Meta-Analyses using the meta package

Neil Yetz & Gemma Wallace

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Nine Steps to Meta Analyses

We recommend in general the following nine steps of meta analysis. These nine steps are in general applicable to all meta-analyses.

1. Frame a question (based on a theory)
2. Run a search (on Pubmed/Medline, Google Scholar, other sources)
3. Read the abstract and title of the individual papers.
4. Abstract information from the selected set of final articles.
5. Determine the quality of the information in these articles. This is done using a judgment of their internal validity but also using the GRADE criteria
6. Determine the extent to which these articles are heterogeneous
7. Estimate the summary effect size in the form of Odds Ratio and using both fixed and random effects models and construct a forest plot
8. Determine the extent to which these articles have publication bias and run a funnel plot
9. Conduct subgroup analyses and meta regression to test if there are subsets of research that capture the summary effects

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We are here

Load Libraries

```
---
title: "Lab 1: Meta-analyses"
output: html_notebook
---


# Load libraries
```{r}
library(tidyverse)
install.packages("meta")
library(meta)
```

```

# Read in data

````
Read in data
```{r}
studies <- read_csv(file="studies.csv")
```
````

```
Parsed with column specification:
cols(
  r = col_double(),
  n = col_double(),
  Study = col_character()
)
```

A look at our dataset

	r	n	Study
1	0.32	210	S1
2	0.21	160	S2
3	0.35	90	S3
4	0.27	410	S4
5	0.29	100	S5
6	0.44	60	S6

- **r** = Study effect size (correlations)
- **n** = Study sample size
- **Study** = Name of study (i.e. Yetz et al., 2003)

Run the meta analysis with metacor()

```
#  Compare correlations across studies
```{r}
MA <-metacor(cor = r, n = n, studlab= Study, data=studies)
MA
```
```

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~~~
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```
~~~

- **MA** = object
- **metacor()** = function to compare correlations across studies (From meta package)
- “**cor =**” = column that correlations are placed (r)
- “**n =**” = column where sample sizes are placed (n)
- “**studlab =**” = column where study names are placed (Study)
- “**data =**” = dataset where information is stored (studies)

```
      COR            95%-CI %W(fixed) %W(random)
S1  0.3200 [ 0.1930; 0.4365]      6.5        6.5
S2  0.2100 [ 0.0567; 0.3536]      4.9        4.9
S3  0.3500 [ 0.1541; 0.5194]      2.7        2.7
S4  0.2700 [ 0.1778; 0.3575]     12.7       12.7
S5  0.2900 [ 0.0992; 0.4602]      3.0        3.0
S6  0.4400 [ 0.2095; 0.6242]      1.8        1.8
S7  0.1700 [-0.0642; 0.3864]      2.2        2.2
S8  0.2900 [ 0.1104; 0.4513]      3.4        3.4
S9  0.1800 [ 0.0169; 0.3337]      4.4        4.4
S10 0.2900 [ 0.1846; 0.3888]      9.6        9.6
S11 0.2000 [ 0.0696; 0.3237]      6.8        6.8
S12 0.2500 [ 0.0918; 0.3959]      4.5        4.5
S13 0.3100 [ 0.1887; 0.4220]      7.1        7.1
S14 0.2200 [ 0.0111; 0.4105]      2.7        2.7
S15 0.4000 [ 0.2148; 0.5574]      2.8        2.8
S16 0.3100 [ 0.1800; 0.4294]      6.2        6.2
S17 0.4000 [ 0.2507; 0.5307]      4.3        4.3
S18 0.3300 [ 0.2070; 0.4427]      6.8        6.8
S19 0.1600 [-0.0125; 0.3233]      4.0        4.0
S20 0.2600 [ 0.0855; 0.4190]      3.7        3.7

Number of studies combined: k = 20

                        COR            95%-CI     z  p-value
Fixed effect model   0.2809 [0.2487; 0.3124] 16.34 < 0.0001
Random effects model 0.2809 [0.2487; 0.3124] 16.34 < 0.0001

Quantifying heterogeneity:
 tau^2 = 0 [0.0000; 0.0064]; tau = 0 [0.0000; 0.0800];
 I^2 = 0.0% [0.0%; 37.5%]; H = 1.00 [1.00; 1.27]

Test of heterogeneity:
     Q d.f.  p-value
 15.84   19   0.6682

Details on meta-analytical method:
- Inverse variance method
- DerSimonian-Laird estimator for tau^2
- Jackson method for confidence interval of tau^2 and tau
- Fisher's z transformation of correlations
```

Output!

- Weight each study encompasses for both fixed & random effect models.
- Weighted average correlation for both fixed & random effects models.
- **I²**: Percentage of total variability due to *true heterogeneity across studies. [Hopefully lower than 30%]*
- **Cochran's Q**: The sum of squared deviations of ES estimates from the overall mean value. A significant value is an indicator of heterogeneity [Not good].

Forest Plot with forest()

````
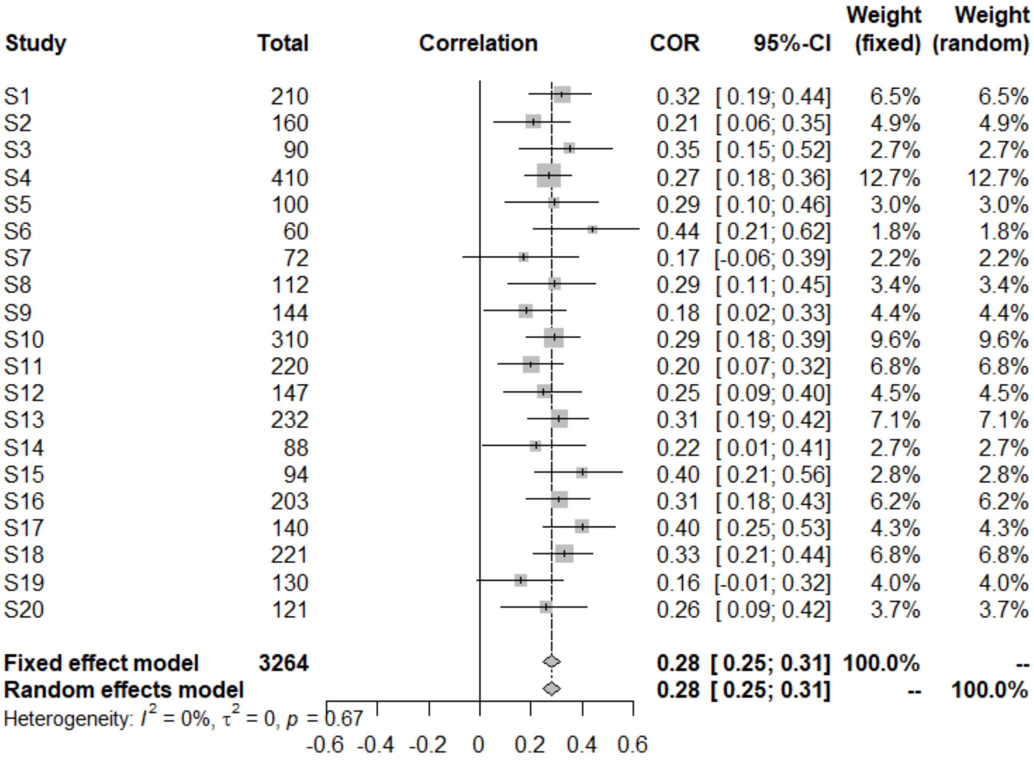
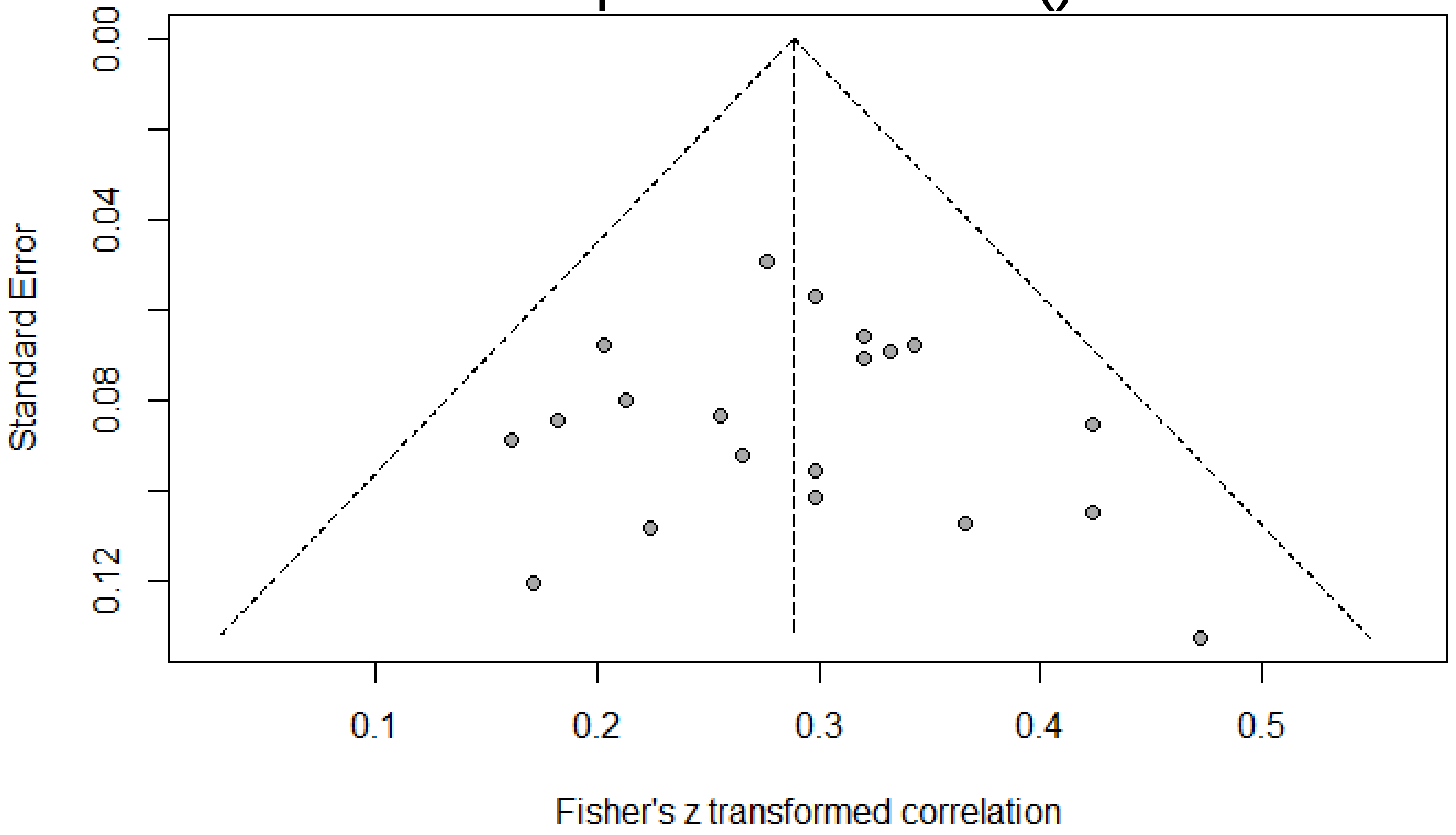
```{r, fig.height = 8}
forest(MA)
```
````

Will make the outputted figure look nicer

Forest Plot with forest()



Funnel plot with funnel()

````
```{r}
funnel(MA)
```
````

Funnel plot with funnel()



A note on the meta package

- The meta package allows you to run many more meta analyses rather than comparing correlations across studies.

- You can compare different effect sizes such as Odds ratios (metabin) or Cohen's d values (metacont) and more!

- To read more on the meta package, view the vignette here:
  - https://cran.r-project.org/web/packages/meta/meta.pdf