

Answer on Question #69227 – Math – Statistics and Probability

Question

Among 100,000 women with negative mammograms, 20 will be diagnosed with breast cancer in 2 years, whereas 1 woman in 10 with positive mammograms will be diagnosed with breast cancer in 2 years. Suppose that 10% of the general population of woman will have a positive mammogram. What is the probability that a woman who develops breast cancer over the next 2 years has a negative mammogram?

Solution

Let $A = \{\text{mammogram}+\}$ and $B = \{\text{breast cancer}\}$. Then

$$P(B|\bar{A}) = \frac{20}{10^5} = 0.0002$$

$$P(B|A) = \frac{1}{10} = 0.1$$

The two events A and B would be highly dependent

$$RR = \frac{P(B|A)}{P(B|\bar{A})} = \frac{0.1}{0.0002} = 500$$

The probability that a woman who develops breast cancer over the next 2 years has a negative mammogram

$$P(\bar{A}|B) = \frac{P(B|\bar{A})P(\bar{A})}{P(B)}$$

$$P(\bar{A}) = 1 - P(A) = 1 - 0.1 = 0.9$$

Using total probability rule

$$P(B) = P(B|A)P(A) + P(B|\bar{A})P(\bar{A})$$

$$P(B) = 0.1(0.1) + 0.0002(0.9) = 0.01018.$$

Then

$$P(\bar{A}|B) = \frac{0.0002(0.9)}{0.01018} \approx 0.0177$$

Answer: 0.0177.