Chapter 13
Inferential Statistics
Inferential Statistics

Inferential statistics are used to determine whether we can, in fact, determine that the results reflect what would happen if we were to conduct the experiment again and again with multiple samples.
Inferential Statistics

• Differences between groups will never be exactly zero because of random error (chance). What is the probability that the results from one sample are due to chance?

• Null and research hypotheses
Type I and Type II errors

- The probability that the results are due to chance is called **Type I error**. We reject the null even though it is true.
- **Type II** errors occur when the null hypothesis is accepted although in the population the research hypothesis is true.
## Type I and Type II errors

<table>
<thead>
<tr>
<th>Decision</th>
<th>True State</th>
<th>Type I (Correct decision)</th>
<th>Type II (Correct decision)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Null is true</td>
<td>Null is false</td>
<td></td>
<td></td>
</tr>
<tr>
<td>“Accept” Null</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reject Null</td>
<td></td>
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<td>Reject Null</td>
<td>Type I error</td>
<td>Correct</td>
<td>Correct decision</td>
</tr>
<tr>
<td>Accept Null</td>
<td>Correct decision</td>
<td>Type II error</td>
<td></td>
</tr>
</tbody>
</table>
Importance of Type I and II errors

- Missile detector
- UFO detector
Importance of Type I and II errors

• The problem is that you can’t have your cake and eat it, too.
• Type I and Type II errors are inversely related.
• As you increase the requirements for asserting that something is happening, you’re going to “miss” those events that don’t satisfy every requirement.
Significance testing

- Significance is determined by three interrelated factors.
  - Alpha level — which level of alpha to choose? Generally, this is set to .05
  - Sample size
  - Power = 1 - \( \beta \) (effect size)
    - Telescope example
Significance testing

Effect size

Sample size
Statistical tests

- T-test – used for 2 groups
- F-test – used for more than 2 groups and with factorial designs
Practical significance

- As you may have guessed, with a large enough sample, you can see any difference, no matter how small.

- The question then becomes, How important is the difference? This is called practical significance.
  
  - E.g., If I find that those who wear red t-shirts on Wednesdays live significantly longer, but only by 1.63 weeks, who cares?