Analysis

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Importing the libraries

```
##
## Attaching package: 'dplyr'

## The following objects are masked from 'package:stats':
##
##     filter, lag

## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union

## Loading required package: Matrix

## Loading required package: metadat

## Loading required package: numDeriv

##
## Loading the 'metafor' package (version 4.4-0). For an
## introduction to the package please type: help(metafor)
```

Reading and Cleaning the dataframe

```
## New names:
## * `` -> `...4`
## * `` -> `...11`
## * `` -> `...20`
## * `` -> `...25`
## * `` -> `...26`
## * `` -> `...34`
## * `` -> `...36`

##  [1] "Authors"
##  [2] "Year of publication"
##  [3] "Origin Country of study"
##  [4] "Total sample size"
##  [5] "Sample size included"
##  [6] "Sex (%female)"
##  [7] "Ethnic background (% white)"
##  [8] "age range"
##  [9] "mean age"
## [10] "Task design (Correlational/Group comparisons/Experimental)"
## [11] "Task"
## [12] "Manipulation"
```

```
## [13] "Trait or phase (state)"
## [14] "Clinical sample"
## [15] "Control Group (yes/no)"
## [16] "Social anxiety measure trait"
## [17] "Social anxiety measure state"
## [18] "Metacognition trait or state"
## [19] "Metacognition measure"
## [20] "Dimensions used (if looked at different dimension make separate rows for each dimension)"
## [21] "Number of items"
## [22] "Statistical anlysis"
## [23] "Relationship between social anxiety and metacognition"
## [24] "d or R"
## [25] "effect size"
## [26] "V"
## [27] "95% CI"
## [28] "Major finding"
## [29] "Risk of bias (selection bias, attrition bias, detection bias and reporting bias)"
```

Select only the columns you're interested in:

Change the names of the columns:

```
## [1] "Authors"                          "Sample_size_included"
## [3] "Sex_(%female)"                    "Ethnic_background_(%_white)"
## [5] "age_range"                        "d_or_R"
## [7] "effect_size"                      "V"
## [9] "95%_CI"
```

Select only the effect size available (r or d)

Remove all the rows that present a NA value inside the variance variable

Convert the percentages into prevalence value between 0 and 1:

For the varibles ethnic and female, convert some variables from "-" to NA and then convert all the percentages variables

Checking if Sex is numeric:

```
## [1] TRUE
```

Converting the wrong value of effect size (we can see that the correct has the point from the confidence interval)

```
## [1] "1177"
```

```
## [1] "1.177"
```

```
## tibble [43 x 10] (S3: tbl_df/tbl/data.frame)
##  $ Authors                    : chr [1:43] "Yu, Meng and Lv, Fangyan and Liu, Zicheng and Gao, Dinggu
##  $ Sample_size_included       : num [1:43] 357 33 40 169 169 169 169 169 169 62 ...
##  $ Sex_(%female)              : num [1:43] 0.75 0.558 0.575 0.787 0.787 0.787 0.787 0.787 0.787 0.70
##  $ Ethnic_background_(%_white): num [1:43] 0 0 0.9 NA NA NA NA NA NA NA ...
##  $ age_range                  : chr [1:43] "11 till 17" "13 - 19" "-" "18 - 24 (most people 111) but
##  $ d_or_R                     : Factor w/ 2 levels "d","r": 2 1 1 2 2 2 2 2 2 2 ...
##  $ effect_size                : num [1:43] 0.19 5.22 -0.119 0.587 0.333 0.54 0.338 0.229 0.349 0.52
##  $ V                          : num [1:43] 0.004 0.53 0.1 0.006 0.006 0.006 0.006 0.006 0.006 0.017
##  $ 95%_CI                     : chr [1:43] "[0,0694, 0,315]" "[3.791, 6.658]" "[-0,738,  0,502]" "[0
##  $ std                        : num [1:43] 0.0632 0.728 0.3162 0.0775 0.0775 ...
```

handling the CI

Convert the CI that present 3 commas (error) into only 1 (the second)

```
##  [1] "[0.0694, 0.315]"  "[3.791, 6.658]"   "[-0.738,  0.502]" "[0.478, 0.678]"
##  [5] "[0.192, 0.461]"   "[0.424, 0.639]"   "[0.197, 0.465]"   "[0.080, 0.367]"
##  [9] "[0.209, 0.475]"   "[0.311, 0.681]"   "[0.018, 0.206]"   "[0.413, 0.662]"
## [13] "[0.308, 0.589]"   "[0.449, 0.687]"   "[0.141, 0.462]"   "[0.285, 0.572]"
## [17] "[0.024, 0.364]"   "[-0.070, 0.290]"  "[0.097, 0.427]"   "[0.332, 0.517]"
## [21] "[0.375, 0.552]"   "[-0.888, -0.105]" "[-0.581, 0.567]"  "[-1.395, -0.088]"
## [25] "[-0.797, 0.214]"  "[-0.439, 0.813]"  "[-0.262, 0.988]"  "[-0.524, 0.717]"
## [29] "[-0.362, 0.882]"  "[0.505, 1.848]"   "[-0.107, 0.247]"  "[0.203, 0.362]"
## [33] "[-0.107, 0.248]"  "[0.057, 0.412]"   "[-0.259, 0.385]"  "[0.471, 1.142]"
## [37] "[-0.147, 0.499]"  "[-0.105, 0.985]"  "[2.978, 4.681]"   "[0.369, 0.487]"
## [41] "[0.782, 0.936]"   "[0.048, 0.275]"   "[0.373, 0.622]"
```

Define a function to separate the two values of the confidence interval:

```
##    lower_CI upper_CI
## 1    0.0694    0.315
## 2    3.7910    6.658
## 3   -0.7380    0.502
## 4    0.4780    0.678
## 5    0.1920    0.461
## 6    0.4240    0.639
## 7    0.1970    0.465
## 8    0.0800    0.367
## 9    0.2090    0.475
## 10   0.3110    0.681
## 11   0.0180    0.206
## 12   0.4130    0.662
## 13   0.3080    0.589
## 14   0.4490    0.687
## 15   0.1410    0.462
## 16   0.2850    0.572
## 17   0.0240    0.364
## 18  -0.0700    0.290
## 19   0.0970    0.427
## 20   0.3320    0.517
## 21   0.3750    0.552
## 22  -0.8880   -0.105
## 23  -0.5810    0.567
## 24  -1.3950   -0.088
## 25  -0.7970    0.214
## 26  -0.4390    0.813
## 27  -0.2620    0.988
## 28  -0.5240    0.717
## 29  -0.3620    0.882
## 30   0.5050    1.848
## 31  -0.1070    0.247
## 32   0.2030    0.362
## 33  -0.1070    0.248
## 34   0.0570    0.412
## 35  -0.2590    0.385
## 36   0.4710    1.142
## 37  -0.1470    0.499
```

```
## 38  -0.1050    0.985
## 39   2.9780    4.681
## 40   0.3690    0.487
## 41   0.7820    0.936
## 42   0.0480    0.275
## 43   0.3730    0.622
```

Using the formula for calculating the SE from the CI, but

Using the formula for calculating the SE from the CI for both lower and upper values:

```
##  [1]  0.06153174  0.72909503  0.31582213  0.05561327  0.07194010  0.05918476
##  [7]  0.07194010  0.07602181  0.07142988  0.10663461  0.04847028  0.06989924
## [13]  0.07755245  0.06683796  0.08622607  0.07908309  0.08979757  0.09183842
## [19]  0.08826693  0.04949071  0.04744985  0.12653294  0.29133188  0.39031329
## [25]  0.19745261  0.32143448  0.31888341  0.31327106  0.31735277  0.34286344
## [31]  0.09030778 -0.00153064  0.09030778  0.08826693  0.16275809  0.16786023
## [37]  0.16173767  0.27806633  0.43470187  0.03112302  0.05000092  0.05714391
## [43]  0.04438857
```

```
##  [1] 0.06377668 0.73368695 0.31684256 0.04642942 0.06530732 0.05051113
##  [7] 0.06479711 0.07040946 0.06428690 0.08214437 0.04744985 0.05714391
## [13] 0.06581754 0.05459284 0.07755245 0.06734818 0.08367501 0.09183842
## [19] 0.08010351 0.04489878 0.04285793 0.27296420 0.29439316 0.27653569
## [25] 0.31837320 0.31735277 0.31888341 0.31990384 0.31735277 0.34235323
## [31] 0.09030778 0.08265458 0.09081800 0.09285885 0.16581937 0.17449300
## [37] 0.16786023 0.27806633 0.43419165 0.02908217 0.02857195 0.05867455
## [43] 0.08265458
```

Comparing it to the standard deviation of the estimate is identicale: therefore you used the sd for calculating the CI, but this is indeed wrong!

```
##  [1] 0.06324555 0.72801099 0.31622777 0.07745967 0.07745967 0.07745967
##  [7] 0.07745967 0.07745967 0.07745967 0.13038405 0.04472136 0.08944272
## [13] 0.08944272 0.08944272 0.08944272 0.08944272 0.08944272 0.08944272
## [19] 0.08944272 0.05477226 0.05477226 0.33316662 0.33316662 0.33316662
## [25] 0.33316662 0.31780497 0.31937439 0.31622777 0.31780497 0.34205263
## [31] 0.08944272 0.08944272 0.08944272 0.08944272 0.16431677 0.17029386
## [37] 0.16431677 0.27748874 0.43474130 0.03162278 0.16733201 0.05477226
## [43] 0.06324555
```

You need to use the SE = sqrt(sd/n)

Rewriting the CI correctly!

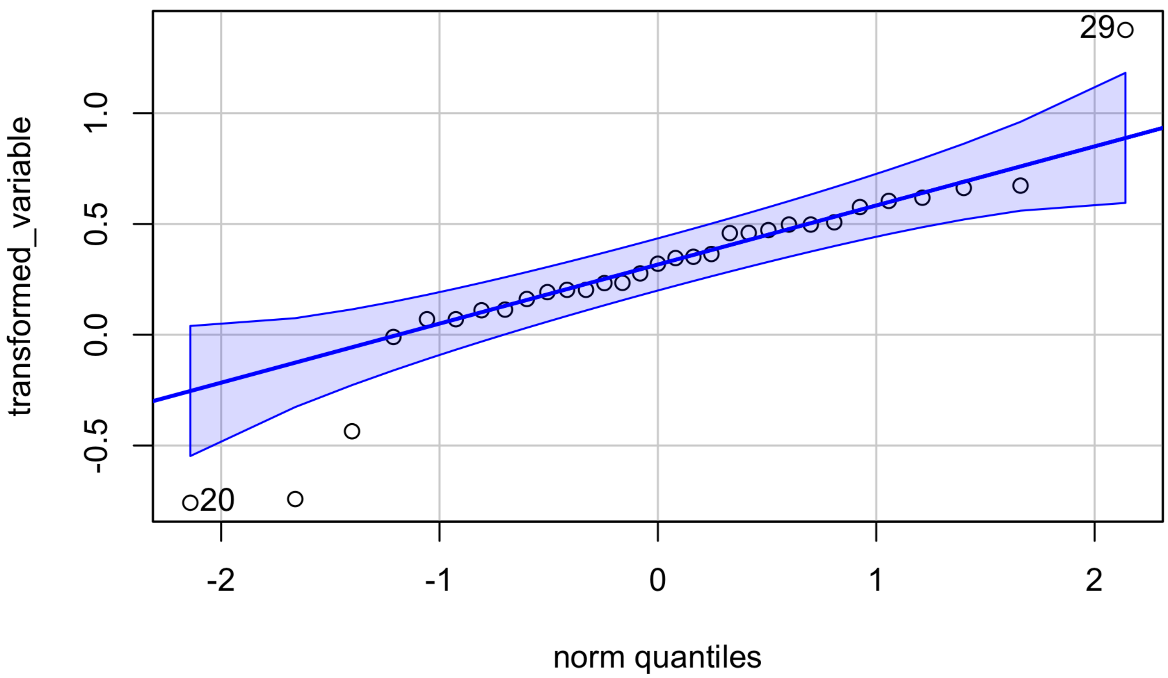
```
##  [1] "Authors"                       "Sample_size_included"
##  [3] "Sex_(%female)"                 "Ethnic_background_(%_white)"
##  [5] "age_range"                     "d_or_R"
##  [7] "effect_size"                   "V"
##  [9] "95%_CI"                        "std"
## [11] "lower_CI"                      "upper_CI"
## [13] "SE"
```

Considering only the r

Selecting some columns and renaming some of them:

Meta-Analysis for the r-correlation

```
## [1] "Smith, et al."   "Doe, et al."     "Johnson, et al."
```




```
## [1] 29 20
```

Notice that there are 4 outliers!

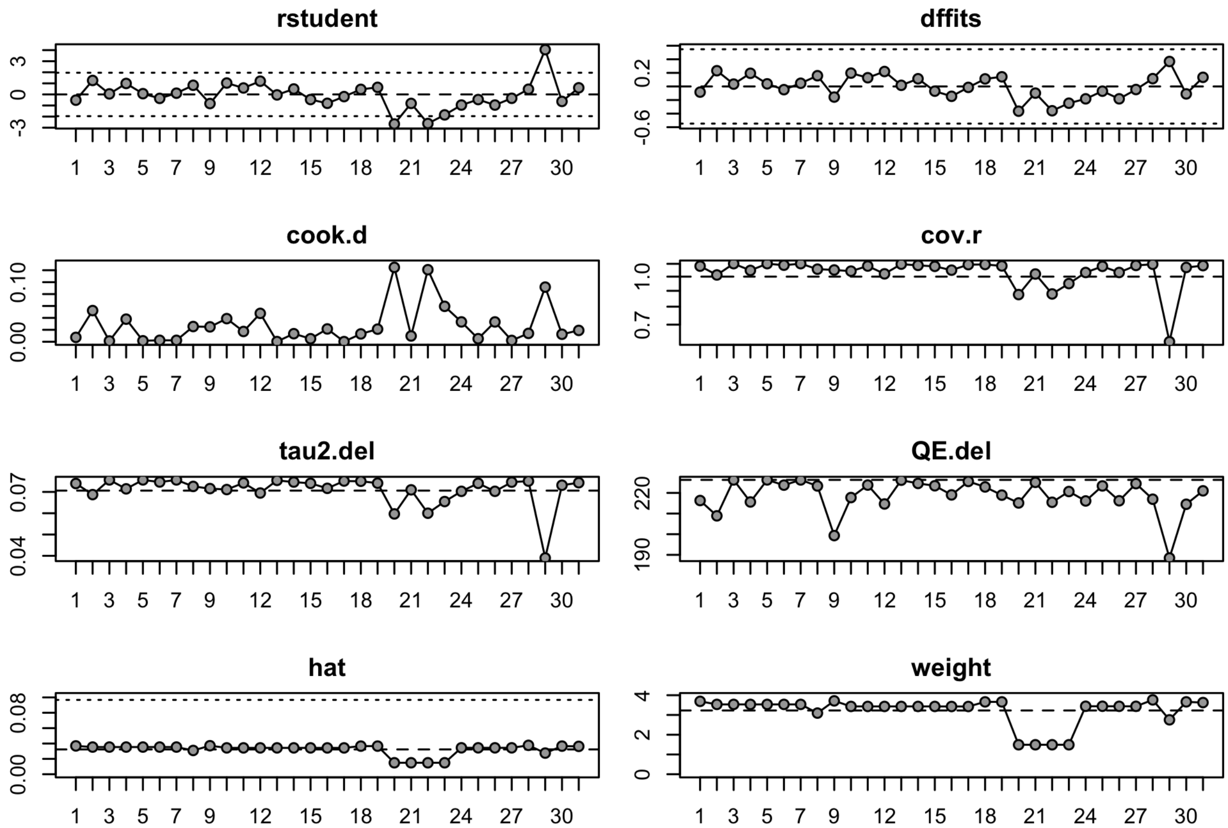
```
##
## Random-Effects Model (k = 31; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.0706 (SE = 0.0212)
## tau (square root of estimated tau^2 value):      0.2657
## I^2 (total heterogeneity / total variability):   92.07%
## H^2 (total variability / sampling variability):  12.61
##
## Test for Heterogeneity:
## Q(df = 30) = 226.2882, p-val < .0001
##
## Model Results:
##
## estimate      se    zval    pval   ci.lb   ci.ub
##   0.3339  0.0520  6.4152  <.0001  0.2319  0.4359  ***
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

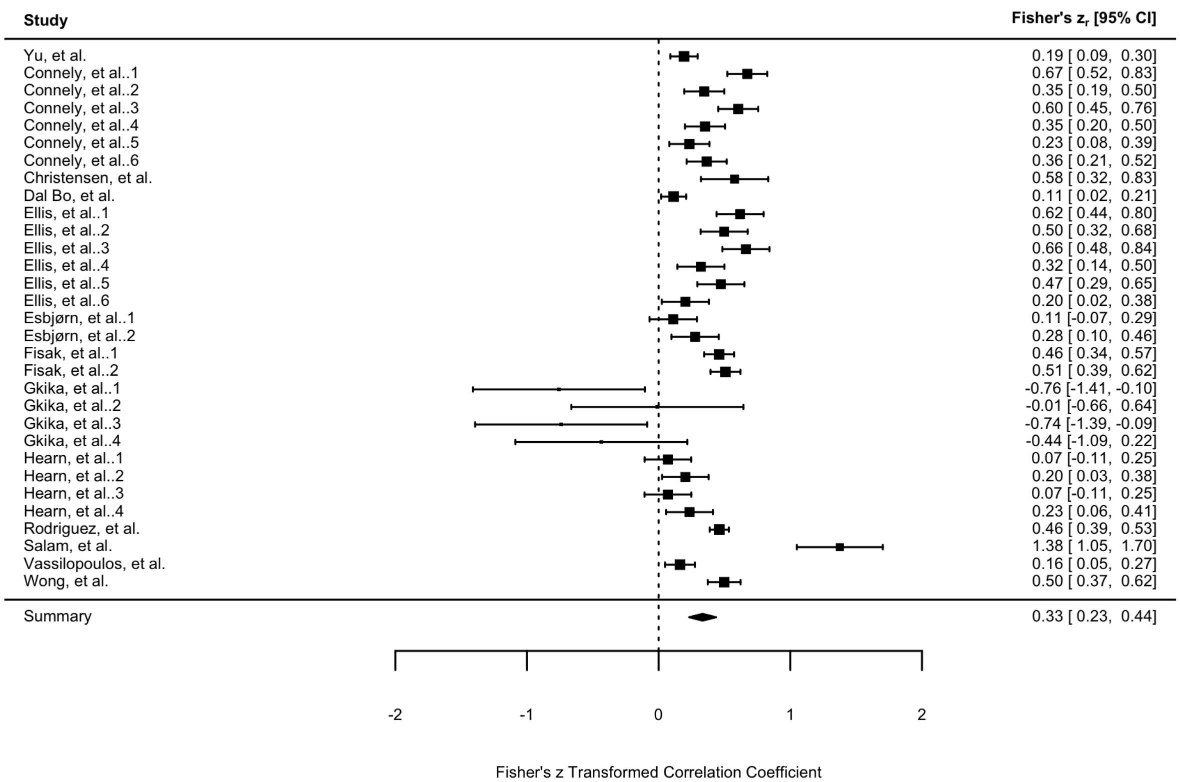
Usually reported the Q statistics: binary test

I^2 it is sensitive from the sample size of our dataframe tau^2 harder to interpret

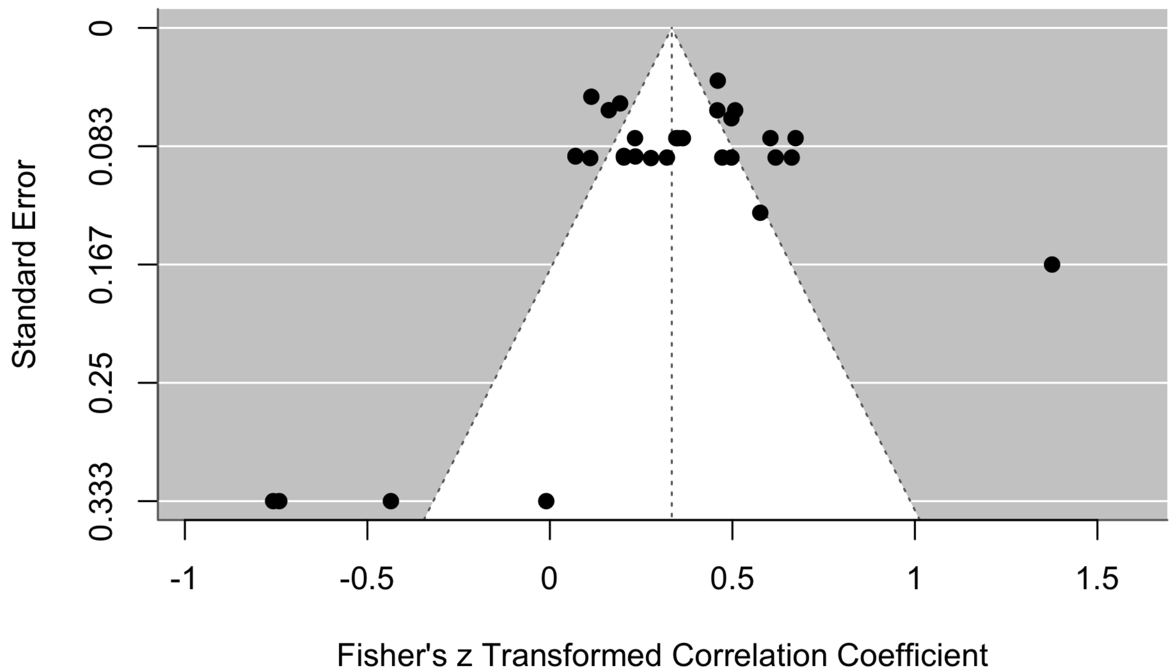
```
##  [1] "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" ""
## [26] "" "" "" "" "" ""
```

No influencial studies, since no "*" in the inf column




Study
Fisher's z_r [95% CI]
Yu, et al. 0.19 [0.09, 0.30]
Connely, et al..1 0.67 [0.52, 0.83]
Connely, et al..2 0.35 [0.19, 0.50]
Connely, et al..3 0.60 [0.45, 0.76]
Connely, et al..4 0.35 [0.20, 0.50]
Connely, et al..5 0.23 [0.08, 0.39]
Connely, et al..6 0.36 [0.21, 0.52]
Christensen, et al. 0.58 [0.32, 0.83]
Dal Bo, et al. 0.11 [0.02, 0.21]
Ellis, et al..1 0.62 [0.44, 0.80]
Ellis, et al..2 0.50 [0.32, 0.68]
Ellis, et al..3 0.66 [0.48, 0.84]
Ellis, et al..4 0.32 [0.14, 0.50]
Ellis, et al..5 0.47 [0.29, 0.65]
Ellis, et al..6 0.20 [0.02, 0.38]
Esbjørn, et al..1 0.11 [-0.07, 0.29]
Esbjørn, et al..2 0.28 [0.10, 0.46]
Fisak, et al..1 0.46 [0.34, 0.57]
Fisak, et al..2 0.51 [0.39, 0.62]
Gkika, et al..1 -0.76 [-1.41, -0.10]
Gkika, et al..2 -0.01 [-0.66, 0.64]
Gkika, et al..3 -0.74 [-1.39, -0.09]
Gkika, et al..4 -0.44 [-1.09, 0.22]
Hearn, et al..1 0.07 [-0.11, 0.25]
Hearn, et al..2 0.20 [0.03, 0.38]
Hearn, et al..3 0.07 [-0.11, 0.25]
Hearn, et al..4 0.23 [0.06, 0.41]
Rodriguez, et al. 0.46 [0.39, 0.53]
Salam, et al. 1.38 [1.05, 1.70]
Vassilopoulos, et al. 0.16 [0.05, 0.27]
Wong, et al. 0.50 [0.37, 0.62]
Summary 0.33 [0.23, 0.44]
-2
-1
0
1
2
Fisher's z Transformed Correlation Coefficient

Study Bias:




```
##
## Regression Test for Funnel Plot Asymmetry
##
## Model:     mixed-effects meta-regression model
## Predictor: standard error
##
## Test for Funnel Plot Asymmetry: z = -2.9154, p = 0.0036
## Limit Estimate (as sei -> 0):   b =  0.5591 (CI: 0.3786, 0.7396)
```

There is some Funnel Plot asymmetry, also proven by this formal test

Moderator analysis on r

```
##  [1] "Authors"         "ni"              "type"            "effect_size"
##  [5] "V"               "std"             "lower_CI"        "upper_CI"
##  [9] "SE"              "female_perc"     "white_ethnicity" "yi"
## [13] "vi"
```

```
## Warning: 1 study with NAs omitted from model fitting.
```

```
##
## Mixed-Effects Model (k = 30; tau^2 estimator: REML)
##
## tau^2 (estimated amount of residual heterogeneity):     0.0435 (SE = 0.0142)
## tau (square root of estimated tau^2 value):             0.2086
## I^2 (residual heterogeneity / unaccounted variability): 88.01%
## H^2 (unaccounted variability / sampling variability):   8.34
## R^2 (amount of heterogeneity accounted for):            0.00%
```

```
##
## Test for Residual Heterogeneity:
## QE(df = 28) = 184.1213, p-val < .0001
##
## Test of Moderators (coefficient 2):
## QM(df = 1) = 4.3411, p-val = 0.0372
##
## Model Results:
##
##              estimate      se     zval    pval    ci.lb    ci.ub
## intrcpt        0.7830  0.2283   3.4300  0.0006   0.3356   1.2304  ***
## female_perc   -0.6836  0.3281  -2.0835  0.0372  -1.3267  -0.0405    *
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
## Warning: 13 studies with NAs omitted from model fitting.
```

```
##
## Mixed-Effects Model (k = 18; tau^2 estimator: REML)
##
## tau^2 (estimated amount of residual heterogeneity):     0.0527 (SE = 0.0212)
## tau (square root of estimated tau^2 value):             0.2296
## I^2 (residual heterogeneity / unaccounted variability): 90.08%
## H^2 (unaccounted variability / sampling variability):   10.08
## R^2 (amount of heterogeneity accounted for):            19.55%
##
## Test for Residual Heterogeneity:
## QE(df = 16) = 124.0092, p-val < .0001
##
## Test of Moderators (coefficient 2):
## QM(df = 1) = 5.7961, p-val = 0.0161
##
## Model Results:
##
##                  estimate      se     zval    pval    ci.lb    ci.ub
## intrcpt            0.7000  0.1491   4.6949  <.0001   0.4078   0.9922  ***
## white_ethnicity   -0.4438  0.1843  -2.4075  0.0161  -0.8050  -0.0825    *
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

We get a significant result for white_ethnicicy prevalence (maybe we need to tranform this variable too!).

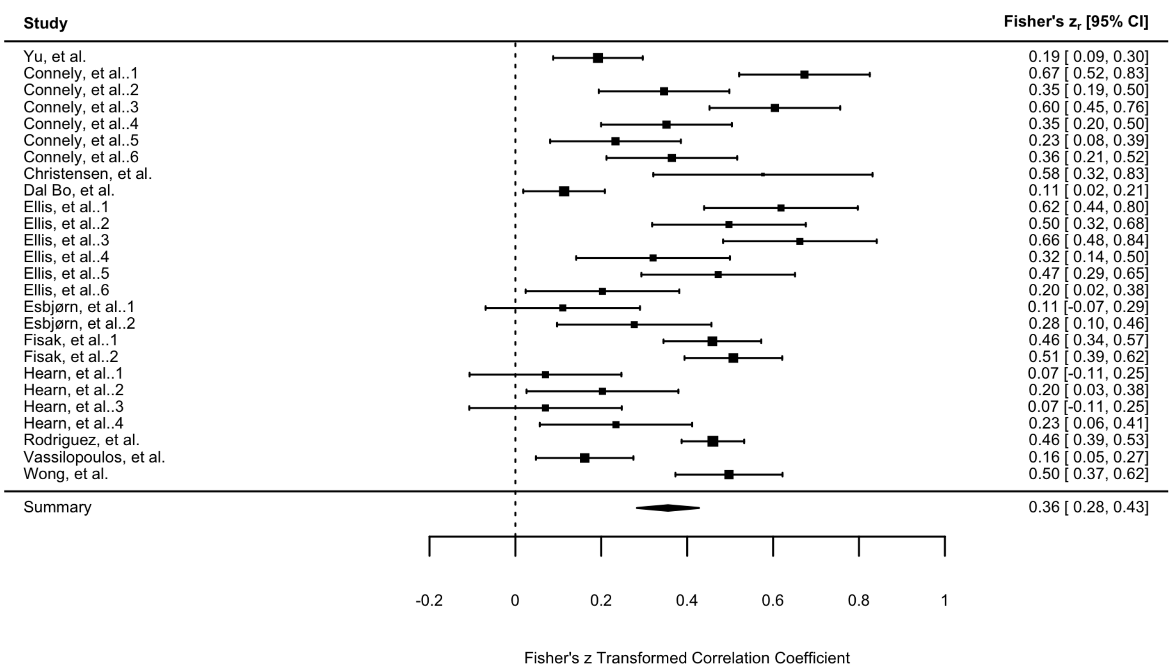
Removing Outliers only r

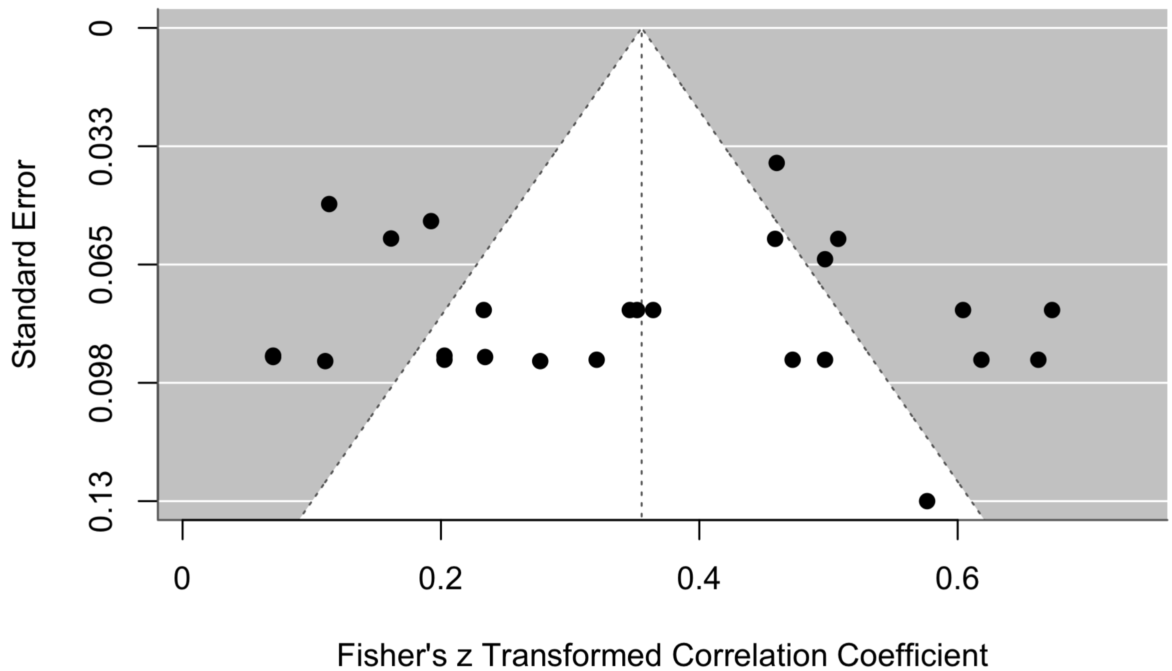
Removing the rows of the author Gkika and Salam

```
##  [1]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
## [13]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE FALSE FALSE FALSE FALSE  TRUE
## [25]  TRUE  TRUE  TRUE  TRUE FALSE  TRUE  TRUE
```

```
##
## Random-Effects Model (k = 26; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.0289 (SE = 0.0100)
## tau (square root of estimated tau^2 value):      0.1701
```

```
## I^2 (total heterogeneity / total variability):   84.89%
## H^2 (total variability / sampling variability):  6.62
##
## Test for Heterogeneity:
## Q(df = 25) = 159.9674, p-val < .0001
##
## Model Results:
##
## estimate      se    zval    pval   ci.lb   ci.ub
##   0.3554  0.0369  9.6379  <.0001  0.2831  0.4276  ***
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```






```
##
## Regression Test for Funnel Plot Asymmetry
##
## Model:     mixed-effects meta-regression model
## Predictor: standard error
##
## Test for Funnel Plot Asymmetry: z = 0.3717, p = 0.7101
## Limit Estimate (as sei -> 0):   b = 0.2975 (CI: -0.0165, 0.6115)
```

Accounting for non-independece of the effect sizes from same study only in r

Aooo

```
## # A tibble: 6 x 11
##   Authors            ni type  effect_size     V    std lower_CI upper_CI      SE
##   <chr>           <dbl> <fct>       <dbl> <dbl>  <dbl>    <dbl>    <dbl>   <dbl>
## 1 Yu, Meng and L~   357 r           0.19  0.004 0.0632    0.183    0.197 0.00335
## 2 Connely, K.       169 r           0.587 0.006 0.0775    0.575    0.599 0.00596
## 3 Connely, K.       169 r           0.333 0.006 0.0775    0.321    0.345 0.00596
## 4 Connely, K.       169 r           0.54  0.006 0.0775    0.528    0.552 0.00596
## 5 Connely, K.       169 r           0.338 0.006 0.0775    0.326    0.350 0.00596
## 6 Connely, K.       169 r           0.229 0.006 0.0775    0.217    0.241 0.00596
## # i 2 more variables: female_perc <dbl>, white_ethnicity <dbl>
```

```
## RVE: Hierarchical Effects Model with Small-Sample Corrections
##
## Model: yi ~ 1
```

```
##
## Number of clusters = 14
## Number of outcomes = 31 (min = 1 , mean = 2.21 , median = 1.5 , max = 6 )
## Omega.sq = 0
## Tau.sq = 0.04231477
##
##                Estimate StdErr t-value  dfs P(|t|>) 95% CI.L 95% CI.U Sig
## 1 X.Intercept.    0.343 0.0656    5.23 7.37 0.00103    0.189    0.496 ***
## ---
## Signif. codes: < .01 *** < .05 ** < .10 *
## ---
## Note: If df < 4, do not trust the results
```

Considering only d

```
##  [1] "Authors"         "ni"              "type"            "effect_size"
##  [5] "V"               "std"             "lower_CI"        "upper_CI"
##  [9] "SE"              "female_perc"     "white_ethnicity"
```

Full meta-analysis

Converting r to d, standardize and perform the analysis

```
## # A tibble: 31 x 2
##    effect_size      SE
##          <dbl>   <dbl>
##  1       0.19  0.00335
##  2       0.587 0.00596
##  3       0.333 0.00596
##  4       0.54  0.00596
##  5       0.338 0.00596
##  6       0.229 0.00596
##  7       0.349 0.00596
##  8       0.52  0.0166
##  9       0.113 0.00216
## 10       0.55  0.00806
## # i 21 more rows
```

```
## # A tibble: 31 x 2
##    effect_size_d    SE
##            <dbl> <dbl>
##  1         0.387 0.508
##  2         1.45  1.05
##  3         0.706 0.663
##  4         1.28  0.932
##  5         0.718 0.667
##  6         0.471 0.602
##  7         0.745 0.675
##  8         1.22  1.15
##  9         0.227 0.440
## 10         1.32  1.03
## # i 21 more rows
```

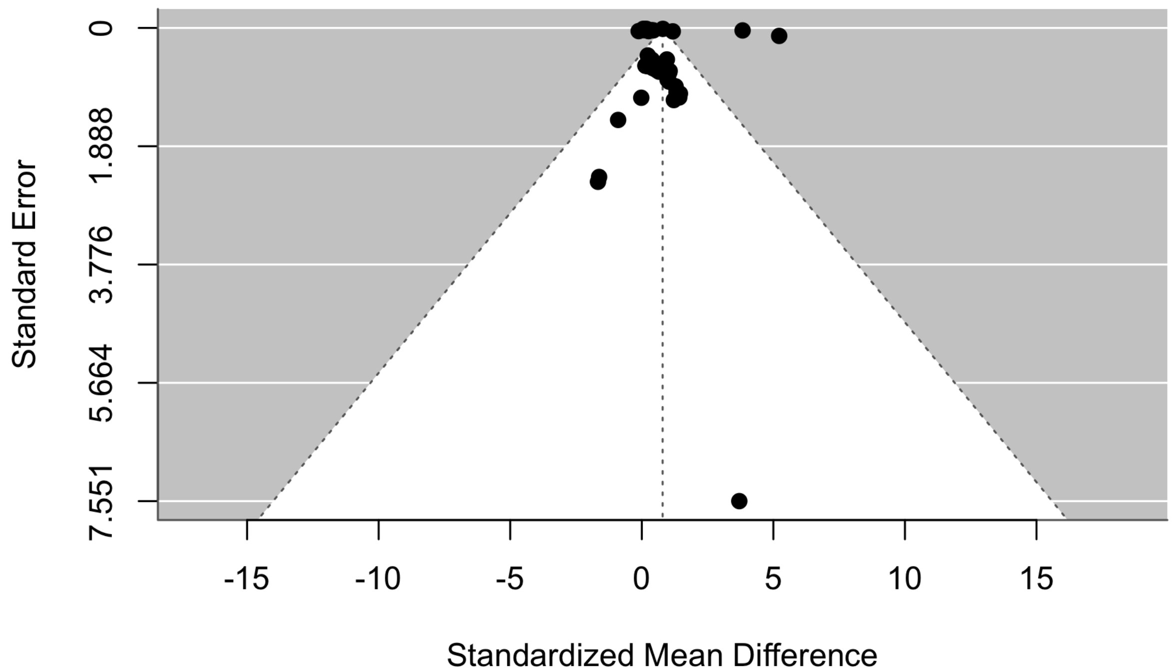
Now all our effect sizes are d!

metafor analysis

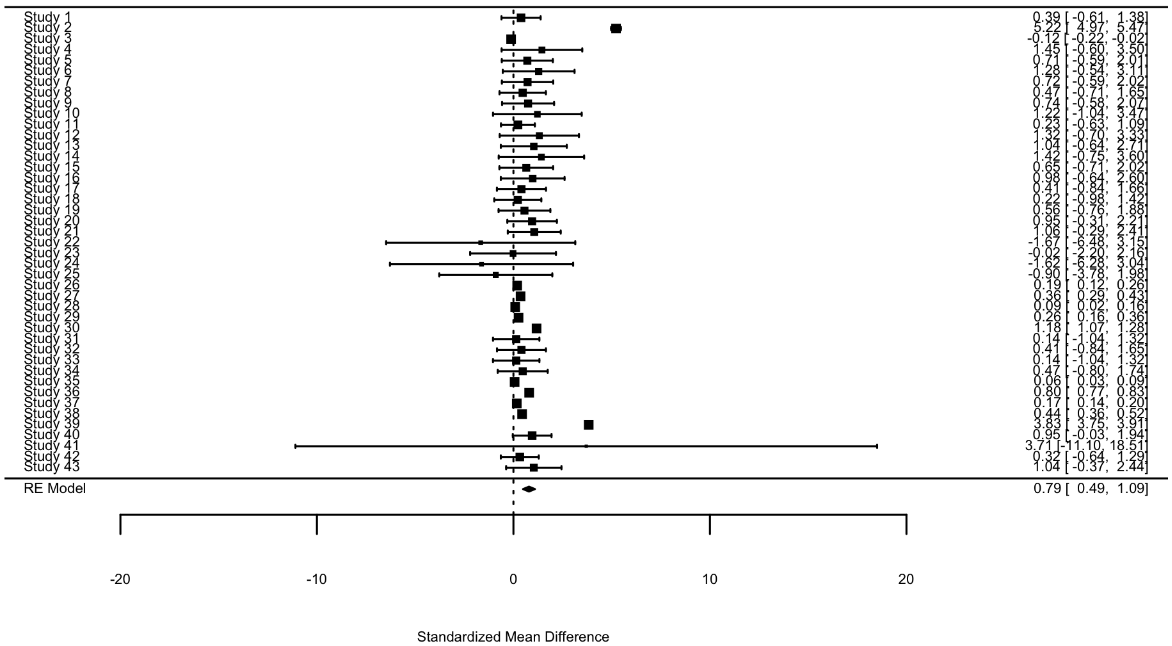
```
## # A tibble: 43 x 2
##    effect_size    SE
##          <dbl> <dbl>
##  1       0.387 0.508
##  2       5.22  0.127
##  3      -0.119 0.05
##  4       1.45  1.05
##  5       0.706 0.663
##  6       1.28  0.932
##  7       0.718 0.667
##  8       0.471 0.602
##  9       0.745 0.675
## 10       1.22  1.15
## # i 33 more rows
```

Converting our effect sizes into the SMD, need to check that this is indeed true

```
##
## Random-Effects Model (k = 43; tau^2 estimator: DL)
##
## tau^2 (estimated amount of total heterogeneity): 0.6593 (SE = 0.4414)
## tau (square root of estimated tau^2 value):      0.8120
## I^2 (total heterogeneity / total variability):   99.62%
## H^2 (total variability / sampling variability):  262.98
##
## Test for Heterogeneity:
## Q(df = 42) = 11045.2953, p-val < .0001
##
## Model Results:
##
## estimate      se    zval    pval   ci.lb   ci.ub
##   0.7912  0.1544  5.1254  <.0001  0.4886  1.0937  ***
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```



Standard Error
0
1.888
3.776
5.664
7.551
-15
-10
-5
0
5
10
15
Standardized Mean Difference


Study 1 0.39 [-0.61, 1.38]
Study 2 5.22 [4.97, 5.47]
Study 3 -0.12 [-0.22, -0.02]
Study 4 1.45 [-0.60, 3.50]
Study 5 0.71 [-0.59, 2.01]
Study 6 1.28 [-0.54, 3.11]
Study 7 0.72 [-0.59, 2.02]
Study 8 0.47 [-0.71, 1.65]
Study 9 0.74 [-0.58, 2.07]
Study 10 1.22 [-1.04, 3.47]
Study 11 0.23 [-0.63, 1.09]
Study 12 1.32 [-0.70, 3.33]
Study 13 1.04 [-0.64, 2.71]
Study 14 1.42 [-0.75, 3.60]
Study 15 0.65 [-0.71, 2.02]
Study 16 0.98 [-0.64, 2.60]
Study 17 0.41 [-0.84, 1.66]
Study 18 0.22 [-0.98, 1.42]
Study 19 0.56 [-0.76, 1.88]
Study 20 0.95 [-0.31, 2.21]
Study 21 1.06 [-0.29, 2.41]
Study 22 -1.67 [-6.48, 3.15]
Study 23 -0.02 [-2.20, 2.16]
Study 24 -1.62 [-6.28, 3.04]
Study 25 -0.90 [-3.78, 1.98]
Study 26 0.19 [0.12, 0.26]
Study 27 0.36 [0.29, 0.43]
Study 28 0.09 [0.02, 0.16]
Study 29 0.26 [0.16, 0.36]
Study 30 1.18 [1.07, 1.28]
Study 31 0.14 [-1.04, 1.32]
Study 32 0.41 [-0.84, 1.65]
Study 33 0.14 [-1.04, 1.32]
Study 34 0.47 [-0.80, 1.74]
Study 35 0.06 [0.03, 0.09]
Study 36 0.80 [0.77, 0.83]
Study 37 0.17 [0.14, 0.20]
Study 38 0.44 [0.36, 0.52]
Study 39 3.83 [3.75, 3.91]
Study 40 0.95 [-0.03, 1.94]
Study 41 3.71 [-11.10, 18.51]
Study 42 0.32 [-0.64, 1.29]
Study 43 1.04 [-0.37, 2.44]
RE Model 0.79 [0.49, 1.09]
-20
-10
0
10
20
Standardized Mean Difference