
CHAPTER 10

Overview

Introduction
Nomenclature

INTRODUCTION

Most meta-analyses are based on one of two statistical models, the fixed-effect model or the random-effects model.

Under the fixed-effect model we assume that there is one *true effect size* (hence the term *fixed effect*) that underlies all the studies in the analysis, and that all differences in observed effects are due to sampling error. While we follow the practice of calling this a fixed-effect model, a more descriptive term would be a *common-effect* model. In either case, we use the singular (*effect*) since there is only one true effect.

By contrast, under the random-effects model we allow that the true effect could vary from study to study. For example, the effect size might be higher (or lower) in studies where the participants are older, or more educated, or healthier than in others, or when a more intensive variant of an intervention is used, and so on. Because studies will differ in the mixes of participants and in the implementations of interventions, among other reasons, there may be *different effect sizes* underlying different studies. If it were possible to perform an infinite number of studies (based on the inclusion criteria for our analysis), the true effect sizes for these studies would be distributed about some mean. The effect sizes in the studies that actually *were performed* are assumed to represent a random sample of these effect sizes (hence the term *random effects*). Here, we use the plural (*effects*) as there is an array of true effects.

In the chapters that follow we discuss the two models and show how to compute a summary effect using each one. Because the computations for a summary effect are not always intuitive, it helps to keep in mind that the summary effect is nothing more than the mean of the effect sizes, with more weight assigned to the more precise studies. We need to consider what we mean by the *more precise* studies and how this translates into a study weight (this depends on the model), but not lose track of the fact that we are simply computing a weighted mean.

NOMENCLATURE

Throughout this Part we distinguish between a true effect size and an observed effect size. A study's *true effect size* is the effect size in the underlying population, and is the effect size that we would observe if the study had an infinitely large sample size (and therefore no sampling error). A study's *observed effect size* is the effect size that is actually observed.

In the schematics we use different symbols to distinguish between true effects and observed effects. For individual studies we use a circle for the former and a square for the latter (see Figure 10.1). For summary effects we use a triangle for the former and a diamond for the latter.

	True effect	Observed effect
Study	●	■
Combined	▼	◆

Figure 10.1 Symbols for true and observed effects.

Worked examples

In meta-analysis the same formulas apply regardless of the effect-size index being used. To allow the reader to work with an effect size of their choosing, we have separated the formulas (which are presented in the following chapters) from the worked examples (which are presented in Chapter 14). There, we provide a worked example for the standardized mean difference, one for the odds ratio, and one for correlations.

The reader is encouraged to select one of the worked examples and follow the details of the computations while studying the formulas. The three datasets and all computations are available as Excel spreadsheets on the book's website