TABLE 107-2 RESULTS OF NATIONAL LUNG SCREENING TRIAL

	Event Number		Rates of Events per 100,000 Person-Years		Relative Risk (95% CI)	
	LDCT (n = 26,772)	CXR (n = 26,732)	LDCT	CXR	RR	*p* Value
Lung cancer mortality	356	443	247	309	0.80 (0.73–0.93)	.004
All-cause mortality	1877	2000	1303	1395	0.93 (0.86–0.99)	.02
Mortality not due to lung cancer	1521	1557	1056	1086	0.99 (0.95–1.02)	.51

Abbreviations: CI, confidence interval; CXR, chest x-ray; LDCT, low-dose computed tomography; RR, rate ratio.

Source: Modified from PB Bach et al: JAMA 307:2418, 2012.

number needed to screen (NNTS) to prevent one lung cancer death was calculated to be 320.

LDCT screening for lung cancer comes with known risks including a high rate of false-positive results, false-negative results, potential for unnecessary follow-up testing, radiation exposure, overdiagnosis, changes in anxiety and quality of life, and substantial financial costs. By far the biggest challenge confronting the use of CT screening is the high false-positive rate. False positives can have a substantial impact on patients through the expense and risk of unneeded further evaluation and emotional stress. The management of these patients usually consists of serial CT scans over time to see if the nodules grow, attempted fine-needle aspirates, or surgical resection. At $300 per scan (NCI estimated cost), the outlay for initial LDCT alone could run into the billions of dollars annually, an expense that only further escalates when factoring in various downstream expenditures an individual might incur in the assessment of positive findings. A formal cost-effectiveness analysis of the NLST is expected soon that should help resolve this crucial concern.

Despite the aforementioned caveats, screening of individuals who meet the NLST criteria for lung cancer risk (or in some cases, modified versions of these criteria) seems warranted, provided comprehensive multidisciplinary coordinated care and follow-up similar to those provided to NLST participants are available. Algorithms to improve candidate selection are under development. When discussing the option of LDCT screening, use of absolute risks rather than relative risks is helpful because studies indicate the public can process absolute terminology more effectively than relative risk projections. A useful guide has been developed by the NCI to help patients and physicians assess the benefits and harms of LDCT screening for lung cancer (Table 107-3). Finally, even a small negative effect of screening on smoking behavior (either lower quit rates or higher recidivism) could easily offset the potential gains in a population. Fortunately no such impact has been reported to date. Nonetheless, smoking cessation must be included as an indispensable component of any screening program.

CLINICAL MANIFESTATIONS

Over half of all patients diagnosed with lung cancer present with locally advanced or metastatic disease at the time of diagnosis. The majority of patients present with signs, symptoms, or laboratory abnormalities that can be attributed to the primary lesion, local tumor growth, invasion or obstruction of adjacent structures, growth at distant metastatic sites, or a paraneoplastic syndrome (Tables 107-4 and 107-5). The prototypical lung cancer patient is a current or former smoker of either sex, usually in the seventh decade of life. A history of chronic cough with or without hemoptysis in a current or former smoker with chronic obstructive pulmonary disease (COPD) age 40 years or older should prompt a thorough investigation for lung cancer even in the face of a normal CXR. A persistent pneumonia without constitutional symptoms and unresponsive to repeated courses of antibiotics also should prompt an evaluation for the underlying cause. Lung cancer arising in a lifetime never smoker is more common in women and East Asians. Such patients also tend to be younger than their smoking counterparts at the time of diagnosis. The clinical presentation of lung cancer in never smokers tends to mirror that of current and former smokers.

Patients with central or endobronchial growth of the primary tumor may present with cough, hemoptysis, wheeze, stridor, dyspnea, or postobstructive pneumonitis. Peripheral growth of the primary tumor may cause pain from pleural or chest wall involvement, dyspnea on a restrictive basis, and symptoms of a lung abscess resulting from tumor cavitation. Regional spread of tumor in the thorax (by contiguous growth or by metastasis to regional lymph nodes) may cause tracheal obstruction, esophageal compression with dysphagia, recurrent laryngeal paralysis with hoarseness, phrenic nerve palsy with elevation of the hemidiaphragm and dyspnea, and sympathetic nerve paralysis with Horner's syndrome (enophthalmos, ptosis, miosis, and anhydrosis). Malignant pleural effusions can cause pain, dyspnea, or cough. Pancoast (or superior sulcus tumor) syndromes result from local extension of a tumor growing in the apex of the lung with involvement of the eighth cervical and first and second thoracic nerves, and present with shoulder pain that characteristically radiates in the ulnar

TABLE 107-3 THE BENEFITS AND HARMS OF LDCT SCREENING FOR LUNG CANCER BASED ON NLST DATA

	LDCT	CXR
Benefits: How Did CT Scans Help Compared To CXR?		
4 in 1000 fewer died from lung cancer	13 in 1000	17 in 1000
5 in 1000 fewer died from all causes	70 in 1000	75 in 1000
Harms: What Problems Did CT Scans Cause Compared to CXR?		
223 in 1000 had at least 1 false alarm	365 in 1000	142 in 1000
18 in 1000 had a false alarm leading to an invasive procedure	25 in 1000	7 in 1000
2 in 1000 had a major complication from an invasive procedure	3 in 1000	1 in 1000

Abbreviations: CXR, chest x-ray; LDCT, low-dose computed tomography; NLST, National Lung Screening Trial.

Source: Modified from S Woloshin et al: N Engl J Med 367:1677, 2012.

TABLE 107-4 PRESENTING SIGNS AND SYMPTOMS OF LUNG CANCER

Symptom and Signs	Range of Frequency
Cough	8–75%
Weight loss	0–68%
Dyspnea	3–60%
Chest pain	20–49%
Hemoptysis	6–35%
Bone pain	6–25%
Clubbing	0–20%
Fever	0–20%
Weakness	0–10%
Superior vena cava obstruction	0–4%
Dysphagia	0–2%
Wheezing and stridor	0–2%

Source: Reproduced with permission from MA Beckles: Chest 123:97-104, 2003.