Inference for $\mu$

- Who? Young adults.
- What? Heart rate (beats per minute).
- When?
- Where? In a physiology lab.
- How? Take pulse at wrist for one minute.

Inference for $\mu$

- What is the mean heart rate for all young adults?
- Use the sample mean heart rate, $\overline{y}$, to make inferences about the population mean heart rate, $\mu$.

Inference for $\mu$

- Sampling distribution of $\overline{y}$
  - Shape: Approximately normal
  - Center: Mean, $\mu$
  - Spread: Standard Deviation,
    \[ SD(\overline{y}) = \frac{\sigma}{\sqrt{n}} \]
Problem

- The population standard deviation, $\sigma$ is unknown.
- Therefore, $\text{SD}(\bar{y}) = \frac{\sigma}{\sqrt{n}}$ is unknown as well.

Solution

- Use the sample standard deviation, $s$ and the standard error of $\bar{y}$

$$\text{SE}(\bar{y}) = \frac{s}{\sqrt{n}}$$

Problem

- The distribution of the standardized sample mean

$$\frac{\bar{y} - \mu}{\text{SE}(\bar{y})}$$

does not follow a normal model.
Solution

• The distribution of the standardized sample mean
\[
\frac{\bar{y} - \mu}{SE(\bar{y})}
\]
does follow a Student’s t-model with df = n – 1.

Inference for \( \mu \)

• Do NOT use Table Z!

\[\text{Table Z}\]

• Use Table T instead!
### Conditions

- Randomization condition.
- 10% condition.
- Nearly normal condition.

### Randomization Condition

- Data arise from a random sample from some population.
- Data arise from a randomized experiment.

### 10% Condition

- The sample is no more than 10% of the population.
- Not as critical for means as it is for proportions.
Nearly Normal Condition

• The data come from a population whose shape is unimodal and symmetric.
  – Look at the distribution of the sample.
  – Could the sample have come from a normal model?

Confidence Interval for $\mu$

$$\bar{y} - t^*_{n-1} \text{SE}(\bar{y}) \text{ to } \bar{y} + t^*_{n-1} \text{SE}(\bar{y})$$

$t^*_{n-1}$ is from Table T

$$\text{SE}(\bar{y}) = \frac{s}{\sqrt{n}}$$

Table T

<table>
<thead>
<tr>
<th>df</th>
<th>$t^*_{1}$</th>
<th>$t^*_{2}$</th>
<th>$t^*_{3}$</th>
<th>$t^*_{4}$</th>
<th>$t^*_{5}$</th>
<th>$t^*_{6}$</th>
<th>$t^*_{7}$</th>
<th>$t^*_{8}$</th>
<th>$t^*_{9}$</th>
<th>$t^*_{n-1}$</th>
</tr>
</thead>
</table>