Meta-analysis Criterion validity

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2025-09-10

Introduction

This is part of a meta-analysis of a larger systematic review about the measurement properties of the Borg scales. In this analysis, we meta-analysed the correlation coefficients (treated as effect size) of the studies that about *Criterion Validity* of the *Borg 6-20 scale*.

Code & output

Install packages

```
install.packages(c("readxl", "dplyr", "metafor"), dependencies = TRUE)
```

```
## Installing packages into '/cloud/lib/x86_64-pc-linux-gnu-library/4.5'
## (as 'lib' is unspecified)
```

```
library(readxl)
library(dplyr)
```

```
##
## 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
```

```
library(metafor)
```

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

```
## Loading required package: metadat
```

```
## Loading required package: numDeriv
```

```
##
## Loading the 'metafor' package (version 4.8-0). For an
## introduction to the package please type: help(metafor)
```

Import data

```
borg <- read_excel("Data_Borg.xlsx")

library(knitr)
kable(borg, caption = "Borg dataset")
```

Table 1: Borg dataset

author_year	n	prom	validity_type	comparator	r
Liu,2000	36	Borg6-20	criterion	VO2peak	0.83
Kerrigan,2016	24	Borg6-20	criterion	VO2R	0.91
Levinger,2004	14	Borg6-20	criterion	HRmax	0.43
Connolly,1996	9	Borg6-20	construct	VO2	0.8
Connolly,1996	9	Borg6-20	construct	HR	0.49
Connolly,1996	9	Borg6-20	construct	VE	0.75
Tang,2016	97	Borg6-20	construct	HR	0.44
Tang,2016	47	Borg6-20	construct	HR_beta_blockers	0.52
Shephard,1996	36	Borg6-20	responsiveness	VO2	NA
Buckley,2009	11	Borg6-20	reliability	ICC	0.85
Iellamo,2014	16	BorgCR10	criterion	TRIMPi	0.72

Cleaning (ensure numeric r and n)

```
to_num <- function(x) {
  if (is.numeric(x)) return(x)
  x <- gsub(",", ".", as.character(x))
  suppressWarnings(as.numeric(x))
}

borg <- borg %>%
  mutate(
    r             = to_num(r),
    n             = to_num(n),
    validity_type = as.character(validity_type),
    comparator    = as.character(comparator),
    prom          = as.character(prom),
    author_year   = as.character(author_year)
  )
```

Analysis. Filter: criterion validity + Borg 6–20

```
criterion <- borg %>%
  filter(validity_type == "criterion") %>%
  filter(prom != "BorgCR10")
```

Compute Fisher's Z effect sizes for r

```
criterion_es <- escalc(
  measure = "ZCOR",
  ri = r,
  ni = n,
  data = criterion
)
```

Fit random-effects meta-analysis

```
res <- rma(yi, vi, data = criterion_es, method = "REML")
```

```r
print(summary(res))
```

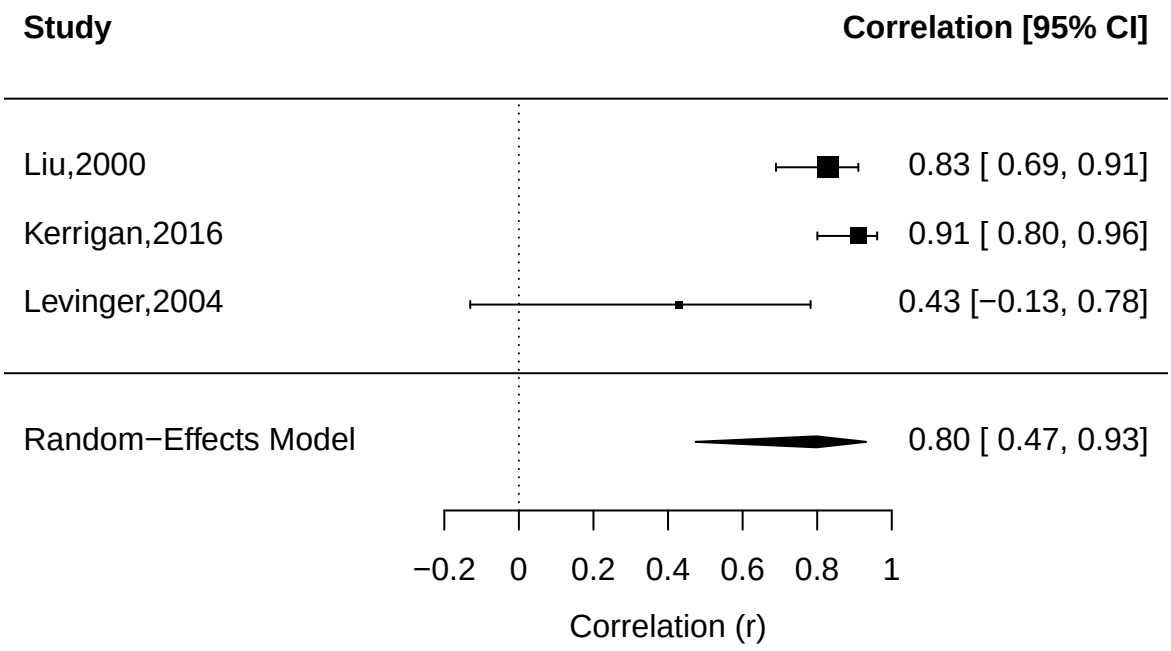
```
##
## Random-Effects Model (k = 3; tau^2 estimator: REML)
##
##   logLik  deviance       AIC       BIC      AICc
##  -1.5635    3.1270    7.1270    4.5133   19.1270
##
## tau^2 (estimated amount of total heterogeneity): 0.2055 (SE = 0.2599)
## tau (square root of estimated tau^2 value):      0.4533
## I^2 (total heterogeneity / total variability):   80.27%
## H^2 (total variability / sampling variability):  5.07
##
## Test for Heterogeneity:
## Q(df = 2) = 8.2405, p-val = 0.0162
##
## Model Results:
##
## estimate      se    zval    pval   ci.lb   ci.ub
##   1.0916  0.2940  3.7127  0.0002  0.5154  1.6679  ***
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
print(predict(res, transf = transf.ztor))
```

```
##
##    pred  ci.lb  ci.ub  pi.lb  pi.ub
##  0.7975 0.4741 0.9313 0.0327 0.9733
```

Forest plot

```r
slabs <- criterion$author_year
forest(
  res,
  slab   = slabs,
  xlab   = "Correlation (r)",
  transf = transf.ztor
)
```


Study
Correlation [95% CI]
Liu,2000
0.83 [0.69, 0.91]
Kerrigan,2016
0.91 [0.80, 0.96]
Levinger,2004
0.43 [−0.13, 0.78]
Random−Effects Model
0.80 [0.47, 0.93]
−0.2
0
0.2
0.4
0.6
0.8
1
Correlation (r)