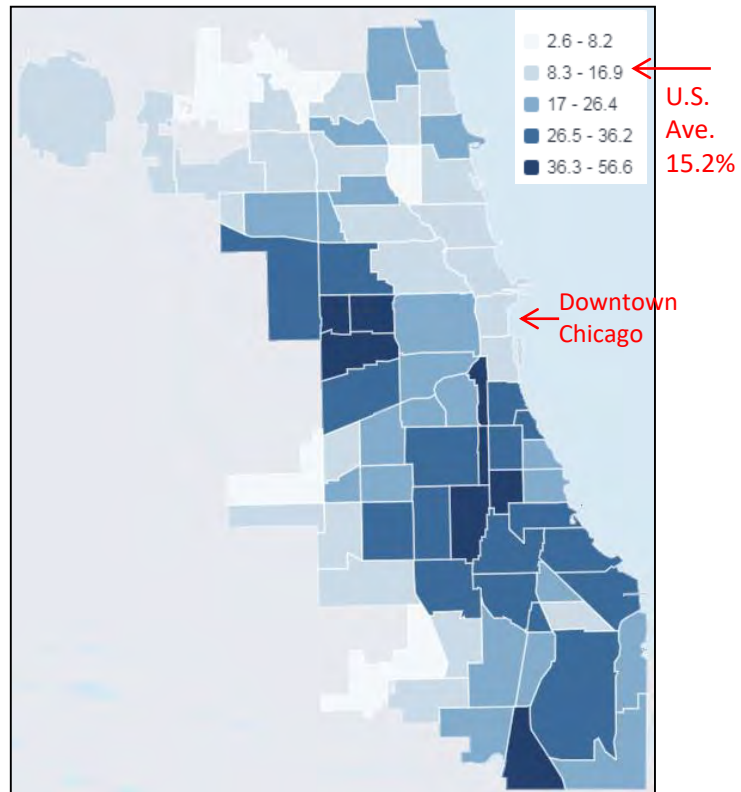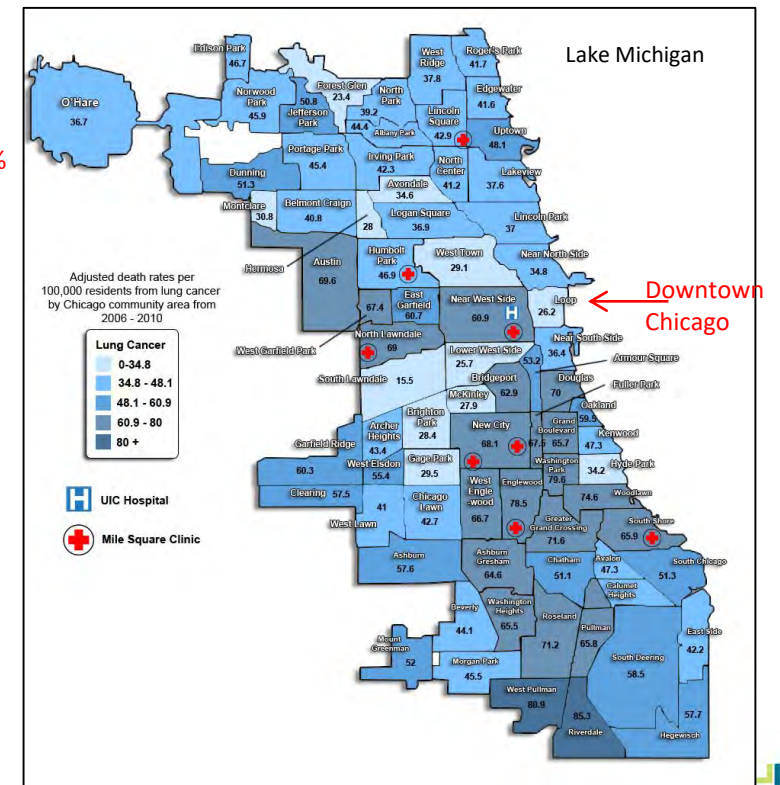
Lung Cancer Mortality and UI Health's Service Area

- 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)
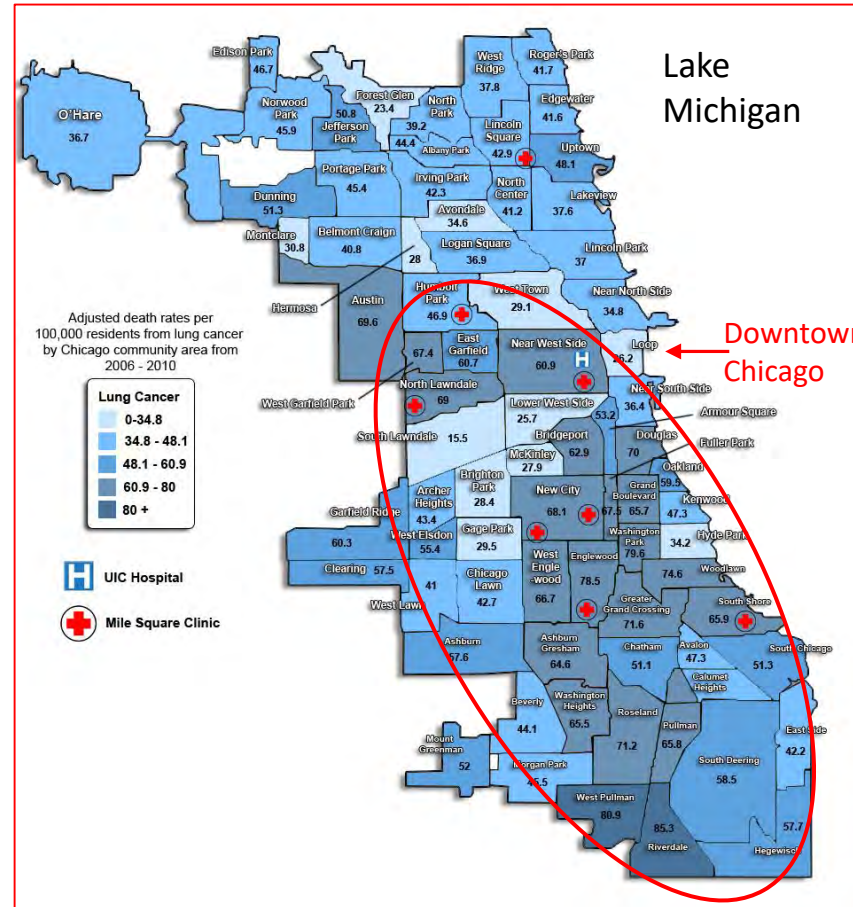
History of Lung Cancer Screening Program at UI Health

CMS Approves Coverage for
Lung Cancer Screening

| 2013 - 2014 | 2/2015 | 2015 --- 2018 |

$99 Lung
Screening

Lung Cancer Screening Program Using USPSTF Guidelines:

Age 55-80, smoking history of ≥30 pys, current smokers or
quit within the past 15 years

(Grade B Recommendation)
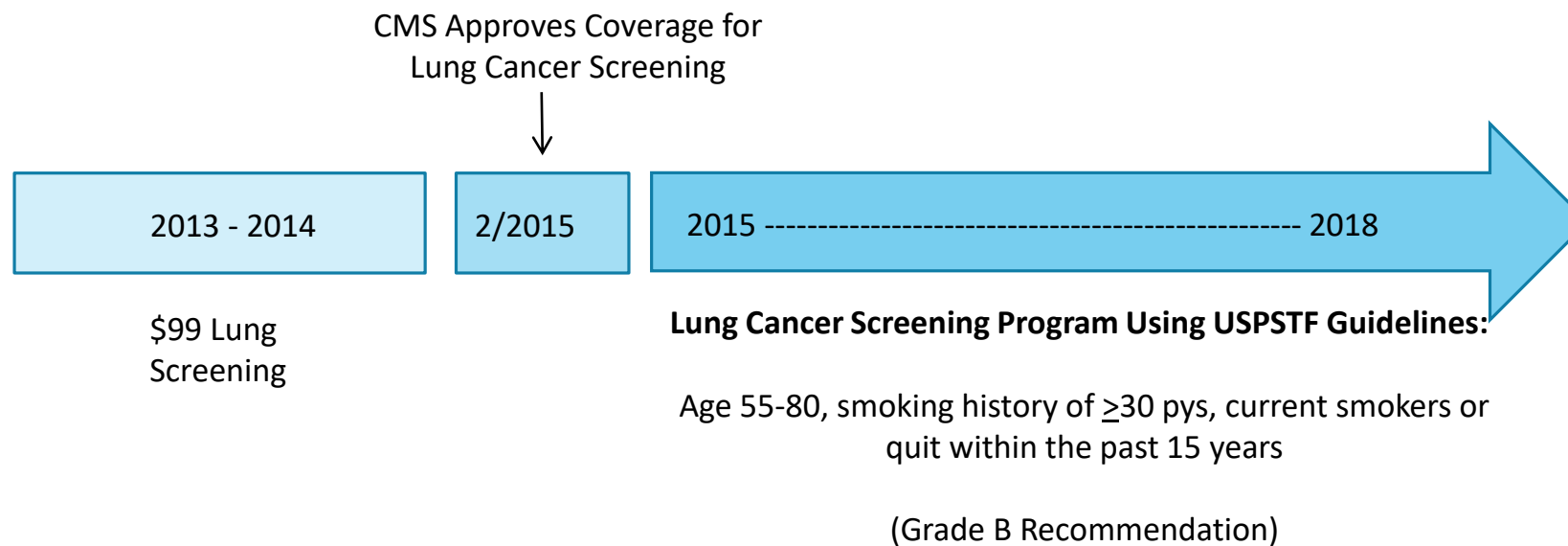
4

750+

Current UI Health's Lung Cancer Screening Workflow
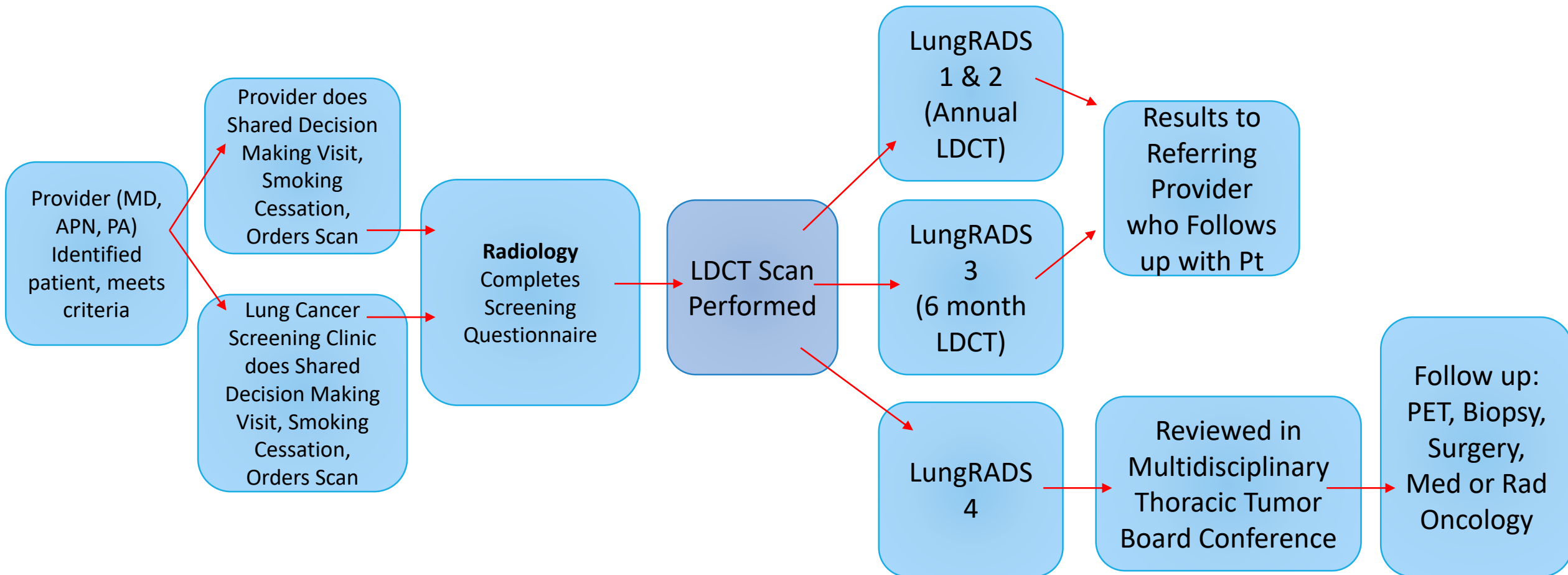
2019: Centralized Screening Clinic for Tobacco Related Diseases

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

→

Lung Screening Clinic: Shared Decision Making Visit, Tobacco Related Cancer Assessment, Smoking Cessation

→

Radiology Completes Screening Questionnaire

→

LDCT scan performed and is seen by APN same day for results and counseling

→ LungRADS 1 & 2 (Annual LDCT)

→ LungRADS 3 (6 month LDCT)

→ LungRADS 4

LDCT screening clinic tracks patients and provides follow up scans, counsels on tobacco related diseases

Reviewed in Multidisciplinary Thoracic Tumor Board Conference

→

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

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

UI Health
From Patient to Community Engagement
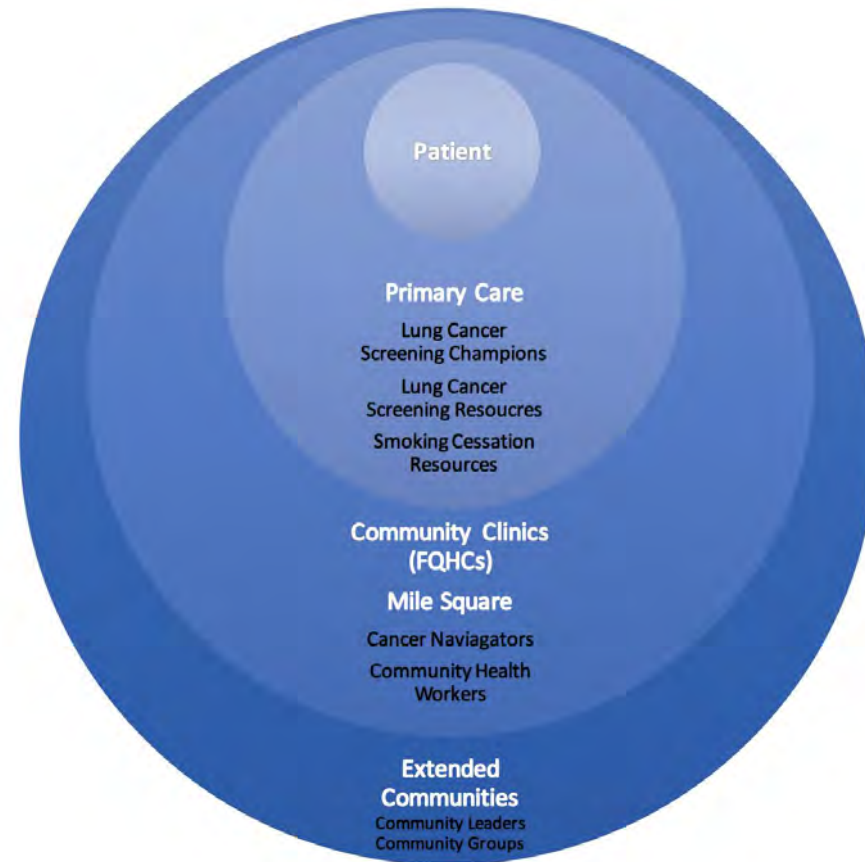
Results of UI Health's Lung Cancer Screening Program

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

M. PASQUINELLI, DNP

PASQUINELLI MM, KOVITZ KL, KOSHY M, ET AL. OUTCOMES FROM A MINORITY-BASED LUNG CANCER SCREENING PROGRAM VS THE NATIONAL LUNG SCREENING TRIAL. JAMA ONCOL. 2018;4(9):1291-1293

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[1]

Characteristic	No. (%)		P Value
	UIC (n = 500)	NLST (n = 26 722)[a]	
Age, mean (SD)	62.8 (5.69)	61.4 (5.03)	<.001
Sex			
Male	262 (52.4)	15 770 (59.0)	.01
Female	238 (47.6)	10 952 (41.0)	
Race			
White	144 (28.8)	24 289 (90.9)	
African American	348 (69.6)	1195 (4.5)	
Asian	7 (1.4)	559 (2.1)	<.001
Other/>1	1 (0.2)	516 (1.9)	
Missing	0	163 (0.6)	
Ethnicity			
Hispanic or Latino	53 (10.6)	479 (1.8)	
Neither Hispanic nor Latino	447 (89.4)	26 079 (97.6)	<.001
Missing	0	164 (0.6)	
Smoking status			
Current	364 (72.8)	12 860 (48.1)	<.001
Former	136 (27.2)	13 862 (51.9)	

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

[a] Table adapted from Aberle et al,[1] 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 2. Lung-RADS Classification From the UIC Cohort and the LDCT Arm of the NLST[a,b]

Lung-RADS Classification[a,b]	UIC, No. (%)[c]	UIC With Cancer, No./No. (%)	NLST, No. (%)[d]	NLST With Cancer, No./No. (%)[d]
1	136 (27.2)	0/136	14 709 (55.6)	15/14 709 (0.1)
2	241 (48.2)	0/241	8145 (30.8)	29/8145 (0.4)
3	77 (15.4)	0/77	1697 (6.4)	21/1697 (1.2)
3, 4A[e]	0	0/0	97 (0.4)	0/97
3, 4A, 4B[e]	0	0/0	193 (0.7)	22/193 (11.4)
4A	33 (6.6)	4/33 (12.1)	1107 (4.2)	78/1107 (7.0)
4B	10 (2.0)	6/10 (60.0)	358 (1.4)	124/358 (34.6)
4X	3 (0.6)	3/3 (100)	149 (0.6)	3/149 (2.0)
All	500 (100)	13/500 (2.6)	26 455 (100)	292/26 455 (1.1)

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

[a] Adapted from Pinsky et al[4] to compare NLST and UIC data.

[b] 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 indicate nodules with additional features increasing the degree of suspicion of malignancy).

[c] The distributions of Lung-RADS categories were significantly different between UIC and NLST cohorts (P < .001).

[d] Percentages may not sum to 100 due to rounding.

[e] These classifications were consistent with more than 1 Lung-RADS category in the NLST.

M. PASQUINELLI, DNP

PASQUINELLI MM, KOVITZ KL, KOSHY M, ET AL. OUTCOMES FROM A MINORITY-BASED LUNG CANCER SCREENING PROGRAM VS THE NATIONAL LUNG SCREENING TRIAL. JAMA ONCOL. 2018;4(9):1291-1293

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

1. 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]).

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

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

4. Refining risk-based guidelines would improve the beneficial results of LDCT screening.

Meeting the Goal of Early Detection: Results of UI Health's Lung Cancer Screening Program (N = 500)
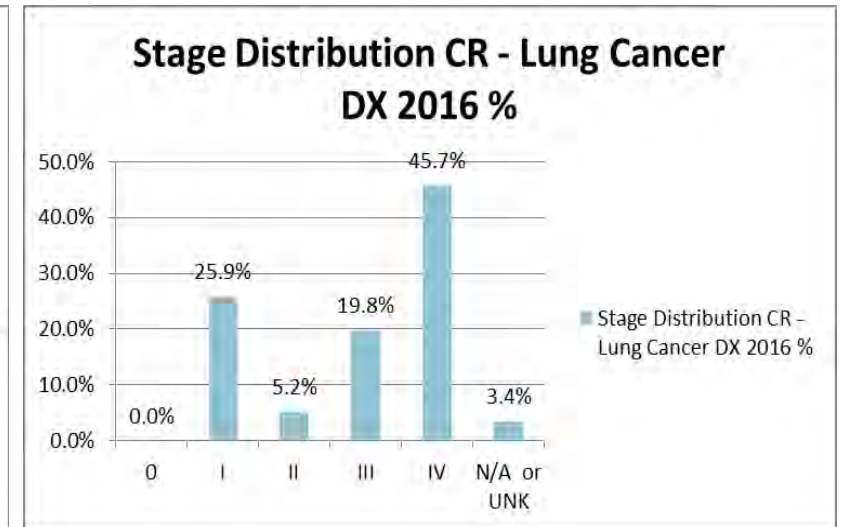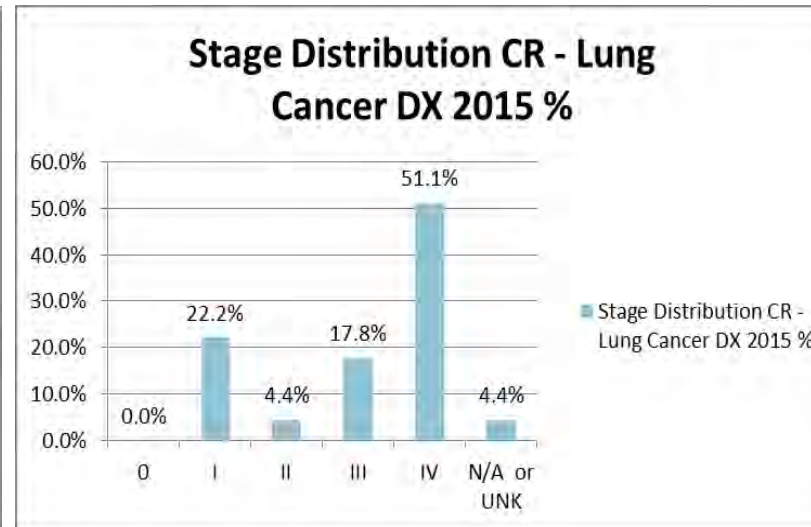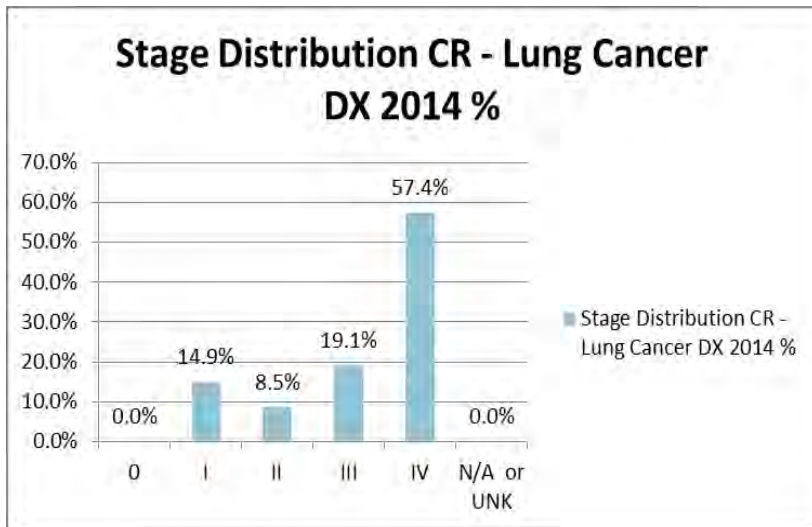
Downstream Revenue

Downstream Revenue Attributable to Lung Cancer Screening Program Serving a Minority Predominant Population

Arden Plumb, Mary Pasquinelli, Lawrence Feldman

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

Background

The National Lung Screening Trials (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 incidental findings such as aneurysms, cardiac disease, etc.) As a result of this study, the US Preventative Service Task force (grade B) recommends 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 cases of lung cancer in early stages of development and thereby reduce mortality. University of Illinois Health System (UIH) 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 UIH. 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 – this could 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/Medicaid Managed Care and 46% have Medicare as their insurance provider. Approximately 70% patients screened are black/African American.

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 nodules. 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 4x, representing findings that are increasingly suspicious for lung cancer. Based on the category, different follow up protocols are encouraged.

Compass® was queried using the MRN list & screening dates provided by Mary Pasquinelli, APN Lung Screening Program Director, for the LDCT program between FY15 and FY17. Downstream patient activity was queried in Compass® by MRN 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, Trendstar® was queried to gather cost and operating margin data.

Insurance Breakdown

- BLUE CROSS
- BC MANAGED CARE
- COMMERCIAL
- HMO/PPO
- MEDICAID
- MEDICAID MANAGED CARE
- MEDICARE
- MEDICARE MANAGED CARE

Percentage of Lung Cancer Diagnosed at an Early Stages (SEER statistics) = 16%
Percentage of Lung Cancer Diagnosed at an Early Stages within Screening Program = 50%

Ethnicity

- Black
- Hispanic
- Asian
- White
- Native Hawaiian/Pacific Islander
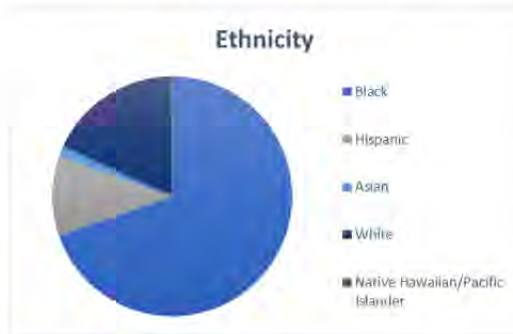
Results

❖ The downstream revenue for screened patients in the LDCT program resulted in a net revenue of approximately $515K. This is approximately $770/case in net revenue.

❖ There were a total of 21 inpatient screening cases in this time span which accounted for a downstream revenue of approximately $270K. The Medicare Managed Care payor represented 34% of the payor mix. The Medicare payor represented 19% of the payor mix.

❖ There were a total of 647 outpatient cases which resulted in an operating margin of $244K.

❖ Of the patients screened, 13 patients were diagnosed with cancer. All subsequent diagnostic work and treatment after the initial screening of these patients was totaled and the net revenue was $157K. This equates to approximately $5,900/patient in downstream revenue of this subset of patients.

Discussion

The downstream revenue attributable to the lung cancer screening program at UIH is approximately $770/case. The overall net revenue for the screening program is approximately $515K from 2015-2017.

The screening program has detected 16 cancer cases, 8 of which were early stage cancers. In consideration of the mortality benefit of this program and the higher risk population it serves, Further research could evaluate the financial value of ta positive downstream revenue of $770/case demonstrates that a lung cancer screening program is viable in a low socioeconomic environment. his screening program as it continues 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 this screening. Further research could evaluate the financial value of this screening program as it continues to expand in coming years.

It is notable 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

The National Lung Screening Trial Research Team, August 2011. Reduced Lung-Cancer Mortality with Low-Dose Computed Tomographic Screening. N Engl J Med 2011; 365:395-409

Thomas B, Lanni; Craig Stevens; Michael Farah; Andrew Boyer; James Davis; Robert Welsh; Daniel Keena; Adil Akhtar; Duane Mezwa, 2015 Dec 8. Early Results From the Implementation of a Lung Cancer Screening Program: The Beaumont Health System Experience. American Journal of Clinical Oncology

Pastis, Nicholas J., et al. "Understanding the Economic Impact of Introducing a New Procedure." Chest, vol. 141, no. 2, 2012, pp. 506–512., doi:10.1378/chest.11-0254.

M. PASQUINELLI, DNP

PLUMB A, PASQUINELLI M, FELDMAN LE. DOWNSTREAM REVENUE ATTRIBUTABLE TO LUNG CANCER SCREENING PROGRAM SERVING A MINORITY PREDOMINANT POPULATION. JCO. 2018;36(15):E18909.

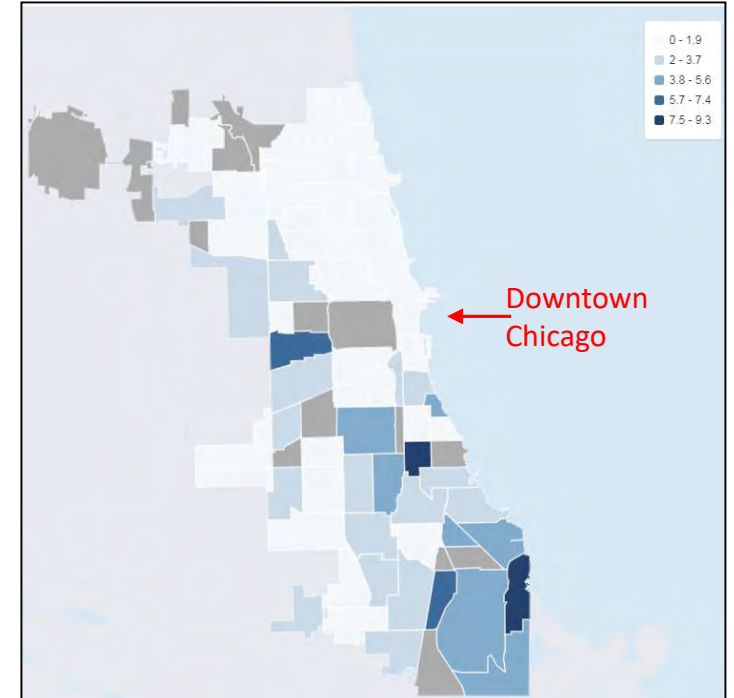# Screening Can Reduce Health Disparities and Save Lives

BREAST CANCER MORTALITY
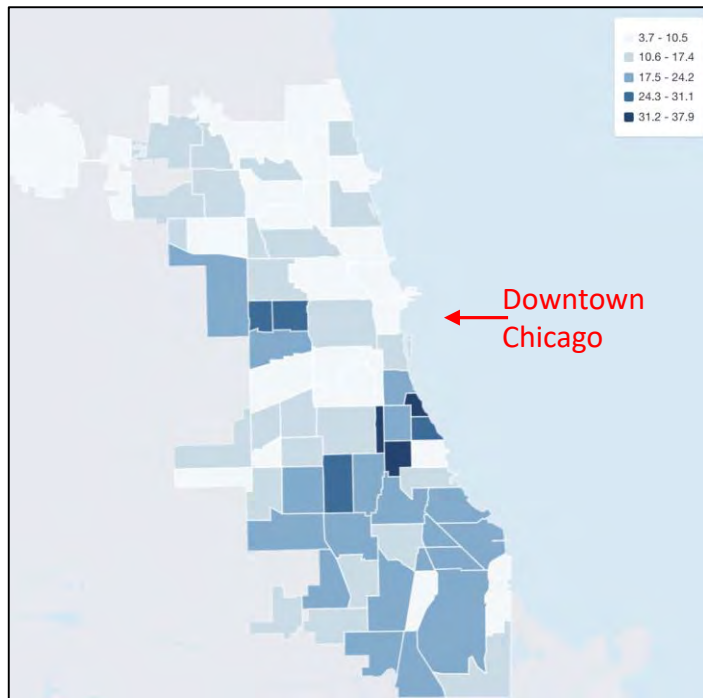
PROSTATE CANCER MORTALITY
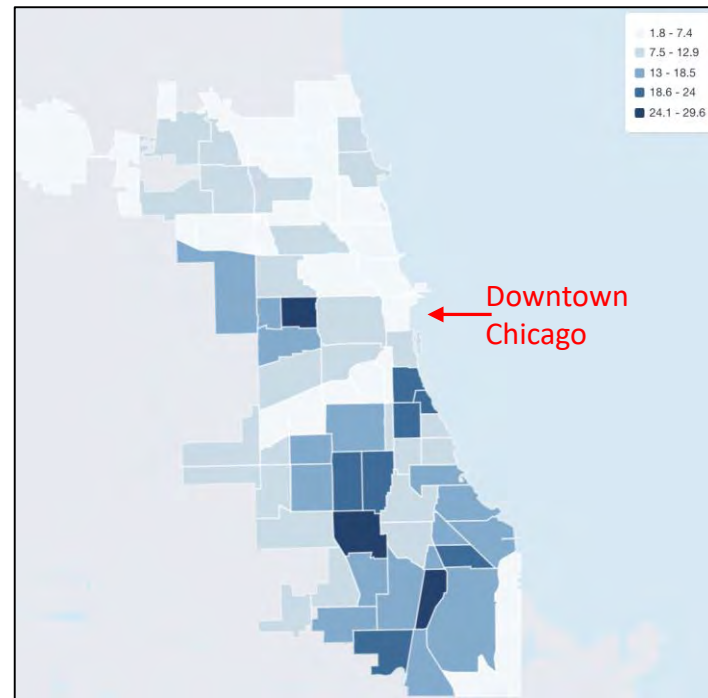
CERVICAL CANCER MORTALITY

Conclusions

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

2. High risk communities may benefit most by lung cancer screening and help to reduce health disparities.

3. Providing comprehensive cancer screening program in high cancer morality communities reduces health disparities and save lives.

Contact Information

Mary Pasquinelli, DNP, MS, APRN, FNP-BC

mpasqu3@uic.edu