

Estimation

Stat 145

Some things we want to know

Here are some questions we might be interested in.

- What is the typical body temperature of college students?
- Is it really 98.6 like your mother told you?
- Does body temperature for college students differ between men and women?
- By how much do male and female body temperatures differ?
- Do women exercise less than men?
- What proportion of Michigan residents are smokers?
- Are men more or less likely than women to vote for a Republican candidate in the next election?

1. For each question above, decide if the answer will be (a) yes/no, or (b) a number.
2. For each question, say a bit about how you would design a study to answer the question.
 - a. What variables would you need to collect?
 - b. Are your variables categorical or quantitative?
 - c. What parameter(s) are you primarily interested in? (Express this in both words and symbols.)
3. Hypothesis tests are designed to answer yes/no questions: Is the null hypothesis true or false? For each of the yes/no questions above, state the formal null and alternative hypotheses.

We know how to use randomization to compute a p-value for hypothesis tests. We need a slightly different approach for questions that have number answers.

Estimating numbers

- **Estimand:** The number we want to know. This is a parameter – a number describing a feature of the population.
- **Estimate:** A number computed from our sample that tells us about the estimand.

Example: if we are interested in the mean body temperature, then the mean body temperature in the population is our estimand, and the mean body temperature in our sample is an estimate.

Of course, the estimate is probably not exactly correct. It might be too high or too low. But how much too high or too low? How good is our estimate? How do we even measure how good an estimate is?

4. Pick one or more of the estimation questions and
 - a. Say what the **estimand** is.
 - b. Explain how you would compute an **estimate**.

Our goal is to see if we can come up with a way to say **how good an estimate is**. We know our estimate usually won't be exactly correct, but should we expect it to be quite close to the correct answer, or might it be quite far off?

5. What things do you think impact how good an estimate will be? (You might find it easiest to pick a specific example, like estimating the mean body temperature.)
6. If you have extra time, create a few more estimation questions of your own and answer questions 2 and 4 about your additional questions.