Finding the Cure:

Best Practices for Increasing Lung Cancer Screening

Jacob Sands, MD

April 16, 2019

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HARVARD MEDICAL SCHOOL
TEACHING HOSPITAL

Disclosures

- Advisory Board/Consulting:
  - Loxo, Abbvie, AstraZeneca, Genentech, Incyte, Merck, Celgene, Foundation Medicine, Guardant

Increasing Lung Cancer Screening

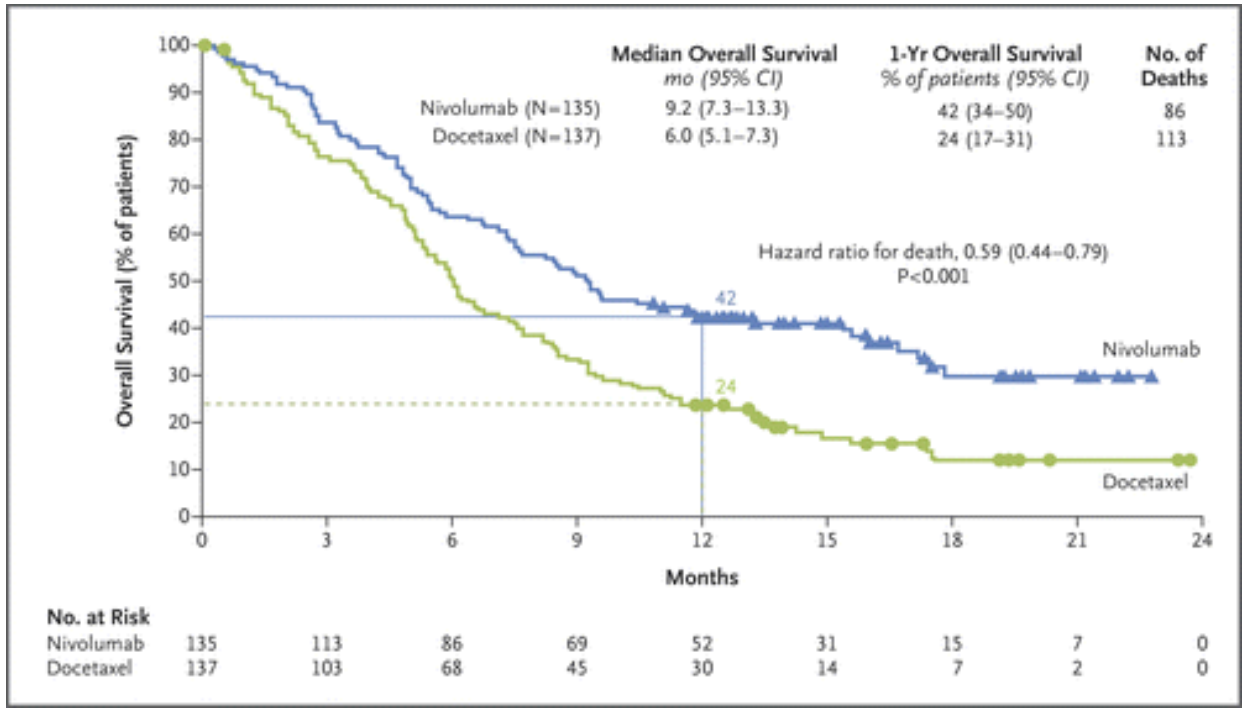
- People generally listen to the advice of their physicians (for testing)

- A robust screening program will successfully screen the majority of qualifying patients in the system
  - This has been demonstrated in multiple hospitals
  - The physicians perspectives always impact rates of testing/treatment

Important questions for perspective

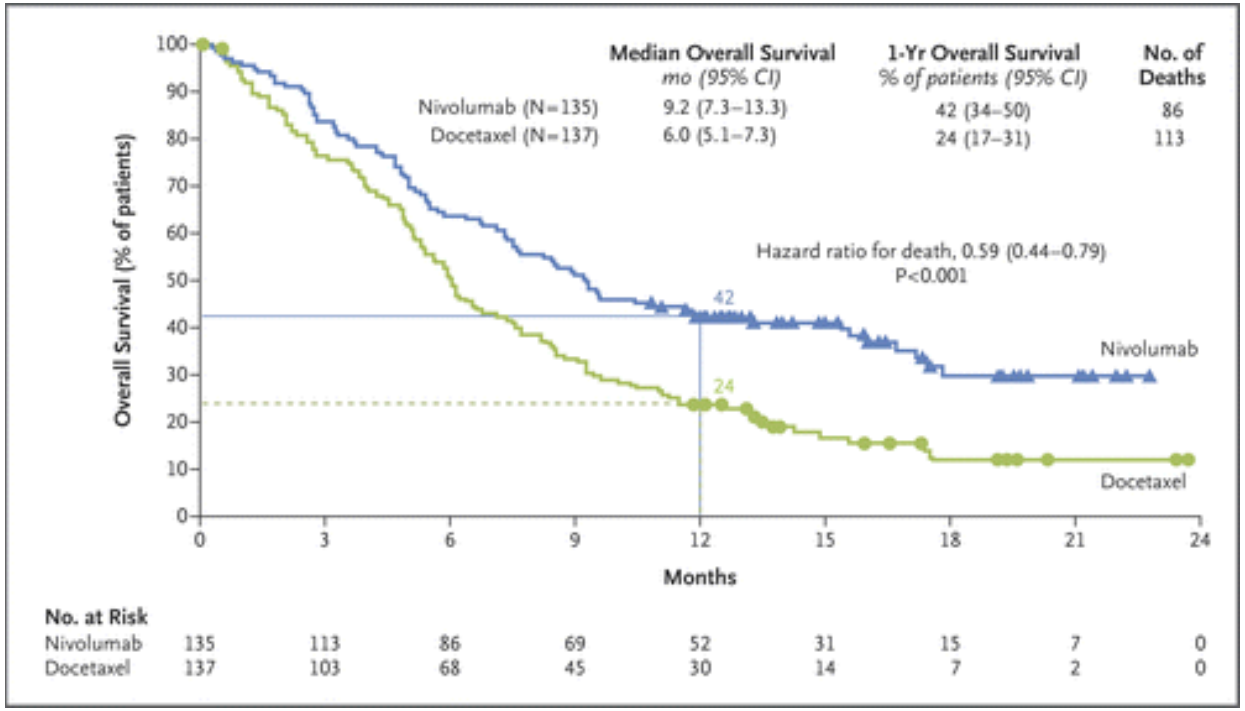
- How much does low dose CT screening (LDCT) actually affect outcomes?
- What are the risks?

Nivolumab in Lung Cancer Celebrated

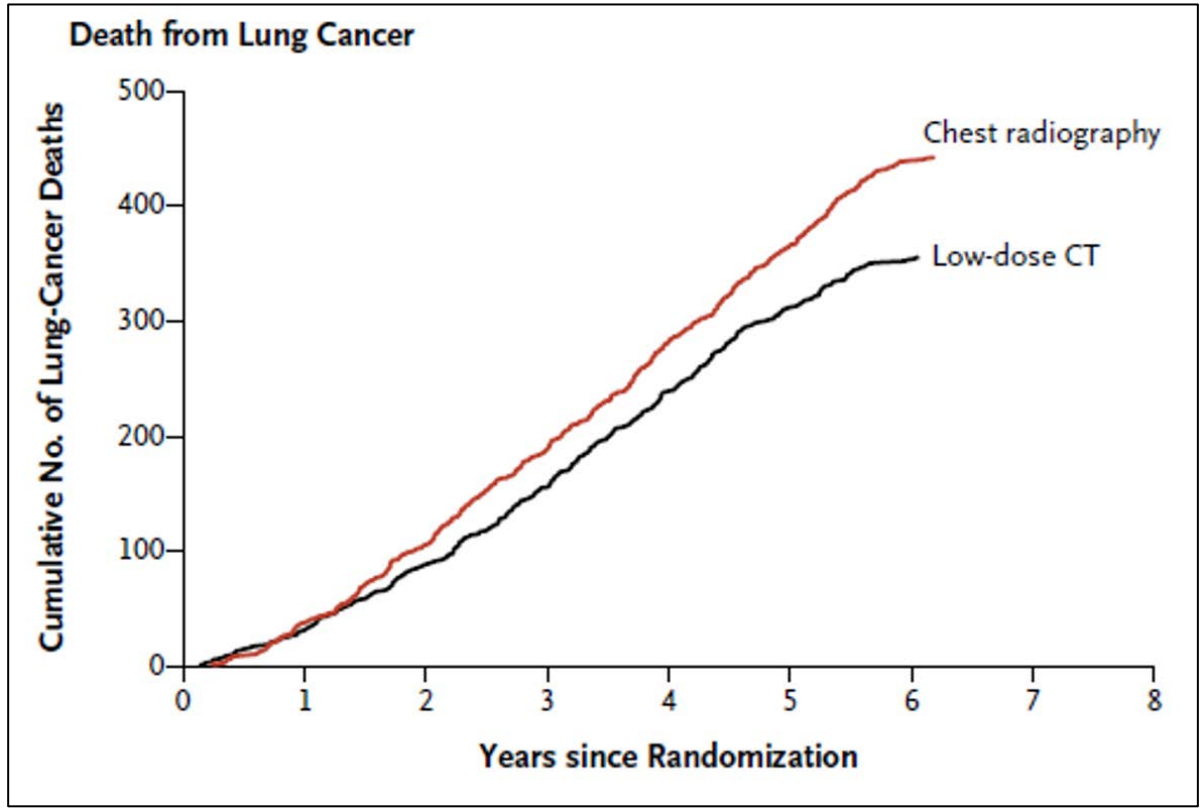


Brahmer et al. NEJM 2015

LDCT also showed significant mortality improvement



Brahmer et al. NEJM 2015



NLST, NEJM 2011

National Lung Screening Trial

LDCT (Table 5 NLST)

Stage	During Screening: Screen Decteted		During Screening: Negative Screening		During Screening: Total During Screening		No Screening Test (Most During Followup)		Overall	
IA	329	52%	5	11%	334	49%	82	23%	416	40%
IB	71	11%	2	5%	73	11%	31	9%	104	10%
IIA	26	4%	2	5%	28	4%	7	2%	35	3%
IIB	20	3%	3	7%	23	3%	15	4%	38	4%
IIIA	59	9%	3	7%	62	9%	37	10%	99	10%
IIIB	49	8%	15	34%	64	9%	58	16%	122	12%
IV	81	13%	14	32%	95	14%	131	36%	226	22%
Total	635		44		679		361		1040	
Early (1 & 2)	446	70%	12	27%	458	67%	135	37%	593	57%
Late (3 & 4)	189	30%	32	73%	221	33%	226	63%	447	43%

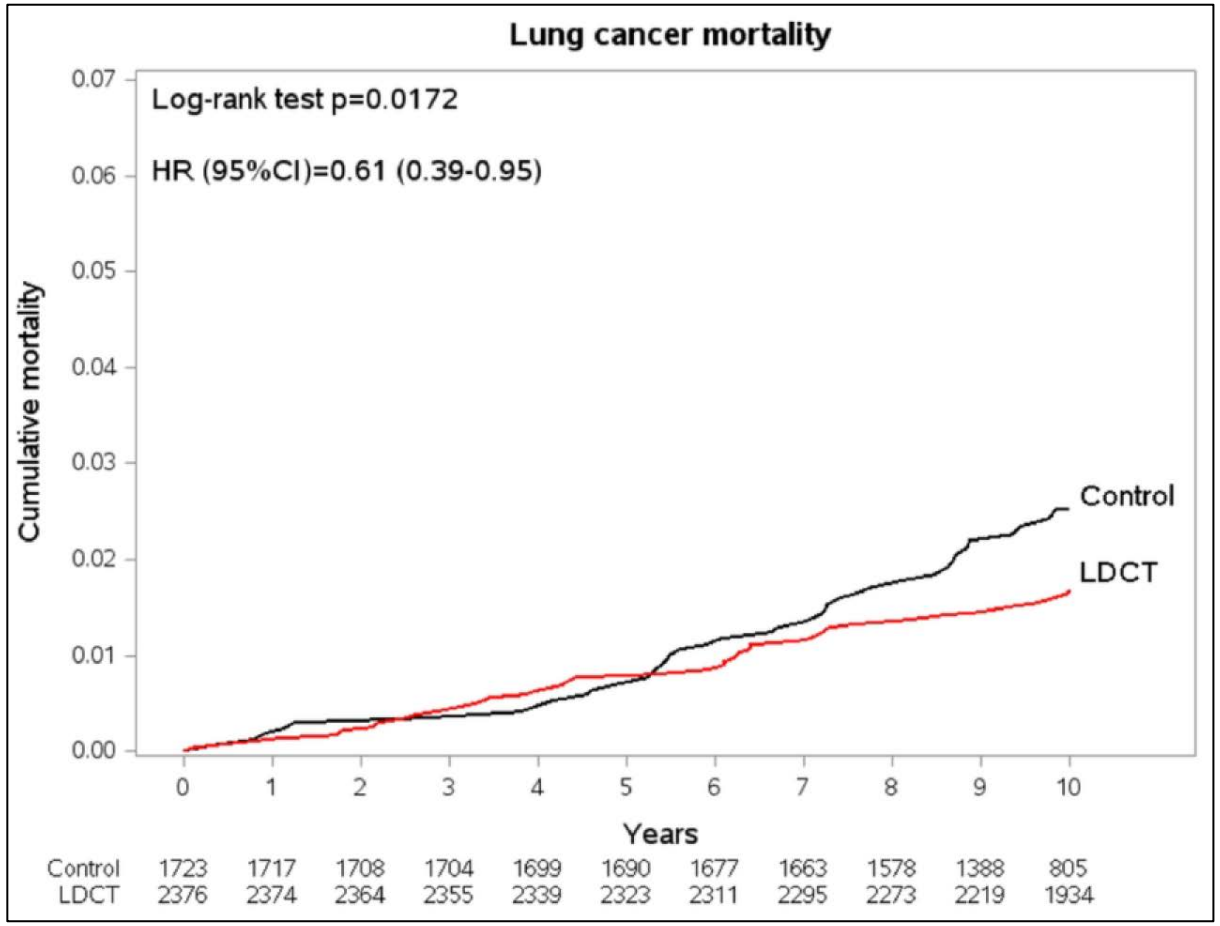
CXR (Table 5 NLST)

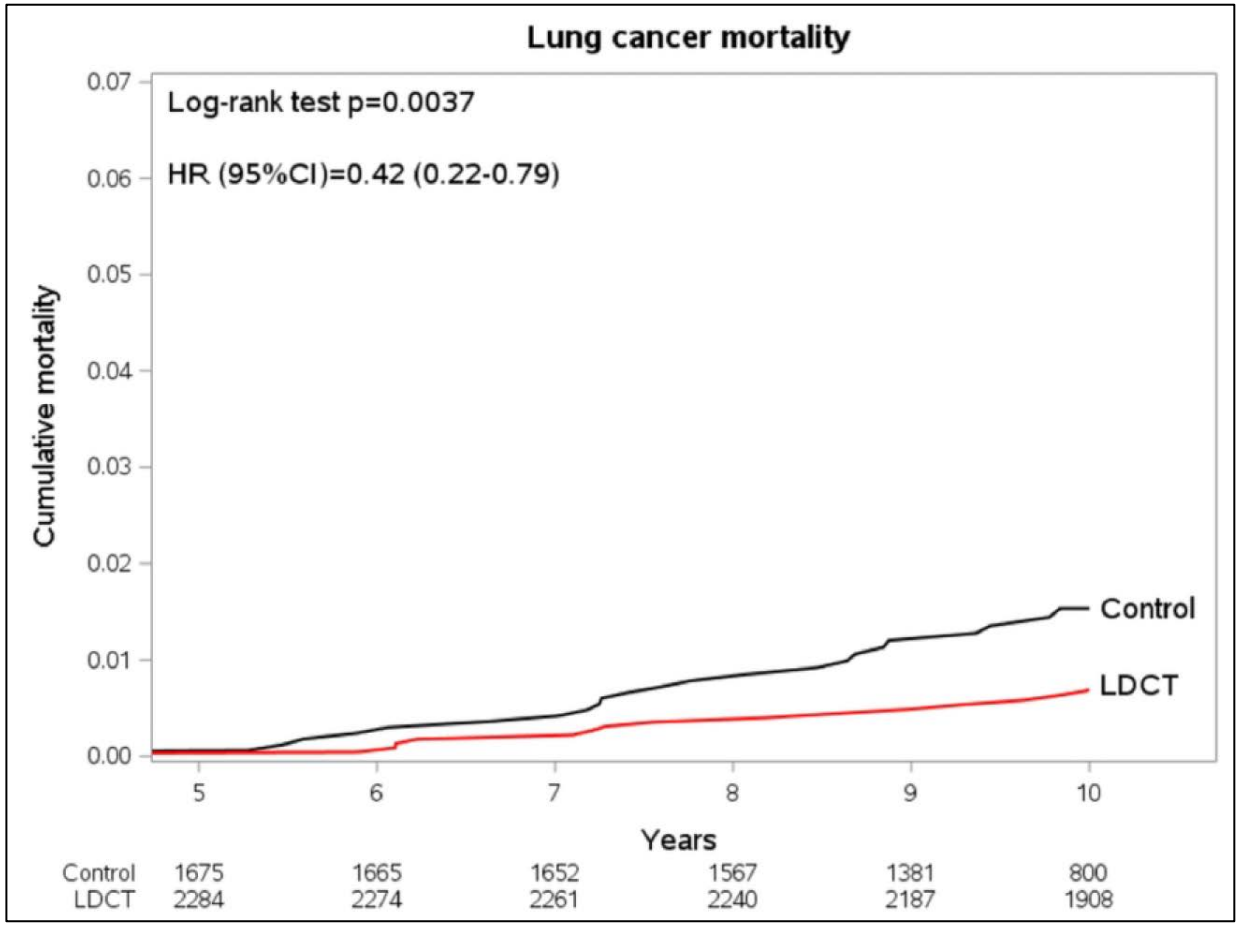
Stage	During Screening: Screen Decteted		During Screening: Negative Screening		During Screening: Total During Screening		No Screening Test (Most During Followup)		Overall	
IA	90	33%	16	12%	106	16%	90	17%	196	19%
IB	41	15%	6	4%	47	7%	46	9%	93	9%
IIA	14	5%	2	1%	16	2%	16	3%	32	3%
IIB	11	4%	6	4%	17	3%	25	5%	42	4%
IIIA	35	13%	21	16%	56	8%	53	10%	109	10%
IIIB	27	10%	24	18%	51	8%	71	14%	122	12%
IV	57	21%	60	44%	117	17%	218	42%	335	32%
Total	275		135		410		519		929	
Early (1 & 2)	156	57%	30	22%	186	45%	177	34%	363	39%
Late (3 & 4)	119	43%	105	78%	224	55%	342	66%	566	61%

NELSON Volume CT screening

- MALES at high risk for lung cancer have a reduced risk of dying from lung cancer of **26%** in the screen arm compared to the male control arm (95% CI 9-40%)
- In WOMEN, reductions are consistently more favourable: **39-61%**
- These results are more favourable than the NLST-results & suggest gender differences
- Volume CT lung cancer screening of high risk former and current smokers results in low referral rates (2.3%), and a very substantial reduction in lung cancer mortality (in both genders)

Prolonged Lung Cancer Screening Reduced 10-year Mortality in the MILD Trial: New Confirmation of Lung Cancer Screening Efficacy





Pastorino et al. Annals of Onc 2019

Lahey Hospital & Medical Center Lung Cancer Database

Lung cancer 2010-2015

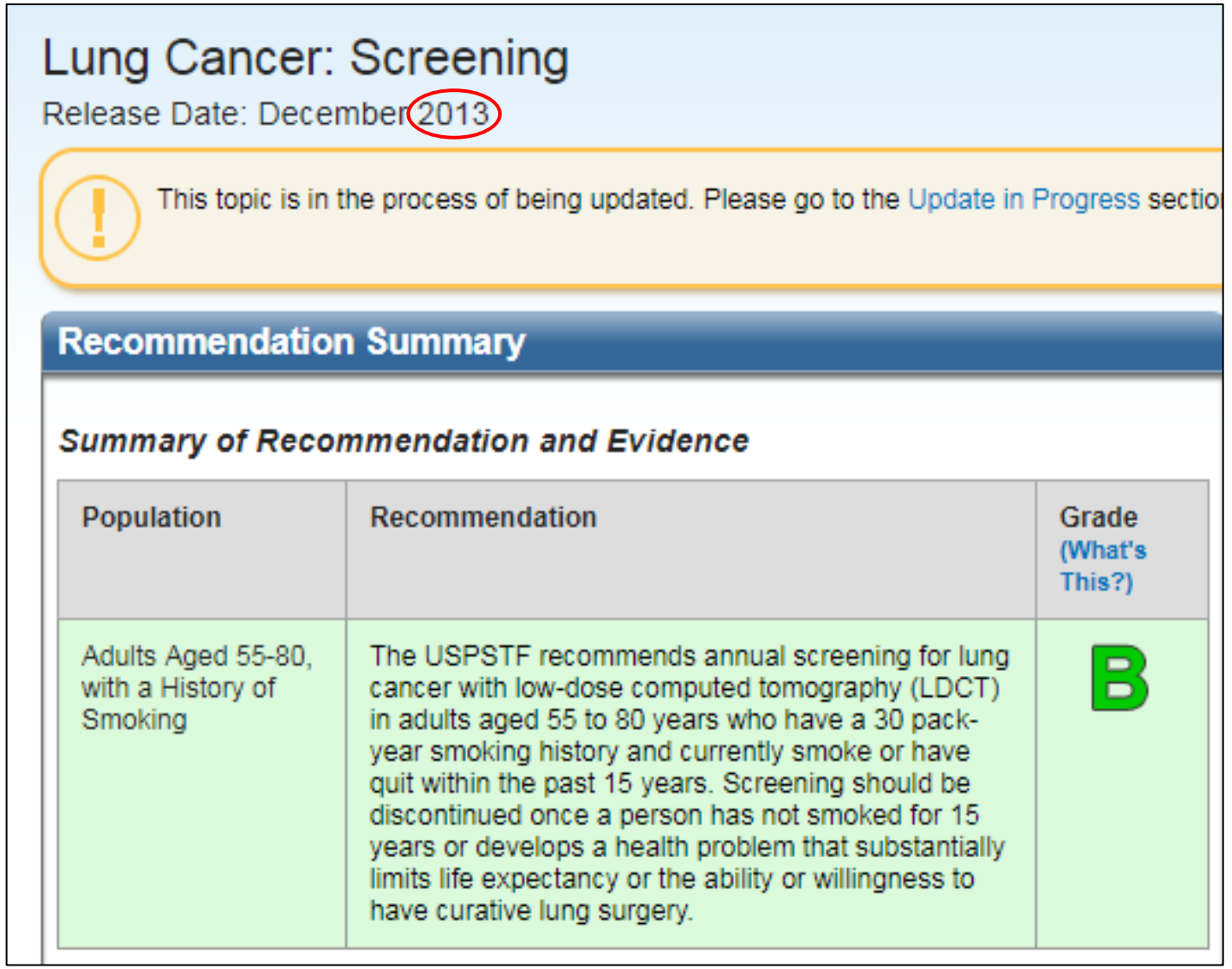
All Histologies	Stage I	Stage II	Stage III	Stage IV	Total
2010	68	26	38	112	244
2011	75	16	55	81	227
2012	65	23	54	93	235
2013	84	19	60	106	269
2014	74	27	58	89	248
2015	109	22	60	99	290
Total	475	133	325	580	1513

NSCLC	Stage I	Stage II	Stage III	Stage IV	Total
2010	68	22	29	93	212
2011	74	16	47	68	205
2012	64	20	46	76	206
2013	84	19	48	84	235
2014	72	26	48	74	220
2015	106	21	52	80	259
Total	468	124	270	475	1337

127	Equal early and late stage	132
106	More stage I than stage IV	80

Slide by Andrea McKee

USPSTF Recommendation for LDCT



Lung Cancer: Screening

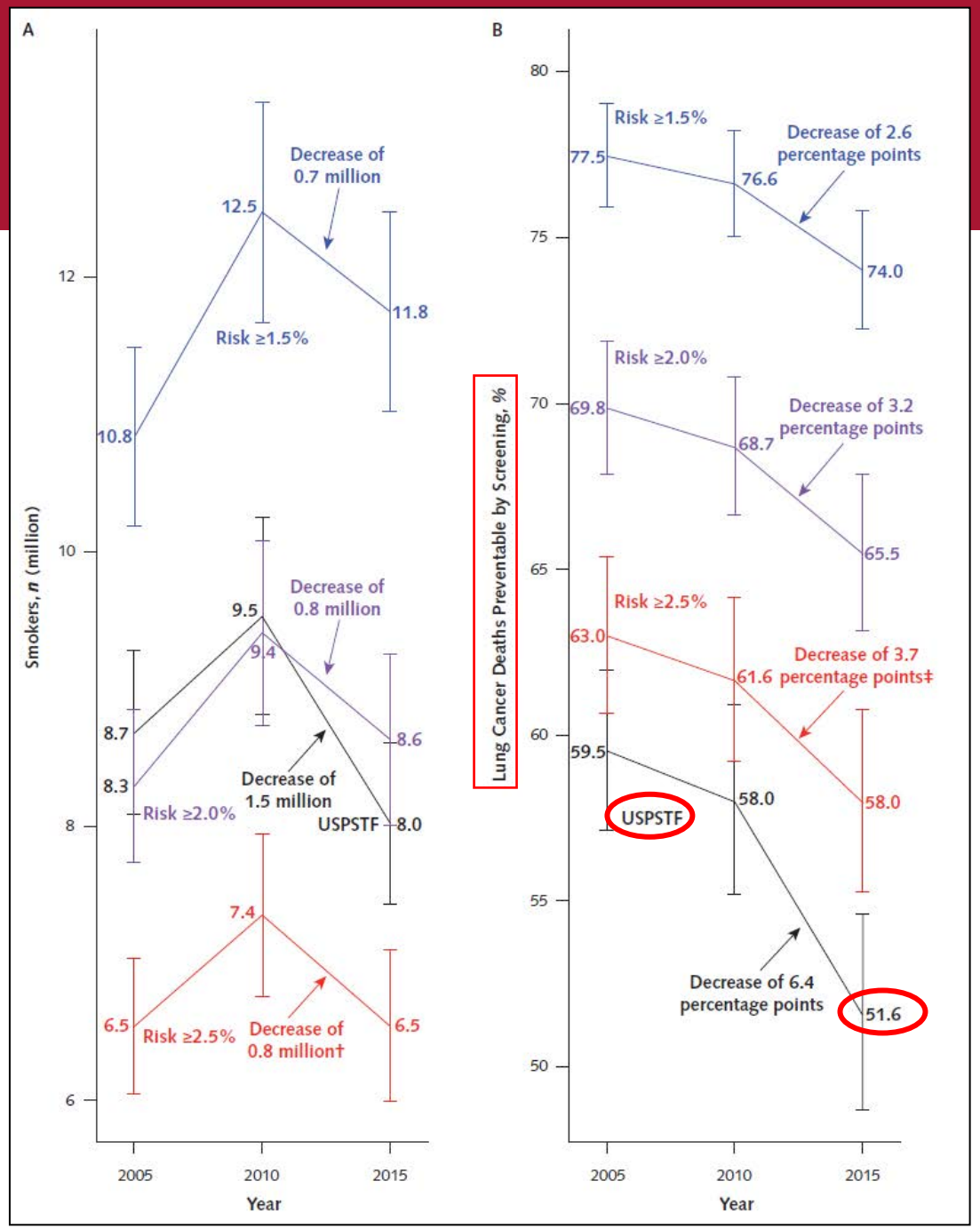
Release Date: December 2013

This topic is in the process of being updated. Please go to the Update in Progress sectio

Recommendation Summary

Summary of Recommendation and Evidence

Population	Recommendation	Grade (What's This?)
Adults Aged 55-80, with a History of Smoking	The USPSTF recommends annual screening for lung cancer with low-dose computed tomography (LDCT) in adults aged 55 to 80 years who have a 30 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



Lung Cancer Deaths Preventable by Screening, %

Annals of Internal Med. Vol 168(3) pgs 229-232

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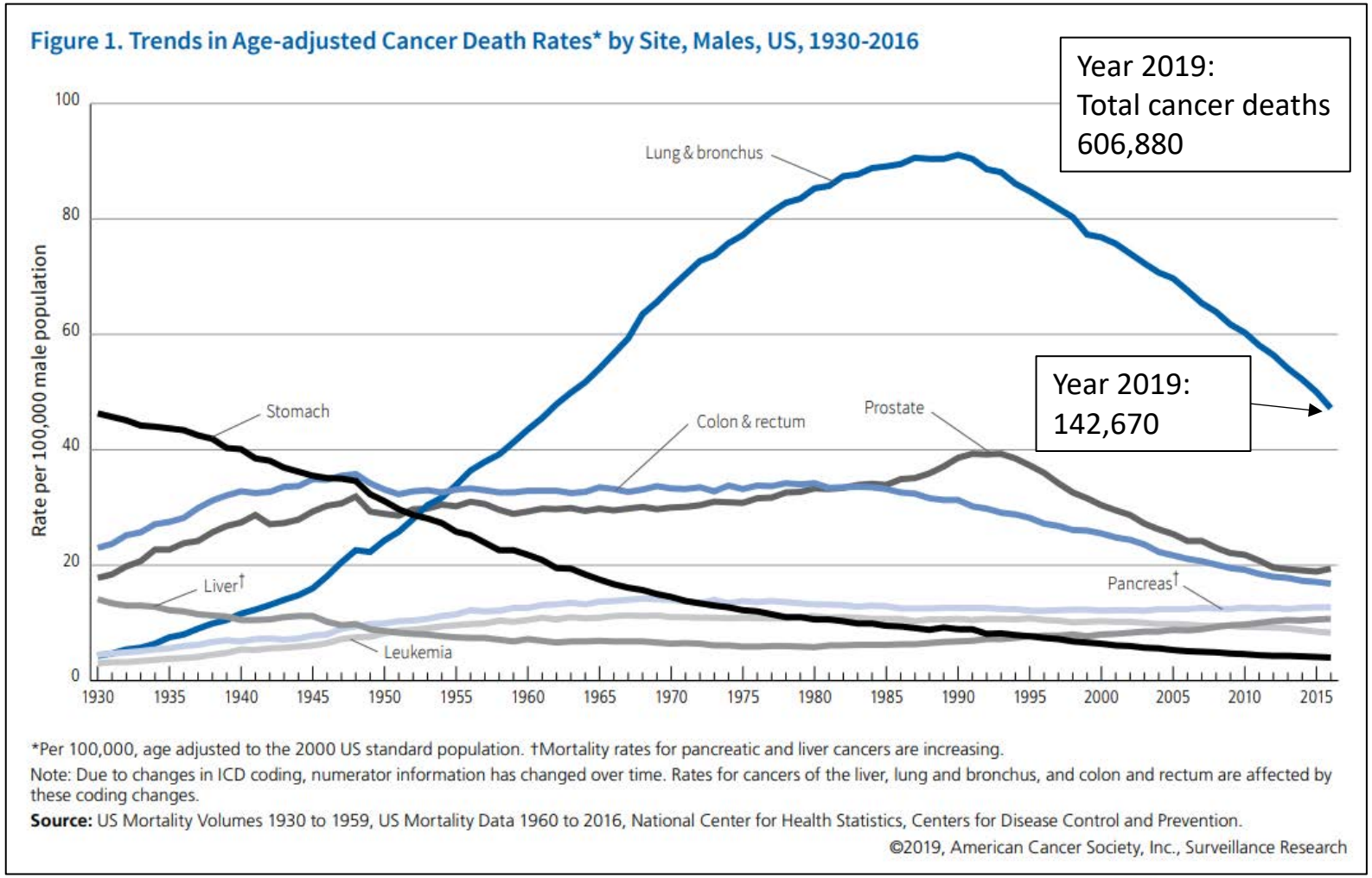
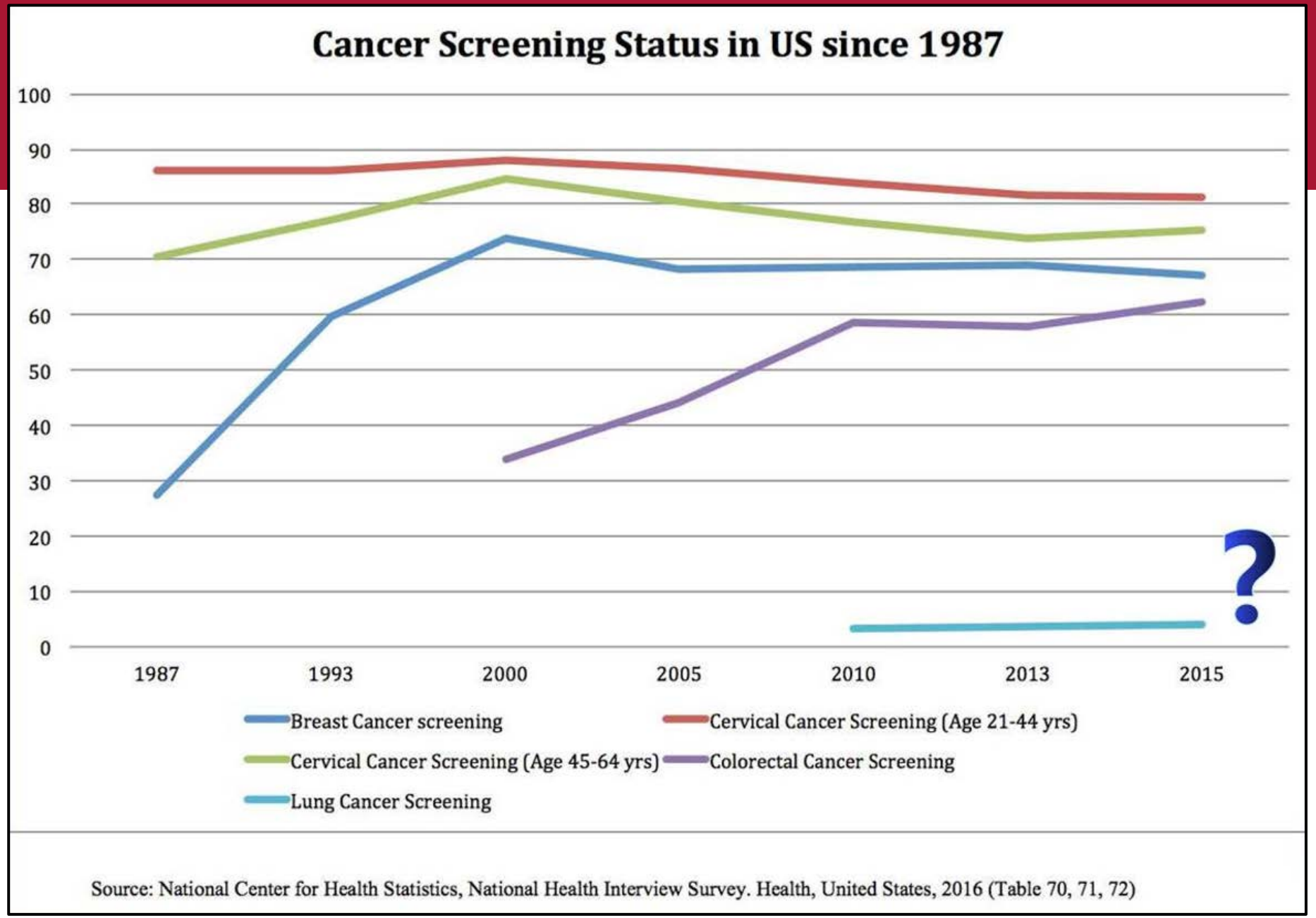
Perspective

- Breast Cancer
  - 42,260 estimated deaths
- Lung Cancer
  - 142,670 estimated deaths
- Decreasing lung cancer mortality by 50% would save more lives than curing breast cancer



Cancer Facts & Figures 2019, American Cancer Society



Slide by Pham et al. ASCO 2018

Why isn’t LDCT being done???

What are the risks?

- Do we (the medical community) believe screening is important?
  - This recently seems to be what is changing most!
- Radiation exposure from multiple scans?
- Unnecessary interventions for “false positives”?
- Are we over-treating indolent cancers?
- Costs?
- Will this overly strain hospital systems?
- Do individuals want to participate in screening?

Stigma is an important part of the discussion

- Smoking wasn't always known to be so bad and is highly addictive!
  - We even gave them to many of our soldiers

Radiation Exposure

LDCT	1 mSv	Years of annual lung screening
Mammogram	.7 mSv	
Lumbar Spine Films	2 mSv	2
Diagnostic Chest CT	10 mSv	10
Triphasic CT AB/P	25 mSv	25
Background Exposure	3 mSv/year	3
Colorado	11.8 mSv/year	11.8
Occupational Exposure	50 mSv/year	50
Transatlantic Flight	.1 mSv	10 flights = 1 LDCT

10 -30 year latency period to develop secondary malignancies from RT exposure

Average age of patients in screening trials is 62

Slide by Andrea McKee

False Positives

- IELCAP reported baseline positive results of 10.2% with 6mm guideline compared to 16% at 4mm without any false negatives

- American College of Radiology, Lung-RADS
  - ACR adopted 6mm as minimum nodule size
  - Ground glass opacity cutoff 2cm
  - Duration of nodule stability 3 months (decreased from 2 yrs)

Retrospective Review of Lahey Database

- Review of 2180 high-risk patients in LDCT screening protocol
- ACR Lung-RADS reduced overall positive rate from 27.6% to 10.6%.

NLST vs ACR

Table 2. Results

	Positive Thresholds			
	NCCN Version 1.2012 (~NLST)		ACR Lung-RADS	
Overall (n = 2,180)				
Negative/benign (Lung-RADS 1 and 2)	1,579	72.4%	1,949	89.4%
Positive (Lung-RADS 3 and 4)	601	27.6%	231	10.6%
Probably benign (Lung-RADS 3)	508	23.3%	138	6.3%
Suspicious (Lung-RADS 4)	93	4.3%	93	4.3%
Clinical follow-up (n = 1,603)				
Negative/benign (Lung-RADS 1 and 2)	1,185	73.9%	1,435	89.5%
Positive (Lung-RADS 3 and 4)	418	26.1%	168	10.5%
Probably benign (Lung-RADS 3)	352	22.0%	102	6.4%
Suspicious (Lung-RADS 4)	66	4.1%	66	4.1%
Diagnosed lung cancer	29 (1.8%)		29 (1.8%)	
• Positive examination result				
• Includes 3 cases of presumed malignancy*				
Positive predictive value	6.9%		17.3%	
Biopsy-proven lung cancer	26 (1.6%)		26 (1.6%)	
• Positive examination result				
• Excludes 3 cases of presumed malignancy*				
Positive predictive value	6.2%		15.5%	

Note: NCCN = National Comprehensive Cancer Network; NLST = National Lung Screening Trial.

*Patients unable to tolerate biopsy were diagnosed with presumed lung cancer on the basis of positive results on PET, suspicious growth rate, and multidisciplinary consensus.

McKee et al. JACR 2015

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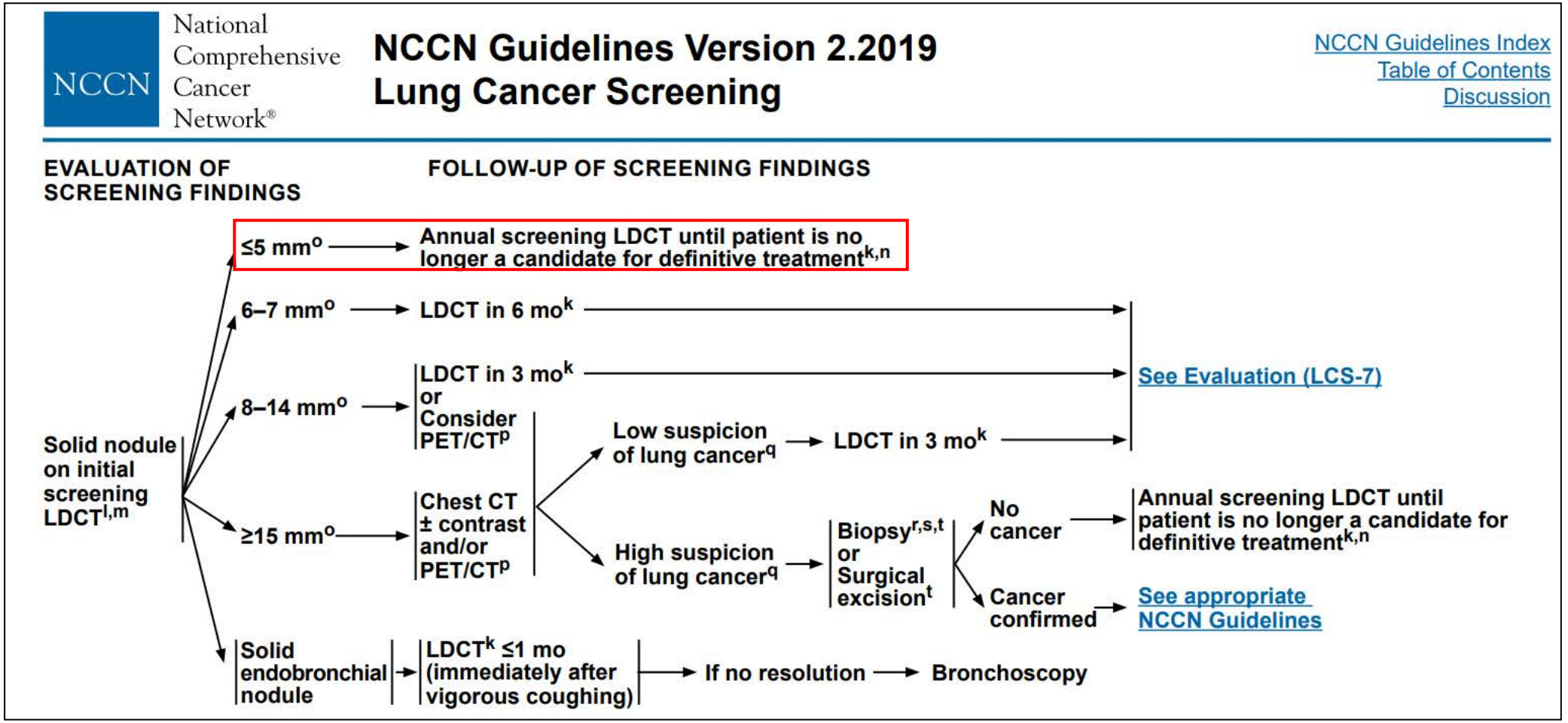
McKee et al. JACR 2015

NCCN Guidelines Recommendations



What is a “positive” scan?

JAMA Internal Medicine | Original Investigation

Implementation of Lung Cancer Screening in the Veterans Health Administration

Linda S. Kinsinger, MD, MPH; Charles Anderson, MD, PhD; Jane Kim, MD, MPH; Martha Larson, BSN, MS; Stephanie H. Chan, MPH; Heather A. King, PhD; Kathryn L. Rice, MD; Christopher G. Slatore, MD, MS; Nichole T. Tanner, MD, MSCR; Kathleen Pittman, BSN, MPH; Robert J. Monte, MBA; Rebecca B. McNeil, PhD; Janet M. Grubber, MSPH; Michael J. Kelley, MD; Dawn Provenzale, MD, MSc; Santanu K. Datta, PhD; Nina S. Sperber, PhD; Lottie K. Barnes, MPH; David H. Abbott, MS; Kellie J. Sims, PhD, MS; Richard L. Whitley, BS; R. Ryanne Wu, MD, MHS; George L. Jackson, PhD, MHA

About 70% early stage cancers

Table 4. Stage and Histologic Findings of Lung Cancers Found on Initial Round of Lung Cancer Screening

Result	All Sites	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8
Total lung cancers found	31	7	4	3	10	0	2	3	2
Stage									
I	20	5	3	2	6	0	2	1	1
II	2	0	0	0	1	0	0	1	0
III	6	2	0	1	2	0	0	1	0
IV	2	0	1	0	1	0	0	0	0
Unknown	1	0	0	0	0	0	0	0	1
Histologic type									
Adenocarcinoma	12	2	2	1	3	0	2	2	0
Squamous cell carcinoma	12	4	2	1	4	0	0	0	1
Non-small-cell carcinoma or other	4	1	0	0	3	0	0	0	0
Small-cell carcinoma	2	0	0	1	0	0	0	1	0
Unknown	1	0	0	0	0	0	0	0	1

22 early stage

8 late stage

What is a “positive” scan?

Table 1. Summary Results for the Initial Round of Lung Cancer Screening in 8 LCSDP Sites

Characteristic	No. (%)								
	All Sites	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8
Patients who met all screening criteria	4246	869	472	389	779	288[a]	272	863	314
Patients who agreed to be screened[b]	2452 (57.7)	546 (62.8)	247 (52.3)	257 (66.1)	489 (62.8)	255 (NA[a])	177 (65.1)	290 (33.6)	191 (60.8)
Patients screened	2106 (85.9)	442 (81.0)	228 (92.3)	213 (82.9)	444 (90.8)	247 (96.9)	135 (76.3)	258 (89.0)	139 (72.8)
Patients with nodular findings on scans[c]	1257 (59.7)	340 (76.9)	70 (30.7)	181 (85.0)	248 (55.9)	153 (61.9)	63 (46.7)	112 (43.4)	90 (64.7)
Patients with nodules to be tracked[d]	1184 (56.2)	323 (73.1)	64 (28.1)	176 (82.6)	225 (50.7)	143 (57.9)	61 (45.2)	108 (41.9)	84 (60.4)
Patients with suspicious findings not confirmed to be lung cancer[e]	42 (2.0)	10 (2.3)	2 (0.9)	2 (0.9)	13 (2.9)	10 (4.0)	0	1 (0.4)	4 (2.9)
Patients with confirmed lung cancer	31 (1.5)	7 (1.6)	4 (1.8)	3 (1.4)	10 (2.3)	0	2 (1.5)	3 (1.2)	2 (1.4)
Patients with incidental, non-nodule findings on scans	857 (40.7)	211 (47.7)	106 (46.5)	135 (63.4)	89 (20.0)	149 (60.3)	54 (40.0)	81 (31.4)	32 (23.0)
Total LDCT scans completed[f]	2694	558	299	306	546	372	171	300	142

What is a “positive” scan?

Table 3. Description of Nodules Identified on Initial Round of Low-Dose Computed Tomography Scans for Lung Cancer Screening

Characteristic	No. (%)
Nodule density[a]	
Solid	1079 (83.4)
Suspicious solid	66 (5.1)
Ground glass	86 (6.7)
Mixed solid and ground glass	62 (4.8)
Nodule size, mm[a]	
<5	710 (54.9)
5	150 (11.6)
6	120 (9.3)
7	88 (6.8)
8	51 (3.9)
>8	164 (12.7)
Unknown	10 (0.8)

[a] N = 1293.

66.5%

Pure ground glass <20mm is not currently considered a “positive” scan

What is a “positive” scan?

The rate of positive findings after 1 round of screening in the LCSDP was more than twice that in the NLST (1257 [59.7%] vs 7191 of 26 309 [27.3%]). The reason for the overall high rate of initially positive examination results in the VHA sites is not certain but may be owing, in part, to the older age and heavier smoking history of veterans screened.[26,27] Nodule follow-up guidelines in the LCSDP included a recommendation to follow up very small nodules (<4 mm) if they were new or grow-

- But they called ANY nodule “positive” vs NLST that used ≥4mm
- Even a 4mm nodule would not be considered “positive” by LungRADS

Editorial

October 2018

Failing Grade for Shared Decision Making for Lung Cancer Screening

Rita F. Redberg, MD, MSc[1,2]

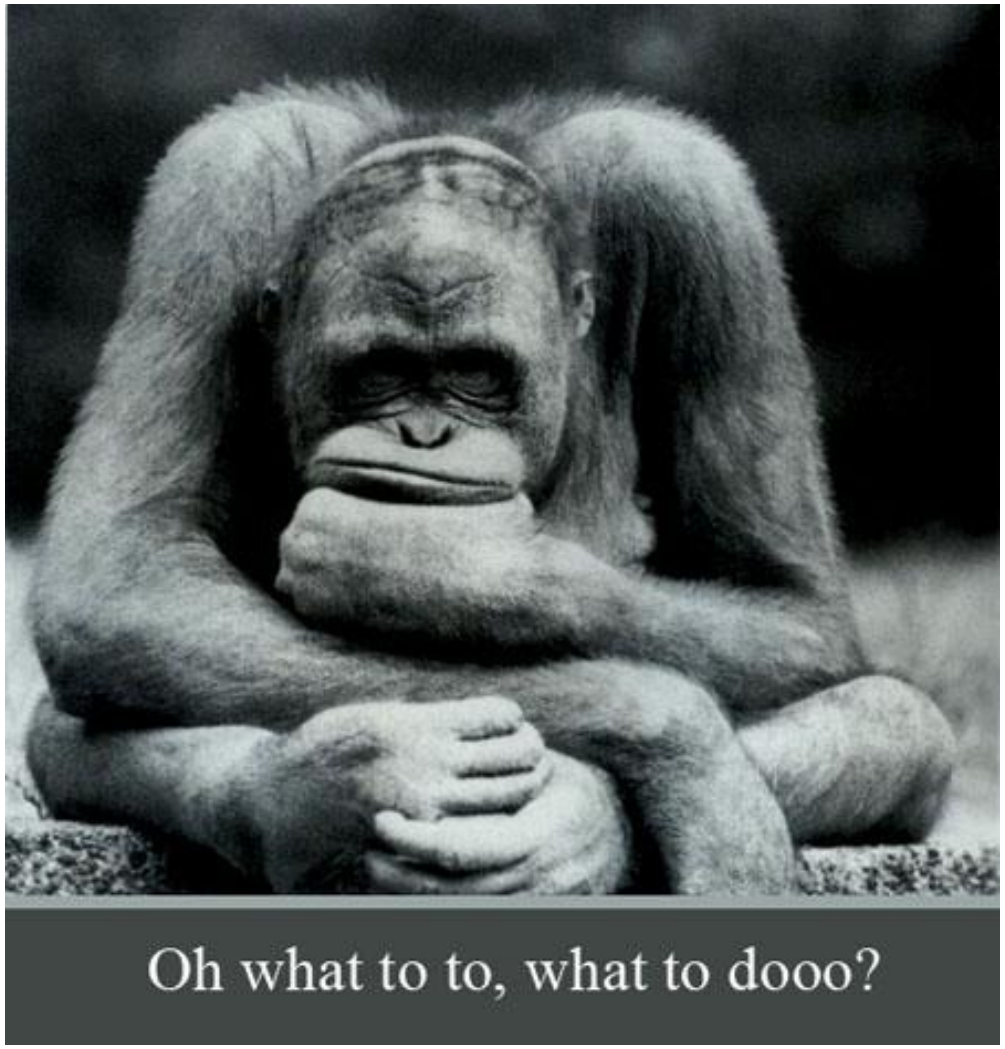
» Author Affiliations | Article Information

JAMA Intern Med. 2018;178(10):1295-1296. doi:10.1001/jamainternmed.2018.3527

"Even in the highest-rated discussions, there was no mention of possible harms from the screening by the physicians, even though these harms include a 98% false-positive rate, which may lead to anxiety; additional testing including imaging or procedures, such as biopsy or lobectomy; and radiation from the LDCT with the small increased risk of cancer. Some evidence suggests that a more-rigorous and -informative SDM discussion about lung cancer screening is occurring in the Veterans Administration system."

- Multiple publications report "false positive" rates that are overstated.
  - This review is quoting a study that called ALL nodules positive
  - "False positive" is also often mis-stated. "False Discovery Rate" is the appropriate term

Inflated “false positive” rates leave everybody confused



Low Provider Knowledge Is Associated With Less Evidence-Based Lung Cancer Screening

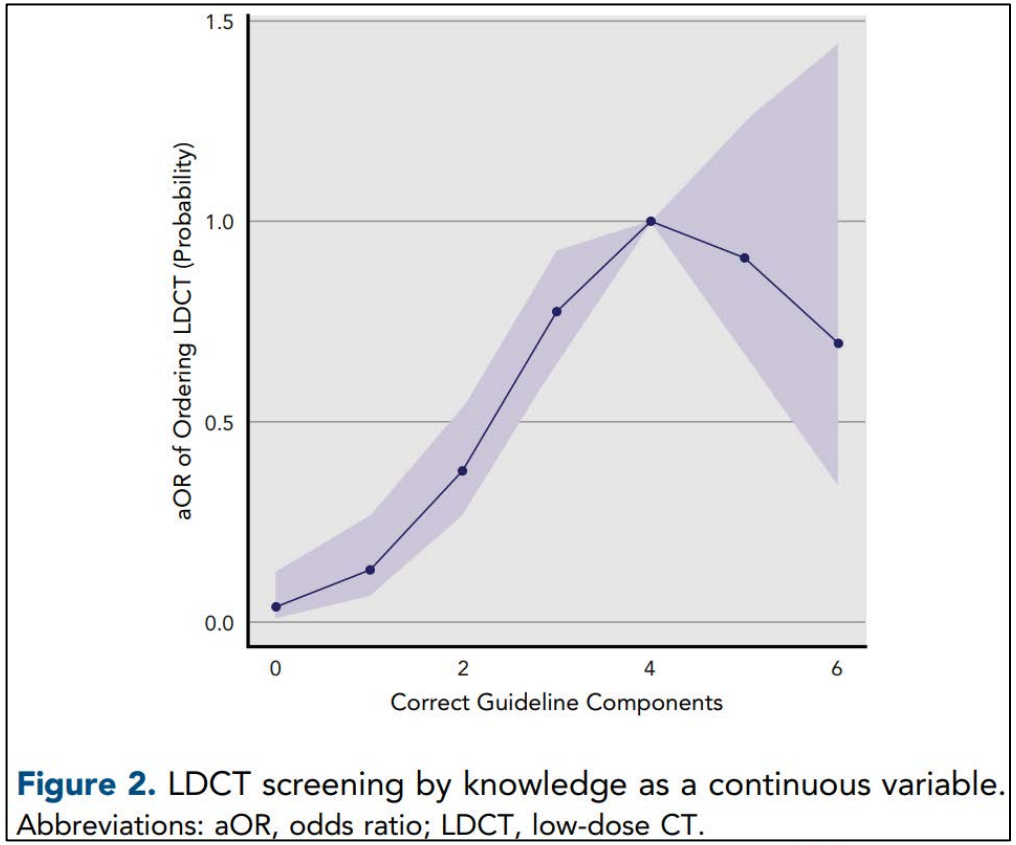


Figure 2. LDCT screening by knowledge as a continuous variable.
Abbreviations: aOR, odds ratio; LDCT, low-dose CT.

Lewis J, et al. JNCCN 2019

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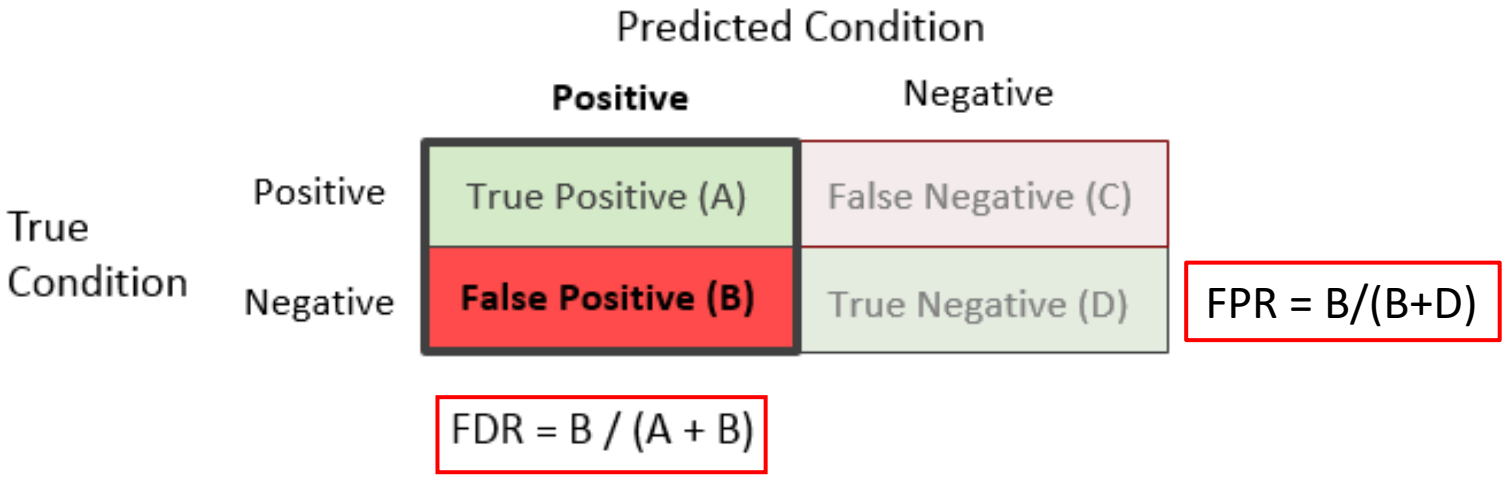
“False Positive” vs “False Discovery” Rate

- False Positive Rate = The ratio of the number of false positive results to the total number of disease absent

- False Discovery Rate = The ratio of the number of false positive results to the number of total positive test results



Slide adapted from Shawn Regis

False Positive vs False Discovery

	False Positive Rate				False Discovery Rate			
Screening Round	NLST	NLST LR	LHMC	MG	NLST	NLST LR	LHMC	MG
T0	26.3%	12.6%	10.6%	~20%	96.2%	92.8%	83.1%	97%
T1	27.2%	5.3%	5.2%	5-10%	97.6%	90.3%	78.2%	95%
T2	15.9%	5.1%	5.0%	5-10%	94.8%	87.2%	84.6%	95%

NLST: National Lung Screening Trial

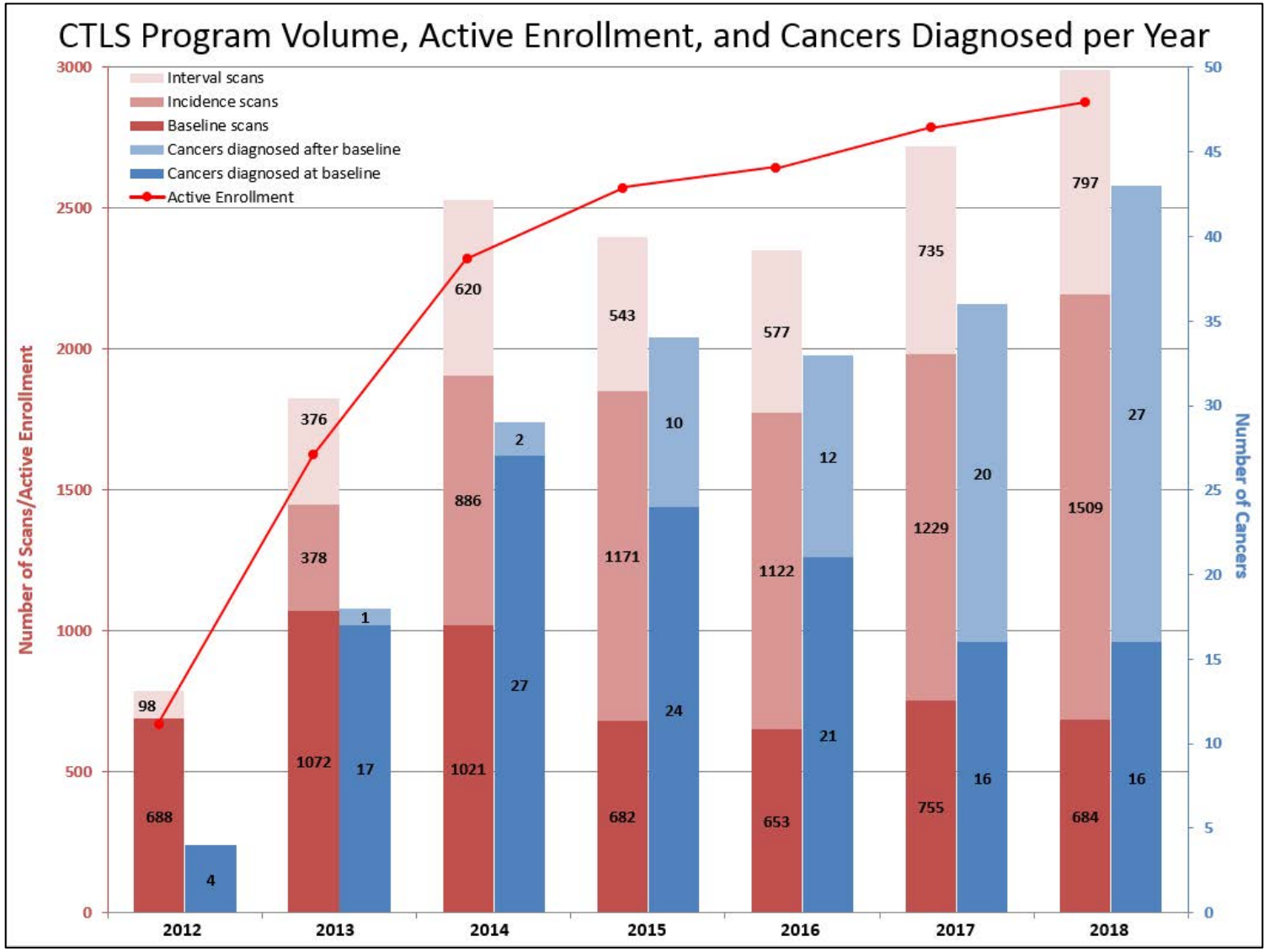
LHMC: Lahey CTLS program

NLST LR: Pinsky et al NLST conversion

MG: Mammography (nationwide)

Slide by Shawn Regis and Andrea McKee

Program population shifts as it matures



Slide by
Brady Mckee

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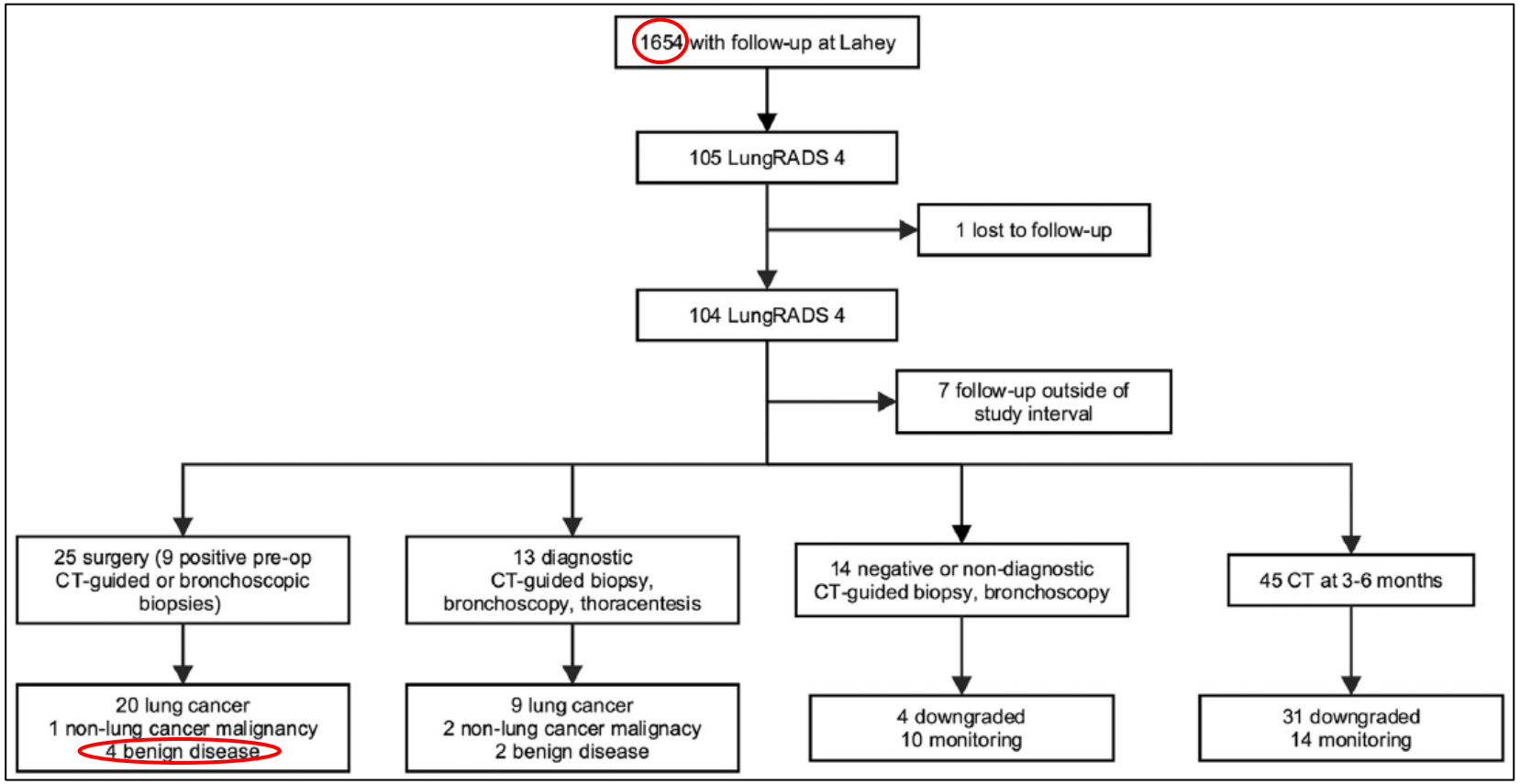
Perspective on False Discovery

- Most nodules considered “positive” are monitored without intervention.
  - Nodules 6-8mm are considered “positive” in LungRADS and called “probably benign”
  - They do NOT all get surgery



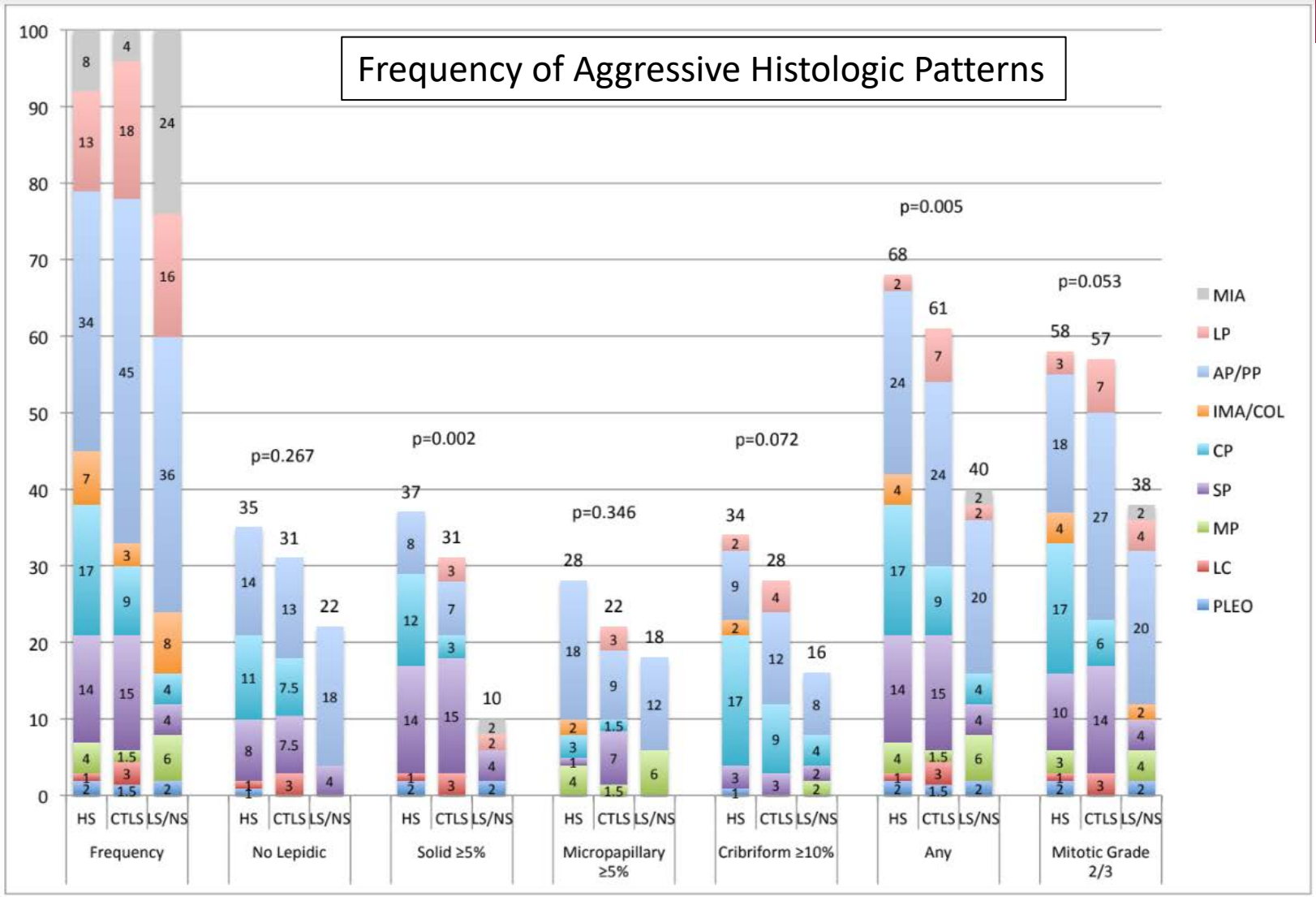
Walker et al. Ann Thorac Surg 2015

“False Positive”

- This is the topic that seems to have the most misunderstanding
- At the same time, this is the area of most needed research
  - How can we stratify the indeterminate nodules?

Are we overtreating indolent cancers?

- Higher incidence of “lepidic predominant” does not necessarily mean they do not have an aggressive sub-type



Pending submission update to Burks E, et al. ASCO 2017

Cost to the System

Table 3. Incremental Cost-Effectiveness.*

Strategy	Cost	Life Expectancy	QALE	Incremental Costs†	Incremental Life Expectancy	Incremental QALE	Cost per Life-Yr	Cost per QALY
	U.S. $	*life-yr*	*QALY*	*U.S. $*	*life-yr*	*QALY*	*U.S. $ (95% CI)*	
CT screening	3,074	14.7386	10.9692	1,631	0.0316	0.0201	52,000 (34,000–106,000)	81,000 (52,000–186,000)
Radiographic screening	1,911	14.7071	10.9491	469	0	0	NA	NA
No screening‡	1,443	14.7071	10.9491	—	—	—	—	—

- Excluded 150 NLST participants from analysis (48 had lung cancer) due to not having adequate info to project survival
  - More in CT group (probable bias against CT)
- Assumed CT screening program did not affect smoking status
- This analysis performed with NSLT (not ACR)

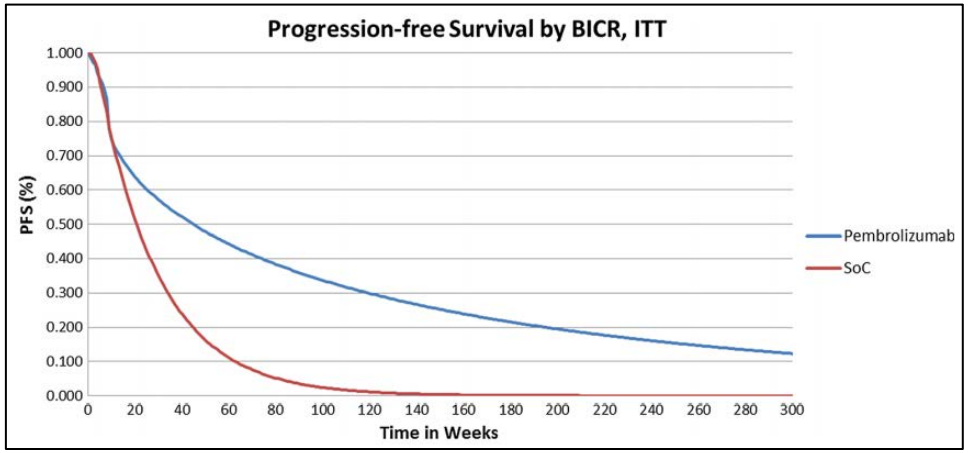
Cost to the System

- Another cost analysis evaluating 2 different cohorts of lung screening

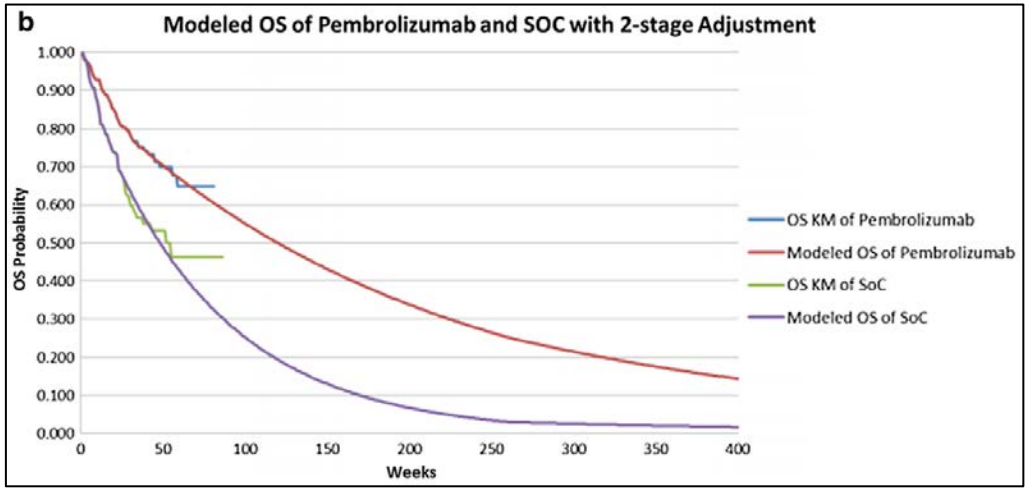
	NY-ELCAP stage shift	NLST stage shift
Screening		
Lung cancer screening and treatment costs	$27,824,282,242	$34,054,299,361
QALYs saved by screening and treatment	985,284	722,795
Cost per QALY saved	$28,240	$47,115
Screening + light smoking cessation intervention		
Additional costs for cessation	$1,361,556,665	$1,361,556,665
Additional QALYs saved by cessation	273,566	273,566
Cost per QALY saved	$23,185	$35,545
Screening + intensive smoking cessation intervention		
A. NRT generic plus behavioral		
Additional costs for cessation	$3,212,191,737	$3,212,191,737
Additional QALYs saved by cessation	930,754	930,754
Cost per QALY saved	$16,198	$22,537
B. Bupropion generic plus behavioral		
Additional costs for cessation	$4,088,822,965	$4,088,822,965
Additional QALYs saved by cessation	930,754	930,754
Cost per QALY saved	$16,656	$23,067
C. Chantix plus behavioral		
Additional costs for cessation	$5,342,861,783	$5,342,861,783
Additional QALYs saved by cessation	930,754	930,754
Cost per QALY saved	$17,310	$23,826

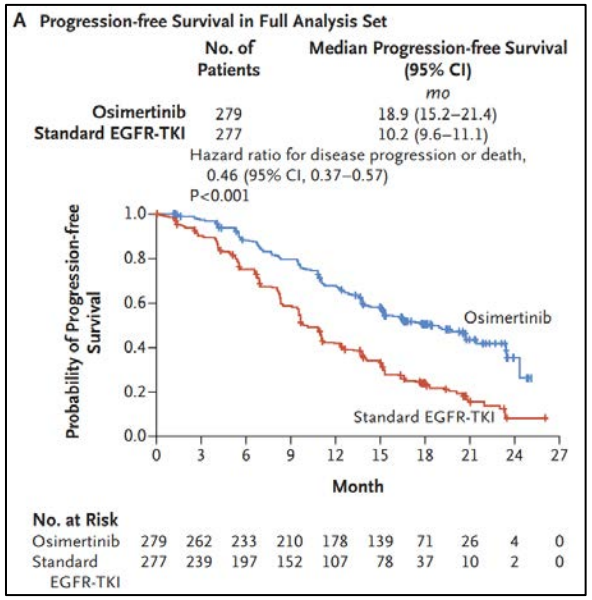
Villanti AC, et al. PLOS ONE 2013

Cost to the System

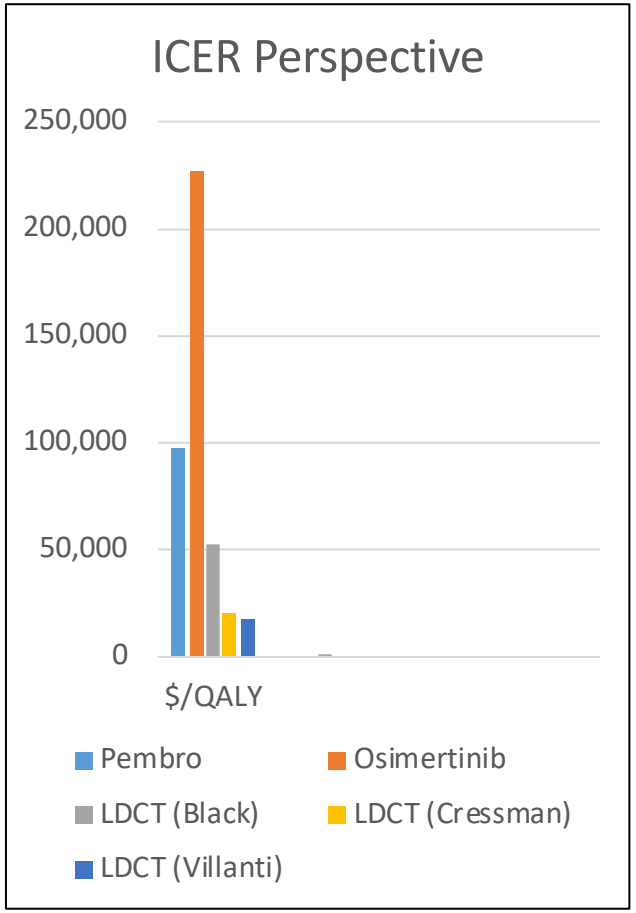


Pembro: Huang et al. 2017





Osimertinib: Soria et al. NEJM 2018

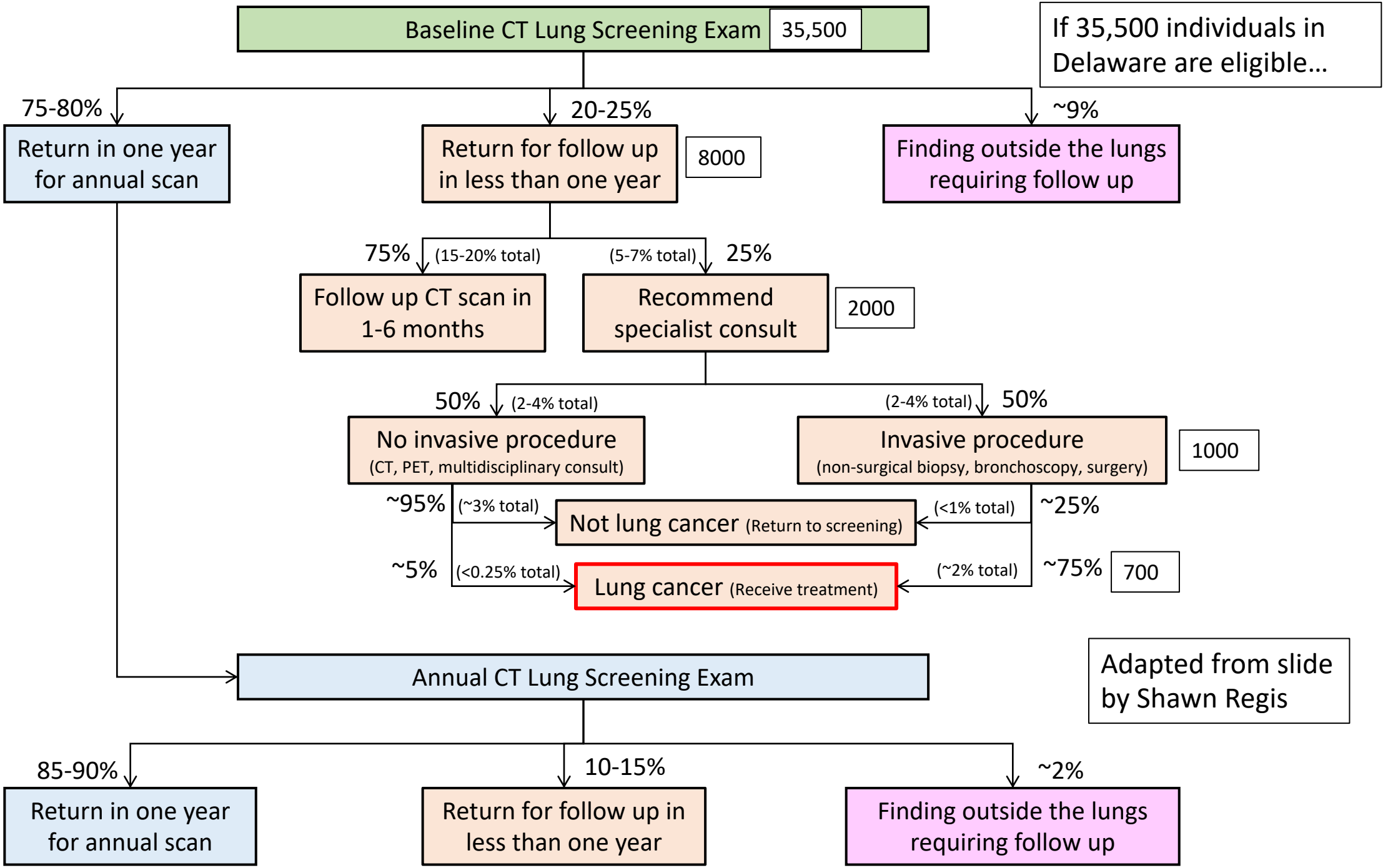


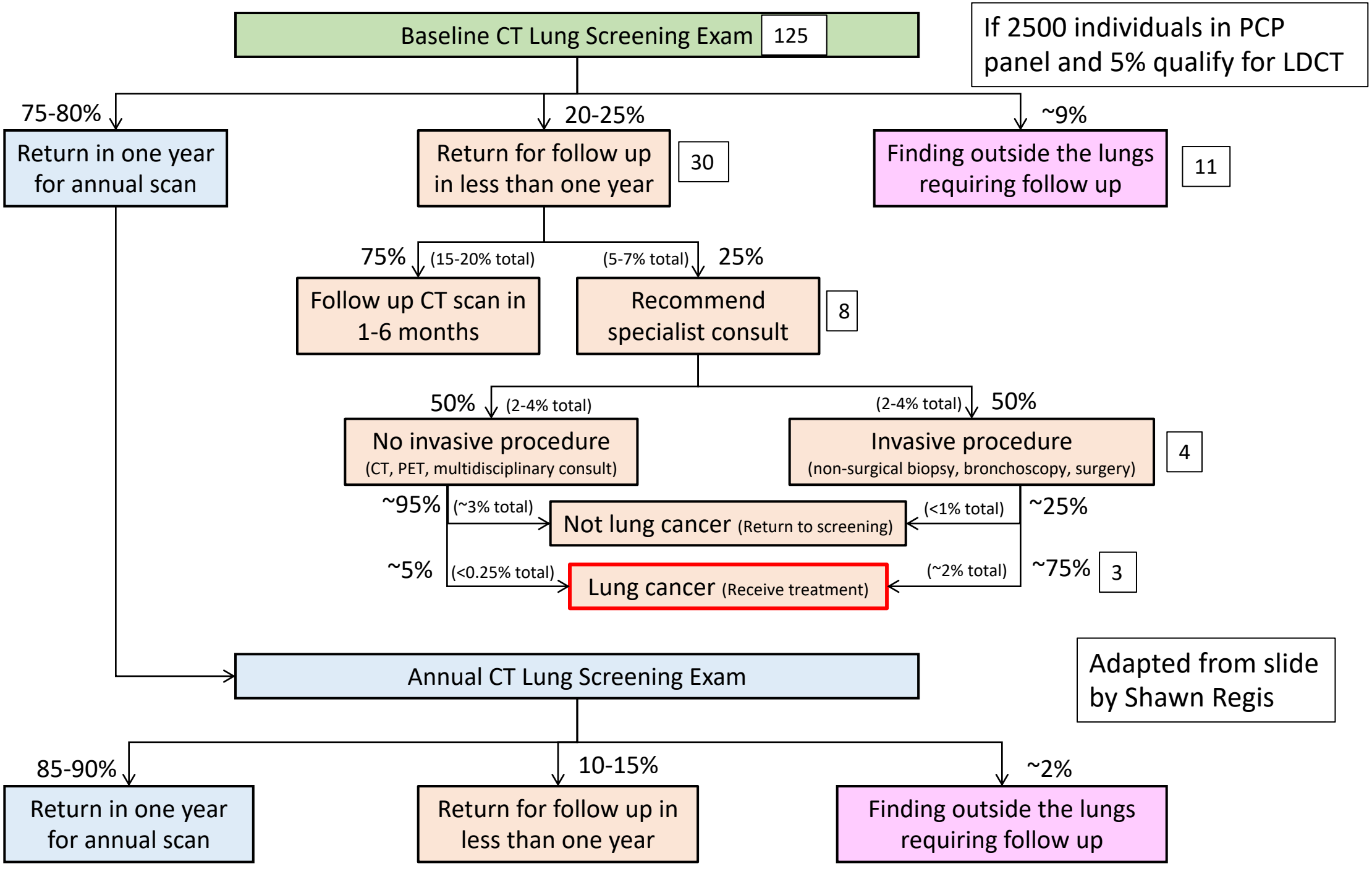
Huang M, et al. PharmacoEconomics 2017

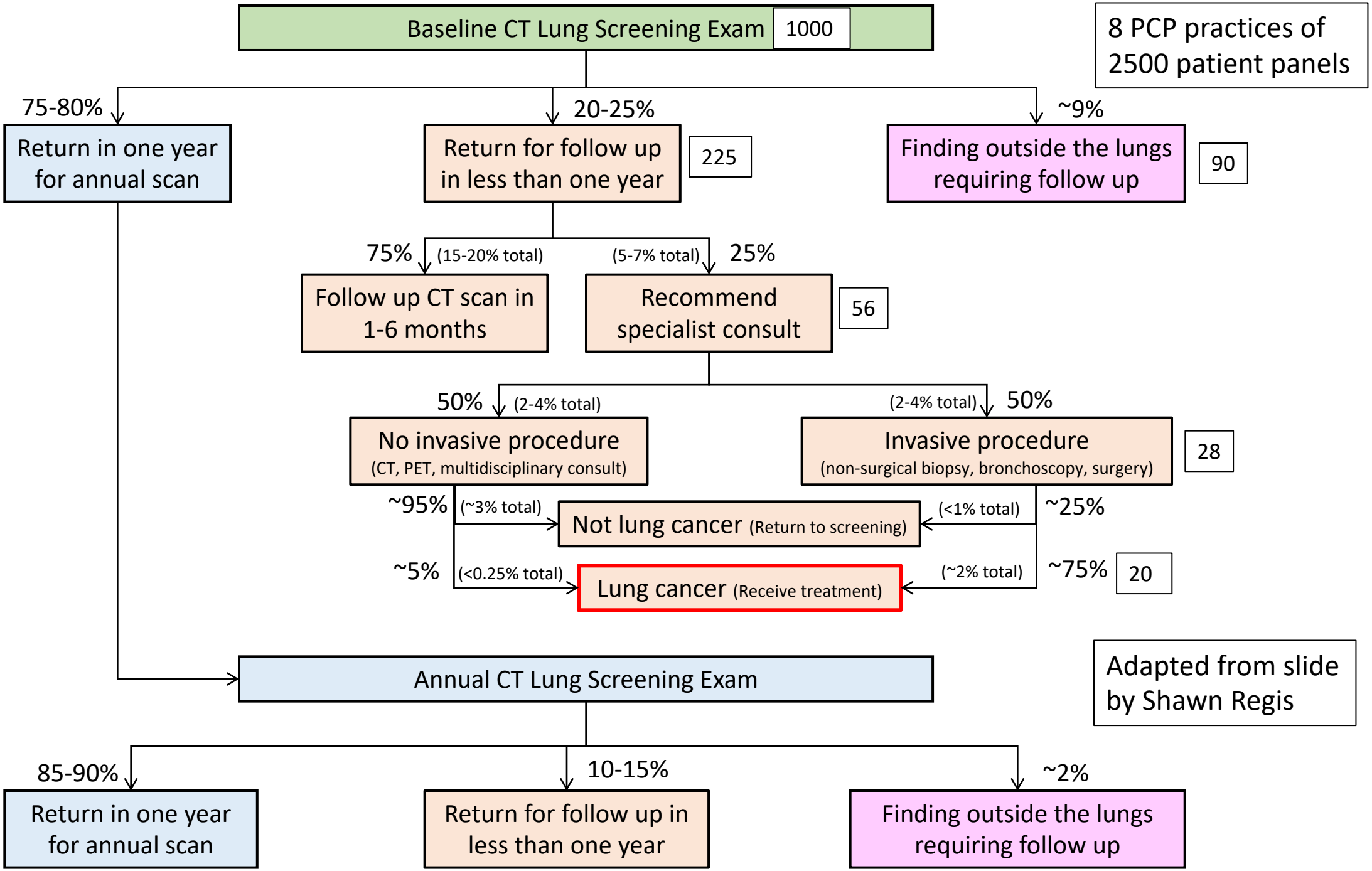
Aguiar, et al. JAMA Onc 2018

Will LDCT program strain hospital systems?

- It is common for busy clinicians to be concerned about getting overwhelmed with many additional office visits


Baseline CT Lung Screening Exam
35,500
If 35,500 individuals in Delaware are eligible…
75-80%
Return in one year for annual scan
20-25%
Return for follow up in less than one year
8000
~9%
Finding outside the lungs requiring follow up
75%
(15-20% total)
Follow up CT scan in 1-6 months
(5-7% total)
25%
Recommend specialist consult
2000
50%
(2-4% total)
No invasive procedure
(CT, PET, multidisciplinary consult)
(2-4% total)
50%
Invasive procedure
(non-surgical biopsy, bronchoscopy, surgery)
1000
~95%
(~3% total)
Not lung cancer (Return to screening)
(<1% total)
~25%
~5%
(<0.25% total)
Lung cancer (Receive treatment)
(~2% total)
~75%
700
Annual CT Lung Screening Exam
Adapted from slide by Shawn Regis
85-90%
Return in one year for annual scan
10-15%
Return for follow up in less than one year
~2%
Finding outside the lungs requiring follow up


If 2500 individuals in PCP panel and 5% qualify for LDCT
Baseline CT Lung Screening Exam
125
75-80%
Return in one year for annual scan
20-25%
Return for follow up in less than one year
30
~9%
Finding outside the lungs requiring follow up
11
75%
(15-20% total)
Follow up CT scan in 1-6 months
(5-7% total)
25%
Recommend specialist consult
8
50%
(2-4% total)
No invasive procedure
(CT, PET, multidisciplinary consult)
(2-4% total)
50%
Invasive procedure
(non-surgical biopsy, bronchoscopy, surgery)
4
~95%
(~3% total)
Not lung cancer (Return to screening)
(<1% total)
~25%
~5%
(<0.25% total)
Lung cancer (Receive treatment)
(~2% total)
~75%
3
Annual CT Lung Screening Exam
Adapted from slide by Shawn Regis
85-90%
Return in one year for annual scan
10-15%
Return for follow up in less than one year
~2%
Finding outside the lungs requiring follow up


Baseline CT Lung Screening Exam
1000
8 PCP practices of 2500 patient panels
75-80%
Return in one year for annual scan
20-25%
Return for follow up in less than one year
225
~9%
Finding outside the lungs requiring follow up
90
75%
(15-20% total)
Follow up CT scan in 1-6 months
(5-7% total)
25%
Recommend specialist consult
56
50%
(2-4% total)
No invasive procedure
(CT, PET, multidisciplinary consult)
(2-4% total)
50%
Invasive procedure
(non-surgical biopsy, bronchoscopy, surgery)
28
~95%
(~3% total)
Not lung cancer (Return to screening)
(<1% total)
~25%
~5%
(<0.25% total)
Lung cancer (Receive treatment)
(~2% total)
~75%
20
Annual CT Lung Screening Exam
Adapted from slide by Shawn Regis
85-90%
Return in one year for annual scan
10-15%
Return for follow up in less than one year
~2%
Finding outside the lungs requiring follow up

Metrics of Positive Scans and Cancer Dx by Years

Table 3. CLTS Metrics by Screening Round: Examination Results

Screening Round	Total Scans			Negative Scans				Positive Scans				Suspicious Scans			
	Overall	Group 1	Group 2	Overall	Group 1	Group 2	*P* Value	Overall	Group 1	Group 2	*P* Value	Overall	Group 1	Group 2	*P* Value
T0	2,927	2,229 76.2%	698 23.8%	2,554 87.3%	1,933 86.7%	621 89.0%	.12	373 12.7%	296 13.3%	77 11.0%	.12	146 5.0%	119 5.3%	27 3.9%	.12
T1	1,772	1,338 75.5%	434 24.5%	1,653 93.3%	1,249 93.3%	404 93.1%	.85	119 6.7%	89 6.7%	30 6.9%	.85	57 3.2%	43 3.2%	14 3.2%	.99
T2	1,094	833 76.1%	261 23.9%	1,029 94.1%	784 94.1%	245 93.9%	.88	65 5.9%	49 5.9%	16 6.1%	.88	34 3.1%	23 2.8%	11 4.2%	.24
≥T3	689	527 76.5%	162 23.5%	648 94.0%	496 94.1%	152 93.8%	.89	41 6.0%	31 5.9%	10 6.2%	.89	25 3.6%	19 3.6%	6 3.7%	.95
Total	6,482	4,927 76.0%	1,555 24.0%	5,884 90.8%	4,462 90.6%	1,422 91.4%	.29	598 9.2%	465 9.4%	133 8.6%	.29	262 4.0%	204 4.1%	58 3.7%	.47

Table 6. CTLS Metrics by Screening Round: CDR, PPV, and SPV

Screening Round	Lung Cancers Detected (CDR)				PPV				SPV			
	Overall	Group 1	Group 2	*P* Value	Overall	Group 1	Group 2	*P* Value	Overall	Group 1	Group 2	*P* Value
T0	66 2.3%	52 2.3%	14 2.0%	.61	16.6%	17.2%	14.3%	.54	37.0%	38.7%	29.6%	.38
T1	28 1.6%	23 1.7%	5 1.2%	.41	21.8%	23.6%	20.0%	.68	43.9%	46.5%	42.9%	.81
T2	11 1.0%	4 0.5%	7 2.7%	.005	15.4%	8.2%	37.5%	.01	29.4%	17.4%	54.5%	.04
≥T3	8 1.2%	6 1.1%	2 1.2%	1	19.5%	19.4%	20.0%	1	32.0%	31.6%	33.3%	1
Total	113 1.7%	85 1.7%	28 1.8%	.84	17.7%	17.6%	18.8%	.76	37.0%	37.3%	37.9%	.93

Do individuals want to participate in screening?

- Essentially, yes.
  - Hospital systems with well-coordinated programs see screening routinely being accomplished for >70% of the estimated eligible population.

- Not many people want to get colonoscopies. They undergo biopsies to determine cancer, and we accept it without concern when they are benign. Why is lung cancer screening discussed so differently?

Important Aspects of Lung Screening

- Patient Flow
  - Ordering the scan (PCP or other setting)
  - Radiologist interpretations/reads
  - Nodule follow up

- Program Level
  - Managing the program: Navigator
  - Managing the data: Database
  - Submission to CMS approved registry
  - Integrated smoking cessation program

Requires investment in infrastructure

Important Aspects of Lung Screening

- It’s not a matter of “everybody doing their respective roles”
- Everybody must understand how their actions impact others respective roles in caring for each patient

Ordering the scan

- For most systems, this is done by the PCP
  - Shared decision making
  - Smoking cessation (ideal is option of referral to specialist in smoking cessation)
  - Accurate smoking history is important to determine
    - This can be done by medical assistants, but the specific questions should be outlined

- A multi-disciplinary steering committee (including a PCP) can help to streamline the system for busy PCPs
  - Automatic EMR alerts/reminders
  - Pre-built forms for increased efficiency

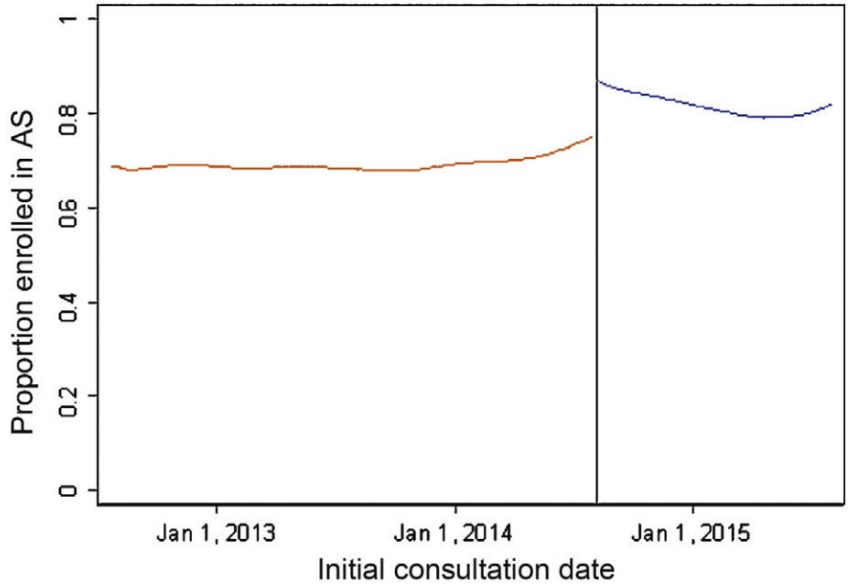
Scan Interpretation

- Reading a LDCT scan is NOT the same as reading a regular chest CT
- Radiologists must specify the category for any lung nodules

- Reads such as *"3mm nodule, cannot rule out cancer" or "5mm nodule was 4mm on prior scan. Could represent cancer. Clinical correlation required."* add to confusion for PCPs and patients.
- Scans should be interpreted within the system used in that hospital. The nodules should be mentioned, but the above text would be more helpful stating nodules as they are seen and scoring as Lung-RADS 2: LDCT in 12 mos
  - Providing a 1mm range (such as 4-5mm) is helpful to understanding if there has truly been growth.

Nodule Management

- Specialty clinic for suspicious nodules
- Favor pulmonology (but variation in hospitals of specialty for bronch biopsy
  - Specific training of staff about communication with patients on monitoring nodules
  - Patients worry about a nodule being cancer and insist on surgery



- Urologists completed 1 hour training about discussing active surveillance for low-risk prostate cancer
- Relative reduction: 30% in risk of unnecessary therapy

Ehdaie B, et al. Eur Assoc Urol. 2017

Important Parts of a Lung Screening Program

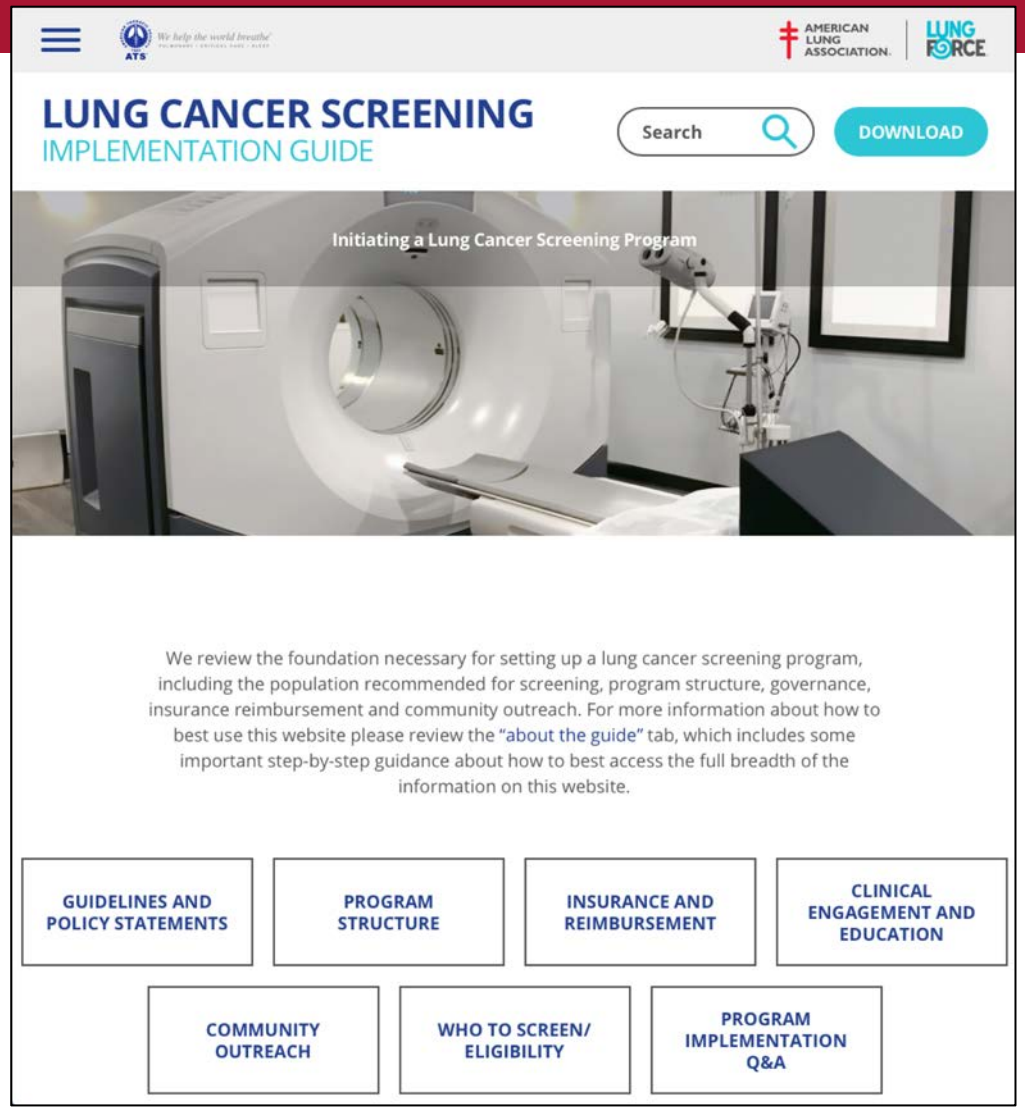
- Multi-disciplinary steering committee (including primary care!)
- All initial scans ordered from PCP (or specialized lung center if present)
  - Shared decision making
  - EMR best practice alert
- Radiologists read strictly by guidelines
- Suspicious findings (Lung-RADS 4) referred to specialist
  - Pulmonology and/or Thoracic Surgery
- Program coordinator/navigator
  - Maintains database and program eligibility integrity

Best Practices for Increasing Lung Cancer Screening

- Education of medical teams/hospitals about the risks and benefits are **very** important for improving screening rates.
  - PCPs have been getting mixed signals.

- Development of lung screening programs requires multi-disciplinary coordination and resources for program navigator(s) and a database

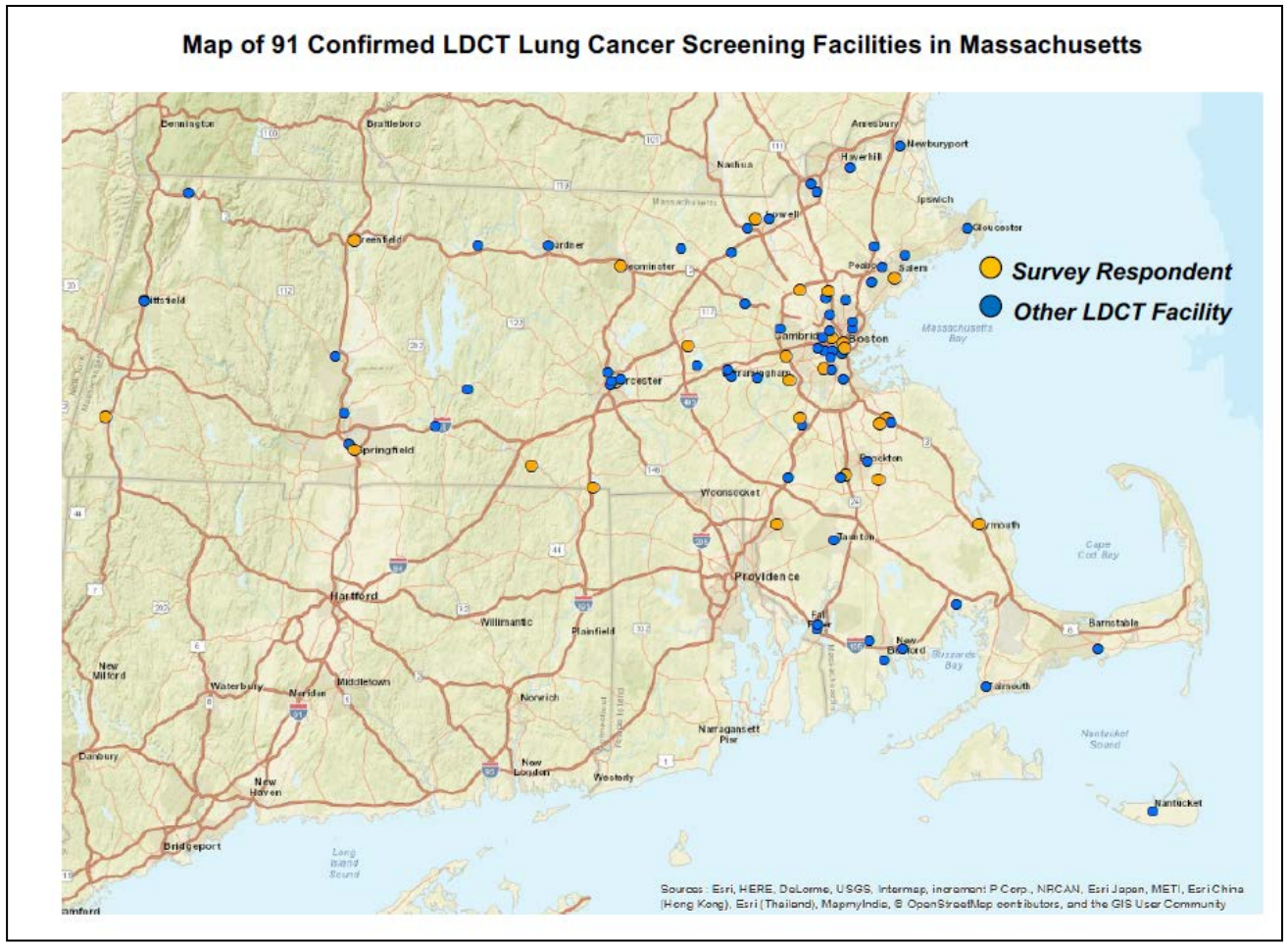
Lung Screening Implementation Guide



https://www.lung.org/about-us/media/press-releases/lung-cancer-screening-implementation-guide-2.html

Massachusetts State Based Initiative

- Survey sent out to lung screening centers to characterize screening practices, assess barriers, identify needs for information and support.
- LCWG then established a learning collaborative to address needs identified in the survey



Slide adapted from Andrea McKee

Survey Findings

- Most sites reported operating below capacity
- Greatest challenges/barriers
  - Lack of infrastructure/resources
  - Coordination of follow-up scans
  - Limited staff for workload
  - Data tracking
  - Getting accurate info from providers
- Desire to learn about data tracking, shared decision making, smoking cessation counseling, and documentation of these

Specific Findings Massachusetts Lung Cancer Screening Site Survey
62% had multidisciplinary governance group
82% used a decentralized model for shared decision making
Average number screened/month = 65 with 21% of sites screening over 100 and 45% having capacity to screen over 100/month
36% of sites reported <75% of participants received annual follow up LCS exam and 29% didn't know how many had received their follow up
44% reported participants were evaluated by physician team
24% capture whether radiologist recommendation was completed and/or track complications of biopsies

Slide adapted from Andrea McKee

Best Practices for Increasing Lung Cancer Screening

- Educate staff about the risks/benefits of lung screening
- Form a multi-disciplinary team (including PCP!)
- Create workflow for ordering (including shared decision making and smoking cessation counseling)
- Radiologists must read scans by specific guidelines
- Nodule management plan

- Resources for individual(s) to manage the program
- Database

Best Practices for Increasing Lung Cancer Screening

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There are a lot of lives depending on us!