



How a Lung Cancer Screening Program Can Help Reduce Health Disparities

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No Disclosures



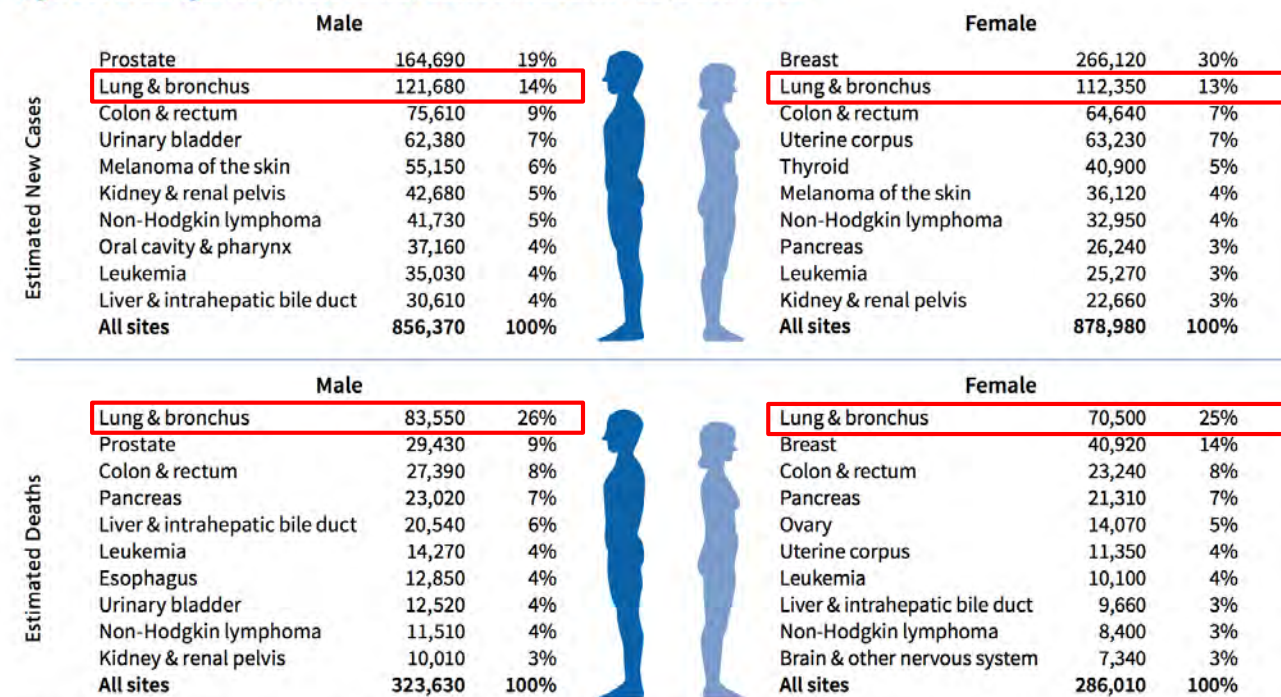
Equity Issues with Lung Cancer Screening: Today's Focus

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

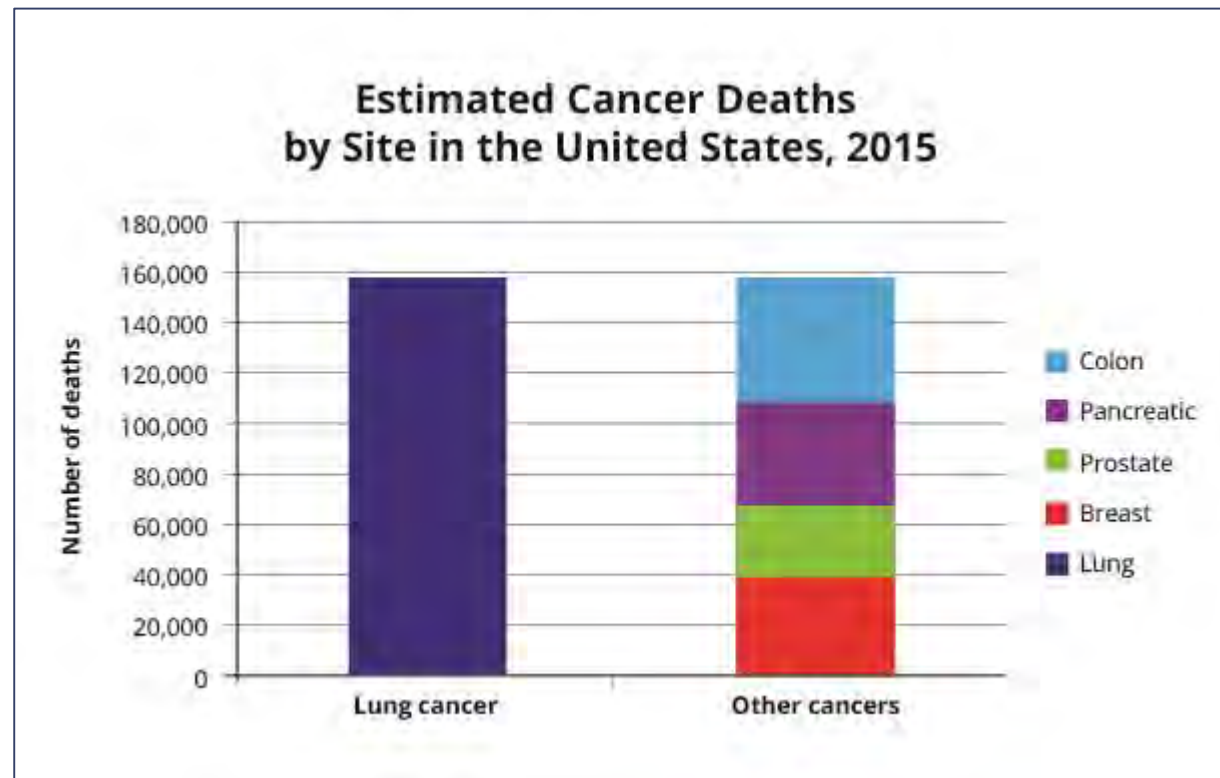


Estimates are rounded to the nearest 10, and cases exclude basal cell and squamous cell skin cancers and in situ carcinoma except urinary bladder. Ranking is based on modeled projections and may differ from the most recent observed data.

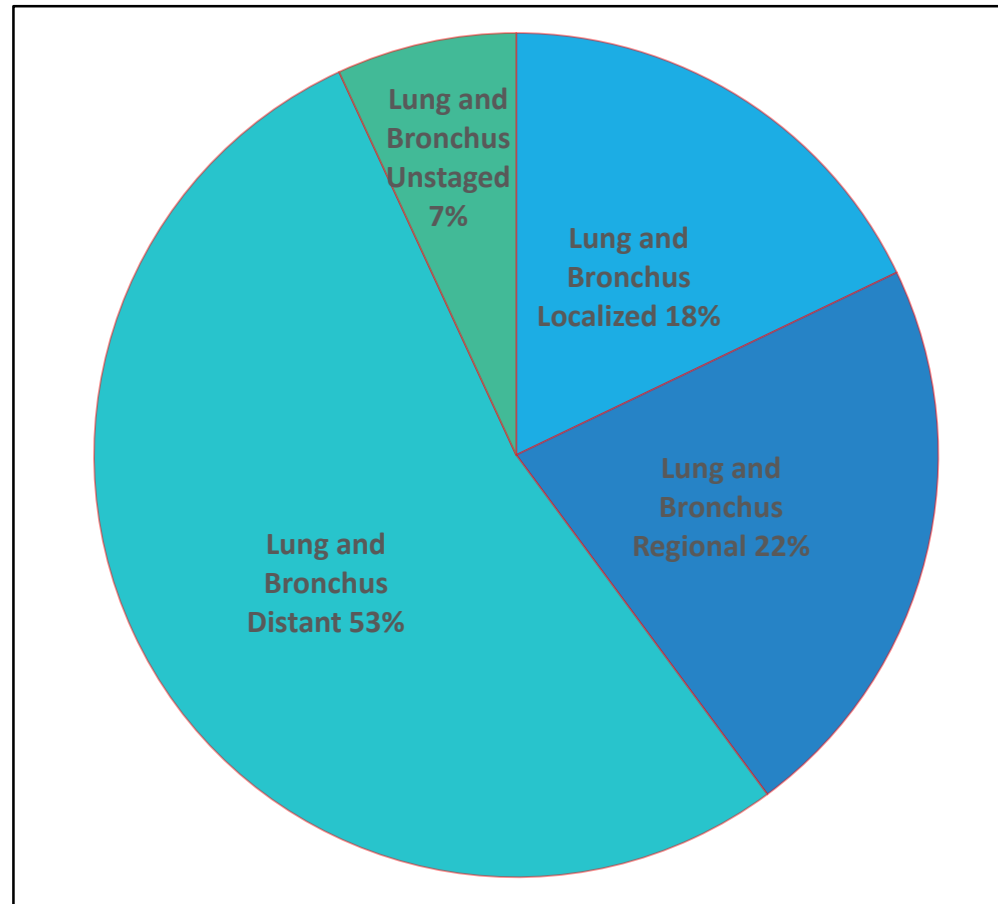
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Lung Cancer Mortality



Lung Cancer Diagnosed by Stage in the U.S.



Lung Cancer and Health Disparities



AFRICAN-AMERICAN MEN AND LUNG CANCER

PROTECT YOUR FAMILY AND YOURSELF!

AFRICAN-AMERICAN MEN have the HIGHEST RATES OF LUNG CANCER in the U.S.
LUNG CANCERS are mostly caused by SMOKING.

IT'S NEVER TOO LATE TO QUIT.



U.S. Department of Health and Human Services
Centers for Disease Control and Prevention



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?



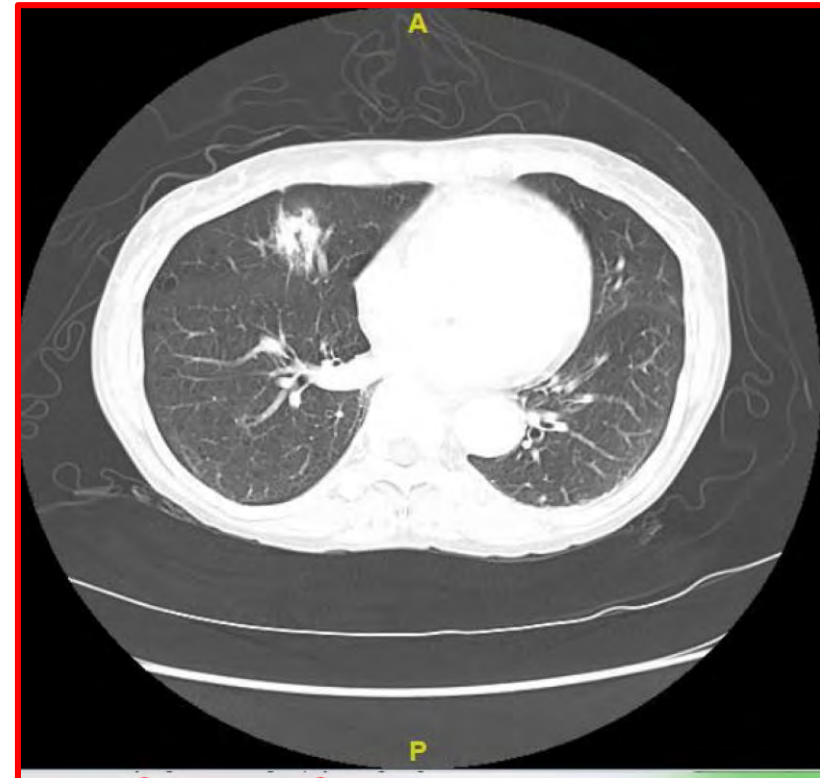
National Lung Screening Trial Chest X-Ray vs. Low-dose CT

CHEST X-RAY



VS

LOW-DOSE CT

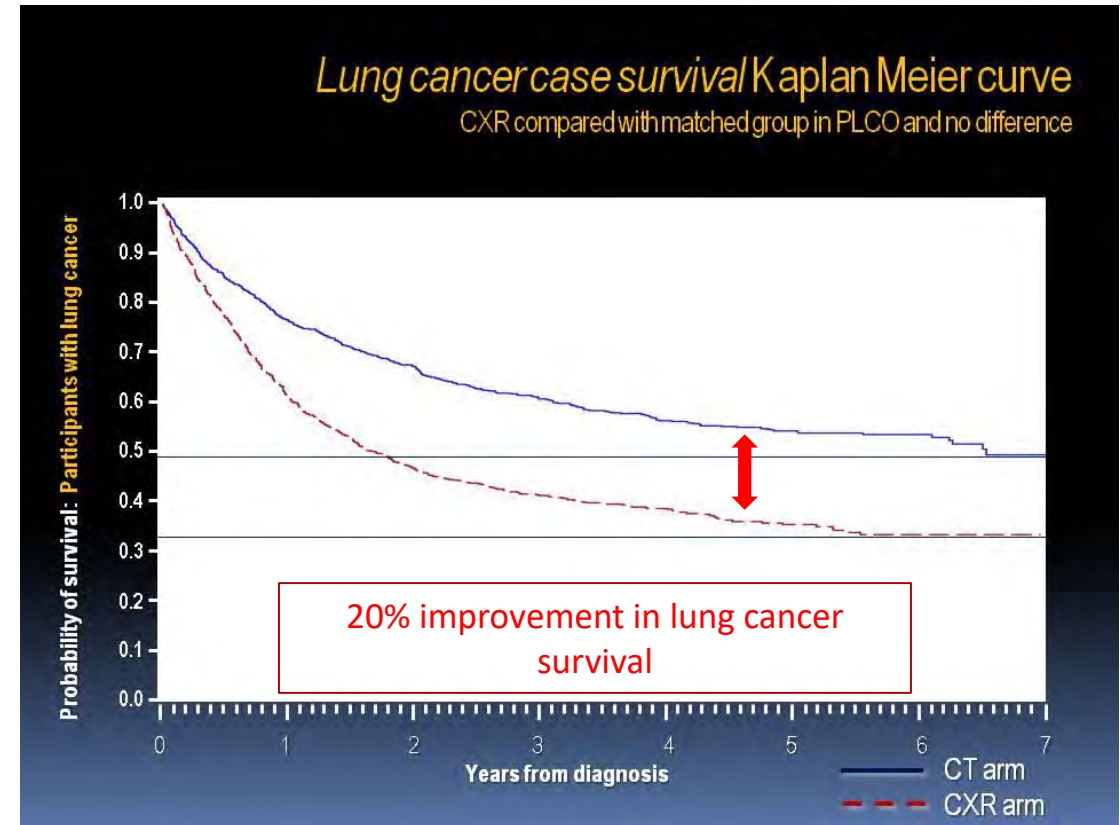


Landmark National Lung Screening Trial (NLST) Results Showed Lung Cancer Mortality Benefit - 2011

Results:

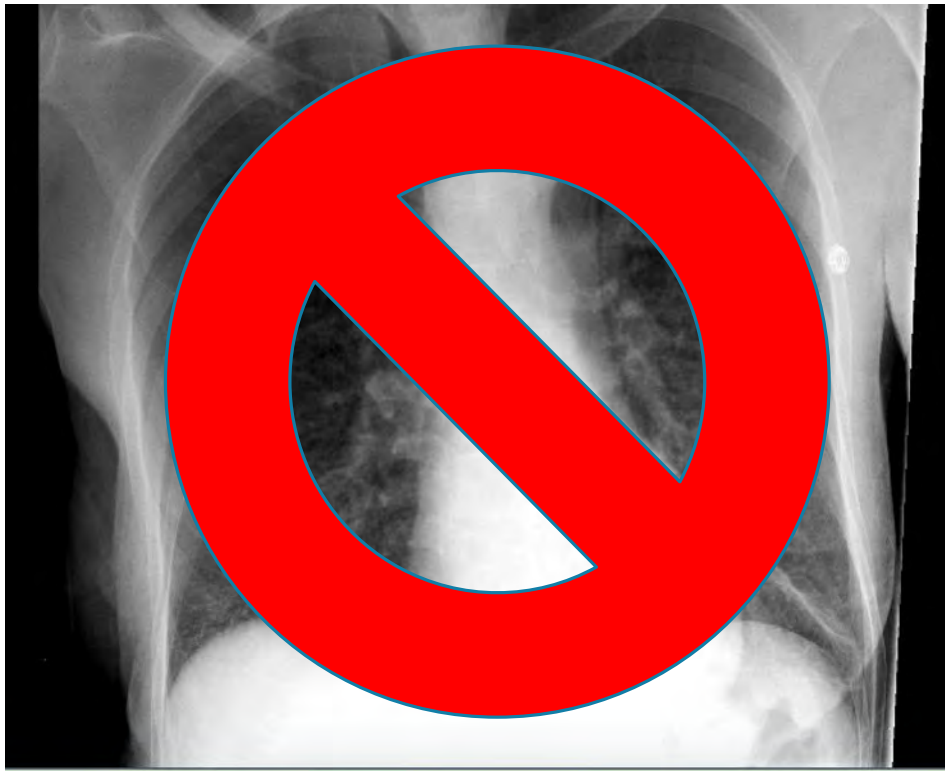
- 20 % decrease in lung cancer deaths in those who received Low-Dose CT vs. chest x-ray
- 6.7% decrease in all-cause mortality (deaths due to any factor, including lung cancer)
- 1.1% lung cancer detection rate

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

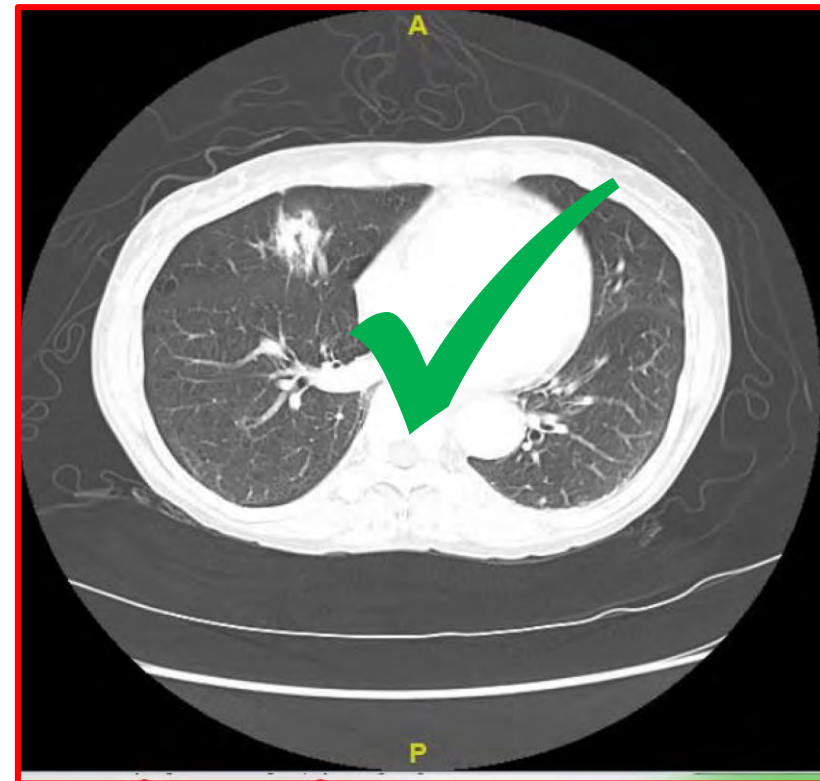


National Lung Screening Trial Chest X-Ray vs. Low-dose CT

CHEST X-RAY

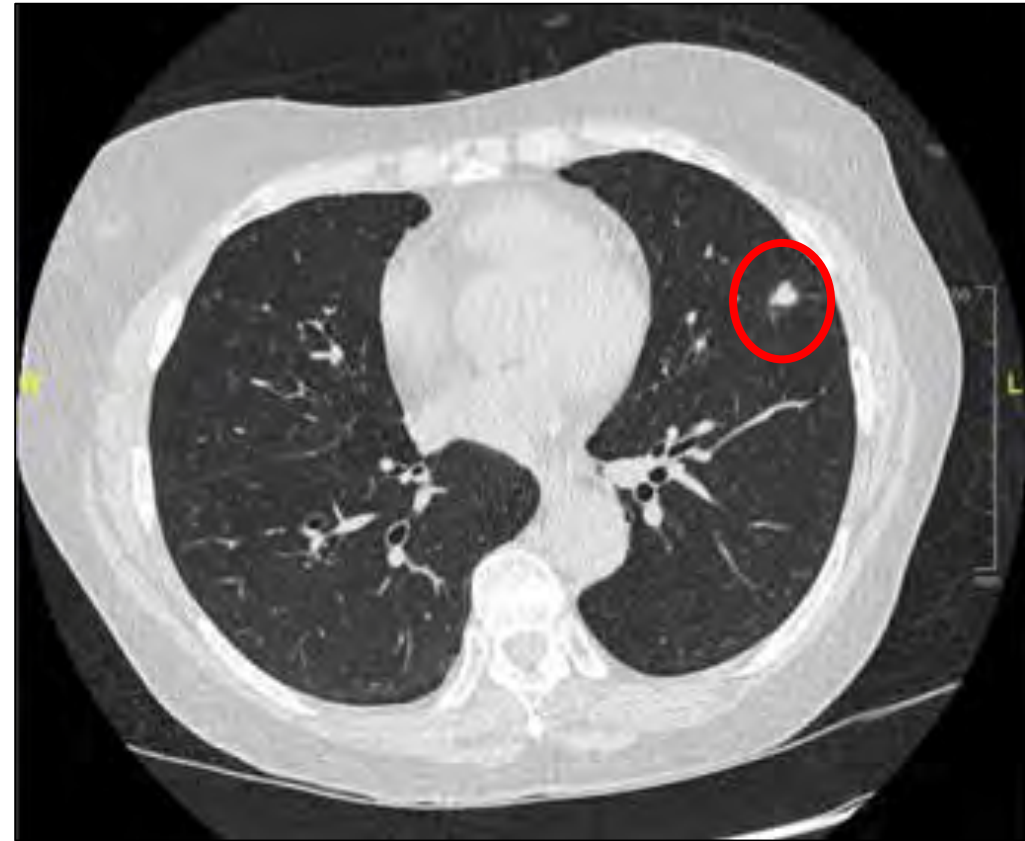


LOW-DOSE CT



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?

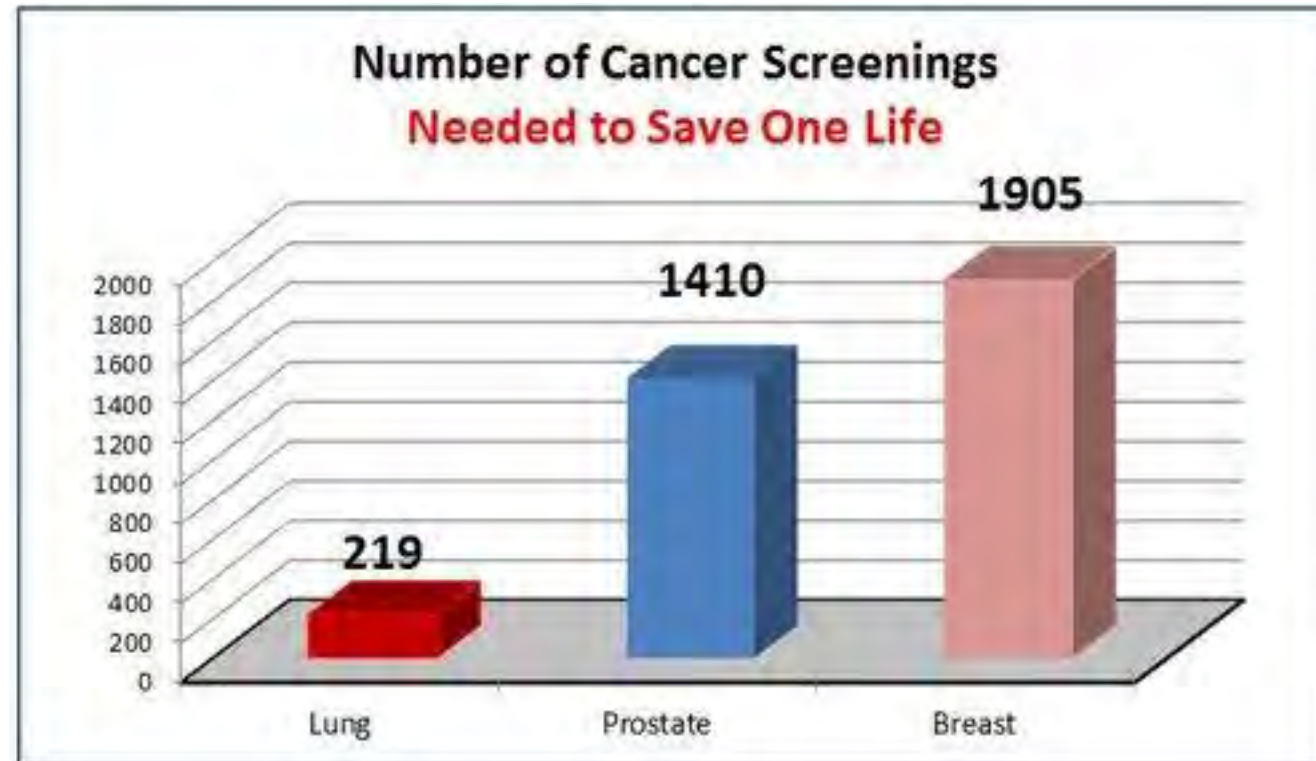


A low-dose CT scan continuously rotates in a spiral motion taking several 3-dimensional x-rays of the lungs:

- 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

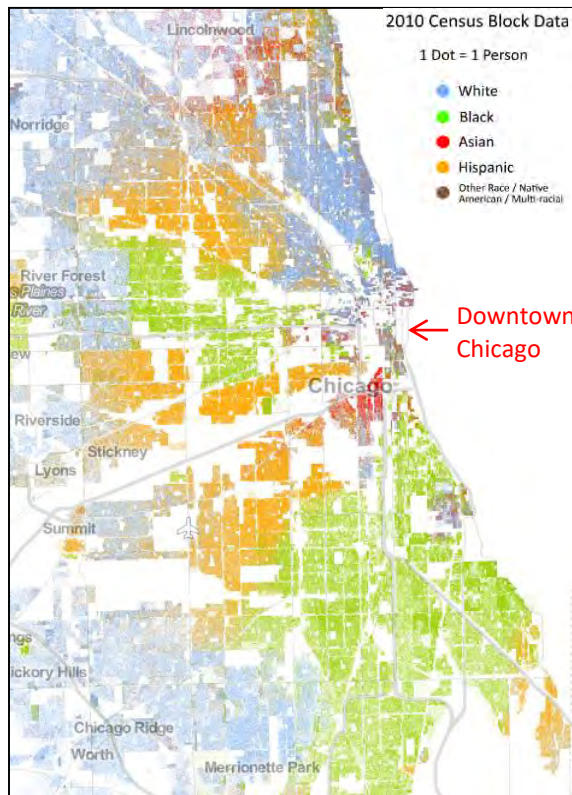


Disparities in Chicago

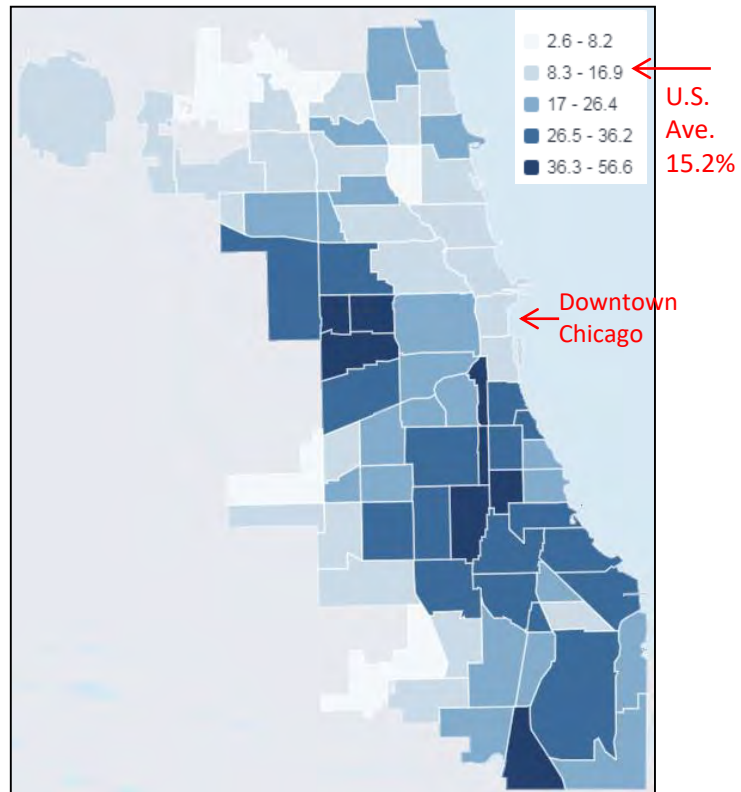
Racial & Ethnic Group Distribution

Chicago:
2.7 million

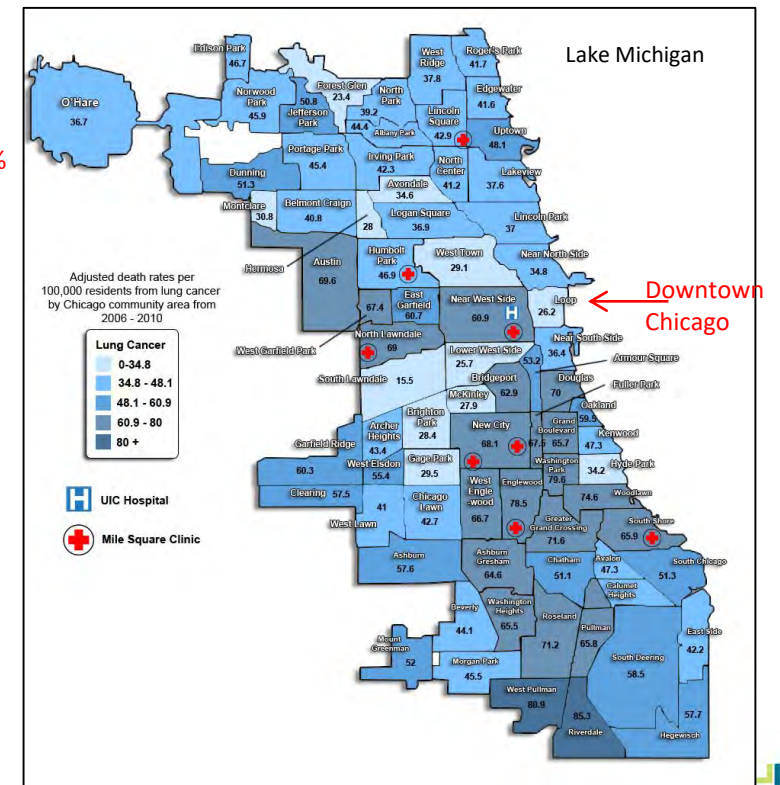
45% White
33% Black



Poverty Distribution

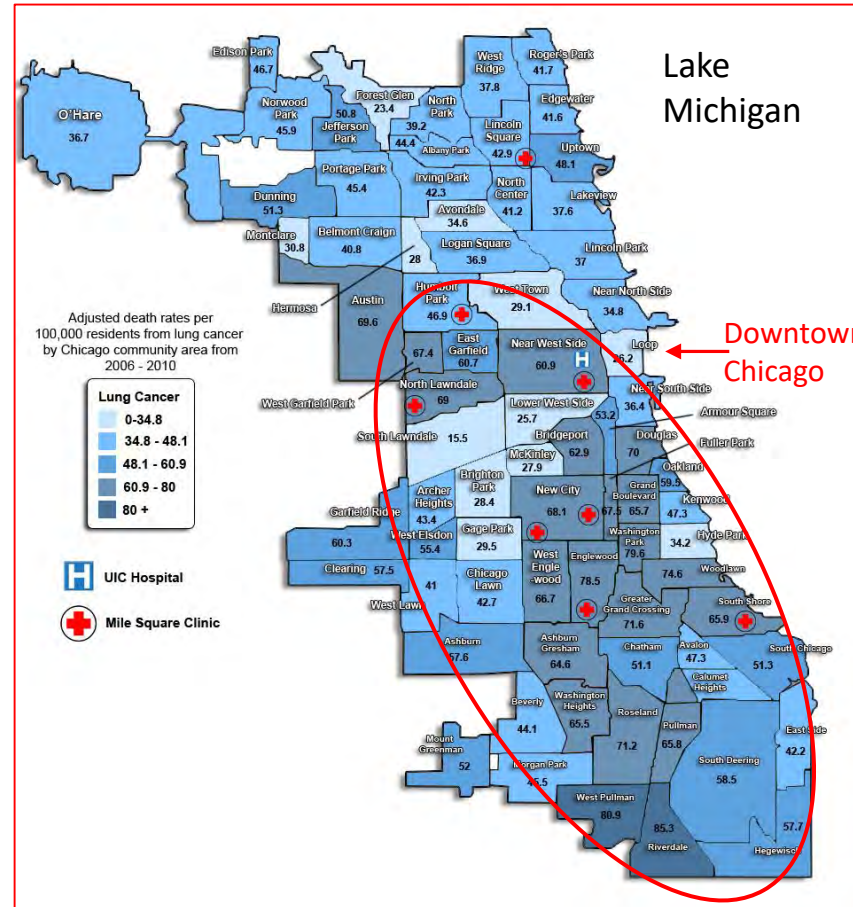


Lung Cancer Mortality Rates

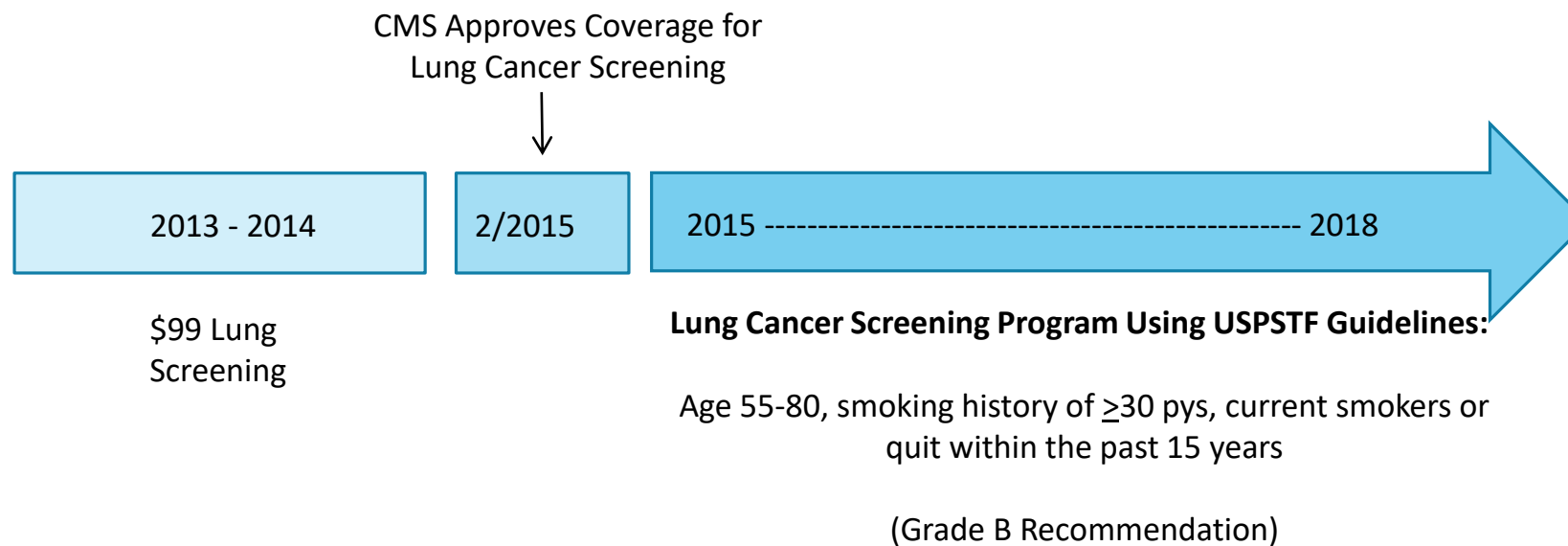


Lung Cancer Mortality and UI Health's Service Area

- 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

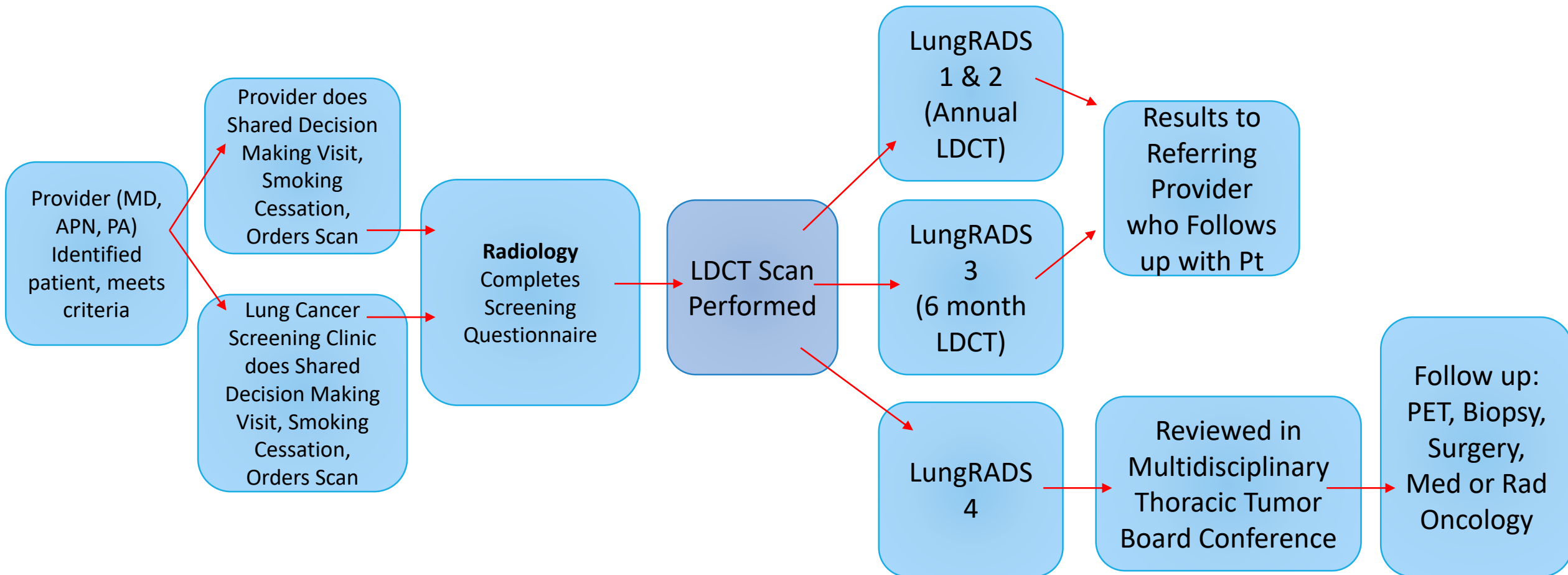


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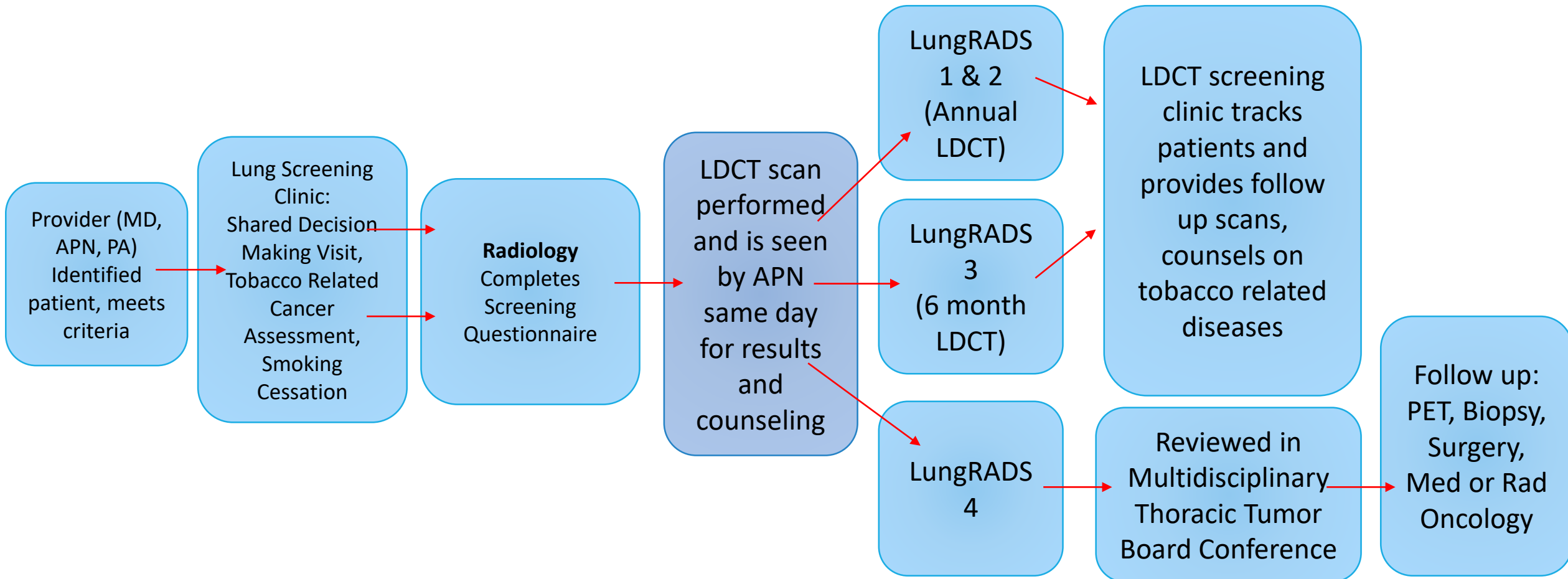
750+



Current UI Health's Lung Cancer Screening Workflow



2019: Centralized Screening Clinic for Tobacco Related Diseases



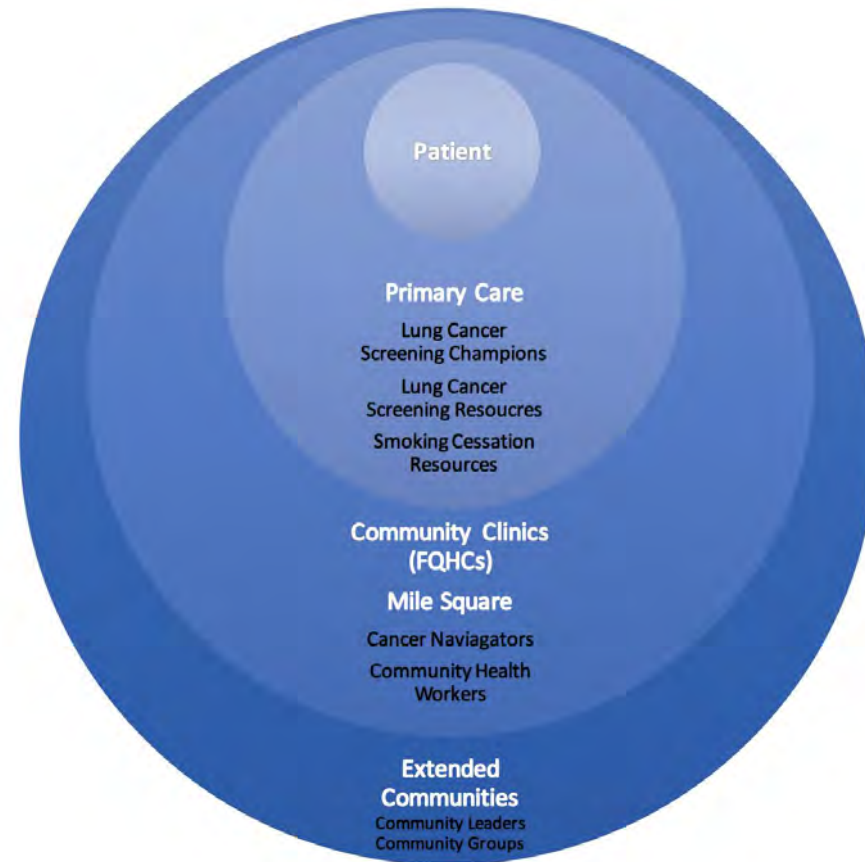
Physician Engagement – A Key to Lung Cancer Screening

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

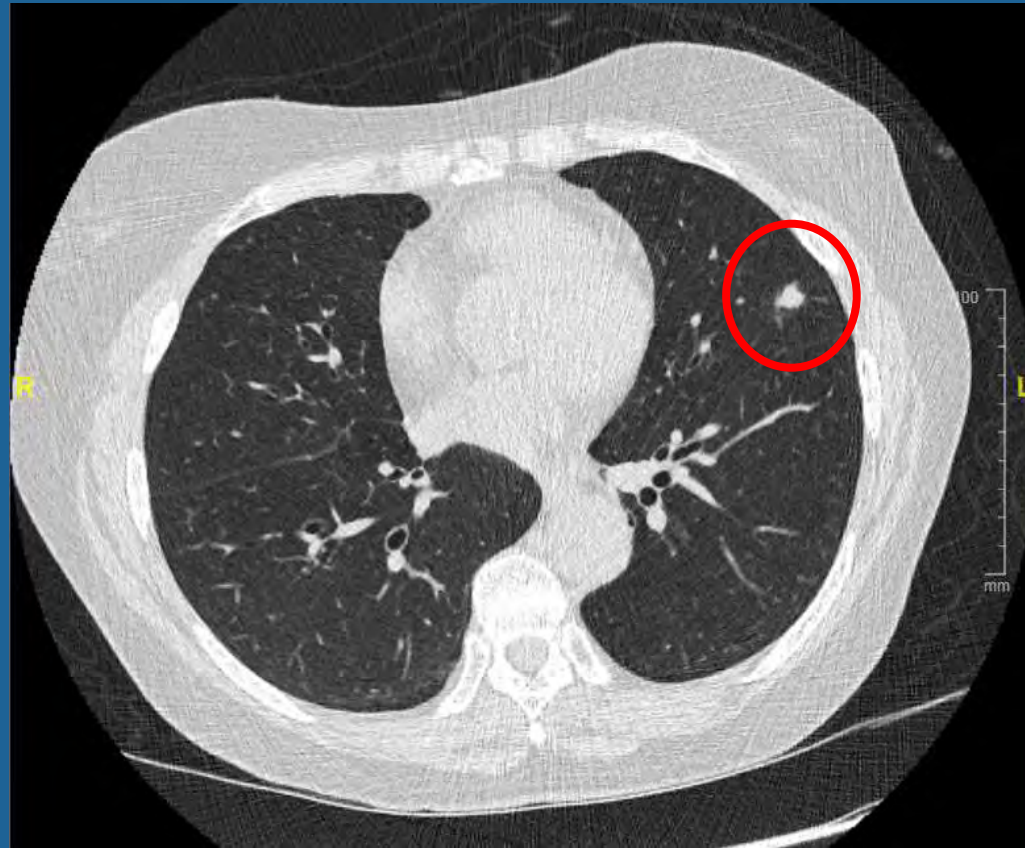


UI Health

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

Letters

RESEARCH LETTER

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

The National Lung Screening Trial (NLST) showed a 20% reduction in lung cancer (LC) mortality by detection of LC at an early stage with low-dose computed tomography (LDCT) scanning vs chest radiography for individuals who are at high-risk for LC based largely on age and smoking history.¹ A total of 90.9% of the NLST participants were white, and only 4.5% were African American. Yet, although the overall incidence and mortality from LC have been declining in the United States, African Americans have the highest LC mortality rate compared with other races. The magnitude of this racial disparity has increased over the past 4 decades.² Screening programs tailored to high-risk patients of minority races/ethnicities could help to reduce this health disparity and save even more lives.³ The goal of this study was to assess the demographic characteristics, baseline LDCT scan findings (lung reporting and data system, Lung-RADS⁴), and detected LCs in an inner city, minority-based population at the University of Illinois at Chicago (UIC) that included federally qualified health centers vs that of the NLST.

Methods | We performed a retrospective analysis of the first 500 baseline LDCT screens at UIC and evaluated these data against the NLST LDCT (26 722 baseline screens) arm. The study was conducted from September 4, 2015, to December

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^a

Characteristic	UIC (n = 500)	NLST (n = 26 722) ^a	P Value
Age, mean (SD)	62.8 (5.69)	61.4 (5.03)	<.001
Sex			
Male	262 (52.4)	15 770 (59.0)	
Female	238 (47.6)	10 952 (41.0)	.01
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
Others ^b -1	1 (0.2)	516 (1.9)	
Missing	0	163 (0.6)	
Ethnicity			
Hispanic or Latino	33 (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.

Table 2. Lung-RADS Classification From the UIC Cohort and the LDCT Arm of the NLST^{a,b}

Lung-RADS Classification ^a	UIC, No. (%) ^c	UIC With Cancer, No./No. (%)	NLST, No. (%) ^d	NLST With Cancer, No./No. (%) ^e
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*	0	0/0	97 (0.4)	0/97
3, 4A, 4B*	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 Prineas et al⁴ for comparison NLST and UIC data.

^b Lung-RADS category descriptors: 0 (no complete 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 Percentages may not sum to 100 due to rounding.

^d These classifications were consistent with more than 1 Lung-RADS category in the NLST.

^e The distributions of Lung-RADS categories were significantly different between UIC and NLST cohorts ($P < .001$).

^f Percentages may not sum to 100 due to rounding.

^g These classifications were consistent with more than 1 Lung-RADS category in the NLST.

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Letters

28, 2017. Inclusion criteria for the UIC cohort were the same as in the NLST study.¹ We compared UIC LDCT findings with those of the NLST using Lung-RADS criteria that were established by the American College of Radiology in 2015 and retrospectively applied to the NLST in a secondary analysis (26 455 evaluable).⁴ Lung-RADS is now in common use as a system for risk stratifying and standardizing LDCT findings on a scale of 0 to 4 primarily based on the presence and/or characteristics of lung nodules. Demographic data, Lung-RADS scores of baseline LDCT scans, and diagnosed LC cases were collected and evaluated vs data of the NLST LDCT arm. Summary statistics and statistical tests (2-tailed, unpaired *t* tests for continuous variables and χ^2 tests for categorical variables) were applied to compare the UIC cohort with the NLST LDCT arm. The study was approved by the UIC Institutional Review Board. Statistical analysis was performed using SAS, version 9.4 (SAS Institute Inc).

Results | Demographic characteristics of the UIC cohort did not resemble those of the NLST LDCT arm (Table 1). The UIC cohort had a different racial and ethnic composition than the NLST LDCT arm ($P < .001$) of African American (UIC, 69.6% [348 of 500] vs NLST, 4.5% [1195 of 26 722]) and Hispanic or Latino (UIC, 10.6% [53 of 500] vs NLST, 1.8% [479 of 26 722]) individuals. The UIC cohort had a higher percentage of current smokers than the NLST LDCT arm (72.8% [364 of 500] vs 48.1% [12 860 of 26 722], respectively). The outcome distribution of Lung-RADS categories in the UIC sample was different from that in the NLST LDCT arm sample ($P < .001$). Proportion of positive (Lung-RADS class 3 or 4) LDCT screens in the UIC cohort (24.6% [123 of 500]) was nearly double that in the NLST LDCT arm (13.7% [3601 of 26 455]) (Table 2). The UIC cohort had a higher LC detection rate (2.6% [13 of 500]) than the NLST LDCT (1.1% [292 of 26 455]) arm ($P = .002$). Consistent with the goal of screening, both cohorts had greater than 50% of LC cases detected at an early (stage I) curable stage (UIC [7 of 13] and NLST [155 of 266]).

Discussion | The UIC cohort had a higher percentage of African American individuals, positive LDCT scans, and percentage of diagnosed LC cases. 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.⁵ This report provides experiential evidence that is consistent with the notion that a more-detailed assessment of individual risk of LC may be more effective than focusing only on age and smoking status criteria.⁶ The magnitude of the disparity in LC mortality between African American and white individuals has been widening.² Screening that is skewed toward the white population could paradoxically increase racial disparities in LC outcomes.³ Refining risk-based guidelines would improve the beneficial results of LDCT screening.⁶

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Author Contributions: Ms Pasquinelli and Dr Liu had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

Concept and design: Pasquinelli, Kovitz, Winn, Feldman.

Acquisition, analysis, or interpretation of data: Pasquinelli, Kovitz, Menchaca, Liu, Feldman.

Drafting of the manuscript: Pasquinelli, Koshy, Liu, Winn, Feldman.

Critical revision of the manuscript for important intellectual content: Pasquinelli, Kovitz, Koshy, Menchaca, Winn, Feldman.

Statistical analysis: Pasquinelli, Koshy, Liu, Feldman.

Administrative, technical, or material support: Pasquinelli, Menchaca, Feldman.

Supervision: Pasquinelli, Kovitz, Koshy, Winn, Feldman.

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Additional Contributions: James P. Zatory, PhD (University of Illinois Cancer Center), reviewed and edited the manuscript; he did not receive financial compensation. We thank the National Cancer Institute for access to their data collected by the National Lung Screening Trial.

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

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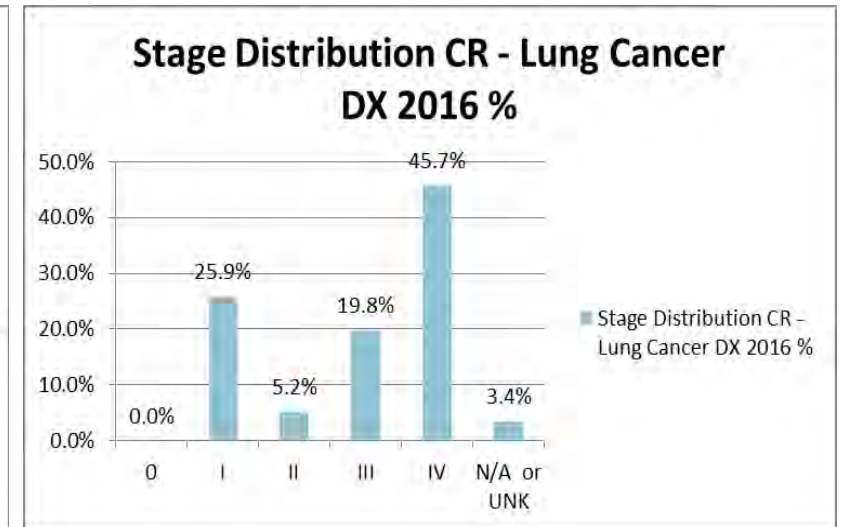
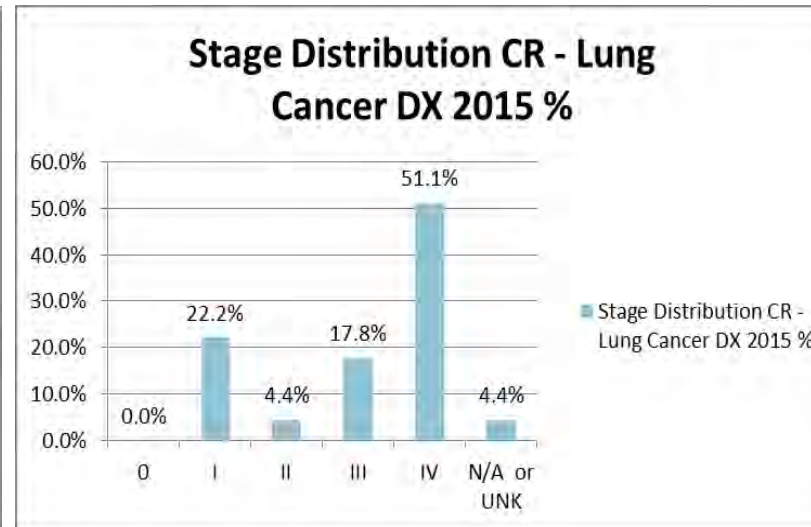
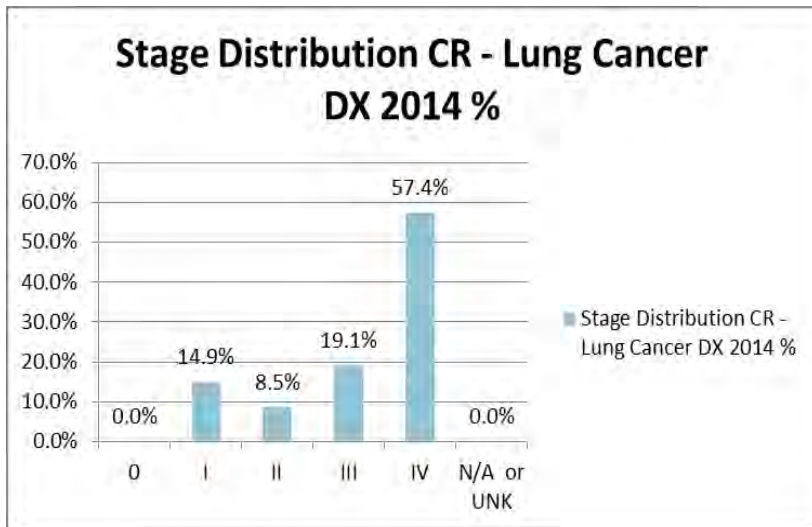


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1. Consistent with the goal of screening, both cohorts had greater than 50% of lung cancer cases detected at an early (stage I) curable stage (UIC [7 of 13] and NLST [155 of 266]).
2. Screening that is skewed toward the white population could paradoxically 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.

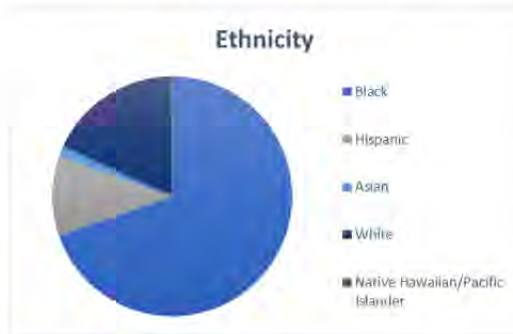
Methods

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.



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%



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

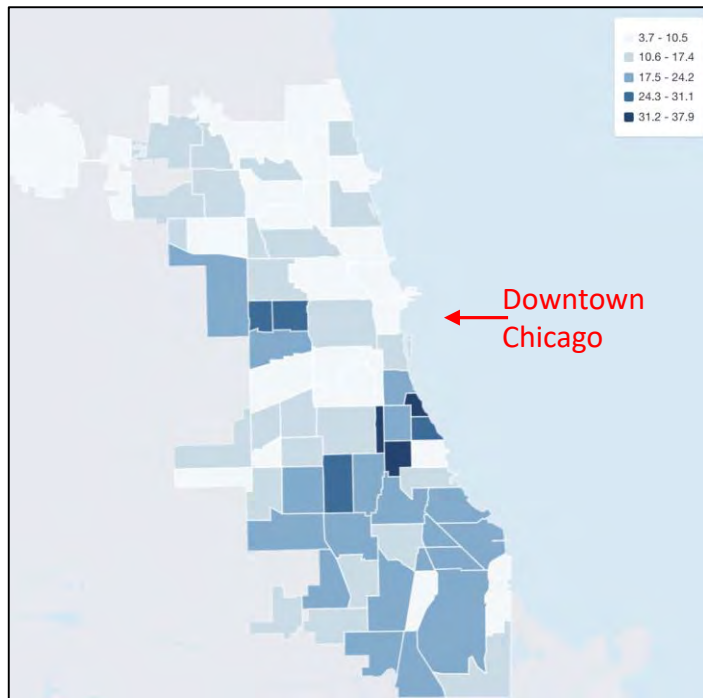
The downstream revenue attributable to the lung cancer screening program at UIH is approximately \$770/case. The overall net revenue for the screening program is approximately \$515K from 2015-2017. The screening program has detected 16 cancer cases, 8 of which were early stage cancers. In consideration of the mortality benefit of this program and the higher risk population it serves, Further research could evaluate the financial value of a 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

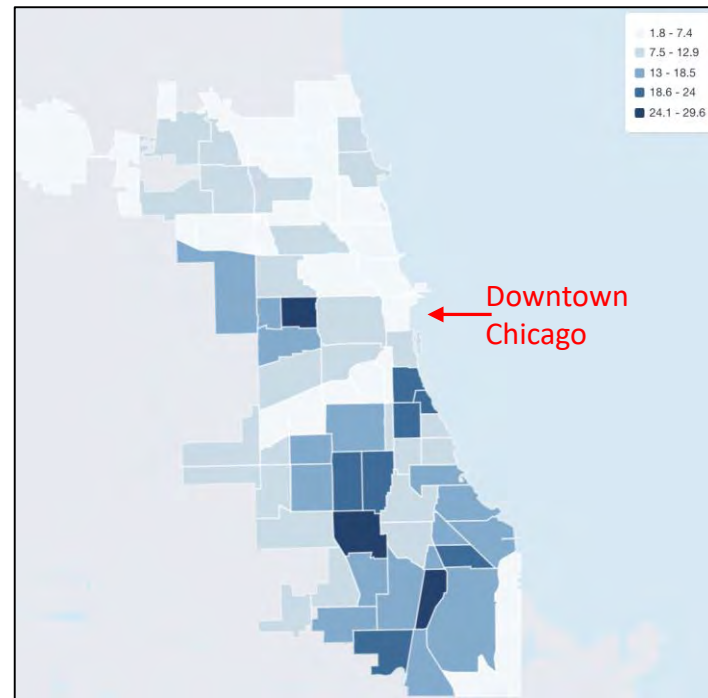
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Screening Can Reduce Health Disparities and Save Lives

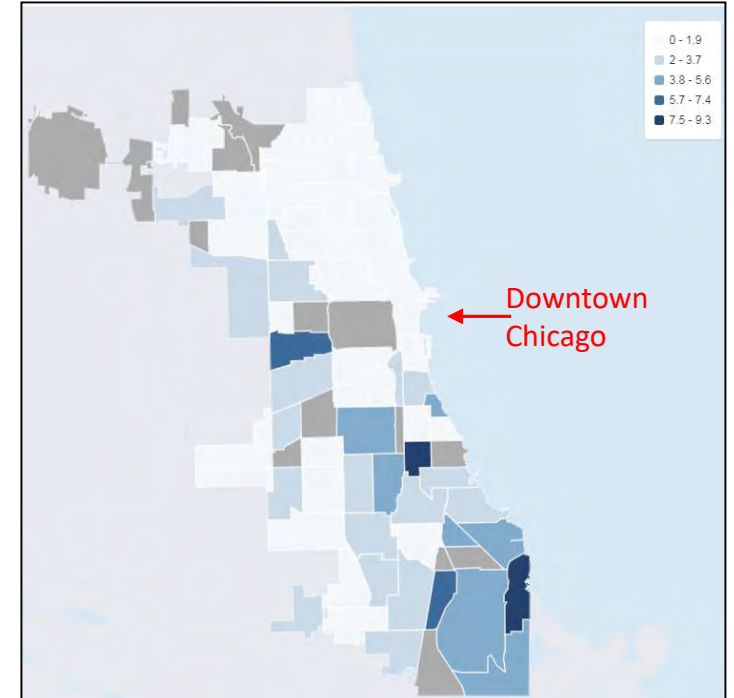
BREAST CANCER MORTALITY



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 mortality communities reduces health disparities and save lives.



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