Week 3

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Type 1 error control

- 5e-2 typical α
- Multiple comparison raise type I to well beyond 5%
- ANOVA 2x2x2, 7 tests results in type 1 error of 1-(0.95)ˆ7 = 30%
- Bonferroni correction for multiple tests α/n
- Holm or Pocock correction is a bit better than Bonferroni
- Optional stopping: start with small sample and $p > 0.05$, increase sample size until $p < 0.05$, bad if no type one error control

Positive predictive value

- A key point in proper statistical analysis is to test a hypothesis with evidence (data) that was not used in constructing the hypothesis
- Low PPV will happen when researchers examine mostly studies where the null-hypothesis is true, with low power, or when the Type 1 error rate is inflated due to p-hacking or other types of bias. Publication bias, power, and Type 1 error rates together determine the probability that significant results in the literature reflect true effects

Optional stopping

- “With a large enough sample size, the p-value for every simulation drops to zero (if there’s a true effect)
- Optional analysis can lead to high type 1 error even if keeping $\alpha < 0.05$ for each look
- Pockock boundary or sequential analysis can help

Pre-registration

- Control type 1 error rate by stating hypothesis before getting data
- If you look at data and create hypothesis the randomness of this data can't be accounted for
- Using a covariate only because it reduces the p-value can lead to studies that lack evidential value
- Confirmatory vs. exploratory research
- HARKing: Hypothesizing After the Results are Known
- De Groot 1956 : "When exploring data, you can perform a hypothesis test but you cannot test and hypothesis"

you cannot test and hypothesis

- Pre-register
  - Justify sample size (stopping rule)
  - IV: Independent variables
  - DV: dependent variables
  - Analysis plan(α, data cleaning, power)
  - Design - Pre-register - Collect - Analyse - Publish