

Ch10.06.A. CT Screening for Lung Cancer

The National Lung Screening Trial (NLST) randomized 53,454 current and former heavy smokers (minimum 30 pack-years) aged 55 to 74 years to either helical CT scanning or chest-x-rays annually for 3 years.(Aberle, Adams et al. 2011) There was a statistically significant (P=0.004) 20% relative risk reduction in the CT group. Results for lung cancer mortality and total mortality are summarized below.

	Lung Cancer Mortality		Total	Risk
	Yes	No		
CT	356	26,366	26,722	1.33%
X-Ray	443	26,289	26,732	1.66%
Total	799	52,655	53,454	

ARR= 0.32%

	Total Mortality		Total	Risk
	Yes	No		
CT	1,877	24,845	26,722	7.02%
X-Ray	2,000	24,732	26,732	7.48%
Total	3,877	49,577	53,454	

ARR= 0.46%

a.) State whether each of the following statements is true or false; explain your answer.

- i. The favorable effect of annual CT screening on lung cancer mortality (compared with chest x-ray) can be explained by lead-time bias or length-time bias.

- ii. Even though this is a randomized trial, a within-group comparison in the CT scan group would probably find longer survival in those whose cancer was detected by scanning (compared with those presenting with symptoms) at least partly due to length-time bias.

- iii. The apparent reduction in lung cancer mortality in the CT screened group could be due to "Sticky Diagnosis Bias."

- iv. Because there was a trend towards decreased mortality due to causes other than lung cancer in the CT scan group, "slippery linkage bias" is unlikely to explain the apparent lung cancer mortality benefit.

b) The following is taken from the CBS News story about the study:
(<http://www.cbsnews.com/stories/2010/11/04/eveningnews/main7023357.shtml>)

"After 50 years of smoking, 67-year-old Steffani Torrighelli knew she was at high risk for lung cancer. Two years ago she enrolled in [the] study, and sure enough a CT scan picked up an early stage tumor before she had any symptoms... Since Torrighelli's lung surgery two years ago, she's cancer free and vigilant about screening."

Could Steffani's good outcome in this randomized trial be due to detection of pseudodisease? Explain.

c) Assume that the lung cancer mortality benefit resulted from 3 years of annual CT scanning. About how many screening CT scans were needed to defer one lung cancer death in the NLST?

d) Press reports say the scans cost about \$300 each. What was the approximate cost of the screening CT scans per lung cancer death deferred?

e) Counts of the invasive diagnostic procedures from Table 3 of the paper are excerpted below. Compared with annual chest x-rays, how many additional invasive diagnostic procedures (percutaneous cytologic examinations or biopsies, bronchoscopies and surgical procedures) were required per lung cancer death deferred?

Excerpted from Table 3	CT	CXR
Total N	26,722	26,732
Percutaneous Cytologic Examinations or biopsies	322	172
Bronchoscopies	671	225
Surgical procedures	713	239
Total	1706	636

Aberle, D. R., A. M. Adams, C. D. Berg, W. C. Black, J. D. Clapp, R. M. Fagerstrom, I. F. Gareen, C. Gatsonis, P. M. Marcus and J. D. Sicks (2011). "Reduced lung-cancer mortality with low-dose computed tomographic screening." *N Engl J Med* **365**(5): 395-409.