

Basic of meta-analysis using R



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Download material

<https://github.com/tengku-hanis/webinar-basic-MA>

The screenshot shows the GitHub repository page for 'tengku-hanis/basic-MA-biostat'. The repository is in the 'main' branch and has 1 branch and 0 tags. The repository description is 'Material for webinar of basic meta-analysis using R'. The repository contains the following files:

- `.gitignore` (upload R code)
- `README.md` (Update README.md)
- `basic-MA-biostat.Rproj` (first commit)
- `ma-basic.R` (upload R code)

The README.md file is displayed, showing the title 'Material for webinar: Basic of meta-analysis using R', the date '18-08-2021', the organizer 'Unit of Biostatistics And Research Methodology, USM', and the content:

1. Slides
2. R script

On the right side of the repository page, there are sections for 'Releases' (No releases published), 'Packages' (No packages published), and 'Languages' (R 100.0%).

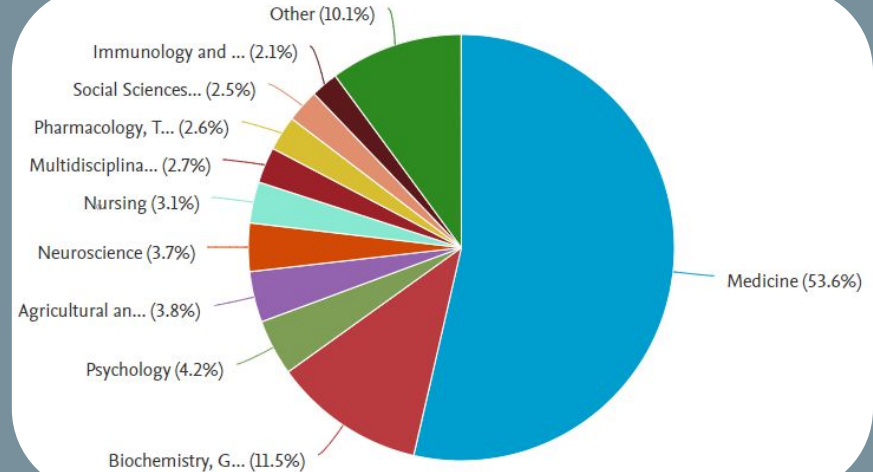
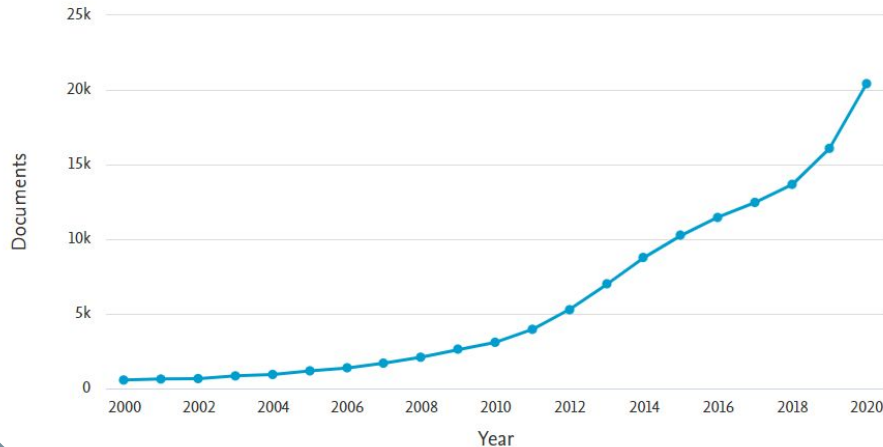
Annotations on the screenshot indicate the steps to download the material:

1. Click the 'Code' button (highlighted in green) to open the download options.
2. Click the 'Download ZIP' button (highlighted in red) to download the repository files.

Background

- Meta-analysis:
 - Statistical methods used to combine individual results into pooled result
- From Scopus database (13-08-2021): 146, 762 documents

Documents by year



Basic jargons

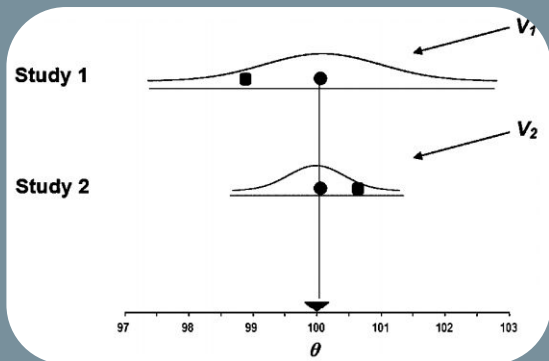
- Fixed vs random effect model
- Between-study heterogeneity
- Publication bias
- Forest plot
- Funnel plot



Basic jargons (cont.)

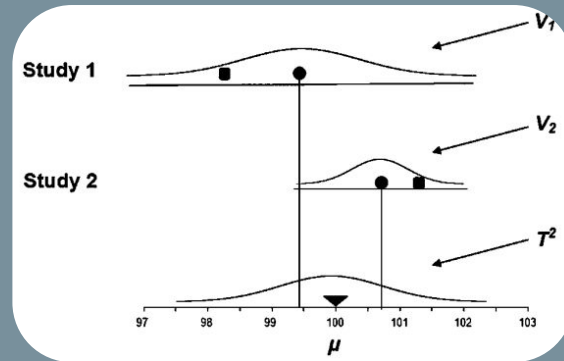
1) Fixed effect:

- One true effect size
- Estimate one true effect size



Random effect:

- True effects varies (ie; distribution of true effect sizes)
- Estimates mean of the distribution of true effects sizes



(Borenstein et al., 2010)

Basic jargons (cont.)

2) Heterogeneity (almost always refer to between study heterogeneity):

- Variation in study outcomes between studies (statistical heterogeneity)
- Measurement: Q -statistics, T^2 , I^2 , H^2
- Other types of heterogeneity refer to Rucker et al., 2008

3) Publication bias:

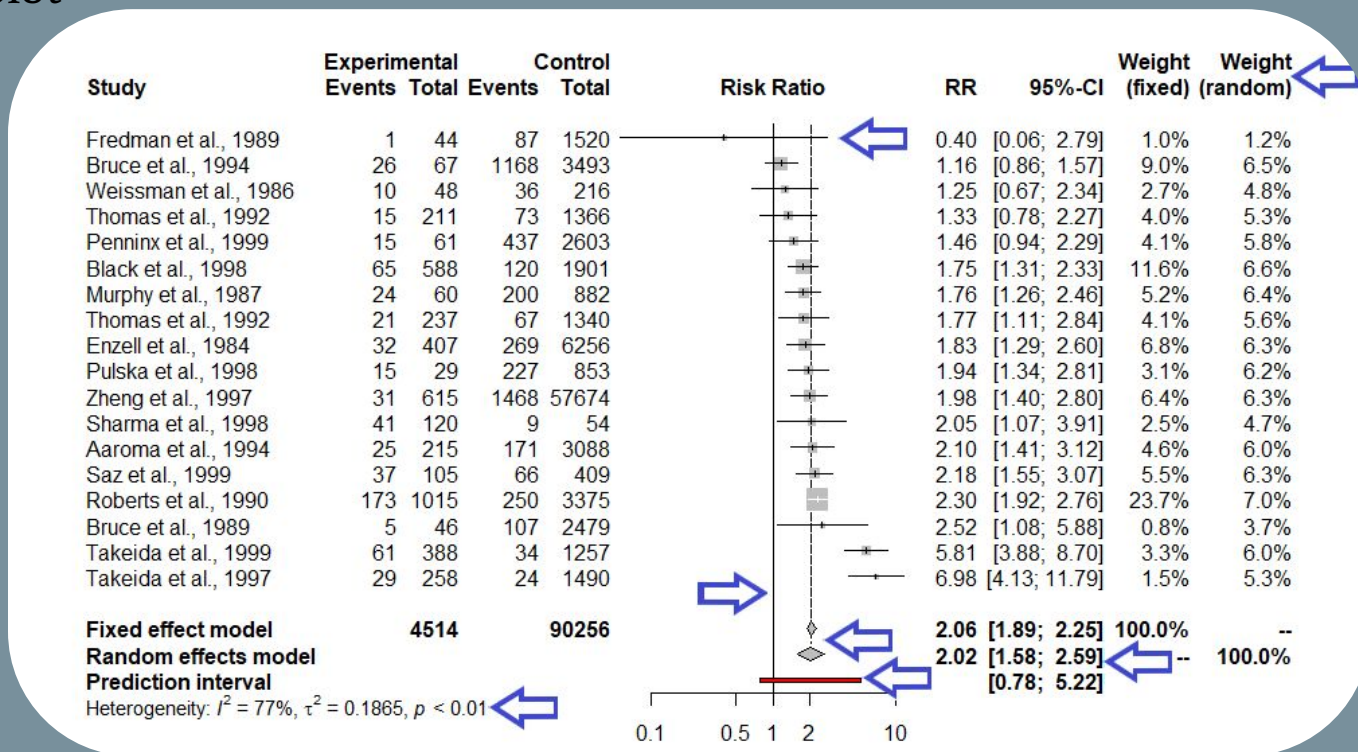
- Studies being published depends on its result
- Consequences:
 - Overestimate the effect size
 - Overlook negative effect size

Basic jargons (cont.)

- Certain publication bias caused by small study effect and p-hacking can be statistically adjusted (most causes usually unknown)
- Publication bias tested using:
 - Visual: Funnel plot
 - Statistical (min $k=10$):
 - Classical: Begg, Egger (default), Thompson
 - Binary outcome: Peters, Harbord (default for OR), Schwarzer, Deeks, etc
 - SMD (for Hedges' g): Pustejovsky

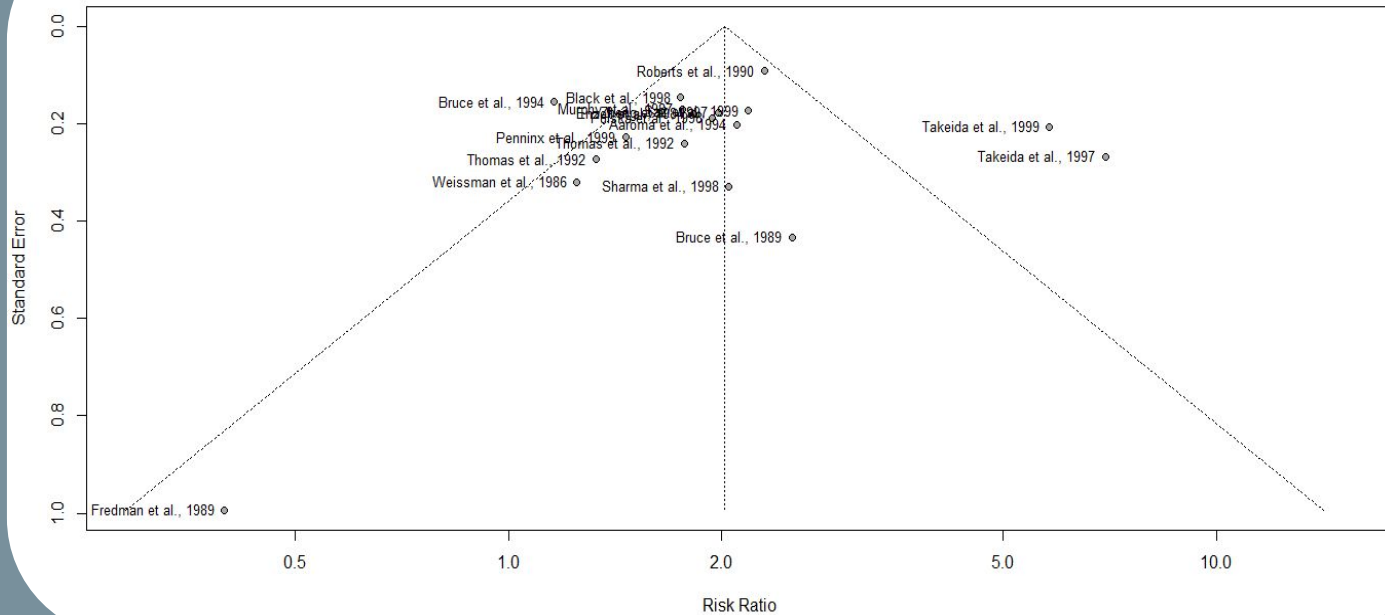
Basic jargons (cont.)

4) Forest plot

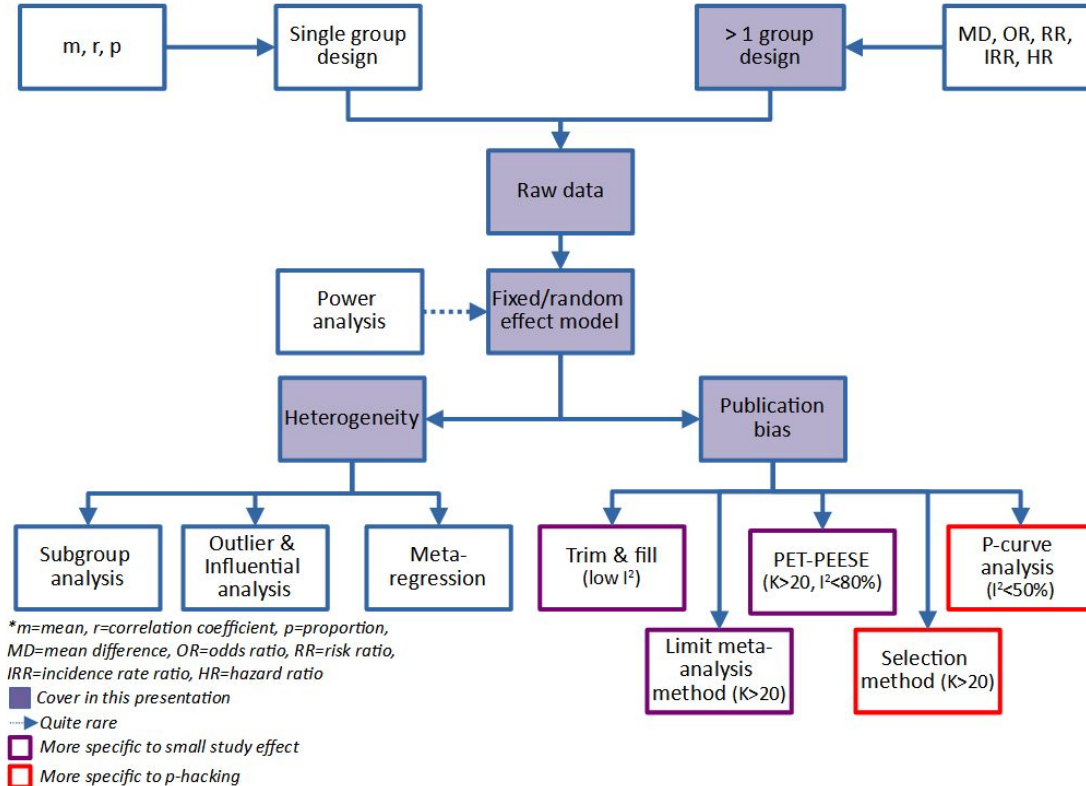


Basic jargons (cont.)

5) Funnel plot



General framework



Advanced method

- Variation of visualization:
 - Forest plot equivalent: Drapery plot
 - Variant of funnel plot: Contour-enhanced funnel plot
- Meta-regression
- Subgroup analysis
- Outlier and influential diagnostic (rule of thumb; $I^2 > 50\%$)
- Other publication bias related method
- GOSH (graphical display of study heterogeneity) analysis
- etc

Type of meta-analysis

1. **“General” meta-analysis (Intervention/observational study)**
 - Single group design: Pool mean, correlation coefficient, prevalence/proportion
 - >1 group design: Pool mean difference, OR, RR, IRR, HR
2. "Multilevel" meta-analysis
 - There is 3rd level
3. Network meta-analysis
 - Compare several treatment effect directly and indirectly
4. Dose response meta-analysis
 - Quantify level of exposure effect to response

Type of meta-analysis (cont.)

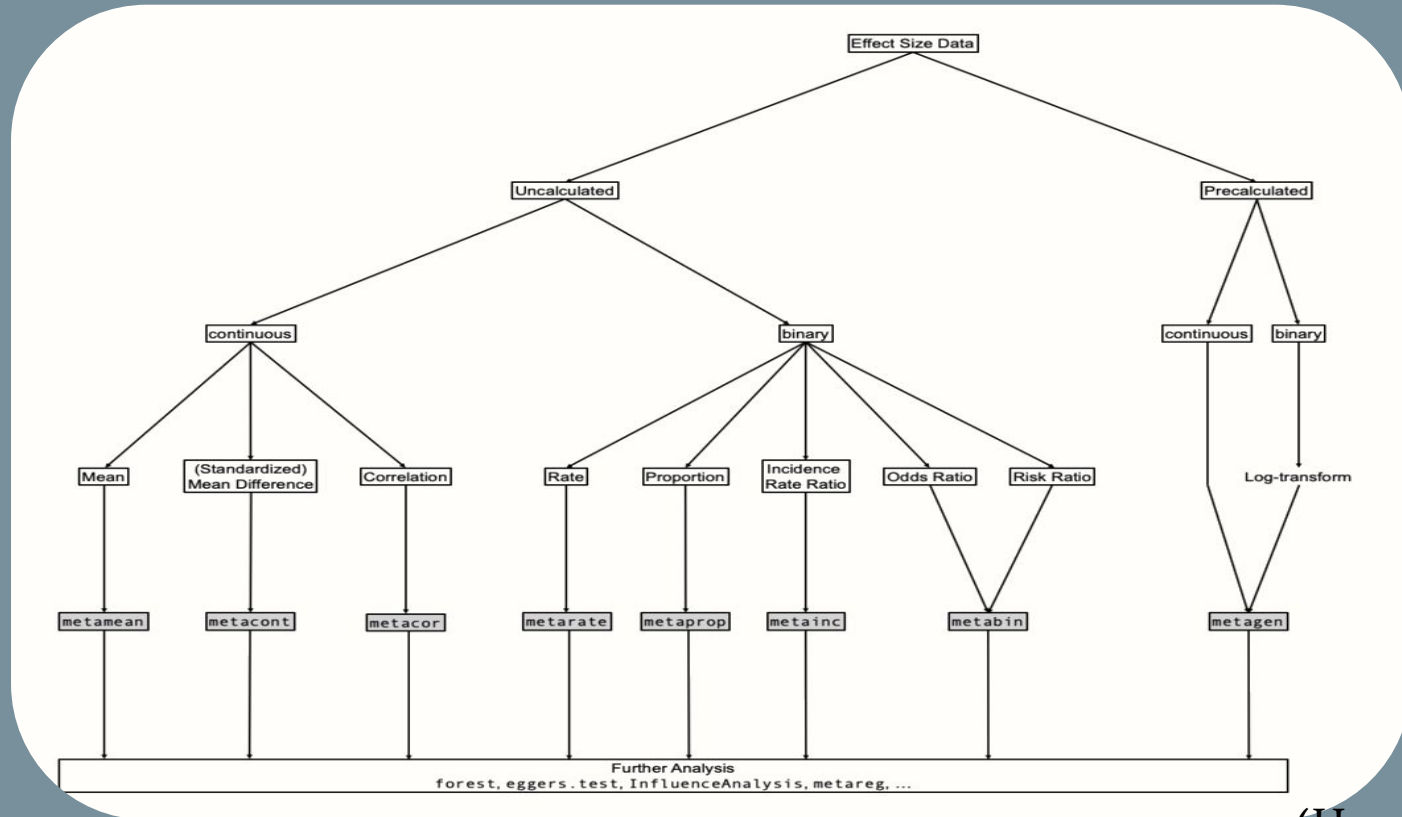
5. Diagnostic test accuracy meta-analysis
 - Pool sensitivity, specificity, AUC
6. Multivariate/Anova/SEM meta-analysis
7. Bayesian approach
8. Genome meta-analysis

Packages in R (CRAN)

Package Characteristics

Package	Version	Title	Effect Size	Power	Missing Data	Dependent Effects	Fixed Effect	Random Effects	Moderator Analyses	Publication Bias	Sensitivity Analysis	Creates Plots	Primary Function
General meta-analysis													
CAMAN	0.7	Finite mixture models and meta-analysis tools						✓	✓				bivariate
epiR	0.9-62	Tools for the analysis of epidemiological data	✓		✓		✓	✓					epi.dsl
gmeta	2.2-3	Meta-analysis via a unified framework under confidence distribution	✓			✓	✓	✓				✓	gmeta
Mac	1.1	Meta-analysis with correlations	✓		✓	✓	✓	✓	✓	✓	✓	✓	mareg
Mad	0.8-2	Meta-analysis with mean differences	✓		✓	✓	✓	✓	✓	✓		✓	mareg
Meta	4.2-0	General package for meta-analysis	✓		✓		✓	✓	✓	✓	✓	✓	metacont
metacor	1.0-2	Meta-analysis of correlation coefficients	✓				✓	✓					metacor.DSL
metafor	1.9-5	Meta-analysis package for R	✓		✓	✓	✓	✓	✓	✓	✓	✓	rma
metaplan	0.7-1	Robust meta-analysis and meta-regression	✓			✓		✓	✓		✓	✓	metaplan
psychometric	2.2	Applied psychometric theory					✓		✓	✓		✓	MetaTable
rmeta	2.16	Meta-analysis	✓				✓	✓		✓	✓	✓	meta.MH

Main functions in meta packages



(Harrer et al., 2021)

References

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Question?



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Hands-on in

