Cheatsheet for Effect size calculation in Social Science Meta-analysis (Version 0.1)

https://ziqian-xia.github.io/

Effect size family

r-based effect sizes representing correlations between the focal predictor and the dependent variable;
d-based effect sizes representing standardized mean differences on Y across categories of X ;
odds-based effect sizes representing the ratio or relative frequency of outcomes on Y across categories of X

Regression Coef Beta → Coefficient ***r*** → Fisher's *Z*

A basic route for Meta-analysis in Economics or Management Science is to standardize the effects by first converting the regression coefficients into correlation coefficients r, which then converted to Fisher's Z.

Difference-of-means design → Cohen's *d* → Fisher's *Z*

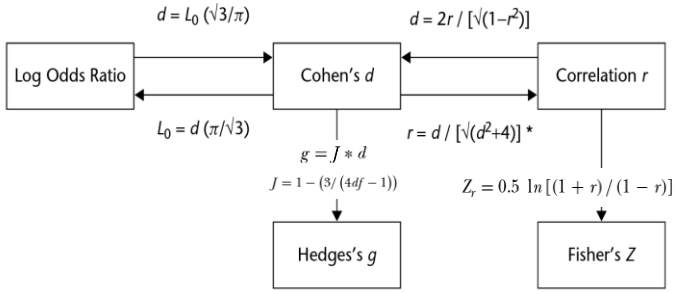
For studies that employed the difference-of-means design, we first calculated the standardized mean differences or Cohen's d and then converted them to Fisher's Z.

r-Based Effect Sizes	*d*-Based Effect Sizes (Independent)	*d*-Based Effect Sizes (Matched or Correlated)
$r = \sqrt{[t^2/(t^2+df)]}$	$d = (\bar{Y}_1 - \bar{Y}_2)/S_{pooled}$	$d = (\bar{Y}_1 - \bar{Y}_2)/S_{within}$
$r = \sqrt{[Z^2/n]}$	$d = t\sqrt{[(n_1+n_2)/(n_1n_2)]}$	$d = t\sqrt{[2(1-r)/n]}$
$r = \sqrt{[X_1^2/n]}$	$d = +/- t^{-1}(p/2)\sqrt{[(n_1+n_2)/(n_1n_2)]}$	$d = +/- t^{-1}(p/2)\sqrt{[2(1-r)/n}$
$V[r] = (1-r^2)^2/(n-1)$	$V[d] = [((n_1+n_2)/(n_1n_2)) + (d^2/2(n_1+n_2))]$	$V[d] = (1/n + d^2/2n)\,2(1-r)$
$Z_r = 0.5\ ln[(1+r)/(1-r)]$	$g = [1-(3/(4df-1))]*d$	$g = [1-(3/(4df-1))]*d$
$V[Z_r] = 1/(n-3)$	$V[g] = [1-(3/(4df-1))]^2 * V[d]$	$V[g] = [1-(3/(4df-1))]^2 * V[d]$

Note: In this cheatsheet, ***t***, ***z***, ***χ2*** are their responding statistics from regression; *V* indicates the effect size's variance; ***S*** indicates the sample variance; ***Z*** = ***Fisher's Z***, ***g*** = ***Hedge's g***, ***d***= ***Cohen's d***, ***df***=***degrees of freedom***, ***p***=***p-value***.

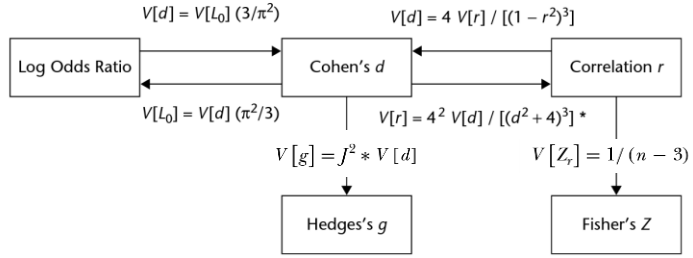
Effect size conversion

FORMULAS FOR CONVERTING BETWEEN EFFECT SIZES IN META-ANALYSIS



* 4 in this equation is an approximation for $(n_1+n_2)^2/(n_1n_2)$.

FORMULAS FOR CONVERTING BETWEEN EFFECT SIZE VARIANCES IN META-ANALYSIS



* 4 in this equation is an approximation for $(n_1+n_2)^2/(n_1n_2)$.

Other Statistics Effect size

ANOVA with F or Z Statistics

$$d = \sqrt{[F(n_1+n_2)/n_1n_2]} \qquad d = Z\sqrt{[(n_1+n_2)/n_1n_2]}$$

Eta-Square, Cohen's f and Cohen's d

$$f^2 = \frac{\eta^2}{1-\eta} \qquad f = \frac{d}{2}$$

Cohen's d to log odds ratio (A~D stands for cells in experiment)

$$\text{log odds ratio} = \frac{d\pi}{\sqrt{3}} \qquad V[L_o] = (1/A)+(1/B)+(1/C)+(1/D)$$

Resources

R Packages:

compute.es which converts from various statistics to d, g, r, z and the log odds ratio, MAc which converts to correlation coefficients, MAd which converts to mean differences, and metafor which converts to effect sizes an extensive set of measures for comparative studies (such as binary data, person years, mean differences and ratios and so on), for studies of association (a wide range of correlation types), for non-comparative studies (proportions, incidence rates, and mean change). It also provides for a measure used in psychometrics (Cronbach's alpha). esc provides a range of effect size calculations with partial overlap with metafor but with some extras, noticeably for converting test statistics, also includes a convenience function for collating its output for input to another package like metafor or producing a CSV file. estimraw estimates the cell frequencies from one of odds ratio, risk ratio, or risk difference. effsize contains functions to compute effect sizes mean difference (Cohen's d and Hedges g), dominance matrices (Cliff's Delta) and stochastic superiority (Vargha-Delaney A). effectsize provides a large number of different effect sizes and converts between them.

Online Calculator:

Practical Meta-Analysis Effect Size Calculator
https://www.campbellcollaboration.org/escalc/html/EffectSizeCalculator-SMD21.php
Effect size conversion tool
https://www.escal.site/

Related Books:

Ringquist, E. J. "Meta-analysis for public policy management." (2013).
Lipse, M. W., and D. Wilson. "Practical Meta-Analysis (Applied Social Research Methods)." (2000).
Mathias, H., et al. "Doing meta-analysis in R: A hands-on guide." (2019).

Reference

Khanna, Tarun M., et al. "A multi-country meta-analysis on the role of behavioural change in reducing energy consumption and CO2 emissions in residential buildings." Nature Energy (2021): 1-8.
Nisa, Claudia F., et al. "Meta-analysis of randomised controlled trials testing behavioural interventions to promote household action on climate change." Nature communications 10.1 (2019): 1-13.

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