Title:
Sample size and number of trials considerations when conducting random-effects
meta-analyses

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Abstract:

In this talk we demonstrate how achieving an appropriate power in a random-effects meta-
analysis can require unrealistic large numbers of trials. The consequence of this is that many
current random-effects meta-analyses will never be able to reject the null hypothesis in the real
world of limited studies. While it is known that random-effects models require a larger number
of participants, the required number of trials for even large intervention effects are a more
unknown factor for achieving a certain level of power.

Meta-analyses are known and made for the increase in precision and power when combining
studies. This is true for meta-analyses in which the effect size is considered identical for all the
included trials and the fixed-effect model is used. Then combining the studies will always result
in a higher power; all that is required is more participants.

In contrast, when heterogeneity is present, we cannot be sure of an increase in precision and
power when we fit a random-effects model. This is due to the added variation coming from the
between-trial-variance. For random-effects models, an increase in power usually requires an
increase in the number of trials and not just an increase in number of participants. Depending
on the size of the heterogeneity, the required number of trials can be high such as requiring
over 100 trials for 80% power. In this talk, we will present examples of such calculations of a
required number of trials and a combined sample size (information size) based on meta-analyses
simulated with a binary outcome under varying assumptions about the size of the heterogeneity
and the intervention effect.

Keywords: Random-effects meta-analysis, power, trial and sample size requirements