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## Overview

### THE CONDITION OF BAYESVILLE

We need to distinguish between the probability of having a disease given a positive test result, and the probability of testing positive given that one has the disease:

$$P(A|B) \neq P(B|A)$$

Whenever we observe new evidence or data, we acquire information that may affect our uncertainties. Conditional probability is the concept that addresses this fundamental question: how should we update our beliefs in light of the evidence we observe? Bayes' rule is an extremely useful theorem that helps us perform such updates. In the disease testing context, it quantifies the distinction that Jimmy came to appreciate: the probability of having conditionitis given a positive test result is not the same as the probability that he tests positive given that he has conditionitis.

Bayes' rule is often used in tandem with the law of total probability, which is a powerful result that lets us express an unconditional probability in terms of conditional probabilities (that hopefully are easier to think about). Together, Bayes' rule and the law of total probability can be used to solve a very wide variety of problems.

### Learning Objectives

In this unit, you will:

- Learn about conditional probability
- Identify and avoid common mistakes when working with probability
- See how Bayes' rule can be used to update probabilities based on evidence
- Practice using the law of total probability to break complicated problems into simpler pieces