Unit 5B
Should You Believe a Statistical Study?

Eight Evaluation Guidelines

1. Identify the goal, population and type of study.
2. Consider the source.
3. Look for bias in the sample.
4. Look for problems in defining or measuring the variables of interest.
5. Watch out for confounding variables.
6. Consider the setting and wording in surveys.
7. Check that results are presented fairly.
8. Stand back and consider the conclusions.

Example 1
A newspaper reports: “Researchers gave each of the 100 participants their astrological horoscopes, and asked them whether the horoscopes appeared to be accurate. Eighty-five percent of the participants reported that the horoscopes were accurate. The researchers concluded that horoscopes are valid most of the time.

Guideline 1
Identify the Goal, Population, and Type of Study
Ask yourself the following questions:
• What was the goal of the study?
• What was the population under study? Was the population clearly and appropriately described?
• What type of study was used? Was the type appropriate for the goal?

Example 2
By 1963, enough research on the health dangers of smoking had accumulated that the Surgeon General of the United States publicly announced that smoking is bad for health. Research done since that time has built further support for this claim. However, while the vast majority of studies show that smoking is unhealthy, a few studies found no dangers from smoking, and perhaps even health benefits. These studies generally were carried out by the Tobacco Research Institute, funded by the tobacco companies.

Guideline 2
Consider the Source
What is the source, particularly with regard to whether the researchers may be biased or have self interest?

A statistical study suffers from bias if its design or conduct tends to favor a certain result.
Guideline 3
Look for Bias in Choosing the Sample
Is the sample truly representative of the population being studied, or is it a biased sample?

Example 3
The TV show Nightline conducted a poll in which viewers were asked whether the UN headquarters should be kept in the US. Viewers could respond to the poll by paying 50 cents to call a “900” number with their opinions. The poll drew 188,000 responses, of which 67% favored moving the UN out of the US. Around the same time, a poll using simple random sampling of 500 people found that 72% wanted the UN to stay in the US. Which poll is more likely to be representative of the general opinions of Americans?

Example Y
"38% of adults in the United States regularly visit a doctor". This conclusion was reached by a college student after she had questioned 520 randomly selected members of her college.

Example Q
A researcher published this survey result: "74% of people would be willing to spend 10 percent more for energy from a non-polluting source". The survey question was announced on a national radio show and 1200 listeners responded by calling in.

Bias In Choosing A Sample
- **Selection bias** occurs whenever the researchers select their sample in a way that tends to make it unrepresentative of the population.

- **Participation bias** occurs primarily with surveys and polls; it arises whenever people choose whether to participate. Because people who feel strongly about an issue are more likely to participate, their opinions may not represent the larger population that is less emotionally attached.

Example 4
A poll in USA Today involved a survey of the wealthiest 1% of Americans. The survey found that these people would pay an average of $487,000 for "true love", $400,000 for "great intellect", $285,000 for "talent", and $259,000 for "eternal youth".

Example 5
Law enforcement authorities try to stop illegal drugs from entering the country. A commonly quoted statistic is that they succeed in stopping only about 10% to 20% of the drugs entering the US.

Guideline 4
Look for Problems in Defining the variables or Measuring the Variables
Are the variables well defined?
Are the variables’ measurements reliable?

A variable is any item or quantity that can vary or take on different values. The variables of interest in a statistical study are the items or quantities that the study seeks to measure.

Example 6
Radon is a radioactive gas produced by natural processes in the ground. The gas can leak into buildings through the foundation and can accumulate in relatively high concentrations if doors and windows are closed. Imagine a study that seeks to determine whether radon gas causes lung cancer by comparing the lung cancer rate in Colorado, where radon gas is fairly common, with the lung cancer rate in Hong Kong, where radon gas is less common.

Suppose the study finds that the lung cancer rates are nearly the same. Is it fair to conclude that radon is not a significant cause of lung cancer?
Guideline 5  
**Watch Out for Confounding Variables**

Are there confounding variables that can invalidate the conclusions of the study?

Confounding occurs in an study when the researcher is not able to distinguish between the effects of different factors.

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Example C  
A survey of 500 married men asked the question: “Have you ever cheated on your wife?”

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Guideline 6  
**Consider the Setting and Wording in Surveys**

Does the setting or the question itself produce dishonest responses?

Is the wording of the question misleading and therefore produce inaccurate responses?

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Example R  
The RNC commissioned a poll to find out whether Americans supported a tax-cut proposal. Asked whether they favored the tax cut, 67% of respondents answered yes. Should we conclude that Americans supported the proposal?

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Guideline 7  
**Check That Results Are Presented Fairly**

Are there misleading graphs or conclusions not supported by the results of the study?

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Example 8  
The school board in Boulder, CO created a hubbub when it announced that 28% of Boulder school children were reading below grade level and hence concluded that methods of teaching reading needed to be changed. The announcement was based on reading tests on which 28% of Boulder school children scored below the national average for their grade.

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Example: A Misleading Graph  

![Salaries of People with Bachelor’s Degrees and with High School Diplomas](image)
Guideline 8

Stand Back and Consider the Conclusions

Did the study achieve its goals? Do the conclusions make sense? Do the results have any practical significance?