IASLC
2023 World Conference on Lung Cancer
SEPTEMBER 9-12, 2023 | SINGAPORE

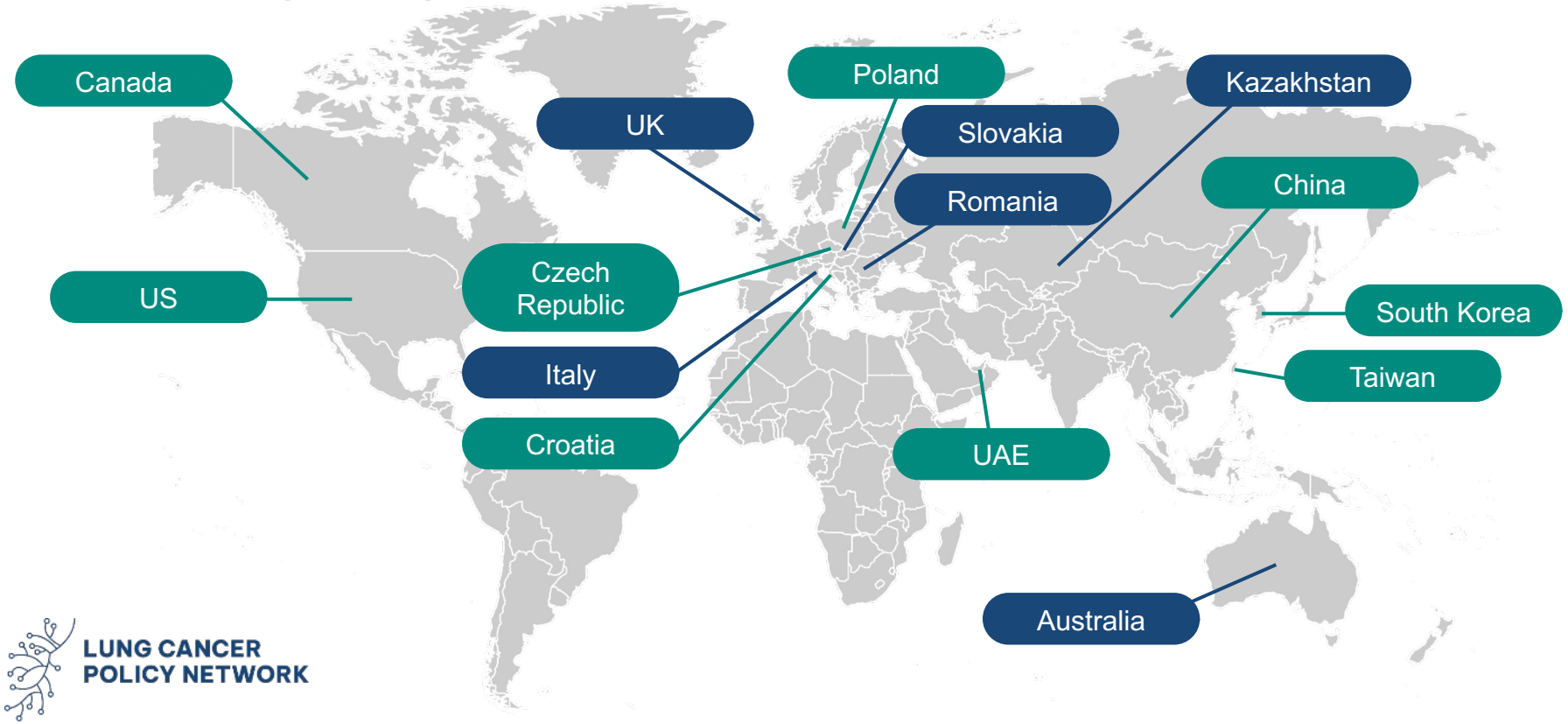
Lung cancer screening and tobacco control

Best of WCLC 2023 San Francisco

Natalie Lui, MD
Stanford Cancer Center, United States

September 30, 2023

We are at a pivotal moment to make a difference for people affected by lung cancer



9 countries have organized LDCT screening programs.

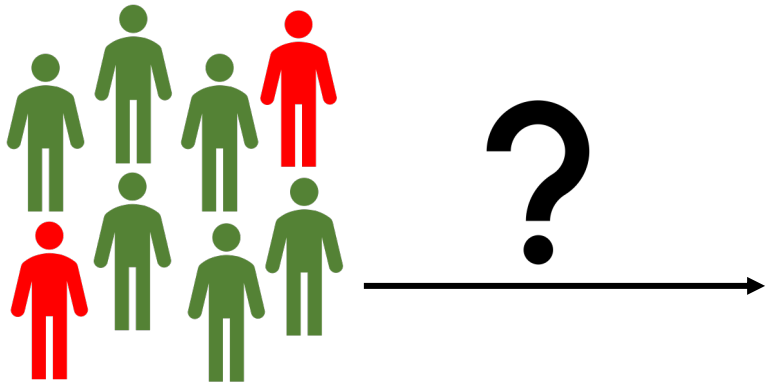
A further **6 countries** have formal commitment to implement LDCT screening.[1]

LUNG CANCER POLICY NETWORK

1. Lung Cancer Policy Network. 2023. Interactive map of lung cancer screening (second edition). Available from: www.lungcancerpolicynetwork.com/interactive-map/

Unmet needs in lung cancer screening

1) Better targeting of high-risk individuals



?

2) Better nodule management

?

Indeterminate nodules

Improving risk assessment

The Early Detection Program for Lung Cancer in Taiwan

Program Description

- Eligible populations:
  - Heavy smokers: 50 to 74 yrs old, > 30 pack-yrs, currently smoke or have quitted smoking <15 yrs.
  - Individuals with a family history of lung cancer: male aged 50 to 74 yrs, and female aged 45 to 74 yrs.
- Qualification for hospitals: A total of 167 hospitals across all cities/counties participated.
  - Staffed with medical professionals: radiologists, radiographer, thoracic surgeons, case managers.
  - Certified as cancer care quality hospitals, or cooperating with cancer care quality hospitals.
  - Equipped with 64 slice (or more) CT scanners.
- Quality indicators:

  radiation exposure, positive rate, cancer detection rate, positive predictive value, etc..

Preliminary results of first year after implementation

Unit:%

LDCT Positive Rate	9.2
Family history	9.3
Heavy smokers	9.0
Both	9.3
Lung Cancer Detection Rate	1.1
Family history	1.4
Heavy smokers	0.6
Both	0.9
Positive Predictive Value	12.1
Family history	15.3
Heavy smokers	7.1
Both	9.8

Unit:%

Stages of lung cancer	National Program		TALENT (family history)	NLST (heavy smokers)
	Family history	Heavy smokers		
0	13.1	13.6	18.8	-
I	76.3	57.6	77.3	58.3
II	3.0	5.1	1.1	6.8
III	4.3	10.2	1.7	19.5
IV	3.3	13.6	1.1	15.4

Source：Taiwan National Lung Cancer Early Detection Program, Taiwan Cancer Registry

Manchester Lung Health Check pilot

Lung Health Checks
N=2,451

High risk
n=1,430

Low risk
n=1,111

Ever-smokers

55-74y

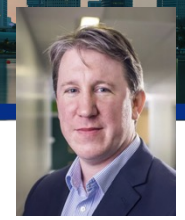
Deprived areas

CT screening — Follow-up 6y

No screening — Follow-up 6y

2016 2017 2018 2019 2020 2021 2022

Lung cancer diagnoses


Phil Crosbie


Richard Booton


Haval Balata

→ Capture cancer diagnoses & outcomes

→ Risk model external validation

Patrick Goodley, University of Manchester, UK

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Most cancers correctly predicted by risk stratification

Lung Health Checks
N=2,451

High risk
n=1,430

Low risk
n=1,111

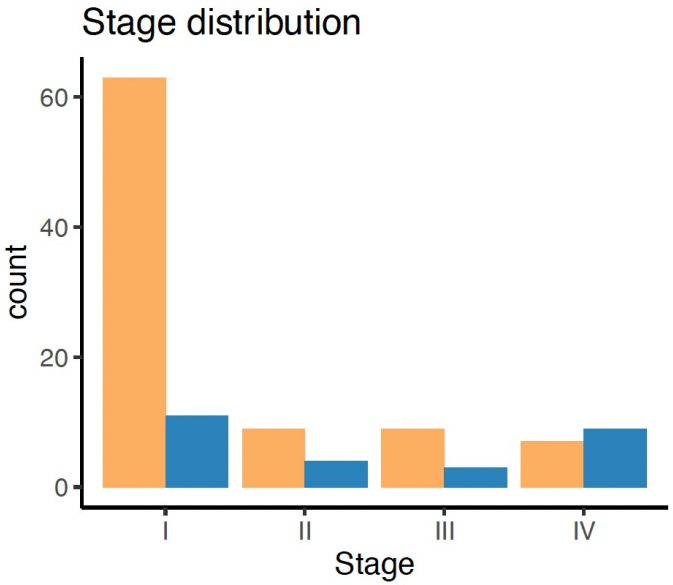
CT screening — 105 cancers (7.3%)

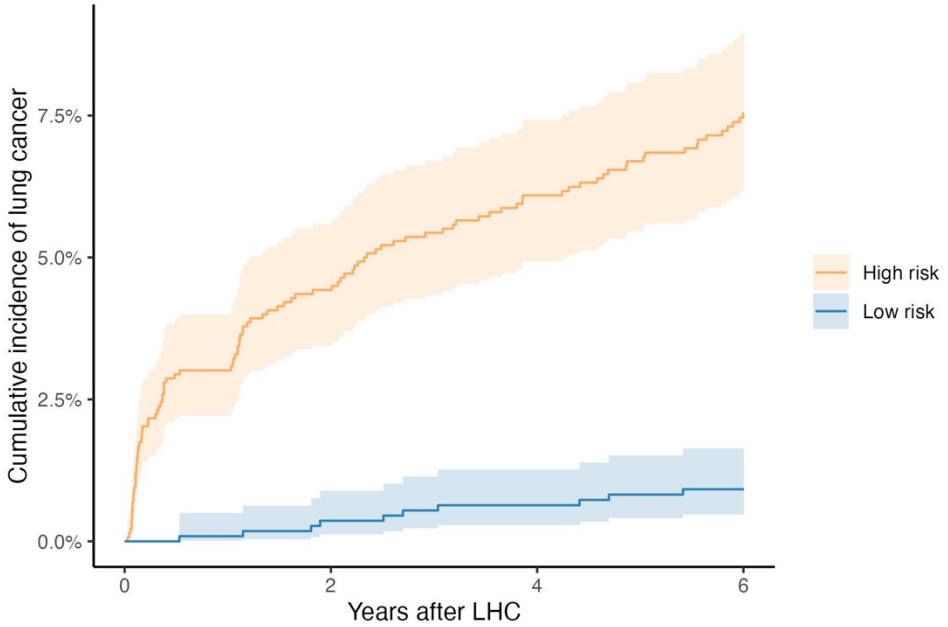
— $PLCO_{m2012} \geq 1.51\%$ —

No screening — 10 cancers (0.9%)

91% of cancers arose in high risk group

83% screen-detected





Sensitivity	91%
Specificity	45%
PPV	7.3%
NPV	99.1%

OA07.03

HANSE Study: Eligibility and Endpoints

Risk scoring

NELSON risk inclusion criteria

- Current smoker or former smoker (smoking quit time ≤ 10 years)
- > 15 cigarettes/day for > 25 years
- > 10 cigarettes/day for > 30 years

$PLCO_{m2012}$ risk score ≥ 1.58 % (6 years)

- Age, Ethnic group, Education
- BMI, COPD
- Personal history of cancer, family history of lung cancer
- Smoking status (current/former), Smoking intensity, Duration of smoking, Smoking quit time

Inclusion/Exclusion criteria

Inclusion criteria

- Male and female subjects aged 55–79 years
- Current or former smokers
- Subjects with calculated risk score $PLCO_{m2012}$ ≥ 1.58 % (6 years) or NELSON inclusion criteria
- Able and willing to give written informed consent

Exclusion criteria

- Comorbidity which would unequivocally contraindicate either screening or treatment if lung cancer is detected
- History of chest CT within the past year preceding the invitation
- Pregnancy
- Risk of non-compliance with study procedures

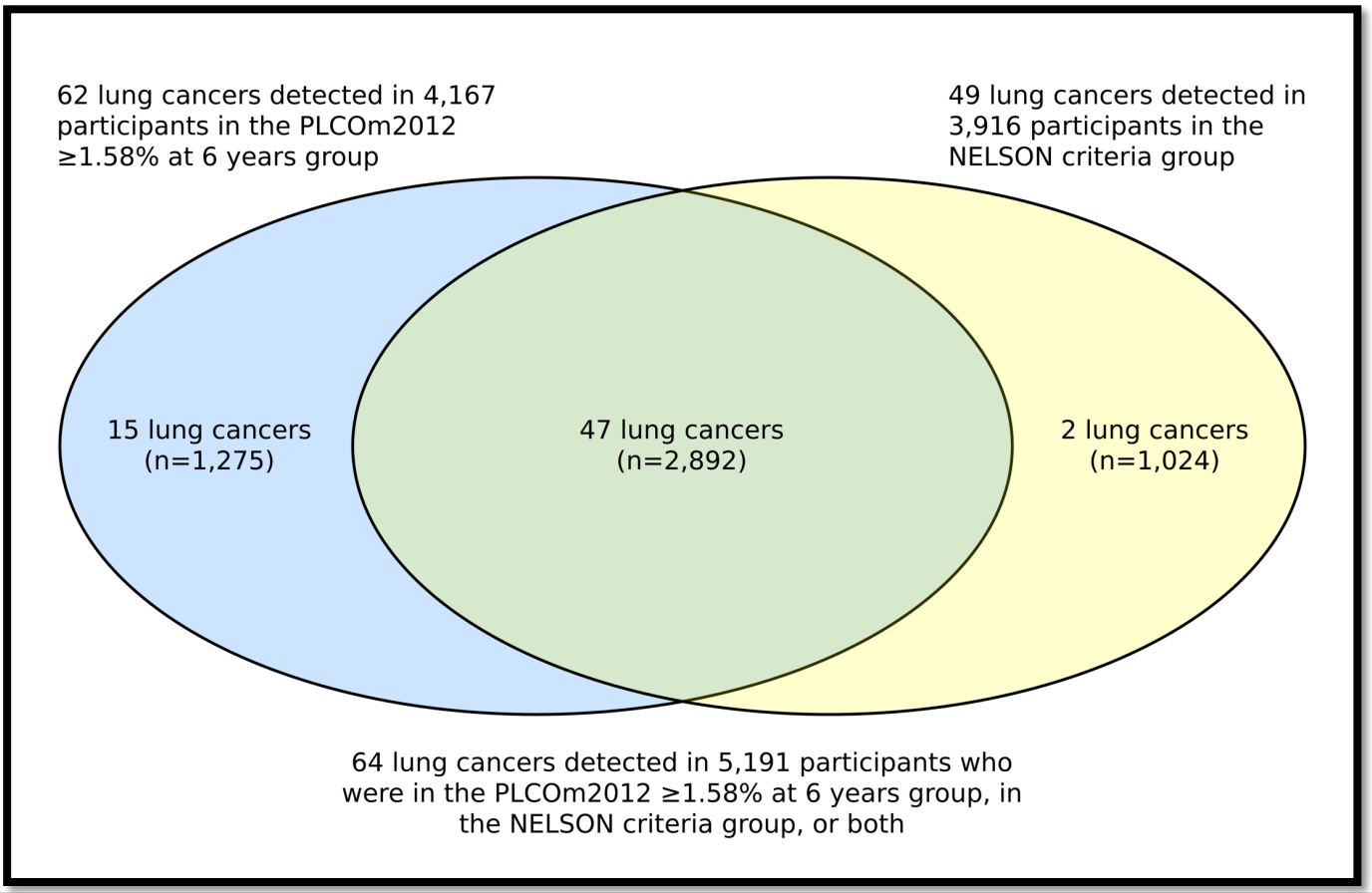
Primary endpoint

- PPV for lung cancers detected in $PLCO_{M2012}$-selected vs. NELSON-selected high-risk groups

Vogel-Claussen et al. Rofo 2022 194(12):1333-1345

Jens Vogel-Claussen, Hannover Medical School (MHH), Germany

HANSE Study: Baseline round Results



- Between July 2021 and August 2022, 5191 high-risk participants (42% female) and 7463 low-risk volunteers were enrolled.
- A total of 64 lung cancers detected (35 stage I, 6 stage II, 11 stage III, 12 stage IV)
- PLCOm2012-missed lung cancers were both stage I adenocarcinomas in two female participants (55 and 57yo)

Jens Vogel-Claussen, Hannover Medical School (MHH), Germany

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Development and validation of a protein-based lung cancer risk prediction model: Initial results from the Lung Cancer Cohort Consortium (LC3)

Study design

Case-cohort design
807 cases and 1144 sub-cohort representatives from 7 cohorts

21 proteins assayed
Absolute quantification (Olink)

Pre-diagnostic blood
Collected up to 3y prior to diagnosis

The Lung Cancer Cohort Consortium (LC3)

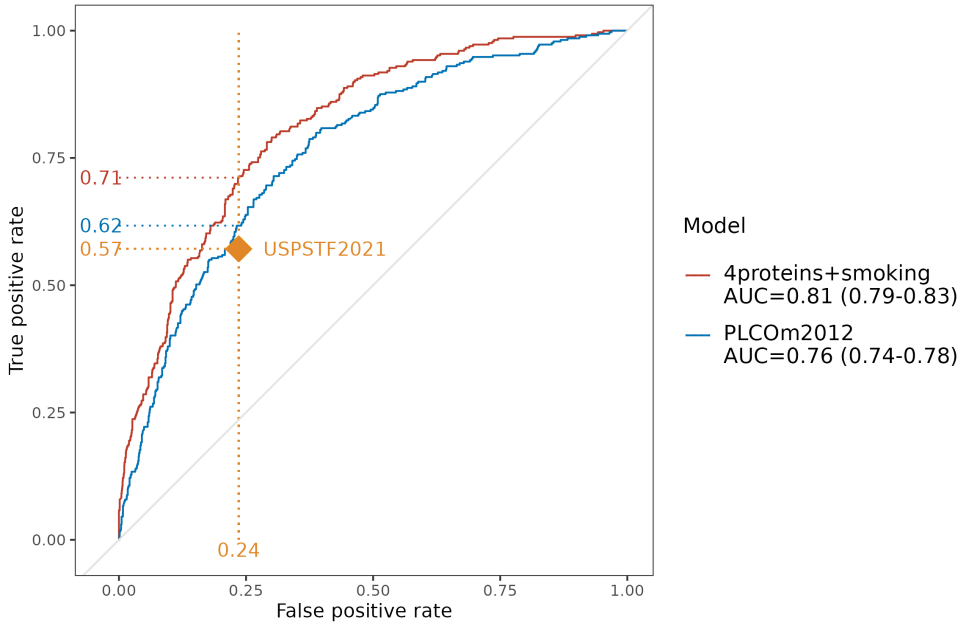
Model development

Preliminary model
- Fit in 4 cohorts
- Tested in 3 cohorts

Results

Performance of **preliminary** model in independent **testing** set (3 cohorts):

- 4 selected proteins: MMP12, CEACAM5, SCF, LPL
- Age, smoking intensity, smoking duration



Model	Cases included (% of cases over 3y)	Years quit, median	Cig. per day, median	COPD	Prior cancer
PLCOm2012 6y risk ≥1.51%	193 (58%)	3	25	16%	16%
Protein model Cutpoint to screen same number of participants	223 (68%)	7	20	13%	12%

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Preliminary Results from the Female Asian Nonsmoker Screening Study (FANSS)

Target n=1000

Inclusion:
- Female
- 40-74 years old
- Identify as from Asian descent
- Nonsmoker[1]

Exclusion:
- History of lung cancer
- Treatment of any cancer <5 years ago

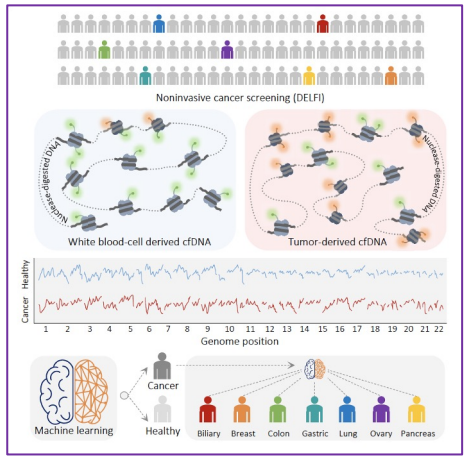
Shared Decision Making Discussion

SCREENING

Low dose CT Chest → Follow-up per Lung-RADS 1.1

Plasma-based cfDNA

Yearly for 3 years



Data Cutoff: January 15, 2023

Primary objective: Develop a database of clinical, demographic and radiographic data of Asian women nonsmokers who undergo LDCT to determine feasibility of lung cancer screening.
Secondary objectives: Lung cancer detection rate, estimate incidental thyroid nodules, estimate incidental coronary artery disease, lung cancer prevalence in WTC exposed participants, lung cancer detection rate by plasma-based cfDNA

Cristiano S, et al. Nature 2019.

[1] Defined as <100 cigarettes in lifetime
[2] Data regarding ethnicity, family history, environmental exposures is collected.

Elaine Shum MD, NYU Perlmutter Cancer Center, USA

	FANSS	NLST	TALENT
Screened population	Asian women who never smoked	Individuals who have smoked at least 30 pack years and if former, quit in previous 15 years	Asian men and women who have smoked and additional risk factor
n	201	26,722	12,011
Positive Screen	Lung-RADS 3 or 4: Solid, part solid nodule ≥6mm; GGO ≥30mm	Non-calcified nodule ≥4mm	Solid nodule >6mm; GGO >5mm
Baseline LDCT Lung Cancer Detection Rate	1.5% (invasive adenocarcinoma)	1.1%	• 2.6% (includes *in situ* and minimally invasive) • 1.5% (invasive adenocarcinoma)

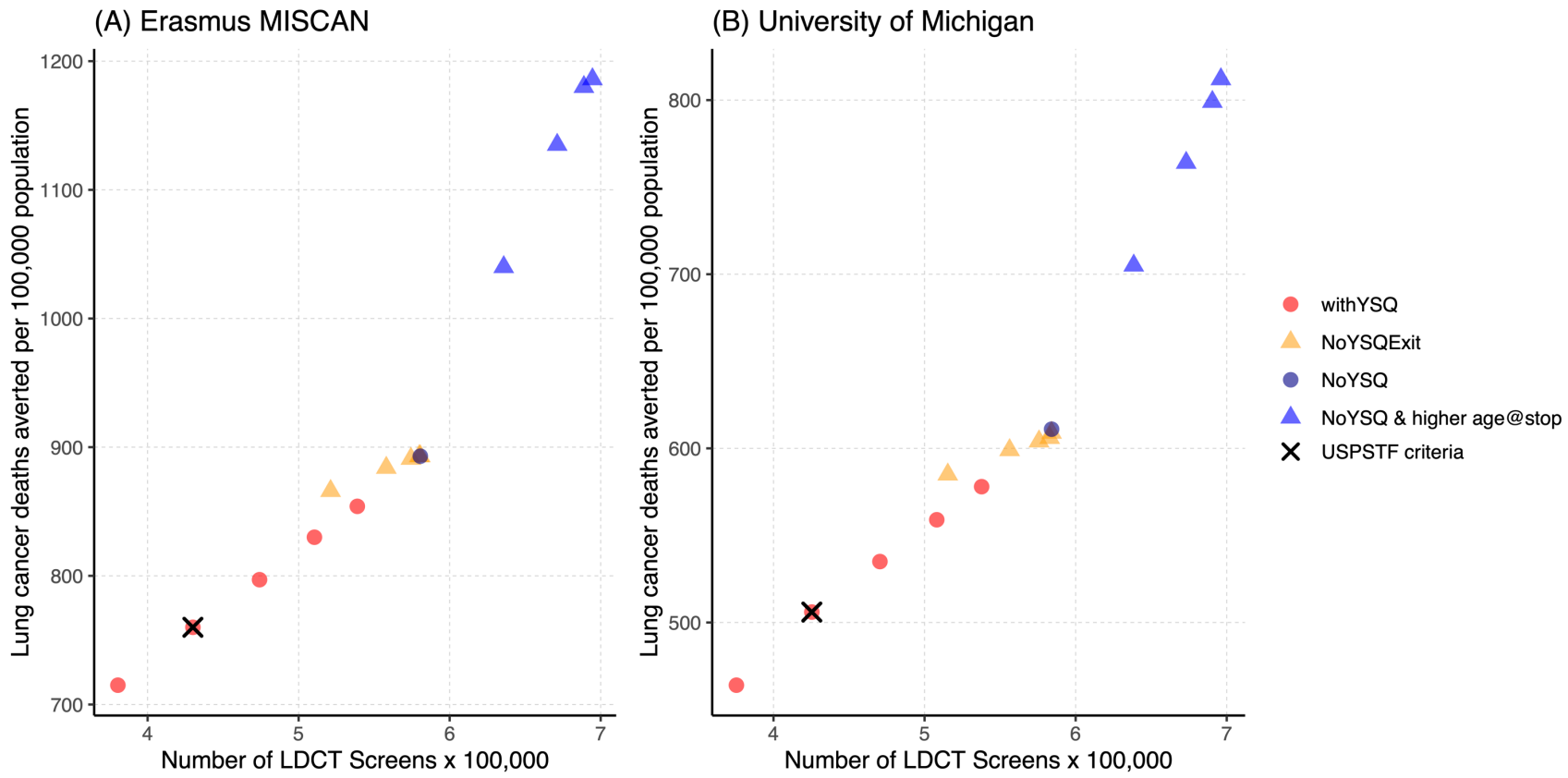
GGO: Groundglass opacity

Updating USPSTF criteria

Assessing the Impact of Increasing Lung Screening Eligibility by Relaxing the Maximum Years since Quit Threshold. A Simulation Modeling Study

YSQ analysis

- Collaboration between CISNET LWG and the American Cancer Society
- Two CISNET LWG models: Erasmus MISCAN and BC Cancer/Michigan
  - 1960 US Birth cohort
- 15 scenarios
  - WithYSQ - changing YSQ criterion in current USPSTF recommendations (YSQ 10,15, 20, 25, 30)
  - NoExitYSQ – Same strategies as above, but enforcing the YSQ criterion only at entry
  - Do not exclude people enrolled in screening who surpass the YSQ threshold
  - NoYSQ – remove YSQ criterion completely
  - NoYSQ and increase the maximum age of screening (80, 85, 90, 95, 100)
- Sensitivity analysis – restrict screening only to those with 5 years or more of life expectancy



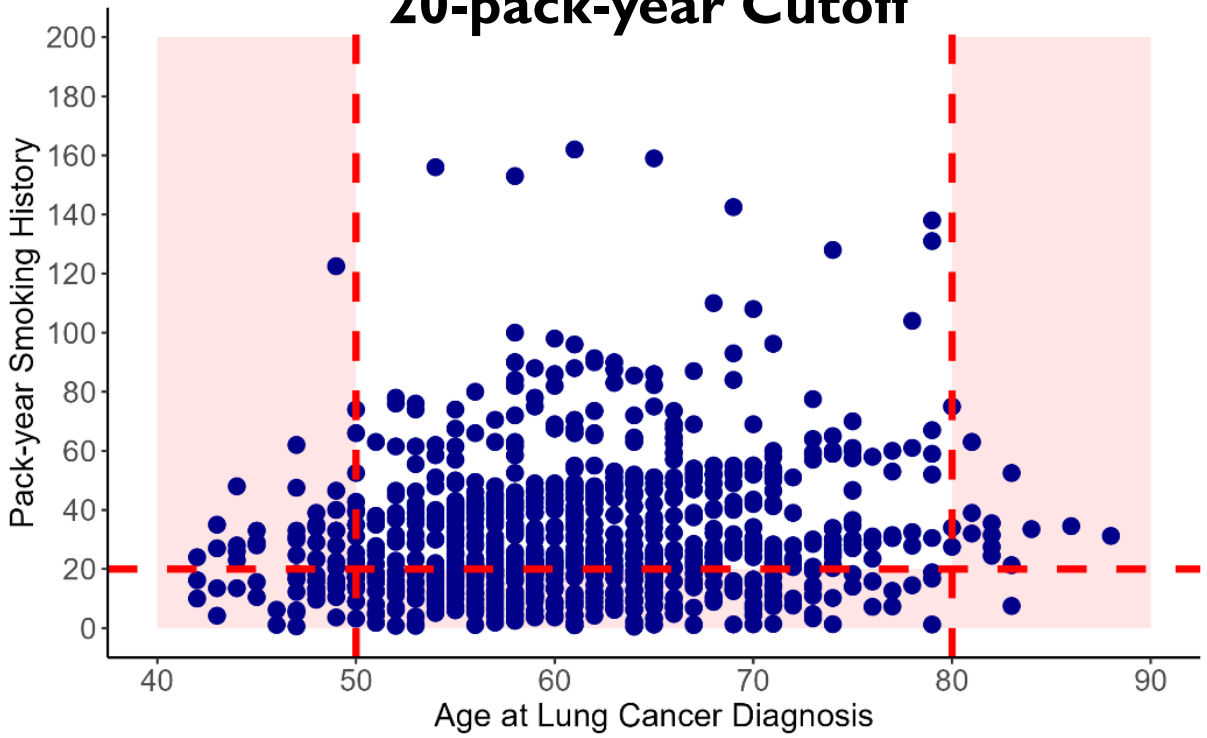
- Relaxing or removing the YSQ criterion results in more screening and increased lung cancer deaths averted

Pack-Year Smoking History: An Inadequate and Biased Measure to Determine Lung Cancer Screening Eligibility

Methods

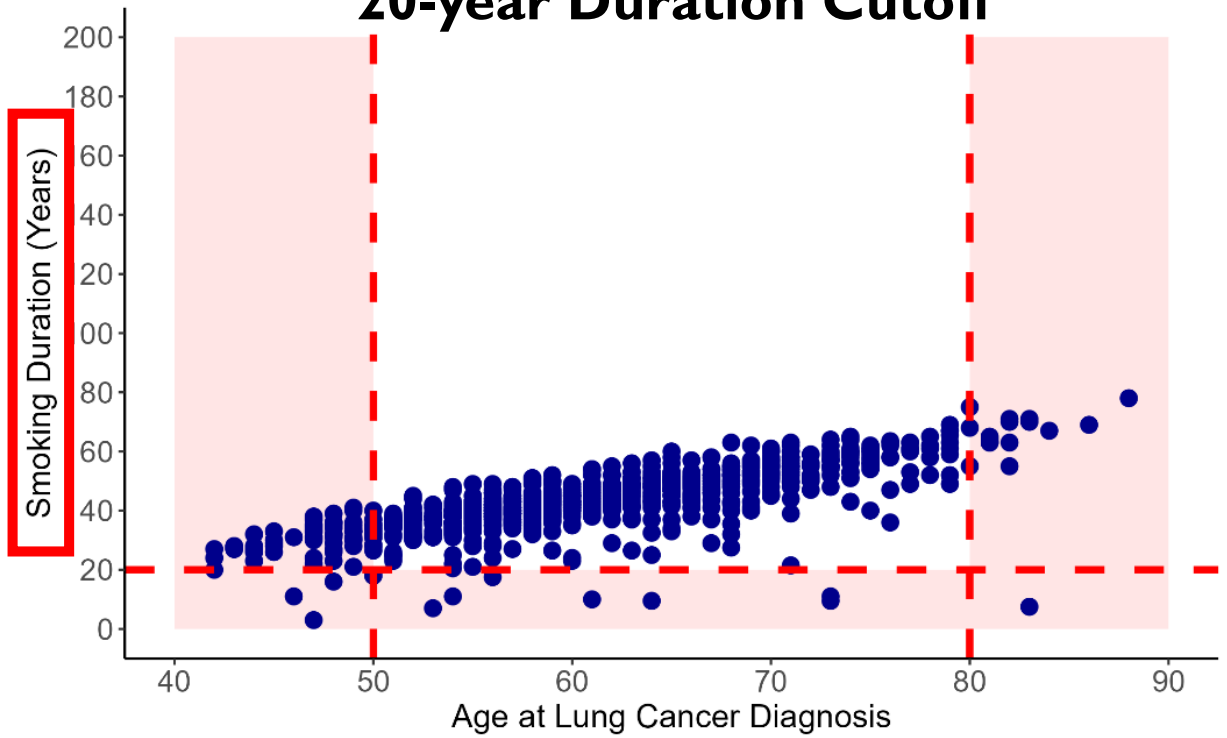
- Inclusion criteria
  - Black and white individuals in the Southern Community Cohort Study (SCCS) who had a history of smoking (n=49,703)
    - 2,140 lung cancer cases in the SCCS
  - Black women in the Black Women's Health Study (BWHS) who had a history of smoking (n=22,126)
    - 486 lung cancer cases in the BWHS
- Statistical analysis:
  - Proportion of individuals who would have qualified under the 2021 USPSTF vs. proposed guideline based on smoking duration was evaluated using Mcnemar's test and the chi-square test

20-pack-year Cutoff



61.8% of Black Lung Cancer Patients Who Currently Smoked Would Have Qualified

20-year Duration Cutoff



92.0% of Black Lung Cancer Patients Who Currently Smoked Would Have Qualified

Incidentally-Detected Lung Cancer in Individuals Who Smoked v Never Smoked in a US Cohort

Methods

- Prospective observational cohort 'Detecting Early Lung Cancer (DELUGE) in the Mississippi Delta'
- Incidentally-detected pulmonary nodules identified and managed by Fleischner Society guidelines.
- We compared individuals in DELUGE who had never smoked with those who had.
- Statistical Methods: Chi-Squared, t-test, Kaplan-Meier, proportional hazards models adjusted for age, sex, race, insurance type, and Charlson score.

Results: Nodules Identified in DELUGE (2015-2022)

24,017 Overall

Lung Cancer Diagnosed in
- 157 of 9,435 (1.7%) of those who had never smoked
- 1,436 of 14,582 (9.8%) of those who had.

Individuals who had never smoked were:

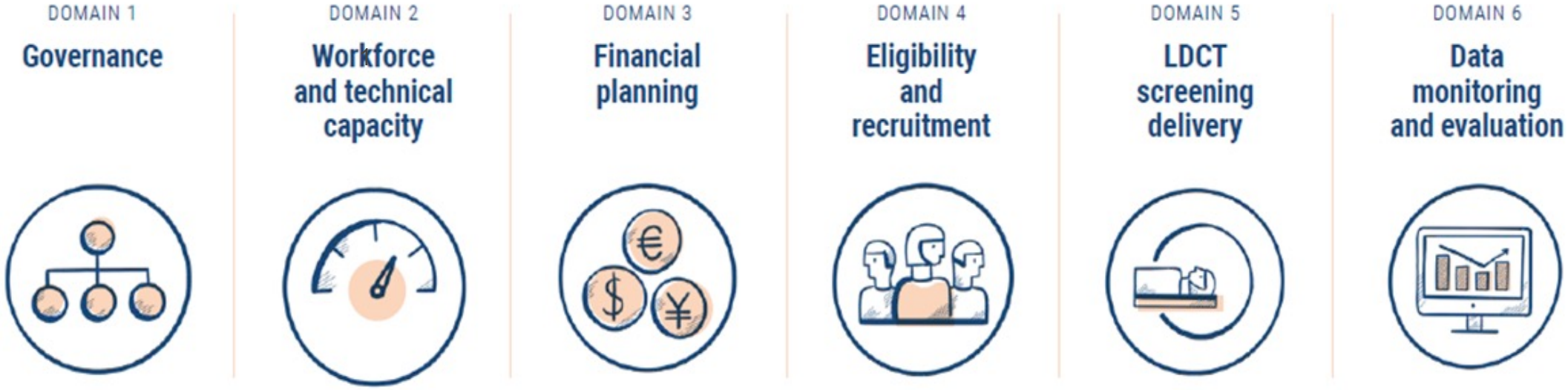
Younger (63 v 65 years, p<0.0001)
More frequently Female (67% v 49%, p<0.0001)
More frequently Black (33% v 25%, p<0.0001)
Less rural residents (18% v 24%, p<0.0001)
Less family history of LC (7% v 10%, p<0.0001)

Longer OS in lung cancer patients who had never smoked

Implementation

A health systems approach was used to help determine how best to implement a screening program within each health system

- Framework covers 6 key areas that will be required for successful implementation of an effective lung cancer screening program:



- Each domain addresses why it is important, and the planning that is needed.

Figure derived from: Lung Cancer Policy Network. 2023. *A framework to support the implementation of LDCT lung cancer screening*. London: The Health Policy Partnership.

A Strategic Plan to Accelerate Lung Cancer Screening:
An American Cancer Society
National Lung Cancer Roundtable Initiative

Final Strategy Rankings: Top 3 of 18 Prioritized Strategies

Information Technology (IT)/Electronic Health Records (EHR) – National consensus on standardizing core EHR elements (tobacco history, data sharing, best practice alerts, quality, risk models, communication, program orders, and education for providers and patients).

Primary Care Practice – Partner with the primary care community to implement lung cancer screening as a quality measure.

Health Equity & Population Gaps – Develop a community engagement, outreach, and advocacy framework to prioritize health equity.

https://nlcrt.org/about/task-groups/lung-cancer-screening-implementation-strategies-task-group/

Lauren S. Rosenthal, MPH, American Cancer Society National Lung Cancer Roundtable, USA

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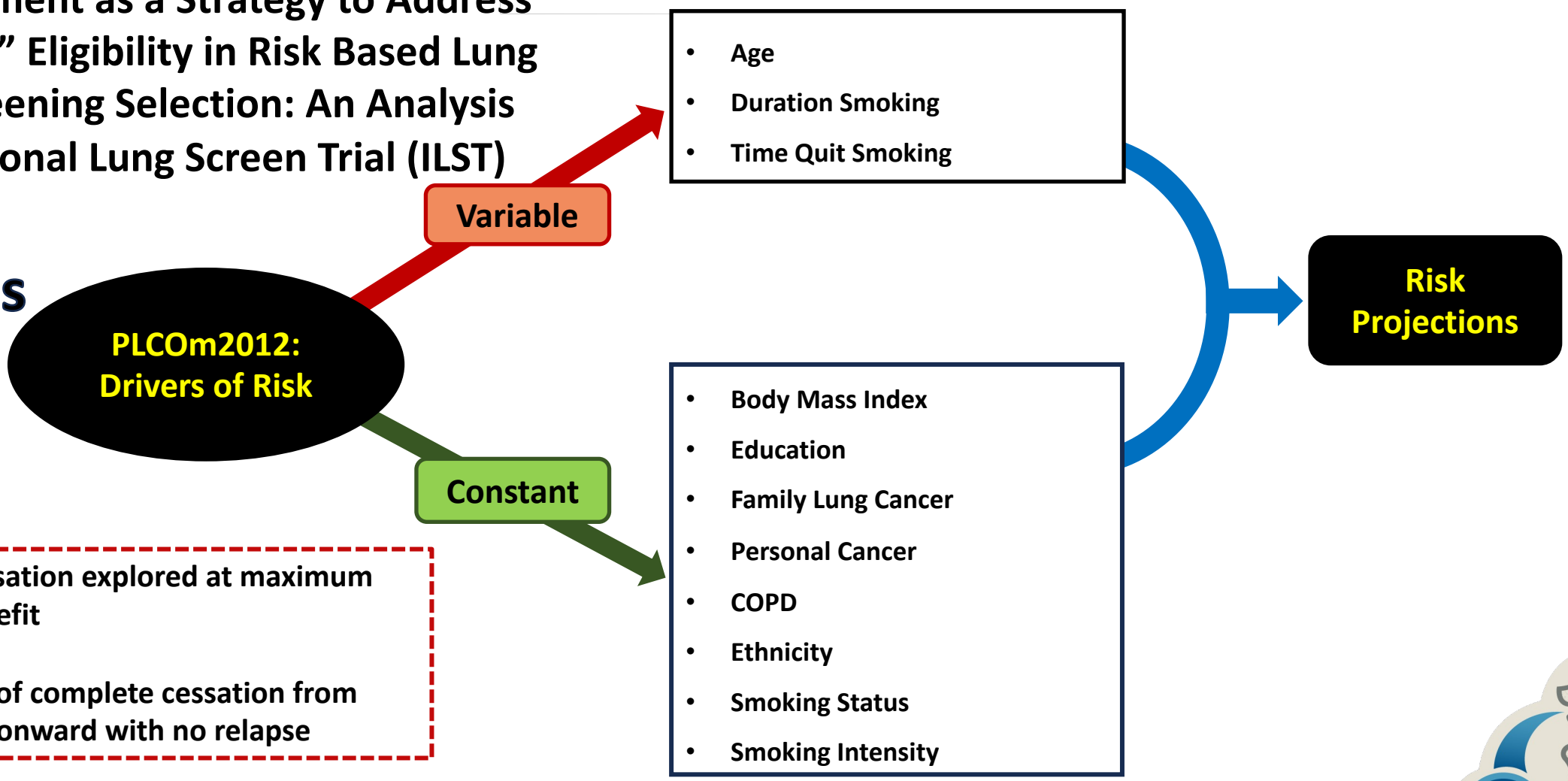
Curtin University

Pre-recruitment as a Strategy to Address "Near-Miss" Eligibility in Risk Based Lung Cancer Screening Selection: An Analysis of International Lung Screen Trial (ILST) Data

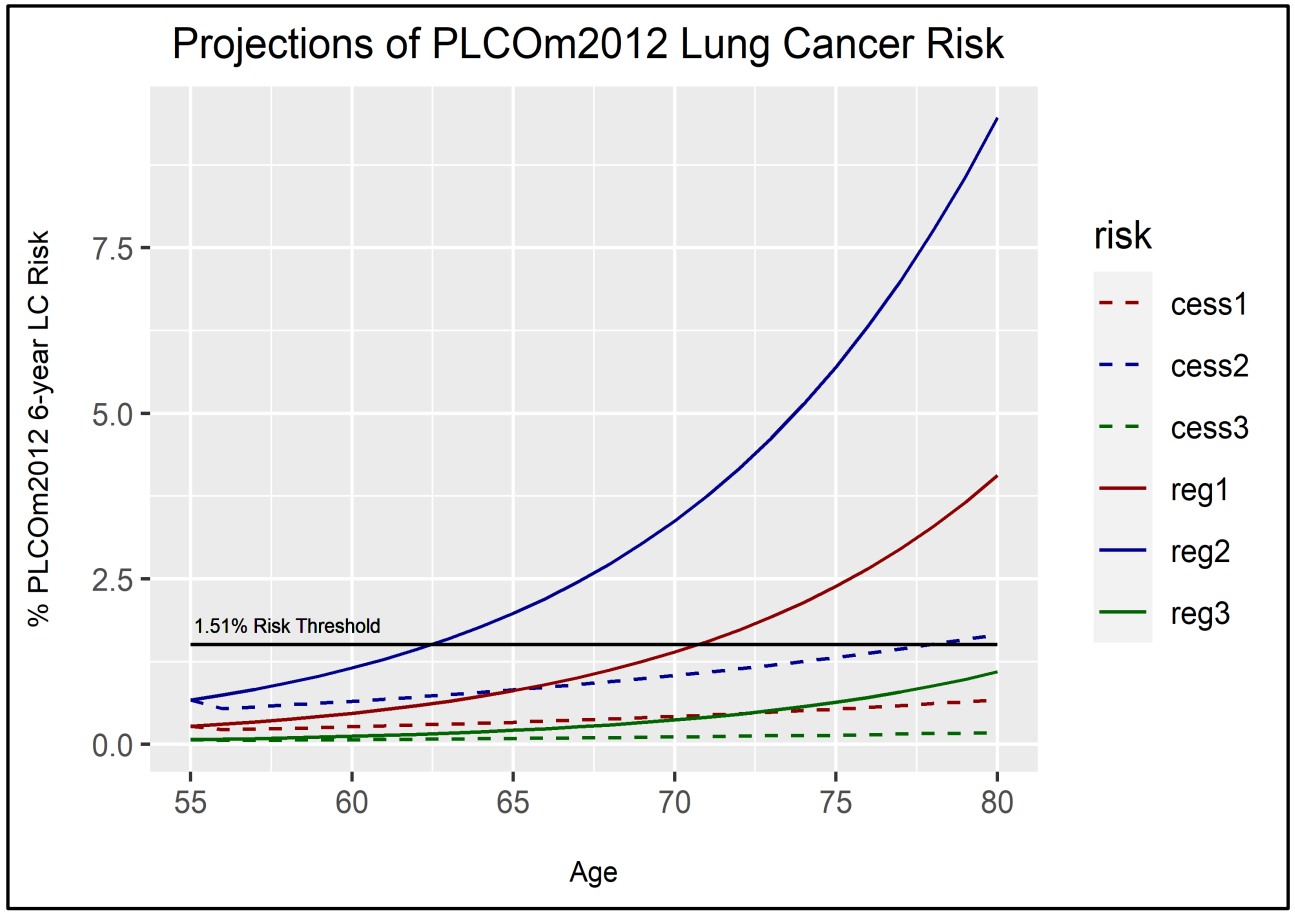
Methods



Smoking cessation explored at maximum possible benefit

Assumption of complete cessation from second year onward with no relapse

Results



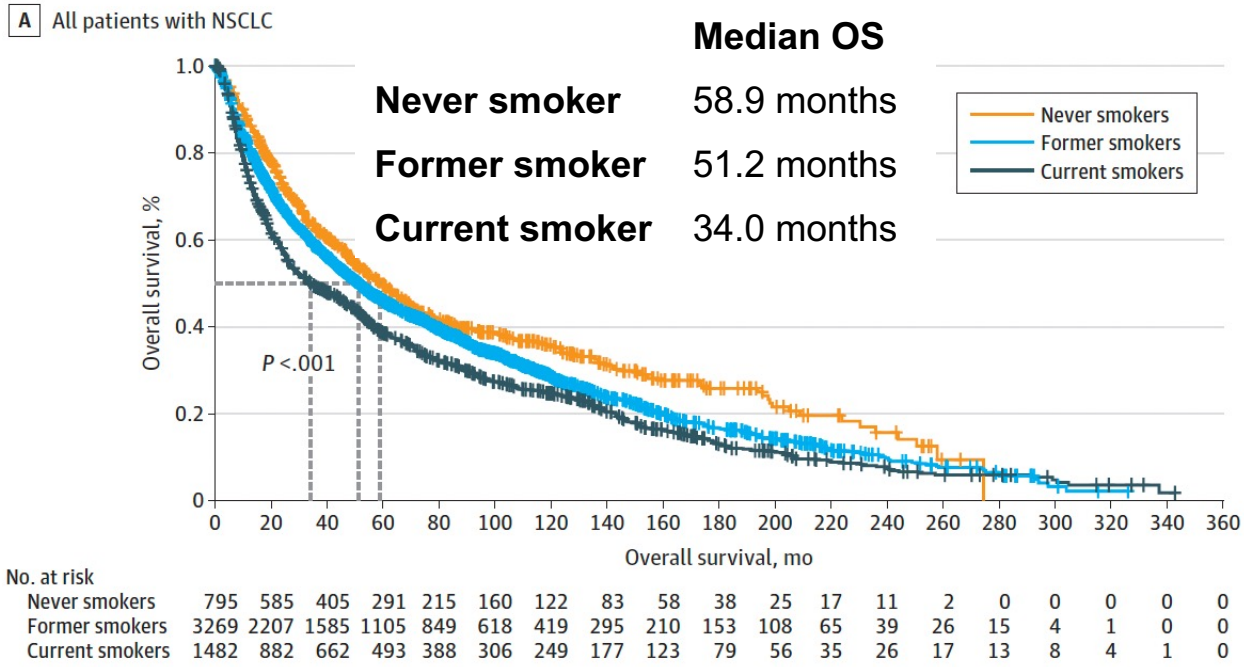
Total (n = 2465)		Median (Inter Quartile Range) / n (%)	Male (53%, n = 1295)	Female (47%, n = 1170)	p – value
Age (years)		61 (58 – 67)	62 (58 – 68)	61 (57 – 66)	0.0018
Body Mass Index		27.2 (24.2– 30.5)	27.7 (25 – 30.9)	26.5 (23.4 – 30.1)	<0.001
Smoking Status	Former	1989 (80.6%)	1059 (43%)	930 (37.7%)	0.1656
	Current	475 (19.3%)	236 (9.6%)	240 (9.7%)	
Chronic Obstructive Pulmonary Disorder		210 (8.5%)	95 (3.9%)	115 (4.7%)	0.0322
Smoking Exposure (Pack Years)		17.5 (9 – 27)	18 (9.75 – 28)	17 (8.5 – 26)	0.0074
Personal Cancer		290 (11.8%)	135 (5.5%)	155 (6.3%)	0.3487
Family Lung Cancer		359 (14.6%)	158 (6.4%)	201 (8.2%)	<0.001

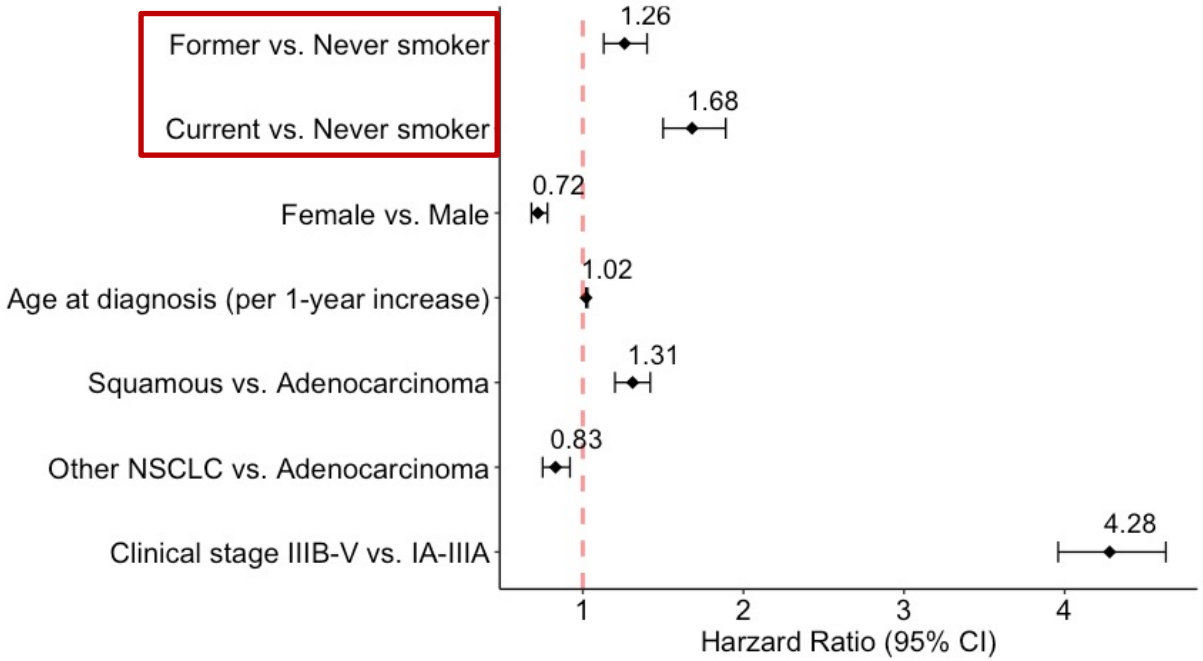
Table 1. Demographic and clinical characteristics of study cohort.

Figure 3. Lung cancer risk trends and impact of smoking cessation

Smoking cessation

Pre-diagnosis smoking status is associated with reduced OS





In adjusted analyses,

- Former vs. Never smokers: HR = 1.26 (95% CI: 1.13 - 1.40, P < .001)
- Current vs. Never smokers: HR = 1.68 (95% CI: 1.50 - 1.89, P < .001)

Factors associated with smoking cessation of participants in national lung cancer screening program in Korea

Results

Figure 2. Change in smoking status after lung cancer screening (unit: %)

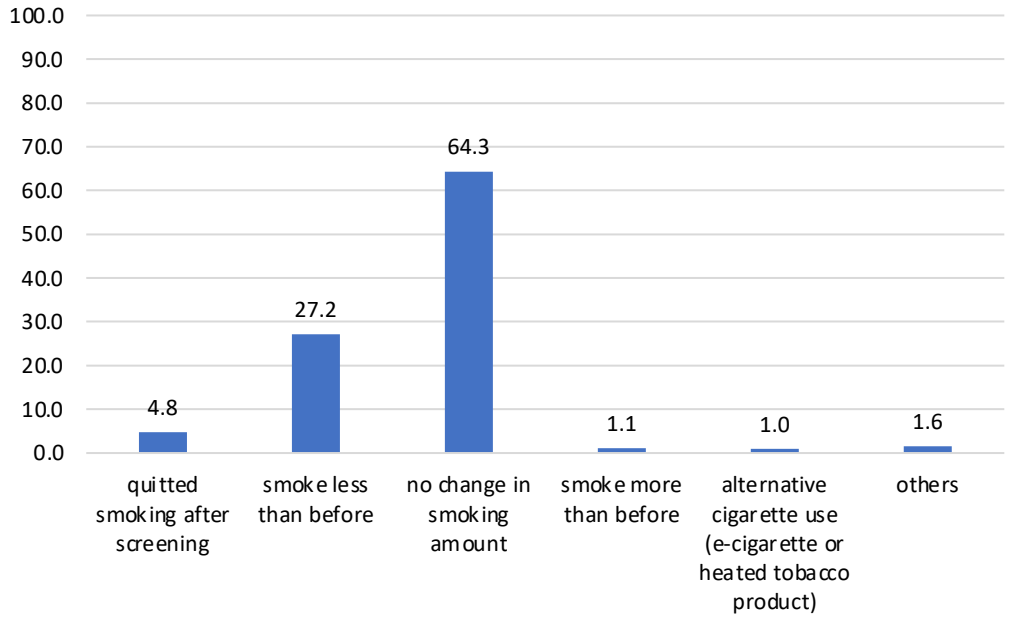


Table1. General characteristics of the study population

Variables (N=1,309)	Total		Success in smoking cessation					Willingness to quit smoking				
			Yes		No		*P-value*	Yes		No		*P-value*
	N	%	N	%	N	%		N	%	N	%	
	1,309	100.0	63	4.8	1,246	95.2		657	50.2	652	49.8	
Participation in result counseling							0.000					0.016
No	685	52.3	17	2.5	668	97.5		322	47.0	363	53.0	
Yes	624	47.7	46	7.4	578	92.6		335	53.7	289	46.3	
Activeness of physician's recommendation							0.000					0.000
Non-participation	685	52.3	17	2.5	668	97.5		322	47.0	363	53.0	
Not active/Normal	298	22.8	10	3.4	288	96.6		118	39.6	180	60.4	
Active	326	24.9	36	11.0	290	89.0		217	66.6	109	33.4	
Sex							0.652					0.983
Men	1277	97.6	62	4.9	1215	95.1		641	50.2	636	49.8	
Women	32	2.4	1	3.1	31	96.9		16	50.0	16	50.0	
Age							0.049					0.776
54-59	227	17.3	9	4.0	218	96.0		116	51.1	111	48.9	
60-64	510	39.0	29	5.7	481	94.3		255	50.0	255	50.0	
65-69	308	23.5	7	2.3	301	97.7		148	48.1	160	51.9	
Over 70	264	20.2	18	6.8	246	93.2		138	52.3	126	47.7	
Educational level							0.556					0.932
Middle school or below	502	38.3	28	5.6	474	94.4		255	50.8	247	49.2	
High school	554	42.3	23	4.2	531	95.8		275	49.6	279	50.4	
University or beyond	253	19.3	12	4.7	241	95.3		127	50.2	126	49.8	
Income level							0.623					0.331
Less than 1.99 million KRW	707	54.0	36	5.1	671	94.9		356	50.4	351	49.6	
2-3.99 million KRW	444	33.9	18	4.1	426	95.9		230	51.8	214	48.2	
≥4 million KRW	158	12.1	9	5.7	149	94.3		71	44.9	87	55.1	
Marital status							0.245					0.364
Never-married	54	4.1	3	5.6	51	94.4		29	53.7	25	46.3	
Married	1054	80.5	55	5.2	999	94.8		536	50.9	518	49.1	
Seperated/divorced/widowed	201	15.4	5	2.5	196	97.5		92	45.8	109	54.2	
Region							0.068					0.137
Metropolitan	383	29.3	12	3.1	371	96.9		180	47.0	203	53.0	
Medium and small city/Rural	926	70.7	51	5.5	875	94.5		477	51.5	449	48.5	
Abnormal findings							0.000					0.932
No/don't know	1008	77.0	28	2.8	980	97.2		461	45.7	547	54.3	
Yes	301	23.0	35	11.6	266	88.4		196	65.1	105	34.9	
Interpretation of examination reports							0.967					0.175
Easy	844	64.5	41	4.9	803	95.1		419	49.6	425	50.4	
Normal	286	21.8	13	4.5	273	95.5		137	47.9	149	52.1	
Hard	179	13.7	9	5.0	170	95.0		101	56.4	78	43.6	
Pack-year							0.342					0.000
<40 pack-year	679	51.9	29	4.3	650	95.7		379	55.8	300	44.2	
≥40 pack-year	630	48.1	34	5.4	596	94.6		278	44.1	352	55.9	

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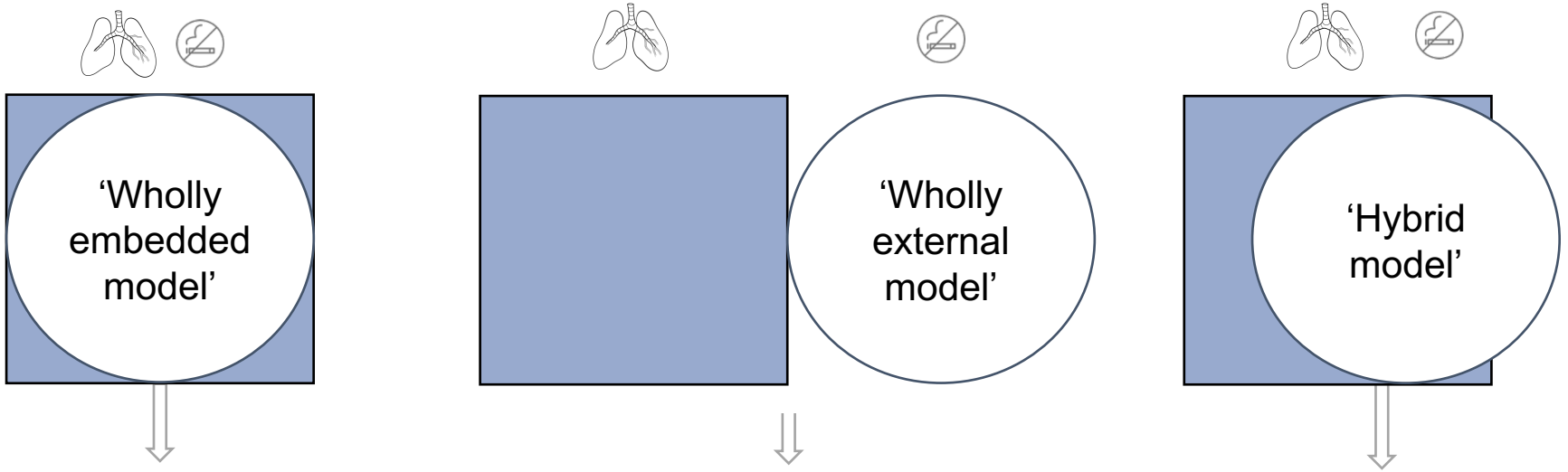
Embedding Smoking Cessation into a Potential Lung Cancer Screening Program: Australian Tobacco Control Expert Perspectives



Preference of *n*=5 **(17%)**:

- resource-intensive
- lower feasibility.

Partially embedded/ telehealth also suggested

No outright support:

- insufficient to engage participants for uptake
- other models required

Preference of *n*=17 **(57%)**, to maximise:

- cost-effectiveness
- extent of cessation supports that could be offered

"So why wouldn't you connect to Quitline and refer people there for this, for that behavioural intervention component? And then ideally the people would be walking away with appointments…and pharmacotherapy…"

[#05, researcher]

Nathan Harrison, Flinders University, Australia | nathan.harrison@flinders.edu.au | @nathan_harrison

Unpublished results in progress

MA03.09

Thanks!