Lung cancer screening

Clinical Policy ID: CCP.1229

Recent review date: 3/2024

Next review date: 7/2025

Policy contains: Low-dose computed tomography; lung cancer screening.

Coverage policy

Lung cancer screening with low-dose computed tomography scanning, also known as spiral computed tomography or helical computed tomography scanning, is clinically proven and, therefore, may be medically necessary when all of the following criteria are met (American Cancer Society, 2023, U.S. Preventive Services Task Force, 2021):

- Annual screening for lung cancer with low-dose computed tomography scan criteria:
  - Age 50 – 80 years.
  - Asymptomatic (no signs or symptoms of lung disease).
  - Tobacco-smoking history of at least 20 pack years (one pack year = smoking one pack per day for one year; one pack = 20 cigarettes).
  - Current smoker or one who has quit smoking
  - A written order for low-dose computed tomography scan lung cancer screening:
    - For the initial low-dose computed tomography scan lung cancer screening service, a written order must be provided during a lung cancer screening counseling visit.
    - For subsequent low-dose computed tomography scan lung cancer screenings, a written order may be provided during any appropriate visit (Moyer, 2014; U.S. Preventive Services Task Force, 2021).

Limitations

All other indications for lung cancer screening with low-dose computed tomography, including chest X-rays and positron emission tomography scanning, are not clinically proven/investigational and, therefore, not medically necessary (Wender, 2013).

Health conditions potentially increasing harm or limiting benefits of lung cancer screening include, but are not limited to severe heart failure, advanced chronic obstructive pulmonary disease, significant cirrhosis, end-stage renal disease, severe dementia, recent advanced cancer treatment, home oxygen dependence, current lung cancer symptoms, high clinical frailty, or a life expectancy of less than 5 years. Additionally, individuals unwilling to undergo treatment for detected cancer may not benefit from screening (American Cancer Society, 2023)

Screening may be discontinued once a person age 50 – 80 has not smoked for 15 years or develops a health problem that substantially limits life expectancy or the ability or willingness to have curative lung surgery (Moyer, 2014; U.S. Preventive Services Task Force, 2021Alternative covered services

- Monitoring by treating provider.
- Smoking cessation program.

Background

Lung cancer is the leading cause of cancer death in the United States, with 238,340 new cases and 238,340 deaths estimated in 2023 (National Comprehensive Cancer Network, 2023). Of Americans diagnosed with the disease five-year survival rates for lung cancer are only 22.9%, partly because most patients have advanced-stage lung cancer at initial diagnosis. (National Comprehensive Cancer Network, 2023).

The most important risk factor for lung cancer is smoking. Among new lung cancer cases worldwide, 15% to 20% of males and over 50% of females are never-smokers, defined as smoking 100 or fewer cigarettes in a lifetime (Centers for Disease Control and Prevention, 2023a). The Centers for Disease Control and Prevention found that 12.5% of Americans ages 18 and older in 2020 are smokers, representing a decline by more than two-thirds of the 1965 peak of 42.4% (; Centers for Disease Control and Prevention, 2023a).

Most lung cancer cases are non-small-cell lung cancer, and thus most screening programs focus on the detection and treatment of early-stage non-small-cell lung cancer. Although chest radiography and sputum cytologic evaluation have been used to screen for lung cancer, low-dose computed tomography scanning has greater sensitivity for detecting early-stage cancer. The major risks of low-dose computed tomography scanning include radiation exposure, high false-positive rates, and overdiagnosis (Aberle, 2013).

Although lung cancer screening is not an alternative to smoking cessation, guidelines issued by various professional medical organizations support annual screening for lung cancer with low-dose computed tomography scanning in a defined population of high-risk people. These screening guidelines are designed to diagnose lung cancer in an early stage and prevent a substantial number of lung cancer-related deaths by initiating early treatment.

The magnitude of benefit to the person depends on that person's risk for lung cancer because those who are at highest risk are most likely to benefit. Screening cannot prevent most lung cancer-related deaths, nor can it guarantee smoking cessation. Combination therapy with counseling and medications is more effective at increasing cessation rates than either component alone. The U.S. Food and Drug Administration has approved several forms of nicotine replacement therapy (gum, lozenge, transdermal patch, inhaler, and nasal spray), as well as bupropion and varenicline (Moyer, 2014).

Findings

Professional Guidelines

The U.S. Preventive Services Task Force recommends annual screening for lung cancer with low-dose computed tomography scanning in adults ages 50 to 80 years who have at least a 20-pack-year smoking history and currently smoke or have quit within the past 15 years. Screening should be discontinued once a person has not smoked for 15 years or develops a health problem that substantially limits life expectancy or the ability or willingness to have curative lung surgery. The task force relied on seven randomized controlled trials to arrive at its recommendations, which updated a 2014 version (Moyer, 2014; U.S. Preventive Services Task Force, 2021).

The Centers for Disease Control and Prevention (2023b) and American Cancer Society (2023) have issued guidelines on lung cancer screening compliant with U.S. Preventive Services Task Force criteria.

The American College of Chest Physicians issued a guideline suggesting that, during the COVID-19 pandemic, lung cancer screening can be delayed for eligible individuals who either have never been screened for lung cancer or were assigned to Lung CT Screening Reporting and Data System category 1 or 2 in the prior examination (Mazzone, 2020).

A National Comprehensive Cancer Network guideline recommends consideration of annual screening with low-dose computed tomography for those considered high risk. Those meeting criteria include people who age > 50, with a smoking history of > 20 pack years, with at least one risk factor (National Comprehensive Cancer Network, 2023).

In 2023, the American Cancer Society updated its lung cancer screening guidelines for the first time in 10 years, aligning closely with those issued by the U.S. Preventive Services Task Force. A significant change was the elimination of the years since quitting recommendations for former smokers. This adjustment was based on modeling analyses and observational data indicating that the risk of lung cancer remains high for longer periods post-quitting than previously understood. By removing the years since quitting criterion, more individuals became eligible for screening, potentially reducing the number of lung cancer deaths (American Cancer Society, 2023).

Screening Methods

A systematic review of 34 studies found that low-dose computed tomography in lung cancer screening had an overdiagnosis of 10.99% versus 25.83% for chest X-rays. It also had a median false positive estimate of 25.53% for once-only screening; a median of 11.18 deaths and 52.03 patients with major complications per 1,000 screened undergoing invasive follow-up procedures; and a median of 9.74 and 5.28 individuals per 1,000 screened with benign conditions with minor and major invasive follow-up procedures (Usman Ali, 2016).
Screening methods for lung cancer other than computed tomography exist. One such method is blood and serum-based biomarkers; however, a systematic review of three trials found no high-quality evidence for its use in clinical practice (Chu, 2018).

Mortality Reduction

A systematic review of seven randomized controlled trials cited large studies that documented large reductions in lung cancer mortality in smoking populations after screening. These included declines of 20% after 6.5 years, 24% after 10 years (males), and 39% after 10 years (Goudemant, 2021).

A systematic review/meta-analysis of nine studies (n = 88,497) compared outcomes for cigarette smokers screened for lung cancer with low-dose computerized tomography versus those screened with X-rays or not screened. The review showed significant improvements in lung cancer-related mortality (-13%), early-stage tumors diagnosis (+184%), resectability rate (+157%), and late-stage tumor diagnosis (-25%). However, no change was observed in all-cause mortality (-1%), and the overdiagnosis rate was 38% (Passiglia, 2021).

A systematic review/meta-analysis of 10 randomized controlled trials showed that screening smokers for lung cancer using low-dose computed tomography significantly reduced lung cancer mortality by 12%. A large proportion of positive tests (84% – 96%) were later classified as false positives, making the risk of overdiagnosis 19% to 69% of diagnosed lung cancers (Hunger, 2021).

Updates to the National Lung Screening Trial Research Team study confirmed the 20% reduction in lung cancer mortality (356 versus 443 deaths) and 6.7% reduction in all-cause mortality (Bach, 2012; Humphrey, 2013). Four other trials did not result in significant decreases of disease-specific and all-cause mortality with low-dose computed tomography scan screening compared to chest X-rays (Coureau, 2016).

A systematic review/meta-analysis of seven trials (n = 84,458) of lung cancer screening using low-dose computed tomography screening in populations with at least 15 pack years of smoking documented significant reductions of 17% and 4%, respectively, in lung cancer mortality and all-cause mortality (Sadate, 2020).

A meta-analysis of nine randomized controlled trials determined low-dose computed tomography screening was linked with significantly lower mortality rates of lung cancer (-16%), but higher rates of all-cause mortality (+26%). Compared to chest X-rays or no screening, tomography detected significantly more lung cancer cases (risk ratio = 1.58, and especially stage I cases (risk ratio 3.45); both are significant at $P < .001$ (Tang, 2019).

A systematic review/meta-analysis of nine randomized controlled trials (n = 97,244) compared lung cancer screening using low-dose computed tomography with chest X-rays or no screening. Lung cancer mortality was significantly lower for the scan group (-17%) but all-cause mortality was not (-5%) (Huang, 2019).

A study of 6,549 subjects screened for lung cancer with spiral computed tomography and followed over eight years identified a 16.3% lower mortality rate from all causes (299 versus 357 deaths per 100,000 person years) (Infante, 2017).

A Cochrane review of 11 studies (n = 94,445) found 21% and 5% reductions in lung cancer and all-cause mortality, in patients followed 5 - 12 years after low-dose computed tomography screening for lung cancer (Bonney, 2022).

A meta-analysis of 80 articles (n= 265, 292) showed a decrease in lung cancer mortality (pooled relative risk 0.86, 95% confidence interval 0.77 to 0.96) with little statistical heterogeneity. The network meta-analysis supported these findings, showing a similar effect size when comparing low-dose computed tomography with chest X-ray or usual care (Duer, 2023).

Adherence and Cost-Effectiveness

A systematic review/meta-analysis of 15 studies (n = 16,863) revealed adherence to continued lung cancer screening (after initial screening) was significantly higher among college graduates and former (versus current) smokers (Lopez-Olivo, 2020).

A meta-analysis of 21 studies found 57% defined adherence and 65% anytime adherence for lung cancer screening, which authors described as “suboptimal” (Lin, 2022).
- A review of 45 studies showed 39 indicated lung cancer screening was cost effective and was optimal in persons 55-75 and those with a history of at least 20 pack-years of smoking (Grover, 2022).

Validation of Screening
A review of 46,345 persons screened for lung cancer found nearly 20% (9,028) were diagnosed with the disease. Of these, most (7,928) died from all causes within 5-10 years of diagnosis. Authors conclude that the review validates the use of computed tomography in lung cancer screening (Guerini, 2021).

Prior Lung Disease and Screening
A systematic review/meta-analysis of 73 studies (n = 7,859,024) showed that a history of lung disease within the previous 10 years was a risk factor for lung cancer. Diseases included asthma, chronic obstructive pulmonary disease, emphysema, pneumonia, and tuberculosis, but not hay fever. Authors suggest people with these disorders should be prioritized for lung cancer screening (Ang, 2021).

Potential for Mortality Reduction with Widespread Screening

If all high-risk Americans were screened, 12,250 lung cancer deaths would be averted each year (Ma, 2013). However, a federal survey determined the percentage of Americans considered high risk by the U.S. Preventive Services Task Force who undergo lung cancer screening was 3.3% in 2010 and 3.9% in 2015, or 262,700 of 6.8 million. Notably, 57% of those considered high risk were uninsured or insured by Medicaid (Jemal, 2017).
In 2024, the findings section was reorganized for clarity and the Duer meta-analysis was added.

References

On January 3, 2024, we searched PubMed and the databases of the Cochrane Library, the U.K. National Health Services Centre for Reviews and Dissemination, the Agency for Healthcare Research and Quality, and the Centers for Medicare & Medicaid Services. Search terms were “lung cancer screening” and “mortality.” We included the best available evidence according to established evidence hierarchies (typically systematic reviews, meta-analyses, and full economic analyses, where available) and professional guidelines based on such evidence and clinical expertise.

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Policy updates

4/2016: initial review date and clinical policy effective date: 7/2016

4/2017: Policy references updated.

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