

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 α

Descriptive Measures of Effect Size (ES)

- Post-hoc analysis: d
- d = standardized difference between two means (similar to a Z score; in SD units)
- Population parameter: δ (lowercase delta)
- Difference relative to the variability of the observations
- $d = (\bar{Y}_1 - \bar{Y}_2) / s_{12}$; where s_{12} is the pooled SD
- 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: ω^2 (omega)
- Proportion of variance accounted for by an effect
- $R^2 = SS_A / SS_{total}$ OR $(a-1)F / (a-1)F + a(n-1)$
- Small = .01, medium = .06, large = .15

Descriptive Measures of Effect Size (ES)

- Post-hoc analysis: η^2 (eta-squared)
- SPSS will calculate η^2 or partial η^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 η^2 (some use those for η^2 but these are considered too large)

Estimating Effect Size (ES) in the Population

- d , R^2 and η^2 overestimate population treatment effects
- $\omega^{2(est)} = SS_A - (a-1)MS_{S/A} / SS_{total} + MS_{S/A}$
 - If the anova summary table is available
- $\omega^{2(est)} = (a - 1)(F-1) / (a - 1)(F-1) + an$
 - 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

- 1) Tables: Keppel & Wickens (2004, p. 173); Cohen (1988)
- 2) Pearson-Hartley Charts in K&W and many other reference books (requires the calculation of ϕ)
- 3) Software: GPOWER, MINSIZE (URL for free software on class website)
