# Bias
# Evaluating a statistical study

Our goal in a statistical study is to estimate a population parameter by collecting data from a sample. We have previously seen how randomness in sampling can lead to poor estimates occasionally. But there are other ways that are estimates can go wrong.

For many studies, it can be quite challenging to select a sample that represents the population well.

**Definition: Bias**- A sampling method that consistently either underemphasizes or overemphasizes some characteristic of the population is said to be **biased**.

If a sampling method is biased the conclusions drawn from the statistical process will probably be misleading. Bias can occur either intentionally or unintentionally and consumers of statistics should always be on the lookout for bias.

Some guidelines (questions) to use in determining if a study is biased
✓ Identify the goal, type and population - are these appropriately defined

Before you evaluate if a statistical study is sound you need to know what it is about. It is difficult to evaluate the study if you can not identify the goal, type and population.
✓ Consider the source of the study - who funded it

You need to careful with studies that are funded by organizations that have an interest in the outcome of the study. Just being funded by the organization does not mean that it is biased, but it is a reasonable question to ask.

✓ Look for self selection bias or a non-representative sample

In the last section you saw how a non-representative sample (such as a convenience sample) could bias a study. Was the sample chosen correctly? Self selection bias – means you have the choice of being part of the sample or not. Why is this a problem? Well if you have a choice you will probably not respond unless you have a strong positive or negative opinion. This will definitely skew the outcomes.

✓ Look for difficulties in defining or measuring quantities of interest

One statement you often hear on the news is something like – we only catch about 10% of the criminals out there or we only apprehend about 40% of the illegal aliens that enter this country. One question you might ask here is how

do they know? If they knew they only caught 10% of the criminals they would know who the other 90% are and could catch them. This is an example of a quantity that is hard to measure or define

✓ Consider the wording and setting of the survey

Sometimes survey questions are asked in an inflammatory manner. For example – "to balance the budget do you favor tax cuts or cutting wasteful government programs". Here using the word wasteful places a value judgment on one option – so you are less likely to accept that option. The order of the choice matters

✓ Check for consistency between results and interpretation

Are the results presented fairly? This can occur in concluding statements and in graphs (more on that in section 5C) If you say that 30% of a school district reads below grade level – this may seem shocking – but it also does mean that 70% reads above or at grade level

✓ Consider the conclusion - use your common sense

Did the study answer the questions it set out to accomplish? Are there alternative reasons for the result? Use your common sense to tell you if something is wrong

Examples:
1) In conducting a survey, Taxpayers Revolt, a group supporting tax decreases, asked the following question:
Do you favor balancing the budget by reducing taxes or eliminating wasteful government programs?


2) ADT security systems advertised that "when you go on vacation, burglars go to work". Their ad stated that according to FBI statistics, over 26% of home burglaries take place between Memorial day and Labor day.


3) Years ago your instructor was watching Nightline during the Iran-Contra Crisis. They had a survey where you could call a 900 number and state whether you believed Oliver North was guilty or innocent. What is wrong with this method of analysis?


4) To determine the effectiveness of their program, the SFCC math department mailed recent graduates a survey. 1000 questionnaires were mailed and 150 responded. What is wrong with this method

5) A student researcher does a survey to determine if SFCC professors or fly fisherman are more "satisfied" with their lives

6) The Newport Chronicle claims that pregnant mothers can increase their chances of having healthy babies by eating lobsters. The claim is based on a study showing that babies born to lobster eating mothers have fewer health problems than babies born to mothers who don't eat lobster

7) For about 60 years the Gallup organization has been polling people about their attendance at religious services. A recent poll of Roman Catholics in a county in Ohio showed that 51% said they attended church the week before the poll. Yet actual results were only 24%

8) Kiwi Brands - a shoe polish manufacturer makes the following claim in an advertisement : According to a nationwide survey of 250 hiring professionals scuffed shoes was the most common reason for a male job seeker's failure to make a good impression"

9) In order to survey the entire Casper College student body you stand outside Robert's Commons and interview every 5th student

10) A very large study was conducted in France in the early 1990's titled "AIDS and Sexual Behavior in France". This was a massive telephone survey on sexual lifestyles in France, and involved more than 20,000 participants and more than 100 interviewers. The main results of this survey are shown in the table below:

What are you skeptical about in this study?

TABLE 1 Results of 20,055 questionnaires (including 4,820 long questionnaires)

| | MEN Age (years) | | | | WOMEN Age (years) | | | |
|---|---|---|---|---|---|---|---|---|
| | 18–24 | 25–34 | 35–44 | 45–69 | 18–24 | 25–34 | 35–44 | 45–69 |
| Population | 1,716 | 2,232 | 2,284 | 3,696 | 1,670 | 2,238 | 2,261 | 3,958 |
| Age at first intercourse (years) | 16.5 | 16.9 | 17.6 | 18.2 | 17.1 | 17.9 | 18.8 | 20.8 |
| Multipartner — 1 year | 27.6 | 14.1 | 11.5 | 8.3 | 12.1 | 6.8 | 5.9 | 2.9 |
| Intercourse (no.) — 4 weeks (m) | 7.6 | 9.6 | 9.8 | 6.8 | 8.3 | 8.9 | 8.5 | 5.8 |
| Homosexuality — life (%) | 2.4 | 4.2 | 4.3 | 4.5 | 1.2 | 3.8 | 2.8 | 2.4 |
| Intercourse with prostitutes — 5 years | 4.7 | 3.8 | 3.4 | 1.8 | — | — | — | — |
| IV drugs — life (%) | 0.4 | 1.2 | 0.6 | 0.0 | 0.2 | 0.5 | 0.2 | 0.0 |
| Condoms — life (%) | 73.1 | 58.1 | 57.8 | 48.1 | 54.7 | 48.9 | 49.6 | 33.9 |
| Condoms — 1 year | 58.8 | 32.3 | 30.5 | 17.2 | 40.8 | 26.7 | 23.0 | 11.1 |
| Monopartner | 50.5 | 26.0 | 26.5 | 14.6 | 37.8 | 24.1 | 22.3 | 10.2 |
| Multipartner (heterosex.) | 79.0 | 69.0 | 59.7 | 42.7 | 62.4 | 62.0 | 33.3 | 33.1 |