Power Concepts, Part 2
Calculating/Estimating ES
Planning Sample Size

Overview
- Diagnosis / Description
  - Finding the effect size of a completed study
- Planning
  - Determining/estimating effect size
  - Determining sample size using ES, desired power, and \( \alpha \)

Descriptive Measures of Effect Size (ES)
- Post-hoc analysis: \( d \)
- \( d = \frac{\bar{Y}_1 - \bar{Y}_2}{s_{12}} \); where \( s_{12} \) is the pooled SD
- Population parameter: \( \delta \) (lowercase delta)
- Difference relative to the variability of the observations
- Cohen’s guidelines: small = .20; med = .50; large = .80
Descriptive Measures of Effect Size (ES)

- Post-hoc analysis: $R^2$
- $R^2$ = proportion of variance accounted for
- Population parameter: $\omega^2$ (omega)
- Proportion of variance accounted for by an effect
- $R^2 = \frac{SS_A}{SS_{total}}$ OR $\frac{(a-1)F}{(a-1)F + a(n-1)}$
- Small = .01, medium = .06, large = .15

Descriptive Measures of Effect Size (ES)

- Post-hoc analysis: $\eta^2$ (eta-squared)
- SPSS will calculate $\eta^2$ or partial $\eta^2$ for a variety of tests (t, F, etc.)
- Proportion of variance accounted for by an effect
  - Main effect or interaction, excluding other sources
- Ranges from 0 to 1
- Conventions: small = .01, med = .06; large = .14
- No conventions have been established for partial $\eta^2$ (some use those for $\eta^2$ but these are considered too large)

Estimating Effect Size (ES) in the Population

- $d$, $R^2$ and $\eta^2$ overestimate population treatment effects
- $\omega^2^{(est)} = \frac{SS_A - (a-1)MS_{S/A}}{SS_{total} + MS_{S/A}}$
  - If the anova summary table is available
- $\omega^2^{(est)} = \frac{(a - 1)(F-1)}{(a - 1)(F-1) + an}$
  - If only F stats are available
- K&W recommendations:
  - Report $d$ if discussing the difference between two means
  - Otherwise, report $\omega^2^{(est)}$
Planning: How to Determine Sample Size

- Need an effect size
- Need to determine desired power level
  - Recall that .50 power = flipping a coin
- Select power in range .50 to .95
- The current convention is become .80 for the behavioral sciences; balance between need for adequate power and available resources

Where do we get ES from?

- From the literature: "Actuarial approach" (reviews or meta-analyses)
- From the literature: Empirical articles
  - Use a set of plausible means typical of a DV
  - Use the F statistics of a study with similar IV/DV
  - See Keppel & Wickens for procedure
- Pilot data
  - Convert this information into an ES (handout)
- Assumptions:
  - With no other information, assume a small effect size
  - Minimum effect needed to justify the research

Determining Sample Size

- We need desired power, ES, and alpha
  2) Pearson-Hartley Charts in K&W and many other reference books (requires the calculation of phi $\phi$)
  3) Software: GPOWER, MINSIZE (URL for free software on class website)