1.1: What is Statistics?

Statistics is a field build from the foundations of mathematics as a tool to answer questions about nearly any aspect of reality. The term "**statistics**" generally refers to all the field-specific procedures and formulas that can be used to summarize information gathered from samples or to test hypotheses and assumptions with sample data. The term "**statistic**" is used to refer to the summary or outcome of those procedures. Therefore, the term "statistics" is also used as the plural form of "statistic" to refer to multiple summaries of outcomes. Thus, in statistics (the field), we use statistics (meaning the procedures from the field of statistics) to yield statistics (summaries of outcomes of those procedures).

Statistics includes many procedures which generally serve one overarching goal: to summarize or understand what is likely true based on incomplete information. To get there, statisticians start by using mathematical techniques to first summarize the data they have. This form of statistics is referred to as **descriptive statistics**. Then, when desired and possible, more advanced techniques are applied to test what is likely true beyond those data based upon those data. This form of statistics is referred to as **inferential statistics**. Most of us have taken math classes in the past where we learned about things like adding, subtracting, multiply, and dividing. These are all part of a type of math called arithmetic. One great thing (or frustrating thing, depending on how you view it) about this kind of math is that there is often one correct, knowable answer. For example, we know that $3 + 2 = 5$. The answer is knowable. We even get to learn about "proofs" in some more advanced math classes. When we say something is proven we mean it is known and true.

However, there are times when we have incomplete information and the pieces of information we do have don't all tell the same story but we still want to use them to understand what is generally or likely true about the world. Statistics was developed to address these situations. Statisticians still use those mathematical foundations and operations (such as adding and dividing) but develop and implement specific techniques and language to allow them to summarize data and estimate what is likely true rather than what is absolutely known to be true. To understand the kinds of situations for which statistics were built and how the field functions, we can start by reviewing some key tenets of statistics.

> *Statistics is the study of data from samples.*