

APPLIED META-ANALYSIS IN R

5-Day Intensive Course

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Course description	This intensive course provides participants with a rigorous introduction to the principles and practice of meta-analysis in biomedical research. Emphasis will be placed not only on the statistical models underlying evidence synthesis, but also on the critical interpretation of meta-analytic findings and the methodological decisions required to conduct high-quality analyses. The course will combine theoretical discussion with extensive hands-on training in R, allowing participants to directly apply the concepts introduced through real-world biomedical examples and published case studies. Particular attention will be devoted to understanding the assumptions, limitations, and interpretation of commonly used meta-analytic methods, including heterogeneity assessment, small-study effects, subgroup analyses, and meta-regression.
Course objectives	By the end of the course, participants will: • Understand the methodological and statistical foundations of meta-analysis • Assess and interpret between-study heterogeneity • Detect and address reporting/publication bias • Run subgroup analyses and meta-regression models • Produce publication-ready forest plots and results following PRISMA guidelines • Independently conduct a complete meta-analysis
Course audience	Master's-level students, PhD candidates, early-stage biostatistics trainees, and researchers in biomedical and health sciences.
Prerequisites	Basic statistics (linear regression, hypothesis testing) + minimal familiarity with R.
Course outline	The course runs over five consecutive days and includes one 3-hour session per day, with a final 2-hour session on Day 5, for a total of 14 instructional hours. Each session integrates theoretical content with hands-on exercises in R, allowing participants to directly apply the methodological concepts introduced during the course. Day 1 — Foundations of Evidence Synthesis and Meta-Analysis • Introduction to evidence synthesis in biomedical research • PICO framework and study selection principles • Fixed- versus random-effects models: assumptions and interpretation • Hands-on: R setup, data preparation, computation of common effect sizes Day 2 — Statistical Models and Interpretation of Results • Estimation and interpretation of pooled effects • Confidence intervals and uncertainty • Interpretation of forest plots beyond the pooled estimate • Hands-on: model implementation, comparison, and forest plot customization Day 3 — Heterogeneity and Small-Study Effects • Between-study heterogeneity: Q, I^2, τ^2, prediction intervals • Publication bias versus small-study effects • Funnel plots, Egger's test, and trim-and-fill methods • Hands-on: heterogeneity and bias assessment, funnel plots

Day 4 — Subgroup Analysis and Meta-Regression

- Subgroup analysis: rationale, common pitfalls
- Meta-regression: principles and interpretation
- Interpretation of moderator effects
- Hands-on: subgroup analysis and meta-regression

Day 5 — Putting It All Together: Capstone Exercise

- PRISMA reporting guidelines: essentials for publication
- **Capstone exercise:** participants independently conduct a complete meta-analysis on a provided real-world dataset
- Group discussion: comparison of results, methodological choices, and interpretation

Software

R / RStudio (packages: metafor, meta).
Participants should bring a laptop with R or RStudio pre-installed.

Materials provided

Complete set of course slides, R scripts, and practice datasets.

A certificate of attendance will be provided to participants who successfully attend the course
