dbtstmetaanalysis

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January 15, 2018

The following random-effects meta analysis will follow steps provided from A. C. Del Re's (2015) article: "A Practicial Tutorial on Conducting Meta-Analysis in R" to compute Hedge's g effect sizes of Dialetical Behavior Therapy Skills Trainning outcomes. However, unlike A. C. Rel Re's tutorial, moderators were not used in the analysis

Citation: Del Re, A. C. (2015). A practical tutorial on conducting meta-analysis in R. The Quantitative Methods for Psychology, 11(1), 37-50.

Load packages

```
#install.packages("metafor")
library("metafor")
```

```
## Loading required package: Matrix
```

```
## Loading 'metafor' package (version 2.0-0). For an overview
## and introduction to the package please type: help(metafor).
```

```
#install.packages("compute.es")
library("compute.es")
```

```
#install.packages("MAd")
library("MAd")
```

```
#install.packages("readxl")
library("readxl")
```

Eating Outcomes

Load eating data

```
# study id, author, year, outcome, test, treatment mean, treatment standard deviation, treatment n, con
dbtst_eating_raw <- read_excel("larson(eating_raw_ma).xlsx")
View(dbtst_eating_raw)

# study id, author, year, outcome, test, treatment n, control n, hedge's g, variance of hedge's g, p-va
```

```
dbtst_eating_es <- read_excel("larson(eating_es_ma).xlsx")
View(dbtst_eating_es)
```

Calculate effect sizes of eating data

```
res2 <- mes(m.1 = m1T, m.2 = m1C, sd.1 = sd1T, sd.2 = sd1C, n.1 = nT, n.2 = nC, id = id, data = dbtst_ea
```

```
# View data
res2
```

```
##    id N.total n.1 n.2     d var.d   l.d   u.d  U3.d  cl.d cliffs.d pval.d
## 1  15      86  43  43 -0.54  0.05 -0.98 -0.11 29.31 35.02    -0.30   0.02
## 2  15      86  43  43 -0.38  0.05 -0.81  0.05 35.26 39.45    -0.21   0.09
## 3  15      86  43  43 -0.33  0.05 -0.76  0.10 37.19 40.86    -0.18   0.14
## 4  15      86  43  43 -0.54  0.05 -0.98 -0.11 29.33 35.03    -0.30   0.02
## 5  15      86  43  43 -0.18  0.05 -0.60  0.25 43.05 45.07    -0.10   0.42
## 6  15      86  43  43 -0.18  0.05 -0.61  0.25 42.79 44.89    -0.10   0.40
## 7  15      29  14  15 -0.94  0.15 -1.74 -0.13 17.42 25.37    -0.49   0.02
## 8  10      29  14  15 -0.82  0.15 -1.62 -0.03 20.50 28.01    -0.44   0.04
## 9  10      29  14  15 -0.58  0.14 -1.36  0.20 27.99 34.01    -0.32   0.14
## 10 11      34  18  16 -1.24  0.14 -2.01 -0.48 10.72 19.00    -0.62   0.00
## 11 11      34  18  16 -1.04  0.13 -1.79 -0.30 14.84 23.03    -0.54   0.01
## 12 11      34  18  16 -0.33  0.12 -1.04  0.37 37.03 40.75    -0.19   0.35
## 13 11      34  18  16 -0.95  0.13 -1.69 -0.21 17.13 25.11    -0.50   0.01
## 14 11      34  18  16 -0.84  0.13 -1.57 -0.11 19.94 27.54    -0.45   0.02
## 15 11      34  18  16 -1.47  0.15 -2.26 -0.68  7.12 14.98    -0.70   0.00
## 16 11      34  18  16 -0.35  0.12 -1.05  0.36 36.40 40.29    -0.19   0.32
## 17 11      34  18  16 -1.40  0.15 -2.19 -0.62  8.01 16.04    -0.68   0.00
## 18 11      34  18  16 -0.84  0.13 -1.57 -0.11 20.10 27.67    -0.45   0.03
## 19 11      34  18  16 -0.95  0.13 -1.69 -0.21 17.13 25.11    -0.50   0.01
## 20 11      34  18  16 -0.66  0.12 -1.38  0.06 25.52 32.08    -0.36   0.07
## 21 16     101  41  60 -0.54  0.04 -0.95 -0.13 29.43 35.11    -0.30   0.01
## 22 16     101  41  60 -0.34  0.04 -0.75  0.06 36.60 40.43    -0.19   0.10
## 23 16     101  41  60 -0.42  0.04 -0.83 -0.01 33.69 38.30    -0.23   0.04
## 24 16     101  41  60 -0.74  0.04 -1.15 -0.32 23.09 30.14    -0.40   0.00
## 25 16     101  41  60 -0.65  0.04 -1.06 -0.24 25.72 32.24    -0.36   0.00
## 26 16     101  41  60  0.26  0.04 -0.15  0.66 60.16 57.23     0.14   0.21
## 27 16     101  41  60 -0.74  0.04 -1.15 -0.32 23.11 30.16    -0.40   0.00
## 28 16     101  41  60 -0.62  0.04 -1.04 -0.21 26.60 32.93    -0.34   0.00
## 29 16     101  41  60 -0.06  0.04 -0.46  0.34 47.62 48.31    -0.03   0.77
## 30 16     101  41  60 -0.08  0.04 -0.49  0.32 46.62 47.61    -0.05   0.68
##        g var.g   l.g   u.g  U3.g  cl.g pval.g     r var.r   l.r   u.r
## 1  -0.54  0.05 -0.97 -0.11 29.48 35.14   0.02 -0.26  0.01 -0.45 -0.05
## 2  -0.38  0.05 -0.80  0.05 35.38 39.54   0.09 -0.19  0.01 -0.39  0.03
## 3  -0.32  0.05 -0.75  0.10 37.30 40.94   0.14 -0.16  0.01 -0.36  0.06
## 4  -0.54  0.05 -0.97 -0.11 29.50 35.16   0.02 -0.26  0.01 -0.45 -0.05
## 5  -0.17  0.05 -0.60  0.25 43.11 45.12   0.42 -0.09  0.01 -0.30  0.13
## 6  -0.18  0.05 -0.61  0.25 42.85 44.93   0.40 -0.09  0.01 -0.30  0.13
## 7  -0.91  0.14 -1.69 -0.13 18.11 25.97   0.02 -0.42  0.02 -0.69 -0.05
## 8  -0.80  0.14 -1.57 -0.03 21.16 28.56   0.04 -0.38  0.02 -0.67  0.00
## 9  -0.57  0.14 -1.32  0.19 28.55 34.43   0.14 -0.28  0.03 -0.60  0.11
## 10 -1.21  0.13 -1.96 -0.47 11.27 19.57   0.00 -0.53  0.01 -0.74 -0.22
```

2

```
## 11 -1.02  0.13 -1.75 -0.29 15.42 23.57   0.01 -0.46  0.02 -0.70 -0.13
## 12 -0.32  0.11 -1.01  0.36 37.33 40.96   0.35 -0.16  0.03 -0.49  0.20
## 13 -0.93  0.13 -1.65 -0.21 17.70 25.61   0.01 -0.43  0.02 -0.68 -0.09
## 14 -0.82  0.12 -1.54 -0.11 20.50 28.01   0.02 -0.39  0.02 -0.65 -0.04
## 15 -1.43  0.14 -2.20 -0.66  7.60 15.56   0.00 -0.59  0.01 -0.78 -0.30
## 16 -0.34  0.11 -1.03  0.35 36.71 40.51   0.32 -0.17  0.03 -0.49  0.19
## 17 -1.37  0.14 -2.13 -0.61  8.52 16.61   0.00 -0.57  0.01 -0.77 -0.28
## 18 -0.82  0.12 -1.53 -0.11 20.66 28.14   0.03 -0.39  0.02 -0.65 -0.04
## 19 -0.93  0.13 -1.65 -0.21 17.70 25.61   0.01 -0.43  0.02 -0.68 -0.09
## 20 -0.64  0.12 -1.34  0.06 26.03 32.48   0.07 -0.31  0.02 -0.60  0.04
## 21 -0.54  0.04 -0.94 -0.13 29.57 35.21   0.01 -0.26  0.01 -0.43 -0.06
## 22 -0.34  0.04 -0.74  0.06 36.70 40.50   0.10 -0.17  0.01 -0.35  0.03
## 23 -0.42  0.04 -0.82 -0.01 33.81 38.39   0.04 -0.20  0.01 -0.38  0.00
## 24 -0.73  0.04 -1.14 -0.32 23.26 30.28   0.00 -0.34  0.01 -0.50 -0.15
## 25 -0.65  0.04 -1.06 -0.24 25.88 32.36   0.00 -0.30  0.01 -0.47 -0.11
## 26  0.26  0.04 -0.14  0.66 60.09 57.17   0.21  0.13  0.01 -0.07  0.32
## 27 -0.73  0.04 -1.14 -0.32 23.28 30.29   0.00 -0.34  0.01 -0.50 -0.15
## 28 -0.62  0.04 -1.03 -0.21 26.76 33.05   0.00 -0.29  0.01 -0.46 -0.10
## 29 -0.06  0.04 -0.46  0.34 47.63 48.33   0.77 -0.03  0.01 -0.23  0.17
## 30 -0.08  0.04 -0.48  0.32 46.65 47.63   0.68 -0.04  0.01 -0.24  0.16
##    pval.r fisher.z var.z   l.z   u.z   OR l.or u.or pval.or   lOR l.lor
## 1    0.02    -0.27  0.01 -0.49 -0.05 0.37 0.17 0.82    0.02 -0.99 -1.78
## 2    0.09    -0.19  0.01 -0.41  0.03 0.50 0.23 1.10    0.09 -0.69 -1.47
## 3    0.14    -0.16  0.01 -0.38  0.06 0.55 0.25 1.21    0.14 -0.59 -1.38
## 4    0.02    -0.27  0.01 -0.49 -0.05 0.37 0.17 0.82    0.02 -0.99 -1.78
## 5    0.43    -0.09  0.01 -0.31  0.13 0.73 0.33 1.59    0.42 -0.32 -1.10
## 6    0.41    -0.09  0.01 -0.31  0.13 0.72 0.33 1.57    0.40 -0.33 -1.11
## 7    0.03    -0.45  0.04 -0.86 -0.05 0.18 0.04 0.78    0.02 -1.70 -3.16
## 8    0.05    -0.40  0.04 -0.80  0.00 0.22 0.05 0.95    0.04 -1.49 -2.93
## 9    0.15    -0.29  0.04 -0.69  0.12 0.35 0.08 1.43    0.14 -1.06 -2.47
## 10   0.00    -0.59  0.03 -0.95 -0.22 0.11 0.03 0.42    0.00 -2.25 -3.64
## 11   0.01    -0.50  0.03 -0.87 -0.13 0.15 0.04 0.58    0.01 -1.89 -3.25
## 12   0.37    -0.16  0.03 -0.53  0.20 0.55 0.15 1.97    0.35 -0.60 -1.88
## 13   0.02    -0.46  0.03 -0.82 -0.09 0.18 0.05 0.68    0.01 -1.72 -3.06
## 14   0.03    -0.41  0.03 -0.78 -0.04 0.22 0.06 0.81    0.02 -1.53 -2.85
## 15   0.00    -0.68  0.03 -1.04 -0.31 0.07 0.02 0.29    0.00 -2.66 -4.09
## 16   0.34    -0.17  0.03 -0.54  0.19 0.53 0.15 1.91    0.32 -0.63 -1.91
## 17   0.00    -0.65  0.03 -1.02 -0.29 0.08 0.02 0.32    0.00 -2.55 -3.96
## 18   0.03    -0.41  0.03 -0.77 -0.04 0.22 0.06 0.82    0.03 -1.52 -2.84
## 19   0.02    -0.46  0.03 -0.82 -0.09 0.18 0.05 0.68    0.01 -1.72 -3.06
## 20   0.08    -0.32  0.03 -0.69  0.04 0.30 0.08 1.12    0.07 -1.19 -2.50
## 21   0.01    -0.26  0.01 -0.46 -0.06 0.37 0.18 0.79    0.01 -0.98 -1.72
## 22   0.10    -0.17  0.01 -0.37  0.03 0.54 0.26 1.12    0.10 -0.62 -1.36
## 23   0.04    -0.21  0.01 -0.41  0.00 0.47 0.22 0.97    0.04 -0.76 -1.50
## 24   0.00    -0.35  0.01 -0.55 -0.15 0.26 0.12 0.56    0.00 -1.33 -2.09
## 25   0.00    -0.31  0.01 -0.52 -0.11 0.31 0.15 0.65    0.00 -1.18 -1.93
## 26   0.21     0.13  0.01 -0.07  0.33 1.60 0.77 3.32    0.21  0.47 -0.26
## 27   0.00    -0.35  0.01 -0.55 -0.15 0.26 0.12 0.56    0.00 -1.33 -2.09
## 28   0.00    -0.30  0.01 -0.50 -0.10 0.32 0.15 0.68    0.00 -1.13 -1.88
## 29   0.77    -0.03  0.01 -0.23  0.17 0.90 0.43 1.86    0.77 -0.11 -0.84
## 30   0.68    -0.04  0.01 -0.24  0.16 0.86 0.41 1.78    0.68 -0.15 -0.88
##    u.lor pval.lor lOR.1 l.lor.1 u.lor.1 pval.lor.1    NNT
## 1  -0.20     0.02 -0.99   -1.78   -0.20       0.02  -8.54
## 2   0.10     0.09 -0.69   -1.47    0.10       0.09 -11.26
```

```
## 3   0.19    0.14 -0.59  -1.38   0.19    0.14 -12.70
## 4  -0.19    0.02 -0.99  -1.78  -0.19    0.02  -8.55
## 5   0.46    0.42 -0.32  -1.10   0.46    0.42 -22.05
## 6   0.45    0.40 -0.33  -1.11   0.45    0.40 -21.31
## 7  -0.24    0.02 -1.70  -3.16  -0.24    0.02  -6.16
## 8  -0.05    0.04 -1.49  -2.93  -0.05    0.04  -6.57
## 9   0.35    0.14 -1.06  -2.47   0.35    0.14  -8.14
## 10 -0.87    0.00 -2.25  -3.64  -0.87    0.00  -5.51
## 11 -0.54    0.01 -1.89  -3.25  -0.54    0.01  -5.87
## 12  0.68    0.35 -0.60  -1.88   0.68    0.35 -12.57
## 13 -0.38    0.01 -1.72  -3.06  -0.38    0.01  -6.12
## 14 -0.21    0.02 -1.53  -2.85  -0.21    0.02  -6.49
## 15 -1.23    0.00 -2.66  -4.09  -1.23    0.00  -5.28
## 16  0.65    0.32 -0.63  -1.91   0.65    0.32 -12.07
## 17 -1.13    0.00 -2.55  -3.96  -1.13    0.00  -5.33
## 18 -0.20    0.03 -1.52  -2.84  -0.20    0.03  -6.51
## 19 -0.38    0.01 -1.72  -3.06  -0.38    0.01  -6.12
## 20  0.11    0.07 -1.19  -2.50   0.11    0.07  -7.51
## 21 -0.24    0.01 -0.98  -1.72  -0.24    0.01  -8.58
## 22  0.11    0.10 -0.62  -1.36   0.11    0.10 -12.22
## 23 -0.03    0.04 -0.76  -1.50  -0.03    0.04 -10.35
## 24 -0.58    0.00 -1.33  -2.09  -0.58    0.00  -7.01
## 25 -0.43    0.00 -1.18  -1.93  -0.43    0.00  -7.55
## 26  1.20    0.21  0.47  -0.26   1.20    0.21  12.56
## 27 -0.58    0.00 -1.33  -2.09  -0.58    0.00  -7.01
## 28 -0.39    0.00 -1.13  -1.88  -0.39    0.00  -7.77
## 29  0.62    0.77 -0.11  -0.84   0.62    0.77 -61.27
## 30  0.58    0.68 -0.15  -0.88   0.58    0.68 -43.69
```

Aggregate dependent effect sizes of eating data

```r
# When studies report multiple outcome measures, aggregating them prior to analysis is necessary so to

dbtst_eating_agg <- agg(id = id, es = g, var = var.g, n.1 = nT, n.2 = nC, cor = 0.5, method = "BHHR", da

# View aggregated data
dbtst_eating_agg
```

```
##   id         es        var
## 1 15 -0.4342857 0.03453053
## 2 10 -0.6850000 0.10500000
## 3 11 -0.8936364 0.06833176
## 4 16 -0.3910000 0.02200000
```

Estimate summary effect by random-effects omnibus test of eating data

```r
# A summary effect is a weighted average of the individual study effect size, where each study is weigh
```

```r
# Random-effect omnibus test
m1 <- mareg(es ~ 1, var = var, method = "REML",data = dbtst_eating_agg)

# View summary effect
summary(m1)
```

```
##
##  Model Results:
##
##          estimate      se      z   ci.l   ci.u p
## intrcpt    -0.509   0.102 -4.976 -0.709 -0.308 0
##
##  Heterogeneity & Fit:
##
##            QE  QE.df    QEp     QM  QM.df QMp
## [1,]    3.254  3.000  0.354 24.765  1.000   0
```

```r
# Positive or negative effect size depends on which sample means were labeled 1 and 2. If M1 is bigger
```

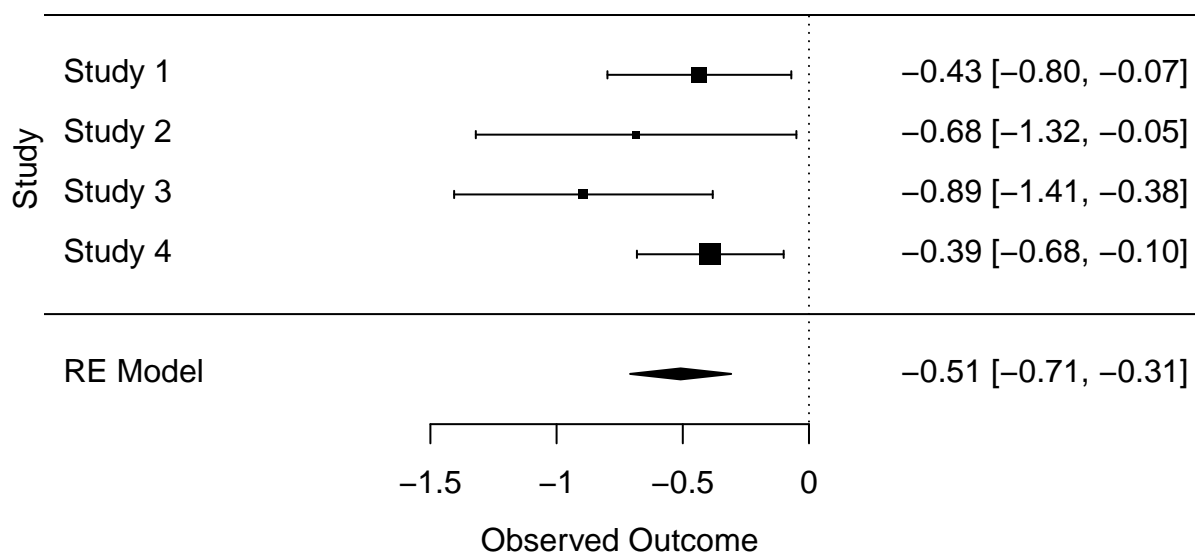## Forest plot of all outcomes of eating data

```r
# The effect sizes and heterogeneity estimates can be seen visually with a forest plot

forest(m1)
title(main="Eating Outcomes", ylab="Study")
```

Eating Outcomes

Study 1   −0.43 [−0.80, −0.07]

Study 2   −0.68 [−1.32, −0.05]

Study 3   −0.89 [−1.41, −0.38]

Study 4   −0.39 [−0.68, −0.10]

RE Model   −0.51 [−0.71, −0.31]

Evaluate heterogeneity of summary effect of eating data

```
# Heterogeneity is the measure of variability of effect sizes between different studies. A considerable

confint(m1, digits=2)
```

```
##
##         estimate ci.lb ci.ub
## tau^2       0.00  0.00  0.71
## tau         0.03  0.00  0.84
## I^2(%)      1.96  0.00 93.99
## H^2         1.02  1.00 16.64
```

Funnel plot of all outcomes of eating data

```
# A common way to investigate potential publication bias in a meta-analysis is the funnel plot, asymmet

funnel(m1)
```