

EXTRA PROBLEM 4: SCREENING FOR COLORECTAL CANCER

The fecal occult blood test, widely used both in physicians' offices and at home to screen patients for colon and rectal cancer, examines a patient's stool sample for blood, a condition indicating that cancer may be present. A recent study funded by the National Cancer Institute found that of 15,000 people tested on an annual basis, 10% were found to have blood in their stools. These 10% underwent further testing, including colonoscopy, the insertion of an optical-fiber tube through the rectum in order to inspect the colon and rectum visually for direct indications of cancer. Only 2.5% of those having colonoscopy actually had cancer. Additional information in the study suggests that, of the patients who were tested, approximately 5 out of 1000 tested negative (no blood in stool) but eventually did develop cancer.

A. Create a probability table that shows the relationship between blood in a stool sample and colorectal cancer. Calculate $P(\text{Cancer}|\text{Blood})$ and $P(\text{Cancer}|\text{No Blood})$.

The Study results have led some medical researchers to agree with the American's Cancer Society's long-standing recommendation that all US-residents over 50 years of age be tested annually. On the other hand, many researchers claim the cost of such screening, including the cost of follow-up testing on 10% of the populations, far exceeds its value. Assume that the test can be performed for as little as \$10 per person, that colonoscopy cost \$750 on average, and that about 60 million people in the United States are over age 50.

B. What is the expected cost (including follow up colonoscopy) of implementing a policy of screening everyone over age 50? What is the expected number of people who must undergo colonoscopy? What is the expected number of people who undergo colonoscopy only to find that they do not have cancer after all?

Over 13 years of follow-up study, 0.6% (6 out of 1000) of those who were screen annually with the fecal blood test died from colon cancer anyway. Of those who were not screen, 0.9% (9 out of 1000) died of colon cancer during the same 13 years. Thus the screening procedure saves approximately 3 liver per 1000 every 13 years.

C. Use this information, along with your calculations from Questions A and B, to determine the expected cost of saving a life by implementing a policy requiring everyone over 50 to be screened every year.

D. What is your conclusion? Do you think everyone over 50 should be screened? From your personal point of view, informed now by your calculations above, would the saved lives be worth the money spent and the inconvenience, worry, discomfort and potential complications of subjecting approximately 6 million people to each year to colonoscopy even though relatively few of them actually have detectable and curable cancer?

(Source: J.S. Mandel, J.H.Bond, T.R.Church, D.C. Snover, G.M. Braley, L.M. Schuman, and F. Ederer (1993). "Reducing Mortality from Colorectal Cancer by Screening for Fecal Occult Blood. (Minnesota Colon Cancer Study)." New England Journal of Medicine, 328 (19) 1365-1371.)