EPA Region 3 Radon Stakeholder Meeting

Keynote:

Lung Cancer:
Causes, Diagnosis, Treatment and Screening

9/26/2023

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Cancer Institute

Thanks to

US Environmental Protection Agency

Pennsylvania Department of Environmental Protection

Rich Negrin, Secretary
Robert Lewis, Radon Division Chief

Kansas State University National Radon Program Services

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Cancer Institute

Keynote Outline

Introduction and Epidemiology

Rebecca Bascom MD MPH

Professor of Medicine and Public Health Sciences

Frontline Lung Cancer Diagnosis, Treatment and Screening

Yu Maw Htwe MBBS

Assistant Professor of Medicine, Interventional Pulmonology

Radon, Environmental Justice and Vulnerable Populations

Mia Ray BS

Pulmonary Research Specialist

Questions and Discussion

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Epidemiology: United States Lung Cancer

- Annual new cases :
  - 117,190 males,
  - 118,830 females

2 among all cancers

- Annual deaths:
  - 68, 820 males
  - 61, 360 females

1 among all cancers

Based on data from SEER 17 (2012–2018), https://seer.cancer.gov/canques/survival.html
American Cancer Society, Cancer Statistics 2022, https://www.cancer.org/research/cancer-facts-statistics/all-cancer-facts-figures/cancer-facts-figures-2022.html

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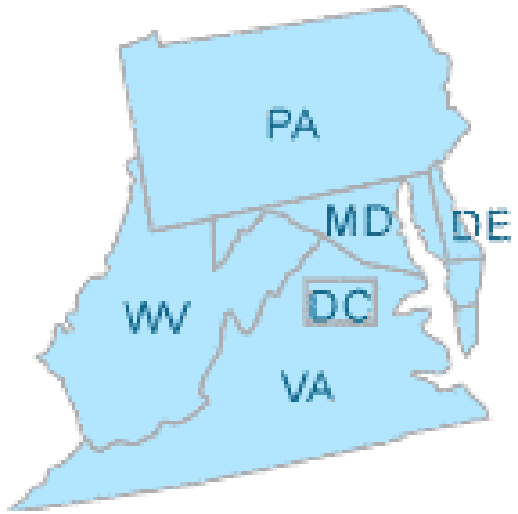
PennState Cancer Institute

Lung Cancer in EPA Region 3

Site	New Cases*	5 Year Survival (%)
Pennsylvania	62	26.8
West Virginia	78.3	20.4
Maryland	54.2	26.8
Delaware	62.2	26
D.C.	44.2	27.7
Virginia	53.9	Not available
National	56.7	25



* Age-adjusted incidence rate/100,000

Source https://www.lung.org/research/state-of-lung-cancer

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Tobacco Use in the United States*

Northeast 10.4%
Midwest 14.0%
South 12.4%
West 8.9%

White, non-Hispanic 12.9%
Black, non-Hispanic 11.7%
Asian, non-Hispanic 5.4%
Hispanic 7.7%

18-24 years 5.3%
25-44 12.6%
45-64 14.9%
≥ 65 8.3%

Male 13.1%
Female 10.1%

*Every day or some days

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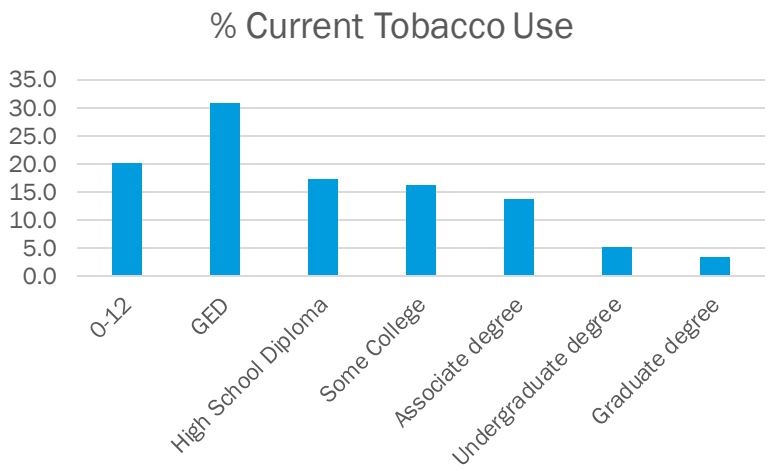
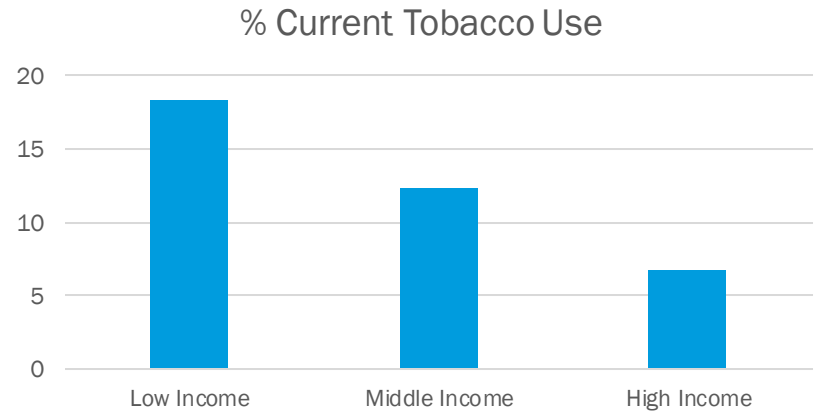
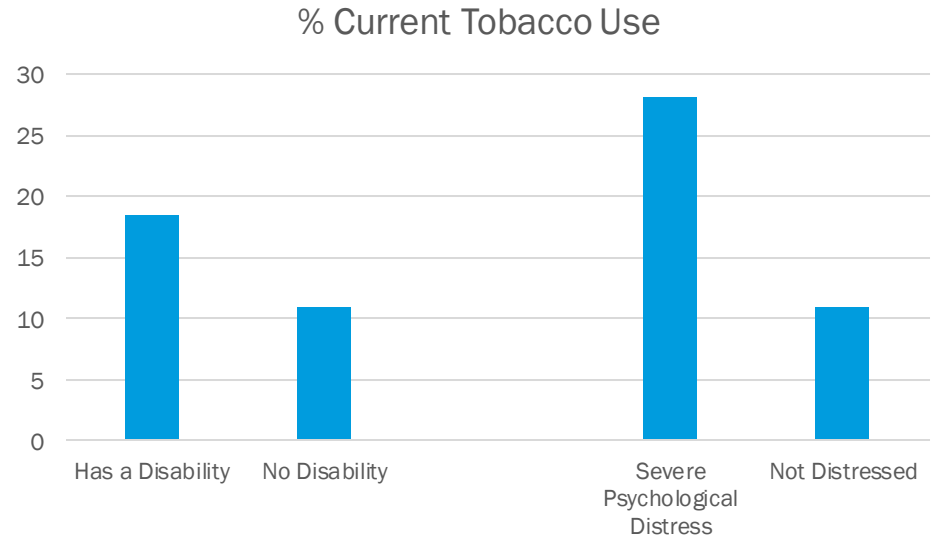
Tobacco Use in the United States*







*Every day or some days

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Common Lung Cancer Risk Factors

South Carolina Department of Health and Environmental Control

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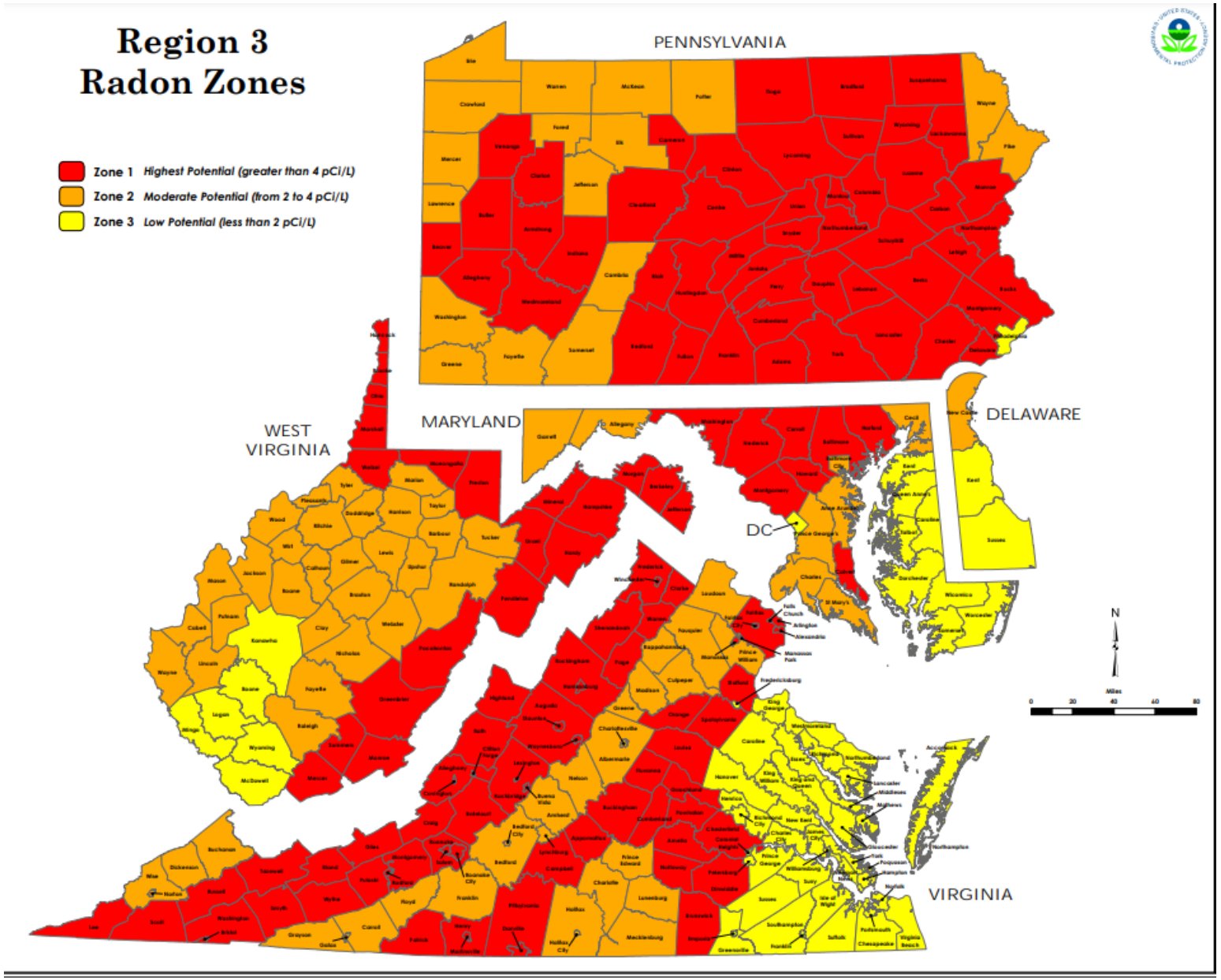

https://19january2017snapshot.epa.gov/sites/production/files/2015-01/documents/radon_zones_new_region3.pdf

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Synergistic Risk Factors

Table 1: Radon Exposure in Smokers vs. Nonsmokers

If 1,000 people were exposed to this level over a lifetime*		
Radon Level	**Smokers**	**Non-smokers**
20 pCi/L	About 260 people could get lung cancer	About 36 people could get lung cancer
8 pCi/L	About 20 people could get lung cancer	About 15 people could get lung cancer
4 pCi/L	About 62 people could get lung cancer	About 7 people could get lung cancer

2022_MARTIN-THESIS_JHU EJ Eval of Radon in Penn Schools-2022.pdf

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Frontline Lung Cancer Diagnosis, Treatment and Screening

Presented to EPA Region 3 Radon Stakeholder Meeting

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Date : 09/26/2023

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OUTLINE

- Why Early Detection Matters
- Diagnosis and Staging
- Treatment
- The Future: Lung Cancer Screening

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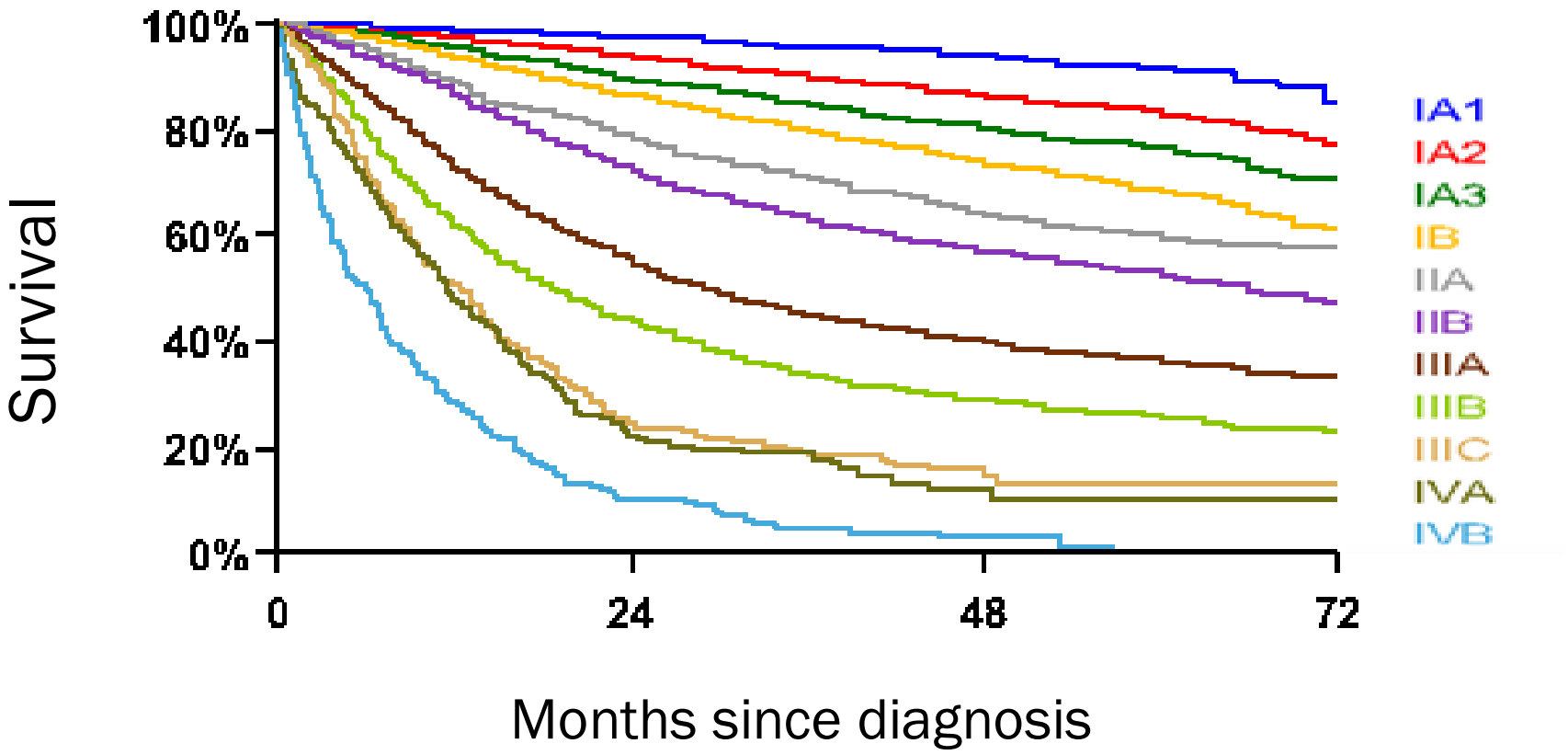
Early Detection = Better Prognosis



Early Stage, Localized at Diagnosis

Regional Spread

Distant Spread, Metastasized

The IASLC Lung Cancer Staging Project: Proposals for Revision of the TNM Stage Groupings in the Forthcoming (Eighth) Edition of the TNM Classification for Lung Cancer

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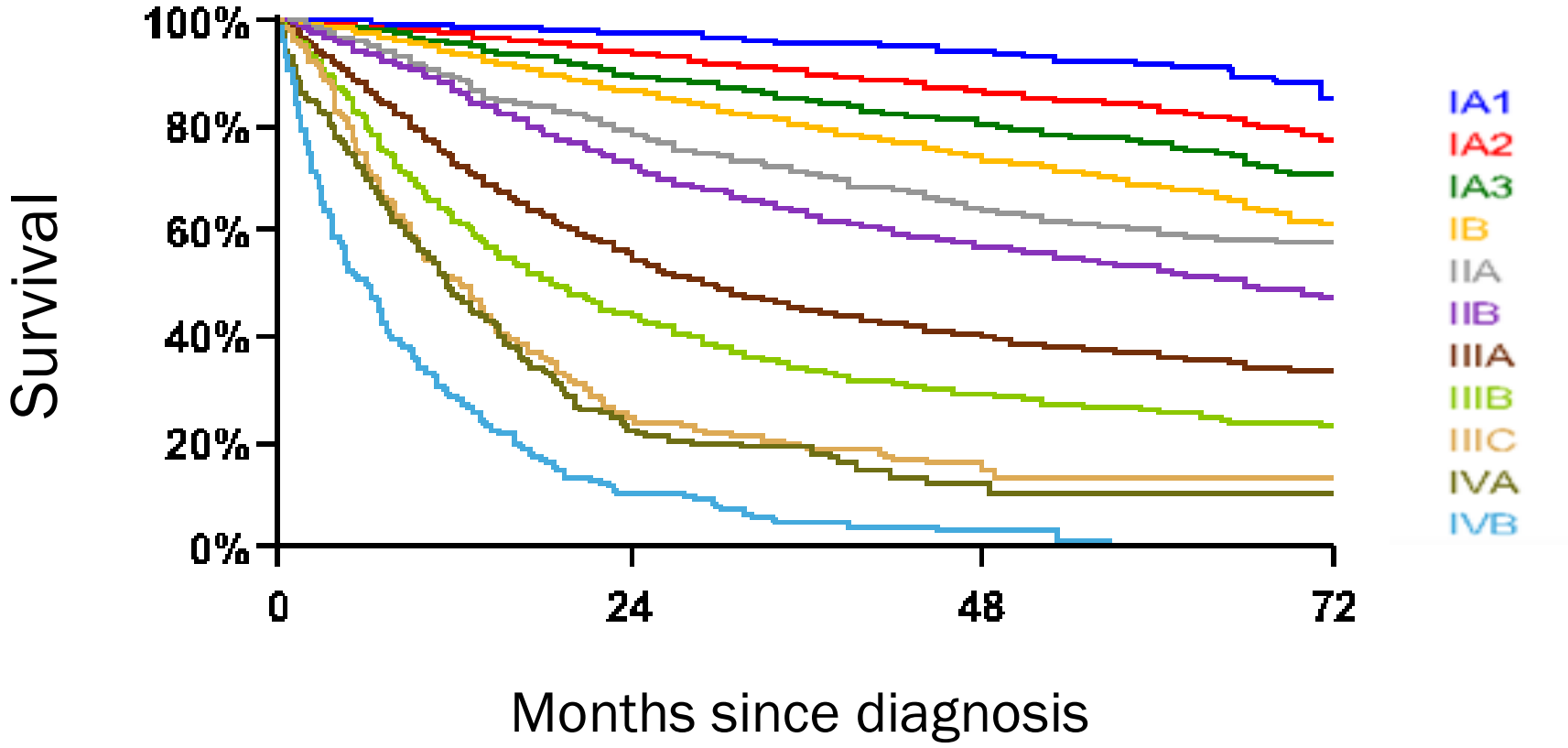


Stage at Diagnosis in Pennsylvania, 2022

26%

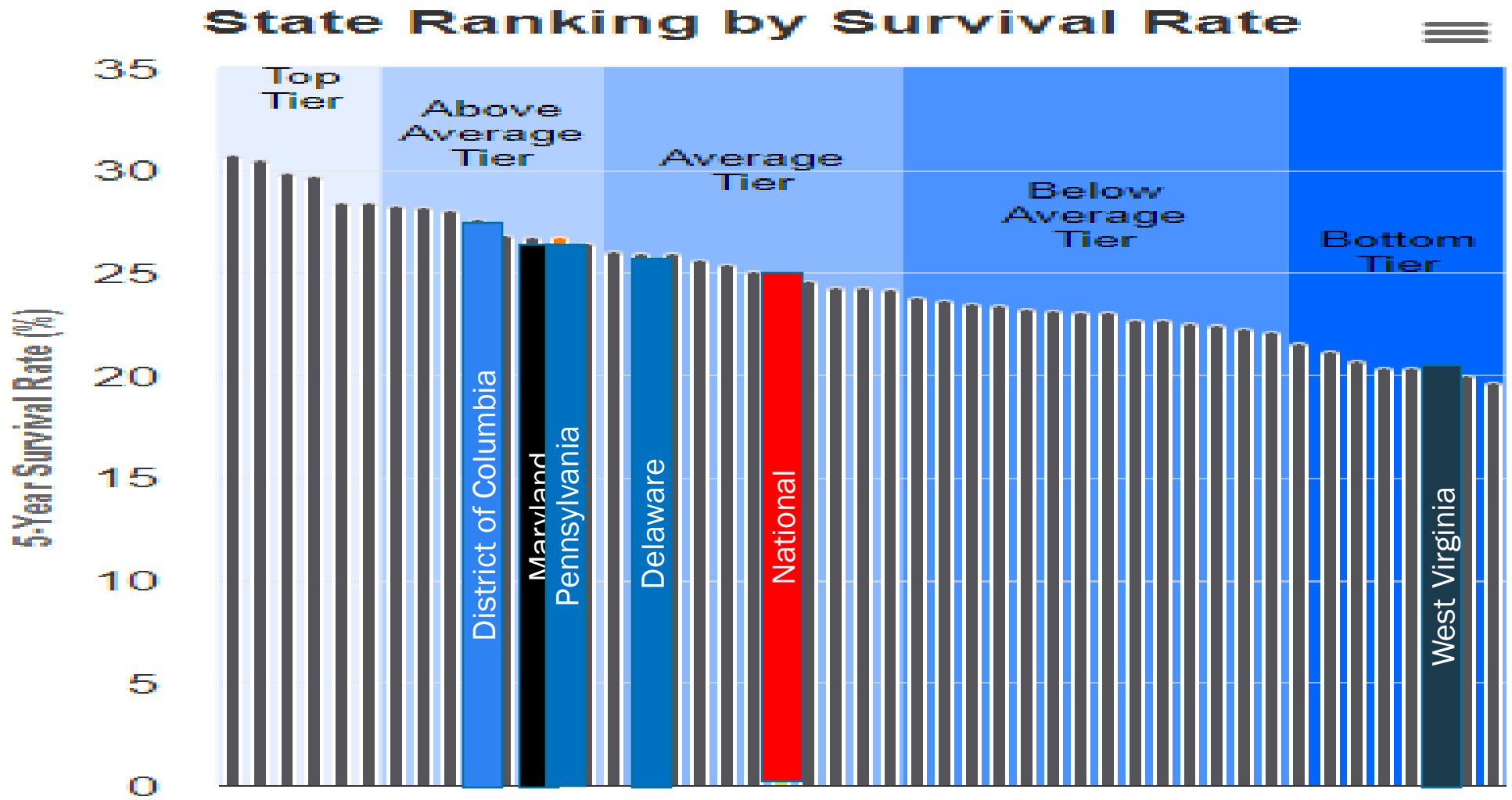
22%

44%

(9% unstaged)

The IASLC Lung Cancer Staging Project: Proposals for Revision of the TNM Stage Groupings in the Forthcoming (Eighth) Edition of the TNM Classification for Lung Cancer

Surviving Lung Cancer in EPA Region 3



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OUTLINE

- Why Early Detection Matters
- Diagnosis and Staging
- Treatment
- The Future: Lung Cancer Screening

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Steps in Lung Cancer Diagnosis and Staging

- Recognizing Evaluation is Needed
  - Symptoms
  - Screening (will discuss later)

- Diagnosing the type of lung cancer
  - Tissue sample by bronchoscopy, transthoracic, or surgical biopsy
  - Pathology and molecular analysis

- Diagnosing the stage of lung cancer

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Common symptoms leading to evaluation for lung cancer

Symptom	Patients (percent)
Cough	45-74
Weight loss	46-68
Dyspnea	37-58
Chest pain	27-49
Hemoptysis	27-29
Bone pain	20-21
Hoarseness	8-18

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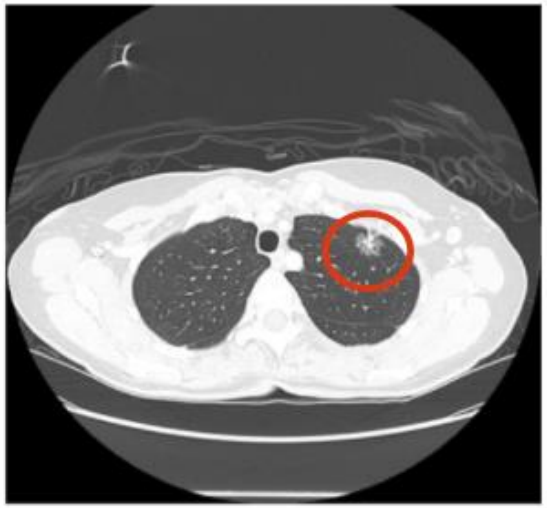
Modified from: Hyde, L, Hyde, CI. Chest 1974; 65:299-306 and Chute CG, et al. Cancer 1985; 56:2107-2111.

Pulmonary Nodules:
Earliest warning of possible lung cancer

GGO



Part solid, part GGO

Solid

Solitary pulmonary nodule (SPN)

- Single, spherical, well-circumscribed, radiographic opacity less than or equal to 30 mm in diameter, surrounded by aerated lung and not associated with atelectasis, hilar enlargement or pleural effusion

Ost et al, Clinical practice. The solitary pulmonary nodule, NEJM 2003
Gould et al, Evaluation of patients with pulmonary nodules, ACCP clinical practice guideline (2nd Ed), Chest 2007

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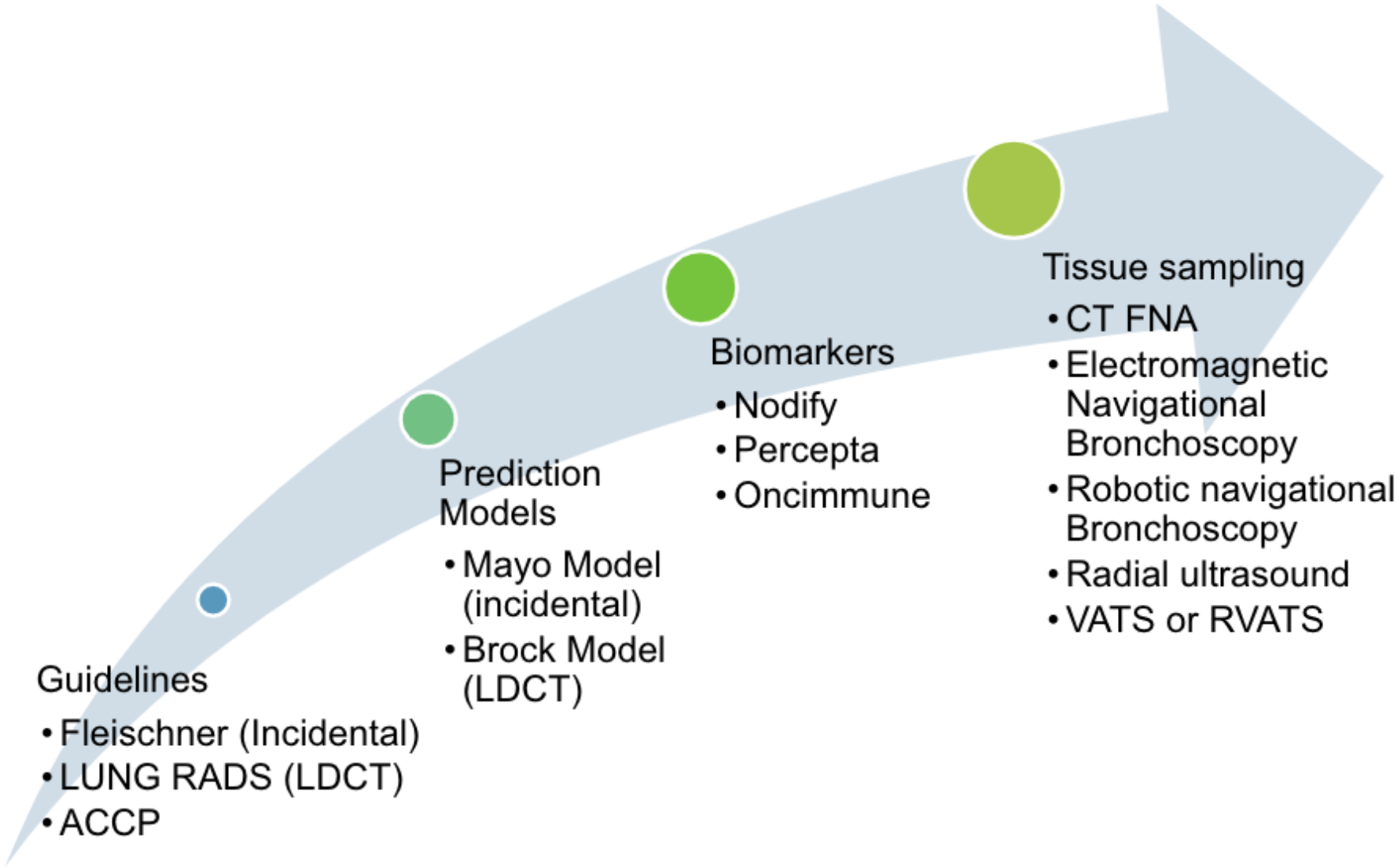
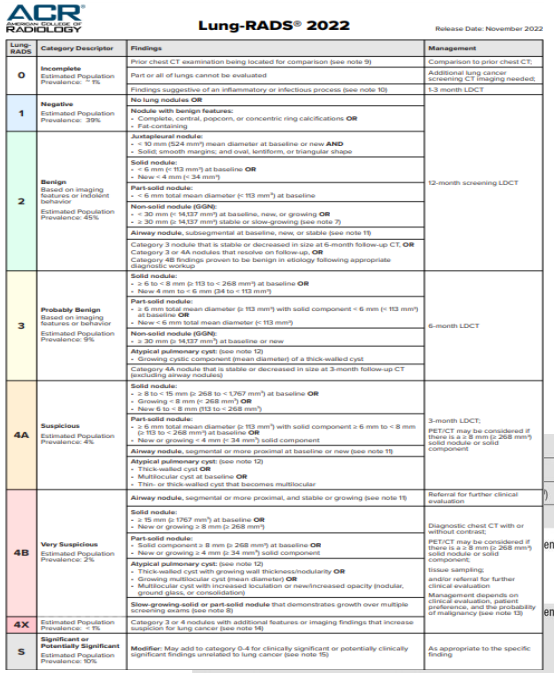
Tools to risk stratify and diagnose lung nodules



Detailed prediction models have been developed



ACR AMERICAN COLLEGE OF RADIOLOGY

Lung-RADS® 2022

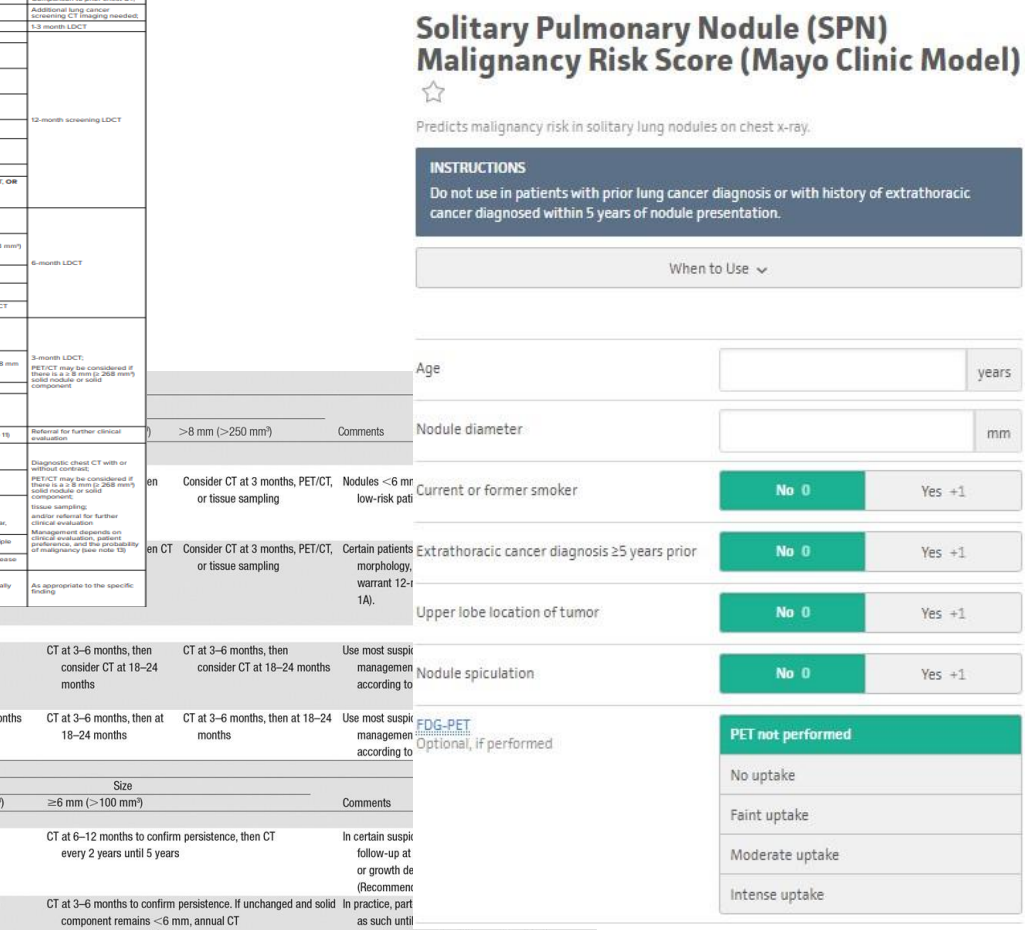
Release Date: November 2022

Lung-RADS	Category Descriptor	Findings	Management
0	**Incomplete** Estimated Population Prevalence: ~ 1%	Prior chest CT examination being located for comparison (see note 9)	Comparison to prior chest CT;
		Part or all of lungs cannot be evaluated	Additional lung cancer screening CT imaging needed;
		Findings suggestive of an inflammatory or infectious process (see note 10)	1-3 month LDCT
1	**Negative** Estimated Population Prevalence: 39%	**No lung nodules OR** **Nodule with benign features:** • Complete, central, popcorn, or concentric ring calcifications **OR** • Fat-containing	12-month screening LDCT
2	**Benign** Based on imaging features or indolent behavior Estimated Population Prevalence: 45%	**Juxtapleural nodule:** • < 10 mm (524 mm³) mean diameter at baseline or new **AND** • Solid; smooth margins; and oval, lentiform, or triangular shape **Solid nodule:** • < 6 mm (< 113 mm³) at baseline **OR** • New < 4 mm (< 34 mm³) **Part-solid nodule:** • < 6 mm total mean diameter (< 113 mm³) at baseline **Non-solid nodule (GGN):** • < 30 mm (< 14,137 mm³) at baseline, new, or growing **OR** • ≥ 30 mm (≥ 14,137 mm³) stable or slow-growing (see note 7) **Airway nodule**, subsegmental at baseline, new, or stable (see note 11) Category 3 nodule that is stable or decreased in size at 6-month follow-up CT, **OR** Category 3 or 4A nodules that resolve on follow-up, **OR** Category 4B findings proven to be benign in etiology following appropriate diagnostic workup	
3	**Probably Benign** Based on imaging features or behavior Estimated Population Prevalence: 9%	**Solid nodule:** • ≥ 6 to < 8 mm (≥ 113 to < 268 mm³) at baseline **OR** • New 4 mm to < 6 mm (34 to < 113 mm³) **Part-solid nodule:** • ≥ 6 mm total mean diameter (≥ 113 mm³) with solid component < 6 mm (< 113 mm³) at baseline **OR** • New < 6 mm total mean diameter (< 113 mm³) **Non-solid nodule (GGN):** • ≥ 30 mm (≥ 14,137 mm³) at baseline or new **Atypical pulmonary cyst:** (see note 12) • Growing cystic component (mean diameter) of a thick-walled cyst Category 4A nodule that is stable or decreased in size at 3-month follow-up CT (excluding airway nodules)	6-month LDCT
4A	**Suspicious** Estimated Population Prevalence: 4%	**Solid nodule:** • ≥ 8 to < 15 mm (≥ 268 to < 1,767 mm³) at baseline **OR** • Growing < 8 mm (< 268 mm³) **OR** • New 6 to < 8 mm (113 to < 268 mm³) **Part-solid nodule:** • ≥ 6 mm total mean diameter (≥ 113 mm³) with solid component ≥ 6 mm to < 8 mm (≥ 113 to < 268 mm³) at baseline **OR** • New or growing < 4 mm (< 34 mm³) solid component **Airway nodule**, segmental or more proximal at baseline or new (see note 11) **Atypical pulmonary cyst:** (see note 12) • Thick-walled cyst **OR** • Multilocular cyst at baseline **OR** • Thin- or thick-walled cyst that becomes multilocular	3-month LDCT; PET/CT may be considered if there is a ≥ 8 mm (≥ 268 mm³) solid nodule or solid component
4B	**Very Suspicious** Estimated Population Prevalence: 2%	**Airway nodule**, segmental or more proximal, and stable or growing (see note 11)	Referral for further clinical evaluation
		Solid nodule: • ≥ 15 mm (≥ 1767 mm³) at baseline **OR** • New or growing ≥ 8 mm (≥ 268 mm³)	Diagnostic chest CT with or without contrast;
		Part-solid nodule: • Solid component ≥ 8 mm (≥ 268 mm³) at baseline **OR** • New or growing ≥ 4 mm (≥ 34 mm³) solid component	PET/CT may be considered if there is a ≥ 8 mm (≥ 268 mm³) solid nodule or solid component;
		Atypical pulmonary cyst: (see note 12) • Thick-walled cyst with growing wall thickness/nodularity **OR** • Growing multilocular cyst (mean diameter) **OR** • Multilocular cyst with increased loculation or new/increased opacity (nodular, ground glass, or consolidation)	tissue sampling; and/or referral for further clinical evaluation
		Slow-growing-solid or part-solid nodule that demonstrates growth over multiple screening exams (see note 8)	Management depends on clinical evaluation, pattern of behavior, and the probability of malignancy (see note 13)
4X	Estimated Population Prevalence: < 1%	Category 3 or 4 nodules with additional features or imaging findings that increase suspicion for lung cancer (see note 14)	
S	**Significant or Potentially Significant** Estimated Population Prevalence: 10%	**Modifier:** May add to category 0-4 for clinically significant or potentially clinically significant findings unrelated to lung cancer (see note 15)	As appropriate to the specific finding

			>8 mm (>250 mm³)	Comments
Multiple				
Low risk†	No routine follow-up	CT at 3–6 months, then consider CT at 18–24 months	CT at 3–6 months, then consider CT at 18–24 months	Use most suspic management according to
High risk†	Optional CT at 12 months	CT at 3–6 months, then at 18–24 months	CT at 3–6 months, then at 18–24 months	Use most suspic management according to

B: Subsolid Nodules*

	Size		
Nodule Type	<6 mm (<100 mm³)	≥6 mm (>100 mm³)	Comments
Single			
Ground glass	No routine follow-up	CT at 6–12 months to confirm persistence, then CT every 2 years until 5 years	In certain suspic follow-up at or growth de (Recommend
Part solid	No routine follow-up	CT at 3–6 months to confirm persistence. If unchanged and solid component remains <6 mm, annual CT should be performed for 5 years.	In practice, part as such until do not usually require follow-up. Persistent part-solid nodules with solid components ≥6 mm should be considered highly suspicious (recommendations 4A-4C)
Multiple	CT at 3–6 months. If stable, consider CT at 2 and 4 years.	CT at 3–6 months. Subsequent management based on the most suspicious nodule(s).	Multiple <6 mm pure ground-glass nodules are usually benign, but consider follow-up in selected patients at high risk at 2 and 4 years (recommendation 5A).



Solitary Pulmonary Nodule (SPN) Malignancy Risk Score (Mayo Clinic Model)

Predicts malignancy risk in solitary lung nodules on chest x-ray.

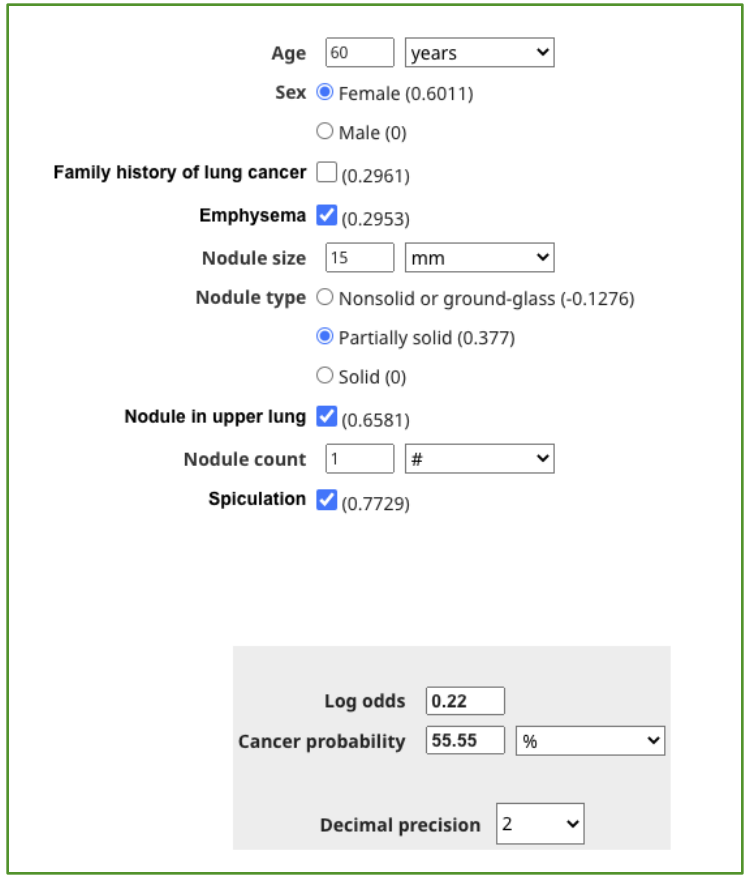
INSTRUCTIONS

Do not use in patients with prior lung cancer diagnosis or with history of extrathoracic cancer diagnosed within 5 years of nodule presentation.

When to Use

Age		years
Nodule diameter		mm
Current or former smoker	No 0	Yes +1
Extrathoracic cancer diagnosis ≥5 years prior	No 0	Yes +1
Upper lobe location of tumor	No 0	Yes +1
Nodule spiculation	No 0	Yes +1
FDG-PET Optional, if performed	PET not performed	
	No uptake	
	Faint uptake	
	Moderate uptake	
	Intense uptake	

Brock University cancer prediction equation



Age	60	years
Sex	◉ Female (0.6011)	
	○ Male (0)	
Family history of lung cancer	☐ (0.2961)	
Emphysema	☑ (0.2953)	
Nodule size	15	mm
Nodule type	○ Nonsolid or ground-glass (-0.1276)	
	◉ Partially solid (0.377)	
	○ Solid (0)	
Nodule in upper lung	☑ (0.6581)	
Nodule count	1	#
Spiculation	☑ (0.7729)	
Log odds	0.22	
Cancer probability	55.55	%
Decimal precision	2	

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Tissue Sampling

- Traditional gold standard test or peripheral pulmonary nodule
  - CT guided biopsy
  - Pool sensitivity 90% (70-82% <1.5 cm)
  - Higher complication rate : pneumothorax (up to 15-42%), hemorrhage, air embolism, needle tract implants

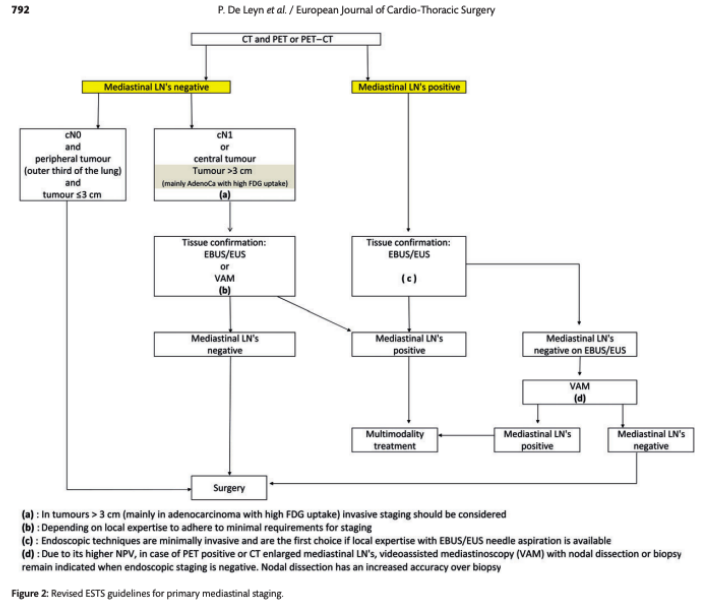

Figure 2: Revised ESTS guidelines for primary mediastinal staging.

- Bronchoscopic strategies for peripheral pulmonary nodules
  - Radial EBUS, thin and ultra thin scope, fluoroscopy guidance
  - Virtual navigational bronchoscopy
  - Electromagnetic navigational bronchoscopy
  - Robotic navigation bronchoscopy

Algorithms guide decision-making for tissue sampling options

Schreiber et al Chest 2003
Gould et al Chest 2013

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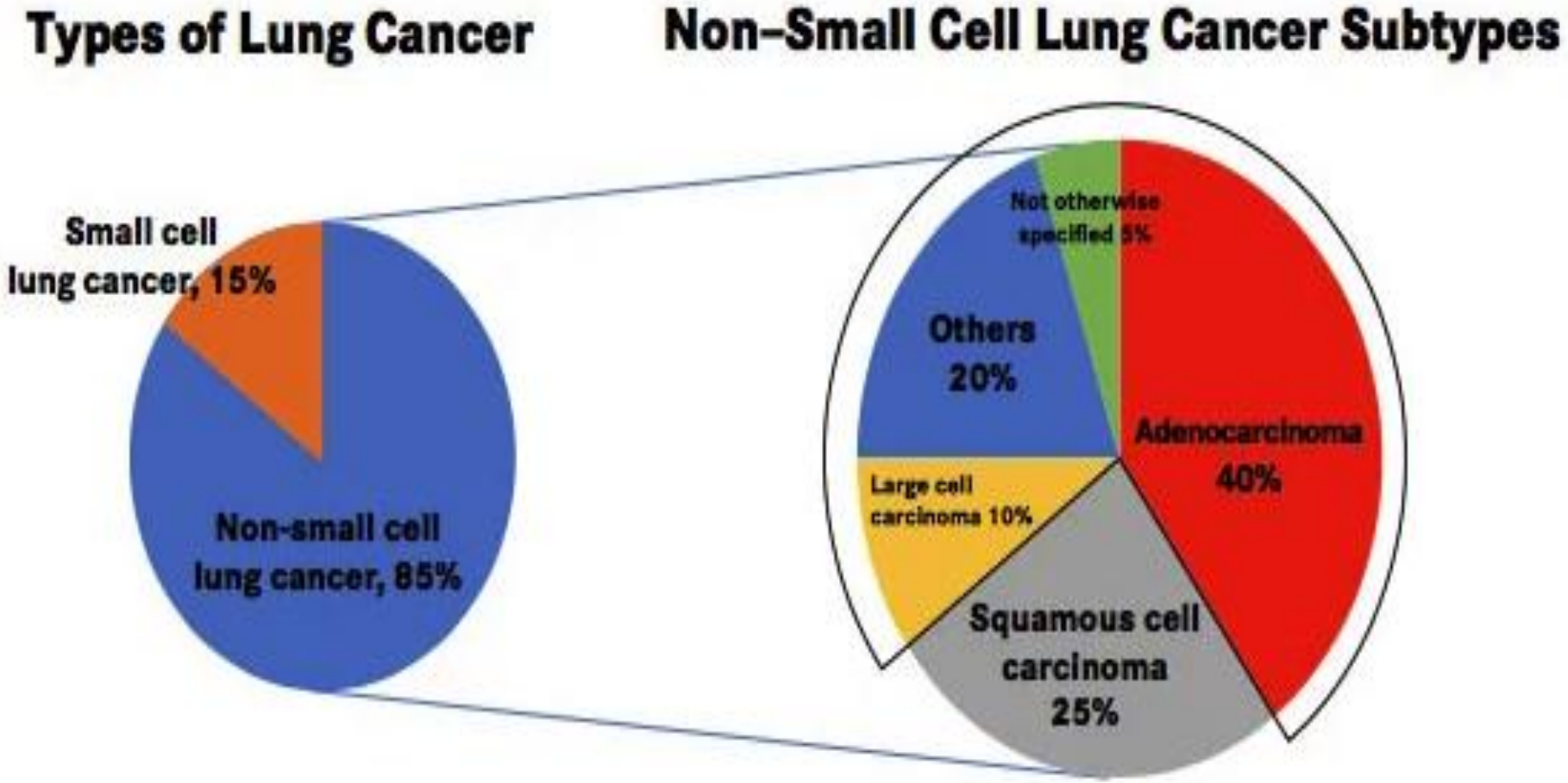
Tissue Sampling and Analysis Identifies the Type of Lung Cancer and Guides Treatment Decisions

Types of Lung Cancer	
Non-small cell lung cancer	85%
Small cell lung cancer	15%
Non-Small Cell Lung Cancer Subtypes	
Adenocarcinoma	40%
Squamous cell carcinoma	25%
Large cell carcinoma	25%
Others	20%
Not otherwise specified	5%



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Lung Cancer Staging

- Purpose: To determines if the cancer is localized, has spread to the nearby (regional) lymph nodes, or has spread to distant locations (metastasized)
- Why: To identify the best treatment options
  - Surgery
  - Chemotherapy
  - Palliative Care

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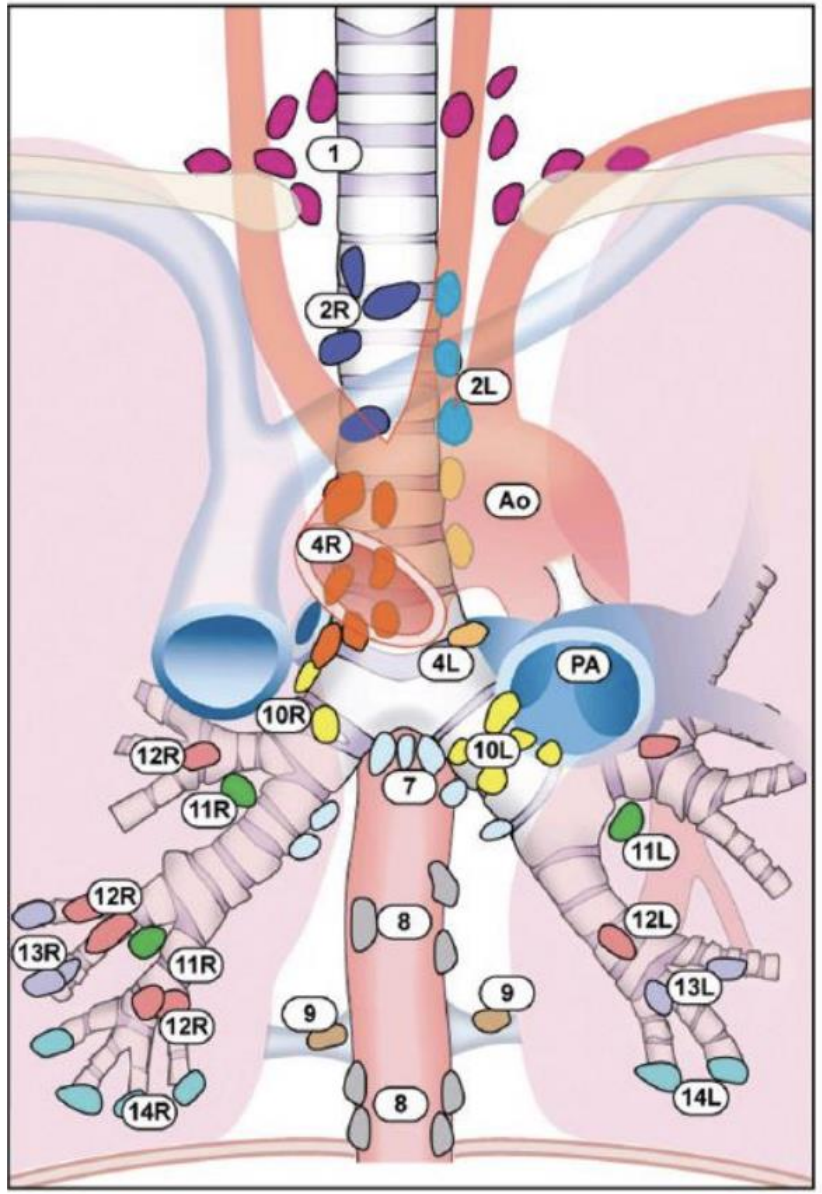
Has the Cancer Spread to the Central Chest Lymph Nodes? (aka “Mediastinal Staging”)

- Non-Invasive Imaging
  - Chest CT
  - PET-CT (a tracer identifies cancerous tissue)
- Tissue Sampling
  - Surgical
    - Mediastinoscopy
    - VATS (Video Assisted Thoracoscopic Surgery)
  - Interventional
    - IR guided : TTNA
    - IP : EBUS-TBNA, TBNA
    - EUS-TNA



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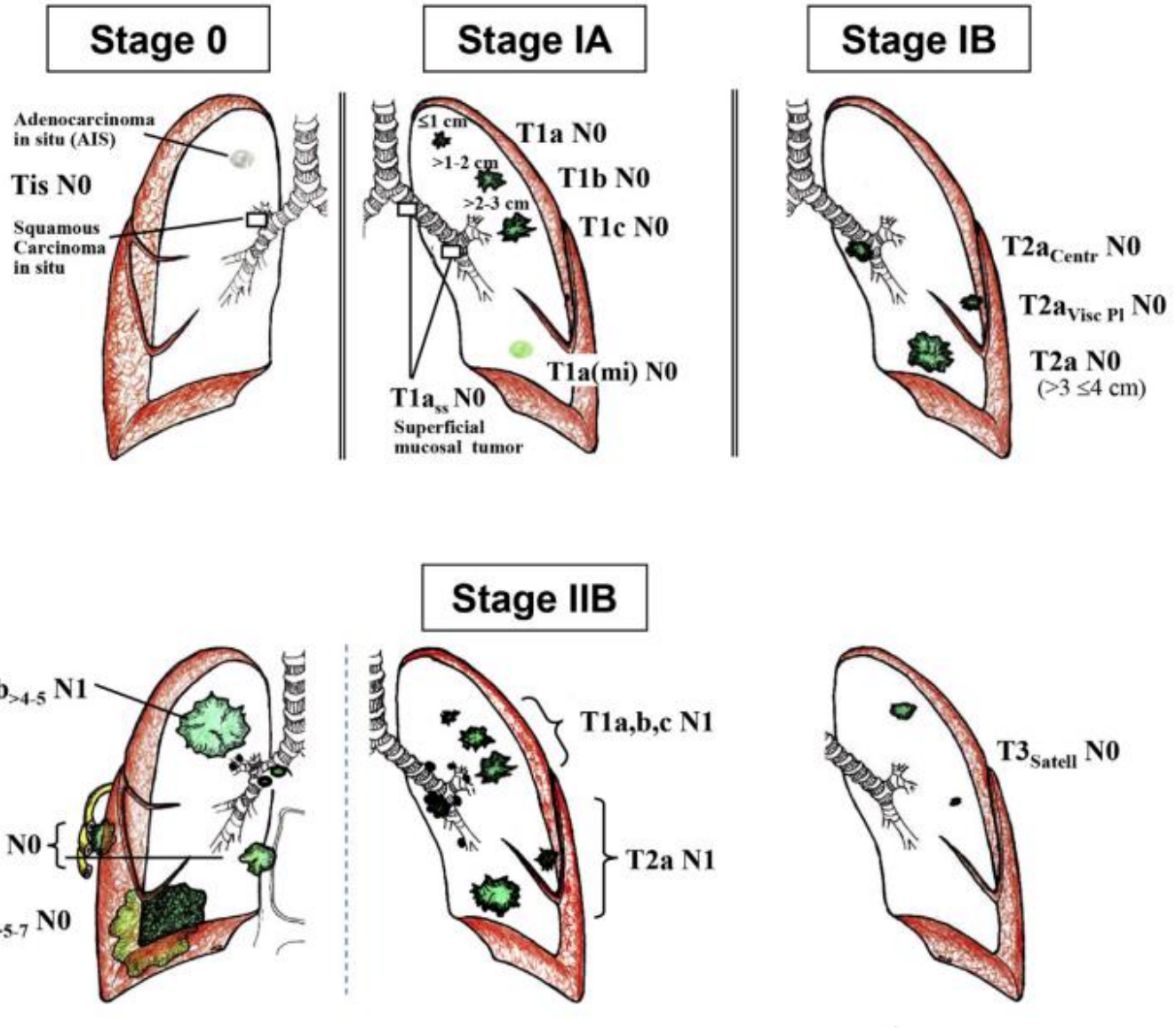
Detailed analysis classifies early stage lung cancer

General Note:
All Stage 1-III tumors are M0

Tx, Nx should be used only if no information at all is available about T or N stage (including no clinical staging information).

Mx is not allowed, because symptoms and physical exam information is always available.



Detterbeck F, et al. Chest. 2017; 151(1):193-203.

Examples of more advanced lung cancer stages

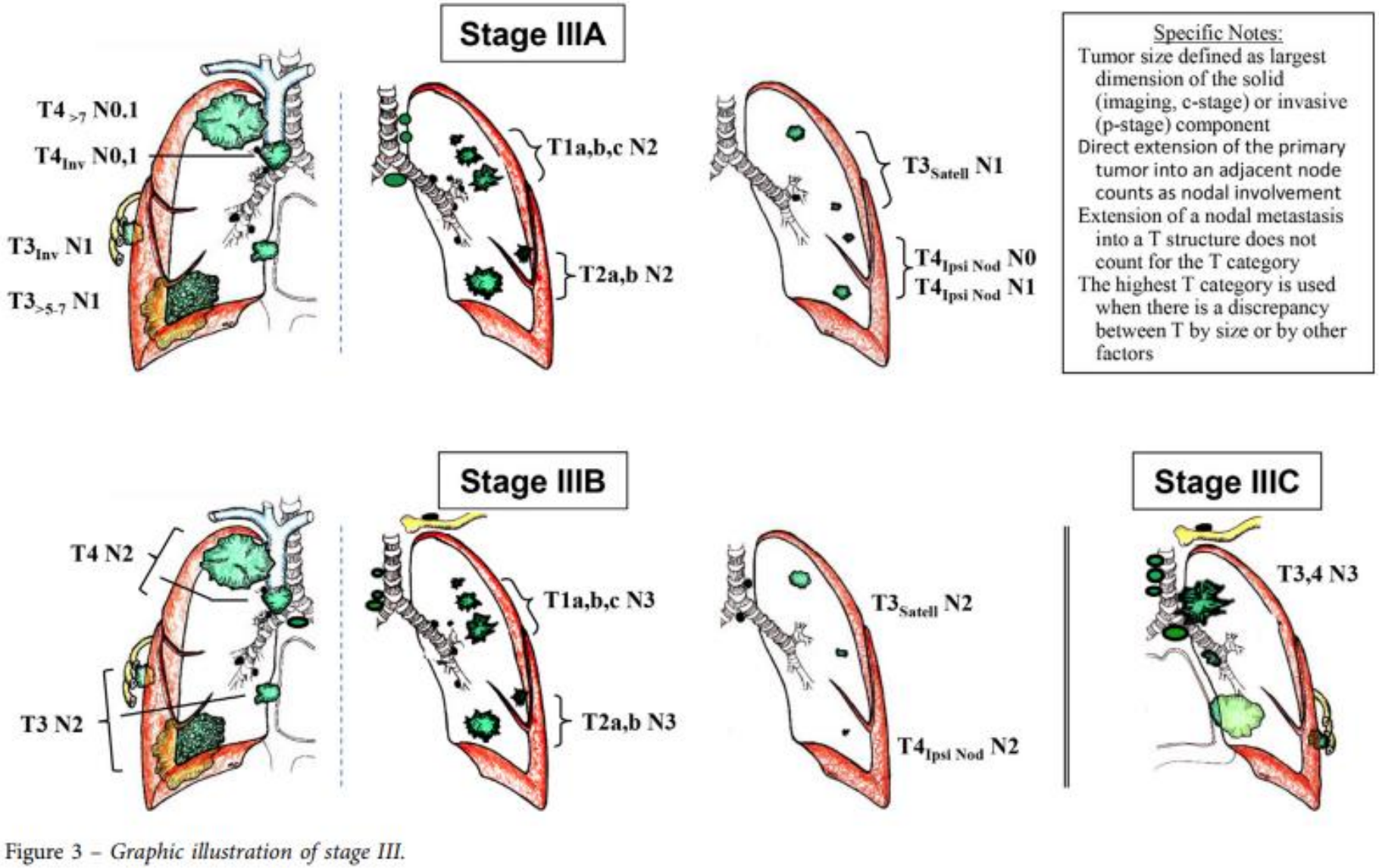


Figure 3 – *Graphic illustration of stage III.*

Detterbeck F, et al. Chest. 2017; 151(1):193-203.

Metastatic lung cancer: The most advanced

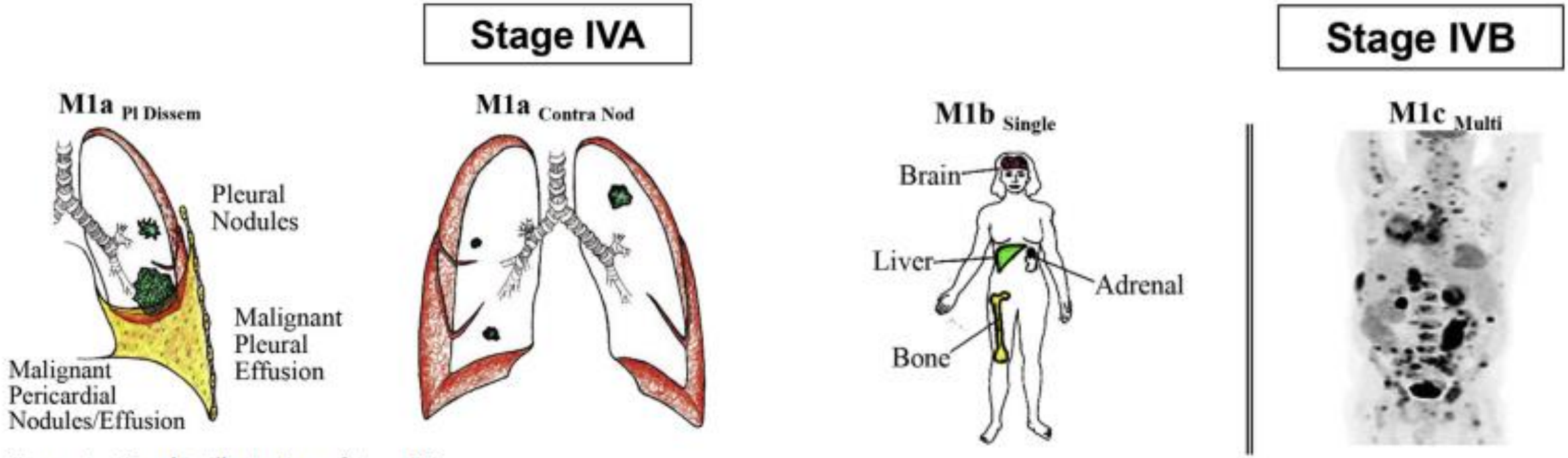
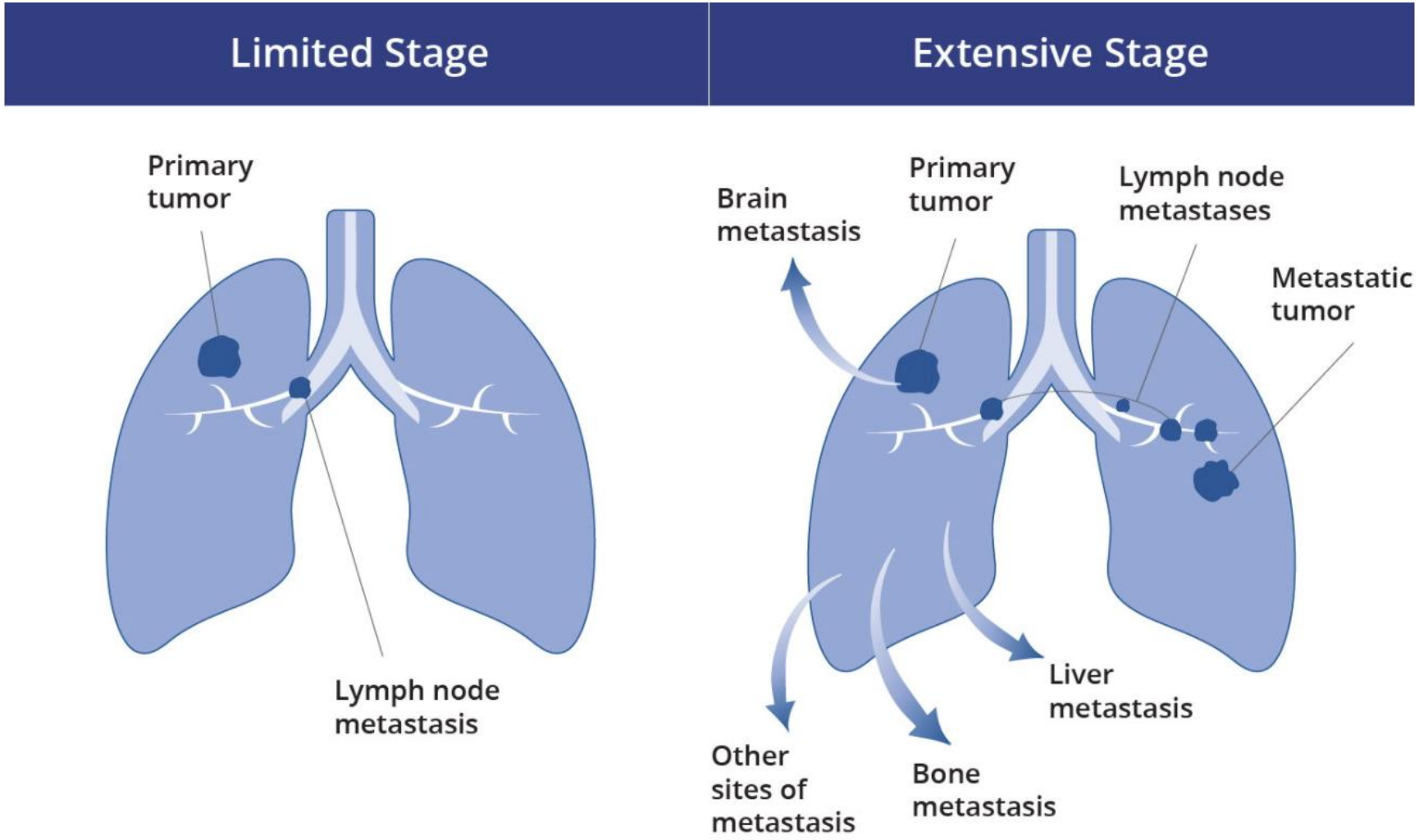


Figure 4 – *Graphic illustration of stage IV.*

Detterbeck F, et al. Chest. 2017; 151(1):193-203.

A different staging system is used for a particular subset of Lung Cancer, termed Small Cell Lung Cancer (SCLC)



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OUTLINE

- **Why Early Detection Matters**
- Diagnosis and Staging
- Treatment
- The Future: Lung Cancer Screening

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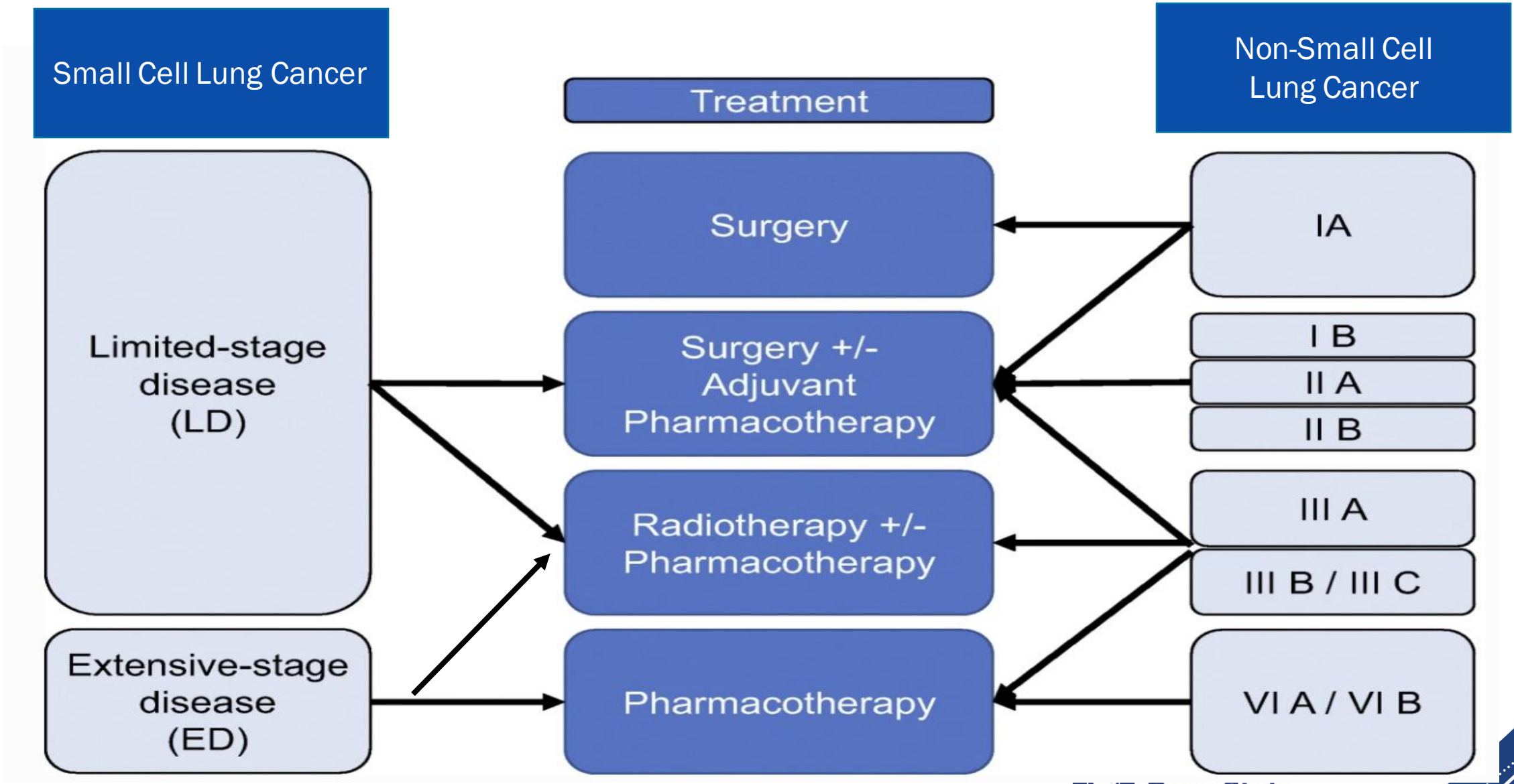
Lung Cancer Type and Stage Guide Treatment Recommendations



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Curr. Treat. Options in Oncol. (2021) 22: 71

The Era of Personalized Cancer Care has arrived: Molecular Profiling of Lung Cancer Tissue Guides Pharmacotherapy Treatment Recommendations

- EGFR Mutation
  - 1st line : Afatinib or Osimertinib
  - 2nd line: Erlotinib or Geftinib or Dacomtinib
- KRAS Mutation
  - Systemic chemotherapy
- ALK Mutation
  - Alectinib, brigatinib, certinib or lorlatinib
- ROS1 rearrangement positive
  - 1st line: Entrecitinib, Crizotinib
  - 2nd line: Certinib
- PD-L 1 > 50%
  - Atezolizumab, Cemiplimab

NCCN Guidelines NSCLC, Version 3.2022

J Natl Compr Canc Netw 2022;20(5):497–530 doi: 10.6004/jnccn.2022.0025

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Molecular Signature of the Lung Cancer Guides Detailed, Precise Algorithms for Therapy or Immunotherapy

EGFR Exon 19* Deletion or *L858R
- First-line therapy
  - Afatinib[1]
  - Erlotinib[2]
  - Dacomitinib[3]
  - Gefitinib[4,5]
  - Osimertinib[6]
  - Erlotinib + ramucirumab[7]
  - Erlotinib + bevacizumab[c] (nonsquamous)[8]
- Subsequent therapy
  - Osimertinib[9]

EGFR S768I, L861Q,* and/or *G719X
First-line therapy
- Afatinib[1,10]
- Erlotinib[2]
- Dacomitinib[3]
- Gefitinib[4,5]
- Osimertinib[6,11]
- Subsequent therapy
  - Osimertinib[9]

***EGFR Exon 20* Insertion Mutation Positive**
- Subsequent therapy
  - Amivantamab-vmjw[12]
  - Mobocertinib[13]

***KRAS G12C* Mutation Positive**
- Subsequent therapy
  - Sotorasib[14]

***ALK* Rearrangement Positive**
- First-line therapy
  - Alectinib[15,16]
  - Brigatinib[17]
  - Ceritinib[18]
  - Crizotinib[15,19]
  - Lorlatinib[20]
- Subsequent therapy
  - Alectinib[21,22]
  - Brigatinib[23]
  - Ceritinib[24]
  - Lorlatinib[25]

***ROS1* Rearrangement Positive**
- First-line therapy
  - Ceritinib[24]
  - Crizotinib[27]
  - Entrectinib[28]
- Subsequent therapy
  - Lorlatinib[29]
  - Entrectinib[28]

***BRAF* V600E Mutation Positive**
- First-line therapy
  - Dabrafenib/trametinib[30,31]
  - Dabrafenib[30]
  - Vemurafenib
- Subsequent therapy
  - Dabrafenib/trametinib[31,32]

***NTRK1/2/3* Gene Fusion Positive**
- First-line/Subsequent therapy
  - Larotrectinib[33]
  - Entrectinib[34]

***MET* Exon 14 Skipping Mutation**
- First-line therapy/Subsequent therapy
  - Capmatinib[35]
  - Crizotinib[36]
  - Tepotinib[37]

***RET* Rearrangement Positive**
- First-line therapy/Subsequent therapy
  - Selpercatinib[38]
  - Pralsetinib[39]
  - Cabozantinib[40.41]

PD-L1 ≥1%
- First-line therapy[d]
  - Pembrolizumab[42-44]
  - (Carboplatin or cisplatin)/pemetrexed/ pembrolizumab (nonsquamous)[45,46]
  - Carboplatin/paclitaxel/bevacizumab[c]/ atezolizumab (nonsquamous)[47]
  - Carboplatin/(paclitaxel or albumin-bound paclitaxel)/pembrolizumab (squamous)[48]
  - Carboplatin/albumin-bound paclitaxel/ atezolizumab (nonsquamous)[48]
  - Nivolumab/ipilimumab[49]
  - Nivolumab/ipilimumab/pemetrexed/ (carboplatin or cisplatin) (nonsquamous)[50]
  - Nivolumab/ipilimumab/paclitaxel/carboplatin (squamous)[50]

PD-L1 ≥50% (in addition to above)
- First-line therapy[d]
  - Atezolizumab[51]
  - Cemiplimab-rwlc[52]

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J Natl Compr Canc Netw 2022;20(5):497–530 doi: 10.6004/jnccn.2022.0025

OUTLINE

- **Why Early Detection Matters**
- Diagnosis and Staging
- Treatment
- The Future: Lung Cancer Screening

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Lung Cancer Screening has come a long way

A Brief History

1996

Routine screening with chest x-ray or sputum cytology

NOT recommended

2004

Evidence insufficient to recommend screening

2013

Recommend annual low-dose chest computerized tomography (LDCT), age 55-80, 35 pack-years, active smoking or quit <15 years ago

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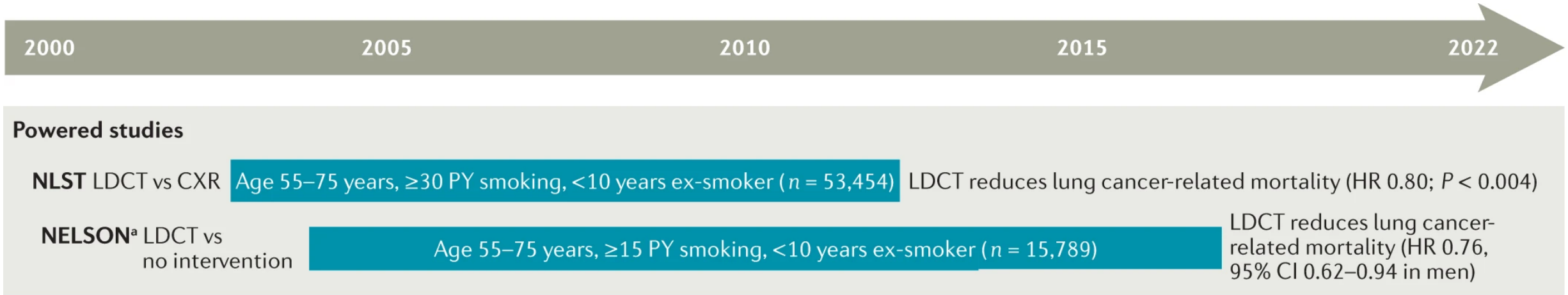
USPSTF. *JAMA*. 2021

Low Dose Chest CT scans reduce lung cancer mortality: two key studies



Oudkerk, et al. *Nature Rev Clin Onc*. 2021.

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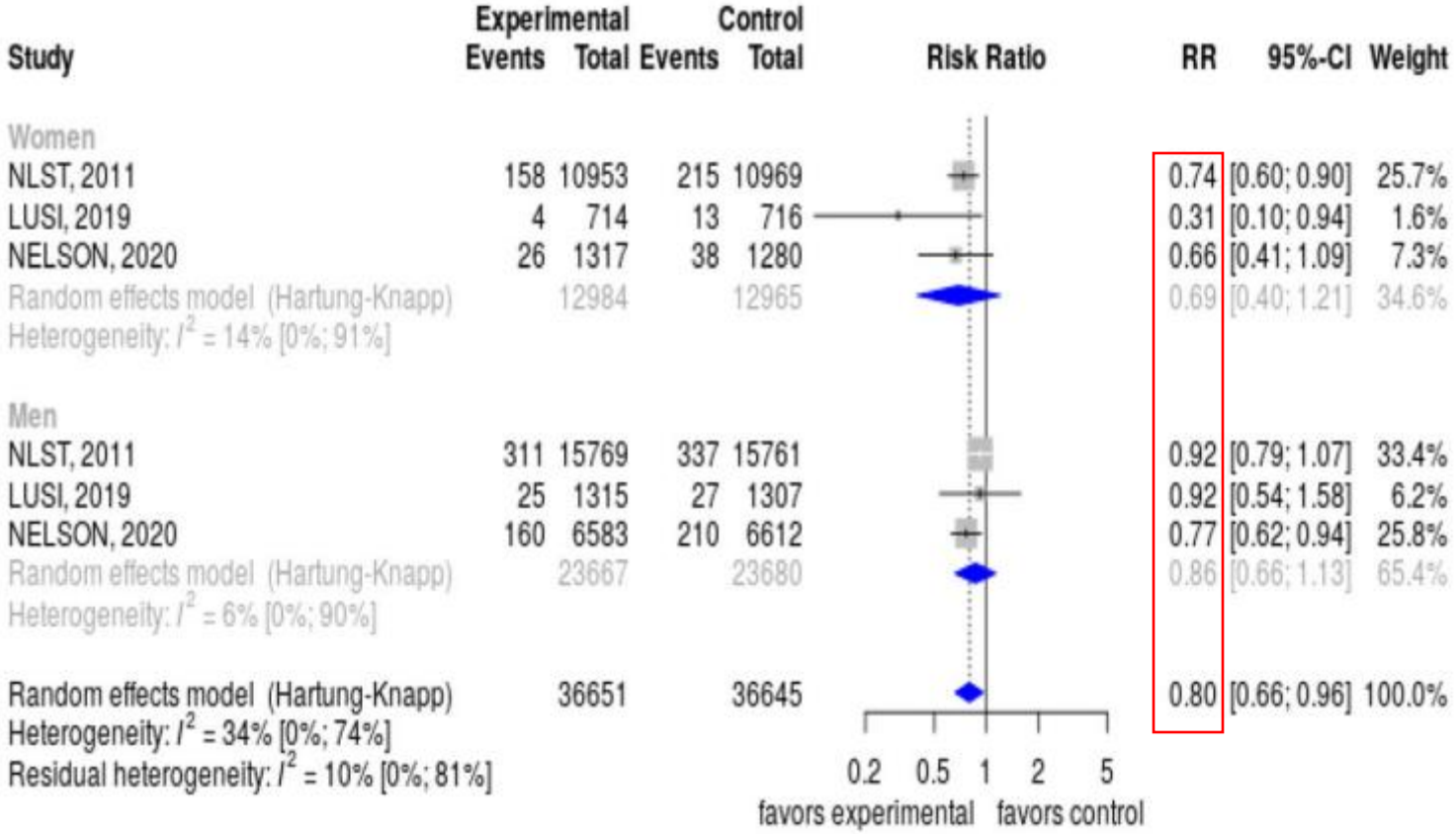
Low Dose Chest CT scans reduce lung cancer mortality in both women and men



Hoffman RM, Atallah RP, Struble RD, Badgett RG. Lung Cancer Screening with Low-Dose CT: a Meta-Analysis. J Gen Intern Med. 2020 Oct;35(10):3015-3025. doi: 10.1007/s11606-020-05951-7. Epub 2020 Jun 24. PMID: 32583338; PMCID: PMC7573097.

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United States Preventive Services Task Force Guidelines for Low Dose Chest CT Lung Cancer Screening

	USPSTF Guidelines 2013-2021	USPSTF Guidelines 2021
Age	55-80 years	50-80 years
Smoking History	30 or more pack years (this means 1 pack a day for 30 years, 2 packs a day for 15 years, etc.)	20 or more pack years (this means 1 pack a day for 20 years, 2 packs a day for 10 years, etc.)
Smoking Status	Current smoker or quit within the last 15 years	

https://www.uspreventiveservicestaskforce.org/uspstf/recommendation-topics/

USPSTF. *JAMA*. 2021

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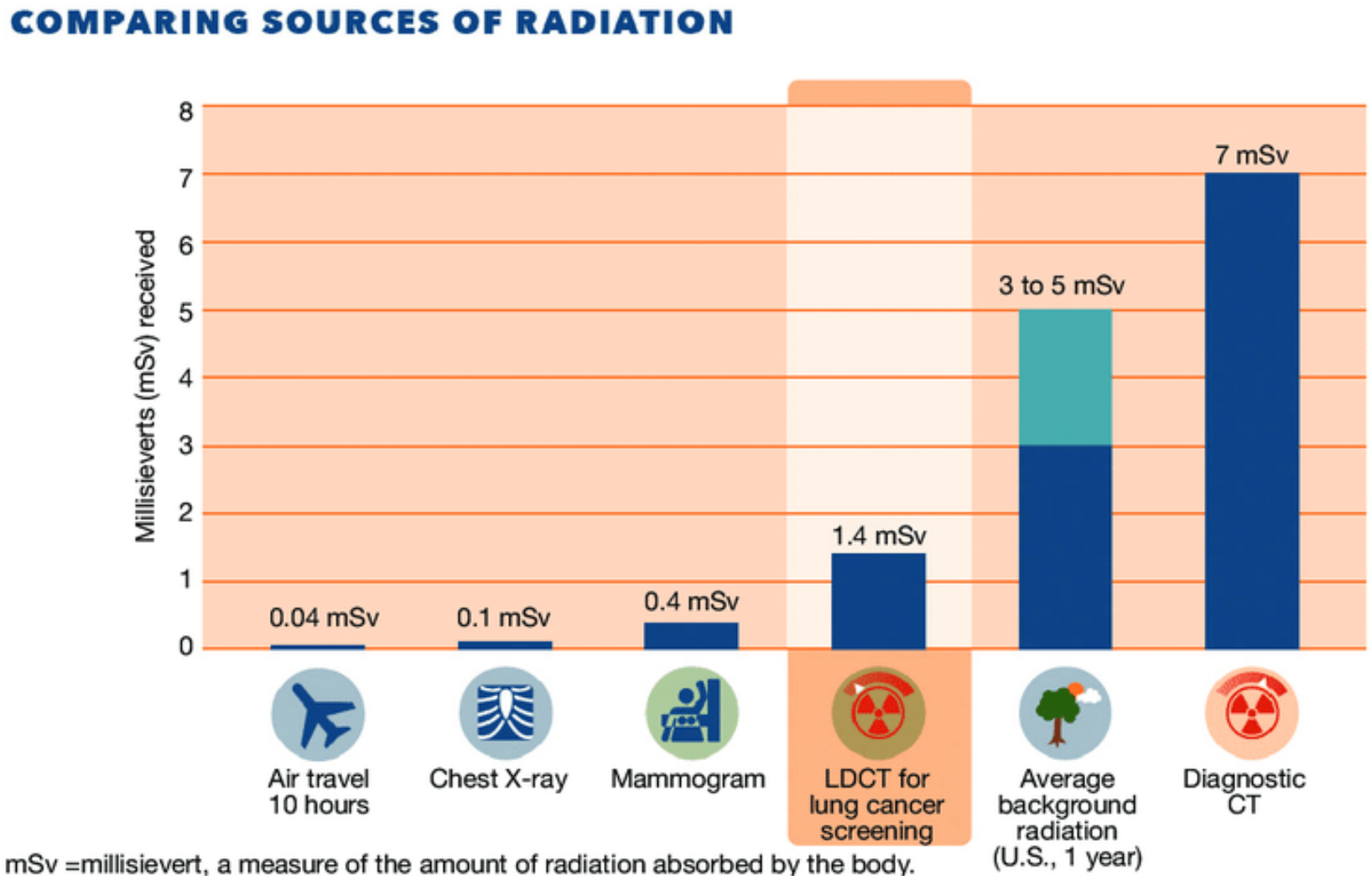
Potential Harm of LDCT



- Radiation
- Risk of false positives, lead-time bias, subsequent risk of biopsy
- Psychosocial stress related to screening

Lowenstein L, Nishi S. *Transl Lung Cancer Res*. 2018.
Gutierrez A, et al. *Sem Int Rad*. 2013.

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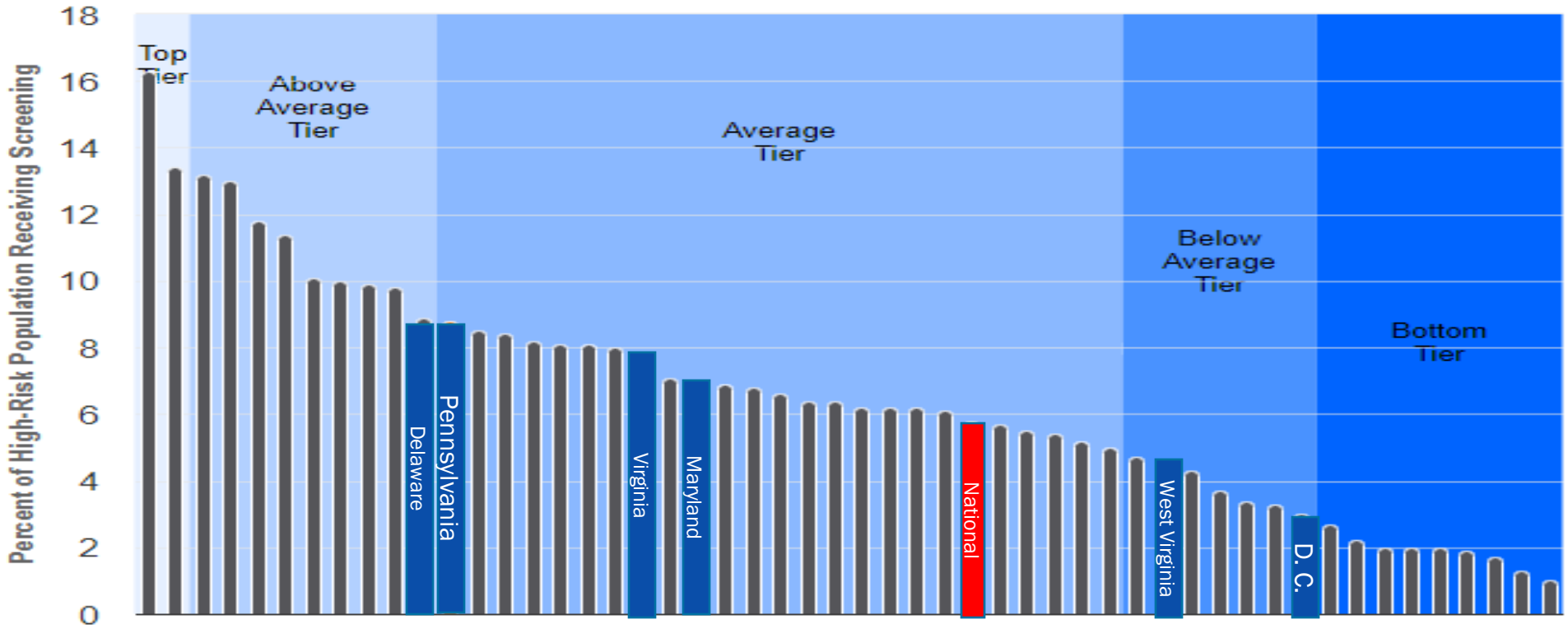
High Risk Lung Cancer Screening Rates in EPA Region 3



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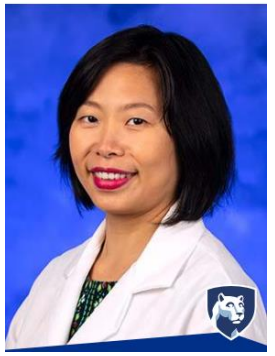
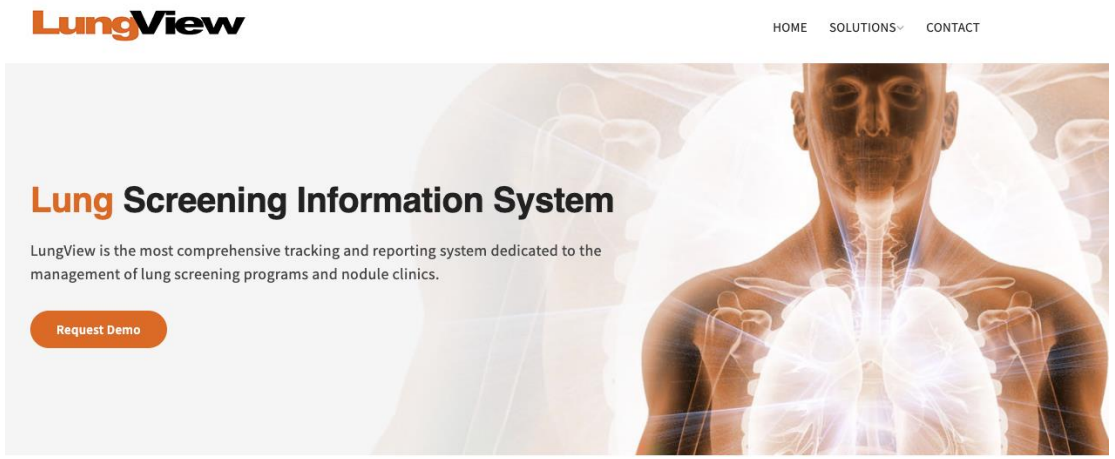
Lung Cancer Screening Program at Penn State



- YuMaw Htwe, MBBS, Director
- Multidisciplinary Lung Cancer Screening Group meets monthly
  - Track Screening Program
  - Increase awareness, screening rates, and proportion of early stage lung cancer cases
  - Impact lung cancer in the Penn State Cancer Institute catchment area
- Lung View Database
  - September 2021
  - To tract all lung cancer screens performed in Penn State Health System
  - Provide tracking and management for lung cancer screening results



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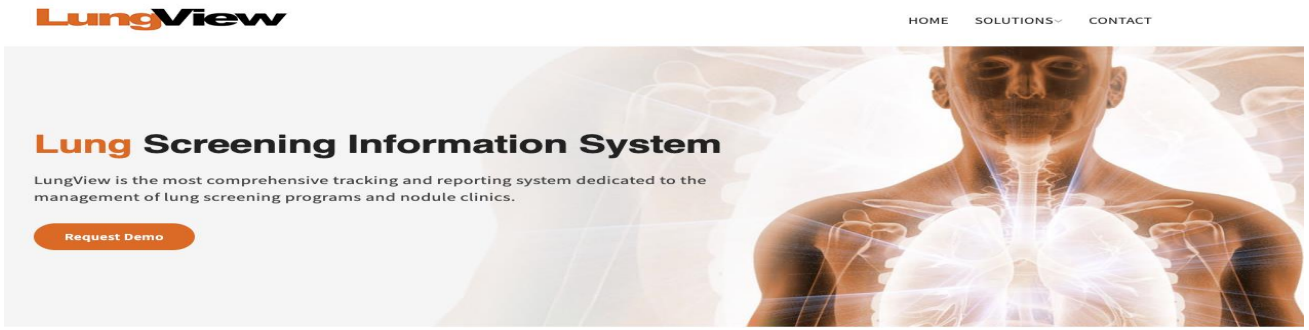
Lung Cancer Screening Program at Penn State

- Our Team
  - Trevor Eiswerth, RN – Program Coordinator
- Eligibility Criteria
  - 50-80 years old, 20 pack-years , current smoker or quit within the last 15 years
- For referral to us
  - Self referral : 1-866-778-5864
  - For providers: 717-531-6985
  - E message : Lung Cancer Screening
  - Email : teiswerth@pennstatehealth.psu.edu



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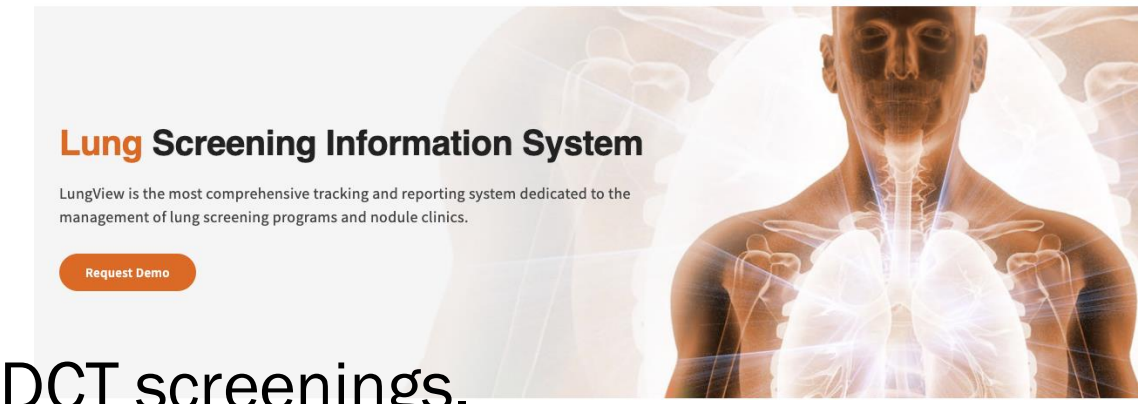
Lung Cancer Screening Program at Penn State



- Lung View Database
- Uses the Lung-RADS classifications for LDCT screenings.
  - Lung-RADS category 0 is an incomplete result
  - Lung-RADS categories 1 to 2 constitute negative screening results
  - Lung-RADS categories 3 to 4 constitute positive results
- Follow-up
  - Our team will reach out to patients and providers with the following criteria
  - Patients :
    - All lung RADs 1 &2 for annual follow up screening –reminder email.
    - All lung RADs 0, 3 & 4 will receive a call to arrange for follow up either by providers or Interventional Pulmonology
  - Providers:
    - All lung RADs 0, 3 & 4 will receive a call to arrange for follow up
    - To reach out our coordinator Mr. Eiswerth : 717-531-0003 ext 289397

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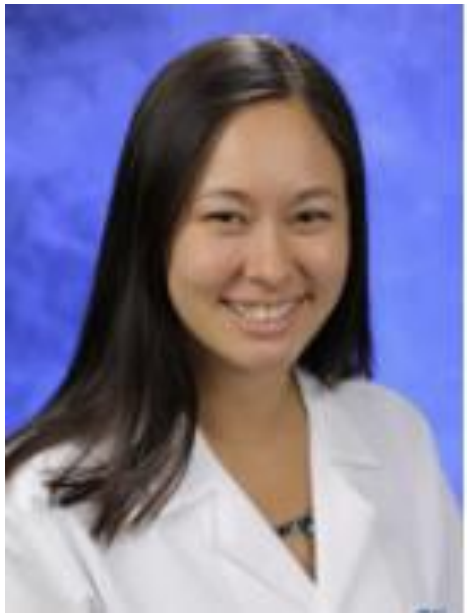
Lung Cancer Risk Reduction Efforts: Smoking Cessation Program at Penn State

- Our team
  - Linda Farling , MSN, CRNP, FNP-BC, NCTTP – Counselor
  - Natasha Breen PA-C, TTS – Counselor
  - Trevor Eiswerth, RN - Coordinator
- Structure
  - Initial visit is 30-60 min, prefer in person but telehealth options available
  - Length of program is individualized
  - Focus : Behavior Modification and Nicotine Replacement therapy
- For referral
  - Telephone: 717-531-6985
  - E message : PSH Smoking Cessation Pool
  - Email: teiswerth@pennstatehealth.psu.edu



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SUMMARY

Lung cancer survival is much better when cancer is detected at an early stage

Only one-quarter of lung cancer cases are currently diagnosed at early stage

Treatment options are personalized, based on cancer type and stage, and new molecular markers

Effective lung cancer screening offers a chance to improve lung cancer outcomes through early stage detection and curative therapies.

Lung cancer risk reduction includes attention to smoking cessation and radon exposure reduction

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Radon, Environmental Justice, & Vulnerable Populations

Mia Ray B.S.

Penn State College of Medicine

9/26/2023

EPA Region 3 Radon Stakeholder Meeting

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OUTLINE

- Environmental Justice
- Mapping Radon & EJ Communities in Pennsylvania
- EJScreen: EPA Region 3 Cancer Disparities
- Dimensions of Vulnerability
- Implementation Science: Frameworks for Solutions

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Environmental Justice

"The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies"

Environmental Justice | US EPA

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Environmental Justice Communities are Overburdened

- Minority, low-income, tribal, or indigenous populations or geographic locations in the United States that:
  - potentially experience disproportionate environmental harms and risks.

- This disproportionality can be as a result of:
  - **greater vulnerability to environmental hazards,**
  - **lack of opportunity for public participation,**
  - **or other factors.**

Environmental Justice | US EPA

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OUTLINE

- Environmental Justice
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Questions

1. Is elevated radon found in Pennsylvania?
2. Are there EJ communities in Pennsylvania
3. Are EJ communities in Pennsylvania only urban?
4. Are there cancer disparities in Region 3?

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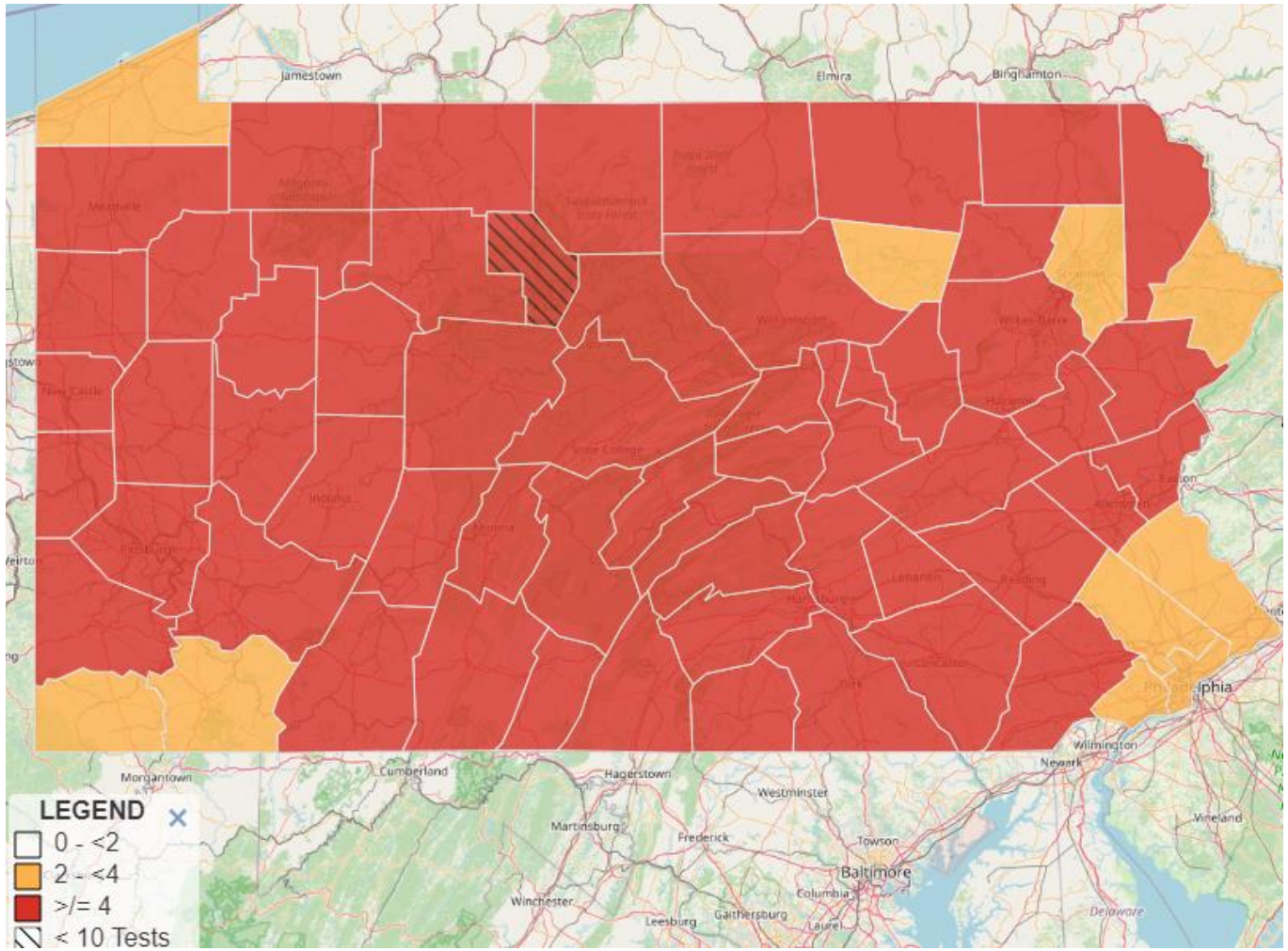
Elevated radon levels throughout Pennsylvania



National Environmental Public Health Tracking Network Data Explorer (cdc.gov)

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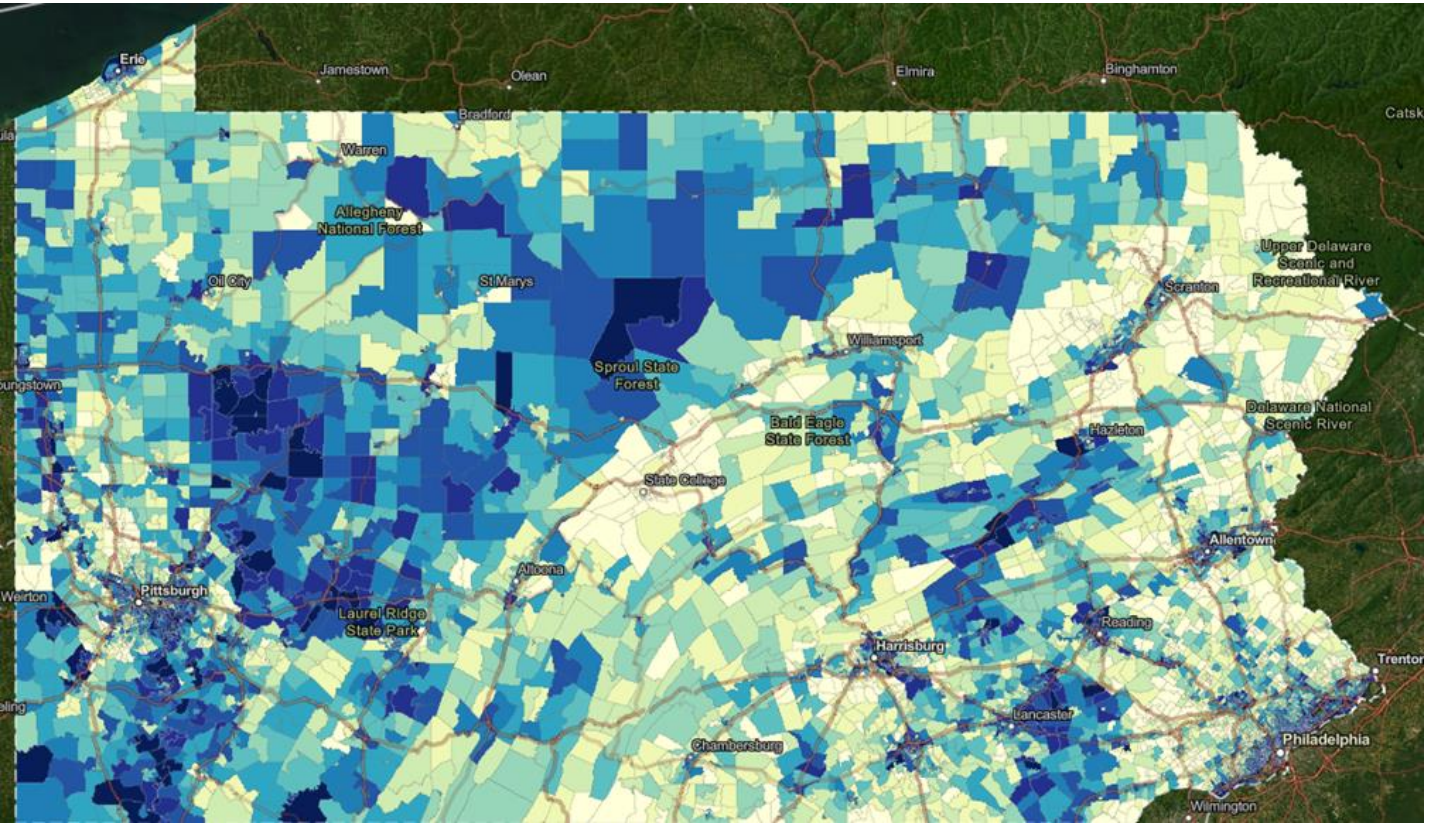
EJ Scores in Pennsylvania



Dark Blue= Highest EJ score

EJ score is based on indices of poverty & proportion of non-white minority population

https://gis.dep.pa.gov/PennEnviroScreen/

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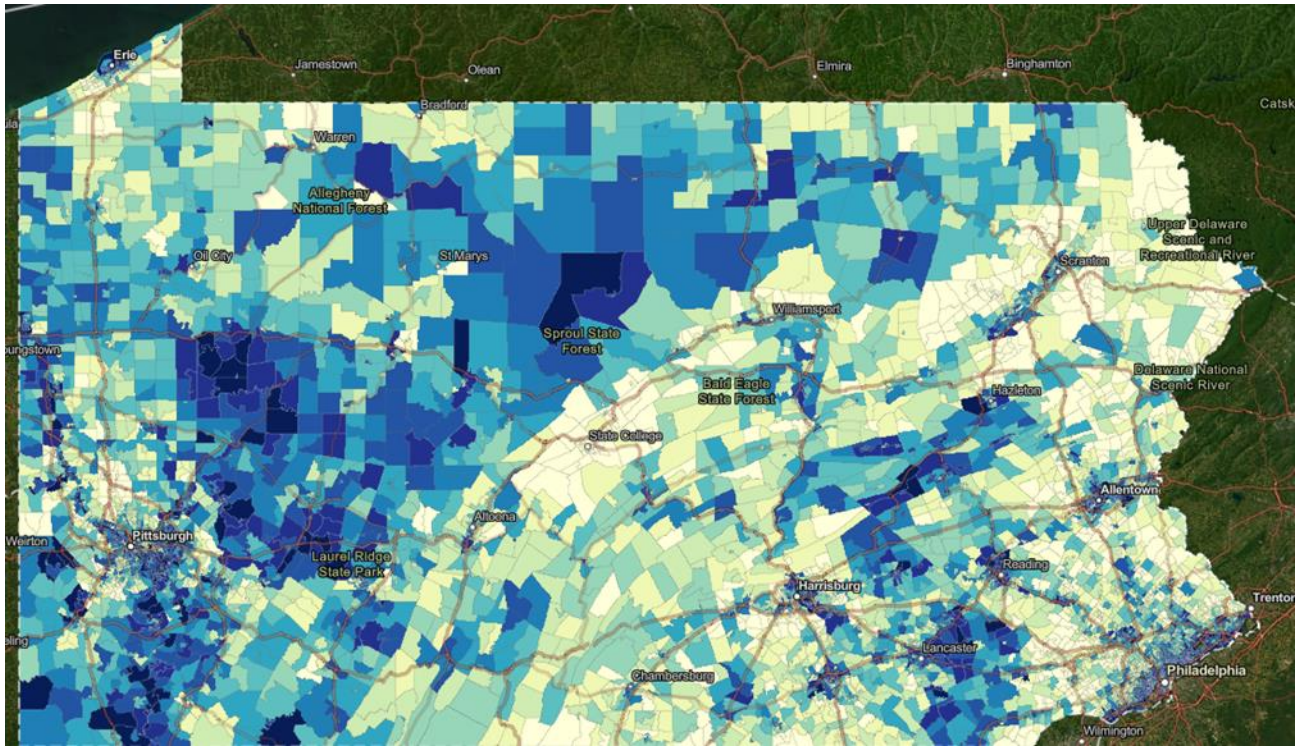
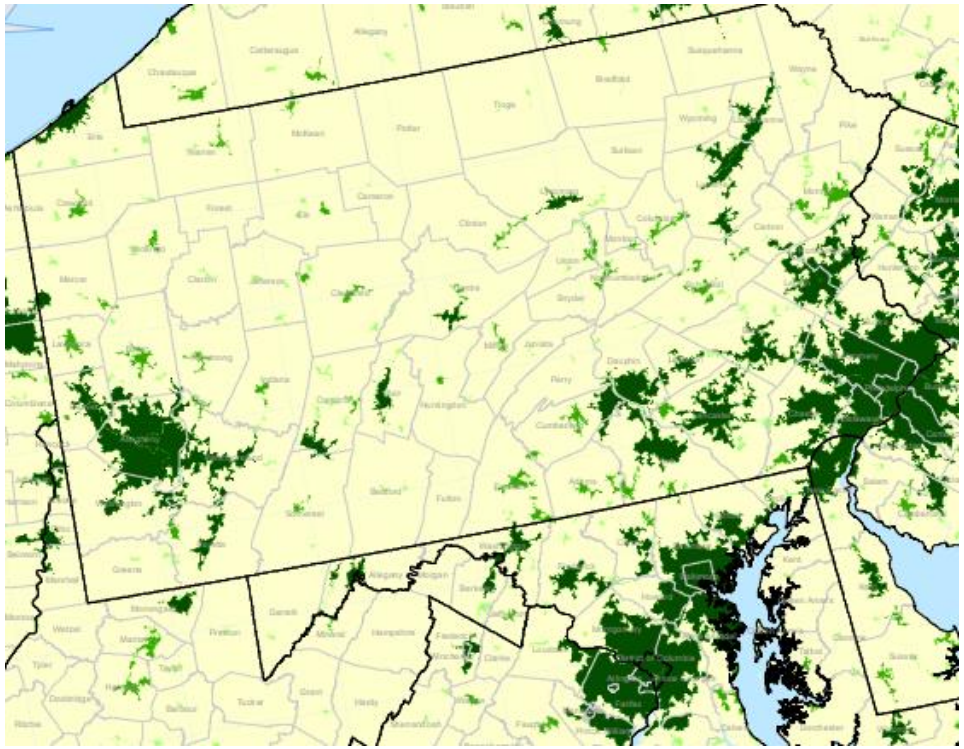
EJ Communities exist in urban & rural PA



Dark blue= High EJ Score
Light yellow= Low EJ Score



Pale yellow-light green = Rural areas
Dark green= urban areas

https://www.ers.usda.gov/webdocs/DataFiles/53180/25593_PA.pdf?v=0

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OUTLINE

- Environmental Justice
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- EJScreen: EPA Region 3 Cancer Disparities
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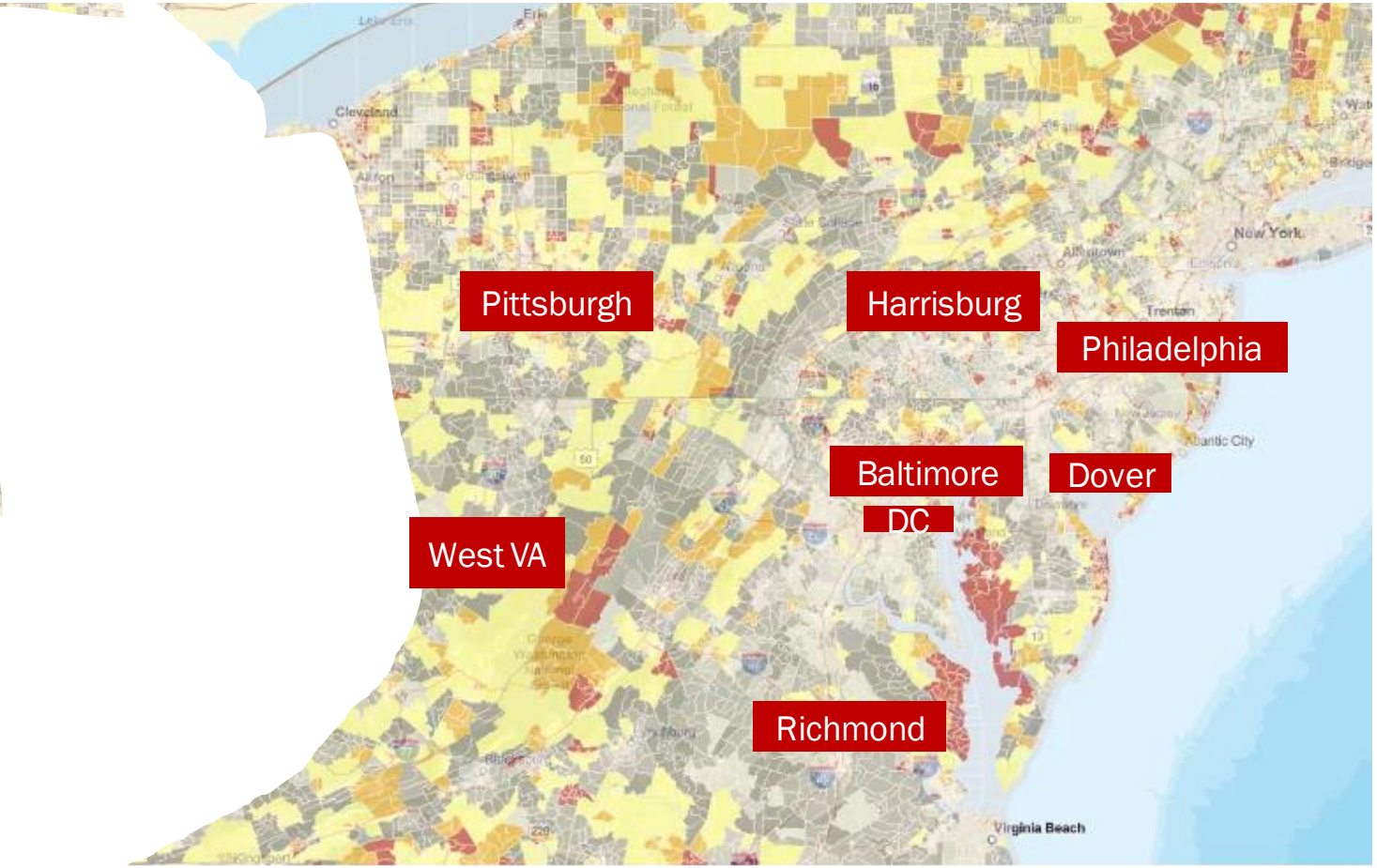
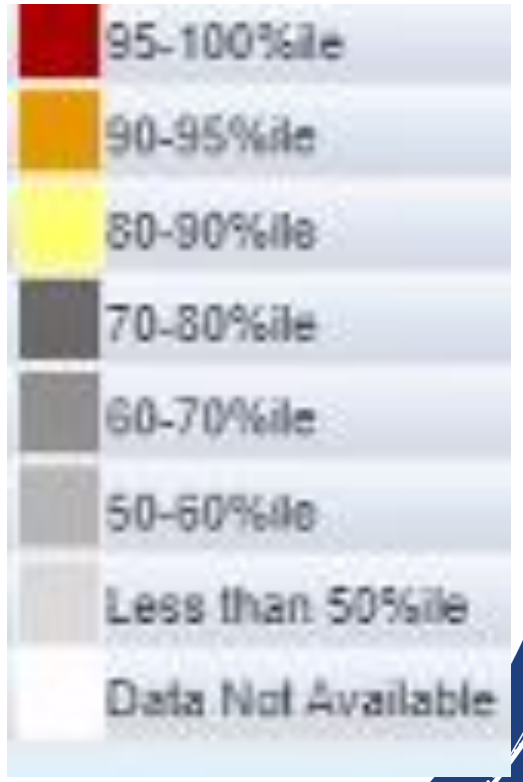
EPA EJScreen Shows Region 3 Cancer Disparities



Highest Cancer rates



https://ejscreen.epa.gov/mapper/

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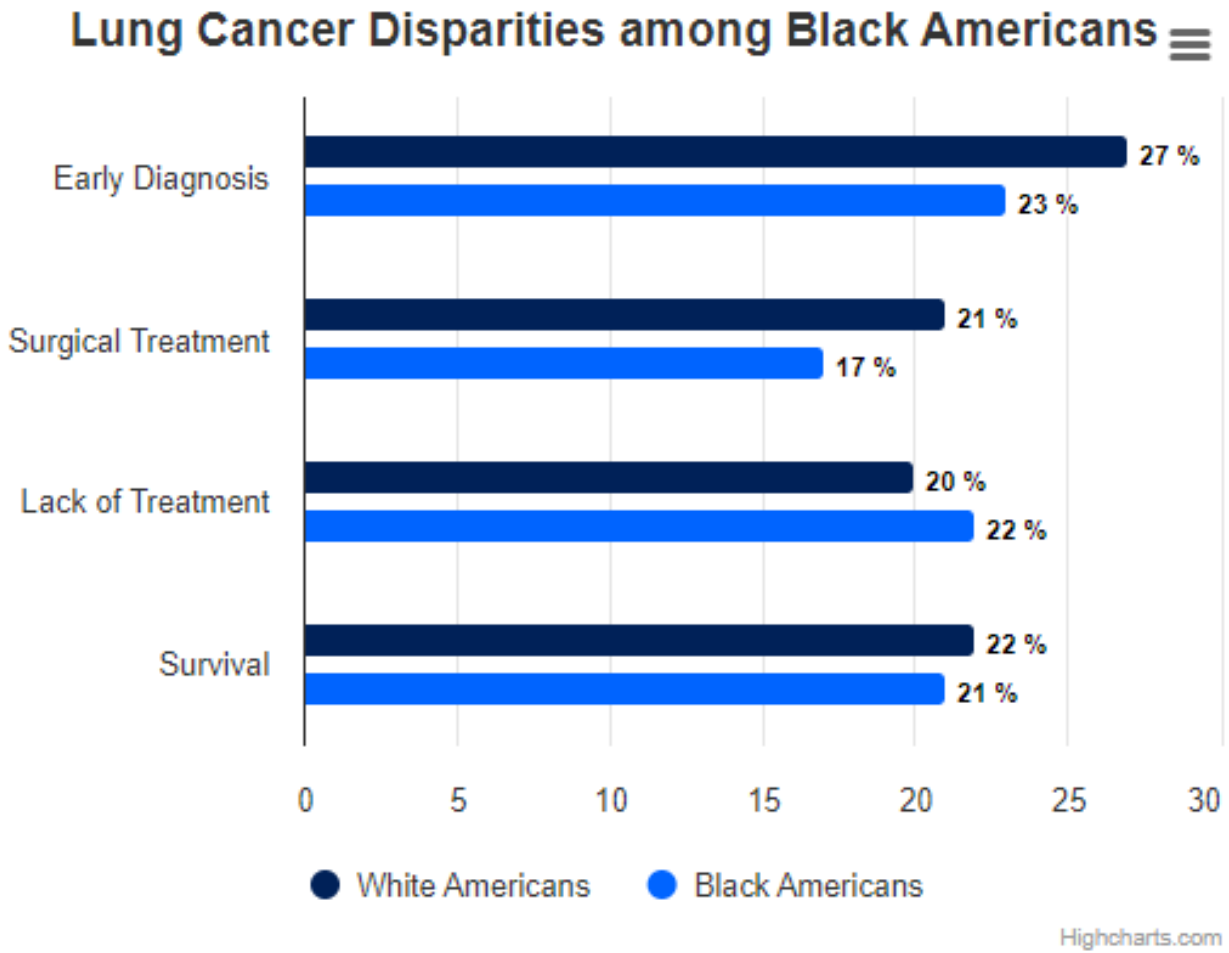
U.S. Lung Cancer Disparities by Race



https://www.lung.org/research/state-of-lung-cancer/racial-and-ethnic-disparities

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OUTLINE

- Environmental Justice
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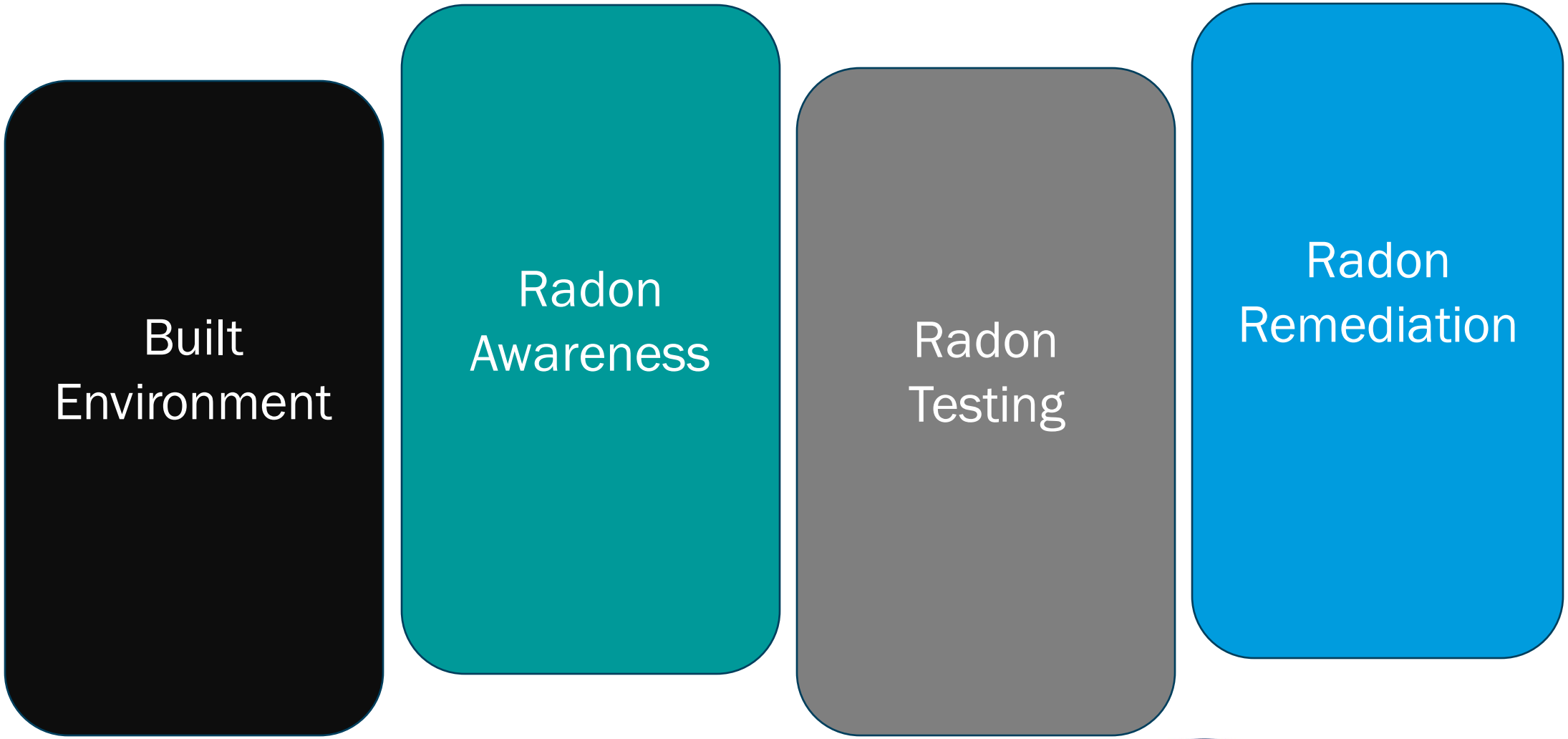
Dimensions of Vulnerability



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Dimensions of Vulnerability

Built Environment

- Structural Integrity of buildings & homes

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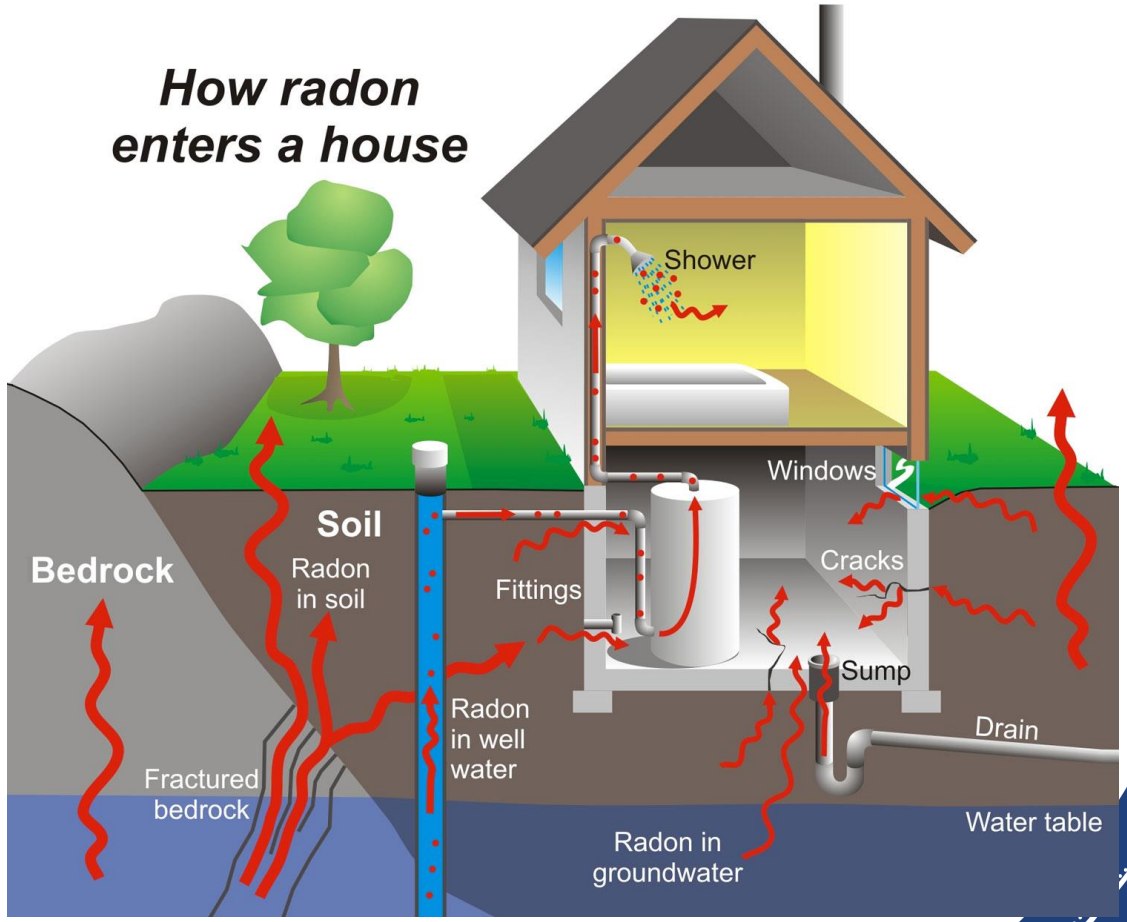
Radon exposure risk and Building features

- Found mainly in soil, rocks & air
- Travels through cracks and gaps in building foundations
  - Also through construction materials



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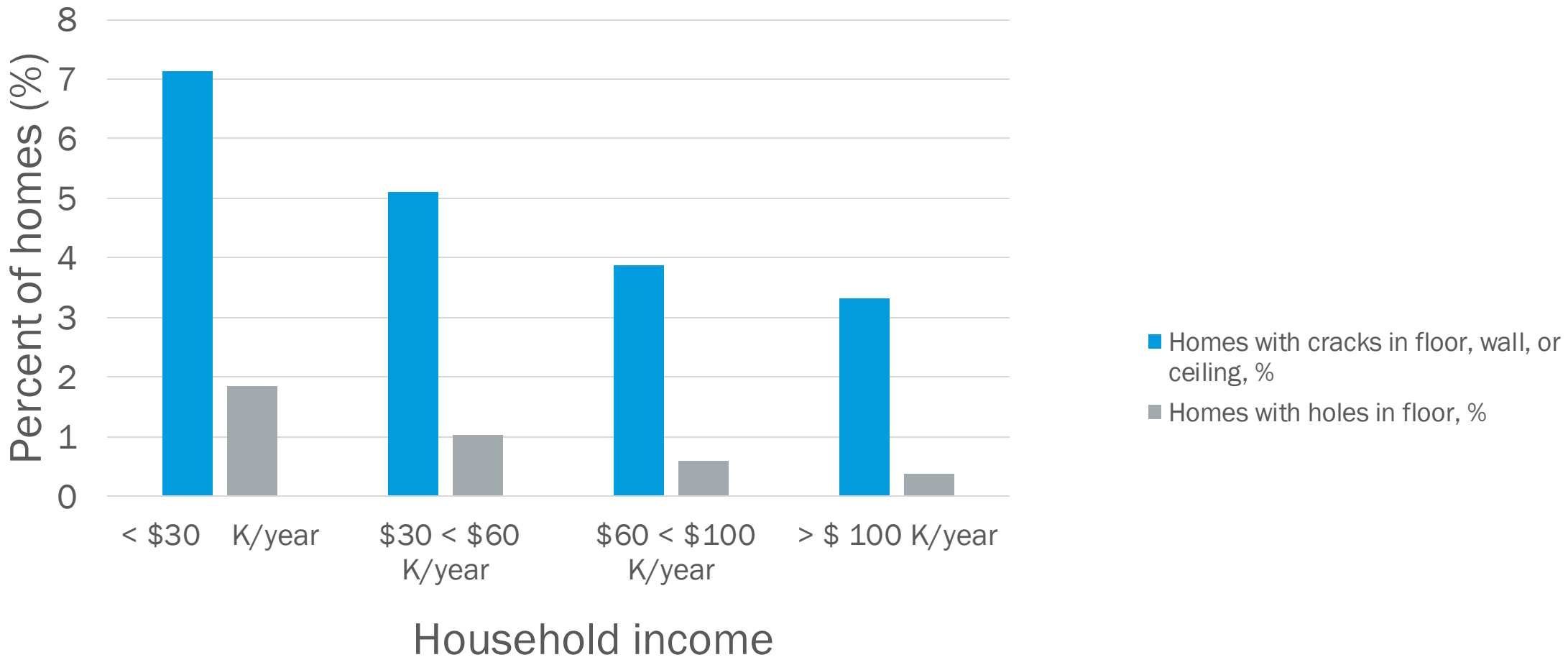
Radon Testing in Watertown MA - New England Radon

Linking low income to Radon exposure risk



Adamkiewicz G, Zota AR, Fabian MP, Chahine T, Julien R, Spengler JD, Levy JI. Moving environmental justice indoors: understanding structural influences on residential exposure patterns in low-income communities. Am J Public Health. 2011 Dec;101 Suppl 1(Suppl 1):S238-45. doi: 10.2105/AJPH.2011.300119. Epub 2011 Aug 11. PMID: 21836112; PMCID: PMC3222513.

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Other possible contributors to indoor radon

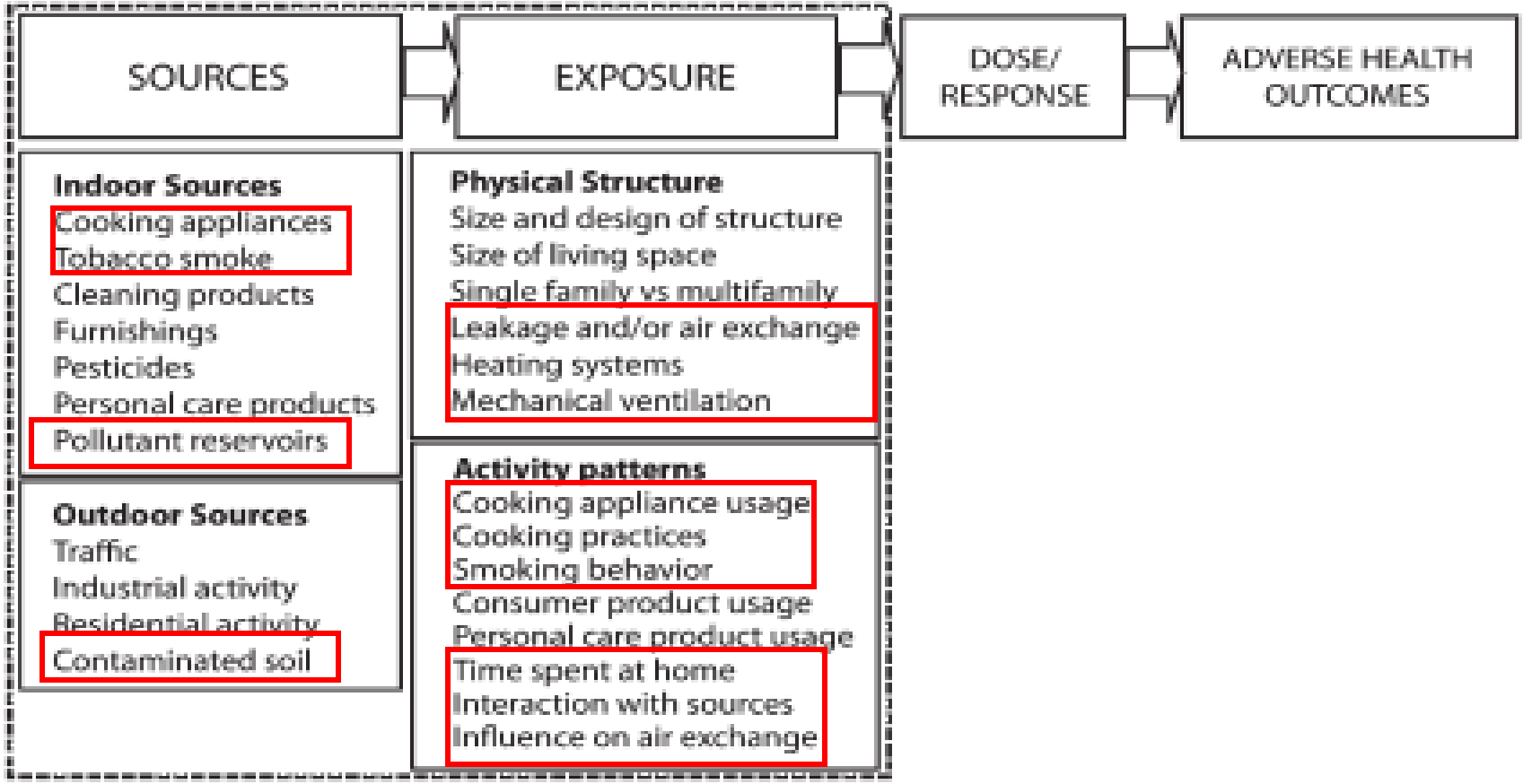

FIGURE 1—Conceptual framework—contributors to indoor environmental exposure.

Adamkiewicz G, Zota AR, Fabian MP, Chahine T, Julien R, Spengler JD, Levy JI. Moving environmental justice indoors: understanding structural influences on residential exposure patterns in low-income communities. Am J Public Health. 2011 Dec;101 Suppl 1(Suppl 1):S238-45. doi: 10.2105/AJPH.2011.300119. Epub 2011 Aug 11. PMID: 21836112; PMCID: PMC3222513.

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Dimensions of Vulnerability

Built Environment

Radon Awareness

- Lack of effective radon-risk communication

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A Systematic Review of Radon Risk Perception, Awareness, and Knowledge

- Objective: To study the effectiveness of radon risk-reduction communication in the recent research
- Results
  - Knowledge of radon risk is low when there is no specific communication on the topic
  - In high risk areas (EJ communities), federal information campaigns did not reach these communities
  - Health personnel were found to have insufficient knowledge about radon

Cori, L., Curzio, O., Donzelli, G., Bustaffa, E., & Bianchi, F. (2022). A Systematic Review of Radon Risk Perception, Awareness, and Knowledge: Risk Communication Options. *Sustainability*, *14*(17), 10505. MDPI AG. Retrieved from http://dx.doi.org/10.3390/su141710505

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Dimensions of Vulnerability

Built Environment

Radon Awareness

Radon Testing

- Lack of access to testing materials
- Lack of knowledge on how to test for radon

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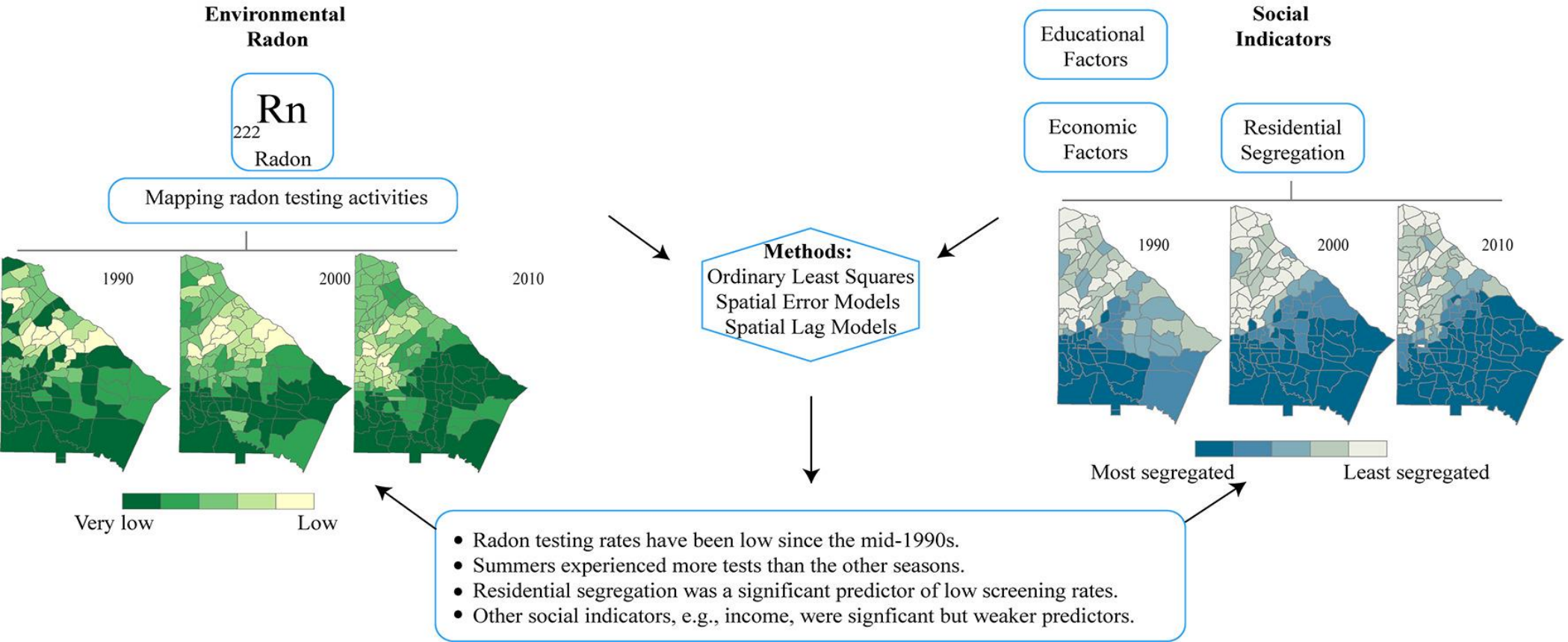
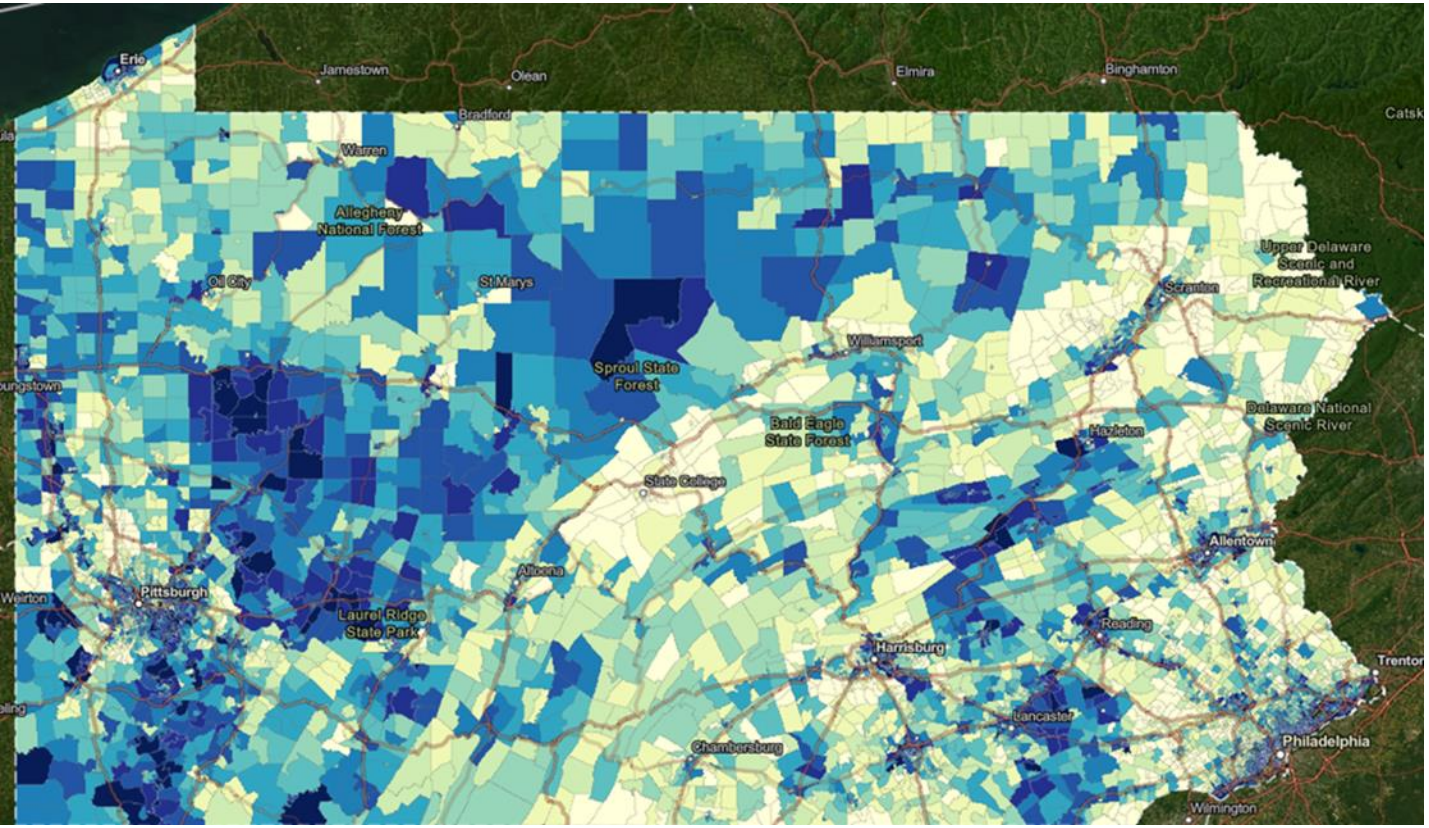
Predictors of Community Low Screening Rates:
Residential Segregation > Income
1990, 2000 and 2010

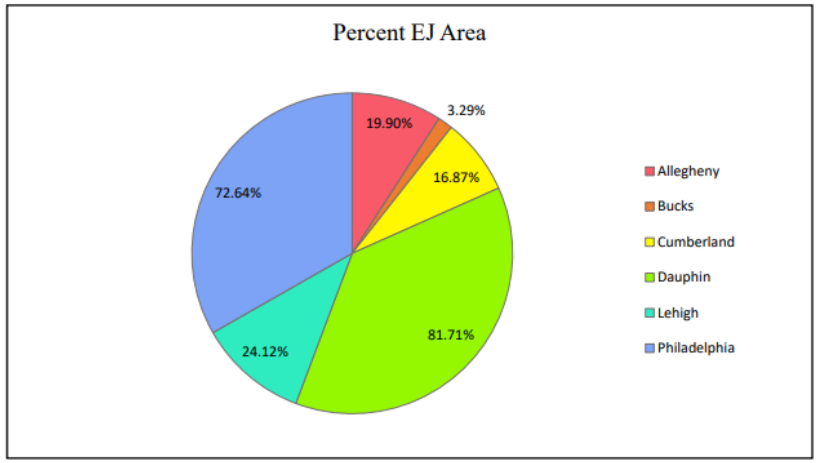


Radon Testing in Schools



COUNTY	EJ AREA TESTS	TOTAL TESTS	PERCENT EJ AREA
ALLEGHENY	285	1432	19.90
BUCKS	158	4800	3.29
CUMBERLAND	341	2021	16.87
DAUPHIN	2569	3144	81.71
LEHIGH	730	3027	24.12
PHILADELPHIA	77	106	72.64

Figure 23: Percent of Testing Data in Environmental Justice Areas



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Dimensions of Vulnerability

Built Environment

Awareness

Testing

Remediation

- Lack of access to radon mitigation services
- Cannot afford radon mitigation services

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Remediation

- EJ communities do not have access/cannot afford radon mitigation tools/services.
  - **Ex: Ventilation systems, certified radon professionals**
- This can lead to disproportionate radon exposure in EJ vs non-EJ communities

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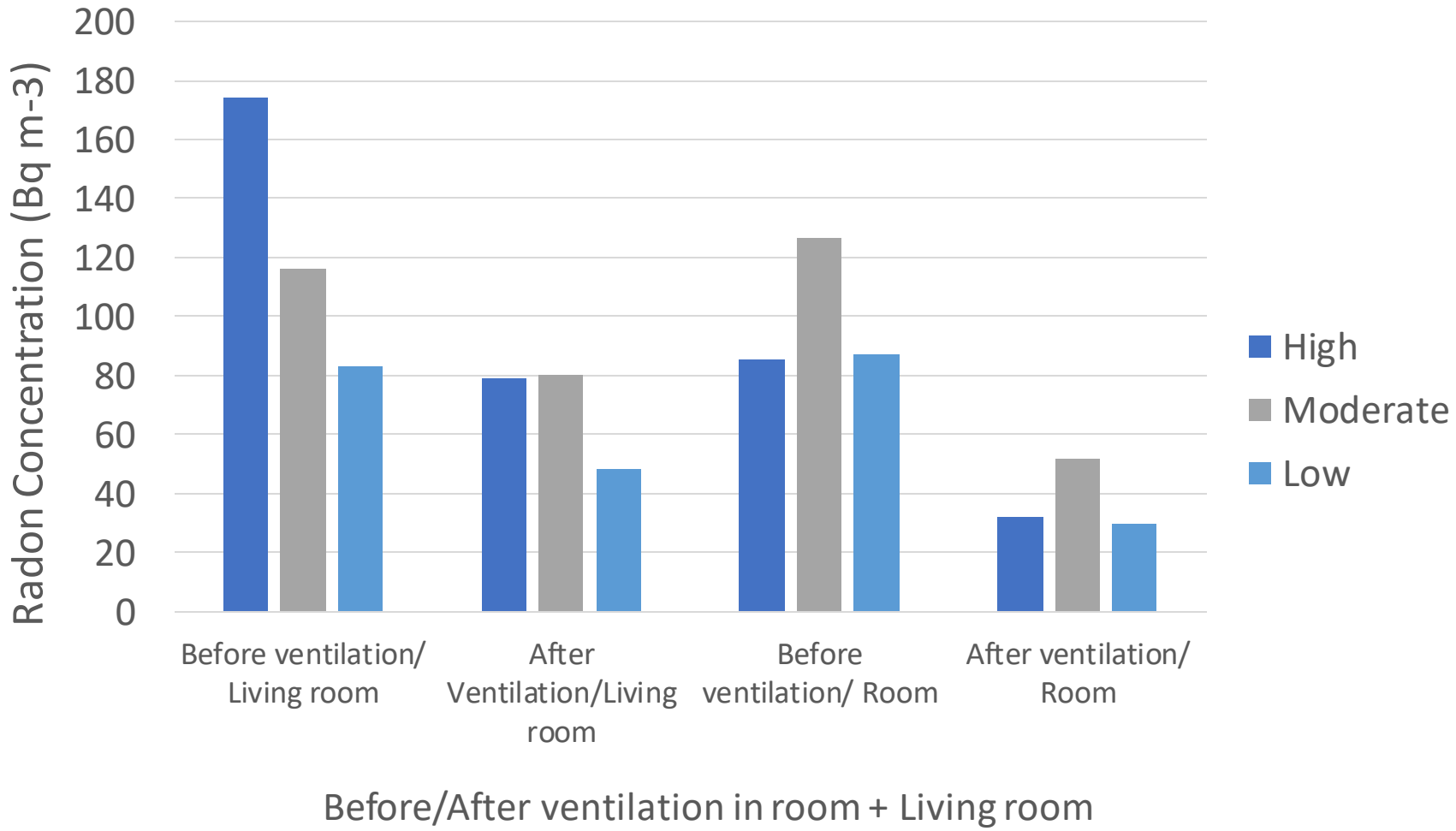
AC Ventilation can mitigate radon concentration levels



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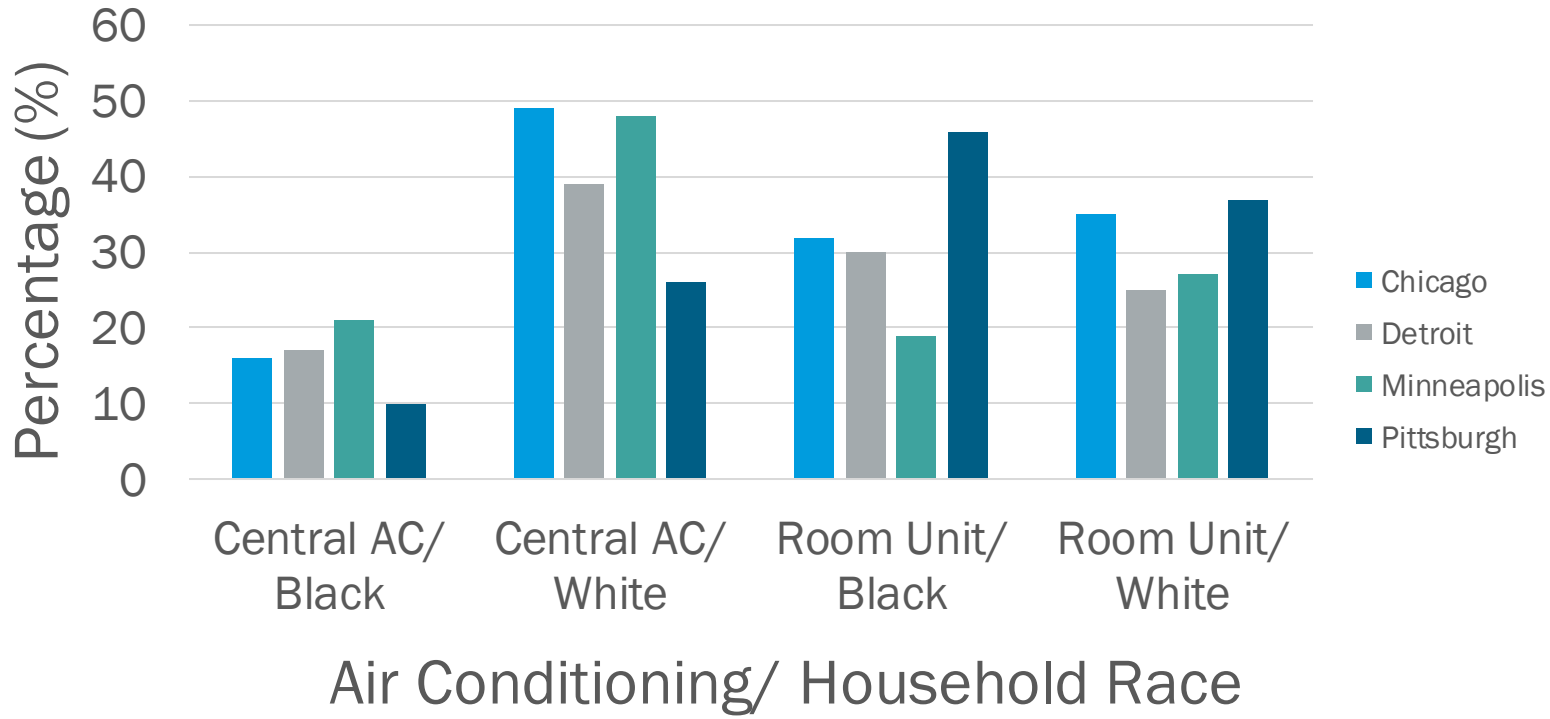
Decreased Central Air Conditioning & Household Race



Adamkiewicz G, Zota AR, Fabian MP, Chahine T, Julien R, Spengler JD, Levy JI. Moving environmental justice indoors: understanding structural influences on residential exposure patterns in low-income communities. Am J Public Health. 2011 Dec;101 Suppl 1(Suppl 1):S238-45. doi: 10.2105/AJPH.2011.300119. Epub 2011 Aug 11. PMID: 21836112; PMCID: PMC3222513.

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OUTLINE

- Environmental Justice
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- EJScreen: EPA Region 3 Cancer Disparities
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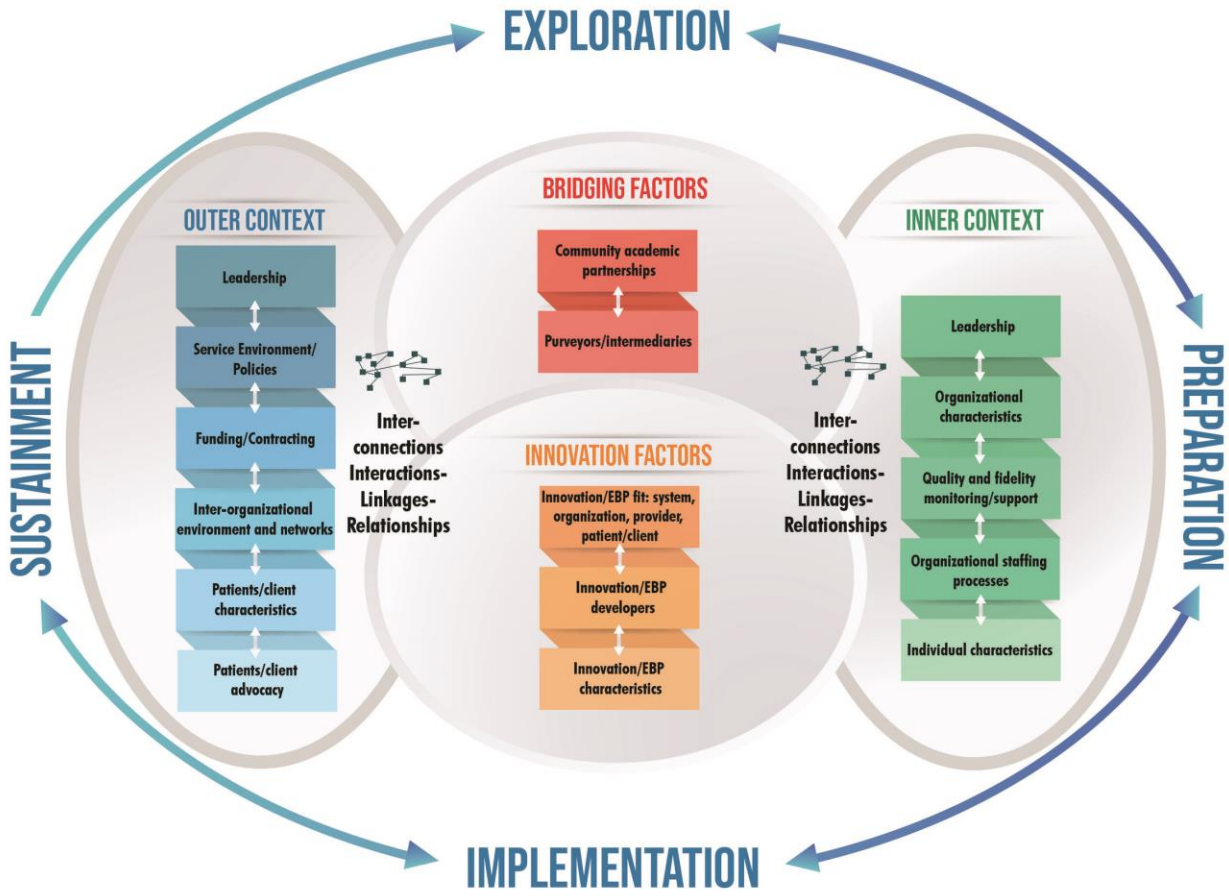
Implementation Science

- Goal: To integrate evidence-based practices and interventions on a community-based level in order to improve the impact on population health
- Provides a Framework to Address Radon Mitigation Disparities



https://episframework.com/

2011 Federal Radon Action Plan: Population approach to radon exposure

- Accomplishments:
  - Completed 88% of their commitments
  - Awareness and education efforts reached 1.6 million homes, schools, and childcare facilities
    - Aim: 860,000
    - 12.5% were tested and mitigated as seen fit
  - Higher rates of radon mitigation
  - Radon introduced in 27 CDC cancer plans

The Federal Radon Action Plan
(Environmental Protection Agency & U.S. Department of Health and Human Services, 2011)

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2021-2025 National Radon Action Plan Aims

- Built in Risk reduction
  - Local, State, Federally backed policies requiring radon testing + Mitigation
- Support Radon Risk Reduction
  - Inclusion of radon in all exposure and cancer control plans
- Build Capacity for Professional Radon Services
  - Expand availability of radon professional networks/ radon data
- Increase Awareness of Radon Risk + Control Strategies
  - Tailor radon awareness messaging to vulnerable and overburdened populations

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Increasing awareness

- Education & Awareness can affect rates of radon testing

- Recommendation:
  - Identify EJ communities
  - Raise local awareness about radon
  - Use community partners and engagement for messaging about radon and why they are at risk for exposure disparities

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EJ Community Members Deserve a Seat at the Table

- Local community engagement about radon & health risks is crucial to increasing awareness in EJ communities
- Recommendation for engagement activities:
  - Workshops
  - Informational sessions
  - Townhalls
  - Link with environmental Justice grassroots organizations
- Question:
  - How can radon risk-reduction professionals/advocates ensure they are meeting the specific needs of EJ communities?
  - Need to track community level rates of testing and mitigation

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Increase data collection about other environmental factors

- Collecting data on a local scale can identify communities in need of radon mitigation services
- Recommendation:
  - Don’t work on radon as an isolated issue:
- Its not just radon:
  - Income
  - Renting vs Owning
  - Exposure to other Pollutants
  - Everyday life (competing priorities, resource limitations)

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Creating sustainability for radon mitigation

- Introducing laws requiring radon testing and mitigation
  - Requiring financial assistance for radon mitigation for communities in need
  - Requiring testing for radon in schools

- Funding/Creating radon mitigation programs in EJ Communities
  - Lending programs
  - Financial assistance programs
  - Funded radon testing and mitigation certification programs

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It Takes All of Us!

Health Specialists
- Local Allergy and Asthma Treatment Centers
- Immunologists
- Ear, Nose and Throat Specialists
- Pulmonologists
- Pediatric Physicians
- General Practitioners
- Local Hospitals (Community Investment)

Care Givers
- In-home Nurses and Care Givers

Local Government
- Public Health Agencies
- Certified Lead Paint Abatement Contractor
- Licensed Mold Remediation Service Provider
- Become a Certified Radon Tester
- Federal/State Certification for Asbestos Remediation

Educators
- Provide Information to Parent/Teacher Assns.
- Integrate healthy housing into CC curricula

Real Estate Professionals
- Realtors, Appraisers, and Inspectors
- Lenders

Shows
- Bridal Shows
- Pet Shows (differentiate from the home & garden crowd)

Media
- Provide Case Studies to Local TV, Radio and Newspapers
- Participate in Social Media Sites Relating to Health Issues
- Build a Strong Web Site with Credible Information
- Engage SEO/SEM and Lead Generation Consultants

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Questions?

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