exercise1

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```r
# Load packages
library(metafor)
```

```
## Loading required package: Matrix

##
## Loading the 'metafor' package (version 3.0-2). For an
## introduction to the package please type: help(metafor)
```

```r
# (1) Create dataframe
study <- c('Goldham', 'Graham', 'Madison', 'Manning', 'Moyer')
t_died <- c(8, 12, 8, 80, 20)
t_total <- c(100, 100, 100, 1000, 250)
c_died <- c(14, 16, 12, 200, 24)
c_total <- c(100, 100, 100, 1000, 250)

df1 <- data.frame(study, t_died, t_total, c_died, c_total)
df1
```

```
##     study t_died t_total c_died c_total
## 1 Goldham      8     100     14     100
## 2  Graham     12     100     16     100
## 3 Madison      8     100     12     100
## 4 Manning     80    1000    200    1000
## 5   Moyer     20     250     24     250
```

```r
# (1a) Inverse-variance weighted meta-analysis on the log odds ratio (FEM)
## Calculate log-odds ratio and sampling variance
df2 <- escalc(ai=t_died, ci=c_died, n1i=t_total, n2i=c_total,
              measure = 'OR',
              data=df1,
              append=TRUE)
df2
```

```
##     study t_died t_total c_died c_total      yi     vi
## 1 Goldham      8     100     14     100 -0.6271 0.2189
## 2  Graham     12     100     16     100 -0.3342 0.1691
## 3 Madison      8     100     12     100 -0.4499 0.2306
## 4 Manning     80    1000    200    1000 -1.0561 0.0198
## 5   Moyer     20     250     24     250 -0.1999 0.1004
```

```r
## FEM
## Weighted estimation (with inverse-variance weights) is used by default
FEM <- rma(yi=yi, vi=vi, data=df2, method="FE")
summary(FEM)
```

```
##
## Fixed-Effects Model (k = 5)
##
##   logLik  deviance       AIC       BIC      AICc
##  -3.5016    8.7957    9.0032    8.6126   10.3365
##
## I^2 (total heterogeneity / total variability):   54.52%
## H^2 (total variability / sampling variability):  2.20
##
## Test for Heterogeneity:
## Q(df = 4) = 8.7957, p-val = 0.0664
##
## Model Results:
##
## estimate      se     zval    pval    ci.lb    ci.ub
##  -0.8249  0.1153  -7.1524  <.0001  -1.0509  -0.5988  ***
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
# (1b) What would you conclude about the mean effect size?
## The mean log-odds is about -0.82 meaning that the log-odds of
## dying in treatment condition are lower than in the control
## The result is statistically significant

# (1c) Is there evidence for study heterogeneity?
## The Q statistics is not significant at 5% alpha level (p=.07)
## so we cannot reject the null hypothesis of homogeneity
## However, Q-statistics and stat. power:
## we cannot conclude that there is actually homogeneity.
```

```r
# (1d) Remove Manning study

df3 <-df2[-4,]
FEM3 <- rma(yi=df3$yi, vi=df3$vi, data=df3, method="FE")
summary(FEM3)
```

```
##
## Fixed-Effects Model (k = 4)
##
##   logLik  deviance       AIC       BIC      AICc
##  -0.4546    0.6193    2.9091    2.2954    4.9091
##
## I^2 (total heterogeneity / total variability):   0.00%
## H^2 (total variability / sampling variability):  0.21
##
## Test for Heterogeneity:
## Q(df = 3) = 0.6193, p-val = 0.8920
##
## Model Results:
##
## estimate      se     zval    pval    ci.lb   ci.ub
##  -0.3545  0.2009  -1.7643  0.0777  -0.7482  0.0393  .
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
summary(FEM)
```

```
##
## Fixed-Effects Model (k = 5)
##
##   logLik  deviance       AIC       BIC      AICc
##  -3.5016    8.7957    9.0032    8.6126   10.3365
##
## I^2 (total heterogeneity / total variability):   54.52%
## H^2 (total variability / sampling variability):  2.20
##
## Test for Heterogeneity:
## Q(df = 4) = 8.7957, p-val = 0.0664
##
## Model Results:
##
## estimate      se     zval    pval    ci.lb    ci.ub
##  -0.8249  0.1153  -7.1524  <.0001  -1.0509  -0.5988  ***
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
## I^2 moves from ~ 55% to 0%
## Test for homogeneity moves from p-value of 0.07 to 0.89
## Mean-estimate moves from -0.82 to -0.35: substantial decrease
## Mean-estimate is not significant anymore
## Indeed standard error is larger and the effect is not significant
## at 5% alpha level
```

```r
# Prof. way to remove study and compare
leave1out(FEM)
```

```
##
##   estimate     se    zval   pval   ci.lb   ci.ub      Q     Qp      I2     H2
## 1  -0.8377 0.1190 -7.0393 0.0000 -1.0709 -0.6044 8.6054 0.0350 65.1381 2.8685
## 2  -0.8668 0.1201 -7.2140 0.0000 -1.1022 -0.6313 7.2504 0.0643 58.6230 2.4168
## 3  -0.8478 0.1188 -7.1363 0.0000 -1.0807 -0.6150 8.1486 0.0430 63.1838 2.7162
## 4  -0.3545 0.2009 -1.7643 0.0777 -0.7482  0.0393 0.6193 0.8920  0.0000 0.2064
## 5  -0.9203 0.1238 -7.4325 0.0000 -1.1629 -0.6776 4.3128 0.2296 30.4400 1.4376
```

```r
# MY PROGRAMMING EXERCISES
# (2a) Inverse-variance weighted meta-analysis on the log odds ratio (FEM)
## Build function that returns a vector with the log odds
log_odds_ratio = function(v) {
  num <- v[1]*(v[4]-v[3])
  den <- v[3]*(v[2]-v[1])
  or <- (num)/(den)
  log_or <- log(or)
}
## Apply to all dataset
df1_log_or <- apply(df1[,2:5], 1, log_odds_ratio)

## Create new column in dataframe with log-odds-ratio
df1$log_or <- df1_log_or
df1
```

```
##     study t_died t_total c_died c_total     log_or
## 1 Goldham      8     100     14     100 -0.6270571
## 2  Graham     12     100     16     100 -0.3342021
## 3 Madison      8     100     12     100 -0.4499169
## 4 Manning     80    1000    200    1000 -1.0560527
## 5   Moyer     20     250     24     250 -0.1998659
```