

Effect Sizes Based on Correlations

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INTRODUCTION

For studies that report a correlation between two continuous variables, the correlation coefficient itself can serve as the effect size index. The correlation is an intuitive measure that, like δ , has been standardized to take account of different metrics in the original scales. The population parameter is denoted by ρ (the Greek letter rho).

COMPUTING r

The estimate of the correlation parameter ρ is simply the sample correlation coefficient, r . The variance of r is approximately

$$V_r = \frac{(1 - r^2)^2}{n - 1}, \quad (6.1)$$

where n is the sample size.

Most meta-analysts do not perform syntheses on the correlation coefficient itself because the variance depends strongly on the correlation. Rather, the correlation is converted to the Fisher's z scale (not to be confused with the z -score used with significance tests), and all analyses are performed using the transformed values. The results, such as the summary effect and its confidence interval, would then be converted back to correlations for presentation. This is shown schematically in Figure 6.1, and is analogous to the procedure used with odds ratios or risk ratios where all analyses are performed using log transformed values, and then converted back to the original metric.

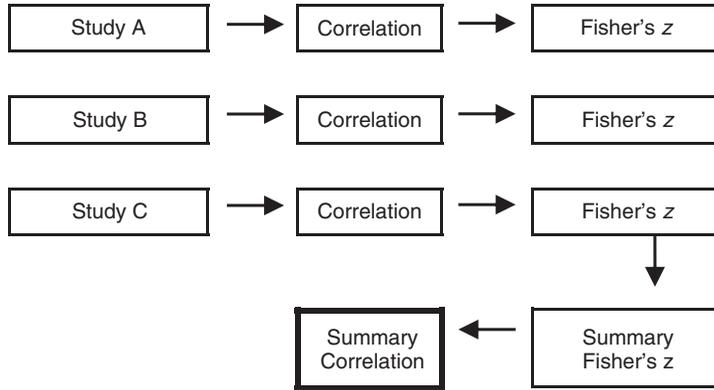


Figure 6.1 Correlations are analyzed in Fisher's z units.

The transformation from sample correlation r to Fisher's z is given by

$$z = 0.5 \times \ln\left(\frac{1+r}{1-r}\right). \quad (6.2)$$

The variance of z (to an excellent approximation) is

$$V_z = \frac{1}{n-3}, \quad (6.3)$$

and the standard error is

$$SE_z = \sqrt{V_z}. \quad (6.4)$$

When working with Fisher's z , we do not use the variance for the correlation. Rather, the Fisher's z score and its variance are used in the analysis, which yield a summary effect, confidence limits, and so on, in the Fisher's z metric. We then convert each of these values back to correlation units using

$$r = \frac{e^{2z} - 1}{e^{2z} + 1}. \quad (6.5)$$

For example, if a study reports a correlation of 0.50 with a sample size of 100, we would compute

$$z = 0.5 \times \ln\left(\frac{1+0.5}{1-0.5}\right) = 0.5493,$$

$$V_z = \frac{1}{100-3} = 0.0103,$$

and

$$SE_z = \sqrt{0.0103} = 0.1015.$$

To convert the Fisher's z value back to a correlation, we would use

$$r = \frac{e^{(2 \times 0.5493)} - 1}{e^{(2 \times 0.5493)} + 1} = 0.5000.$$

OTHER APPROACHES

Hunter and Schmidt (2004) advocate an approach for working with correlations that differs in several ways from the one presented here. This approach is discussed in Chapter 38.

SUMMARY POINTS

- When studies report data as correlations, we usually use the correlation coefficient itself as the effect size. We transform the correlation using the Fisher's z transformation and perform the analysis using this index. Then, we convert the summary values back to correlations for presentation.