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Lung Cancer Screening:
'Pro and Contra'

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ESMO Preceptorship on
Lung Cancer
06/03/2019

MANCHESTER 1824
The University of Manchester

Disclosure

- Nil to declare

Agenda – 40 minutes

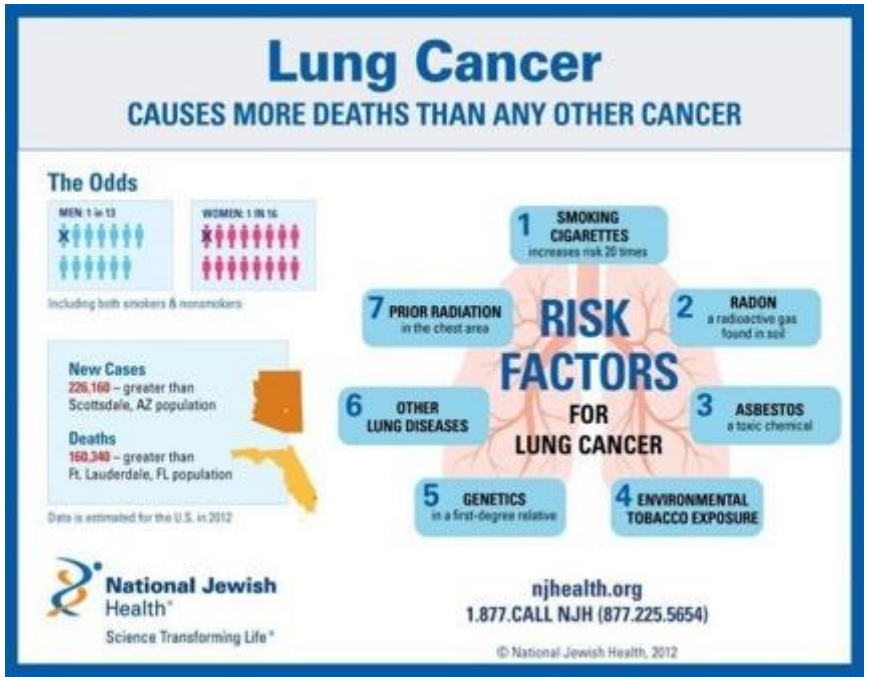
- Lung cancer
  - Is there a need for screening?
- Lung cancer screening background
  - Story so far (pro)
  - Concerns (contra)

- The Manchester ‘Lung Health Check’ Pilot

- Conclusions

Lung Cancer – The problem globally

- Leading cause of cancer related death worldwide – 1.6million
- Europe: 400,000 new cases; 270,000 death annually
- 1 in 5 all cancer deaths
- Commonest cancer death in men; second in women
- Incidence rising in some countries
- Significant economic burden



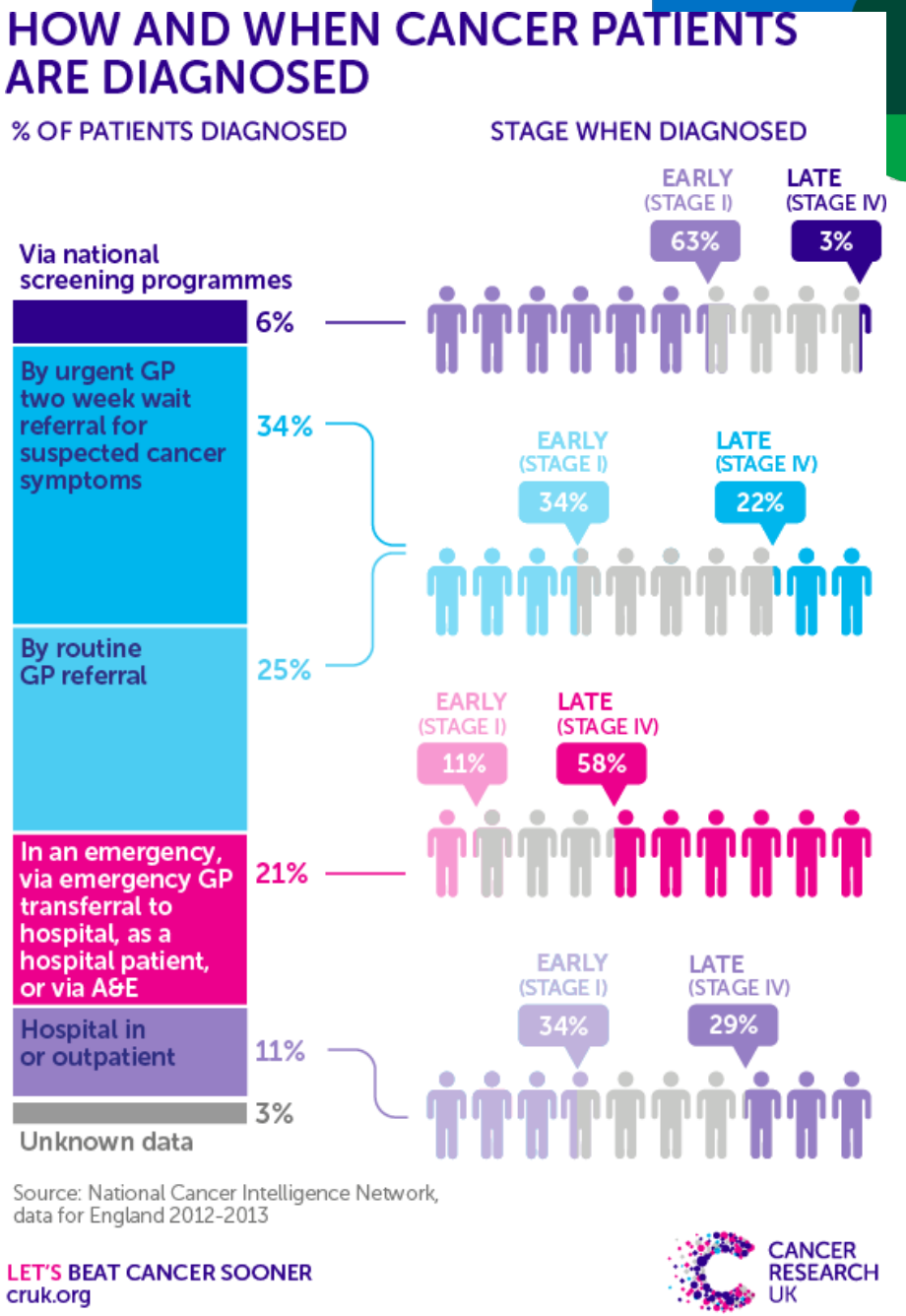
- Ferlay J, et al. Int J Cancer 2015;136:E359-86.
- Torre LA, et al. Lung Cancer Statistics. Adv Exp Med Biol 2016;893:1-19.
- Ferlay J, et al. Eur J Cancer. 2013;49(6):1374-403

Lung Cancer – the need for screening

- 70% present at late stage – non-curable
  - 30% of these die within 3 months
- 35% diagnosed as an emergency presentation
- Europe: Mean 5-year survival 12%
  - Range from 5% - 15%

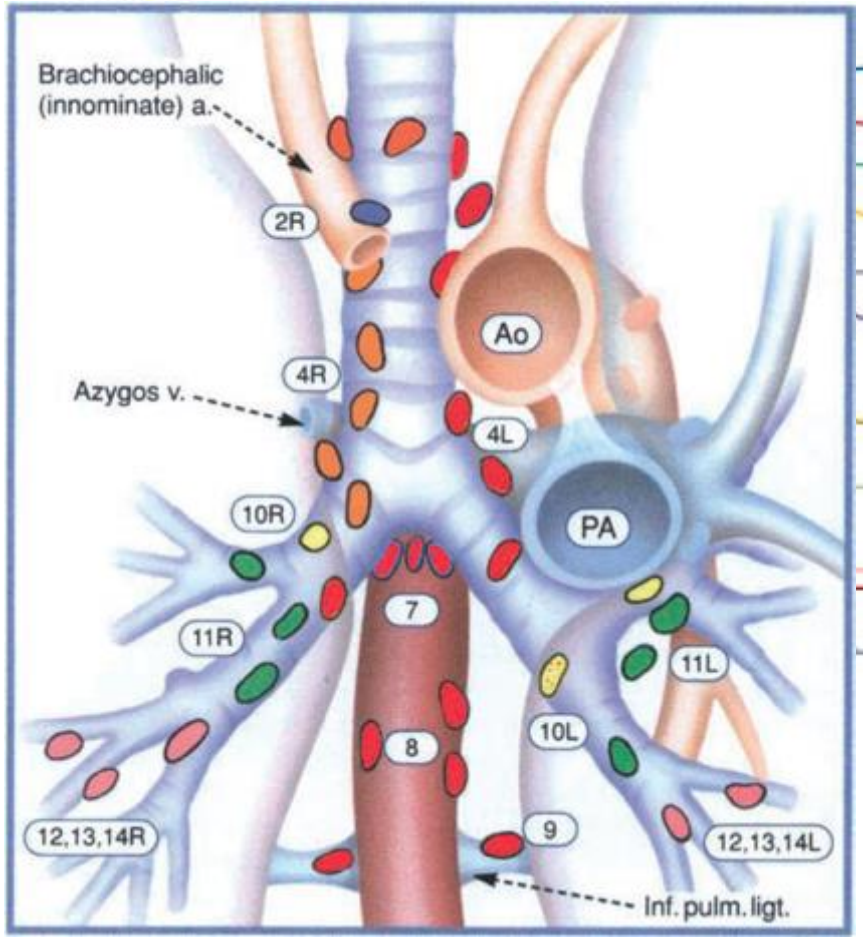
VS

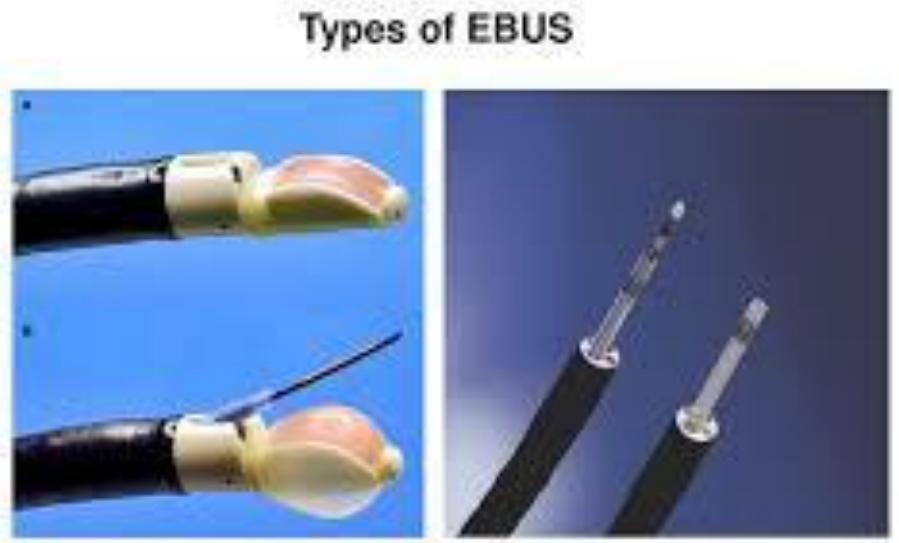
- Surgical resections: 5-year survival 70% (stage I-II)
- 10-year survival in patients having resection within 1 month of diagnosis has been quoted as high as 92%

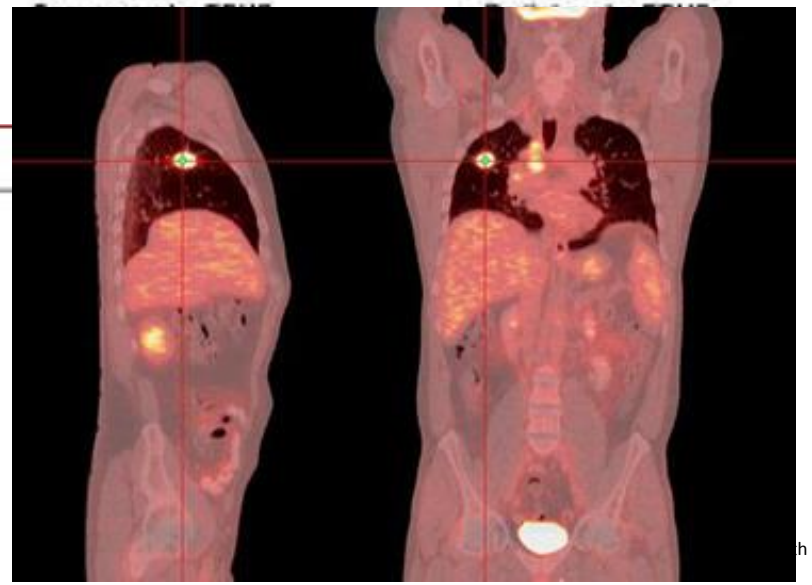


- CRUK. Lung cancer statistics. 2016
- O'Dowd EL, et al. Thorax 2015;70:161-8
- Goldstraw P, et al. J Thorac Oncol 2007;2:706-14.
- Henschke CI, et al. N Engl J Med 2006;355:1763-71

Lung Cancer – every millimeter counts







th edition TNM staging manual.

Lung Cancer Screening…

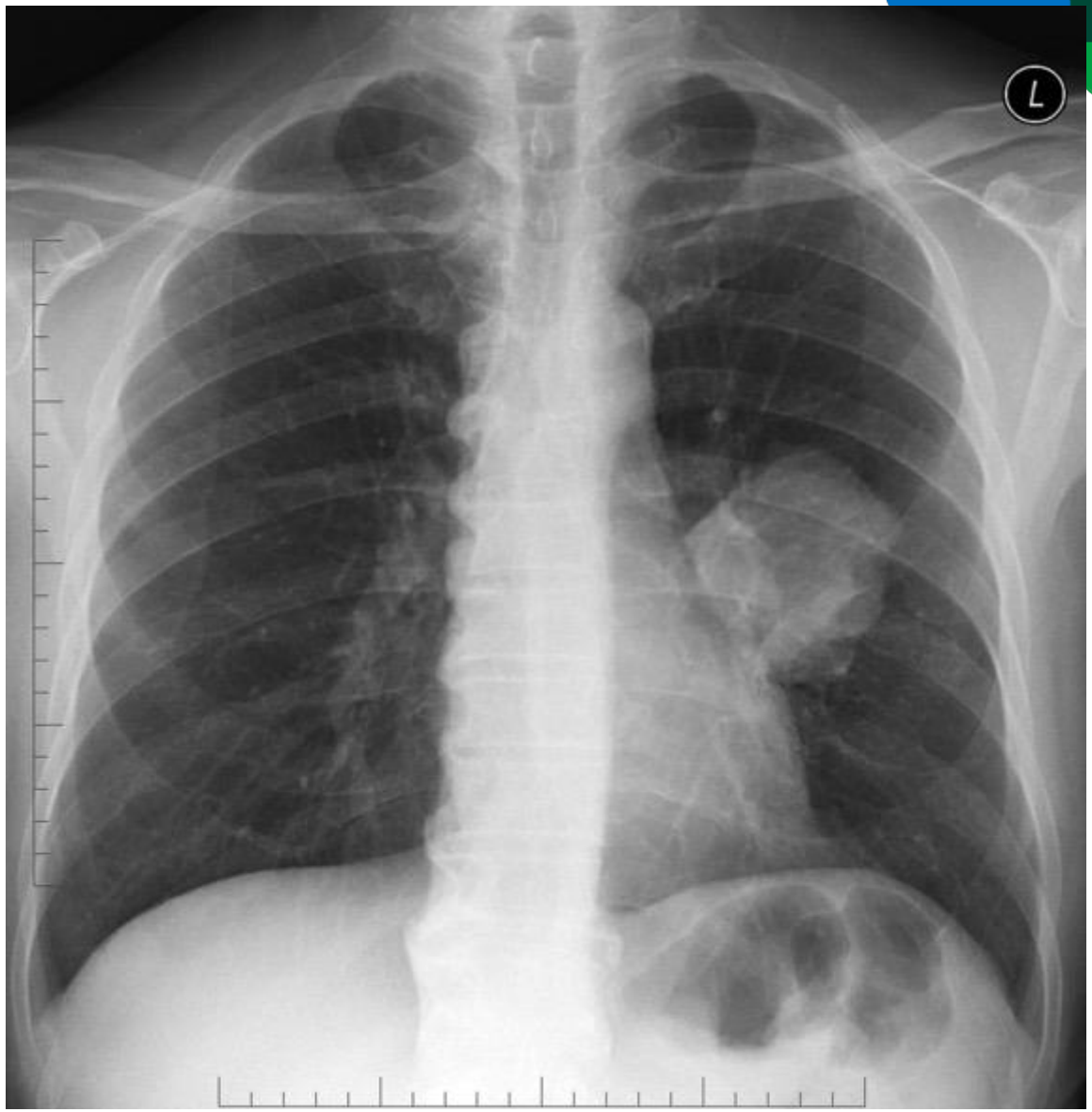
…..the story so far

Sputum Cytology and CXR

- ‘The National Cancer Institute’s Cooperative Early Lung Cancer Detection Program’
  - The Memorial Sloan-Kettering Cancer Centre in New York
  - The John Hopkins Lung Project
  - The Mayo Lung Project
- >30,000 male smokers
- Annual CXR vs Sputum Cytology/Annual CXR
- Increased incidence and resections
- But…..NO mortality benefit

- Berlin NI. Cancer 2000;89:2349-51.
- Berlin NI, Buncher CR, Fontana RS, Frost JK, Melamed MR. Am Rev Respir Dis 1984;130:545-9

So what about the Chest X-Ray?



Prostate Lung Colorectal and Ovarian (PLCO)

- 1993 to 2001
- > 154,000 subjects enrolled
- Aged 55-74. Men, women and never smokers.

- Annual CXR vs ‘usual care’ – 4 years
- Median follow up of 12 years

Hocking WG, Hu P, Oken MM, et al. J Natl Cancer Inst 2010;102:722-31

Prostate Lung Colorectal and Ovarian (PLCO)

- 1,213 lung cancer deaths in screening arm
- 1,230 lung cancer deaths in control arm

- NO mortality benefit with annual CXR

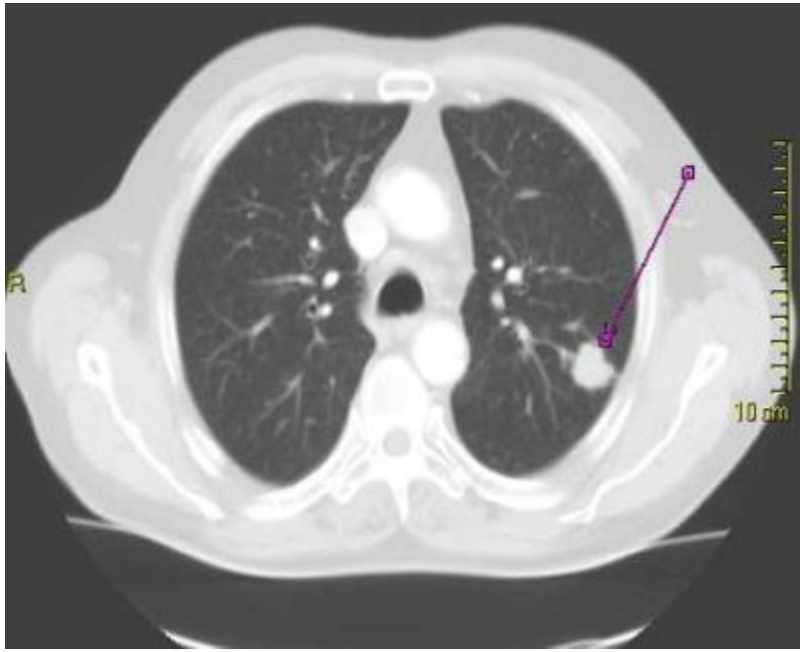
Oken MM, Hocking WG, Kvale PA, et al. JAMA 2011;306:1865-73

But….

- 1990s – the role of Low Dose CT (LDCT) described in detection of lung cancer

- No Contrast
- Less radiation (1.5-mSv vs 7-8-mSv)

What about LDCT for lung cancer screening?



Low Dose CT

- Kaneko et al, 1996
  - CXR & LDCT in 1,369 subjects – LDCT superior
- Sone et al, 1998
  - Mobile LDCT in 5,483 subjects previously screened – LDCT superior
- ELCAP, 1999
  - LDCT vs CXR in 1,000 subjects (60 years, >10 Pack years)
  - 2.7% vs 0.7% detection
  - 2.3% vs 0.4% early stage

- Kaneko M, Eguchi K, Ohmatsu H, et al. Radiology 1996;201:798-802.
- Sone S, Takashima S, Li F, et al. Lancet 1998;351:1242-5.
- Henschke CI, McCauley DI, Yankelevitz DF, et al. Lancet 1999;354:99-105

Turn of the millennium…

Renewed interest in lung cancer screening!

Trial (Recruitment)	Method	Number Enrolled	Age Criteria	Scan Positivity Rate	Baseline Cancer Detection	Early stage cancer
LSS (2004)	Single LDCT vs CXR	3,318	55-74	20.5%	1.9%	53%
DEPISCAN (2002)	Annual LDCT vs CXR 2 years	765	50-75	24%	2.4%	37.5%
DANTE (2001)	Annual LDCT vs No Screen 5 years	2,472	60-74	15%	2.2%	57%
ITALUNG (2004)	Annual LDCT vs No Screen 5 years	3,206	55-69	30.3%	1.5%	47.6%
DLCST (2004)	Annual LDCT vs No Screen 5 years	4,104	50-70	8.7%	0.8%	53%
MILD (2005)	Annual LDCT vs Biennial LDCT vs No Screen 5 years	4,479	≥ 49	15% annual 14% Biennial	0.8%	63%
LUSI (2007)	Annual LDCT vs No Screen 5 years	4,052	50-69	26.6%	1.1%	80%
NLST (2002)	Annual LDCT vs CXR 3 years	53,454	55-74	24.2%	1.0%	57.1%
UKLS (2011)	Single LDCT vs No Screen	4,055	50-75	47.7%	1.7%	85.7%
NELSON (2003)	Annual LDCT vs No Screen 5.5 years	15,792	50-75	6%	0.9%	70.8%

The NEW ENGLAND JOURNAL of MEDICINE

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

Reduced Lung-Cancer Mortality with Low-Dose Computed Tomographic Screening

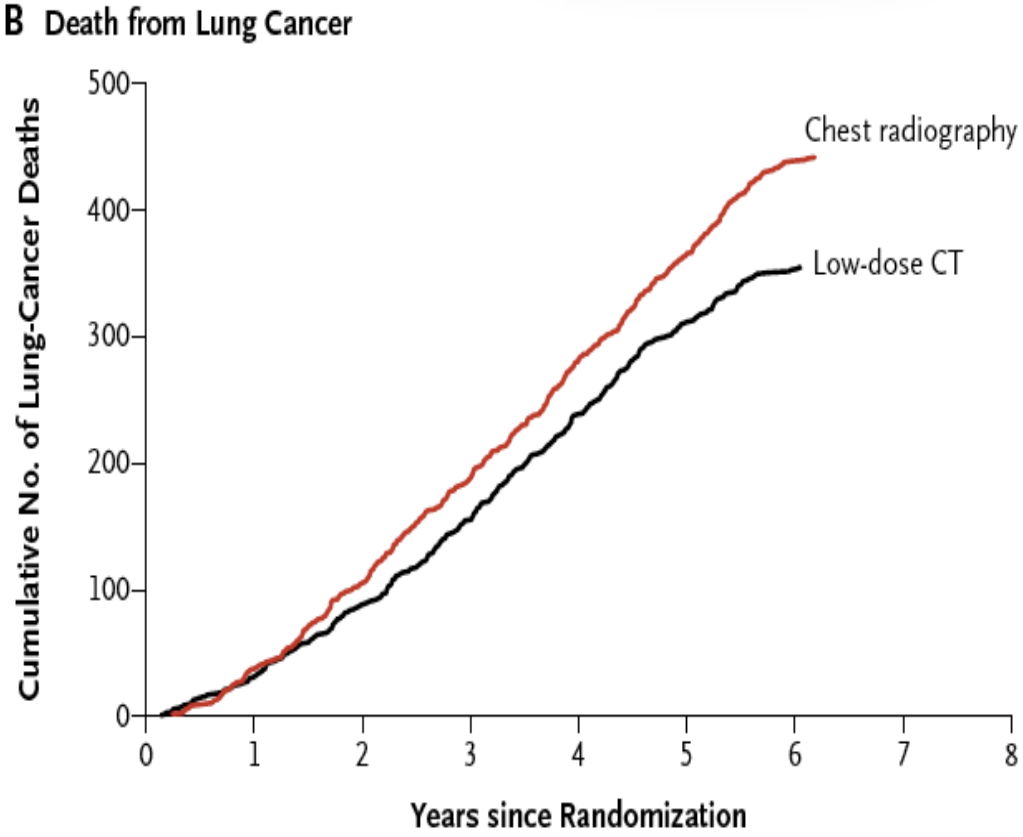
The National Lung Screening Trial Research Team*

National Lung Screening Trial (NLST)

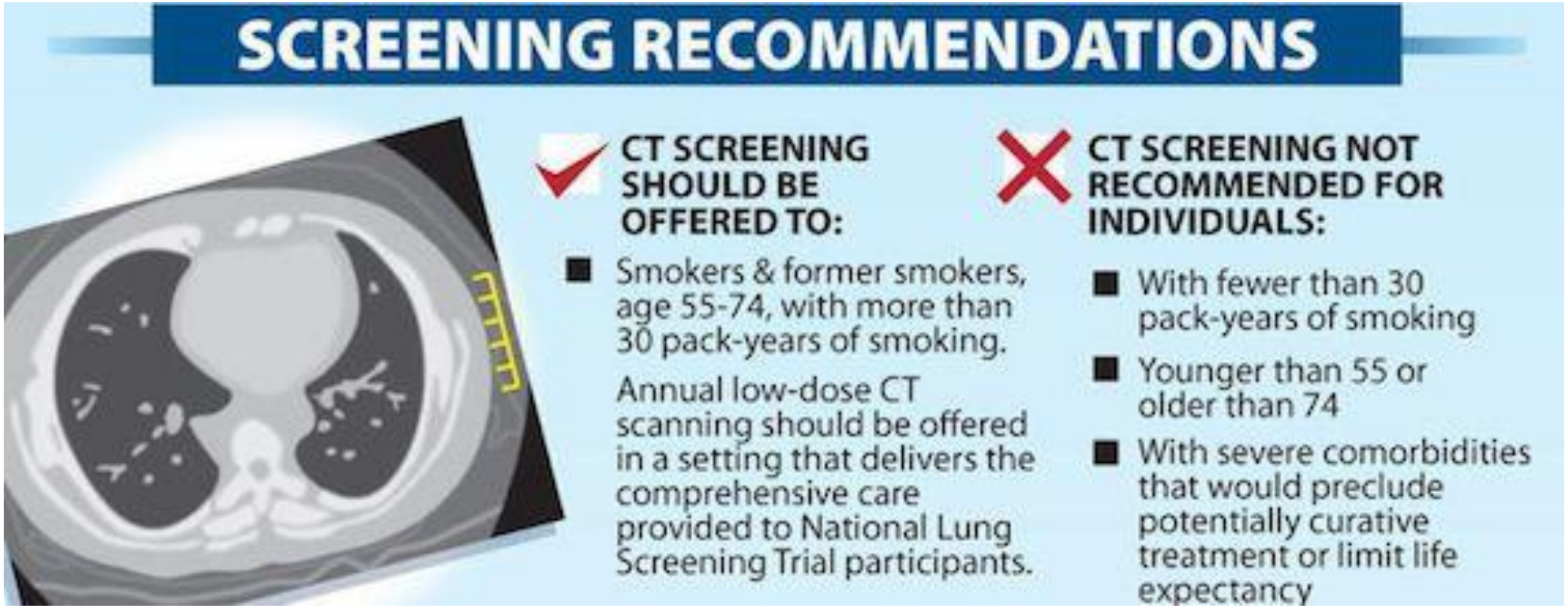
- 53,454 participants
  - Age 55-74
  - 30 pack years
  - Smoked within past 15 years
- Randomised to 3 yearly screening rounds:
  - Low dose CT scans vs. chest X-ray.

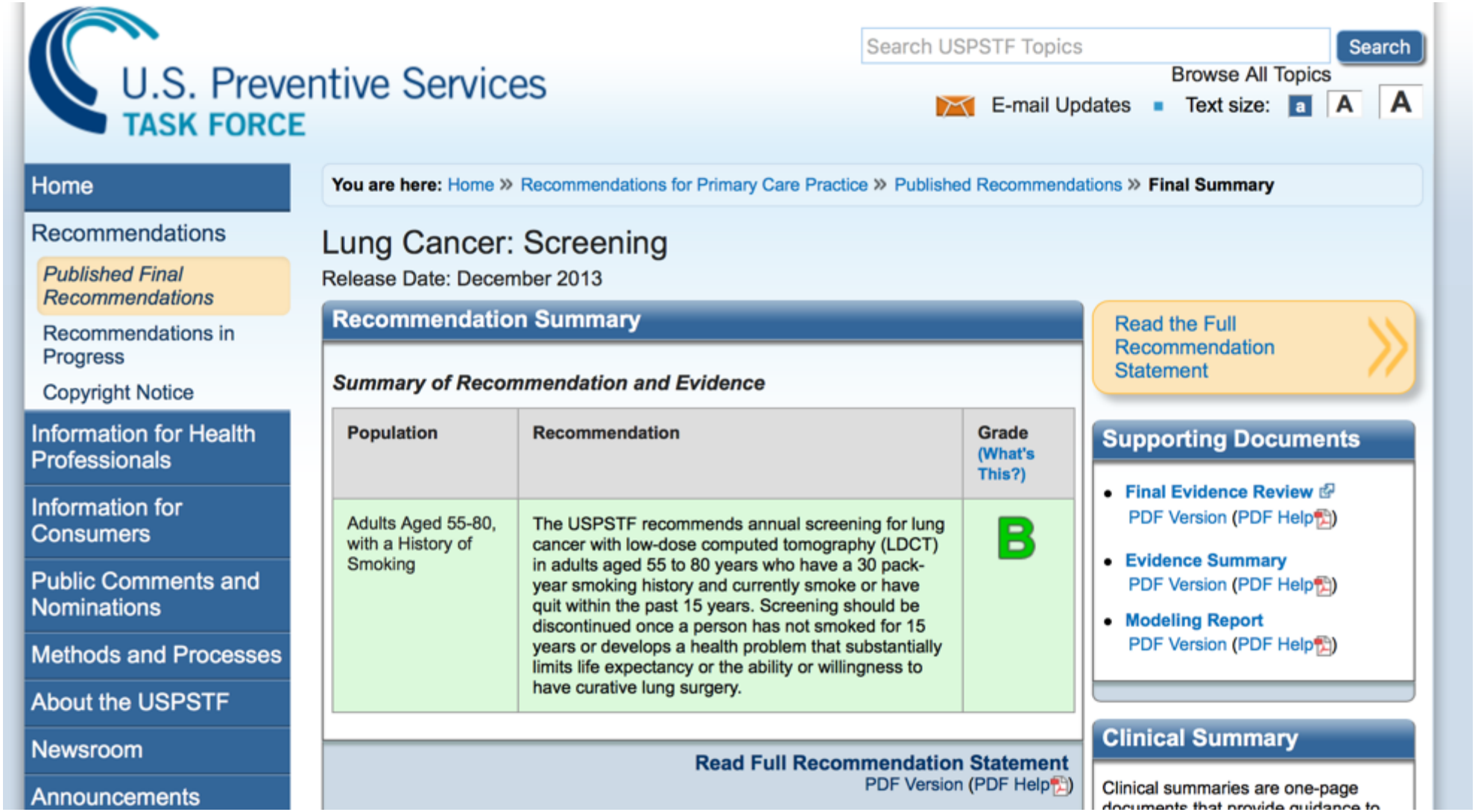
Outcome

- 20% reduction in lung cancer deaths in the CT scan group and
- 6.7% reduction in overall deaths



American College of Chest Physicians (ACCP)

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You are here: Home » Recommendations for Primary Care Practice » Published Recommendations » Final Summary
Lung Cancer: Screening
Release Date: December 2013
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
Read Full Recommendation Statement
PDF Version (PDF Help)
Read the Full Recommendation Statement
Supporting Documents
Final Evidence Review
PDF Version (PDF Help)
Evidence Summary
PDF Version (PDF Help)
Modeling Report
PDF Version (PDF Help)
Clinical Summary
Clinical summaries are one-page

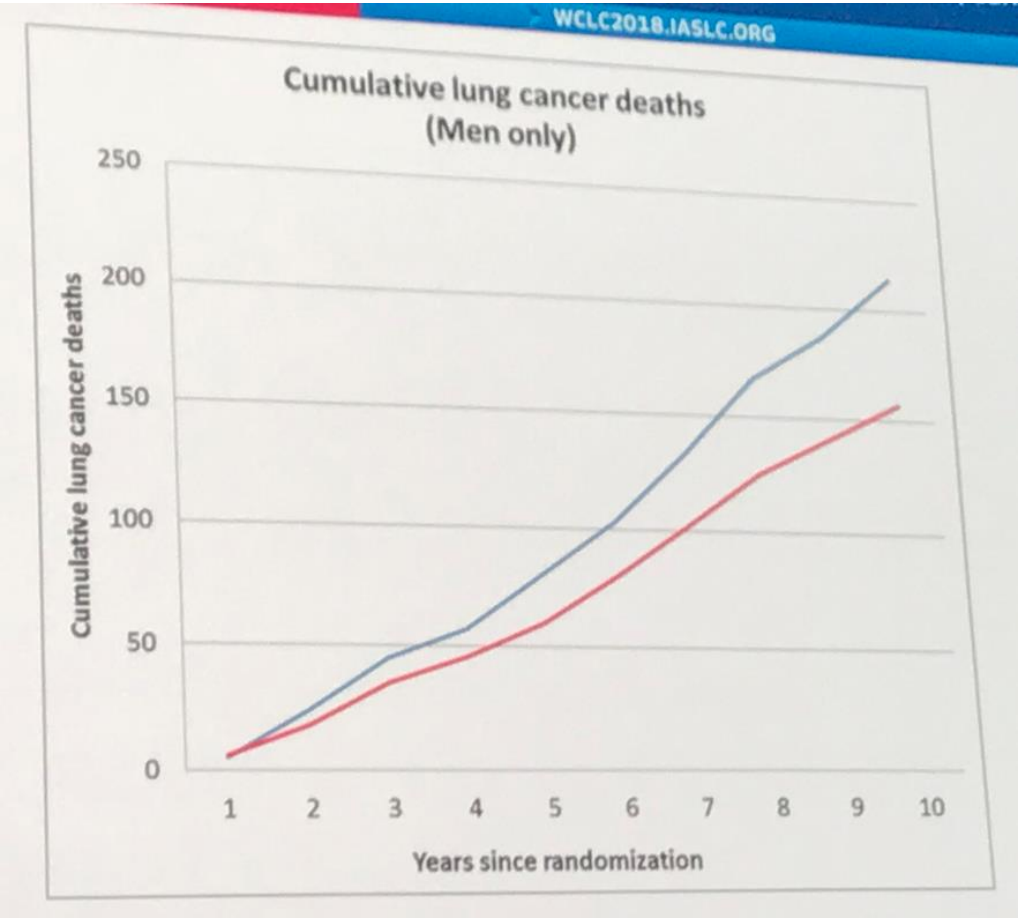
The NELSON trial –results

Round	Screening uptake	Indeterminate results	Positives	Lung cancer	PPV
1	7,557 (95.6%)	1,451 (19.2%)	197 (2.6%)	70 (0.9%)	36%
2	7,295 (92.3%)	480 (6.6%)	131 (1.8%)	55 (0.8%)	42%
3	6,922 (87.6%)	471 (6.8%)	165 (2.4%)	75 (1.1%)	45%
4	5,279 (66.8%)	101 (1.9%)	105 (2.0%)	43 (0.8%)	41%
TOTAL	**27,053 (85.6%)**	**2,503 (9.3%)**	**598 (2.2%)**	**243 (0.9%)**	**41%**

- Good uptake
- 94% successful 10 year F/U
- Indeterminate results 9.3%
- Positives 2.2%

- *H. de Koning @WCLC2018*

The NELSON trial – mortality results (men)



- Control arm
  - 214 lung cancer deaths
- Screen arm
  - 157 lung cancer deaths

- **26% reduction in lung cancer mortality** in men

- *Slide courtesy of H. de Koning @WCLC2018*

The NELSON trial – mortality results

Lung cancer mortality rate ratio (95% CI)	Year 8	Year 9	Year 10
MALES	0.75 (0.59-0.95, p=0.015)	0.76 (0.60-0.95, p=0.012)	0.74 (0.60-0.91, p=0.003)
FEMALES	0.39 (0.18-0.78, p=0.0037)	0.47 (0.25-0.84, p=0.0069)	0.61 (0.35-1.04, p=0.0543)

- 26% reduction in lung cancer mortality in males (95% CI 9-40%)
- 39-61% reduction in females

- *H. de Koning @WCLC2018*

Lung Cancer Screening…

…..so what's the problem??

1. False Positives

- LDCT detects benign nodules
- Stress, anxiety and fear
- Potential complications from further investigations
  - Further imaging
  - Biopsy
  - Surgery!

- Rate varied between 1-30%

- van den Bergh KA, Essink-Bot ML, Bunge EM, et al. Cancer 2008;113:396-404.
- van den Bergh KA, Essink-Bot ML, Borsboom GJ, et al. Br J Cancer 2010;102:27-34

False Positives – Ix/surgery for benign disease

Additional diagnostics

- NLST 33%
- UKLS 5%
- NELSON 34%
- DANTE 10%
- MILD 53%

Benign resections

- NLST 24%
- UKLS 10%
- NELSON 23%
- DANTE 19%
- ELCAP 8.9%
- ITALUNG 10.5%

False Positives – Nodule Management

- Need to risk assess individual nodules
- Risks:
  - Age
  - Background emphysema
  - Gender
  - Family history
  - Size and location of nodule
  - Pattern (solid vs non-solid)

- Swensen SJ, Silverstein MD, Ilstrup DM, Schleck CD, Edell ES. Arch Intern Med 1997;157:849-55
- McWilliams A, Tammemagi MC, Mayo JR, et al. N Engl J Med 2013;369:910-9

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Lung CT Screening Reporting & Data System

Lung-RADS™ is a quality assurance tool designed to standardize lung cancer screening CT reporting and management recommendations, reduce confusion in lung cancer screening CT interpretations, and facilitate outcome monitoring.

A complete lexicon and atlas will be developed. The atlas will include a description of a medical audit and outcome monitoring process. The lexicon of lung cancer screening CT terms and the reporting format will standardize the language used reports.

The Lung-RADS Assessment Categories document below contains version 1.0 of Lung-RADS, including the assessment categories and management recommendations.

- Lung-RADS Version 1.0 Assessment Categories PDF
- Lung-RADS Summary PDF

License Information

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Contact us: rads@acr.org

Lung-RADS™

Findings	Category	Description	Management
Composition: Solid, Part-solid, Non-solid **Nodule size** **Baseline vs Follow-up**	0	Incomplete	Additional images
	1	Negative	LDCT - 12m
	2	Benign	
	3	Probably Benign	LDCT - 6m
	4A	Suspicious	LDCT - 3m or PET-CT
	4B		PET-CT ± Bx
	4X		

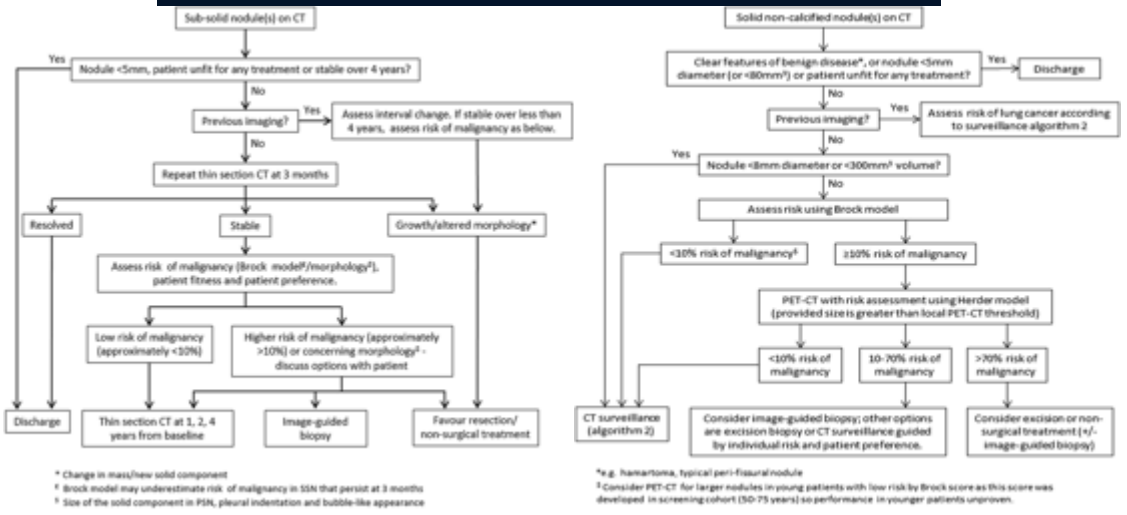
August 2015 Volume 70 Supplement 2

Thorax

AN INTERNATIONAL JOURNAL OF RESPIRATORY MEDICINE

BTS Guidelines for the Investigation and Management of Pulmonary Nodules

British Thoracic Society
Pulmonary Nodule Guideline
Development Group



False Positives – Nodule Management

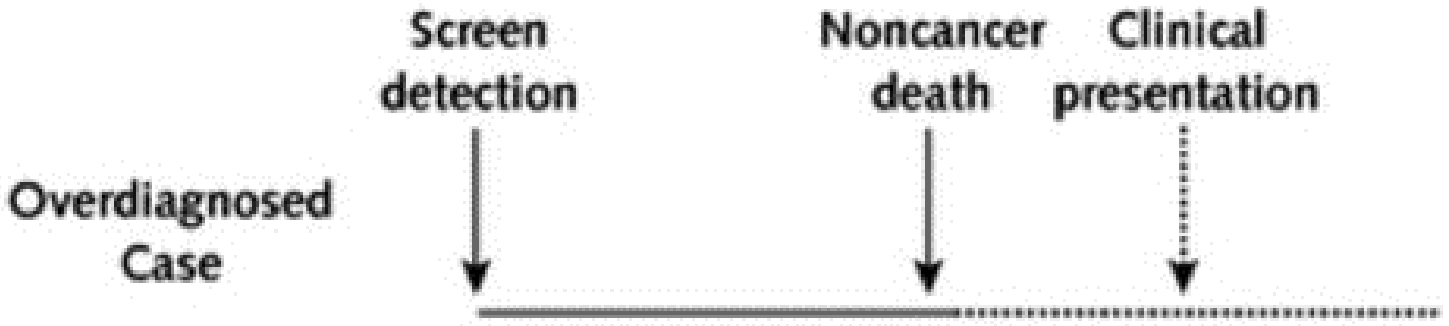
- LUNG-RADS applied to NLST:
  - ↓ false positives by 52%

- NELSON trial
  - 2-step algorithm
  - Sensitivity 84.6%; Specificity 98.6%; NPP 99.8%
  - Size matters!!
    - <5mm: 0.6% risk of malignancy
    - 5-10mm + VDT 400-600 days: 4% risk of malignancy
    - 5-10mm + VDT <400 days: 9.9% risk of malignancy

- Horeweg N, van Rosmalen J, Heuvelmans MA, et al. Lancet Oncol 2014;15:1332-41
- Pinsky PF, Gierada DS, Black W, et al. Ann Intern Med 2015;162:485-91
- Crosbie, P.A., Balata, H., et al. Thorax, 2018 doi:10.1136/thoraxjnl-2017-211377

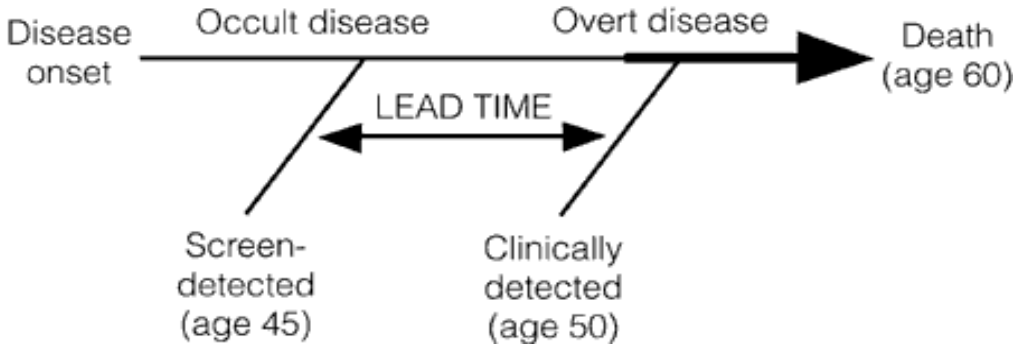
2. Overdiagnosis

- Overdiagnosis is the finding of an indolent lung cancer through screening that would have never had any clinical impact on the patient in their lifetime

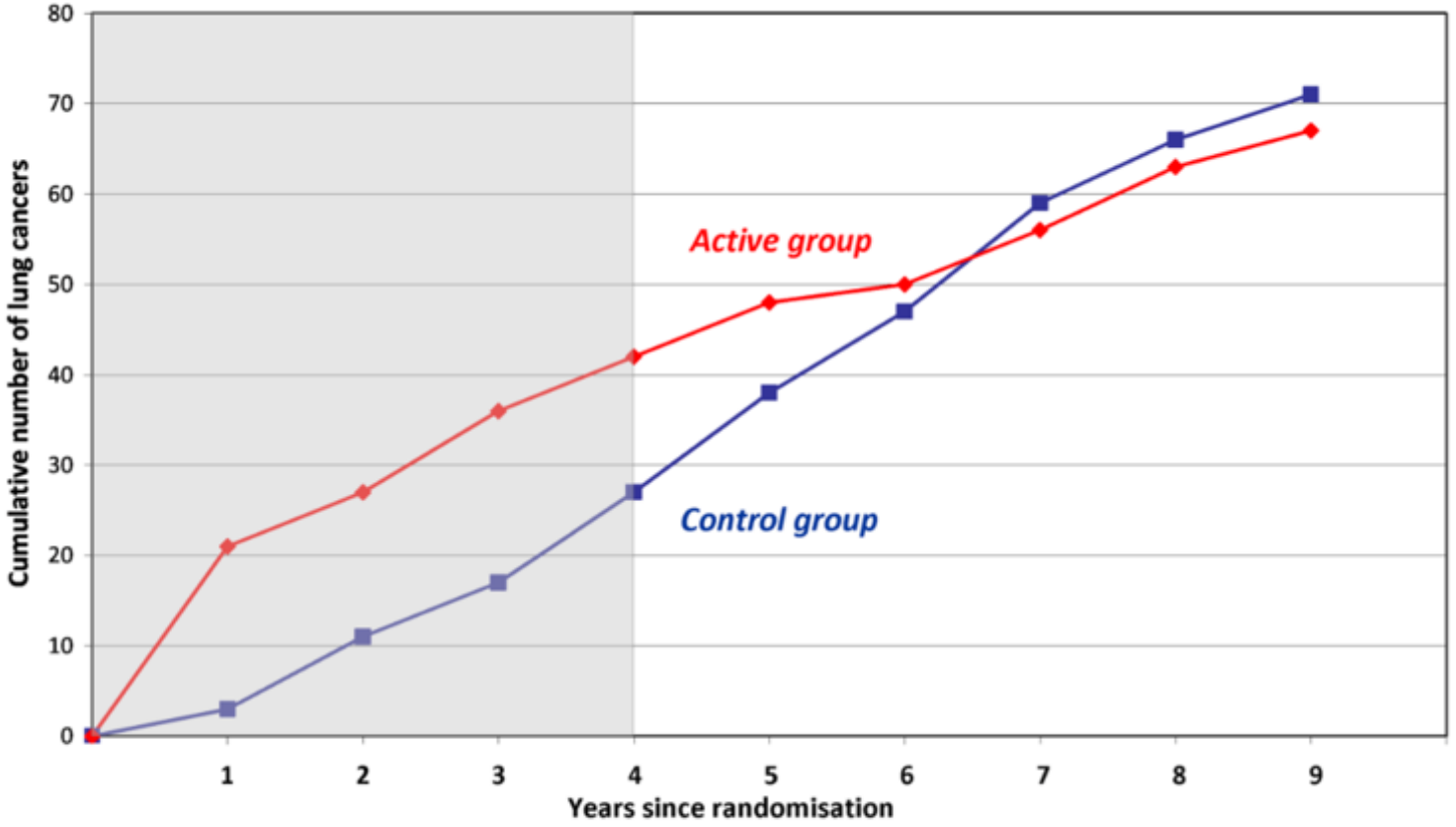


Overdiagnosis

- Concern of overdiagnosis has existed since initial LDCT studies
- Non-cancer mortality is 10% in lung cancer sufferers
- Need to account for lead-time bias
- Rate of overdiagnosis in NLST estimated as 18%
  - Median FU only 6.5 years
  - Control arm received CXR
- Evidence in LDCT is limited – need longer follow-ups



Overdiagnosis



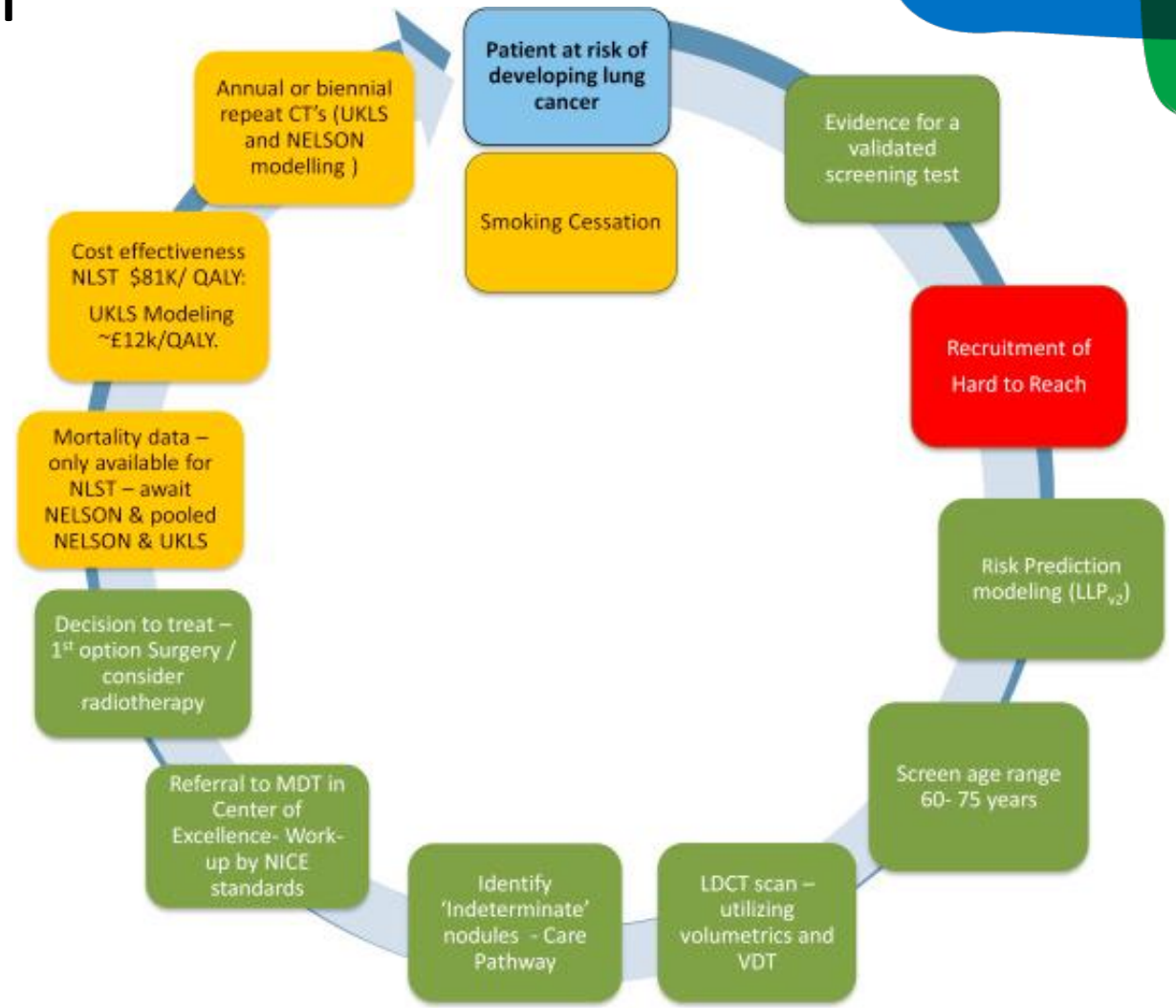
Number of lung cancer:

Control	*3*	*8*	*6*	*10*	*11*	*9*	*12*	*7*	*5*
Active	*21*	*6*	*9*	*6*	*6*	*2*	*6*	*7*	*4*

Paci, E., et al., *Mortality, survival and incidence rates in the ITALUNG randomised lung cancer screening trial.* Thorax, 2017

3. The ‘hard to reach’

- **Increased risk and less likely to participate in screening**
  - Age
  - Active smoking
  - Lower socio-economic status
- **Practical barriers**
  - Travel
  - Costs
  - Distance
- **Emotional barriers**
  - Fear of hospitals
  - Fear of doctors
  - Avoidance
  - Lack of understanding



- Ali N, et al. BMJ Open 2015;5:e008254
- Field JK, et al. Lung Cancer. 2016;91:29-35

4. Who should we screen? – Risk Models

- Kovalchik model
  - NLST data: 20% lowest risk subjects accounted for 1% of prevented deaths
  - NNS to prevent 1 death: 161 vs 5276

- Liverpool Lung Project (LLP) model
  - Smoking, Respiratory disease, Asbestos, Previous cancers, family history.
  - Used in UKLS

- $PLCO_{m2012}$ model
  - Using logistical regression from PLCO trial cohort
  - Age, socioeconomic status, BMI, ethnicity, sex, family history, personal history of cancer and respiratory disease, detailed smoking history

- Kovalchik SA, Tammemagi M, Berg CD, et al. N Engl J Med 2013;369:245-54.
- Tammemagi CM, Pinsky PF, Caporaso NE, et al. J Natl Cancer Inst 2011;103:1058-68.
- Cassidy A, Myles JP, van Tongeren M, et al. Br J Cancer 2008;98:270-6

Risk Models

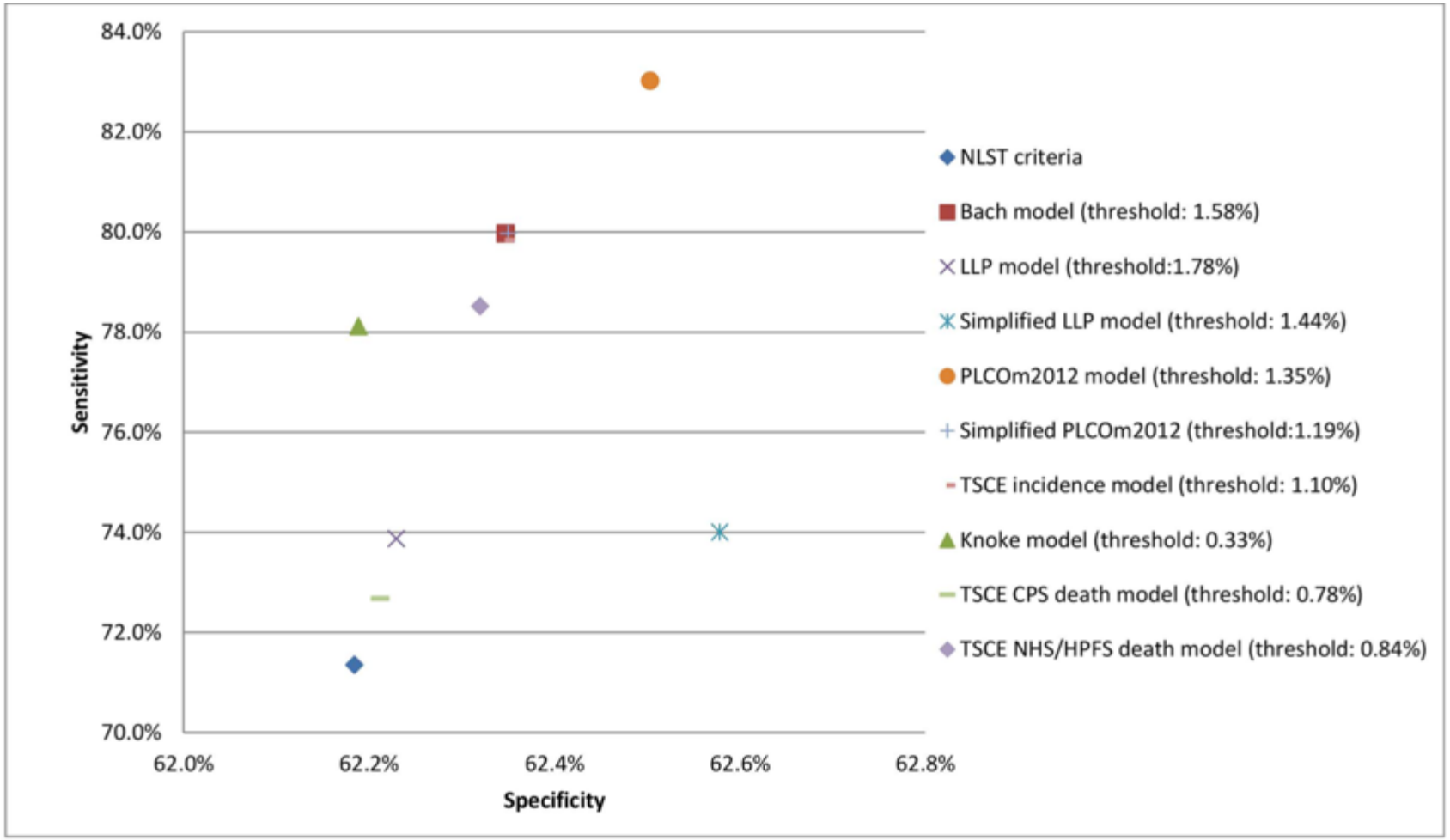


Fig 6. Sensitivity, specificity, and risk thresholds for the investigated risk prediction models and the National Lung Screening Trial criteria for 6-y lung cancer incidence in the Prostate, Lung, Colorectal and Ovarian Cancer Screening Trial chest radiography arm.
CPS, Cancer Prevention Study; HPFS, Health Professionals Follow-up Study; LLP, Liverpool Lung Project; NHS, Nurses' Health Study; NLST, National Lung Screening Trial; TSCE, Two-Stage Clonal Expansion.

Ten Haaf et al. PLoS Med 14(4): e1002277

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Selection Criteria for Lung-Cancer Screening

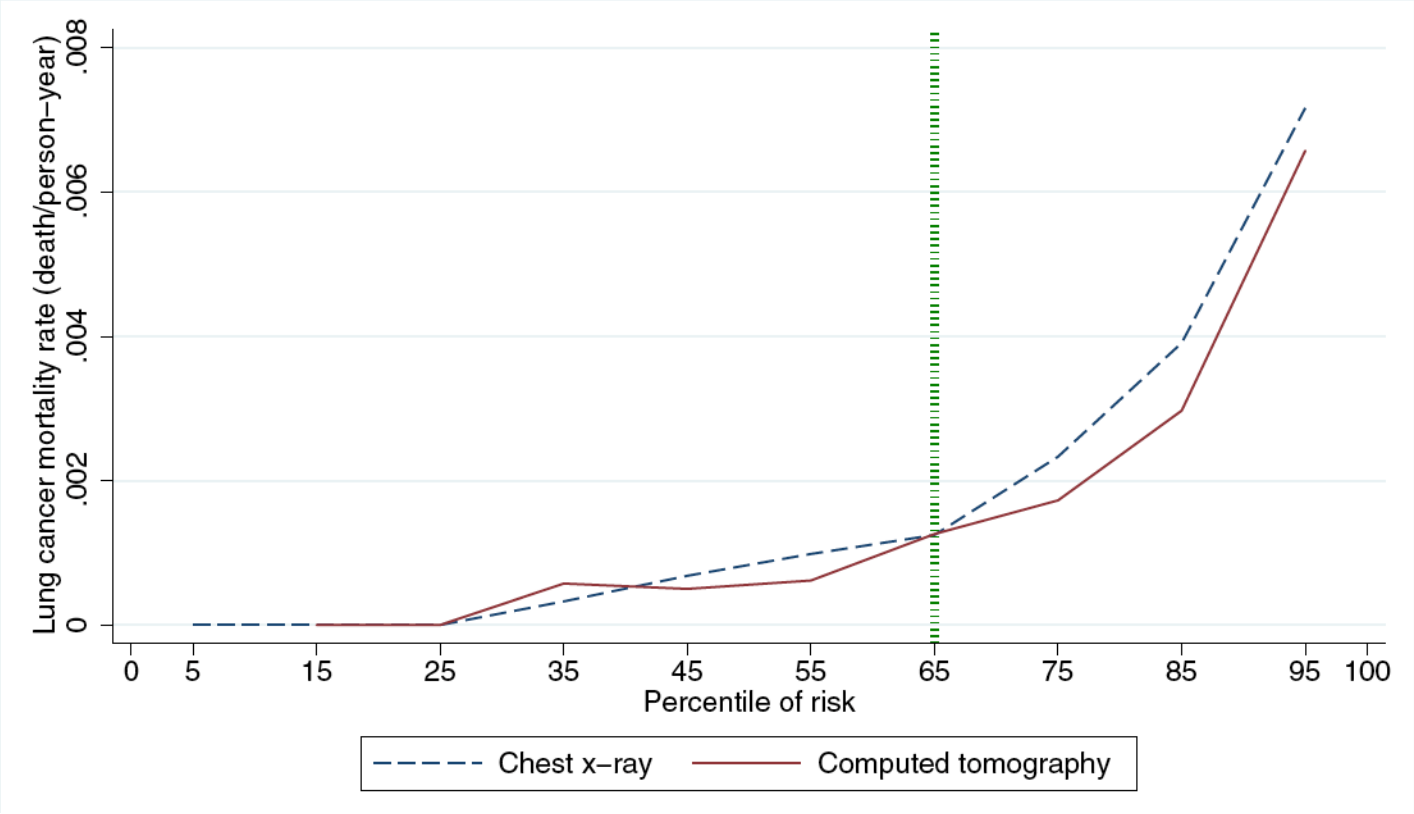
Martin C. Tammemägi, Ph.D., Hormuzd A. Katki, Ph.D., William G. Hocking, M.D., Timothy R. Church, Ph.D., Neil Caporaso, M.D., Paul A. Kvale, M.D., Anil K. Chaturvedi, Ph.D., Gerard A. Silvestri, M.D., Tom L. Riley, B.Sc., John Commins, B.Sc., and Christine D. Berg, M.D.

Risk prediction:
$PLCO_{m2012}$

Tammemagi Lung Cancer Risk Prediction Calculator ©
Calculator predicting 6-year risk of lung cancer by the Tammemag
Instructions: For the characteristics described in Column A fill in t
Note: Values in columns C to F can be ignored and should not be c

Characteristics to be entered	Enter Values
Age in years	65
Education (enter the highest level obtained) 1 = less than high school grad; 2 = high school grad; 3 = Post high school training; 4 = Some college; 5 = College grad; 6 = Postgraduate/professional.	1
Body Mass Index (BMI, weight in kg/height in meters^2)	17
COPD, emphysema or chronic bronchitis (0=No; 1=Yes	1
Personal history of cancer (0=No; 1=Yes)	0
Family history of lung cancer (0=No; 1=Yes)	1
Race/ethnicity	
White (referent group) (0=No; 1=Yes)	1
Black (non-Hispanic) (0=No; 1=Yes)	0
Hispanic (0=No; 1=Yes)	0
Asian (0=No; 1=Yes)	0
American Indian/Alaskan Native (0=No; 1=Yes)	0
Native Hawaiian/Pacific Islander (0=No; 1=Yes)	0
Smoking status, 0 = Former-smoker 1 = Current-smoker	0
Average number of cigarettes smoked per day**	20
Duration smoked (years)	30
Years ago quit smoking. Enter zero for current smokers	15
Model constant	
Probability of lung cancer =	**0.044**

Threshold of risk: 1.51%



Tammemagi MC, Church TR, Hocking WG, et al. PLoS Med 2014;11:e1001764

How often should we screen?

- MILD study
  - Annual vs biennial – no statistical difference
- NELSON Study
  - 2.5 year interval is too long
- Microsimulation models have shown mixed results

- Pastorino U, Rossi M, Rosato V, et al. Eur J Cancer Prev 2012;21:308-15
- Sverzellati N, Silva M, Calareso G, et al. Eur Radiol 2016;26:3821-9.
- Yousaf-Khan U, van der Aalst C, de Jong PA, et al. Thorax 2017;72:48-56

How often should we screen?

Table 3 Stage distribution of screening-detected lung cancers of all rounds

	Round 1			p Value*	Round 2			p Value†	Round 3			p Value‡	Round 4		
	n	Per cent	Cumulative %		n	Per cent	Cumulative %		n	Per cent	Cumulative %		n	Per cent	Cumulative %
				0.37				0.02				0.10			
Stage															
Ia	44	59.5	59.5		43	74.1	74.1		50	64.9	64.9		22	47.8	47.8
Ib	4	5.4	64.9		1	1.7	75.9		6	7.8	72.7		6	13.0	60.9
IIa	7	9.5	74.3		4	6.9	82.8		–	–	76.6		3	6.5	67.4
IIb	–	–	–			–	–		3	3.9	–		4	8.7	76.1
IIIa	10	13.5	87.8		6	10.3	93.1		14	18.2	94.8		3	6.5	82.6
IIIb	4	5.4	93.2		2	3.4	96.6		1	1.3	96.1		2	4.3	87.0
IV	5	6.8	100		2	3.4	100		3	3.9	100		6	13.0	100
Total	74	100	–		58	100	–		77	100	–		46	100	–

*p Value: comparison of stage distribution of the screening-detected lung cancers of round 1 vs round 4.
†p Value: comparison of stage distribution of the screening-detected lung cancers of round 2 vs round 4.
‡p Value: comparison of stage distribution of the screening-detected lung cancers of round 3 vs round 4.

- Yousaf-Khan U, van der Aalst C, de Jong PA, et al. Thorax 2017;72:48-56

How often should we screen?

- ? Risk stratification is the key ?
- A new solid nodule on subsequent screening scans have a higher malignancy risk
- A negative first scan strongly predictive of a negative subsequent scan
  - Less true for very high risk individuals
  - Manchester pilot: mean VDT for those with true negative first scan was only 49 days!

- Yousaf-Khan U. et al. Thorax 2017;72:819-824
- Crosbie, P.A., Balata, H., et al. Second round results from the Manchester 'Lung Health Check' pilot. Thorax, 2018 (in press)
- Walter, J. et al. Lancet oncology 2016: 17; 907-16

5. Radiation Exposure

- LDCT uses less radiation: 1.5mSv vs 7-8-mSv
- Exposure from a single LDCT is less than the average exposure from natural sources

- Repeated scanning is a concern
- Additional tests (eg PET) a concern
- Estimated lifetime risk of radiation induced lung cancer in a 50 female smoker is 0.85%
- Risk models suggest risk > benefit in non-smokers and <50 years

- Smith-Bindman R, Lipson J, Marcus R, et al. Arch Intern Med 2009;169:2078-86
- Brenner DJ. Radiology 2004;231:440-5
- Berrington de Gonzalez A, Kim KP, Berg CD. J Med Screen 2008;15:153-8

6. Cost effectiveness

- Most work so far based on estimation models – variable
- UKLS have estimated a cost of £8,466 per QALY (CI £5,542-£12,569)
  - Within NICE limits for screening

- Targeting high risk subjects improves costs
  - Less eligible
  - Higher prevalence

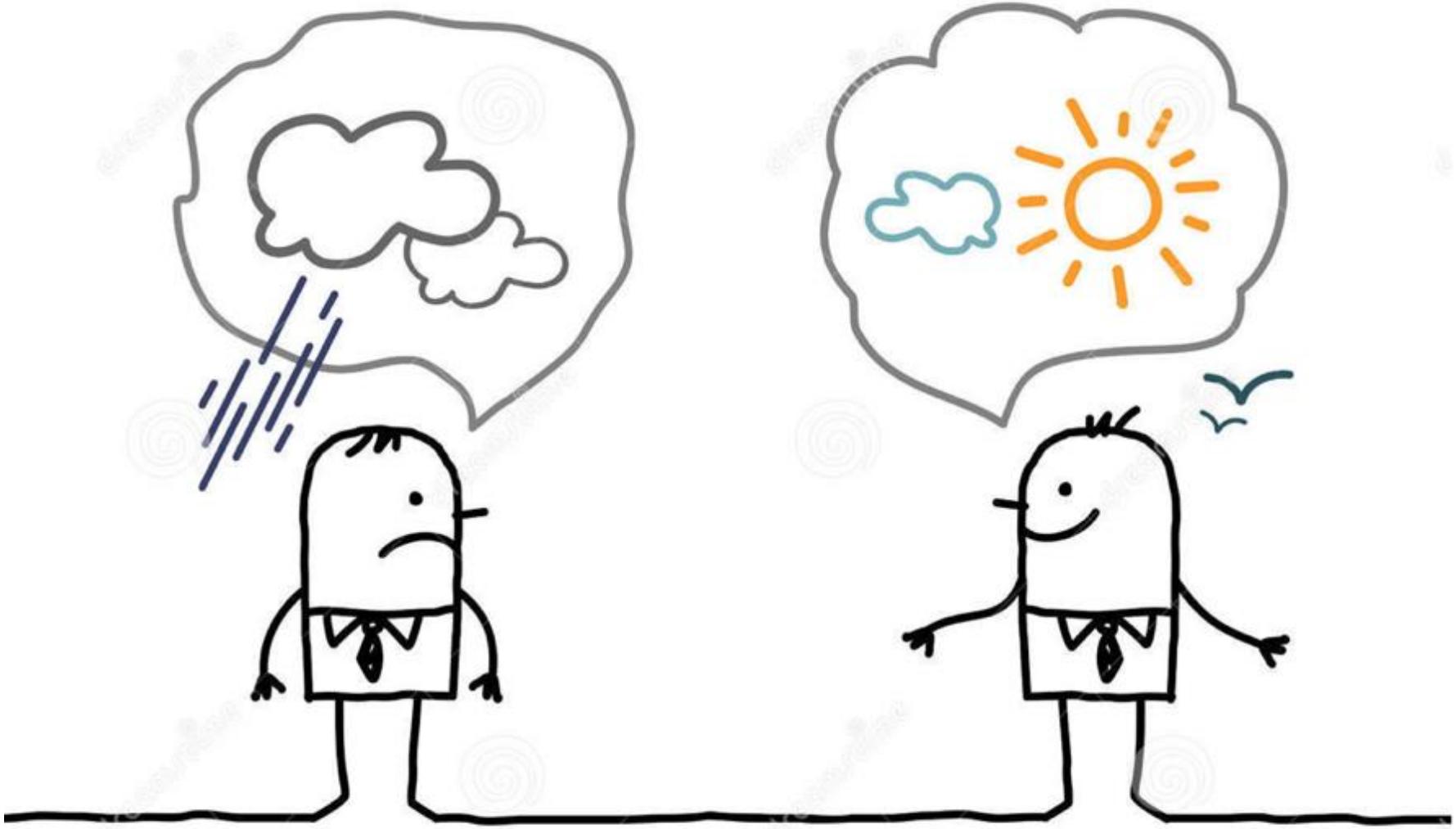
- Field JK, Duffy SW, Baldwin DR, et al. Thorax 2016;71:161-70
- Whynes DK. Cost Eff Resour Alloc 2008;6:5

Do we meet screening criteria?

The Wilson-Jungner criteria for appraising the validity of a screening program (1968)

- The condition being screened for should be an important health problem - YES
- The natural history of the condition should be well understood - YES
- There should be a detectable early stage - YES
- Treatment at an early stage should be of more benefit than at a later stage - YES
- A suitable test should be devised for the early stage - YES
- The test should be acceptable - YES
- The risks, both physical and psychological, should be less than the benefits - YES
- Intervals for repeating the test should be determined – Making progress
- The costs should be balanced against the benefits – Making progress

So, where are we?



'Does it really work?' ***'How can we actually do this?'***

Real world example

The Manchester ‘Lung Health Check’ Screening Pilot

Why Manchester?

Rates of premature death: Manchester

defined as deaths under age 75 per 100,000 (2012-14)

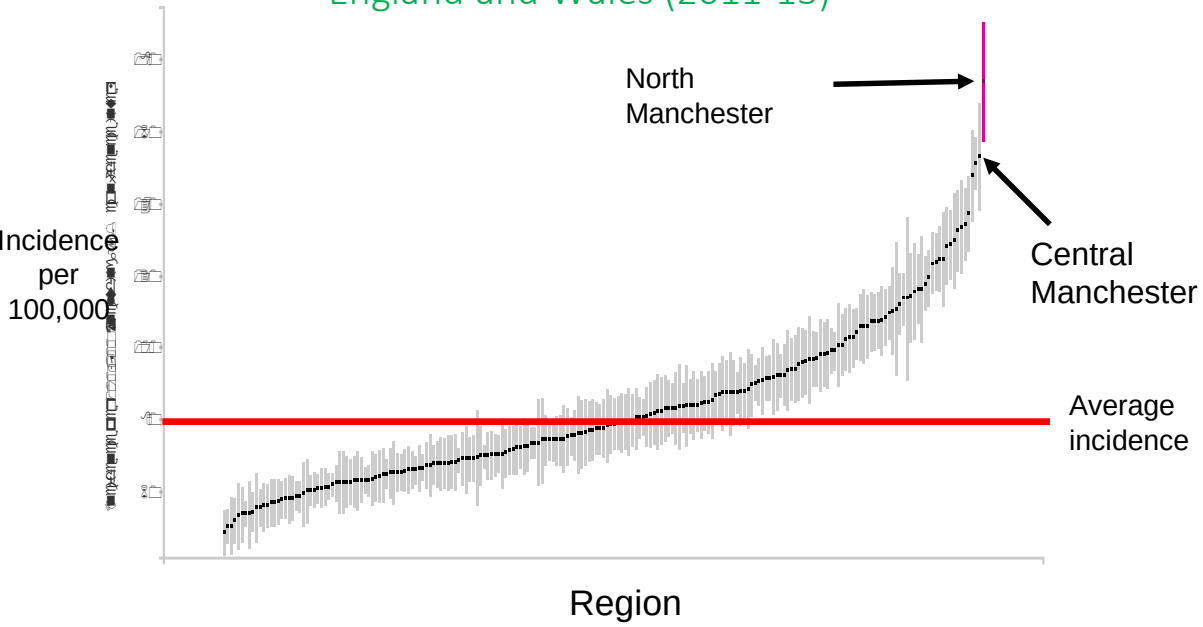
• Overall	150th out of 150 local authorities (LA)
• All Cancer	150th out of 150 LA
• Heart disease	150th out of 150 LA
• Stroke	150th out of 150 LA
• Lung disease	149th out of 149 LA
• Lung cancer	150th out of 150 LA

Public Health England

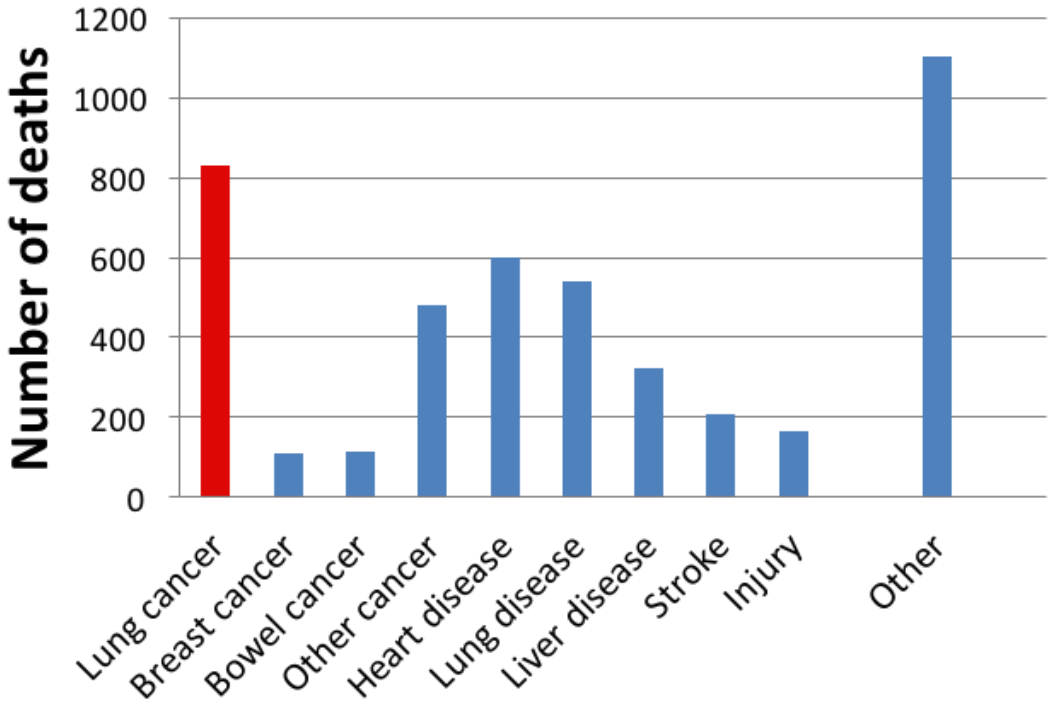
http://healthierlives.phe.org.uk/topic/mortality

Lung Cancer in Manchester

Lung cancer incidence:
England and Wales (2011-13)



Causes of premature death: Manchester
(2011-13)



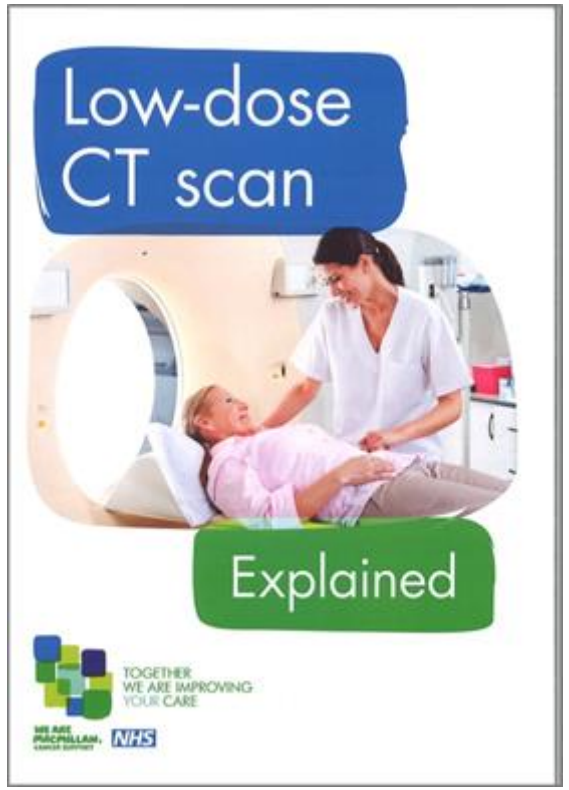
Public Health England
http://healthierlives.phe.org.uk/topic/mortality

The Manchester Lung Health Check Pilot – Key Design Features

- UK's first NHS lung cancer screening implemented service
  - June 2016 – January 2018
  - Two rounds of screening - annual
- Community based
  - Supermarket car parks
- 'Lung Health Check'
  - Not cancer screening
- Targeted at those most at risk
  - Deprived areas
  - Scan only those with $PLCO_{m2012}$ ≥1.51%
- Immediate access to mobile low dose CT scanner
- Use of 14 specialist thoracic radiologists
- Detailed 2-step nodule management algorithms
- Inclusion criteria
  - Age 55-74
  - Ever smokers
  - Registered with participating GPs
- Exclusion Criteria
  - Diagnosis of lung cancer with 5 years
  - Palliative care register

Engagement Approach

- **Co-designed well researched participant info:**
  - GP invite letter
  - Lung Health Check and LDCT scan leaflets
- **Grass roots community engagement**
  - Community networks and events
  - Leafleting and Macmillan bus
  - Awareness sessions e.g. Breathe Easy groups
  - Bookmakers, Vape/E-Cig shops
  - Posters in community venues
- **GP Engagement**
  - Briefing sessions/ staff encouragement
  - Waiting room posters
  - Messages on prescriptions
  - Practice staff answering queries



Broader communication

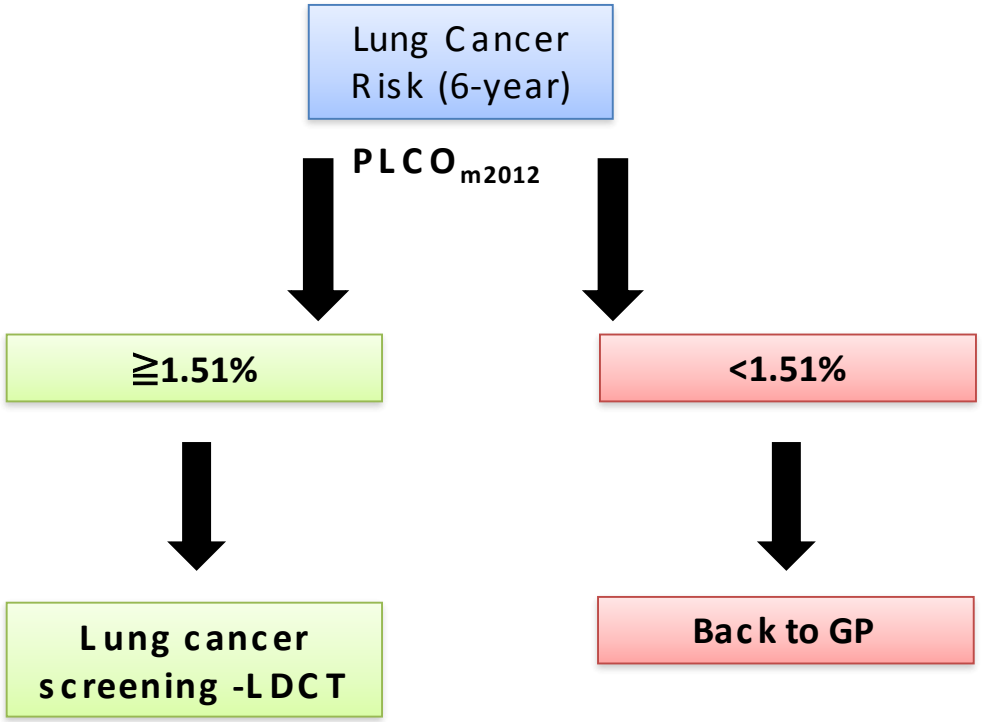
Core Messages:

- “Sooner rather than later”
- “Lung Health Check” or “MOT for your lungs”
- Free
- Time and places limited
- Not normally available

- Local voices - Lord Mayor Film
- Press release, Local radio and TV
- Social media
- Patient stories

The Lung Health Check

- 20 minute appointment
- Experienced respiratory nurse
  - Band 6/7
- History & symptoms
- Performance Status; MRC score
- Measurements
  - Spirometry
  - Height, Weight, BMI
- Non-judgemental stop smoking advice & signposting
- Lung cancer risk score
  - $PLCO_{m2012}$
- Consents
  - Research database (99.5%)
  - Data sharing



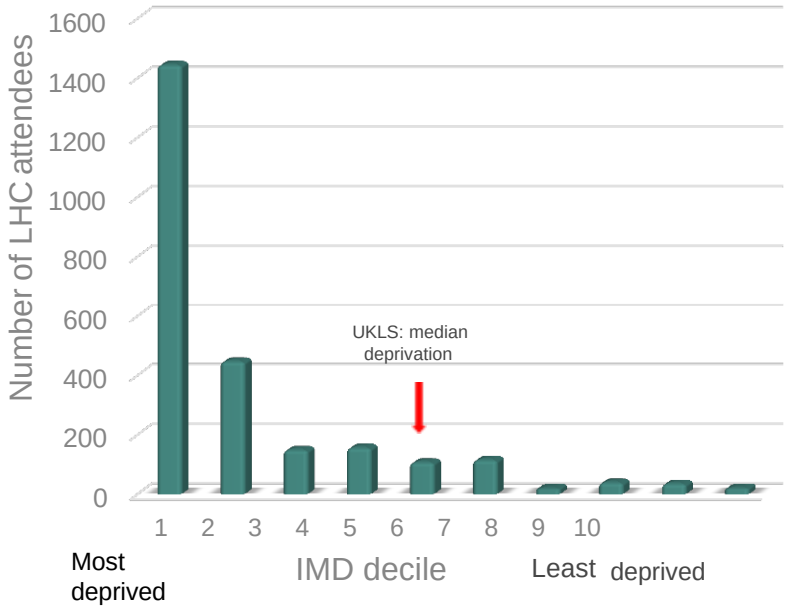
Results – attendance

- All appointments booked within few days
    - Demand > service capacity (~2,800 appointments)
- Low DNA rate
- 2,541 lung health checks carried out
    - 25.6% of invited eligible participants
- 1,384 LDCT scans (56%)

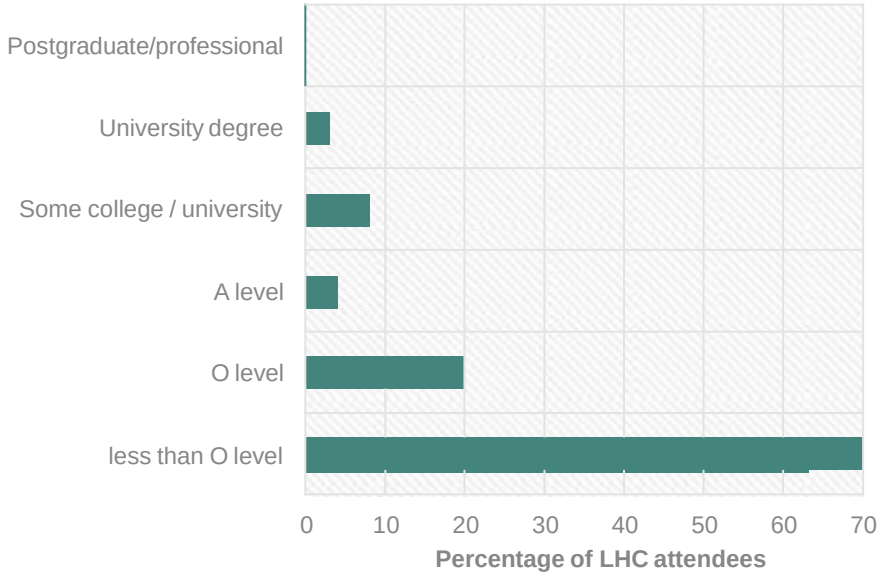
- Mean age 64 (SD 5.5)
- Male 49%:51% Female

Results - attendance

Deprivation (IMD):
Over half lowest decile (56%)
75% lowest quintile



Education:
82% left school by 16
62% without any 'O' levels



Additional Risk
22% FH Lung Cancer
12% Personal Hx of cancer
24% Exposed to Asbestos
35% Current Smokers
(53% in screened group)
22% Hx of COPD

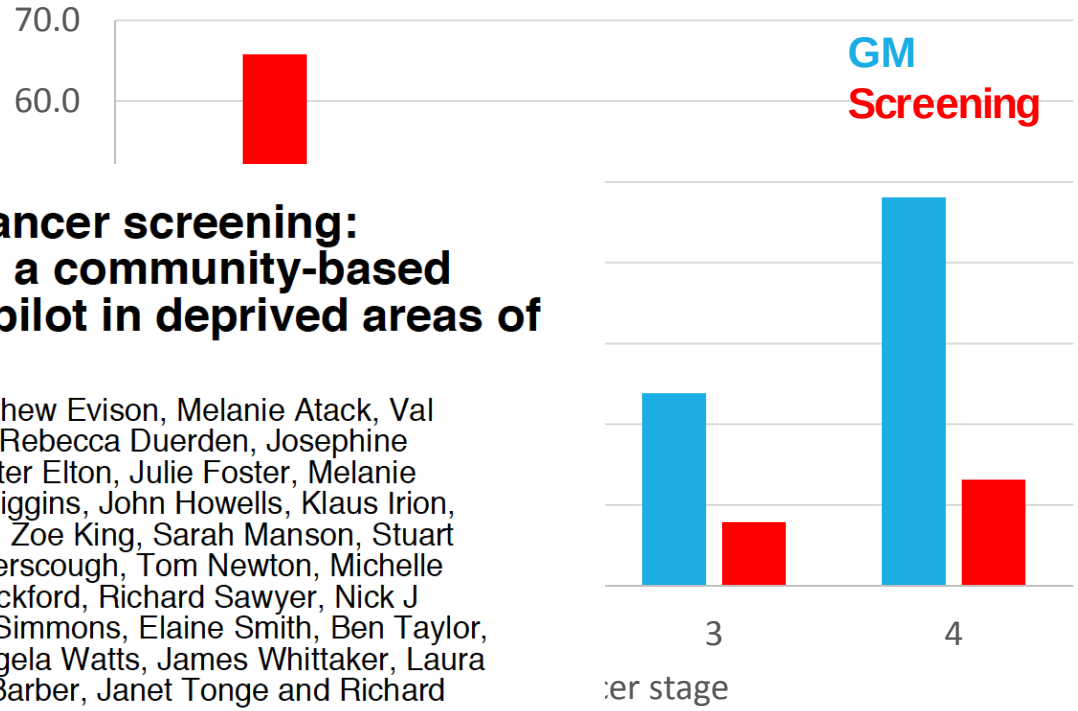
(90% PS 0-1)
(90% MRC 1-2)

IMD = index of multiple deprivation 2015

Results – lung cancer screening

(baseline round – prevalence)

- 1,384 LDCT scans performed
- **Lung cancer diagnosis: 3% (n=42)**
- 80% early stage (I
- 64% Surgical resec
- 89% received trea
- False positives: 2.8
  - No surgery for be
- Interval imaging rate: 12.7%



THORAX

Implementing lung cancer screening: baseline results from a community-based 'Lung Health Check' pilot in deprived areas of Manchester

Phil A Crosbie, Haval Balata, Matthew Evison, Melanie Atack, Val Bayliss-Brideaux, Denis Colligan, Rebecca Duerden, Josephine Eaglesfield, Timothy Edwards, Peter Elton, Julie Foster, Melanie Greaves, Graham Hayler, Coral Higgins, John Howells, Klaus Irion, Devinda Karunaratne, Jodie Kelly, Zoe King, Sarah Manson, Stuart Mellor, Donna Miller, Amanda Myerscough, Tom Newton, Michelle O'Leary, Rachel Pearson, Julie Pickford, Richard Sawyer, Nick J Screaton, Anna Sharman, Maggi Simmons, Elaine Smith, Ben Taylor, Sarah Taylor, Anna Walsham, Angela Watts, James Whittaker, Laura Yarnell, Anthony Threlfall, Phil V Barber, Janet Tonge and Richard Booton

Thorax published online February 13, 2018

Results – Lung cancer screening

(second round – incidence)

- Screening adherence good: >90%
- 1,194 LDCTs performed

- Scan positivity rate: 2.4%
- Interval imaging rate: 6%
  - Significantly lower than baseline round (p=0.0001)

- **19 lung cancers diagnosed – incidence rate 1.6%**
- 79% early stage (all stage I)
- 89% received treatment with curative intent

Results – Lung cancer screening
(second round – incidence)

- False positives: 0.8% of the population screened
- (or) False positives: 34.5% of positive scans
    - Significantly lower than baseline round (p=0.0001)

- No interval lung cancers diagnosed

Results – Lung cancer screening (cumulative)

- **Lung cancer detection rate 4.4%**
  - (3% prevalence round; 1.6% incidence round)

- 1 cancer detected for ev
- 80% early stage (I+II)
- 89% offered curative int

- False positive rate 3.5%
  - 0.8% in the second rou
- Benign surgical resectio
  - One case only
- No Lepidic pattern pred
- Sensitivity 89.5%; specif

Second round results from the Manchester 'Lung Health Check' community-based targeted lung cancer screening pilot

Phil A Crosbie,[1,2] Haval Balata,[1] Matthew Evison,[1] Melanie Atack,[3] Val Bayliss-Brideaux,[3] Denis Colligan,[3,4] Rebecca Duerden,[1] Josephine Eaglesfield,[3] Timothy Edwards,[1] Peter Elton,[5] Julie Foster,[6] Melanie Greaves,[1] Graham Hayler,[3] Coral Higgins,[4] John Howells,[7] Klaus Irion,[8] Devinda Karunaratne,[8] Jodie Kelly,[1] Zoe King,[3] Judith Lyons,[1] Sarah Manson,[1] Stuart Mellor,[9] Donna Miller,[10] Amanda Myerscough,[3] Tom Newton,[9] Michelle O'Leary,[11] Rachel Pearson,[3,4] Julie Pickford,[6] Richard Sawyer,[1] Nick J Screaton,[12] Anna Sharman,[1] Maggi Simmons,[3] Elaine Smith,[1] Ben Taylor,[13] Sarah Taylor,[3,4] Anna Walsham,[14] Angela Watts,[1] James Whittaker,[15] Laura Yarnell,[3,4] Anthony Threlfall,[3] Phil V Barber,[1] Janet Tonge,[3,4] Richard Booton[1]

Cardiovascular risk assessment

- CVD a major cause of morbidity and mortality in populations eligible for lung cancer screening.
- QRISK2 is a widely used UK-validated CVD risk calculator (www.qrisk.org.2017)
- Those at high risk, defined as QRISK2 score of >10%, are recommended to have primary intervention including statin therapy by NICE

Contents lists available at ScienceDirect

Lung Cancer

journal homepage: www.elsevier.com/locate/lungcan

Targeted lung cancer screening selects individuals at high risk of cardiovascular disease

H. Balata[a], S. Blandin Knight[a], P. Barber[a], D. Colligan[b], E.J. Crosbie[c], R. Duerden[d], P. Elton[e], M. Evison[a], M. Greaves[d], J. Howells[f], K. Irion[g], D. Karunaratne[g], M. Kirwan[h], A. Macnab[i], S. Mellor[j], C. Miller[i], T. Newton[j], J. Novasio[k], R. Sawyer[d], A. Sharman[d], K. Slevin[h], E. Smith[d], B. Taylor[k], S. Taylor[b], J. Tonge[b], A. Walsham[l], S. Waplington[b], J. Whittaker[m], R. Booton[a], P.A.J. Crosbie[a,c,*]

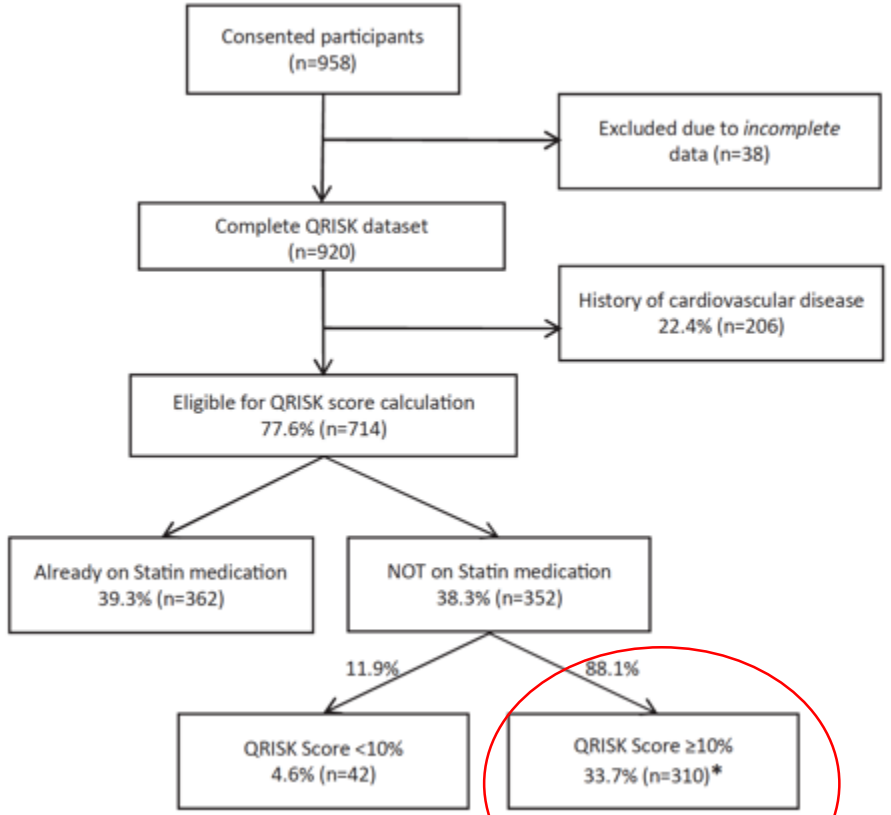


Fig. 1. Flow of participants through study; (* = eligible for statin therapy according to NICE guidance).

NICE. Cardiovascular disease; risk assessment and reduction, including lipid modification 2014 (CG181).

Health economic analysis

Contents lists available at ScienceDirect

Lung Cancer

journal homepage: www.elsevier.com/locate/lungcan

The cost-effectiveness of the Manchester 'lung health checks', a community-based lung cancer low-dose CT screening pilot

Sebastian Hinde[a,*], Tessa Crilly[b], Haval Balata[c], Rachel Bartlett[b], John Crilly[b], Phil Barber[c,d], Anthony Threlfall[d], Janet Tonge[d,e], Richard Booton[c], Phil A. Crosbie[c,f]

[a] Centre for Health Economics, University of York
[b] Crystal Blue Consulting Ltd
[c] Manchester Thoracic Oncology Centre, North West Lung Centre, Manchester University NHS Foundation Trust
[d] Macmillan Cancer Improvement Partnership, Manchester
[e] Manchester Health and Care Commissioning, Manchester
[f] Division of Cancer Sciences, Faculty of Biology, Medicine and Health, University of Manchester

Results: The Manchester programme cost £663,076, diagnosed 42 patients with lung cancer resulting in a gain in population health of 88.13 discounted life years, equivalent to 65.85 QALYs. This implied an incremental cost-effectiveness ratio of £10,069/QALY.

Conclusions: We found the Manchester programme to be a cost-effective use of limited NHS resources. The findings suggest that further research is now needed not as to whether LDCT screening is cost-effective but under what conditions can it improve patient health by the most while remaining cost-effective.

The Manchester screening pilot - what does it teach us?

- Implementation is possible (small scale)
- You can reach those at highest risk and most likely to benefit
- You can reduce the potential harms of screening
- You can find early stage lung cancer amenable to curative treatment
- It can be cost-effective

- *You can incorporate CVD risk assessment*
- *You can incorporate COPD diagnosis*
- *You can influence smoking quit rates*

News

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NHS England action to save lives by catching more cancers early

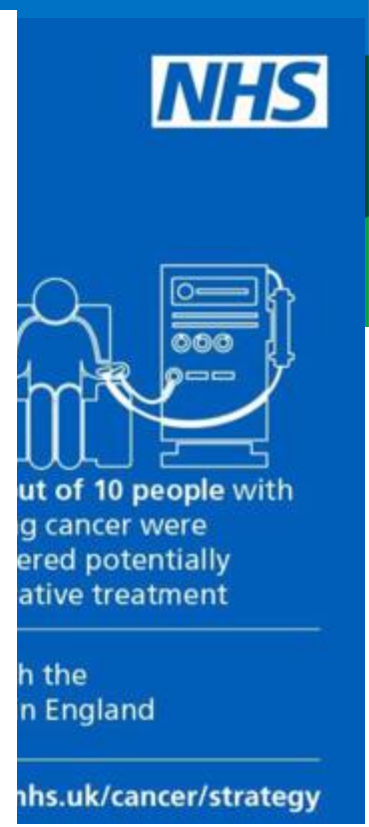
21 November 2017

Cancer | Innovation

NHS England Chief Executive, Simon Stevens, will today announce the scaling up of an innovative scheme that catches lung cancer early by scanning patients, along with new details of a more sensitive bowel cancer test that could save thousands of lives.

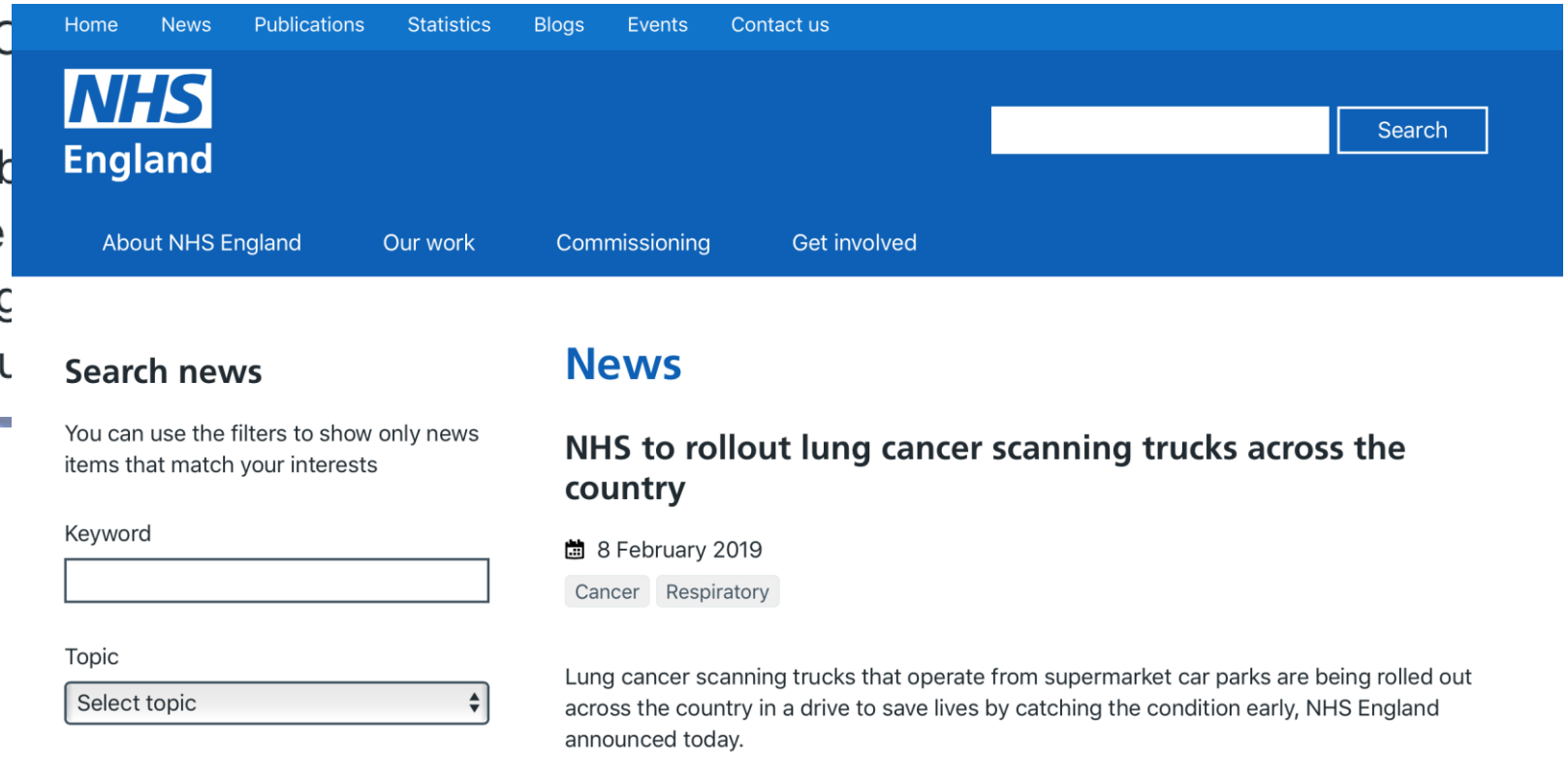
Speaking at the Economist War on Cancer event in London, he will highlight the success of the Manchester scanner scheme, where mobile scanners are detecting four out of five cases of lung cancer in the early stages when it is easier to treat. The mobile scanning trucks have picked up one cancer for every 33 patients scanned over the course of a year.

NHS England is now funding scanners in other areas as part of a national programme to diagnose cancer earlier, improve the care for those living with cancer and ensure each cancer patient gets the right care for them.



What is next…

3.56. **Over the next two years, we will extend the lung health checks that have already produced strong results in Liverpool and Manchester.** Patients will have a breath test and a discussion to assess their individual lung cancer risk. Any patient assessed as being at high risk of lung cancer will have an immediate low-dose C
at stage 1 and 13% at stage 4,
2019, we will deploy more mob
parks – starting in parts of the
cancers quickly, pick up a rang
disease (COPD), and help redu



What do the experts think?

European position statement on lun

Matthijs Oudkerk, Anand Devaraj, Rozemarijn Vliegenthart, Thomas Henzler, Helmut F
Mario Mascalchi, Stefan Delorme, David R Baldwin, Matthew E Callister, Nikolaus Beck
Maurizio V Infante, Ugo Pastorino, Jesper H Pedersen, Eugenio Paci, Stephen W Duffy, H

Lung cancer screening with low-dose CT can save lives. This Europe
available evidence and the major issues that need to be addressed to en
CT lung cancer screening in Europe. This statement identified specifi
screening community to adopt before the implementation of low-
statement recommends the following actions: a risk stratification appr
dose CT programmes; that individuals who enter screening programn
benefits and harms of screening, and smoking cessation should be offe
detected solid nodules should use semi-automatically measured vol
quality assurance boards should be set up to oversee technical stand
should be established and incorporated into clinical practice with a
baseline lung nodules greater than 300 mm³ and new lung nodules

IASLC ISSUES STATEMENT ON LUNG CANCER SCREENING WITH LOW-DOSE COMPUTED TOMOGRAPHY

IASLC INTERNATIONAL ASSOCIATION FOR THE STUDY OF LUNG CANCER

Contact: Becky Bunn
IASLC Public Relations Manager
Becky.Bunn@IASLC.org | 720-325-2946

IASLC Issues Statement on Lung Cancer Screening with Low-Dose Computed Tomography

DENVER, Colo. — The International Association for the Study of Lung Cancer (IASLC) today issued a statement on lung cancer screening with low-dose computed tomography (LDCT)* based on results from the Dutch-Belgian NELSON lung cancer screening trial presented at the **IASLC 19th World Conference on Lung Cancer (WCLC)** in Toronto, Canada. The IASLC Early Detection and Screening Committee, recognizing the importance of these results, now affirms the strength of evidence arising from two large, well designed and well executed randomized trials that LDCT screening in high risk individuals can significantly reduce lung cancer mortality.

Are we ready to implement in Europe?

Still have issues to overcome

- Resources: facilities, staff, money
- Radiology!
- Standardised protocols and quality assurance
- Planning requires collaboration between public health, commissioning, primary care and specialist centres
- Different countries and populations have different systems and different needs

Conclusions

- Evidence of lung cancer screening is now stronger than ever
  - Two RCTs showing significant lung cancer mortality reduction
  - Further evidence coming from the smaller European trials
- Pilot programmes already underway implementing screening for their local populations (inc. Manchester)
- Strong support from international associations
- Logistics of implementation remain a challenge – needs careful planning, standardised protocols and a likely phased approach

Lung Screening…

Coming Soon to a Theater Near You ??

Car Park

NHS
Manchester University
NHS Foundation Trust

Manchester Thoracic Oncology Centre

Thank you

@hsbalata

Email: haval.balata@mft.nhs.uk

MANCHESTER 1824
The University of Manchester