The Future is Here: Low Dose Computed Tomography for Adults at High Risk of Lung Cancer

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Conflict of Interest

- We have no conflict of interest to report

Lung Cancer

- The second most common cancer
- The leading cause of cancer deaths
- Most common risk factors for lung cancer:
  - Increasing age
  - Exposure to Tobacco
  - Length of time since quitting smoking
- Current smokers make up 17.8% of adults aged 18+

1- American Cancer Society. Cancer Facts & Figures 2015. Atlanta, GA: American Cancer Society; 2015. Accessed at http://www.cancer.org/cancer/lungcancer-non-smallcell/detailedguide/non-small-cell-lung-cancer-key-statistics on 14 April 2015
2- Centers for Disease Control and Prevention. Current Cigarette Smoking Among Adults—United States, 2005–2013. Morbidity and Mortality Weekly Report 2014;63(47):1108–12 [Accessed 22 January 2015]
3- Moyer, V. A., and Force, U. S. P. S. T. (2014) Screening for lung cancer: U.S. Preventive Services Task Force recommendation statement. Annals of internal medicine 160, 330-338

The United States Preventive Services Task Force (USPSTF) Recommendation for Lung Cancer Screening

- ✓ Age: 55 to 80
- ✓ 30 pack-years
- ✓ Currently smoke or
  Stopped smoking (past 15 years)

Grade: **B**

AGES 55-74

53,500

men and women

1 pack/day

30 years

SCREENINGS

Chest x-ray

Low-dose spiral CT scan

20% fewer lung cancer deaths

Moyer, V. A., and Force, U. S. P. S. T. (2014) Screening for lung cancer: U.S. Preventive Services Task Force recommendation statement. A

Study Rationale

- The key to effective screening programs is to identify those who are eligible.
- Studies indicate gender differences in median pack-years and lung cancer risk by cigarette smoking.

Objective:

- To investigate the national prevalence of eligibility for lung cancer screening with particular attention to gender.
- To project eligibility for lung cancer screening among Maryland adults

1- International Early Lung Cancer Action Program, I., Henschke, C. I., Yip, R., and Miettinen, O. S. (2006) Women's susceptibility to tobacco carcinogens and survival after diagnosis of lung cancer. Jama 296, 180-184
2- Risch, H. A., Howe, G. R., Jain, M., Burch, J. D., Holowaty, E. J., and Miller, A. B. (1993) Are female smokers at higher risk for lung cancer than male smokers? A case-control analysis by histologic type. American journal of epidemiology 138, 281-293
3- Zang, E. A., and Wynder, E. L. (1996) Differences in lung cancer risk between men and women: examination of the evidence. Journal of the National Cancer Institute 88, 183-192
4- Pinsky, P.F. (2006) Racial and ethnic differences in lung cancer incidence: How much is explained by differences in smoking patterns? Cancer Causes Control. 17, 1017-1024

Methods

- Cross-sectional study
- National Health and Nutrition Examination Survey (NHANES)
- 2011-2012
- Age: 55 to 80
  - ✓ Smoking and tobacco use status and history
  - ✓ Demographics
- Weighted to the US population
- Multiple logistic regression

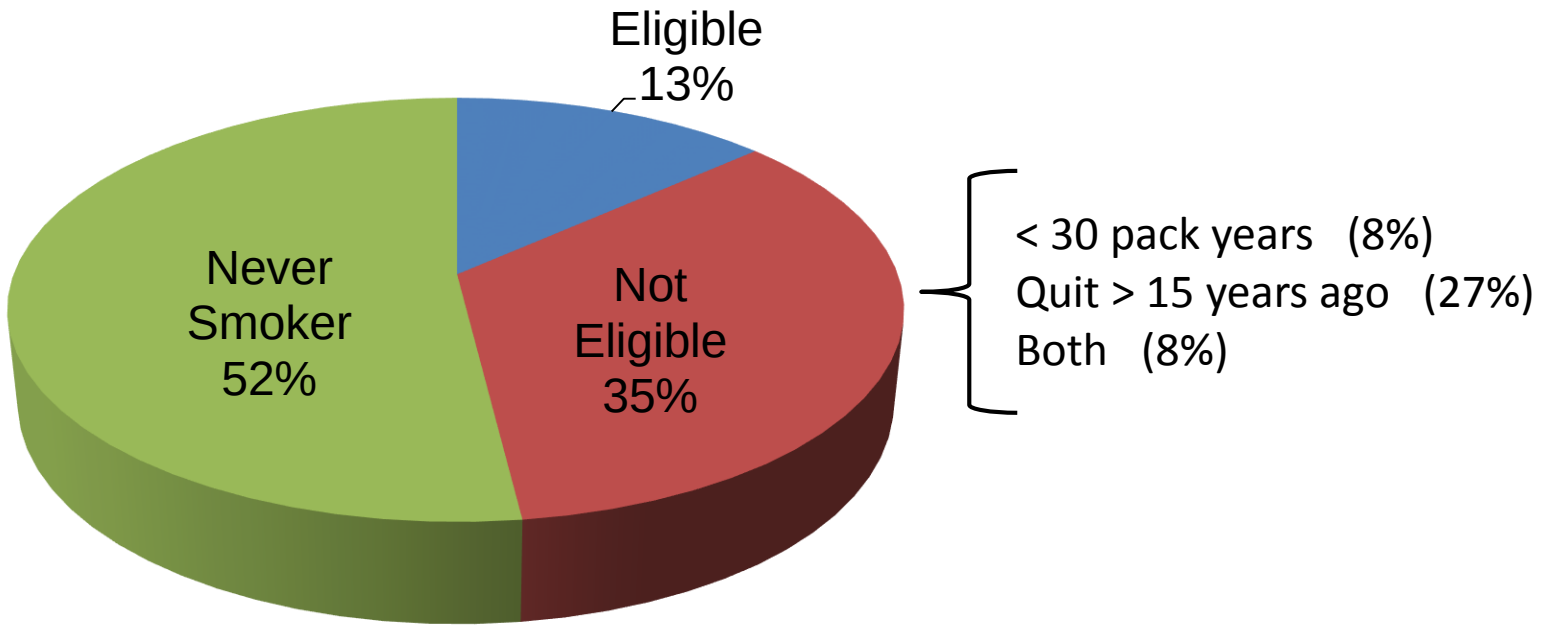
- Projections of the number of Marylanders eligible for lung cancer screening
  - ✓ Prevalence from NHANES
  - ✓ Maryland population from 2011 National Center for Health Statistics

Table 1: Participant characteristics by demographics and lifestyle behavior, adults aged 55-80 years (n= 2190): National Health and Nutrition Examination Surveys, United States, 2011-2012

		Percentage*	SE
Demographics			
Gender	Female	53.52	0.85
	Male	46.48	0.85
Race			
	White	76.20	3.16
	Black	9.59	2.23
	Asian	4.00	0.82
	Mexican American	3.31	0.96
	Other Hispanic	4.64	1.36
	Other race (including multi-racial)	2.25	0.73
Marital status			
	Married or living with a partner	62.85	1.77
	Divorced, widowed or separated	30.58	1.03
	Never married	6.57	0.98
Age			
	55-60 years	26.96	1.16
	60-65 years	23.18	1.63
	65-70 years	15.46	1.30
	70-75 years	12.78	0.82
	75-80 years	21.63	0.93
Education			
	Less than 9th grade	8.49	1.08
	9-11th grade (Includes 12th grade with no diploma)	10.44	1.57
	High school graduate/GED or equivalent	21.25	2.12
	Some college or AA degree	29.66	2.19
	College graduate or above	30.16	3.25
Smoking Status			
	Current smoker	14.83	0.94
	Former smoker	35.56	1.74
	Never smoked	49.61	1.75

*Prevalences are weighted proportionate to the US population.

Graph 1: Proportion of participants (n=2190) by eligibility: National Health and Nutrition Examination Surveys, United States, 2011-2012



*Prevalences are weighted proportionate to the US population.

Table 3: Association between eligibility and demographic characteristics: National Health and Nutrition Examination Surveys, United States, 2011-2012

		Eligible OR	95% CI		Not Eligible OR	95% CI		Never Smoker OR	95% CI	
Gender										
	Female	Reference			Reference			Reference		
	Male	3.37	2.39	4.77	1.92	1.39	2.65	0.32	0.23	0.44
Race										
	White	Reference			Reference			Reference		
	Black	0.85	0.59	1.22	0.96	0.72	1.27	1.13	0.86	1.48
	Asian	0.61	0.41	0.91	0.42	0.25	0.69	2.68	1.87	3.84
	Mexican American	0.35	0.23	0.52	1.35	0.88	2.09	1.12	0.77	1.63
	Other Hispanic	0.56	0.27	1.19	0.74	0.44	1.24	1.69	1.24	2.29
	Other race	1.21	0.40	3.65	1.71	0.72	4.04	0.48	0.16	1.38
Age										
	55-60 years	Reference			Reference			Reference		
	60-65 years	1.14	0.50	2.59	0.77	0.41	1.42	1.18	0.74	1.87
	65-70 years	1.21	0.57	2.58	1.37	0.81	2.32	0.66	0.40	1.10
	70-75 years	0.76	0.30	1.93	1.55	0.86	2.81	0.74	0.45	1.22
	75-80 years	0.54	0.23	1.30	1.59	0.90	2.80	0.82	0.52	1.29

The logistic regression output is adjusted for race, gender, and age and weighted proportionate to the US population.
Odds ratios are calculated comparing one eligibility group to the other two.

Table 4: Association between eligibility and gender and race: National Health and Nutrition Examination Surveys, United States, 2011-2012

		Eligible OR	95% CI		Not Eligible OR	95% CI		Never smoker OR	95% CI	
Gender										
	Female	Reference			Reference			Reference		
	Male	3.60	2.5	5.3	1.95	1.4	2.7	0.30	0.21	0.42
Race										
	White	Reference			Reference			Reference		
	Black	0.61	0.4	0.8	1.01	0.8	1.4	1.25	0.98	1.61
	Asian	0.54	0.4	0.8	0.44	0.3	0.7	2.63	1.88	3.70
	Mexican American	0.20	0.1	0.3	1.53	0.9	2.5	1.34	0.86	2.09
	Other Hispanic	0.37	0.2	0.8	0.81	0.5	1.4	1.91	1.37	2.66
	Other race	0.91	0.3	2.7	1.57	0.7	3.5	0.59	0.21	1.66

Adjusted for gender, age, race, and education.

Table 5: Participant (n=2190) characteristics stratified by eligibility: National Health and Nutrition Examination Surveys, United States, 2011-2012

		Eligible		Not eligible		Never smoker	
Demographics							
Gender		Percentage	SE	Percentage	SE	Percentage	SE
	Female	26.74	3.14	41.97	2.89	65.30	1.77
	Male	73.26	3.14	58.03	2.89	34.70	1.77
Race							
	White	81.01	4.01	78.01	3.30	74.28	3.35
	Black	8.70	2.88	9.17	2.34	10.09	2.18
	Asian	2.72	0.71	2.12	0.57	5.55	1.13
	Mexican American	1.54	0.48	3.88	1.25	3.22	0.92
	Other Hispanic	2.86	1.54	3.76	0.83	5.59	1.70
	Other race (including multi-racial)	3.17	1.67	3.06	1.13	1.26	0.42
Age							
	55-60 years	28.71	6.48	23.98	2.52	26.62	2.06
	60-65 years	27.61	4.72	17.52	2.28	25.87	1.57
	65-70 years	19.83	3.44	17.33	2.42	13.31	1.33
	70-75 years	10.86	2.32	15.27	1.83	12.13	1.41
	75-80 years	12.99	2.29	25.90	1.98	22.07	1.75
Education							
	Less than 9th grade	8.94	1.00	8.18	1.67	8.83	1.16
	9-11th grade	17.86	3.71	9.59	2.05	9.29	1.28
	High school graduate/GED	23.51	4.48	19.15	2.83	21.24	2.20
	Some college or AA degree	31.75	3.27	34.04	4.01	25.78	2.02
	College graduate or above	17.95	3.50	29.05	4.83	34.86	3.01

*Prevalences are weighted proportionate to the US population.

Table 6: Estimated Marylanders eligible for lung cancer screening, 2011-2012

		Eligible (n= 166,732)
Gender		
	Females	44,584 (26.74)
	Males	122,148 (73.26)
Race		
	Whites	135,070 (81.01)
	African American	14,506 (8.70)
	Asians	4,535 (2.72)
	American Indian or Alaska Native	5,285 (3.17)
	Hispanic or Latino	7,336 (4.40)
Age		
	55 - 60 years	47,869 (28.71)
	60 - 65 years	46,035 (27.61)
	65 - 70 years	33,063 (19.83)
	70 - 75 years	18,107 (10.86)
	75 - 80 years	21,658 (12.99)

In 2011, the total number of Marylanders aged 55-80 were 1,244,489.

Discussion

- Nearly one in eight adults in the US aged 55-80 are eligible.
  - Maryland **N= 167,000**
- Three quarters of the eligible in the US are male.
  - Maryland **N=122,000**
- If we get to the point where we are doing low dose CT screening:
  - People who are at very high risk because of the smoking history (30+ pack yrs) need to have a good open conversation with the doctor who understands this information AND make a decision, realizing that there are harms and known benefits.
  - False positive
  - Overdiagnosis
  - Harms due to radiation, biopsies, surgeries, etc.
  - Intermediate risk or low risk individuals (NLST trial did not speak to this group)

Caveats

- Applying US prevalences to Maryland

	Maryland	USA
Female	51.50%	50.80%
White alone, not Hispanic or Latino, 2014	52.60%	62.10%
Black or African American alone, 2014	30.30%	13.20%
Asian alone, 2014	6.40%	5.40%
Hispanic or Latino, 2014	9.30%	17.40%

- Maryland eligible estimates might be slightly different

Mauchley, D. C., and Mitchell, J.D. (2015) **Current Estimate of Costs of Lung Cancer Screening in the United States** . Thoracic Surgery Clinics, 25, 205-215

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Thank you

Health Care Resource	Unit Cost (2011 US$)	Expenditures w/ 100% Screening (US$ Millions)	Expenditures w/ 75% Screening (US$ Millions)	Expenditures w/ 50% Screening (US$ Millions)
LDCT scan	527	3,162.80	2,372.10	1,581.40
F/up CXR	92	22.2	16.6	11.1
F/up Chest CT	527	439.5	329.6	219.7
F/up PET/CT	1,491	207.2	155.4	103.6
Percutaneous biopsy	979	29.5	22.1	14.8
Bronchoscopy w/out biopsy	1,226	37	27.7	18.5
Bronchoscopy w/biopsy	1,270	46.8	31.9	23.4
Mediastinoscopy	3,814	44.7	33.5	22.4
Thoracoscopy	3,795	82.6	62	41.3
Thoracotomy	11,285	548	411	274
Major complications	10,096	84.5	63.4	42.3
Intermediate complications	6,072	81.3	61	40.7
Total imaging and procedure expenditures		**4,786.10**	**3,586.30**	**2,393.20**
Treatment expenditures in screen-detected cases				
Localized stage	35,648.60	1,221.60	916.2	610.8
Regional stage	107,096.50	1,362.60	1,022.00	681.3
Distant stage	141,300.20	1,840.20	1,380.20	920.1
Treatment expenditures for those who missed screening				
Localized stage	35,648.60	0	65.4	130.8
Regional stage	107,096.50	0	288.1	576.3
Distant stage	141,300.20	0	1,088.60	2,177.20
Total screening treatment expenditures		**4,424.40**	**4,688.50**	**5,096.50**
Treatment if screening not adopted				
Localized stage	35,648.60			
Regional stage	107,096.50			
Distant stage	141,300.20			
Total treatment cost if no screening				
Treatment cost offset by screening		**1,343.90**	**1,079.80**	**671.8**
Annual total Expenditures attributable to LDCT screening		**3,442.20**	**2,506.50**	**1,721.40**

Mauchley, D. C., and Mitchell, J.D. (2015) **Current Estimate of Costs of Lung Cancer Screening in the United States** . Thoracic Surgery Clinics, 25, 205-215