Potential Population Health Gains of an Accessible Blood-Based Genomic Test to Improve Lung Cancer Screening

Peter B. Bach,[1] Jesse D. Ortendahl,[2] Niti Trivedi,[1] Chris Cisar[1]

[1]Delfi Diagnostics Inc., Baltimore, MD, USA; [2]Partnership for Health Analytic Research, Beverly Hills, CA, USA

BACKGROUND

- Annual screening for lung cancer by low-dose computed tomography (LDCT) reduces mortality, but sparse adoption has limited population benefits in both the US and worldwide.[1-4]

METHODS

- Multiple Monte Carlo simulations were performed in a hypothetical cohort of 2 million lung cancer screening-eligible individuals to compare clinical outcomes over a 5-year period for the following scenarios:
  - A. NO GENOMIC TEST: The rate of LDCT screening increases from 6% at baseline to 7% by year 5.
  - B. GENOMIC TEST (95/10): The rate of Genomic Test use increases from 6% at baseline to 14% by year 5; 95% of Genomic Test(+) cases and 10% of Genomic Test(−) cases proceed to LDCT screening.
  - C. GENOMIC TEST (75/25): The rate of Genomic Test use increases from 6% at baseline to 14% by year 5; 75% of Genomic Test(+) cases and 25% of Genomic Test(−) cases proceed to LDCT screening.
- The Genomic Test was set to 83% sensitivity and 50% specificity for lung cancer.

MODEL ASSUMPTIONS

- Model assumptions were derived from published clinical trials of LDCT screening,[1] and population smoking and age distribution from the National Health and Nutrition Examination Survey 2017 to March 2020 cohort.[5]
- Individuals met the lung cancer screening eligibility criteria recommended in 2021 by the US Preventive Services Task Force[6]: adults 50-80 years old who have a smoking history of at least 20 pack-years and currently smoke or have quit within the past 15 years.
- Annual probability of having a non-screen-detected cancer is 75%.
- Other model assumptions are shown in the tables.

OUTCOMES

- Impact of the use of a Genomic Test on:
  - Percentage of cancer detected in population, by scenario
  - Stage distribution of screen-detected cancers
  - Number of false-positives, by scenario

REFERENCES

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5. National Health and Nutrition Examination Survey Data. http://www.cdc.gov/nchs/nhanes.htm
6. US Preventive Services Task Force, et al. *JAMA.* 2021;325(10):962-970.
7. Pinsky PF, et al. *J Med Screen.* 2013;20(3):165-168.

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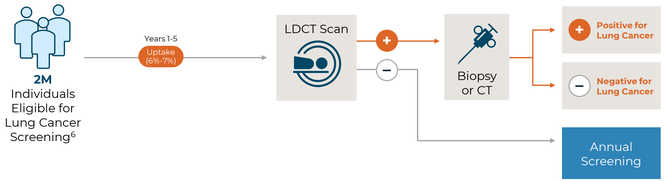
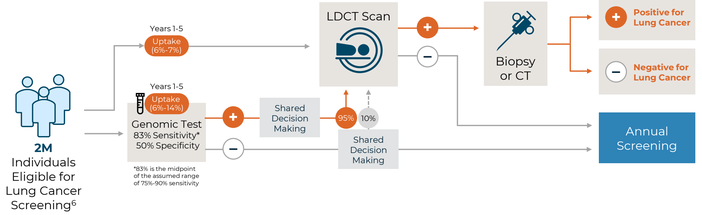
DELFI

How could a blood-based genomic test improve the uptake and efficiency of lung cancer screening?

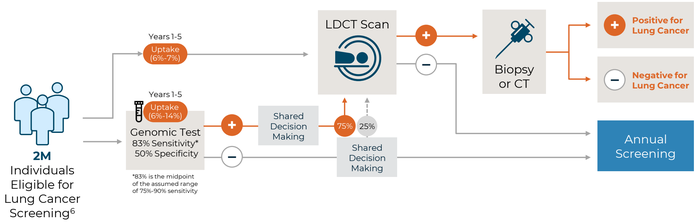
SCENARIO A: NO GENOMIC TEST



SCENARIO B: GENOMIC TEST (95/10)



SCENARIO C: GENOMIC TEST (75/25)



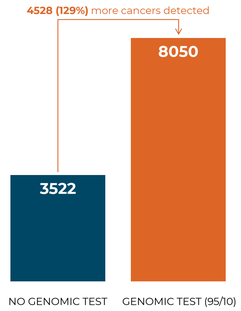
MODEL ASSUMPTIONS

Screening Uptake	Year 1	Year 2	Year 3	Year 4	Year 5
A. LDCT (No Genomic Test)[3]	5.9%	6.2%	6.5%	6.8%	7.0%
B. Genomic Test (95/10)	5.9%	8.0%	10.0%	12.0%	14.0%
LDCT if Test(+)	95%	95%	95%	95%	95%
LDCT if Test(−)	10%	10%	10%	10%	10%
C. Genomic Test (75/25)	5.9%	8.0%	10.0%	12.0%	14.0%
LDCT if Test(+)	75%	75%	75%	75%	75%
LDCT if Test(−)	25%	25%	25%	25%	25%

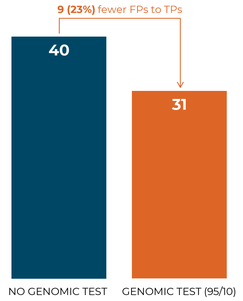
Stage Distribution at Detection[1]	Stage I	Stage II	Stage III	Stage IV
Screen detected at 1st screen	54.2%	7.6%	21.9%	16.3%
Screen detected at 2nd screen	58.9%	10.0%	18.3%	12.8%
Screen detected at 3rd screen	62.8%	5.8%	15.9%	15.5%
Not screen detected	34.7%	7.4%	26.5%	31.4%

Screening Test Characteristics	GENOMIC TEST	LDCT[7]
True-positive rate	75%-90%	93%
False-positive rate	50%	24%
Positive predictive value	1.0%	2.4%
Negative predictive value	99.8%	99.9%

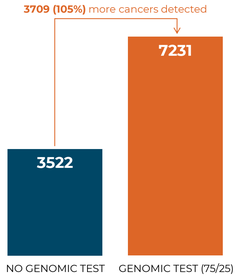
SCREEN-DETECTED CANCERS (A/B)



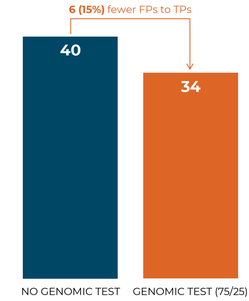
FALSE-POSITIVE TO TRUE-POSITIVE RATE (A/B)



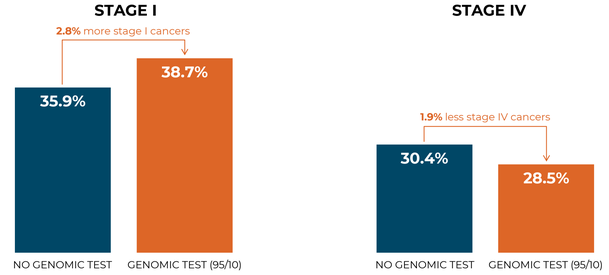
SCREEN-DETECTED CANCERS (A/C)



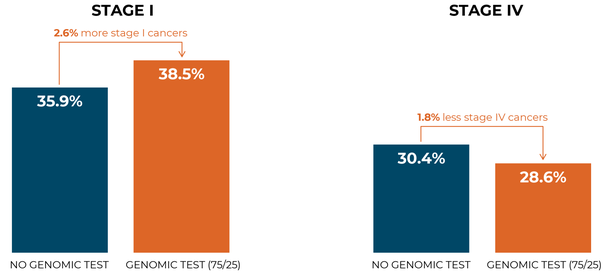
FALSE-POSITIVE TO TRUE-POSITIVE RATE (A/C)



PERCENT OF STAGE I AND STAGE IV CANCERS AT DETECTION (A/B)



PERCENT OF STAGE I AND STAGE IV CANCERS AT DETECTION (A/C)



In this simulation model, a Genomic Test designed to improve uptake and efficiency of lung cancer screening shows substantial population-level health gains across a range of assumptions of its impact on subsequent LDCT utilization.