Appendix Table 1. **Input Variable Values and Sources***

Variable Definition	Value	Range	Sources	Notes
Demographic variables and nodule characteristics				
Starting age of population, *y*	62	30–80	25–28, 30–33, 35	Mean age of participants in eight studies of FDG-PET for pulmonary nodule diagnosis.
Pretest probability of malignant pulmonary nodule	0.55	0–1.00	2, 4, 38–47	Median prevalence of malignancy in 12 studies of CT for pulmonary nodule diagnosis. Studies of CT enrolled less highly selected patients than studies of other diagnostic tests. Range covers all possible values.
Proportion of malignant nodules that are initially:				
Local stage	0.875			Percentage of nodules that are local stage is given by the equation: 1 − percentage of regional stage − percentage of metastatic disease.
Regional stage	0.125	0.078–0.165	12–19	Median prevalence of mediastinal metastases in eight studies of CT in patients with T1 bronchogenic carcinoma. Range determined by IQR.
Metastatic from extra-thoracic primary tumor	0.0	0.0–0.10	23, 25, 27, 30, 32–35	In the base-case analysis, all malignant nodules were assumed to be primary bronchogenic carcinoma. In eight studies of FDG-PET for focal pulmonary lesions, the median (IQR) proportion of malignant pulmonary lesions that were metastases was 7% (3%–10%).
Probability of detecting growth in a benign nodule during observation period:				
During first month	0.28	0.13–0.29	23, 25–28, 30, 32–35	Median percentage of benign pulmonary nodules that were an acute or subacute infectious or inflammatory process in 10 studies of FDG-PET for diagnosis of indeterminate pulmonary lesions. Range determined by IQR.
During subsequent months	0.005	0–0.01	Assumed	Most benign nodules double in volume in <30 days or >400 days.
Doubling time for malignant pulmonary nodule, *d*	Mean, 157	30–510	20	Distribution of doubling times for malignant pulmonary lesions from the Veterans Administration–Armed Forces Cooperative Study on Asymptomatic Pulmonary Nodules. See Appendix Figure 5.
Diameter of nodule, *mm*	20	10–30	Assumed	Nodules measuring <7–10 mm in diameter are generally considered to be too small for biopsy or to reliably characterize with FDG-PET.
Diagnostic testing variables				
Sensitivity of noncontrast CT	0.965	See Notes	2, 4, 38–47	Base-case sensitivity (0.965) is the point on the summary ROC curve for CT that corresponds to the median specificity (0.558) in 12 studies of noncontrast CT (Gould MK. Unpublished data). Range determined by upper and lower 95% confidence limits of summary ROC curve. Also tested multiple other points on summary ROC curve.
Specificity of noncontrast CT	0.558	See Notes	2, 4, 38–47	See preceding entry.
Sensitivity of FDG-PET	0.942	See Notes	23–35	Base-case sensitivity (0.942) is the point on the summary ROC curve for FDG-PET that corresponds to the median specificity (0.833) in 13 studies of FDG-PET for pulmonary nodule diagnosis. Range determined by upper and lower 95% confidence limits of summary ROC curve. Also tested multiple other points on summary ROC curve.
Specificity of FDG-PET	0.833	See Notes	23–35	See preceding entry.
Probability of diagnostic biopsy for malignant nodule (CT guidance)	0.92	0.81–0.94	27, 48–55	Median diagnostic yield of biopsy in patients with malignant nodules in nine studies of CT-guided needle biopsy. Range determined by IQR.
Probability of diagnostic biopsy for benign nodule (CT guidance)	0.56	0.47–0.77	27, 48–55	Median diagnostic yield of biopsy in patients with benign nodules in nine studies of CT-guided biopsy. Range determined by IQR.
Probability of diagnostic biopsy for malignant nodule (fluoroscopic guidance)	0.84	0.53–0.93	56–58	Assumed that diagnostic yield of fluoroscope-guided biopsy was 10% less than diagnostic yield of CT-guided biopsy. Lower limit based on lowest reported yield for nodules <4 cm in diameter. Upper limit assumes that yield equals that of CT-guided biopsy.
Probability of diagnostic biopsy for benign nodule (fluoroscopic guidance)	0.50	0.31–0.556	56–58	Assumed that diagnostic yield of fluoroscopic-guided biopsy was 10% less than diagnostic yield of CT-guided biopsy. Lower limit based on lowest reported yield for nodules <4 cm in diameter. Upper limit assumes that yield equals that of CT-guided biopsy.

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Appendix Table 1—**Continued**

Variable Definition	Value	Range	Sources	Notes
Sensitivity of needle biopsy, provided that a specific benign or malignant diagnosis is obtained	0.963	See Notes	27, 48–55	Base-case sensitivity (0.963) is the point on the summary ROC curve for needle biopsy that corresponds to the median specificity (0.98) in nine studies of CT-guided needle biopsy (Gould MK. Unpublished data). Range determined by upper and lower 95% confidence limits of summary ROC curve. Also tested multiple other points on summary ROC curve. These are conditional estimates of sensitivity and specificity for biopsies that revealed a specific benign or malignant diagnosis.
Specificity of needle biopsy, provided that a specific benign or malignant diagnosis is obtained	0.98	See Notes	27, 48–55	See preceding entry.
Probability of minor pneumothorax from needle biopsy	0.24	0.20–0.35	27, 48–55	Median percentage of minor pneumothorax in nine studies of CT-guided needle biopsy for pulmonary nodule diagnosis. Range determined by IQR.
Probability of major pneumothroax from needle biopsy requiring chest tube	0.05	0.04–0.105	27, 48–55	Median percentage of major pneumothorax requiring chest tube placement in nine studies of CT-guided needle biopsy for pulmonary nodule diagnosis. Range determined by IQR.
Probability of death from needle biopsy	0.0005	0–0.001	27, 48–55	Assumed. No deaths reported in nine studies of CT-guided needle biopsy for pulmonary nodule diagnosis (n = 619).
Probability of death from surgery for malignant nodule (lobectomy)	0.042	0.017–0.053	60–62, 64, 66	In-hospital mortality rate for lobectomy was 4.2% in an observational study of surgical outcomes in California hospitals, 1983–1986 (n = 6569). In-hospital mortality rates for lobectomy were 3.0% for thoracic surgeons (n = 705) and 5.3% for general surgeons (n = 711) in an observational study of outcomes in nonfederal hospitals in South Carolina, 1991–1995. Lower limit of range is based on 30-day mortality in a tertiary care setting (n = 289).
Probability of death from surgery for benign module (VATS)	0.005	0.002–0.016	59, 63, 65, 67	Surgical mortality rate was 0.5% in 300 patients who underwent VATS reported in a voluntary French registry. Weighted mean surgical mortality was 0.5% in four studies of VATS (Gould MK. Unpublished data). Two of the studies reported no operative deaths. The highest reported mortality rate was 1.6%.
Probability of nonfatal complication from surgery for malignant nodule (lobectomy)	0.084	0.048–0.11	60–62, 64, 66	Percentage of patients with "extreme" morbidity following lobectomy performed by thoracic surgeons in South Carolina nonfederal hospitals. Lower limit of range is based on data collected in a tertiary care setting. Upper limit of range is risk for "extreme" complications for lobectomy performed by general surgeons.
Probability of nonfatal complication from surgery for benign nodule (VATS)	0.065	0.033–0.13	59, 63, 65, 67	Weighted mean percentage of serious, nonfatal complications in four studies of VATS for pulmonary nodule diagnosis. Range taken from studies with the lowest and highest reported complication rates.
Transition probabilities for Markov model				
Monthly probability of recurrent disease following surgery for local disease		±50%	11	Methods and assumptions described in text. Probabilities derived from survival data for 1207 Medicare beneficiaries with surgically treated, T1N0M0 non–small-cell lung cancer from the National Cancer Institute's SEER tumor registry, 1990–1993. Range determined by clinical judgment.
Months 1–12	0.014			
Months 13–24	0.012			
Months 25–36	0.010			
Months 37–48	0.008			
Months 48–60	0.006			
Monthly probability that regional disease progresses to distant disease		±50%	11	Methods and assumptions described in text. Probabilities derived from survival data for 1954 Medicare beneficiaries with pathologically staged regional lung cancer from the SEER tumor registry, 1990–1993. Range determined by clinical judgment.
Months 1–12	0.064			
Months 13–24	0.032			
Months 25–36	0.016			
Months 37–48	0.008			
Months 48–60				

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Appendix Table 1—**Continued**

Variable Definition	Value	Range	Sources	Notes
Monthly probability of progression from local to regional disease and regional to distant disease during observation period	See Notes	±50%	11	Methods, assumptions, and data sources described in text. Probability of disease progression assumed to depend on the doubling time of the nodule. Range determined by clinical judgment.
Monthly probability of death from distant stage lung cancer		±50%	11	Observed survival for 10 835 Medicare beneficiaries with distant-stage non–small-cell lung cancer from the SEER tumor registry, 1990–1993.
Months 1–12	0.1238			
Months 13–24	0.0694			
Months 25–36	0.0512			
Months 37–48	0.0300			
Months 49–60	0.0299			
Costs, 2001, *$*				Ranges for costs are ±25% of the base-case estimate.
CT scan	285	228–357	70	Medicare reimbursement in 1999 for CT thorax without contrast material (CPT 71250).
PET scan	1980	1584–2475	70	Medicare reimbursement in 1999 for FDG-PET (G0125).
CT-guided needle biopsy	583	467–729	70	Medicare reimbursement in 1999 for needle biopsy (CPT 32405) plus CT guidance (CPT 76360) plus professional fees (CPT 88171).
Fluoroscope-guided needle biopsy	283	226–353	70	Medicare reimbursement in 1999 for needle biopsy (CPT 32405) plus fluoroscope-guidance (CPT 76003) plus professional fees (CPT 88171).
Minor pneumothorax following needle biopsy	72	58–90	70	Medicare reimbursement in 1999 for chest radiography (CPT 71020) and professional fees (CPT 99213).
Major pneumothorax following needle biopsy (chest tube drainage)	2566	2052–3207	70, 71	Mean Medicare reimbursement in 1997 for DRG 095 (iatrogenic pneumothorax) plus professional services (CPT 99221 and 99231).
Surgery for malignant nodule (lobectomy)	14 875	11 900–18 593	70, 72	Median cost-adjusted charges for lobectomy for patients with lung cancer from the 1996 Health Care Utilization Project database (*n* = 3836) plus Medicare reimbursement in 1999 for professional fees for surgeon (CPT 32480) and pathologist (CPT 88309).
Surgery for benign nodule (VATS)	11 625	9300–14 531	70, 72	Median cost-adjusted charges for thoracoscopy in patients with lung cancer from the 1996 Health Care Utilization Project database (*n* = 73) plus Medicare reimbursement in 1999 for professional fees for surgeon (CPT 32602) and pathologist (CPT 88307).
Fatal or nonfatal surgical complications	8624	6899–10 780	71	Mean Medicare reimbursement in 1997 for DRG 076 (open biopsy of lung or other respiratory system procedures with complications) minus mean Medicare reimbursement in 1997 for DRG 077 (open biopsy of lung or other respiratory system procedures without complications).
Chest radiograph and physician office visit during wait-and-watch period	72	58–90	70	Medicare reimbursement in 1999 for chest radiography (CPT 71020) and professional fees (CPT 99213).
Monthly cost of living with lung cancer for patients with the following: *$*			73	Monthly costs for patients with surgically treated T1N0M0 disease (*n* = 1207), pathologically staged regional disease (*n* = 1954), and distant-stage disease (*n* = 10 835) from a database that links Medicare claims files with information from the SEER tumor registry.
Local-stage disease				
1–12 months	See text	See text		See Appendix Figure 8.
13–60 months	762	609–952		
Regional-stage disease				
1–12 months	See text	See text		See Appendix Figure 8.
13–60 months	934	747–1167		
Distant-stage disease				
1–12 months	See text	See text		See Appendix Figure 8.
13–60 months	1425	1140–1781		
Monthly health care cost of living with benign disease or being disease-free	Variable		74	Average monthly age-specific health care expenditures for U.S. citizens in 1999.
Utilities			75	All relative utility values were used to adjust the age- and sex-specific values from the Beaver Dam Health Outcomes Study (time-tradeoff utility, 0.87 for a 62-year-old man or woman). Ranges for utilities were determined by clinical judgment.

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Appendix Table 1—**Continued**

Variable Definition	Value	Range	Sources	Notes
Utility during observation period	1.00	0.95–1.00		Assumed.
Utility of surgically treated local lung cancer	1.00	0.90–1.00		In two studies of outcomes following thoracotomy for lung cancer, health-related quality of life returned to baseline within 3 months of surgery. See text for citations.
Utility of regional lung cancer	0.70	0.50–0.90	76	Relative utility assigned to chemotherapy with vinorelbine by 14 oncology physicians and nurses.
Utility of distant lung cancer	0.70	0.50–0.90	76	Relative utility assigned to chemotherapy with vinorelbine by 14 oncology physicians and nurses.
Utility of recurrent lung cancer	0.70	0.50–0.90	76	Relative utility assigned to chemotherapy with vinorelbine by 14 oncology physicians and nurses.
Decrement in utility for surgery for malignant nodule (lobectomy), *d*	10	7.5–12.5	71	Average length of stay in 1997 for DRG 075 (lobectomy). Range is ±25% of base-case value.
Decrement in utility for surgery for benign nodule (VATS), *d*	5	3.75–6.25	71	Average length of stay in 1997 for DRG 077 (open biopsy of lung or other respiratory system procedure without complications). Range is ±25% of base-case value.
Decrement in utility for nonfatal surgical complications, *d*	6	4.5–7.5	71	Average length of stay in 1997 for DRG 076 (open biopsy of lung or other respiratory system procedure with complications) minus average length of stay in 1997 for DRG 077 (open biopsy of lung or other respiratory system procedure without complications). Range is ±25% of base-case value.
Decrement in utility for needle biopsy, *d*	0.5	0.75–1.25	Assumed	
Decrement in utility for nonfatal biopsy complications, *d*	4	3–5	71	Average length of stay in 1997 for DRG 095 (iatrogenic pneumothorax). Range is ±25% of base-case value.
Decrement in utility for CT or FDG-PET	0.25	0.19–0.32	Assumed	
Other				
Markov process cycle length, *mo*	1			
Schedule of times for observation with serial chest radiographs	Months 1, 2, 4, and 6, and every 3 months thereafter		Assumed	The optimal time interval between serial chest radiographs has not been determined. We assumed that chest radiography had a sensitivity of 100% for detecting a doubling in tumor volume, which corresponds to a 26% increase in nodule diameter.
Time after which observation period stops, *y*	2		Assumed	Two-year radiographic stability is presumptive evidence of benign solitary pulmonary nodule.
Annual discount rate, %	3	0–5	10	Recommended by the Panel on Cost-Effectiveness in Health and Medicine.

* CPT = Current Procedural Terminology; CT = computed tomography; DRG = diagnosis-related group; FDG-PET = positron emission tomography with 18-fluorodeoxyglucose; IQR = interquartile range; ROC = receiver-operating characteristic; SEER = Surveillance, Epidemiology and End Results; VATS = video-assisted thoracoscopic surgery.