Pursuing Health Equity in Lung Cancer Screening: The ‘what’ and ‘what next’

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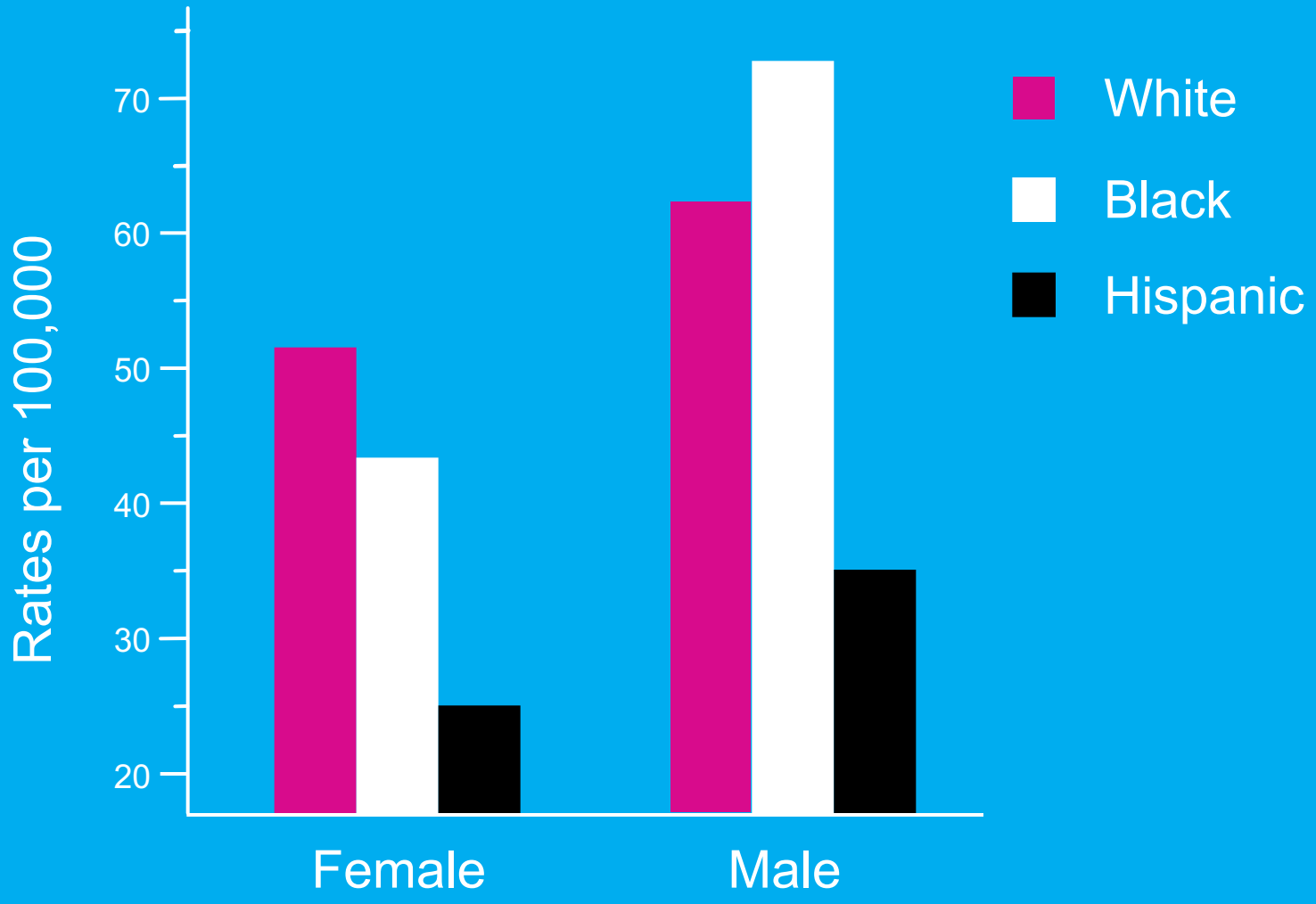
Outline

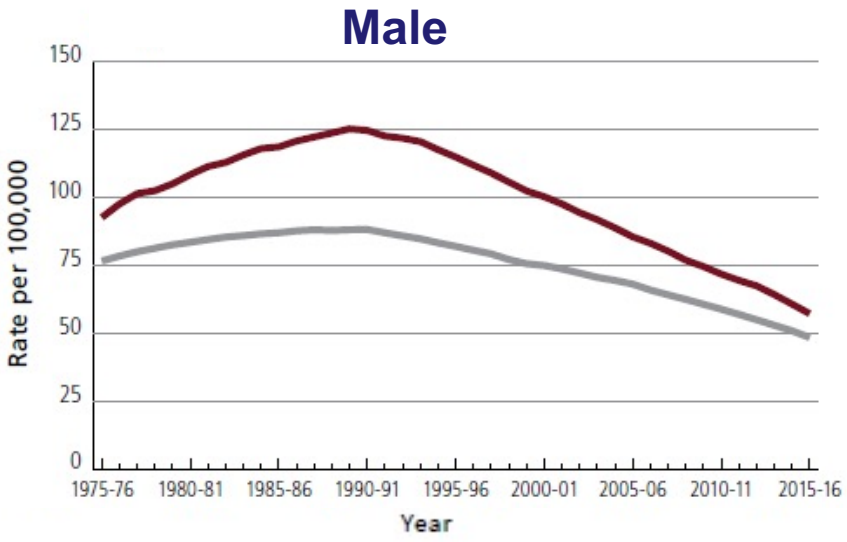
- Disparities in lung cancer burden and outcomes in the US
- Current status of lung cancer implementation
- Barriers to lung cancer screening and impact on racial and ethnic minorities
- Potential solutions

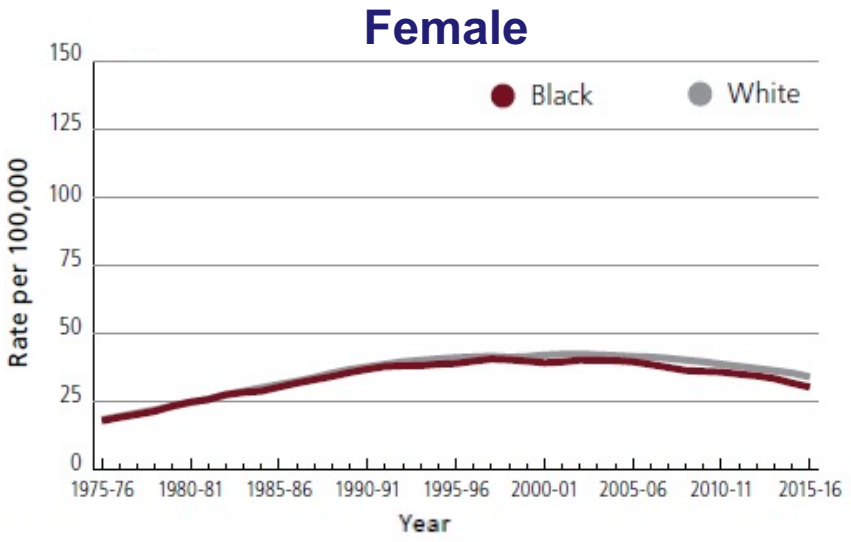
Mortality from Lung Cancer by Race/Ethnicity



Surveillance Epidemiology and End Results

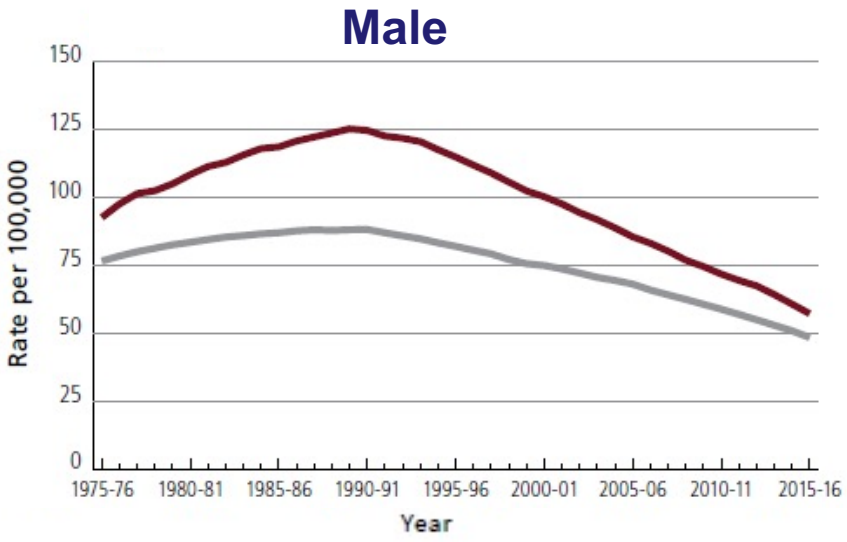
Trends in Death Rates for Lung Cancer in the US

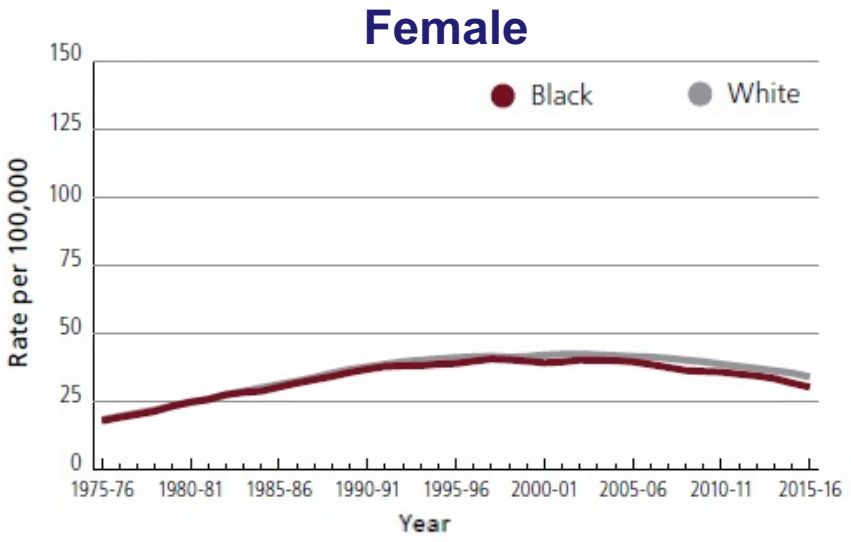




American Cancer Society, Surveillance Research, 2019

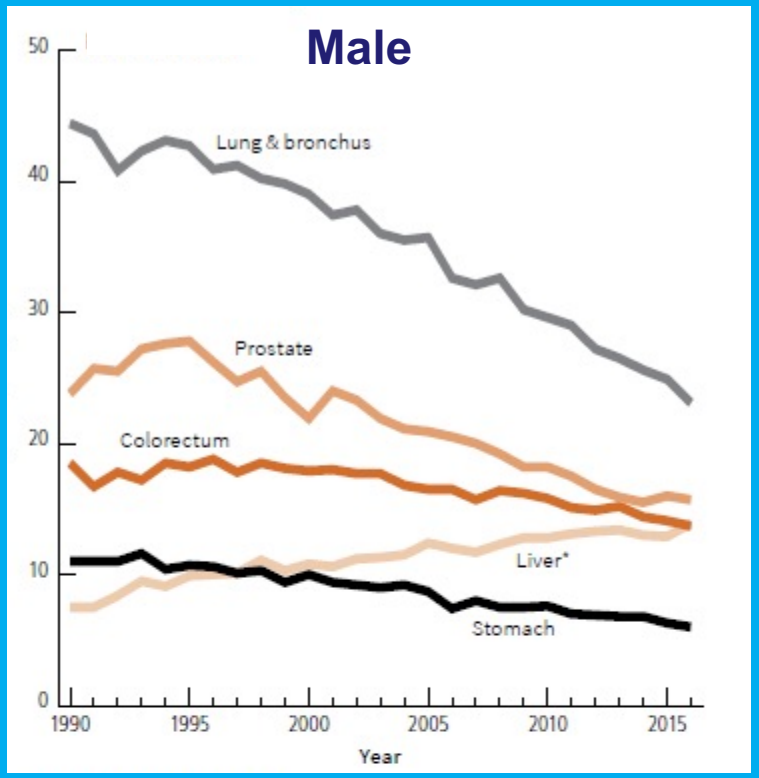
Trends in Death Rates for Lung Cancer in the US

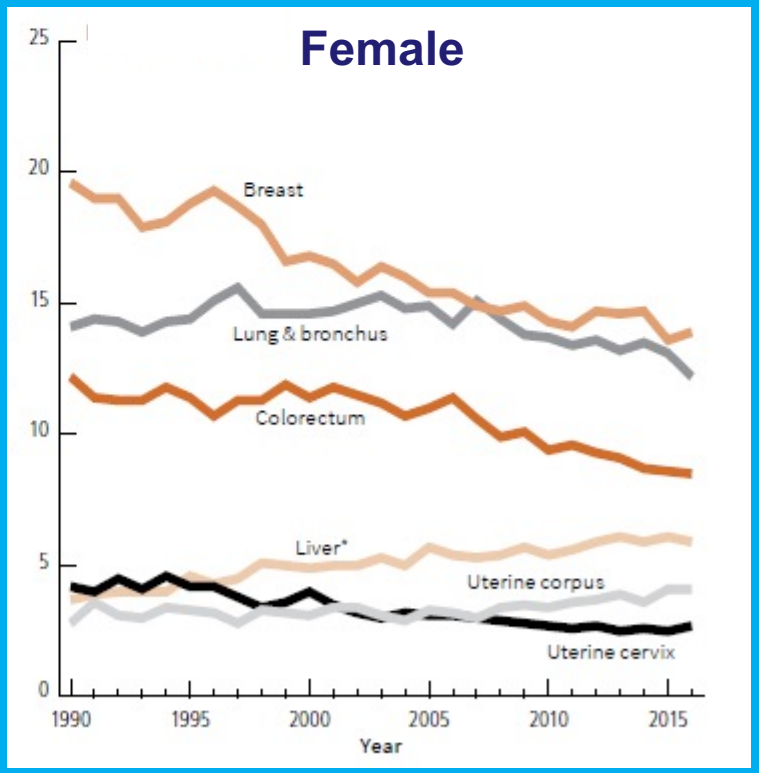




American Cancer Society, Surveillance Research, 2019

Trends in Death Rates for Lung Cancer in the US among Hispanics



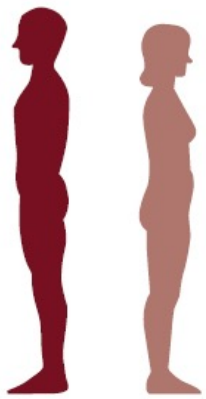


American Cancer Society, Surveillance Research, 2019

Mortality from Cancer in the US: 2018 Estimates

Blacks

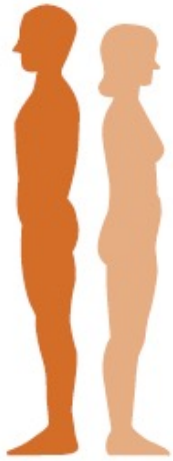
Male		
Lung & bronchus	9,280	25%
Prostate	5,350	15%
Colon & rectum	3,810	10%
Pancreas	2,690	7%
Liver & intrahepatic bile duct	2,670	7%
Stomach	1,230	3%
Myeloma	1,160	3%
Leukemia	1,140	3%
Kidney & renal pelvis	940	3%
Esophagus	850	2%
All sites	**36,840**	



Female		
Lung & bronchus	7,270	20%
Breast	6,540	18%
Colon & rectum	3,300	9%
Pancreas	2,940	8%
Uterine corpus	2,500	7%
Ovary	1,400	4%
Liver & intrahepatic bile duct	1,350	4%
Myeloma	1,200	3%
Leukemia	980	3%
Uterine cervix	770	2%
All sites	**36,190**	

Hispanics

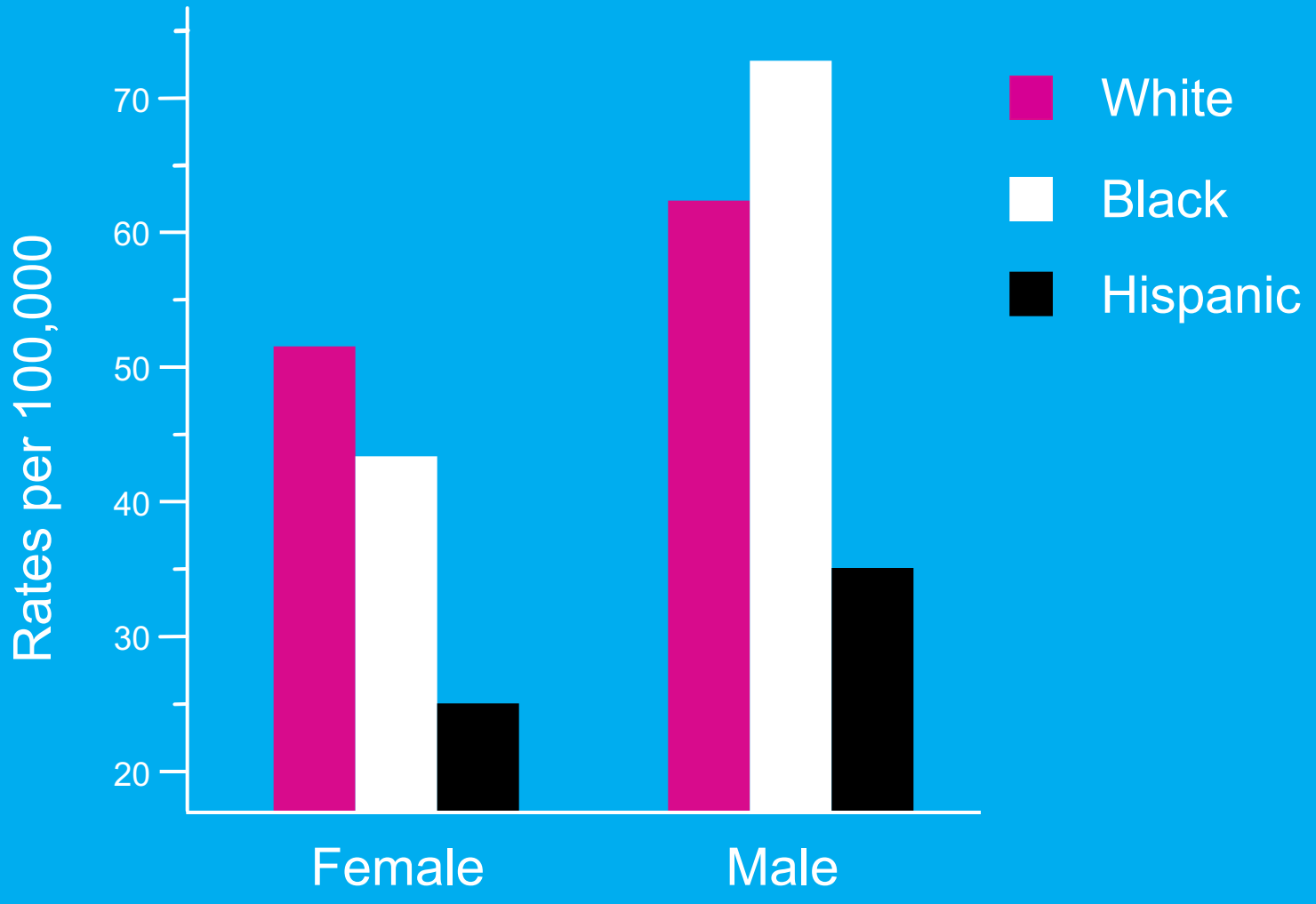
Males		
Lung & bronchus	3,500	16%
Liver & intrahepatic bile duct	2,700	12%
Colon & rectum	2,400	11%
Prostate	2,000	9%
Pancreas	1,700	8%
Stomach	1,100	5%
Leukemia	1,000	5%
Non-Hodgkin lymphoma	1,000	4%
Kidney & renal pelvis	900	4%
Brain & other nervous system	700	3%
All sites	22,300	100%



Females		
Breast	3,200	16%
Lung & bronchus	2,600	13%
Colon & rectum	1,800	9%
Pancreas	1,600	8%
Liver & intrahepatic bile duct	1,300	6%
Ovary	1,100	5%
Uterine corpus	1,000	5%
Leukemia	900	4%
Stomach	800	4%
Non-Hodgkin lymphoma	700	3%
All sites	20,400	100%

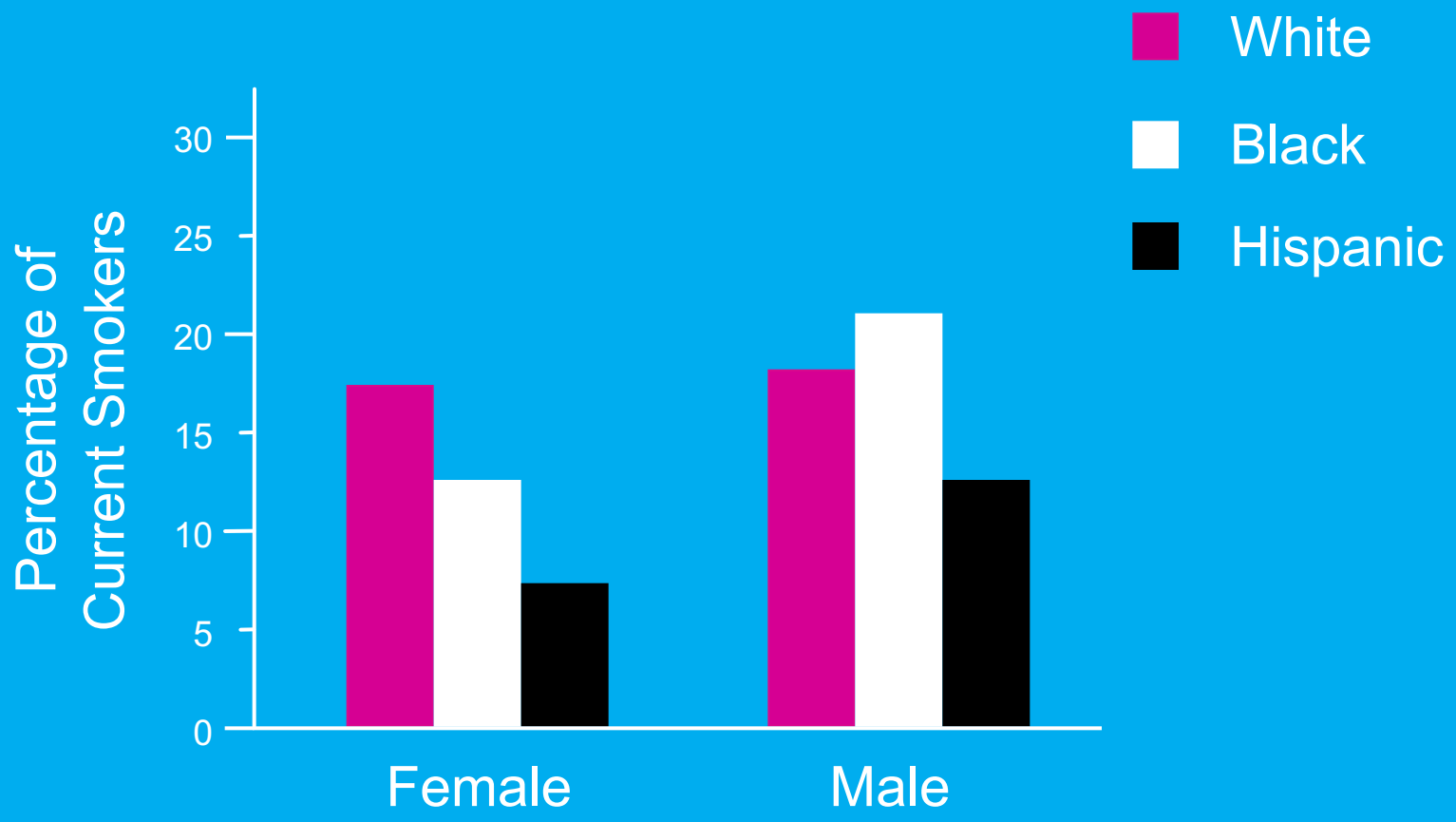
American Cancer Society, Surveillance Research, 2019

Age-Adjusted Lung Cancer Incidence Rates by Race and Ethnicity



Surveillance Epidemiology and End Results 2012-16

Cigarette Smoking Behaviors by Race and Ethnicity

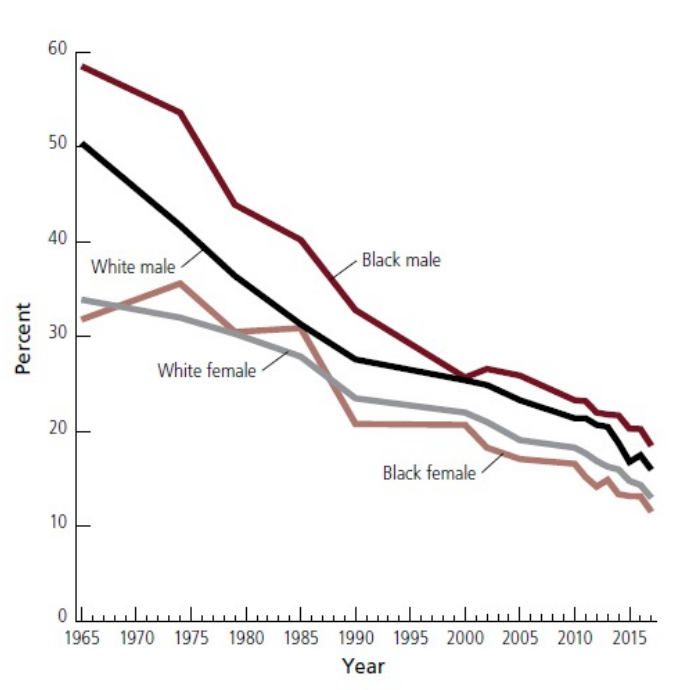


~80% Blacks use menthol cigarettes

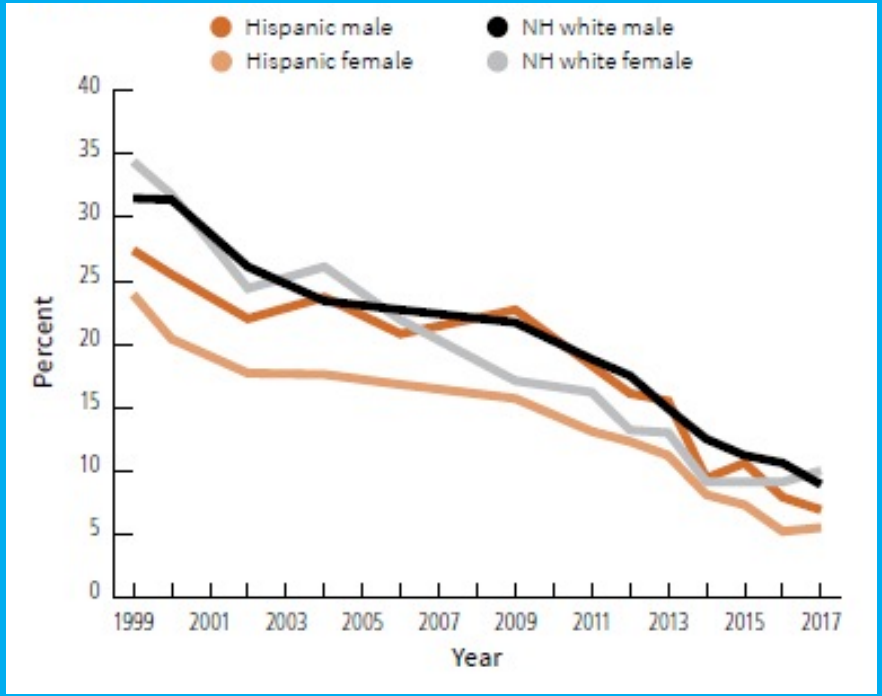
American Lung Association, Smoking Facts, 2019

Trends in Cigarette Smoking Prevalence in the US

Adults

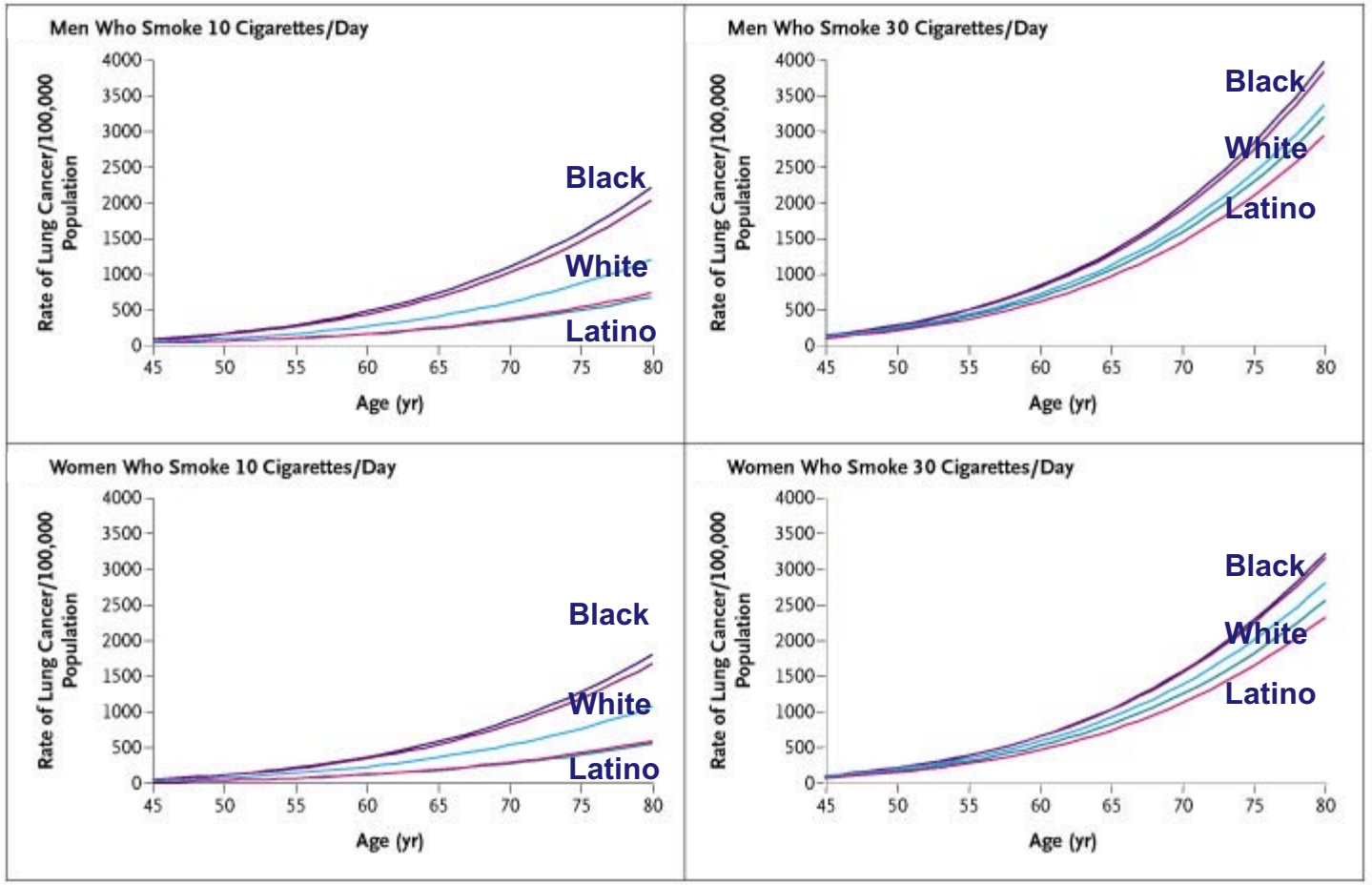


High School Students



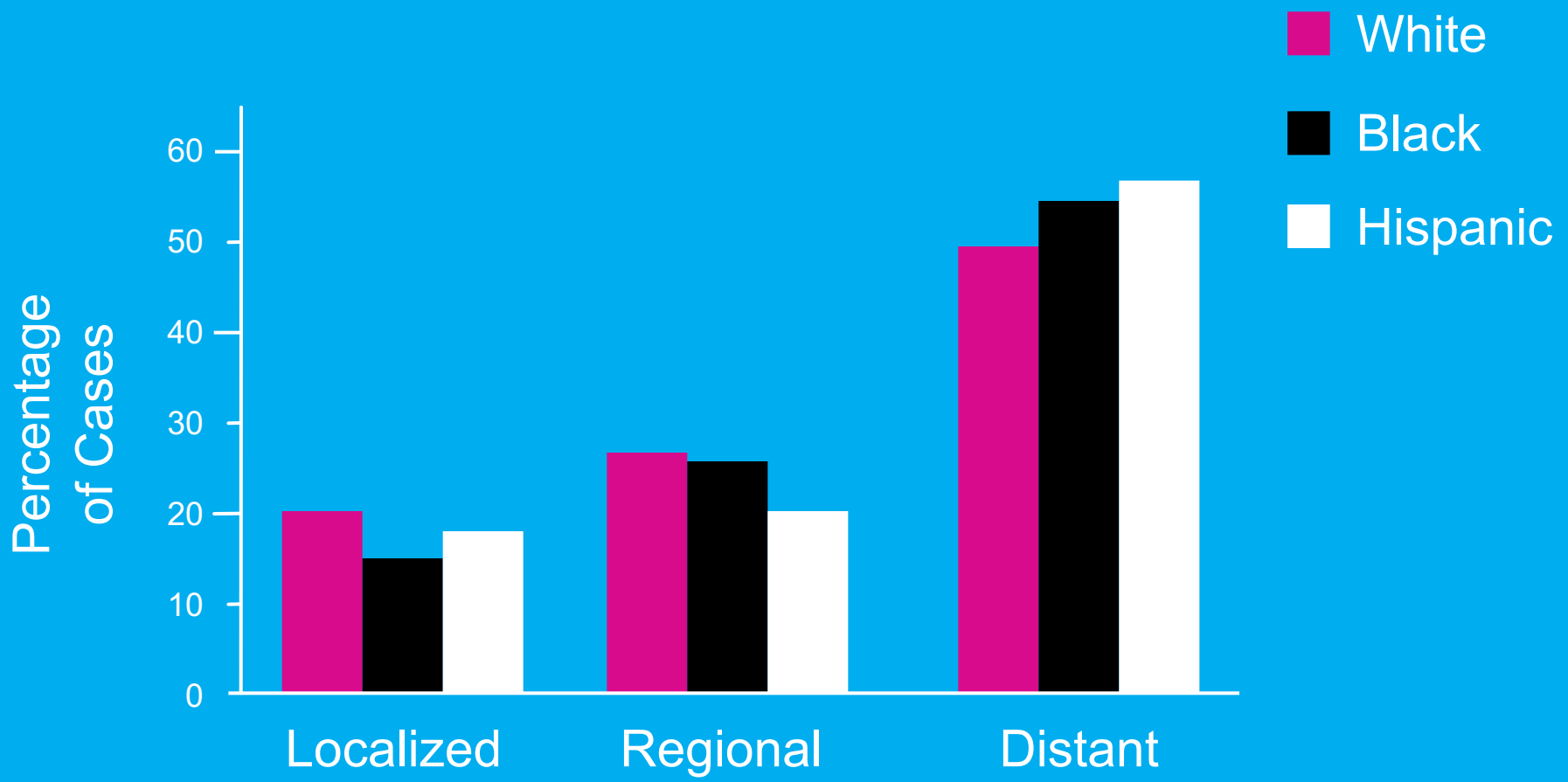
American Cancer Society, Surveillance Research, 2019

Ethnic and Racial Differences in Smoking-Related Lung Cancer Risk



Haiman C, et al. Ethnic and Racial Differences in Smoking-Related Risk of Lung Cancer. NEJM 2006

Lung Cancer Stage at Diagnosis by Race and Ethnicity



American Cancer Society, Surveillance Research, 2019

Equitable LDCT Screening Implementation is Critical Addressing Disparities in Lung Cancer Outcomes

Lung Cancer Screening 1990s

- USPSTF Recommendations:

  "Routine screening of asymptomatic persons for lung cancer with chest radiograph or sputum cytology is not recommended. All patients should be counseled against smoking"

- Based on studies conducted in the 1980s
- No benefit of CXR or sputum cytology vs. observation

Early Lung Cancer Action Project: overall design and findings from baseline screening

Claudia I Henschke, Dorothy I McCauley, David F Yankelevitz, David P Naidich, Georgeann McGuinness, Olli S Miettinen, Daniel M Libby, Mark W Pasmantier, June Koizumi, Nasser K Altorki, James P Smith

Summary

Background The Early Lung Cancer Action Project (ELCAP) is designed to evaluate baseline and annual repeat screening by low-radiation-dose computed tomography (low-dose CT) in people at high risk of lung cancer. We report the baseline experience.

Methods ELCAP has enrolled 1000 symptom-free volunteers, aged 60 years or older, with at least 10 pack-years of cigarette smoking and no previous cancer, who were medically fit to undergo thoracic surgery. After a structured interview and informed consent, chest radiographs and low-dose CT were done for each participant. The diagnostic investigation of screen-detected non-calcified pulmonary nodules was guided by ELCAP recommendations, which included short-term high-resolution CT follow-up for the smallest non-calcified nodules.

Findings Non-calcified nodules were detected in 233 (23% [95% CI 21–26]) participants by low-dose CT at baseline, compared with 68 (7% [5–9]) by chest radiography. Malignant disease was detected in 27 (2·7% [1·8–3·8]) by CT and seven (0·7% [0·3–1·3]) by chest radiography, and stage I malignant disease in 23 (2·3% [1·5–3·3]) and four (0·4% [0·1–0·9]), respectively. Of the 27 CT-detected cancers, 26 were resectable. Biopsies were done on 28 of the 233 participants with non-calcified nodules; 27 had malignant non-calcified nodules and one had a benign nodule. Another three individuals underwent biopsy against the ELCAP recommendations; all had benign non-calcified nodules. No participant had thoracotomy for a benign nodule.

Interpretation Low-dose CT can greatly improve the likelihood of detection of small non-calcified nodules, and thus of lung cancer at an earlier and potentially more curable stage. Although false-positive CT results are common, they can be managed with little use of invasive diagnostic procedures.

Weill Medical College of Cornell University and New York Presbyterian Hospital (Prof C I Henschke MD, Prof D F Yankelevitz MD, Prof O S Miettinen MD, Prof D M Libby MD, Prof M W Pasmantier MD, J Koizumi MD, Prof N K Altorki MD, Prof J P Smith MD) and New York University Medical Center (D I McCauley MD, Prof D P Naidich MD, G McGuinness MD), New York, NY, USA; and McGill University, Montreal, Canada (Prof O S Miettinen)

Correspondence to: Dr Claudia I Henschke, Department of Radiology, New York Presbyterian Hospital-Weill Cornell Medical Center, 525 East 68th Street, New York, NY 10021, USA (e-mail: chensch@mail.med.cornell.edu)

Lancet 1999; 354: 99–105
See Commentary page

Introduction

In the USA in 1998, there were an estimated 160 000 deaths from lung cancer and an estimated 172 000 new cases detected.[1] The cure rate for lung cancer is 12%, and the 5-year survival is only slightly higher. By contrast, when stage I cancer is resected, 5-year survival can be as high as 70%.[2-6] In the absence of resection, survival is a mere 12%.[2,6] Although these rates imply that survival in lung cancer may be substantially improved by screening coupled with earlier intervention, results of randomised trials in the 1970s have been interpreted as failing to show a beneficial effect on mortality.[7]

This paradox suggests that the negative results of the randomised trials
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COMMENTARY

Screening for lung cancer: time to think positive

See page 99

Lung-cancer screening ought to work. The disease is very common, and in its earliest stages up to 70% of cases can be cured by surgery.[1] Despite this, lung cancer has an overall prognosis so dismal that incidence exceeds prevalence. The main risk factor is easily identifiable, and simple non-invasive screening tests such as chest radiographs and sputum cytology are readily available.

And yet dogma states that screening is ineffective. Four randomised trials set up in the 1970s all failed to show a significant reduction in mortality,[2-5] and since then nihilism has generally prevailed.[6] In retrospect, it is a little surprising that these trials have been allowed to close the door so effectively on screening research. The Memorial Sloan-early-stage disease and improved survival in the screened group that merely represented a lead-time bias. It would be strange, nevertheless, if these very small screen-detected cancers do not prove to have a high cure rate.

So what are the snags? First, the 27 malignant tumours emerged from a large background noise of 233 (23%) people found to have non-calcified nodules. This high frequency of nodules is hardly surprising; the researchers outline a pragmatic scheme to follow up these and minimise the need for biopsy. New technology with sputum immuno-cytology may also help in this group. Screening with conventional cytology has not decreased mortality, but immunostaining promises much greater sensitivity: for example, experiments with monoclonal antibody 703D4

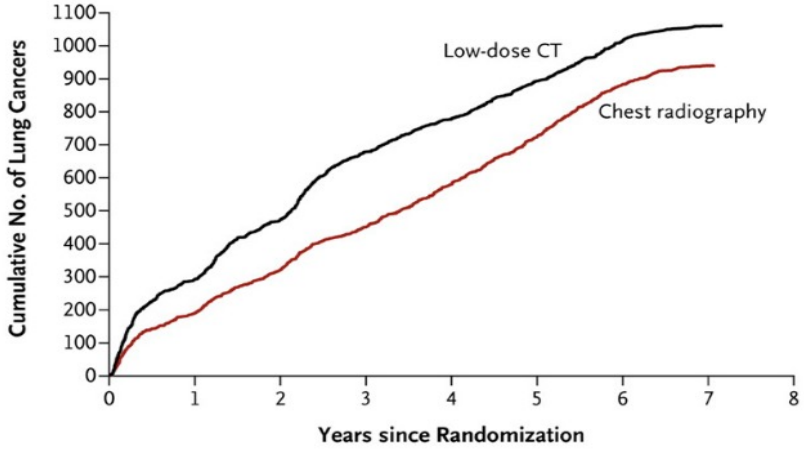
Lung Cancer Screening with LDCT: ELCAP Results from Baseline Round

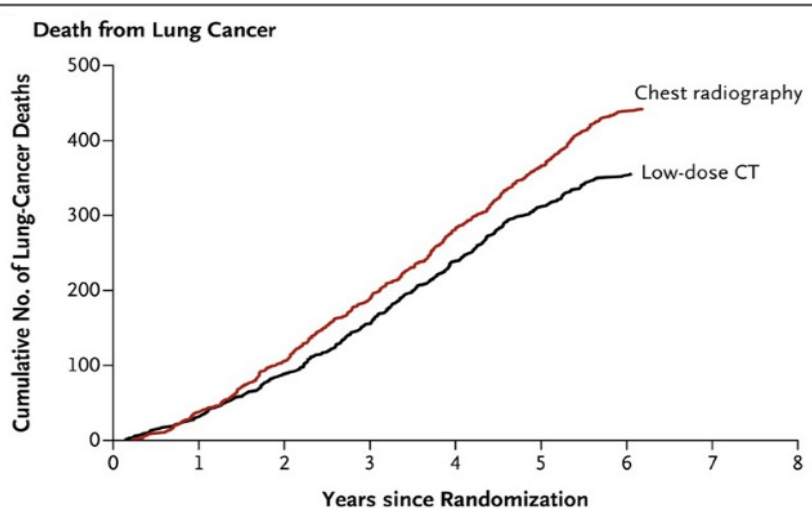
Stage	Screen-detected	Usual Care
	Total (%)	%
IA	22 (82)	13
IB	1 (4)	9
IIA	1 (4)	5
IIB	0 (0)	5
IIIA	2 (8)	12
IIIB	1 (4)	6
IV	0 (0)	47
Total	27 (100)	100

Henschke et al. Early Lung Cancer Action Program: Overall findings from baseline screening. Lancet, 1999.

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 AUGUST 4, 2011 VOL. 365 NO. 5





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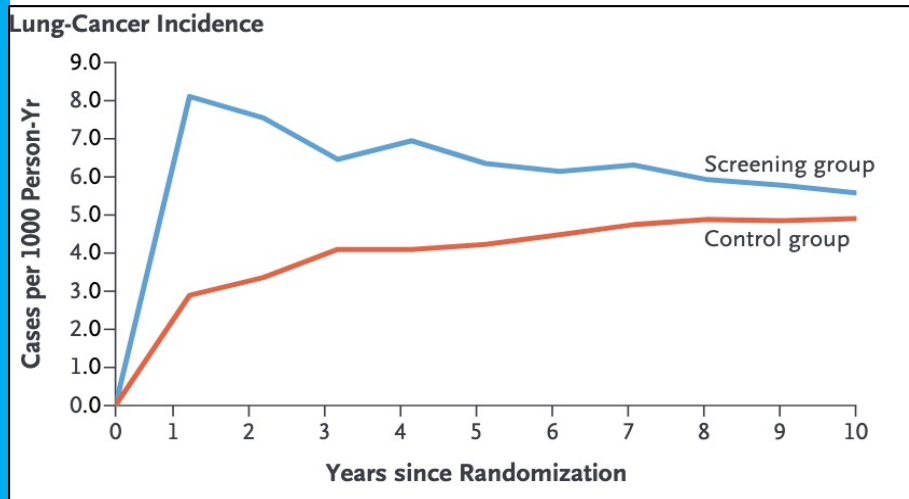
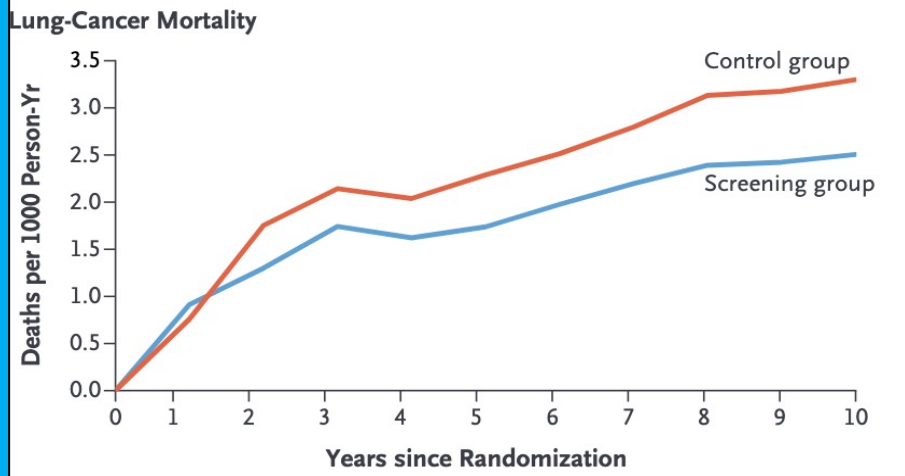
ESTABLISHED IN 1812 FEBRUARY 6, 2020 VOL. 382 NO. 6





Nelson Trial

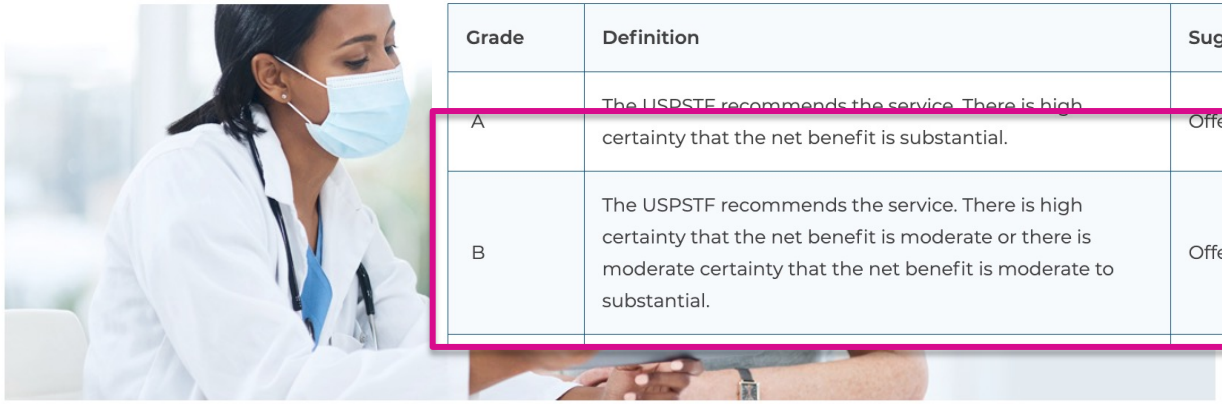
USPSTF Screening Recommendations

Final Recommendation Statement

Lung Cancer: Screening

March 09, 2021

Recommendations made by the USPSTF are in position of the Agency for Healthcare Research



Read the Full Recommendation Statement | Download (PDF)

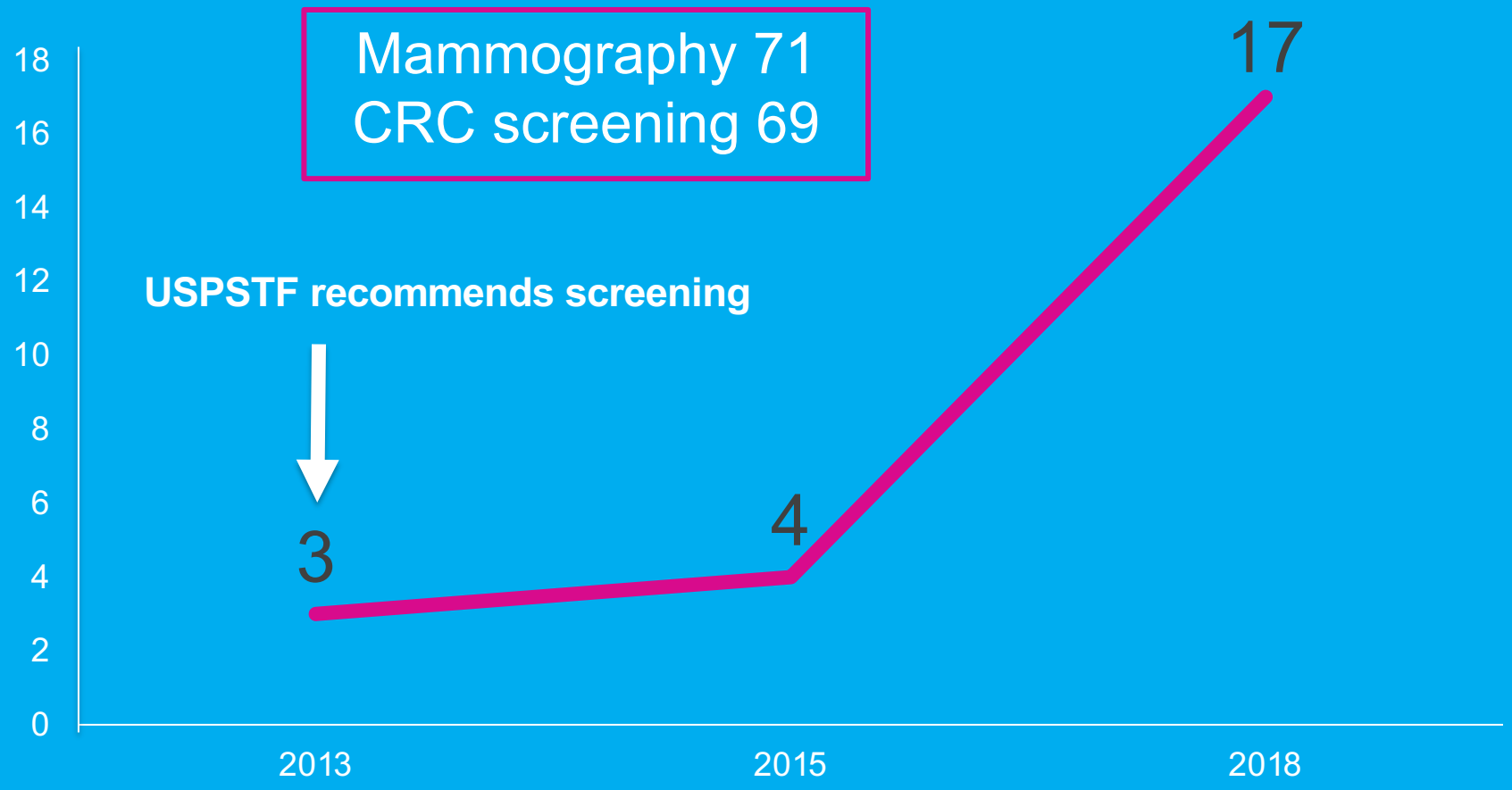
What the Grades Mean and Suggestions for Practice

Grade	Definition	Suggestions for Practice
A	The USPSTF recommends the service. There is high certainty that the net benefit is substantial.	Offer/provide this service.
B	The USPSTF recommends the service. There is high certainty that the net benefit is moderate or there is moderate certainty that the net benefit is moderate to substantial.	Offer/provide this service.

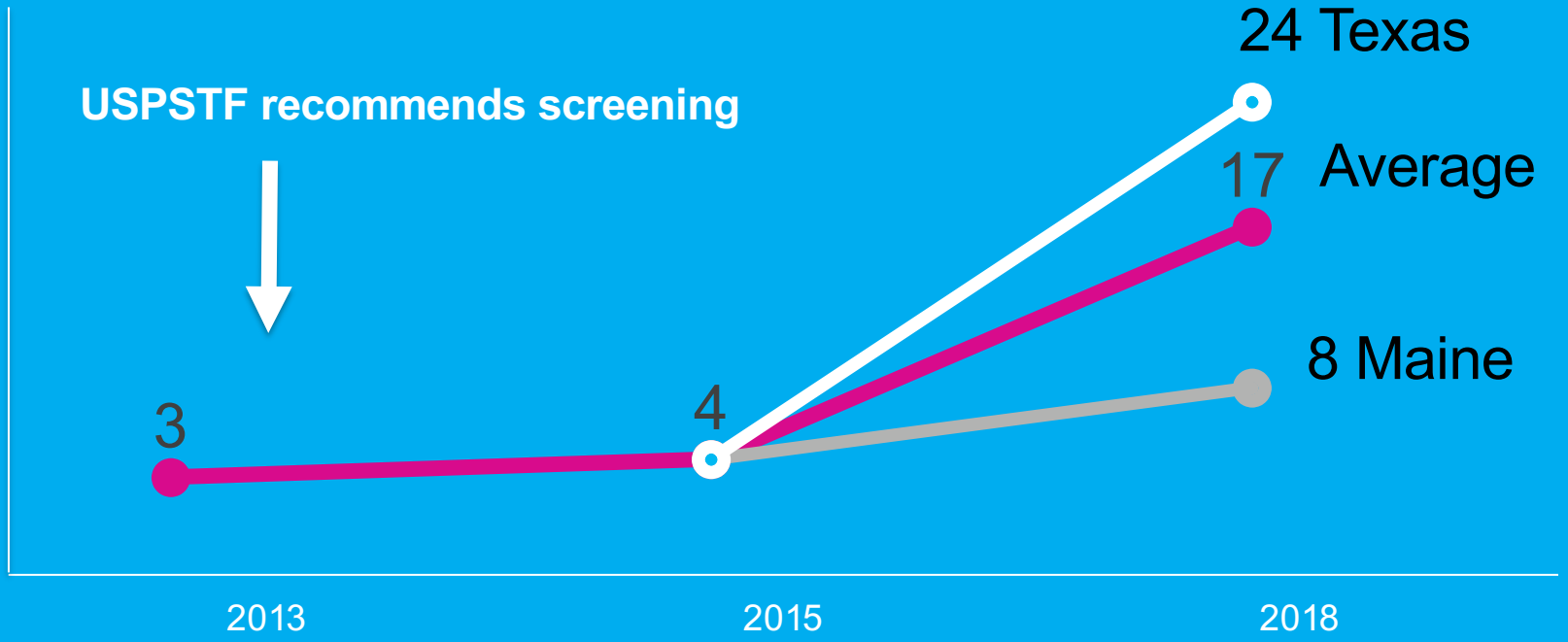
Recommendation Summary

Population	Recommendation	Grade
Adults aged 50 to 80 years who have a 20 pack-year smoking history and currently smoke or have quit within the past 15 years	The USPSTF recommends annual screening for lung cancer with low-dose computed tomography (LDCT) in adults aged 50 to 80 years who have a 20 pack-year smoking history and currently smoke or have quit within the past 15 years. Screening should be discontinued once a person has not smoked for 15 years or develops a health problem that substantially limits life expectancy or the ability or willingness to have curative lung surgery.	B

Rates of Lung, Breast and Colorectal Cancer Screening in the US



Rates of Lung Cancer Screening by State



Lung Cancer Screening Rates among Minorities

Demographic	All Patients (N = 1325)	Screened (n = 809)	Unscreened (n = 516)	*P* Value
Age	64 (58-63)	63 (59-68)	66 (61-73)	<.001
<65 y	695 (52.5)	466 (57.6)	229 (44.4)	
≥65 y	576 (48.0)	343 (42.4)	287 (55.6)	
Gender				.994
Male	801 (60.5)	489 (60.4)	312 (60.5)	
Female	524 (39.5)	320 (39.6)	204 (39.5)	
Race[a]				<.001
White	574 (43.3)	372 (46)	202 (39.2)	
Black	549 (41.4)	304 (37.6)	245 (47.5)	
Asian	33 (2.5)	30 (3.7)	3 (0.6)	
Unknown	169 (12.8)	102 (12.7)	66 (12.8)	
Ethnicity[a]				.131
Non-Hispanic	1182 (89.2)	730 (90.2)	452 (87.6)	
Hispanic	143 (10.8)	79 (9.8)	64 (12.4)	
Language				.160
English	1141 (86.1)	692 (85.5)	449 (87.0)	
Spanish	98 (7.4)	55 (6.8)	43 (8.3)	
Other	86 (6.5)	62 (7.7)	24 (4.7)	

Steiling K, et al. Ann Thorac Surg. 2020.

Lung Cancer Screening Rates in a Community Sample

Characteristics	Total sample (n = 438)	Screeners (n = 274)	Non-screeners (n = 164)	p-Value
Mean age (continuous)	62.65 (5.76	62.12 (5.56)	62.96 (5.87)	0.141
Age (categorical) n (%)				
55–64 years old	288 (65.8)	115 (70.1)	173 (63.1)	0.136
65 years or older	150 (34.2)	49 (29.9)	101 (36.9)	
Sex n (%)				
Male	187 (42.7)	65 (39.6)	122 (44.5)	0.317
Female	251 (57.3)	99 (60.4)	152 (55.5)	
Race n (%)				
White	254 (58.0)	111 (67.7)	143 (52.2)	**0.002***
Black	184 (42.0)	53 (32.3)	131 (47.8)	
Geographic Region n (%)				
Urban	241 (55.0)	78 (47.6)	163 (59.5)	**0.047***
Suburban	56 (12.8)	23 (14.0)	33 (12.0)	
Rural	141 (32.2)	63 (38.4)	78 (28.5)	
Education n (%)				
Less than high school	40 (9.1)	11 (6.7)	29 (10.6)	0.188
High school graduate	132 (30.1)	46 (28.1)	86 (31.4)	
Some college	144 (32.9)	60 (36.6)	84 (30.7)	
College graduate or higher	122 (27.9)	47 (28.7)	75 (27.4)	
Income n (%)				
< $25,000	236 (53.9)	78 (47.6)	158 (57.7)	**0.026***
$25,000–$50,000	115 (26.3)	46 (28.1)	69 (25.2)	
> $50,000	87 (19.9)	40 (24.4)	47 (17.2)	
Health insurance n (%)				
Government	279 (63.7)	86 (52.4)	193 (70.4)	**< 0.001^**
Private	120 (27.4)	54 (32.9)	66 (24.1)	
Government + Private	21 (4.8)	13 (7.9)	8 (2.9)	
None	18 (4.1)	11 (6.7)	7 (2.6)	
Smoking status n (%)				
Current smoker	214 (48.9)	84 (51.2)	130 (47.5)	0.4444
Family history of lung cancer n (%)				
Yes	130 (29.7)	60 (36.6)	70 (25.6)	**0.014***

Cartis-Harris L, et al. Prev Med Rep, 2018.

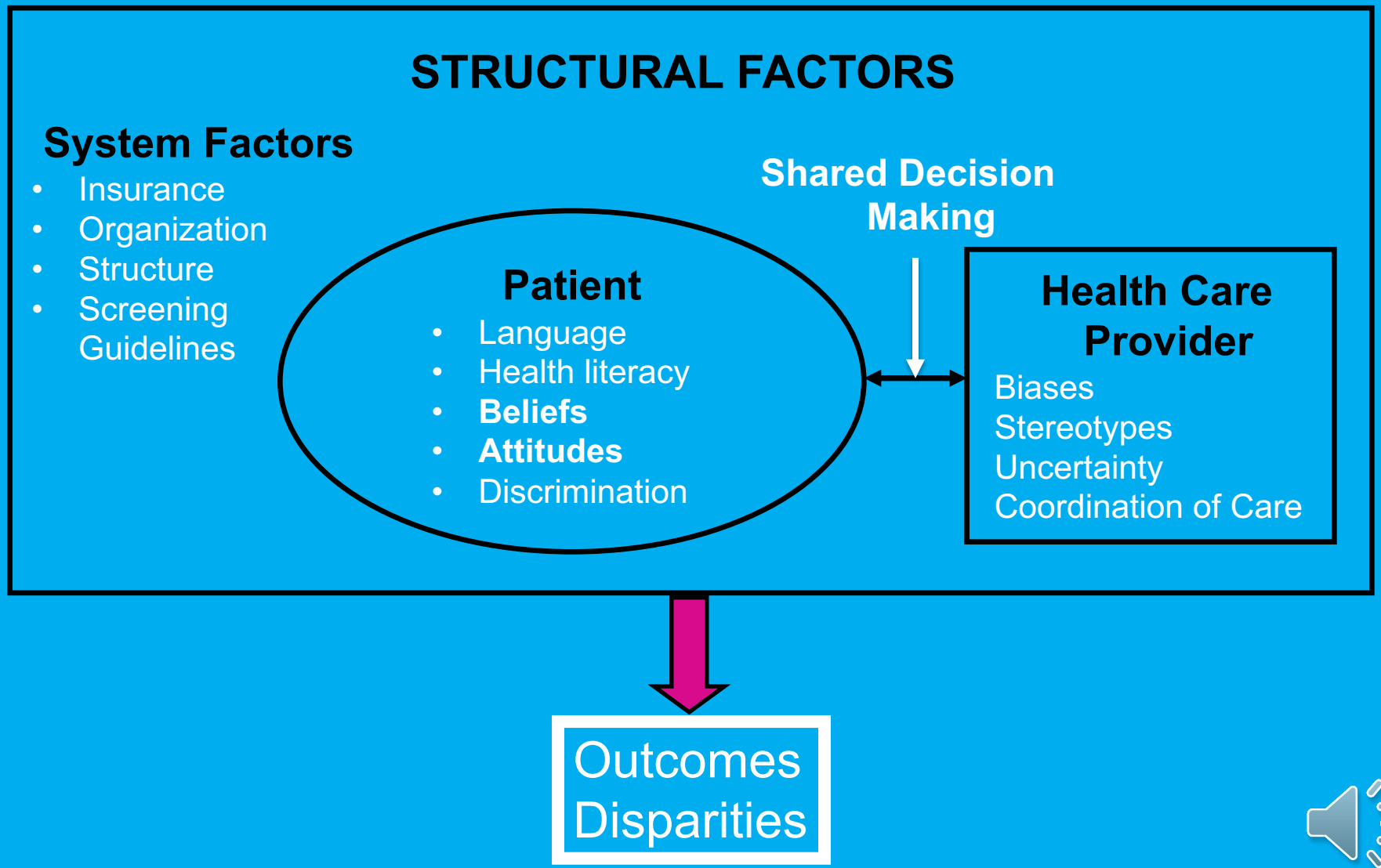
Lung Cancer Screening Adherence Rates among Minorities

Characteristic	Studies, No.	Odds ratio (95% CI)
Sex (female vs male)	4 studies (5 estimates)[12,15,22,28]	1.0 (0.8-1.3)
Smoking status (current vs former)	4 studies (5 estimates)[12,15,25,28]	0.7 (0.6-0.8)
Race/ethnicity (White vs other than White)	4 studies (5 estimates)[15,22,23,28]	2.0 (1.6-2.6)
Age, y		
60-69 (vs ages 40-59)	2 studies[23,28]	2.2 (0.6-7.9)
65-73 (vs ages 50-64)	2 studies[12,23]	1.4 (1.0-1.9)
>70 (vs ages 40-59)	2 studies[23,28]	1.7 (0.8-3.5)
>70 (vs ages 60-69)	2 studies[23,28]	0.7 (0.5-0.9)
Older (vs median age)	1 studies[25]	1.5 (1.0-2.3)

Lopez-Olivo M, et al. JAMA Network, 2020.

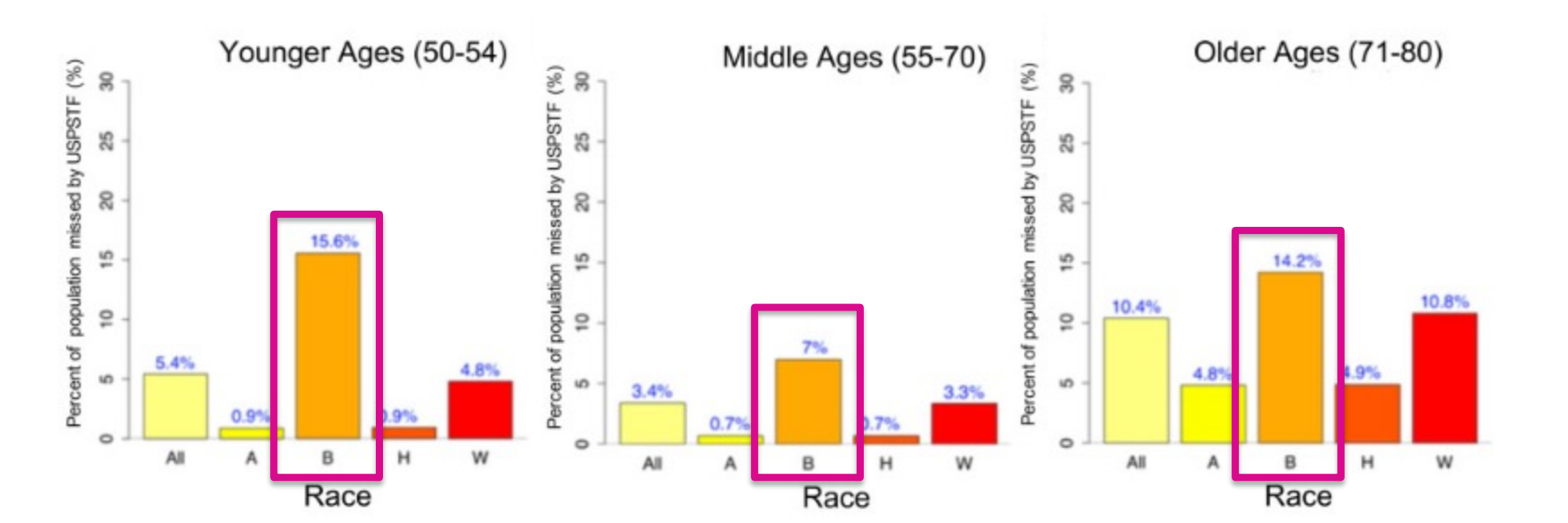
Determinants of Lung Cancer Screening Uptake: Impact on Disparities

Conceptual Framework to Assess Determinants of Lung Cancer Disparities



System Level Factors

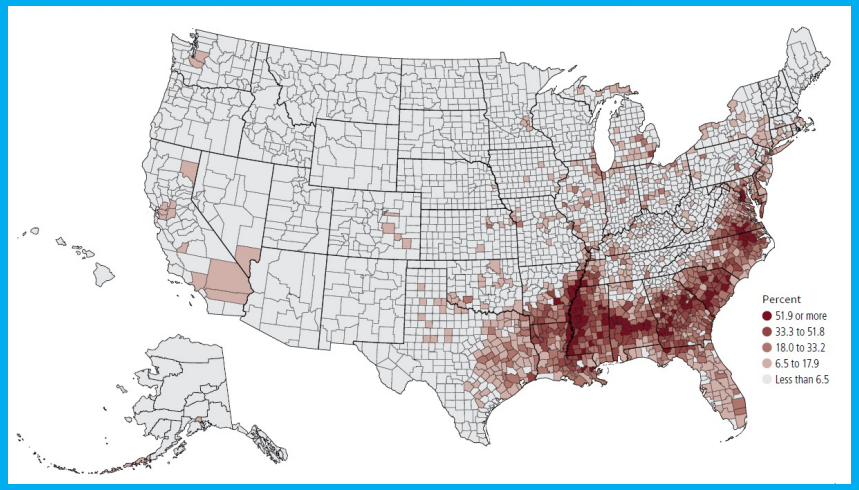
Lung Cancer Screening Eligibility Guidelines Do Not Capture Many Minority Smokers



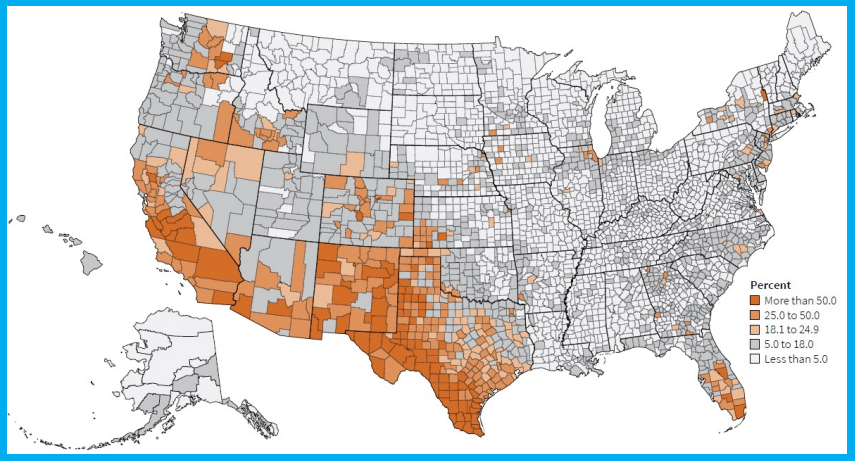
Han S. JNCI, 2020.

Geographic Barriers to Access Screening Centers

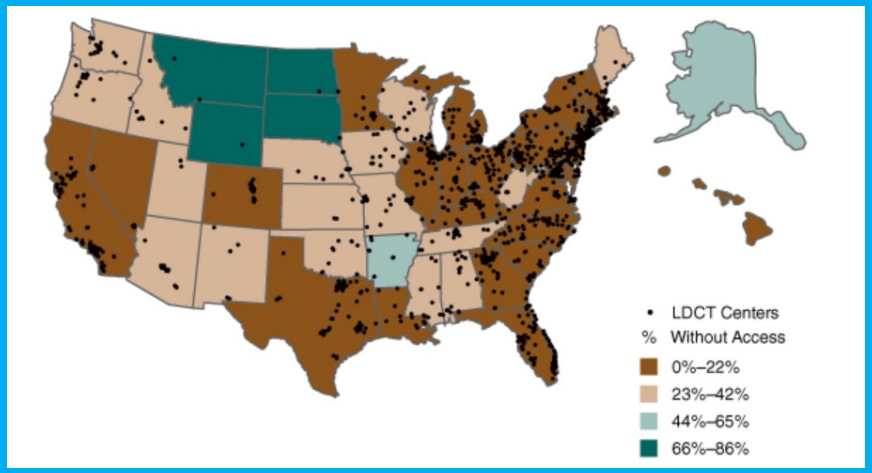
Black Population



Hispanic Population



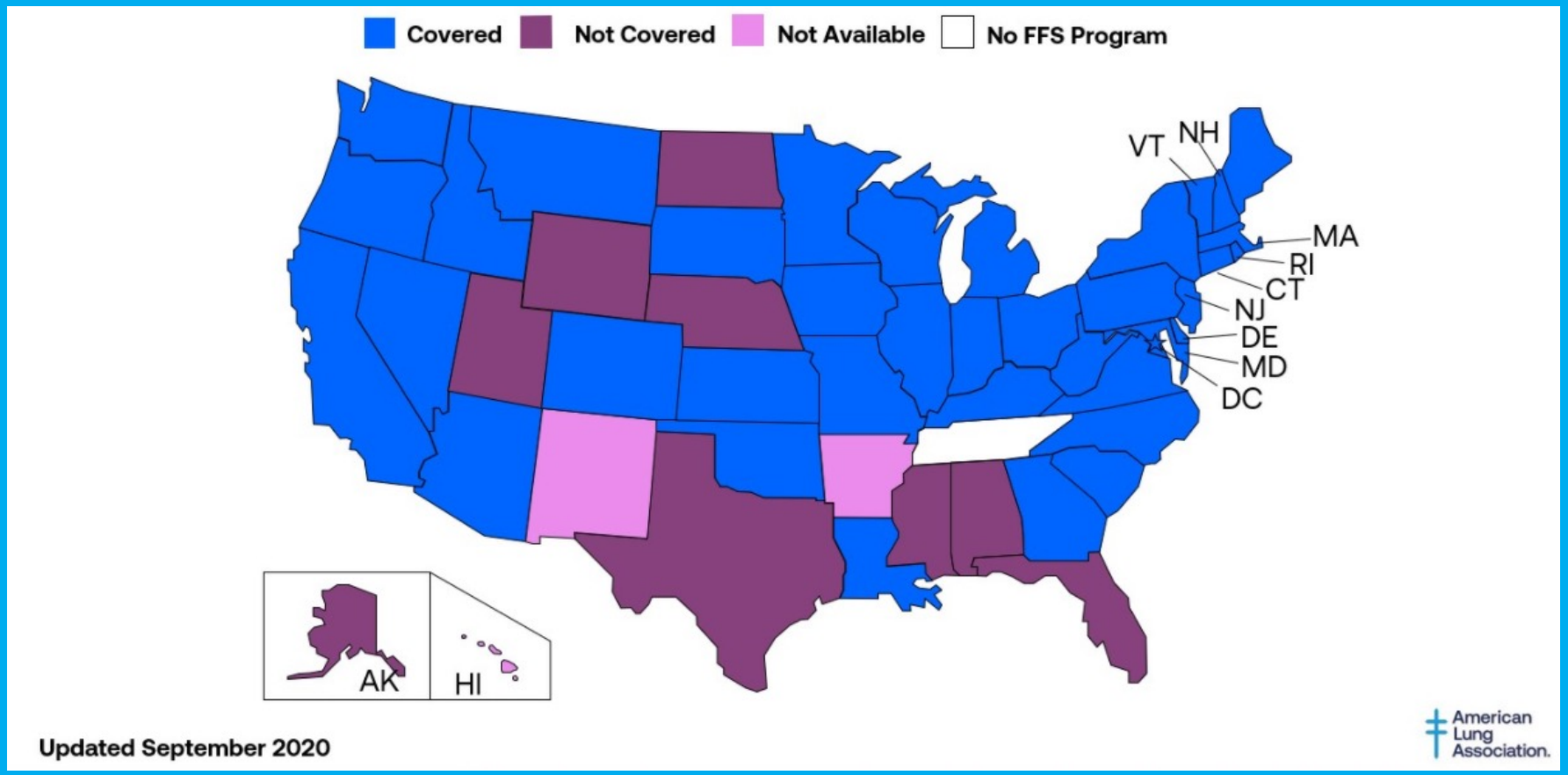
Lung Cancer Screening Centers



- **Availability NOT tied to need**

Kale M, Wisnivesky JP, et al. Chest, 2019.

Uneven Insurance Coverage as a Driver for Lung Cancer Screening Disparities



Provider Level Factors

Minority Representation in Cancer Screening RCTs

Characteristic	Low-Dose CT Group (N = 26,722)	Radiography Group (N = 26,732)
	number (percent)	
Age at randomization		
<55 yr†	2 (<0.1)	4 (<0.1)
55–59 yr	11,440 (42.8)	11,420 (42.7)
60–64 yr	8,170 (30.6)	8,198 (30.7)
65–69 yr	4,756 (17.8)	4,762 (17.8)
70–74 yr	2,353 (8.8)	2,345 (8.8)
≥75 yr†	1 (<0.1)	3 (<0.1)
Sex		
Male	15,770 (59.0)	15,762 (59.0)
Female	10,952 (41.0)	10,970 (41.0)
Race or ethnic group‡		
White	24,289 (90.9)	24,260 (90.8)
Black	1,195 (4.5)	1,181 (4.4)
Asian	559 (2.1)	536 (2.0)
American Indian or Alaska Native	92 (0.3)	98 (0.4)
Native Hawaiian or other Pacific Islander	91 (0.3)	102 (0.4)
More than one race or ethnic group	333 (1.2)	346 (1.3)
Data missing	163 (0.6)	209 (0.8)
Hispanic ethnic group‡		
Hispanic or Latino	479 (1.8)	456 (1.7)
Neither Hispanic nor Latino	26,079 (97.6)	26,039 (97.4)
Data missing	164 (0.6)	237 (0.9)
Smoking status		
Current	12,862 (48.1)	12,900 (48.3)
Former	13,860 (51.9)	13,832 (51.7)

The National Lung Screening Trial Research Team. Reduced Lung-Cancer Mortality with Low-Dose Computed Tomographic Screening. NEJM, 2011.

LDCT Screening is Associated with Decreased Lung Cancer Mortality in Blacks

Variable	White Individuals [*HR (95% Wald CI)*] (*n* = 47,902)	Black Individuals [*HR (95% Wald CI)*] (*n* = 2,361)	Other/Missing [*HR (95% Wald CI)*]
Centered age (by 5 yr)	1.57 (1.44–1.72)*	1.21 (0.85–1.72)	1.49 (0.93–2.40)
Screening group			
CT scan	0.86 (0.75–0.98)†	0.61 (0.37–1.01)	0.72 (0.53–0.98)†
Chest X-ray (reference)	—	—	—
Pack-years (by 5 pack-years)	1.05 (1.04–1.06)*	1.03 (0.97–1.10)	1.07 (1.05–1.09)*
Sum of comorbidities	1.14 (1.08–1.21)*	1.03 (0.84–1.28)	1.18 (0.97–1.42)
Sex			
Male (reference)	—	—	—
Female	0.84 (0.74–0.96)†	0.91 (0.60–1.39)	1.06 (0.66–1.70)
Marital status			
Married (reference)	—	—	—
Not married	1.14 (0.99–1.31)	0.79 (0.48–1.31)	0.79 (0.40–1.57)
Elderly status			
<70 yr old (reference)	—	—	—
⩾70 yr old	0.93 (0.74–1.17)	1.03 (0.40–2.67)	1.73 (0.49–6.14)
Cigarette smoking status			
Former smokers (reference)	—	—	—
Current smokers	2.25 (2.00–2.54)*	4.10 (2.05–8.20)*	2.48 (1.47–4.17)†

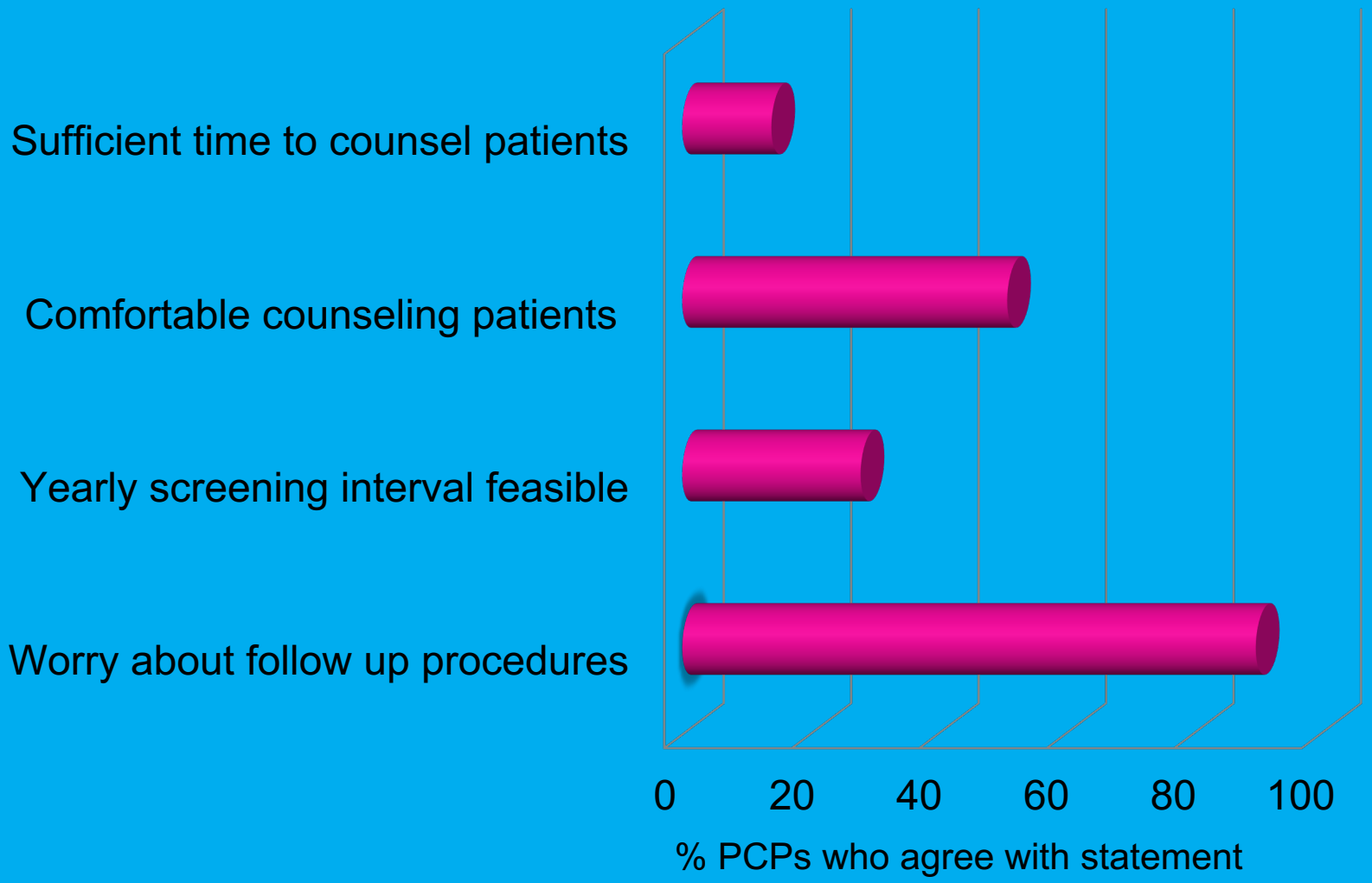
Tanner N, et al. AJRCCM, 2015

PCP Familiarity with USPSTF Cancer Screening Recommendations

Type of Cancer	Not Familiar/A little Familiar (%)	Familiar/Very Familiar (%)
Breast cancer	1	99
Cervical cancer	7	93
Colon cancer	1	99
Lung cancer	46	54

Rajupet S, Wisnivesky JP, Lin JJ, et al. Attitudes about lung cancer screening. Clin Lung Ca 2017.

PCP Attitudes Towards Lung Cancer Screening



Rajupet S, Wisnivesky JP, Lin JJ, et al. Attitudes about lung cancer screening. Clin Lung Ca 2017.

Potential Harms of Screening: False Positives

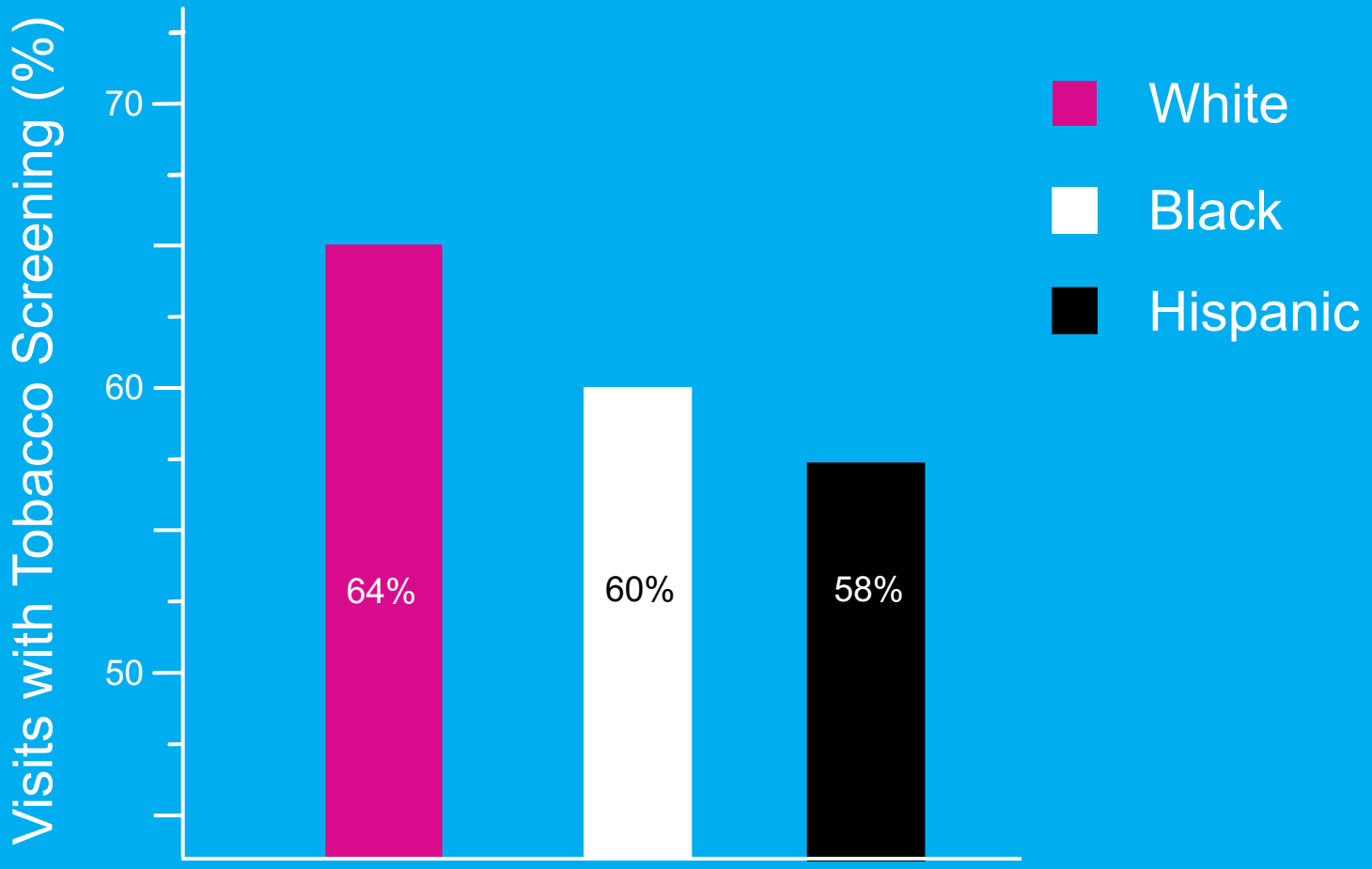
Source	No. Screened	Screening Round	Non-calcified Nodules	Cancers
ELCAP	1,000	Baseline	23%	2.7%
NLST	26,309	Baseline	25%	1.0%
	24,715	Year 1	28%	0.6%
	24,102	Year 2	17%	0.9%
NELSON	7,557	Baseline	21%	0.9%
	7,289	Year 1	8%	0.7%
DLCST	2,047	Baseline	9%	0.8%
ITALLUNG	1,406	Baseline	30%	1.5%
DANTE	1,276	Baseline	18%	3.7%
LSS	1,629	Baseline	19%	1.8%
	1,398	Year 1	26%	0.6%
Depiscan	336	Baseline	24%	2.4%

- Few unnecessary biopsies and/or surgeries

Consensus Medicare Primary Care Core Measures

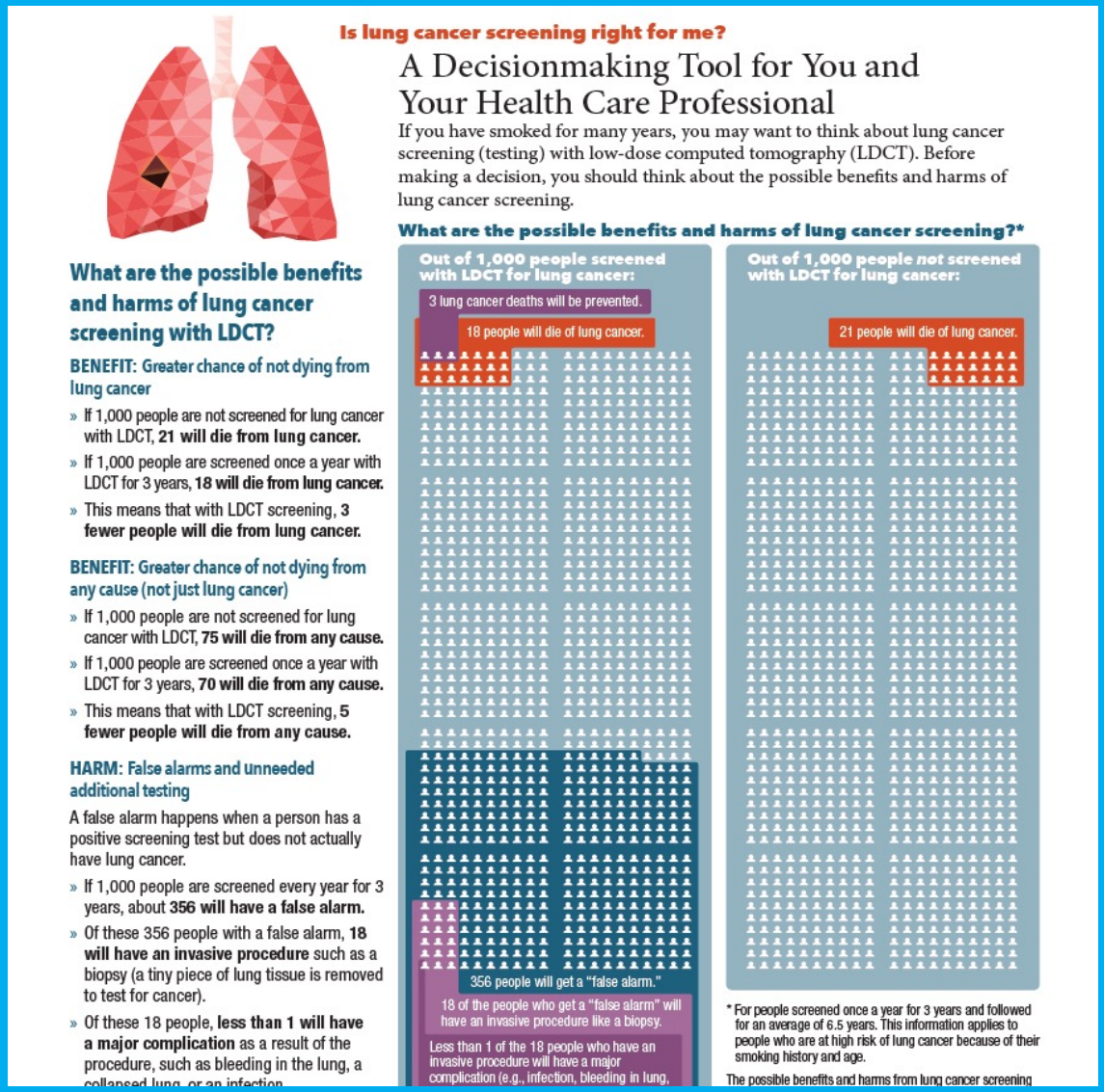
Measure	PCMH	ACO	Measure	PCMH	ACO
Controlling HBP	√	√	Cervical Cancer Screening	√	√
Beta Blocker after MI	√	√	Breast Cancer Screening	√	√
Use ASA for Vascular Disease		√	CRC Cancer Screening	√	√
HbA1c >9.0%	√	√	Tobacco Cessation	√	√
DM Eye Exam	√	√	Timely Appointments	√	√
HbA1c Testing	√	√	Depression Remission	√	√
DM Foot Exam	√	√	Depression Response	√	√
DM Nephropathy	√	√	Medications for Asthma	√	√
Medication Reconciliation		√	Antibiotics for Acute Bronchitis	√	√
BMI Screening	√	√	Use Imaging for LBP	√	√

Tobacco Use Screening During Physician Office Visits



National Ambulatory Medical Care Survey and National Health Interview Survey, United States, 2005–2009

Current CMS Guidelines Require Shared Decision Making with a Decision Aid



Is lung cancer screening right for me?

A Decisionmaking Tool for You and Your Health Care Professional

If you have smoked for many years, you may want to think about lung cancer screening (testing) with low-dose computed tomography (LDCT). Before making a decision, you should think about the possible benefits and harms of lung cancer screening.

What are the possible benefits and harms of lung cancer screening with LDCT?

BENEFIT: Greater chance of not dying from lung cancer

- If 1,000 people are not screened for lung cancer with LDCT, **21 will die from lung cancer.**
- If 1,000 people are screened once a year with LDCT for 3 years, **18 will die from lung cancer.**
- This means that with LDCT screening, **3 fewer people will die from lung cancer.**

BENEFIT: Greater chance of not dying from any cause (not just lung cancer)

- If 1,000 people are not screened for lung cancer with LDCT, **75 will die from any cause.**
- If 1,000 people are screened once a year with LDCT for 3 years, **70 will die from any cause.**
- This means that with LDCT screening, **5 fewer people will die from any cause.**

HARM: False alarms and unneeded additional testing

A false alarm happens when a person has a positive screening test but does not actually have lung cancer.

- If 1,000 people are screened every year for 3 years, about **356 will have a false alarm.**
- Of these 356 people with a false alarm, **18 will have an invasive procedure** such as a biopsy (a tiny piece of lung tissue is removed to test for cancer).
- Of these 18 people, **less than 1 will have a major complication** as a result of the procedure, such as bleeding in the lung, a collapsed lung, or an infection.

What are the possible benefits and harms of lung cancer screening?*

Out of 1,000 people screened with LDCT for lung cancer:

3 lung cancer deaths will be prevented.

18 people will die of lung cancer.

356 people will get a "false alarm."

18 of the people who get a "false alarm" will have an invasive procedure like a biopsy.

Less than 1 of the 18 people who have an invasive procedure will have a major complication (e.g., infection, bleeding in lung,

Out of 1,000 people *not* screened with LDCT for lung cancer:

21 people will die of lung cancer.

* For people screened once a year for 3 years and followed for an average of 6.5 years. This information applies to people who are at high risk of lung cancer because of their smoking history and age.

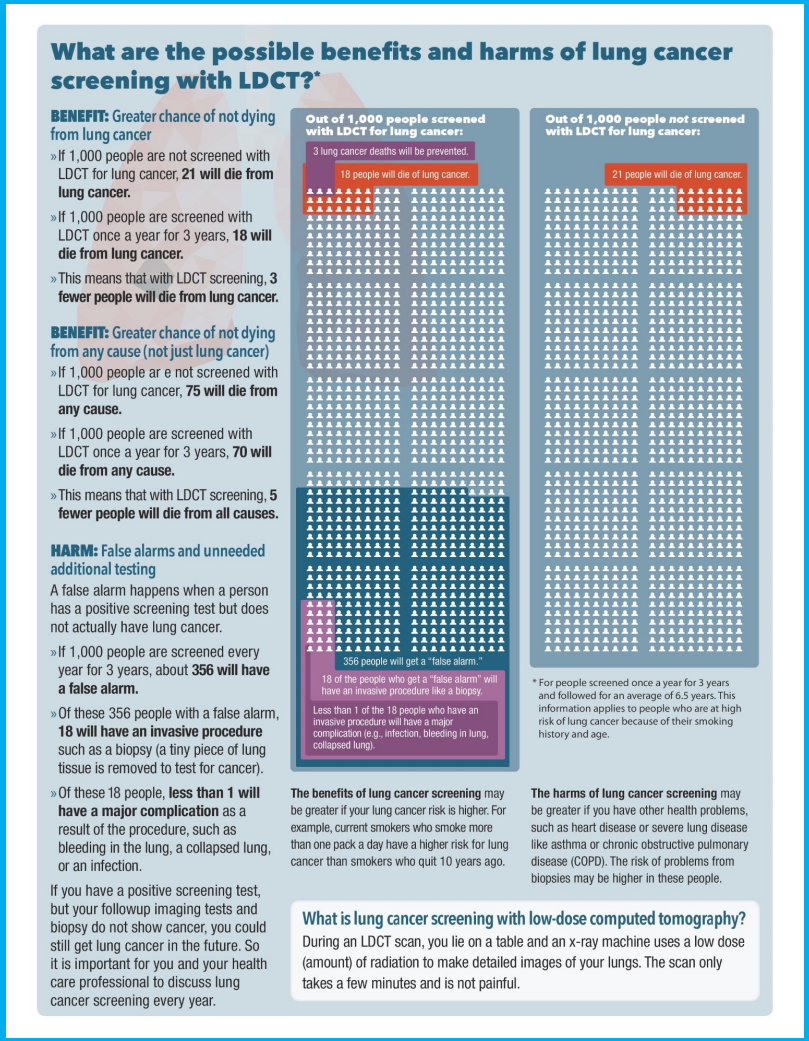
The possible benefits and harms from lung cancer screening

Disparities in Use of Lung Cancer Screening Shared Decision Making

Enrollee Characteristic	No. of Patients With LDCT (n = 19 021)	Patients With SDM in 3 Months Before LDCT, No. (%) (n = 1719)	OR (95% CI)[a]
Age, y			
55-59	1760	152 (8.64)	1 [Reference]
60-64	1912	189 (9.88)	1.21 (0.94-1.54)
65-69	8229	768 (9.33)	1.16 (0.93-1.43)
70-74	5616	482 (8.58)	0.99 (0.80-1.24)
75-77	1504	128 (8.51)	0.99 (0.76-1.30)
Race/Ethnicity			
Black	1203	93 (7.73)	0.76 (0.59-0.97)
Hispanic	445	33 (7.42)	0.74 (0.49-1.11)
Others	688	51 (7.41)	0.87 (0.63-1.19)
White	16 685	1542 (9.24)	1 [Reference]
Sex			
Male	9751	928 (9.52)	1 [Reference]
Female	9270	791 (8.53)	0.88 (0.79-0.98)

Use of the Shared Decision-Making Visit for Lung Cancer Screening Among Medicare Enrollees. JAMA Internal Medicine 2019.

Current Decision Aids are Not Appropriate for Individuals with Limited Health Literacy



What are the possible benefits and harms of lung cancer screening with LDCT?*

BENEFIT: Greater chance of not dying from lung cancer

- If 1,000 people are not screened with LDCT for lung cancer, **21 will die from lung cancer.**
- If 1,000 people are screened with LDCT once a year for 3 years, **18 will die from lung cancer.**
- This means that with LDCT screening, **3 fewer people will die from lung cancer.**

BENEFIT: Greater chance of not dying from any cause (not just lung cancer)

- If 1,000 people ar e not screened with LDCT for lung cancer, **75 will die from any cause.**
- If 1,000 people are screened with LDCT once a year for 3 years, **70 will die from any cause.**
- This means that with LDCT screening, **5 fewer people will die from all causes.**

HARM: False alarms and unneeded additional testing

A false alarm happens when a person has a positive screening test but does not actually have lung cancer.

- If 1,000 people are screened every year for 3 years, about **356 will have a false alarm.**
- Of these 356 people with a false alarm, **18 will have an invasive procedure** such as a biopsy (a tiny piece of lung tissue is removed to test for cancer).
- Of these 18 people, **less than 1 will have a major complication** as a result of the procedure, such as bleeding in the lung, a collapsed lung, or an infection.

If you have a positive screening test, but your followup imaging tests and biopsy do not show cancer, you could still get lung cancer in the future. So it is important for you and your health care professional to discuss lung cancer screening every year.

* For people screened once a year for 3 years and followed for an average of 6.5 years. This information applies to people who are at high risk of lung cancer because of their smoking history and age.

The benefits of lung cancer screening may be greater if your lung cancer risk is higher. For example, current smokers who smoke more than one pack a day have a higher risk for lung cancer than smokers who quit 10 years ago.

The harms of lung cancer screening may be greater if you have other health problems, such as heart disease or severe lung disease like asthma or chronic obstructive pulmonary disease (COPD). The risk of problems from biopsies may be higher in these people.

What is lung cancer screening with low-dose computed tomography?

During an LDCT scan, you lie on a table and an x-ray machine uses a low dose (amount) of radiation to make detailed images of your lungs. The scan only takes a few minutes and is not painful.

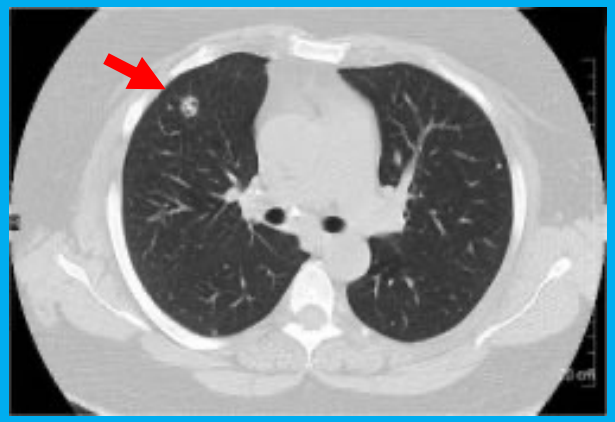
Patient Level Factors

Racial and Ethnic Differences in Attitudes Regarding Lung Cancer Screening

Beliefs/Attitudes (%)	Race/Ethnicity			P-value	Beliefs/ Attitudes	Race/Ethnicity			P-value
	W	B	H			W	B	H	
LC is puzzling to me	21	39	50	0.04	Just accept LC	27	24	44	0.15
Cigarettes cause LC	94	92	77	0.05	Better not know about LC	7	10	12	0.76
Microwave ovens cause LC	16	46	52	0.01	Worry about LC	55	46	50	0.31
If get LC, will die	74	50	53	0.10	CT radiation causes LC	18	47	55	0.01
LC will cause family difficulties	91	82	61	0.01	Afraid CT will find LC	36	18	44	0.04
LC spreads quickly, CT can't help	32	66	66	0.03	Less worry if negative CT	70	50	62	0.22
Good will help with LC	33	87	82	<0.01	CTs are painful	3	16	18	0.14
If get LC it was meant to be	16	35	47	0.03	CT scares me	13	32	47	0.01

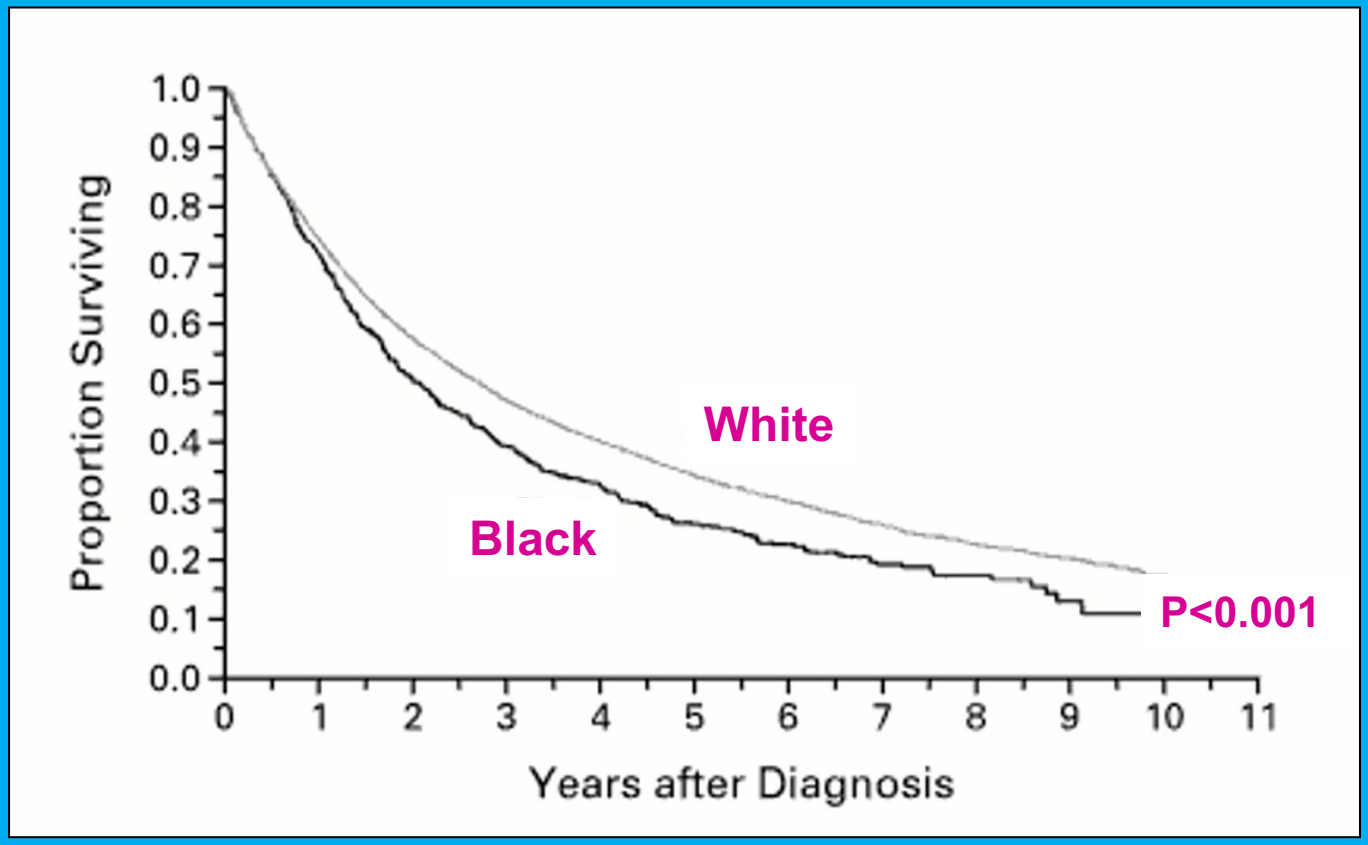
Jonnalagadda S, Wisnivesky J, et al. Lung Cancer , 2012

Lung Cancer Screening Needs to be Tied to Effective Treatment



- Early detection only leads to improved survival if early cancers are effectively treated
- Prior to LDCT screening stage I lung cancer represented <20% of cases
- Limited data regarding the optimal treatment of these cases

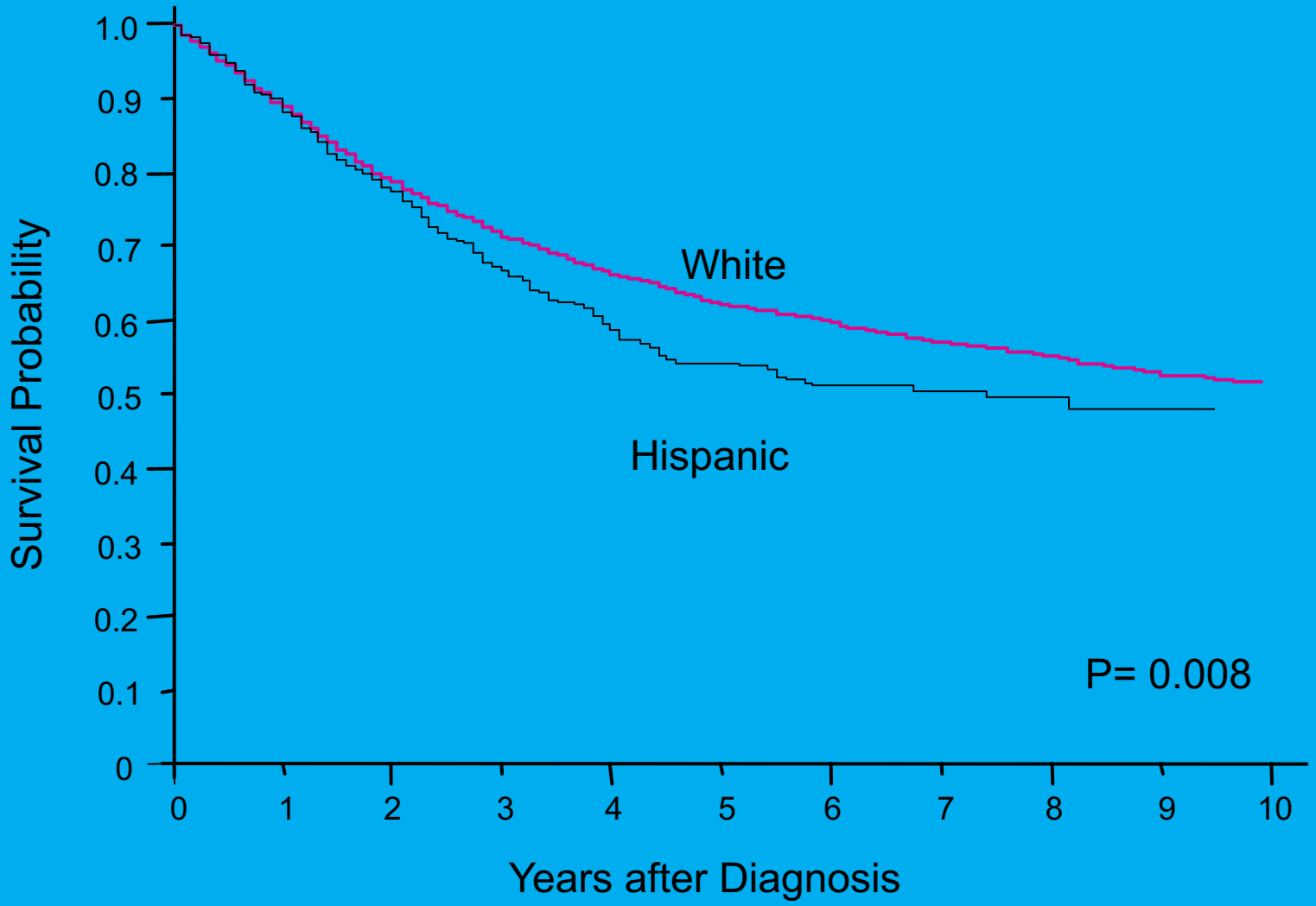
Racial Disparities in Lung Cancer Treatment



- Lower rates of surgery explain survival disparities

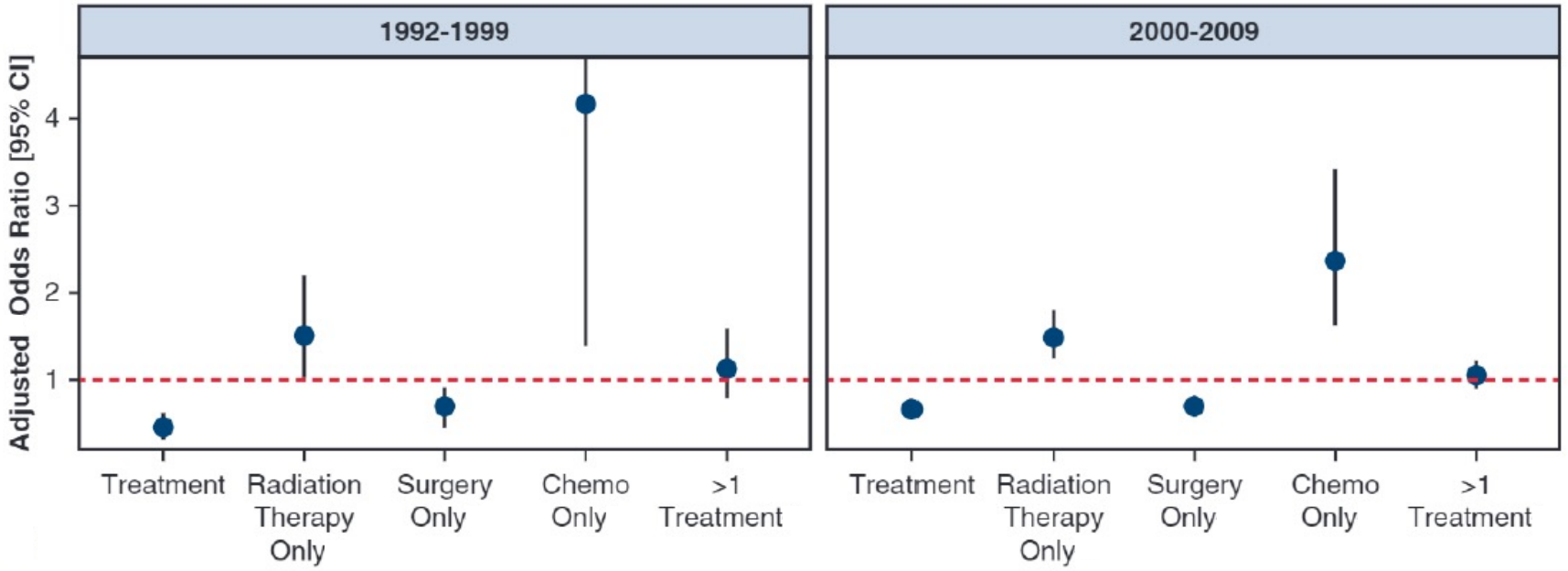
Bach P et al. Racial Differences in the Treatment of Early Stage Lung Cancer. NEJM 1999.

Lung Cancer Survival of Stage I Patients in According to Ethnicity



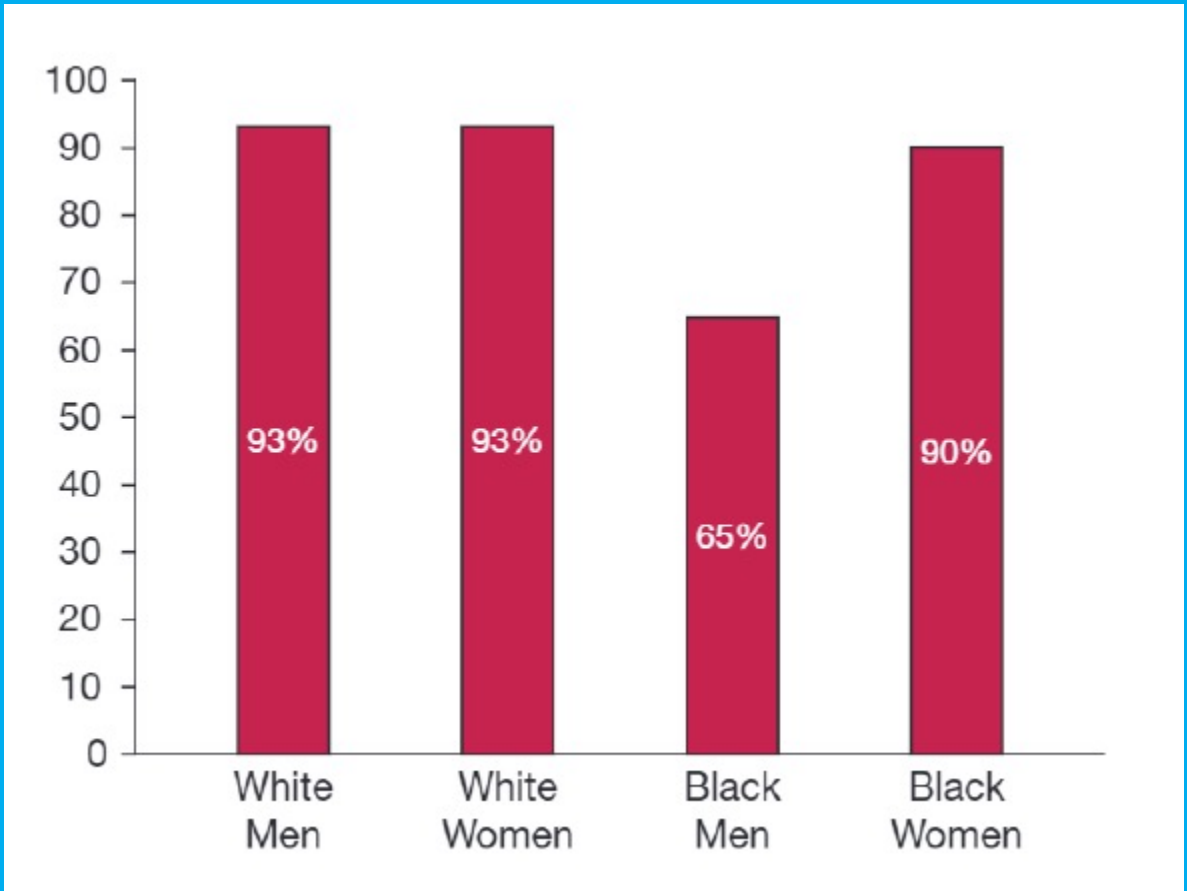
Wisnivesky J, McGinn T, Iannuzzi M, Halm E, et al. Ethnic Disparities in the Treatment of NSCLC. AJRCCM 2005.

Persistence of Racial Disparities in Early Stage NSCLC Treatment



Wolf A, Alpert N, Tran V, Liu B, et al. JTCVS, 2019

Rates of Surgical Resection in Patients with Stage I NSCLC in the National Lung Cancer Screening Trial

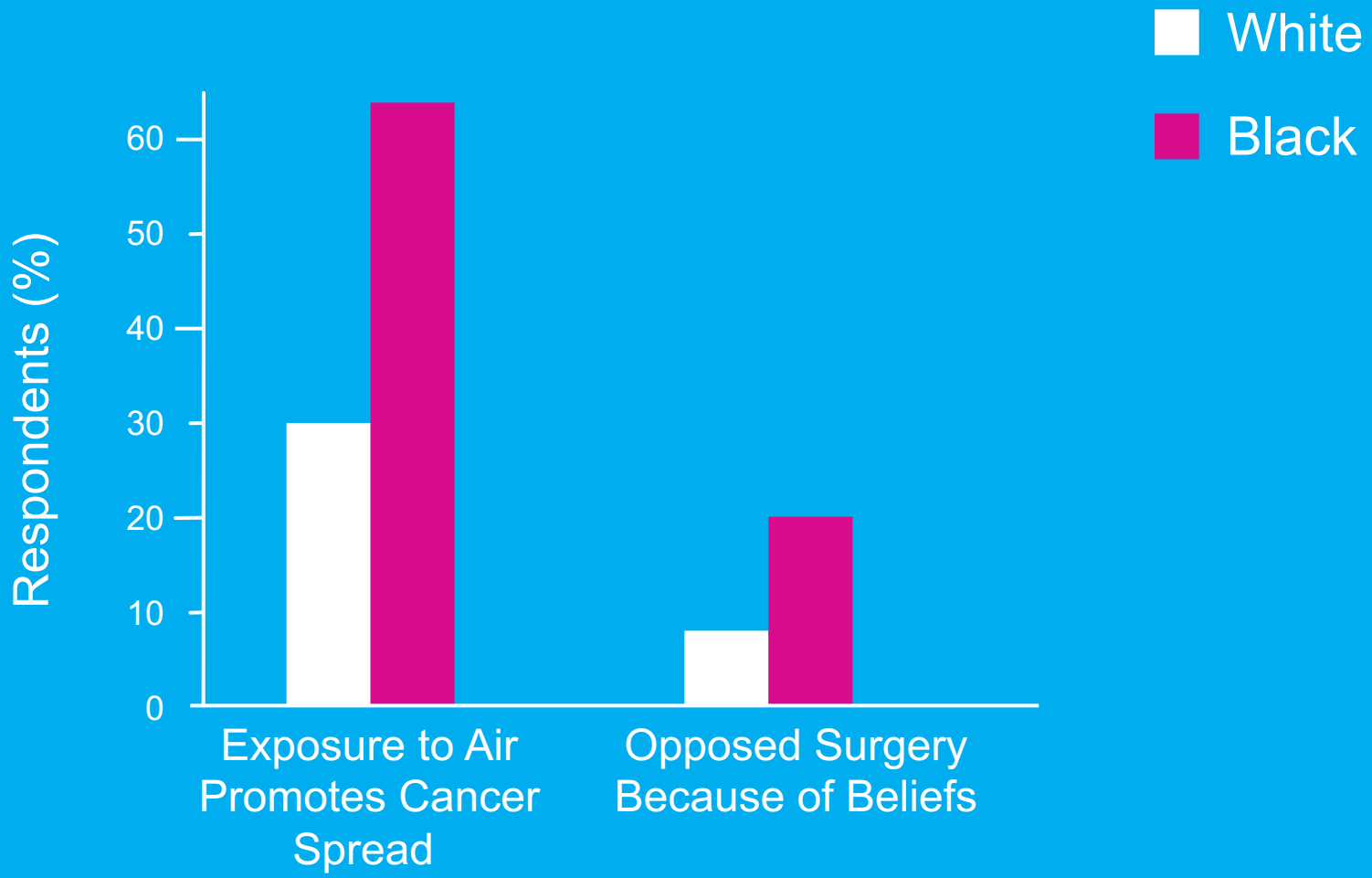


Balekian A, Wisnivesky J, Gould MK. Chest, 2019

Heterogeneity in Surgeon's Rates of Resections in White vs. Black Patients with Early-stage Lung Cancer

Model	Odds Ratio, 95% CI	P-value
Full Cohort		
Black Race	0.57 (0.47-0.69)	<0.001
Between surgeon variability in overall resection rates	-	<0.001
Between surgeons' heterogeneity in resection gap for Blacks vs. Whites	-	<0.05
Limited to Patients Evaluated by Thoracic Surgeons		
Black Race	0.70 (0.55-0.90)	<0.001
Between surgeon variability in overall resection rates	-	<0.001
Between surgeons' heterogeneity in resection gap for Blacks vs. Whites	-	0.01
Limited to Surgeon that Evaluated Black and White Patients		
Black Race	0.45 (0.37-0.55)	
Between surgeon variability in overall resection rates	-	<0.001
Between surgeons' heterogeneity in resection gap for Blacks vs. Whites	-	0.02
Model including Surgeon Specialty		
Black patients evaluated by a non-thoracic surgeon[5]	0.33 (0.22-0.50)	
Black patients evaluated by a thoracic surgeon[6]	0.68 (0.53-0.86)	
Between surgeon variability in overall resection rates	-	<0.001
Between surgeons' heterogeneity in resection gap for Blacks vs. Whites	-	0.03

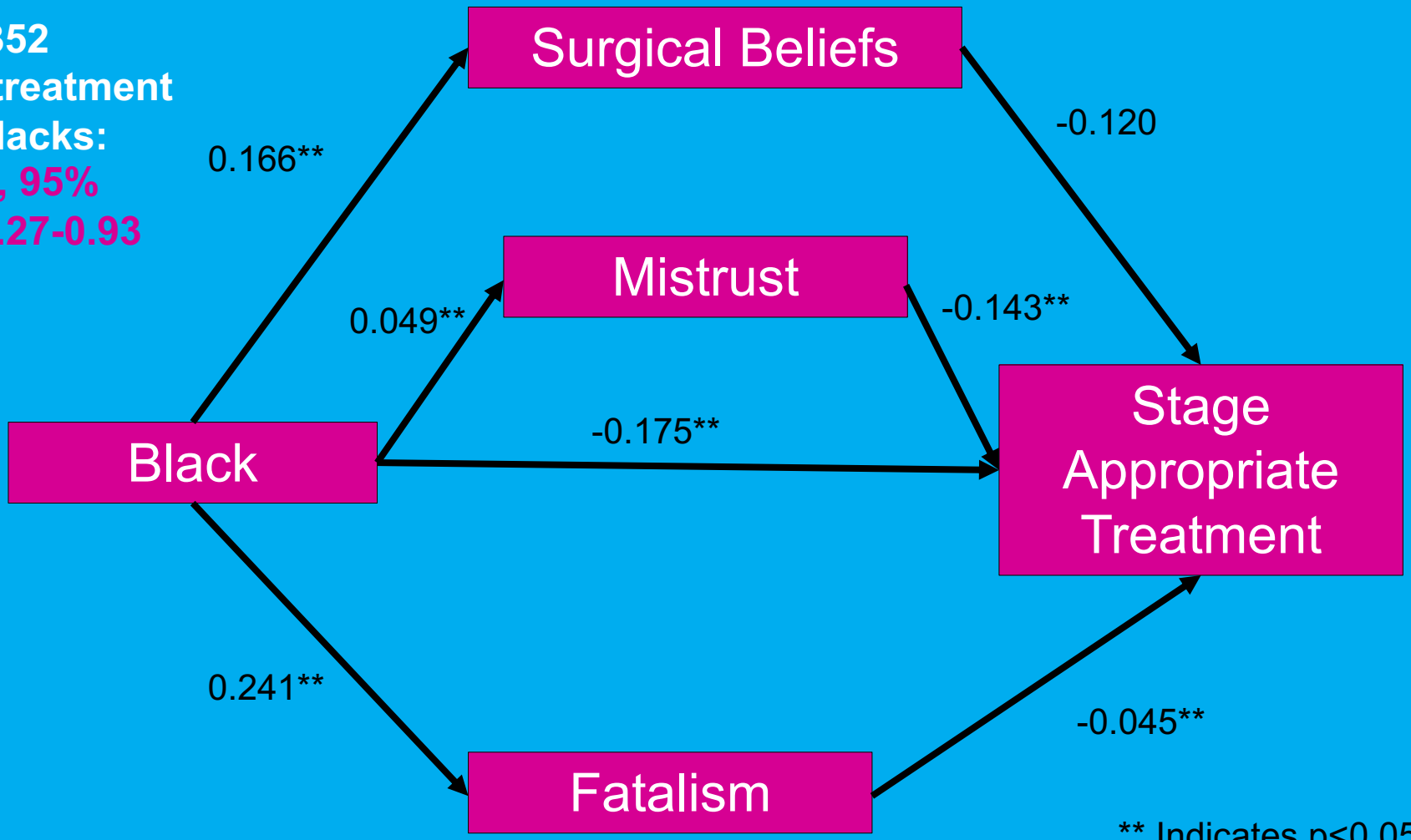
Racial Differences in Lung Cancer Beliefs



Margolis ML et al. Racial Differences Pertaining to a Belief about Lung Cancer Surgery. Ann Int Med, 2003.

Cultural Factors and Lung Cancer Treatment

N= 352
OR treatment in Blacks:
0.50, 95% CI:0.27-0.93



** Indicates p<0.05

- Adjusted for age, sex, SES, comorbidities, and PS

Lin J, Wisnivesky J, Powell, et al. Cultural factors associated with racial disparities in lung cancer care. Annals ATS, 2014.

Reactive Approach to Disparities in Care


Changes
NEXT EXIT

Strategies to Reduce Lung Cancer Screening Disparities

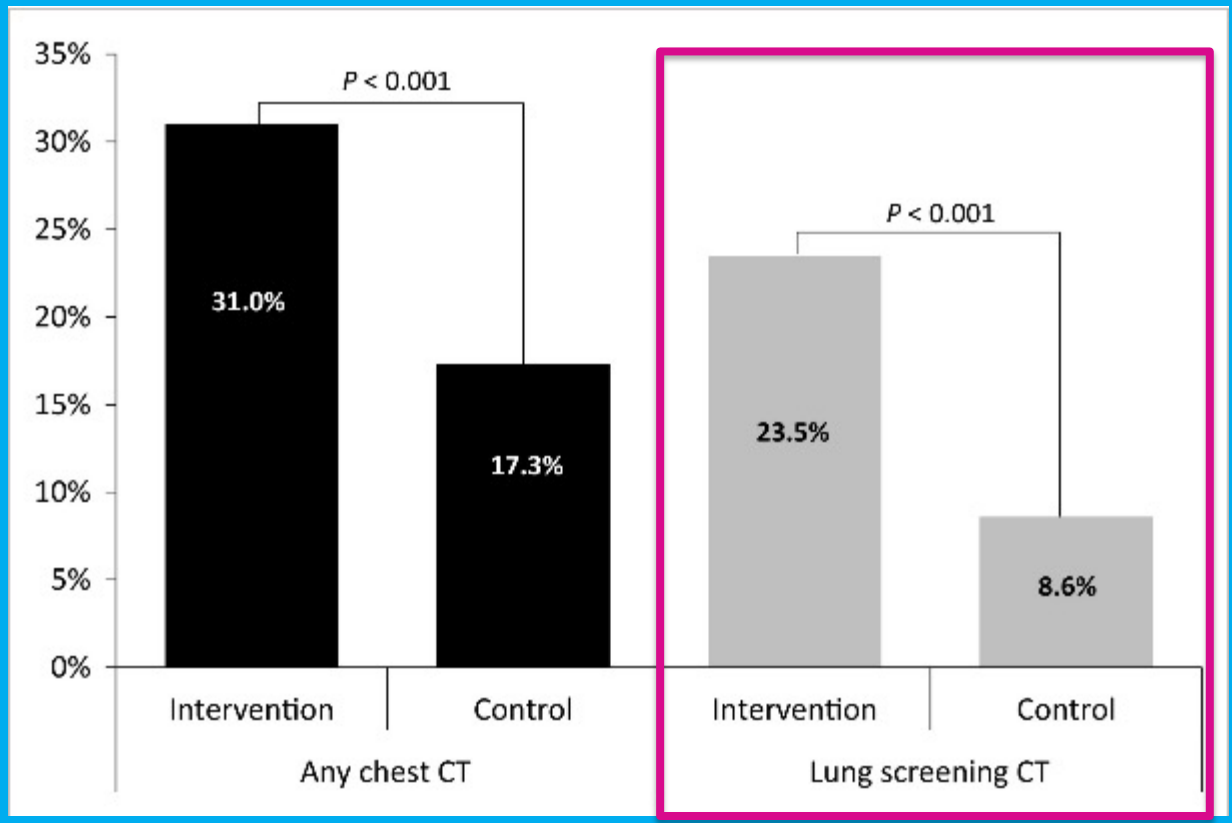
Recent Changes in USPSTF Lung Cancer Screening Recommendations Increase Eligibility of Minorities

Criteria	2013 Recommendations	2020 Recommendations
Age, years	55-80	50-80
Smoking History	≥30 pack-year	≥20 pack-year
Smoking Status	Current or quit within 15 years	Current or quit within 15 years

Increase in Eligibility

Patient Navigation for Lung Cancer Screening in Community Health Centers

- Shared decision making
- Scheduled PCP appointment
- Helped overcome barriers to LDCT



Percac-Lima S, et al. Cancer Medicine, 2018.

Mobile LDCT for Lung Cancer Screening in Underserved Populations

- Bring screening to the community
- Nurse navigator and social worker
- 550 individuals screening
- 20% Black, 3% Hispanic, 70% rural
- Similar results as NLST

Raghavan D, et al. The Oncologist, 2020.

Proposed Strategies to Reduce Screening Disparities

Overall:
- Address existing multilevel barriers to LCS using a multipronged approach
- Propose quality metrics to evaluate equity in LCS dissemination and implementation

1. Strategies to ensure equity in LCS based on screening individuals with equal risk:
   - Generate evidence on the benefits and risks of LCS in diverse populations
   - Consider an approach to LCS eligibility assessment that includes both USPSTF guidelines and risk and/or gained–based assessment for high-risk, high-benefit individuals
2. Strategies to improve tobacco treatment:
   - Provide access to tobacco treatment and develop programs that address differences in cultural beliefs, language, and literacy
3. Strategies to address healthcare system–level barriers:
   - Integrate patient navigators within LCS programs to increase the uptake and adherence among vulnerable populations
4. Strategies to address provider-level barriers:
   - Commit resources toward provider-level support and education to increase awareness and uptake of LCS
   - Offer provider-level training on communication techniques to build and improve patient trust
5. Strategies to address patient-level barriers:
   - Develop SDM tools that are culturally sensitive and understandable by those with lower literacy and numeracy and those with SMI
   - Launch culturally adapted LCS marketing and outreach campaigns to reach vulnerable populations
6. Strategies to reduce geographic barriers:
   - Determine feasibility of mobile LCS units to reach populations confronting geographic barriers
   - Consider telehealth as a pragmatic approach to provide access to LCS services for rural populations
7. Proposed policies to improve LCS access:
   - Mandate expansion of Medicaid coverage for LCS
   - Propose federal mandates similar to the 1990 Breast and Cervical Cancer Mortality Prevention Act and the Mammography Quality Standards Act to ensure that all high-risk adults have access to high-quality LCS for the detection of lung cancer in its earlier, most treatable stages
8. Engage advocacy groups and organizations:
   - Advocacy groups and organizations should leverage their resources to promote strategic planning, research funding, and advocacy to ensure equitable access to high-quality LCS in all populations

Rivera P, Wisnivesky JP, Aldrich M, et al. AJRCCM 2020

System-based Intervention to Reduce Disparities in Treatment of Early-stage Lung Cancer

- Real time warning system
- Feedback to clinical team
- Patient navigator

Comparison group to White retrospective referent group	Treatment outcome	Percentage treated in intervention group (vs White referent group)	Adjusted odds ratio (95% CI)	*P*-value
Black intervention	Surgical treatment for cure only	75 (62)	1.2 (0.73, 1.3)	0.5
White intervention	Surgical treatment for cure only	76 (62)	1.6 (1.1, 2.9)	0.008
Black intervention	Surgery or stereotactic radiation for cure	96 (78)	11.9 (2.9, 49)	0.001
White intervention	Surgery or stereotactic radiation for cure	95 (78)	5.8 (3.0, 11)	<0.001
Black intervention	Stereotactic radiation for cure only	22 (16)	2.7 (1.6, 4.8)	<0.001
White intervention	Stereotactic radiation for cure only	19 (16)	1.9 (1.2, 2.9)	0.005

Cykert S, et al. Cancer Medicine, 2018.

Conclusions

- Minorities face worse lung cancer outcomes
- LDCT screening is effective reducing lung cancer mortality and equitable adoption may decrease racial and ethnic disparities in care
- Minorites face numerous barriers to screening at the system-, provider- and patient-level
- Multisystem strategies are needed to improve screening adoption among minorities

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Questions?