STAT 113
Independent vs. Paired Samples

Colin Reimer Dawson

Oberlin College

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Paired Samples Design

Analyzing Paired Data

Outline

Independent Groups Vs. Paired Samples Design

- Independent Groups: Randomly assign cases to groups (or get two groups, in observational study)
  - Random Assignment: Removes *systematic* differences between groups
  - However, still have *chance* differences between groups.
  - Chance differences are a source of *sample-to-sample variability* that we need to account for in CIs and tests.
- Paired Samples: Each observation in group A has a matched (similar) observation in group B
  - Removes some chance differences between groups
  - Reduces sample-to-sample variability
  - Narrower CIs
  - Easier to reject H_0 (given difference less likely to be caused by chance)

Kinds of Paired Samples Designs

1. *Repeated Measures* Design: Each case produces an observation in each group.
2. *Matched Pairs* Design: Observations come from different sources (e.g., people), but cases are selected to be similar in key ways (e.g., identical twins that share genetics; or pairs matched by gender, race, age, etc.)
3. *Pairing By Time*: Alternate cases between groups so that pairs were collected close in time (e.g., b/c you think time of day / week / year / etc. is a source of variability)

Outline

Analyzing Paired Data: Convert to One Sample

- In a paired samples design, can convert from two sets of original response variable to a single set of *difference scores*. Then
  - Parameter: μ_D, population mean difference score
  - Hypotheses $H_0 : \mu_D = 0$, $H_1 : \mu_D \neq 0$ (or > 0 or < 0)
  - CI: μ_D between A and B with some confidence
- As one sample: Sampling distribution is t, with $n_D - 1$ df (n_D is the number of *pairs*), provided (a) n_D large, and/or (b) population of *differences* is approx. Normal