

Meta-analyses are not inherently well powered

Statistical Power in Meta-Analysis: Distinguishing Retrospective and Prospective Contexts

WANT TO LEARN MORE:

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🌐 <https://osf.io/3kh8p>

including references



Background

Statistical power is often assumed to be high in meta-analysis because evidence is accumulated across studies. However, this assumption overlooks two issues: power has different meanings in retrospective and prospective contexts, and between-study heterogeneity can substantially reduce the probability of detecting a mean effect [1-4].

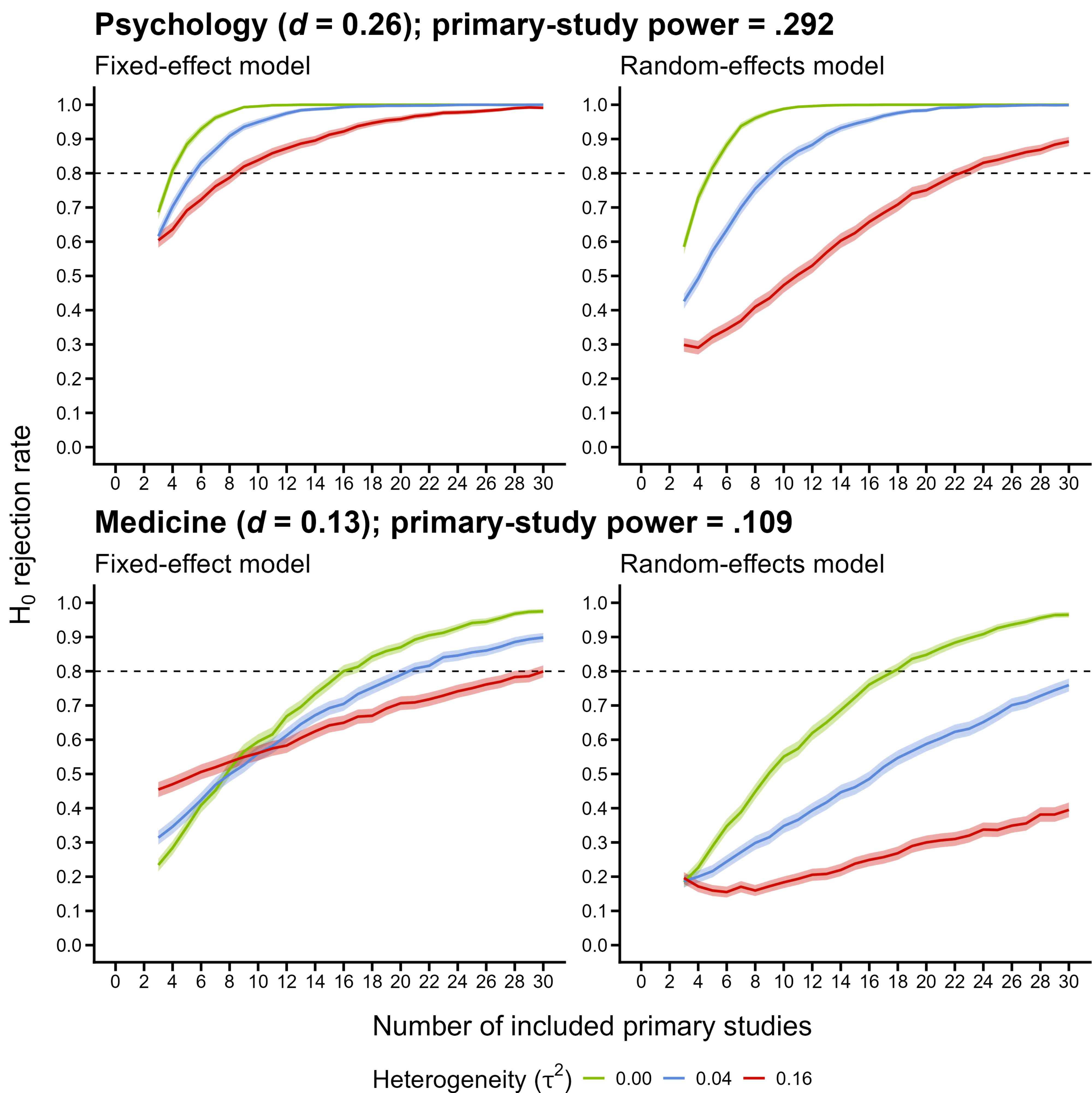
Context distinction

- **Retrospective contexts:** power characterizes a meta-analysis, either by estimating power for working effect sizes or by estimating the smallest detectable effect size for a target power level.
- **Prospective contexts:** power informs how many studies of a given size are needed in a future meta-analysis to detect a prespecified effect.

Simulation parameters

Components	Simulation setting
Context	Retrospective
Models	Fixed-effects & random-effects
Effect sizes	Psychology: $d = 0.26$; Medicine: $d = 0.13$ [5]
Heterogeneity	$\tau^2 = 0.00, 0.04, 0.16$ [6]
Study size	120 participants per study, $n = 60$ per group [7-8]
Replications	2000 per condition

Simulation results



Three take-home findings

1. Power is not determined by total sample size alone.

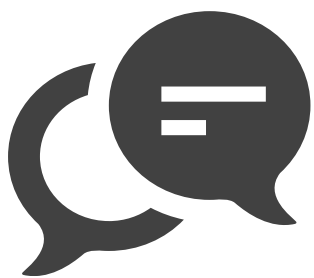
With the same number of participants per study, H_0 rejection rates differed markedly depending on the number of primary studies, model, and heterogeneity.

2. Heterogeneity matters

For medicine, the 80% threshold was not reached with 30 studies under moderate or large heterogeneity in random-effects model.

3. Model choice matters

Fixed-effect models may produce misleading H_0 rejection rates when between-study heterogeneity is ignored.



Accumulating studies is not enough: meta-analytic power depends on how evidence is structured and modelled.