

**Bayesian Probability***(find and work with a partner)*

*Clinical Trials Example.* Say the probability of a disease (D) in the general population is 1 in 100, i.e.  $P(D) = \frac{1}{100}$ . This is our *prior* probability of the disease (i.e. without any data).

Furthermore, say we have test for this disease with 90% accuracy. We will call the results of the test positive (“pos”) and negative (“neg”). 90% accuracy means that  $P(\text{pos}|D) = \frac{9}{10}$ , and  $P(\text{neg}|H) = \frac{9}{10}$ , where H means healthy.

What we actually want to know is: what is the probability of having the disease, given a positive test?

1. Apply Bayes rule to  $P(D|\text{pos})$ . Recall that Bayes rule says:

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

2. We can often write the denominator as the sum of  $P(a, B)$ , for all options  $a \in \text{vals}(A)$ :

$$P(A|B) = \frac{P(A)P(B|A)}{\sum_{a \in \text{vals}(A)} P(a, B)}.$$

Use this idea to expand the denominator in the clinical trials example and compute a numerical value for  $P(D|\text{pos})$ .