Potential Health and Economic Outcomes of a Blood-Based Genomic Test as a Prescreen for Lung Cancer in the US Medicare Population

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BACKGROUND

- Annual screening for lung cancer by low-dose computed tomography (LDCT) reduces mortality.[1,2]
- Despite no cost-share for covered individuals, limited availability and frequent 'false alarm' findings have impeded widespread adoption,[3,4] diminishing potential population health gains.
- Here, we examine a model of the clinical and economic effects of introducing an accessible blood-based genomic test (BGT) used as a prescreen to support more rapid and refined uptake of LDCT screening within the US Medicare population.

METHODS

- Multiple Monte Carlo simulations were performed in a hypothetical cohort of 6-million Medicare lung cancer screening-eligible individuals to compare clinical outcomes over a 5-year period for the following scenarios:
  - A. NO BLOOD-BASED GENOMIC TEST: The rate of primary LDCT screening increases from 5.9% at baseline to 9.3% by year 5 based on real-world estimates.
  - B. BLOOD-BASED GENOMIC TEST: The rate of primary LDCT screening increases from 5.9% at baseline to 9.3% by year 5. The rate of BGT use is 10% each year; 100% of BGT(+) cases and 0% of BGT(−) cases proceed to LDCT screening.
- The BGT was set to 85% sensitivity and 50% specificity for lung cancer.

MODEL ASSUMPTIONS

- Model assumptions were derived from SEER[5] and published clinical trials of LDCT screening,[1] the CISNET Smoking History Generator for population smoking patterns,[6] and published lung cancer treatment costs.[7]
- All individuals were Medicare beneficiaries.
- Individuals met the lung cancer screening eligibility criteria recommended in 2021 by the US Preventive Services Task Force[8]: adults 50-80 years old; smoking history of ≥20 pack-years; currently smoke or quit within the past 15 years.
- Annual probability of having a non-screen-detected cancer was set at 75%.
- Other model assumptions are shown in the tables.

OUTCOMES

- 5-year impact of the use of a BGT on:
  - Number of lung cancer deaths
  - Number of LDCT false-positives
  - Number needed to screen to detect a cancer
  - Stage distribution of lung cancers
  - Cancer treatment costs

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7. Sheehan DF et al. *Cancer Med.* 2019;8(1):94-103.
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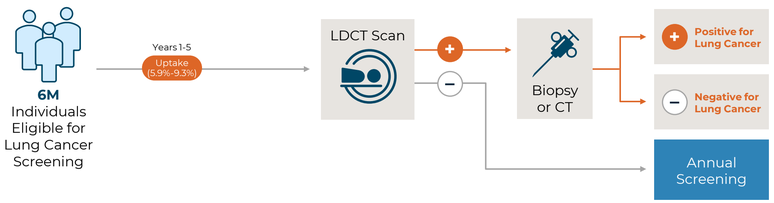
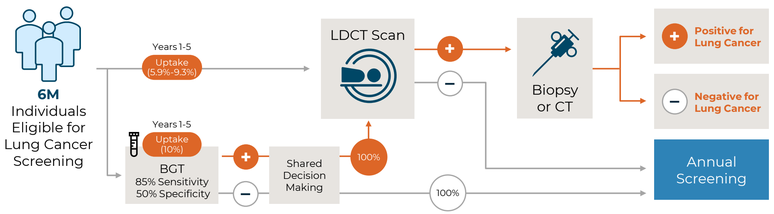
How could a blood-based genomic test improve outcomes in a Medicare lung cancer screening-eligible population?

SCENARIO A: NO BLOOD-BASED GENOMIC TEST



SCENARIO B: BLOOD-BASED GENOMIC TEST



MODEL ASSUMPTIONS

Screening Uptake	Year 1	Year 2	Year 3	Year 4	Year 5
A. LDCT (No Genomic Test)[3]	5.9%	6.8%	7.6%	8.5%	9.3%
B. Genomic Test (100/0)	10%	10%	10%	10%	10%
LDCT if Test(+)	100%	100%	100%	100%	100%
LDCT if Test(−)	0%	0%	0%	0%	0%

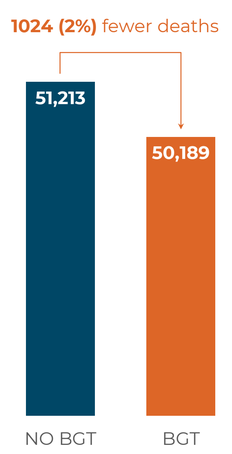
Screening Test Characteristics	Blood-Based Genomic Test	LDCT[9]
True-positive rate	85%	93%
False-positive rate	50%	24%
Positive predictive value	1.0%	2.4%
Negative predictive value	99.8%	99.9%

Stage Distribution at Detection[1]	Stage I	Stage II	Stage III	Stage IV
Screen detected at 1st screen	63.0%	7.2%	17.0%	12.8%
Screen detected at 2nd screen	63.0%	7.2%	17.0%	12.8%
Screen detected at 3rd screen	63.0%	7.2%	17.0%	12.8%
Not screen detected	22.8%	4.7%	24.6%	47.9%

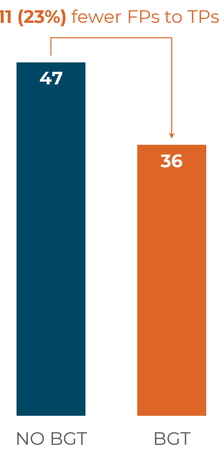
Cancer Costs by Stage at Diagnosis (monthly)[7]	Initial Phase[a]	Continuing Phase	Terminal Phase[b]
Stage 1	$2,226	$2,111	$18,795
Stage 2	$2,226	$2,111	$18,795
Stage 3	$7,964	$4,502	$18,795
Stage 4	$9,740	$6,431	$18,795

[a]Initial phase is the first 6 months after diagnosis; [b]Terminal phase is the final 6 months before death

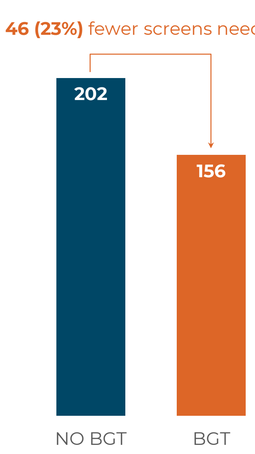
LUNG CANCER DEATHS



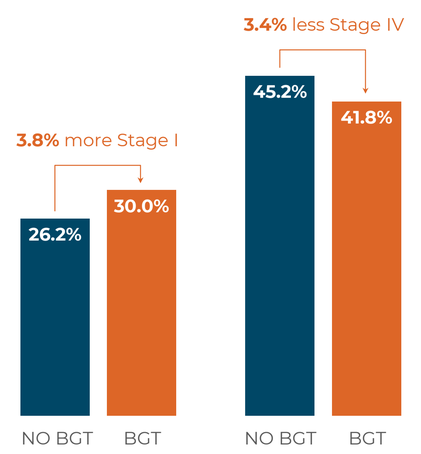
LDCT FALSE-POSITIVE TO TRUE-POSITIVE RATE



NUMBER NEEDED TO SCREEN



PERCENT OF STAGE I AND STAGE IV CANCERS AT DETECTION



CANCER TREATMENT COSTS (USD$)

In this simulation, a blood-based genomic test designed to improve uptake and efficiency of lung cancer screening showed substantial population-level health gains while reducing lung cancer treatment costs.