Package 'metarep'

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Title Replicability-Analysis Tools for Meta-Analysis

Version 1.2.0

Depends R (>= 4.1), meta (>= 6.0-0)

Suggests metafor (>= 1.9.9), lme4, numDeriv, BiasedUrn, knitr, rmarkdown

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URL https://github.com/IJaljuli/metarep

Description User-friendly package for reporting replicability-analysis methods, affixed to meta-analyses summary. The replicability-analysis output provides an assessment of the investigated intervention, where it offers quantification of effect replicability and assessment of the consistency of findings.
- Replicability-analysis for fixed-effects and random-effect meta analysis:
- r(u)-value;
- lower bounds on the number of studies with replicated positive and\or negative effect;
- Allows detecting inconsistency of signals;
- forest plots with the summary of replicability analysis results;
- Allows Replicability-analysis with or without the common-effect assumption.

License GPL (>= 2)

Encoding UTF-8

NeedsCompilation yes

RoxygenNote 7.2.3

VignetteBuilder knitr

LazyData true

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Contents

`CD002943_CMP001` *Data in meta-analysis reported in review CD002943, 'Cochrane library'.*

Description

A dataset containing the meta-data of the the intervention 'Invitation letter' (CMP001), in the review "PStrategies for increasing the participation of women in community breast cancer screening" (CD002943) the results were reported by 5 studies, and analysed by Fixed-Effects meta-analysis.

Usage

```
CD002943_CMP001
```

Format

A data frame with 5 rows of 12 variables:

STUDY Name of the study.

STUDY_WEIGHT Stydy weight in meta-analysis as reported in th review.

N_EVENTS1 Number of events in the first group tested.

N_EVENTS2 Number of events in the second group tested.

N_TOTAL1 Number of patirnts in the first group tested.

N_TOTAL2 Number of patirnts in the second group tested.

GROUP1 Names of the first group in each study.

GROUP2 Names of the second group in each study.

N_STUDIES Overall number of studies in the meta-analysis

CMP_ID Cochrane Database review number

SM A character string indicating which summary measure ("RR", "OR", "RD", or "ASD") is to be used for pooling of studies.

RANDOM "YES" or "NO" indicating whether random-effects meta-analysis was performed.

Source

https://www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD002943/full

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CD003366_CMP005 *Data in meta-analysis reported in review CD003366, 'Cochrane library'.*

Description

A dataset containing the meta-data of the outcome 'Leukopaenia' (CMP005), in the review "Texane-containing regimins for metastatic breast cancer" (CD003366) the results were reported by 28 studies, and analysed by Random-Effects meta-analysis.

Usage

```
CD003366_CMP005
```

Format

A data frame with 28 rows and 12 variables:

STUDY Name of the study.

STUDY_WEIGHT Stydy weight in meta-analysis as reported in th review.

N_EVENTS1 Number of events in the first group tested.

N_EVENTS2 Number of events in the second group tested.

N_TOTAL1 Number of patirnts in the first group tested.

N_TOTAL2 Number of patirnts in the second group tested.

GROUP1 Names of the first group in each study.

GROUP2 Names of the second group in each study.

N_STUDIES Overall number of studies in the meta-analysis

CMP_ID Cochrane Database review number

SM A character string indicating which summary measure ("RR", "OR", "RD", or "ASD") is to be used for pooling of studies.

RANDOM "YES" or "NO" indicating whether random-effects meta-analysis was performed.

Source

https://www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD003366.pub3/full

CD006823_CMP001 *Data in meta-analysis reported in review CD006823, 'Cochrane library'.*

Description

A dataset containing the meta-data of the outcome 'Seroma formation' (CMP001), in the review "Wound drainage after axillary dissection for carcinoma of the breast" (CD006823) the results were reported by 7 studies, and analysed by Random-Effects meta-analysis.

Usage

```
CD006823_CMP001
```

Format

A data frame with 7 rows and 12 variables:

STUDY Name of the study.

STUDY_WEIGHT Stydy weight in meta-analysis as reported in th review.

N_EVENTS1 Number of events in the first group tested.

N_EVENTS2 Number of events in the second group tested.

N_TOTAL1 Number of patirnts in the first group tested.

N_TOTAL2 Number of patirnts in the second group tested.

GROUP1 Names of the first group in each study.

GROUP2 Names of the second group in each study.

N_STUDIES Overall number of studies in the meta-analysis

CMP_ID Cochrane Database review number

SM A character string indicating which summary measure ("RR", "OR", "RD", or "ASD") is to be used for pooling of studies.

RANDOM "YES" or "NO" indicating whether random-effects meta-analysis was performed.

Source

https://www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD006823.pub2/full

CD007077_CMP001 *Data in meta-analysis reported in review CD007077, 'Cochrane library'.*

Description

A dataset containing the meta-data of the outcome 'cosmesis' (CMP001), in the review "Partial breast irradiation for early breast cancer" (CD007077) the results were reported by 5 studies, and analysed by Fixed-Effects meta-analysis.

Usage

```
CD007077_CMP001
```

Format

A data frame with 5 rows and 12 variables:

STUDY Name of the study.

STUDY_WEIGHT Stydy weight in meta-analysis as reported in th review.

N_EVENTS1 Number of events in the first group tested.

N_EVENTS2 Number of events in the second group tested.

N_TOTAL1 Number of patirnts in the first group tested.

N_TOTAL2 Number of patirnts in the second group tested.

GROUP1 Names of the first group in each study.

GROUP2 Names of the second group in each study.

N_STUDIES Overall number of studies in the meta-analysis

CMP_ID Cochrane Database review number

SM A character string indicating which summary measure ("RR", "OR", "RD", or "ASD") is to be used for pooling of studies.

RANDOM "YES" or "NO" indicating whether random-effects meta-analysis was performed.

Source

https://www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD007077.pub3/full

find_umax *Lower bounds on the number of studies with replicated effect*

Description

lower bounds on the number of studies with increased and\ or decreased effect.

Usage

```
find_umax(
  x,
  alternative = "two-sided",
  t = 0.05,
  confidence = 0.95,
  common.effect = FALSE
)
```

Arguments

x	Object of class 'meta'
alternative	'less', 'greater' or 'two-sided'
t	truncation threshold for truncated-Pearsons' test ('t=0.05' by default). t is ignored if 'common.effect = TRUE'.
confidence	Confidence level used in the computaion of the lower bound(s) u^L_{max} and\or u^R_{max}.
common.effect	Use common.effect = FALSE (default) for replicability-analysis combining with no assumptions (Pearson or truncated-Pearson test).

Value

An object of class list reporting the bounds on the number of studies with a positive or negative effect, as follows:

worst.case	A charachter vector of the names of n-u_{max}+1 studies at which the the r(u_{max})-value is computed.
side	The direction of the replicated signal in the 'worst.case' studies. 'less' if the effect is negative, 'greater' if positive.
u_max	The bound on the number of studies with either a positive or a negative effect.
r-value	The 'u-out-of-n' r(u)--value calculated with u=u_max.
Replicability_Analysis	Report of the replicability lower bounds on the number of studies with negative effect and with positive effect.

Examples

```
n.i.1 <- c( 20, 208, 24, 190, 58, 36, 51)
a.i <- c( 2,79,0,98,15,34,9)
n.i.2 <- c( 20, 119, 22, 185, 29, 51, 47)
c.i <- c(9,106,14,98,12,49,9)
m1 <- metabin( event.e = a.i,n.e = n.i.1,
               event.c = c.i,n.c = n.i.2,
               studlab = paste('Study',1:7), sm = 'OR',
               common = FALSE, random = TRUE )
find_umax(m1 , common.effect = FALSE, alternative = 'two-sided',
          t = 0.05 , confidence = 0.95 )
```

`forest.metarep` *Forest plot to display the result of a meta-analysis with replicability analysis resuls*

Description

Draws a forest plot in the active graphics window (using grid graphics system).

Usage

```
## S3 method for class 'metarep'
forest(x, ...)
```

Arguments

`x`	An object of class 'metarep'.
`...`	Arguments to be passed to methods, see `forest.meta`

Value

No return value, called for side effects

See Also

`forest.meta`, `metarep`,

Examples

```
n.i.1 <- c( 20, 208, 24, 190, 58, 36, 51)
a.i <- c( 2,79,0,98,15,34,9)
n.i.2 <- c( 20, 119, 22, 185, 29, 51, 47)
c.i <- c(9,106,14,98,12,49,9)
m1 <- metabin( event.e = a.i,n.e = n.i.1,event.c = c.i,n.c = n.i.2,
               studlab = paste0('Study ' , 1:7) , sm = 'OR' ,
               common = FALSE, random = TRUE )
mr1 <- metarep(  m1 , u = 2, common.effect = FALSE , t = 0.05 ,
```

```
               alternative = 'two-sided', report.u.max = TRUE)
forest(mr1, layout = "RevMan5", common = FALSE,
       label.right = "Favours control", col.label.right = "red",
       label.left = "Favours experimental", col.label.left = "green",
       prediction = TRUE)
```

---

metarep *Replicability-analysis of a meta-analysis*

Description

Add results of replicability-analysis to a meta-analysis, whether common- or random-effects.

Usage

```
metarep(
  x,
  u = 2,
  t = 0.05,
  alternative = "two-sided",
  report.u.max = FALSE,
  confidence = 0.95,
  common.effect = FALSE
)
```

Arguments

x	object of class 'meta'
u	replicability requirement. u must be an intiger between 2 and n (nmber of studies in the meta-analysis).
t	truncation threshold for truncated-Pearsons' test ('t=0.05' by default). t is ignored if 'common.effect = TRUE'.
alternative	use 'less', 'greater' or 'two-sided'
report.u.max	use TREU to report the lower bounds on number of studies with replicated effect.
confidence	Confidence level used in the computaion of the lower bound(s) u^L_{max} and\or u^R_{max}.
common.effect	Use common.effect = FALSE (default) for replicability-analysis combining with no assumptions (Pearson or truncated-Pearson test). Replicability-analysis based on the test-statistic of common-effects model can be applied using common.effect = TRUE.

Value

An object of class list containing meta-analysis and replicability analysis results, as follows:

`worst.case.studies`
: A charachter vector of the names of `n-u+1` studies at which the the `r(u)`-value is computed.

`r.value`
: `r(u)`-value for the specied u.

`side`
: The direction of the effect with the lower one-sided `r(u)`-value

`u_L, u_R`
: Lower bounds of the number of studies with decreased or increased effect, respectively. Both bounds are reported simultinualsly only when performing replicability analysis for two-sided alternative with no assumptions

Examples

```
 n.i.1 <- c( 20, 208, 24, 190, 58, 36, 51)
a.i <- c( 2,79,0,98,15,34,9)
n.i.2 <- c( 20, 119, 22, 185, 29, 51, 47)
c.i <- c(9,106,14,98,12,49,9)
m1 <- metabin( event.e = a.i,n.e = n.i.1,event.c = c.i,n.c = n.i.2,
               studlab = paste0('Study ' , 1:7) , sm = 'OR' ,
               common = FALSE, random = TRUE )
mr1 <- metarep(  m1 , u = 2, common.effect = FALSE , t = 0.05 ,
               alternative = 'two-sided', report.u.max = TRUE)
forest(mr1, layout='revman5',digits.pval = 4 , test.overall = TRUE )
```

---

metaRvalue.onesided.U *One-sided replicability analysis*

Description

One-sided replicability analysis

Usage

```
metaRvalue.onesided.U(
  x,
  u = 2,
  common = FALSE,
  random = TRUE,
  alternative = "less",
  do.truncated.umax = TRUE,
  alpha.tilde = 0.05
)
```

Arguments

x	object of class 'meta'
u	integer between 2-n
common	logical
random	logical
alternative	'less' or 'greater' only.
do.truncated.umax	logical.
alpha.tilde	between (0,1)

Value

No return value, called for internal use only.

---

print.metarep *Print meta-analysis with replicability-analysis results*

Description

Print method for objects of class 'metarep'.

Usage

```
## S3 method for class 'metarep'
print(x, details.methods = TRUE, ...)
```

Arguments

x	An object of class 'metarep'
details.methods	A logical specifying whether details on statistical methods should be printed
...	Arguments to be passed to methods, see print.meta

Value

No return value, called for side effects.

Examples

```
n.i.1 <- c( 20, 208, 24, 190, 58, 36, 51)
a.i <- c( 2,79,0,98,15,34,9)
n.i.2 <- c( 20, 119, 22, 185, 29, 51, 47)
c.i <- c(9,106,14,98,12,49,9)
m1 <- metabin( event.e = a.i,n.e = n.i.1,event.c = c.i,n.c = n.i.2,
               studlab = paste0('Study ' , 1:7) , sm = 'OR' ,
               common = FALSE, random = TRUE )
mr1 <- metarep(  m1 , u = 2, common.effect = FALSE , t = 0.05 ,
               alternative = 'two-sided', report.u.max = TRUE)
print(mr1, digits = 2)
```

---

print.summary.metarep *Print detailed meta-analysis with replicability-analysis results*

Description

Print method for objects of class 'summary.metarep'.

Usage

```
## S3 method for class 'summary.metarep'
print(x, details.methods = TRUE, ...)
```

Arguments

x	An object of class 'summary.metarep'
details.methods	A logical specifying whether details on statistical methods should be printed
...	Arguments to be passed to methods, see `print.summary.meta`

Value

No return value, called for side effects.

Examples

```
n.i.1 <- c( 20, 208, 24, 190, 58, 36, 51)
a.i <- c( 2,79,0,98,15,34,9)
n.i.2 <- c( 20, 119, 22, 185, 29, 51, 47)
c.i <- c(9,106,14,98,12,49,9)
m1 <- metabin( event.e = a.i,n.e = n.i.1,event.c = c.i,n.c = n.i.2,
               studlab = paste0('Study ' , 1:7) , sm = 'OR' ,
               common = FALSE, random = TRUE )
mr1 <- metarep(  m1 , u = 2, common.effect = FALSE , t = 0.05 ,
               alternative = 'two-sided', report.u.max = TRUE)
print(summary(mr1), digits = 2)
```

summary.metarep *Summary of meta-analysis with replicability-analysis results*

Description

Summary method for objects of class 'metarep'.

Usage

```
## S3 method for class 'metarep'
summary(object, ...)
```

Arguments

object	An object of class 'metarep'.
...	Arguments to be passed to methods, see summary.meta

Value

A list of the quantities for replicability analysis, as follows:

meta-analysis results:	Summary of the supplied 'meta' object.
r.value:	r-value of the tested alternative.
u.increased:	Maximal number of studies at which replicability of increasing effect can be claimed. It will be reported unless the alternative is 'less'.
u.decreased:	Maximal number of studies at which replicability of increasing effect can be claimed. It will be reported unless the alternative is 'greater'.

Examples

```
n.i.1 <- c( 20, 208, 24, 190, 58, 36, 51)
a.i <- c( 2,79,0,98,15,34,9)
n.i.2 <- c( 20, 119, 22, 185, 29, 51, 47)
c.i <- c(9,106,14,98,12,49,9)
m1 <- metabin( event.e = a.i,n.e = n.i.1,event.c = c.i,n.c = n.i.2,
               studlab = paste0('Study ' , 1:7) , sm = 'OR' ,
               common = FALSE, random = TRUE )
mr1 <- metarep(  m1 , u = 2, common.effect = FALSE , t = 0.05 ,
               alternative = 'two-sided', report.u.max = TRUE)
               summary(mr1)
```

`truncatedPearson` *Truncated-Pearsons' test*

Description

Apply Truncated-Pearsons' test or ordinary Pearsons' test on one-sided p-values.

Usage

```
truncatedPearson(p, alpha.tilde = 1)
```

Arguments

`p`	one-sided p-values of the individual studies for testing one-sided alternative based on z-test.
`alpha.tilde`	truncartion threshold for truncated-Pearson test. Use alpha.tilde = 1 for ordinary Pearsons' test for combining p-values.

Value

A 'list' containing the following quantities:

`chisq:`	Pearson test statistic
`df:`	degrees of freedom of truncated-Pearson statistic
`rvalue:`	p-value of the test
`validp:`	p-values used in the test.

Examples

```
truncatedPearson( p = c( 0.001 , 0.01 , 0.1  ) , alpha.tilde = 1 )
truncatedPearson( p = c( 0.001 , 0.01 , 0.1  ) , alpha.tilde = 0.05 )
```

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