

# 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 README.md file is selected, showing the title 'Material for webinar: Basic of meta-analysis using R' and the date '18-08-2021'. The content lists two items: '1. Slides' and '2. R script'. A red box highlights the 'Code' button in the top right corner, with a red arrow pointing to it and a circled '1'. Another red box highlights the 'Download ZIP' button in the 'Clone' dropdown menu, with a red arrow pointing to it and a circled '2'.

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main 1 branch 0 tags

tengku-hanis upload R code

File	Commit
.gitignore	upload R code
README.md	Update README.md
basic-MA-biostat.Rproj	first commit
ma-basic.R	upload R code

Go to file Add file Code

Clone

HTTPS SSH GitHub CLI

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

Use Git or checkout with SVN using the web URL.

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README.md

## Material for webinar: Basic of meta-analysis using R

Date: 18-08-2021  
Organiser: Unit of Biostatistics And Research Methodology, USM  
Content:

1. Slides
2. R script

Material for webinar of basic meta-analysis using R

Readme

Releases

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Packages

No packages published  
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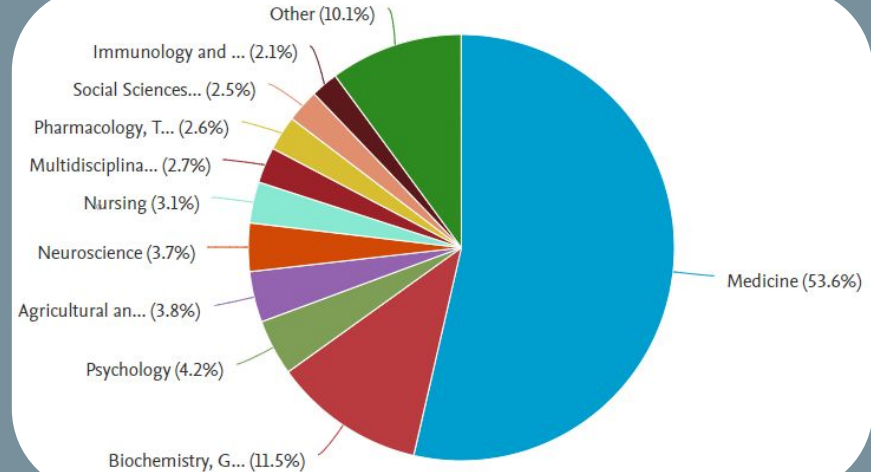
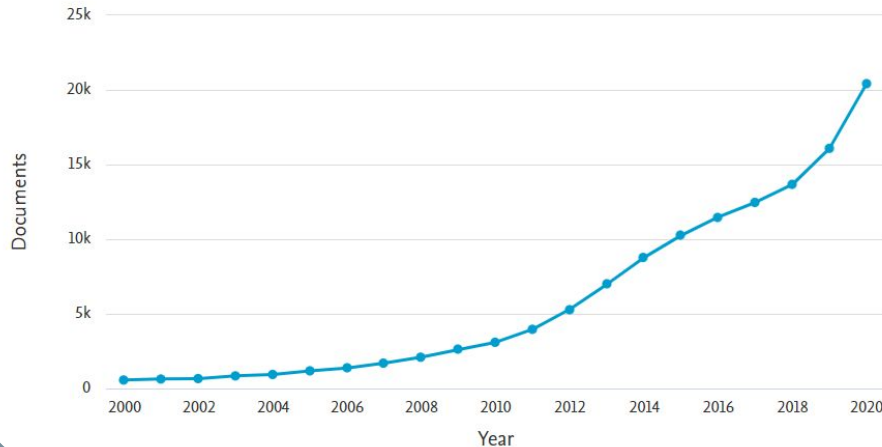
Languages

R 100.0%

# 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

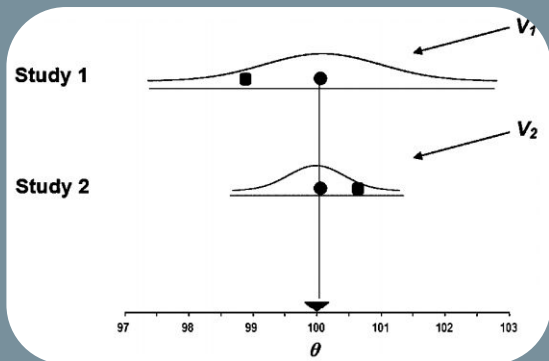
- Fixed vs random effect model
- Between-study heterogeneity
- Publication bias
- Forest plot
- Funnel plot



# Basic jargons (cont.)

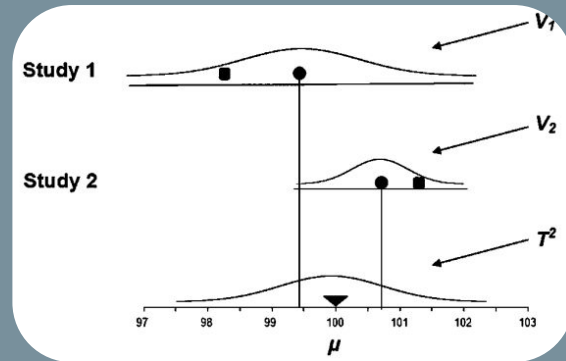
## 1) Fixed effect:

- 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



(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:

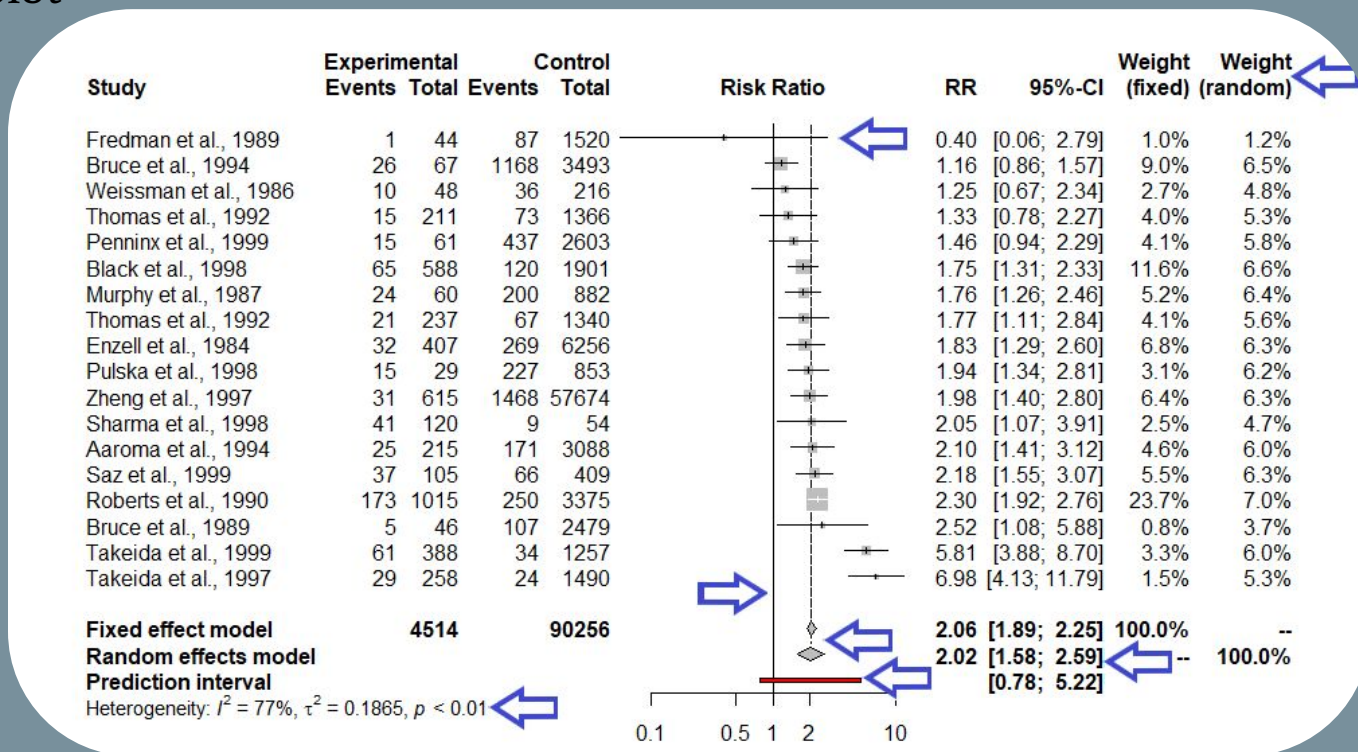
- Studies being published depends on the its result
- Consequences:
  - Overestimate the effect size
  - Overlook negative effect size

## 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.)

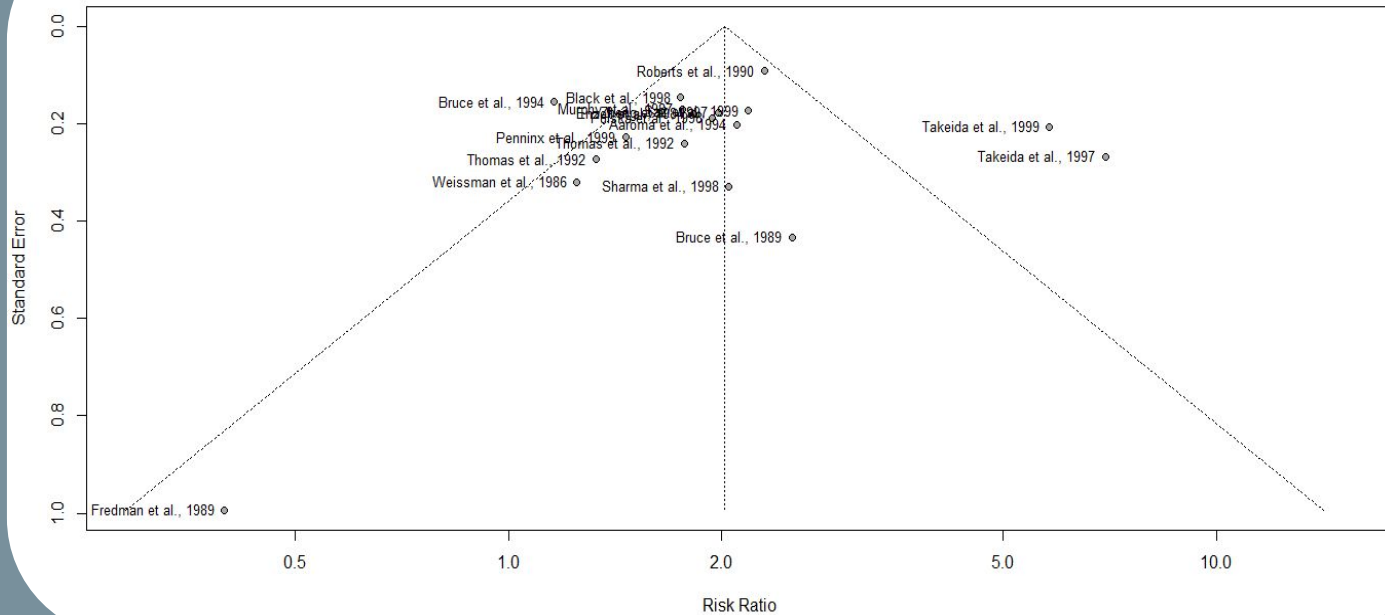
## 4) Forest plot



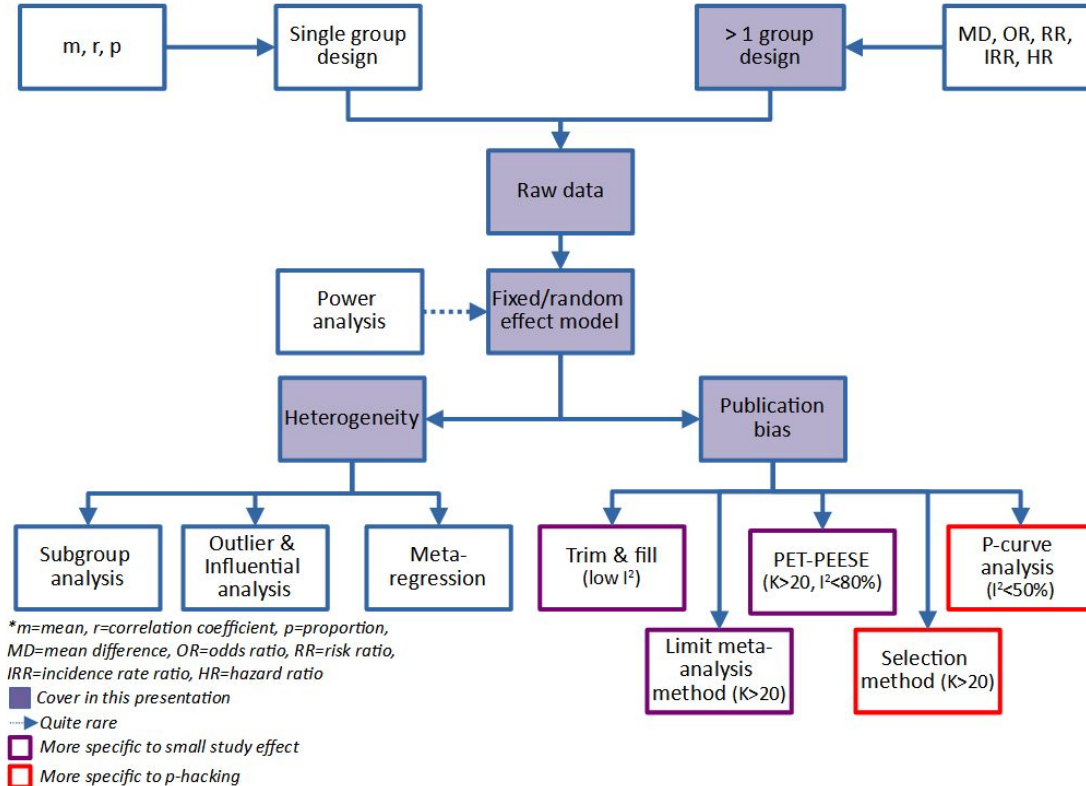


# Basic jargons (cont.)

## 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.)

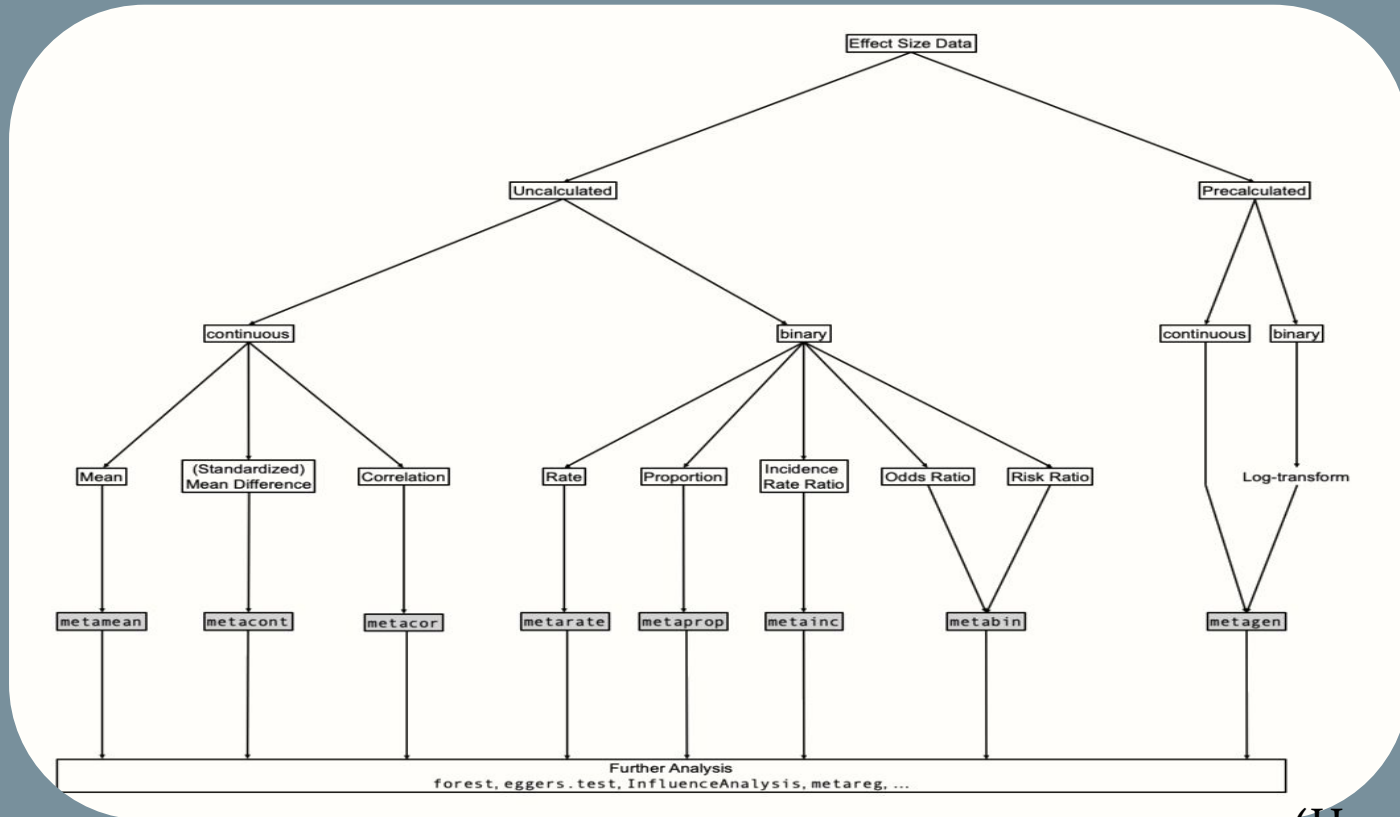
5. Diagnostic test accuracy meta-analysis
  - Pool sensitivity, specificity, AUC
6. Multivariate/Anova/SEM meta-analysis
7. Bayesian approach
8. Genome meta-analysis

# 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
<b>General meta-analysis</b>													
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
metaplust	0.7-1	Robust meta-analysis and meta-regression	✓			✓		✓	✓		✓	✓	metaplust
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

