Original Contribution

Projected Clinical, Resource Use, and Fiscal Impacts of Implementing Low-Dose Computed Tomography Lung Cancer Screening in Medicare

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Abstract

Purpose: The Centers for Medicare and Medicaid Services (CMS) recently issued a national coverage determination that provides reimbursement for low-dose computed tomography (CT) lung cancer screening for enrollees age 55 to 77 years with ≥ 30–pack-year smoking history who currently smoke or quit in the last 15 years. The clinical, resource use, and fiscal impacts of this change in screening coverage policy remain uncertain.

Methods: We developed a simulation model to forecast the 5-year health outcome impacts of the CMS low-dose CT screening policy in Medicare compared with no screening. The model used data from the National Lung Screening Trial, CMS enrollment statistics and reimbursement schedules, and peer-reviewed literature. Outcomes included counts of screening examinations, patient cases of lung cancer detected, stage distribution, and total and per-enrollee per-month fiscal impact.

Results: Over 5 years, we project that low-dose CT screening will result in 10.7 million more low-dose CT scans, 52,000 more lung cancers detected, and increased overall expenditure of $6.8 billion ($2.22 per Medicare enrollee per month). The most fiscally impactful factors were the average cost–per-screening episode, proportion of enrollees eligible for screening, and cost of treating stage I lung cancer.

Conclusion: Low-dose CT screening is expected to increase lung cancer diagnoses, shift stage at diagnosis toward earlier stages, and substantially increase Medicare expenditures over a 5-year time horizon. These projections can inform planning efforts by Medicare administrators, contracted health care providers, and other stakeholders.

Introduction

Approximately 220,000 Americans are diagnosed with lung cancer annually, and only 16.8% survive 5 years after diagnosis.[1] This poor survival prognosis is largely attributable to the fact that lung cancer is typically diagnosed at an advanced stage. A majority of lung cancer cases are diagnosed in patients age > 65 years, so the US Medicare program is particularly affected by this unfavorable stage distribution.[1]

Screening people who are at high risk of developing lung cancer (eg, those with history of heavy smoking) provides an opportunity to detect patient cases at an earlier stage and more effectively intervene with potentially curative treatment. After several earlier trials failed to show a benefit from screening, the National Lung Screening Trial (NLST) showed that screening with low-dose computed tomography (CT) imaging resulted in 50.0% of patient cases being diagnosed at stage I versus 31.1% with radiography.[2,3] Those differences translated into a significant 20.0% (95% CI, 6.8% to 26.7%) reduction in lung cancer–specific mortality over 6.5 years of follow-up, as well as a 6.7% (95% CI, 1.2% to 13.6%) reduction in overall mortality.[2] However, these low-dose CT screening benefits were balanced by a high frequency of false positives (96% of positive findings were false-positive results; 23% of all screening tests were false-positive results).[2,4]

On February 5, 2015, the Centers for Medicare and Medicaid Services (CMS) issued a national coverage determination that provides coverage of low-dose CT lung cancer screening for Medicare enrollees age 55 to 77 years with ≥ 30–pack-year smoking history who are current smokers or quit in the last 15 years (in accordance with NLST inclusion criteria) and who enroll in a CMS-approved registry. The objective of our study was to forecast the 5-year clinical, resource use, and fiscal implications of this screening policy in Medicare enrollees age 55 to 77 years. Our findings can inform planning by a variety of stakeholders and highlight opportunities for implementing and administering lung cancer screening programs.

Methods

Overview

We developed a simulation model in Microsoft Excel (Redmond, WA) to synthesize evidence from the NLST and other peer-reviewed data sources to project 5-year (2015 to 2019) aggregate health outcomes and costs related to low-dose CT lung cancer screening for the Medicare program. Our approach applied NLST stage-specific lung cancer incidence estimates to the Medicare population age 55 to 77 years under two scenarios: low-dose CT lung cancer screening coverage and no screening coverage. Costs included low-dose CT screening tests and associated primary care and other clinic visits, diagnostic work-up (imaging, bronchoscopy, biopsy), lung cancer treatment, and end-of-life care. Expenditure outcomes (total and per enrollee per month) were calculated from the Medicare payer perspective and discounted at 3% per year.

Population and Setting

The Medicare population evaluated in the model was based on Congressional Budget Office estimates for Medicare Part B enrollment from 2015 to 2019 (51 to 57 million enrollees).[5] We assumed that the proportion of enrollees age 55 to 77 years eligible for low-dose CT screening was equal to the proportion of participants in the Prostate, Lung, Colorectal, and Ovarian screening trial who had ≥ 30–pack-year smoking history and were current smokers or had quit within the past 15 years (20.3%).[6] Accordingly, 12.5% of the Medicare population is expected to meet screening criteria after adjusting for the proportion who do not qualify for screening because of age (< 55 or ≥ 77 years).

Low-Dose CT Screening Patient Flow

Lung cancer risk classification. The simulation model tracked patient flow in each scenario over 5 years. First, the cohort was risk stratified (as high risk or low or moderate risk for lung cancer) using NLST criteria.[3] Only high-risk enrollees are considered for screening, and we did not explicitly model health outcomes for low/moderate-risk individuals.

Uptake of low-dose CT screening. We increased the proportion offered low-dose CT screening over the first 5 years of the program to reflect providers gradually building screening infrastructure and capacity. In the base case, we assumed that 30% of high-risk enrollees were offered screening in 2015, and an additional 15% of high-risk enrollees were offered low-dose CT screening in each subsequent year of the model time horizon (ie, 45% offered screening in year 2 to 90% offered screening in year 5). Among high-risk enrollees offered screening, we assumed that only a proportion proceeded to screening (50% in year 1 to 70% in year 5), similar to historic patient behavior with analogous screening technologies.[7] These inputs collectively resulted in 15%, 25%, 36%, 49%, and 63% of high-risk enrollees receiving screening from 2015 to 2019, respectively.

Low-dose CT screening test performance. Using positive (4.9%) and negative predictive value (99.9%) estimates from a subgroup analysis of NLST participants age ≥ 65 years, we calculated the proportion of those screened who were correctly classified as having (and not having) lung cancer.[4] Among true-positive screens, we applied stage distribution estimates from patients age ≥ 65 years enrolled in the low-dose CT arm of NSLT.[2,4,8] Additionally, we assumed that a proportion of false-negative screens and nonadherent high-risk patients went on to clinical detection of disease (with SEER stage distribution).[2,9] Stage distributions for these groups are listed in Appendix Table A1 (online only). The remaining proportion of high-risk enrollees moved on to the subsequent screening interval in the model.

Overdiagnosis. The model used NLST results to model overdiagnosis, the screen-detected lung cancers that would not have been diagnosed in the absence of screening over the 5-year time horizon of the model.[10]

No-Screening Patient Flow

In the no-screening scenario, the Medicare population flowed through the same calculations as the low-dose CT screening scenario, but lung cancer was only clinically detected.

Direct Medical Expenditure Inputs

Initial low-dose CT screening. In accordance with the national coverage determination, high-risk enrollees in the Medicare population were offered low-dose CT screening once annually. The expenditures associated with this annual screening episode represent services involved in the patient-centered care process recommended by the American Lung Association, and costs were obtained from 2014 CMS reimbursement schedules (Appendix Table A1, online only).[11] First, we assumed a prescreening low-complexity office visit (Current Procedural Terminology [CPT] code 99213) to assess smoking history, discuss benefit–risk tradeoffs, and determine if enrollees intended to undergo curative surgical treatment in the event of early-stage lung cancer diagnosis. Second, we assumed smoking cessation counseling (CPT code 99407) and use of a smoking-cessation intervention in 51% of those screened, the proportion of current smokers in NLST.[2,12] Third, we assumed that enrollees received a low-dose CT screening scan at a nonfacility provider (CPT code 71250). Finally, we assumed a low-complexity office visit (CPT code 99213) for all positive screens to discuss the results and subsequent clinical actions. In the base case, this protocol cost an average of $422 per screening episode.

Diagnostic work-up for positive screening examinations. Among enrollees who screened positive for lung cancer, we assumed that all had a moderate-complexity office visit (CPT code 99214), 70% received a follow-up low-dose CT scan (CPT code 71250), and 10% received a follow-up positron emission tomography–CT scan, based on the findings of NLST.[8] True positives were assumed to be confirmed with bronchoscopy and biopsy, and expenditure for those procedures was derived from a prior study of low-dose CT screening based on NLST outcomes and CMS reimbursement schedules.[13]

Evaluation of incidental findings. It is well established that low-dose CT screening will also detect other clinically relevant conditions, such as coronary artery calcifications, liver and kidney cysts, and emphysema.[14] To reflect this reality, we included an average cost for incidental findings based on rates (9.2%) for participants age ≥ 65 years in the NLST (Appendix Table A1, online only). This cost only reflects additional diagnostic tests for characterization or medical and/or surgical intervention, not the cost of treatment itself.

Cancer care. We derived the stage-specific costs of cancer care from a prior study that evaluated lung cancer–attributable expenditures using the SEER-Medicare linked database.[15] The

Table 1. Base-Case Clinical and Resource Use 5-Year Results

	Diagnoses							Screenings				
	Stage I or II		Stage III		Stage IV			False-Positive Screens		False-Negative Screens		
Scenario	No.	%	No.	%	No.	%	Total Lung Cancer Diagnoses	No.	%	No.	%	Total Screening Episodes
Low-dose CT screening scenario	124,000	52.1	56,000	23.5	58,000	24.4	238,000	2,926,000	27.3	4,300	0.04	10,722,000
No-screening scenario	42,000	22.6	63,000	33.9	81,000	43.5	186,000	0	0.0	0	0.0	0
Difference	82,000	29.5	−7,000	−10.3	−23,000	−19.2%	52,000	2,926,000	27.3	4,300	0.04	10,722,000

Abbreviation: CT, computed tomography.

costs were partitioned into initial (first year), continuing, and end-of-life (last year of life) treatment phases (Appendix Table A1, online only).

Out-of-pocket costs. In accordance with CMS screening policy, we assumed there were no copayments or coinsurance to offset Medicare program expenditures.

Mortality Inputs

Lung cancer mortality rates were derived from SEER stage–specific survival in individuals age ≥ 65 years from 2004 to 2010.[1] Other cause-mortality rates were derived from smoker life-tables created as part of the National Cancer Institute CISNET (Cancer Intervention and Surveillance Modeling Network) project.[16]

Alternative Screening Uptake Scenarios

The rate of low-dose CT uptake is uncertain, but it may be highly influential on all model outcomes. Accordingly, we evaluated two additional scenarios in which the annual uptake rate was increased or decreased by 50% relative to the base case. These scenarios provide a plausible range of outcomes associated with variable screening uptake in the United States over the coming 5 years.

Sensitivity Analyses

We evaluated outcome uncertainty using one-way sensitivity analyses in which we propagated low- and high-value estimates through the model and obtained the resulting range of incremental early-stage lung cancer diagnoses and per-enrollee per-month cost impact for each model input. We also conducted a probabilistic sensitivity analysis using Monte Carlo simulation by specifying the distribution of model inputs, simultaneously sampling parameter sets from the distributions, and propagating the values through the model framework to calculate the joint distribution of model outcomes.[17,18] We used these results to calculate 95% CIs around the base-case model outcomes.

Results

Base Case

Over a 5-year time horizon, the model projected 10.7 million (95% CI, 8.0 to 13.4) low-dose CT screening examinations among Medicare enrollees, including 2.9 million (95% CI, 2.2 to 3.7) false-positive screens and 4,300 (95% CI, 3,200 to 5,400) false-negative screens (Table 1). Additionally, approximately 980,000 incidental findings are expected to result in additional diagnostic work-up.

The expected lung cancer impacts of screening include 52,000 (95% CI, 38,000 to 65,000) more patient cases diagnosed and a stage shift, with 29.5% more patient cases diagnosed at an early stage (I or II), 10.3% fewer patient cases diagnosed at stage III, and 19.2% fewer patient cases diagnosed at stage IV (Table 1).

Medicare expenditures are estimated to increase by $4.3 billion (95% CI, $2.6 to $6.0 billion) for screening examinations, $1.0 billion (95% CI, $0.6 to $1.4 billion) for diagnostic work-up, and $1.5 billion (95% CI, $0.6 to $2.3 billion) for cancer care. In total, these expenditures amount to an increase of $6.8 billion (95% CI, $4.5 to $9.1 billion) and a per-enrollee per-month fiscal impact of $2.22 (95% CI, $1.47 to $2.98; Table 2). Across all years of the analysis, the majority of expenditure was attributable to screening examinations (Figure 1).

Scenario Analysis

Scenarios in which low-dose CT screening uptake was 50% lower and 50% higher resulted in 26,000 and 76,000 more patient cases of lung cancer diagnosed, 14.7% and 33.7% more patient cases diagnosed at an early stage, $2.2 and $6.3 billion more in screening examination expenditures, $0.5 and $1.5 billion more in diagnostic expenditures, $0.7 and $2.1 billion more in cancer care expenditures, $3.4 and $10.0 billion more in total expenditure, and per-enrollee per-month fiscal impacts of $1.12 and $3.27, respectively.

One-Way Sensitivity Analysis

The most influential parameters in the one-way sensitivity analyses for the increase in the proportion diagnosed at an early stage were the proportion of high-risk enrollees receiving low-dose CT screening (range, 28% to 31%) and the lung cancer incidence rate in high-risk enrollees not receiving low-dose CT screening (range, 29% to 31%). In one-way sensitivity analyses for total expenditure impact, the most influential parameters were the average cost per screening episode (range, $5.6 to $8.1 billion), proportion of Medicare enrollees eligible for screening by NLST criteria (range, $5.9 to $7.8 billion), and cost of

Table 2. Base-Case Fiscal Impact 5-Year Results

Scenario	Screening Episodes Cost (billion US$)	%	Diagnostic Cost (billion US$)	%	Cancer Care Cost (billion US$)	%	Total Expenditure (billion US$)	Per-Enrollee per-Month Expenditure (US$)
Low-dose CT screening scenario	4.3	18.0	1.3	5.4	18.3	76.6	24.0	$2.22
No-screening scenario	0.0	0.0	0.3	1.7	16.9	98.3	17.2	—
Difference	4.3	18.0	1.0	3.7	1.5	−21.7	6.8	—

NOTE. 2014 US dollars.
Abbreviation: CT, computed tomography.

treatment in the first year after diagnosis with stage I lung cancer (range, $6.3 to $7.4 billion).

Discussion

We estimated the 5-year clinical, resource, and fiscal impacts of implementing low-dose CT lung cancer screening in the Medicare program using recent evidence from a subgroup analysis of participants age ≥ 65 years in the NLST.[4] Our findings suggest that low-dose CT screening will have important clinical impacts by shifting diagnoses toward earlier stages, in which curative treatment may be possible. However, this improvement in clinical outcomes will be accompanied by major expenditure increases for the Medicare program, because screening expenditure will greatly outpace any potential cancer care expenditure savings from a stage shift. Specifically, we project that establishing coverage for screening will increase total Medicare expenditure by approximately $6.8 billion—or $2.22 per enrollee per month over 5 years. This finding is lower than a prior estimate of the fiscal impact of breast cancer screening coverage ($2.50 per enrollee per month) and higher than estimates of the fiscal impact of colorectal and cervical cancer screening coverage ($1.10 and $0.95 per enrollee per month, respectively).[19]

Our findings have important implications for stakeholders involved in lung cancer screening, diagnosis, and care in the Medicare program. First, we demonstrate the potential for low-dose CT screening to precipitate a major shift in lung cancer diagnosis to earlier, more curable stages, even after accounting for suboptimal real-world screening uptake. Providers will diagnose increasing numbers of patients with stage I or II disease. This change has specific implications for surgical specialists and radiation oncologists, who may find rapidly increasing demand for lung cancer–related procedures over the coming 5 years. Second, implementing a screening program will dramatically increase demand for low-dose CT scans, health professionals, and associated information technology infrastructure. We estimate that, on average, implementing low-dose CT screening will require an additional 2.1 million low-dose CT scans per year from the Medicare population in the initial 5 years after implementation—or approximately 5,900 additional scans per day. It is unclear if the current CT scanner and health professional supply can meet this demand. Third, Medicare expenditure increases will require CMS to find cost offsets to balance its budget or to increase premiums to fund the implementation of lung cancer screening. Because the majority of increased expenditure is for screening episodes, there will still be a major fiscal impact even if false-positive rates are substantially improved relative to those from NLST. Nonetheless, the proportion of false-positive screening tests is a material driver of the fiscal impact of implementing low-dose CT screening. Development of screening protocols that increase the positive predictive value of low-dose CT screening, including considering larger nodule sizes for the threshold to define positive screens, could have a substantial impact on the cost of the Medicare screening program. Additionally, further refinement of CT imaging technology, intensive training on interpretation of low-dose CT imaging results for radiologists, and development of inexpensive supplemental methods to adjudicate positive screening results without invasive diagnostic procedures or additional CT imaging could have similar fiscal impacts.

A recent actuarial analysis from Pyenson et al[20] also evaluated the fiscal impact of implementing low-dose CT lung cancer screening in Medicare. The authors' analysis assumed 50% screening uptake among enrollees classified as high risk and estimated that low-dose CT screening coverage would increase Medicare expenditure by $1.02 per enrollee per month over a 1-year time horizon.[20] This figure is approximately half of our estimated cost per enrollee per month ($2.22), because Pyenson et al assumed a lower average cost per screening episode ($241), which only reflected a screening scan and smoking-cessation counseling, used screening effectiveness results that were not specific to the Medicare population age ≥ 65 years, and assumed no overdiagnosis with low-dose CT screening. We be-

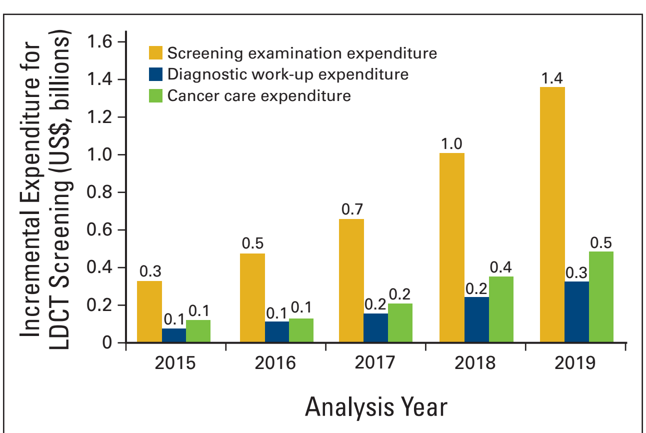

Figure 1. Annual low-dose computed tomography (LDCT) screening, diagnostic work-up, and cancer care incremental expenditure. Incremental expenditure outcomes were calculated as difference between screening and no-screening strategies using base-case model inputs. Results are rounded, therefore the sum across all analysis years differs slightly from results in Table 2.

lieve our analysis better represents the potential impacts of low-dose CT screening in Medicare, because our average cost per screening episode reflects the shared decision-making protocol specified by the CMS national coverage determination, our effectiveness estimates are derived from a subgroup analysis of NLST focused on participants age ≥ 65 years, and we considered the impact of overdiagnosis, a well-documented phenomenon in low-dose CT lung cancer screening and similar screening procedures.[10] Additionally, our analysis has the advantage of considering a 5-year time horizon capturing the longer-term impacts of overdiagnosis, lung cancer treatment cost, and lung cancer mortality.

This study has several important limitations. First, our model framework is a simplified representation of a complex set of considerations related to low-dose CT lung cancer screening and its implementation in Medicare. Accordingly, we focused on population-level factors that are expected to have the greatest influence on the clinical, resource use, and fiscal impacts of low-dose CT screening in Medicare enrollees age 55 to 77 years. Additionally, our outcomes compared the impacts of low-dose CT screening with those of no screening. In reality, a small proportion of the Medicare population might already receive lung cancer screening, and this could lead to small changes in the clinical, resource use, and fiscal impacts of implementing large-scale low-dose CT screening. Second, we limited the time horizon of our analysis to 5 years, although lung cancer screening will have important impacts beyond that period. We chose a short-term time horizon because extending the analysis beyond 5 years would have required many more assumptions, and screening test performance and cancer care costs may change as new technologies and clinical strategies are introduced in the long term. However, a short-term time horizon also introduces lead-time bias, where low-dose CT screening detects some lung cancers that would be clinically detected beyond the analysis time horizon. This is the primary driver of the high 5-year screen-detected patient case overdiagnosis rate, and it increases low-dose CT screening incremental diagnostic and cancer care expenditures relative to a lifetime horizon. We also did not model the clinical impact of smoking cessation counseling provided alongside screening because this is expected to be small over a 5-year time horizon. Finally, we estimated the clinical and economic impacts of implementing screening, but we did not assess the value of screening, as is done in a cost-effectiveness analysis.[21] A recent economic analysis of NLST estimated the cost effectiveness of low-dose CT lung cancer screening at $52,000 per life-year gained and $81,000 per quality-adjusted life-year gained.[22] These findings suggest that low-dose CT screening has good value relative to implied willingness-to-pay thresholds in cancer in the United States, but these are not necessarily applicable to Medicare enrollees, who are older and generally less healthy than the NLST participants.[2,23] Future research should assess the value of low-dose CT lung cancer screening specifically in Medicare.

In conclusion, our analyses suggest that coverage of low-dose CT screening in Medicare enrollees age 55 to 77 years with ≥ 30–pack-year smoking history who are current smokers or quit in the last 15 years will result in more lung cancer diagnoses, a greater proportion of patient cases diagnosed at an early stage, and increased Medicare expenditure. Although the degree of expenditure impact is uncertain, it is clear that the increased cost of conducting millions of screening examinations will greatly outweigh any potential cancer care savings from a stage shift. These results can inform planning efforts by Medicare administrators, contracted health care providers, and other stakeholders.

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Authors' Disclosures of Potential Conflicts of Interest

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AUTHORS' DISCLOSURES OF POTENTIAL CONFLICTS OF INTEREST

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Appendix

Table A1. Model Input Point Estimates, Uncertainty Ranges, Distributions, and Data Sources

Input	Point Estimate	Low	High	Distribution	Reference
Lung cancer stage distribution in no-screening scenario					
Proportion of incident patient cases with					
Stage I	20.2%	18.2%	22.2%	Beta	Dinan et al[9]
Stage II	2.4%	2.2%	2.6%	Beta	Dinan et al[9]
Stage III	33.9%	27.3%	40.4%	Beta	Dinan et al[9]
Stage IV	43.5%	39.2%	47.9%	Beta	Dinan et al[9]
Risk classification					
Proportion of population age 65 to 77 years classified as high risk by NLST criteria	20.3%	16.2%	24.4%	Beta	Oken et al[6]
Screen-detected lung cancer overdiagnosis rate versus no screening (all years)	53.0%	48.0%	56.0%	Beta	Patz et al[10]
Lung cancer annualized incidence in NLST high-risk patients who are not screened	0.005	0.004	0.006	Beta	Dinan et al[9]
Screening diffusion rate					
Proportion of high-risk individuals offered low-dose CT screening in					
Year 1	30.0%			NA	Assumption
Year 2	45.0%			NA	Assumption
Year 3	60.0%			NA	Assumption
Year 4	75.0%			NA	Assumption
Year 5	90.0%			NA	Assumption
Screening use among high-risk individuals by NLST criteria in					
Year 1	50.0%	20.0%	80.0%	Beta	Assumption
Year 2	55.0%	25.0%	75.0%	Beta	Assumption
Year 3	60.0%	30.0%	70.0%	Beta	Assumption
Year 4	65.0%	35.0%	65.0%	Beta	Assumption
Year 5	70.0%	35.0%	65.0%	Beta	Assumption
Screening					
Proportion screening positive	28.7%	25.8%	31.6%	Beta	Pinsky et al[4]
Proportion screening positive and have lung cancer					
Any stage	4.9%	4.4%	5.4%	Beta	Pinsky et al[4]
Stage I	61.1%			NA	Pinsky et al[4]
Stage II	8.2%			NA	Pinsky et al[4]
Stage III	17.5%			NA	Pinsky et al[4]
Stage IV	13.2%			NA	Pinsky et al[4]
Proportion screening negative					
Proportion screening negative and have lung cancer					
Any stage	0.1%	0.1%	0.1%	Beta	Pinsky et al[4]
Stage I	15.9%			NA	Aberle et al[2]
Stage II	11.4%			NA	Aberle et al[2]
Stage III	40.9%			NA	Aberle et al[2]
Stage IV	31.8%			NA	Aberle et al[2]

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Table A1. (continued)

Input	Point Estimate	Low	High	Distribution	Reference
Screening and diagnostic cost, 2014 $US					
Low-dose CT scan cost	$220	$176	$264	Normal	CPT code 71250
Low-complexity office visit cost	$80	$72	$88	Normal	CPT code 99213
Smoking-cessation counseling cost	$30	$24	$36	Normal	CPT code 99407
Smoking-cessation nicotine replacement intervention cost	$200	$160	$220	Normal	Villanti et al[12]
Low-dose CT scan incidental finding cost	$13	$7	$20	Normal	Priola et al[14]
Bronchoscopy with biopsy cost	$1,270	$1,016	$1,524	Normal	Goulart et al[13]
Lung cancer treatment cost, 2014 $US					
Stage I					
Initial year	$41,694	$33,355	$50,033	Normal	Yabroff et al[15]
Continuing	$5,357	$4,286	$6,429	Normal	Yabroff et al[15]
End of life	$53,810	$43,048	$64,572	Normal	Yabroff et al[15]
Stage II					
Initial year	$41,694	$33,355	$50,033	Normal	Yabroff et al[15]
Continuing	$5,357	$4,286	$6,429	Normal	Yabroff et al[15]
End of life	$53,810	$43,048	$64,572	Normal	Yabroff et al[15]
Stage III					
Initial year	$53,106	$42,485	$63,727	Normal	Yabroff et al[15]
Continuing	$5,357	$4,286	$6,429	Normal	Yabroff et al[15]
End of life	$73,316	$58,653	$87,979	Normal	Yabroff et al[15]
Stage IV					
Initial year	$58,450	$46,760	$70,140	Normal	Yabroff et al[15]
Continuing	$5,357	$4,286	$6,429	Normal	Yabroff et al[15]
End of life	$91,386	$73,109	$109,663	Normal	Yabroff et al[15]
Lung cancer mortality, survival					
Stage I or II					
1 year	78.4%	74.5%	82.3%	Beta	Howlader et al[1]
2 years	66.1%	62.8%	69.4%	Beta	Howlader et al[1]
3 years	58.4%	55.5%	61.3%	Beta	Howlader et al[1]
4 years	52.9%	50.3%	55.5%	Beta	Howlader et al[1]
5 years	48.4%	46.0%	50.8%	Beta	Howlader et al[1]
Stage III					
1 year	58.0%	55.1%	60.9%	Beta	Howlader et al[1]
2 years	40.1%	38.1%	42.1%	Beta	Howlader et al[1]
3 years	31.2%	29.6%	32.8%	Beta	Howlader et al[1]
4 years	26.5%	25.2%	27.8%	Beta	Howlader et al[1]
5 years	22.8%	21.7%	23.94	Beta	Howlader et al[1]
Stage IV					
1 year	22.0%	20.9%	23.1%	Beta	Howlader et al[1]
2 years	10.0%	9.5%	10.5%	Beta	Howlader et al[1]
3 years	6.1%	5.8%	6.4%	Beta	Howlader et al[1]
4 years	4.2%	4.0%	4.4%	Beta	Howlader et al[1]
5 years	3.1%	2.9%	3.3%	Beta	Howlader et al[1]
Other-cause mortality					
Annual mortality rate	2.2%	1.8%	2.7%	Beta	Rosenberg et al[16]

Abbreviation: CT, computed tomography; NLST, National Lung Screening Trial.