

Package ‘dSrTest’

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Type Package

Title Tests and Confidence Intervals on Directly Standardized Rates
for Several Methods

Version 1.0.0

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Description Perform a test of a simple null hypothesis about a
directly standardized rate and obtain the matching confidence
interval using a choice of methods.

Encoding UTF-8

License GPL (>= 2)

RoxygenNote 7.2.0

Depends R (>= 2.10)

Imports stats, exactci, asht (>= 0.9.1), loglognorm,

Suggests testthat, knitr, rmarkdown, covr

URL <https://github.com/mnelsonr/dSrTest>

BugReports <https://github.com/mnelsonr/dSrTest/issues>

VignetteBuilder knitr

LazyData true

NeedsCompilation no

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Contents

| | |
|-----------------------------|---|
| dSrTest-package | 2 |
| asymptoticControl | 4 |
| betaControl | 4 |

| | |
|-------------------------|---|
| dobsonControl | 5 |
| downs.mi | 6 |
| dsrTest | 6 |
| gammaControl | 8 |

| | |
|--------------|-----------|
| Index | 10 |
|--------------|-----------|

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|-----------------|------------------------------------------------------------------------------------------|
| dsrTest-package | <i>Tests and Confidence Intervals on Directly Standardized Rates for Several Methods</i> |
|-----------------|------------------------------------------------------------------------------------------|

Description

Perform a test of a simple null hypothesis about a directly standardized rate and obtain the matching confidence interval using a choice of methods.

Details

The DESCRIPTION file:

```

Package:      dsrTest
Type:         Package
Title:        Tests and Confidence Intervals on Directly Standardized Rates for Several Methods
Version:      1.0.0
Date:         2022-06-12
Author:       Michael Nelson
Maintainer:   Michael Nelson <michael.nelson.r.pkg@gmail.com>
Description:  Perform a test of a simple null hypothesis about a directly standardized rate and obtain the matching confidence interval using a choice of methods.
Encoding:     UTF-8
License:      GPL (>= 2)
RoxygenNote: 7.2.0
Roxygen:      list(markdown = TRUE)
Depends:      R (>= 2.10)
Imports:      stats, exactci, asht (>= 0.9.1), loglognorm,
Suggests:     testthat, knitr, rmarkdown, covr
URL:          https://github.com/mnelsonr/dsrTest
BugReports:   https://github.com/mnelsonr/dsrTest/issues
VignetteBuilder: knitr
LazyData:    true

```

Index of help topics:

| | |
|-------------------|----------------------------------------------------------------|
| asymptoticControl | Control Function for Asymptotic Method Confidence Intervals |
| betaControl | Control Function for Beta Method for Confidence Intervals |
| dobsonControl | Control Function for Dobson Method Confidence |

| | |
|-----------------|------------------------------------------------------------------------------------------------------|
| | Intervals |
| downs.mi | Downs' syndrome cases and of total live births by maternal age and birth order, Michigan, 1950-1964. |
| dSrTest | Tests and Confidence Intervals on Directly Standardized Rates |
| dSrTest-package | Tests and Confidence Intervals on Directly Standardized Rates for Several Methods |
| gammaControl | Control Function for Gamma Method Confidence Intervals |

The function `dSrTest()` implements a number of different parameterizations and methods for computing confidence intervals on directly standardized rates. These methods are described in detail in Fay and Feuer (1997), Tiwari et al (2006), Ng et al (2008) and Fay and Kim (2017).

The various `<method>Control()` functions allow modifications to the general approaches.

Author(s)

Michael Nelson

Maintainer: Michael Nelson <michael.nelson.r.pkg@gmail.com>

References

- Dobson, AJ, Kuulasmaa, K, Eberle, E and Scherer, J (1991) 'Confidence intervals for weighted sums of Poisson parameters', *Statistics in Medicine*, **10**: 457-462. doi:10.1002/sim.4780100317
- Swift, MB (1995) 'Simple confidence intervals for standardized rates based on the approximate bootstrap method', *Statistics in Medicine*, **14**, 1875-1888. doi:10.1002/sim.4780141704.
- Fay MP & Feuer EJ (1997) 'Confidence intervals for directly standardized rates: a method based on the gamma distribution.' *Statistics in Medicine*. **16**: 791-801. doi:10.1002/(sici)10970258(19970415)16:7<791::aid-sim500>3.0.co;2#
- Tiwari RC, Clegg LX, & Zou Z (2006) 'Efficient interval estimation for age-adjusted cancer rates.' *Statistical Methods in Medical Research* **15**: 547-569. doi:10.1177/0962280206070621
- Ng HKT, Filardo, G & Zheng G (2008) 'Confidence interval estimating procedures for standardized incidence rates.' *Computational Statistics and Data Analysis* **52**: 3501-3516. doi:10.1016/j.csda.2007.11.004
- Fay, MP & Kim S (2017) 'Confidence intervals for directly standardized rates using mid-p gamma intervals.' *Biometrical Journal* **59**(2): 377-387. doi:10.1002/bimj.201600111

See Also

[wspoissonTest](#)

Examples

```
## using the example from asht::wspoissonTest
## birth data on Down's syndrome from Michigan, 1950-1964
## see Table II of Fay and Feuer (1997)
```

```
## xfive = counts for mothers who have had 5 or more children
## nfive and ntotal are number of live births
xfive<-c(0, 8, 63, 112, 262, 295)
nfive<-c(327, 30666, 123419, 149919, 104088, 34392)
ntotal<-c(319933, 931318, 786511, 488235, 237863, 61313)
## use mult =10^5 to give rates per 100,000
## gamma method of Fay and Feuer (1997) is default
dsrTest(xfive, nfive, ntotal, method = "gamma", mult = 1e5)
## Dobson et al (1991)
dsrTest(xfive, nfive, ntotal, method = "dobson", mult = 1e5)
## Asymptotic with log transformation
dsrTest(xfive, nfive, ntotal, method = "asymptotic", mult = 1e5,
control = list(trans = "log"))
```

| | |
|-------------------|--------------------------------------------------------------------|
| asymptoticControl | <i>Control Function for Asymptotic Method Confidence Intervals</i> |
|-------------------|--------------------------------------------------------------------|

Description

Specify the transformation to apply to the distribution of the MLE.

Usage

```
asymptoticControl(trans = c("none", "log", "loglog", "logit"), ...)
```

Arguments

| | |
|-------|-----------------------------------------------|
| trans | Transformation apply to the MLE distribution. |
| ... | Currently ignored. |

Value

A list with values

trans

| | |
|-------------|------------------------------------------------------------------|
| betaControl | <i>Control Function for Beta Method for Confidence Intervals</i> |
|-------------|------------------------------------------------------------------|

Description

Modification to the Beta method. The options are "none" or the same modifications as applied to the Gamma Method (see [gammaControl](#)) are implemented. wmtpe="none" and wmtpe="tcz" have been investigated by Tiwari et al (2006) and Ng et al (2008).

Usage

```
betaControl(wmtpe = c("none", "tcz", "max", "mean", "minmaxavg"), ...)
```

Arguments

wmtype character type of modification to the Beta Confidence Interval
 ... Currently ignored.

Value

a list with values
 wmtype modification to Beta Confidence Interval to implement

References

Tiwari RC, Clegg LX, & Zou Z (2006). 'Efficient interval estimation for age-adjusted cancer rates.' *Statistical Methods in Medical Research* **15**: 547–569. doi:10.1177/0962280206070621

Ng HKT, Filardo, G & Zheng G (2008). 'Confidence interval estimating procedures for standardized incidence rates.' *Computational Statistics and Data Analysis* **52** 3501–3516. doi:10.1016/j.csda.2007.11.004

| | |
|---------------|----------------------------------------------------------------|
| dobsonControl | <i>Control Function for Dobson Method Confidence Intervals</i> |
|---------------|----------------------------------------------------------------|

Description

Provides a list of arguments to pass to [poisson.exact](#).

Usage

```
dobsonControl(midp = FALSE, tsmethod = c("central", "minlike", "blaker"), ...)
```

Arguments

midp logical, use mid-p values? Currently only permitted where tsmethod = "central".
 tsmethod character giving two-sided method
 ... Currently ignored..

Value

a list with values
 midp
 tsmethod

See Also

[poisson.exact](#)

| | |
|----------|-------------------------------------------------------------------------------------------------------------|
| downs.mi | <i>Downs' syndrome cases and of total live births by maternal age and birth order, Michigan, 1950-1964.</i> |
|----------|-------------------------------------------------------------------------------------------------------------|

Description

This data reproduces table 14.4 in Fleiss (1981) and which is drawn from a large-scale study in Michigan 1950-1964 of the effect of Maternal age and Birth order on Down Syndrome and Leukemia (Stark and Mantell, 1966).

Usage

downs.mi

Format

This data.frame contains the following columns:

Age The age category of the mothers.

BirthOrder The birth order.

Cases The number of cases of Down's Syndrome.

Births The number of live births.

Standard A "standard" population, derived as the total number of births in each age category

Source

The data were obtained from table 14.4 (p 249) in

Fleiss, JL (1981) *Statistical Methods for Rates and Proportions*, Wiley, New York.

The original study is

Stark CR and Mantel N (1966) 'Effects of maternal age and birth order on the risk of mongolism and leukemia' *J Natl Cancer Inst* **37** (5) 687–698. [doi:10.1093/jnci/37.5.687](https://doi.org/10.1093/jnci/37.5.687)

| | |
|---------|----------------------------------------------------------------------|
| dsrTest | <i>Tests and Confidence Intervals on Directly Standardized Rates</i> |
|---------|----------------------------------------------------------------------|

Description

A number of methods have been proposed for calculating confidence intervals for directly standardized rates. Ng et al (2008), compare a number of methods, some of which are implemented here. The default uses the Gamma method by Fay and Feuer (1997) and implemented in [wspoissonTest](#).

Usage

```
dstrTest(
  x,
  n,
  w,
  null.value = NULL,
  alternative = c("two.sided", "less", "greater"),
  conf.level = 0.95,
  mult = 1,
  method = c("gamma", "asymptotic", "dobson", "beta", "bootstrap"),
  control = list()
)
```

Arguments

| | |
|-------------|---------------------------------------------------------------------------------------------------------------------|
| x | a vector of strata-specific counts. |
| n | a vector of strata-specific time bases for counts. |
| w | a vector of strata-specific weights (or standard populations). |
| null.value | a null hypothesis value of the directly rate, if NULL no test is done. If not NULL, provide in rate per mult. |
| alternative | type of alternative hypothesis. |
| conf.level | confidence level for the returned confidence interval. |
| mult | a factor to multiply the estimate and confidence intervals by, to give rates per mult. |
| method | Method used to perform the test and construct the confidence interval. See details. |
| control | list of arguments / type of modification used for each method. See details and relevant "xxxxControl" documentation |

Details

Five classes of method have been implemented here:

"gamma" Calls [wspoissonTest](#). By default uses the Gamma Method proposed by Fay and Feuer (1997). Modifications proposed by Tiwari et al (2006) and Fay and Kim (2017) also implemented - see [gammaControl](#).

"asymptotic" Using the normal approximation of the MLE or transformed MLE distribution - see [asymptoticControl](#)

"dobson" Uses the method proposed by Dobson et al (1991). Estimating the confidence interval on the unweighted sum is done by calling [poisson.exact](#) - both the exact method and a mid-p method are possible - see [dobsonControl](#).

"beta" Methods based on the beta distribution by Tiwari et al (2006) - see [betaControl](#).

"bootstrap" Approximate Bootstrap method by Swift (1995). P-values are estimated by solving for p.

For each method there is a control function that will return a list of parameters that can be used to define sub-types of each of the broad groups

Value

a list with class "htest" containing the following components:

| | |
|-------------|------------------------------------------------------------|
| statistic | number of strata or summands: $k = \text{length}(x)$ |
| parameter | mult |
| p.value | p-value, set to NA if null.value = NULL |
| conf.int | confidence interval on the true directly standardized rate |
| estimate | directly standardized rate |
| null.value | null hypothesis value for the DSR |
| alternative | alternative hypothesis type |
| method | description of the method |
| data.name | description of the data |

References

- Dobson, AJ, Kuulasmaa, K, Eberle, E and Scherer, J (1991) 'Confidence intervals for weighted sums of Poisson parameters', *Statistics in Medicine*, **10**: 457–462. doi:10.1002/sim.4780100317
- Swift, MB (1995). 'Simple confidence intervals for standardized rates based on the approximate bootstrap method', *Statistics in Medicine*, **14**, 1875–1888. doi:10.1002/sim.4780141704.
- Fay MP & Feuer EJ (1997). 'Confidence intervals for directly standardized rates: a method based on the gamma distribution. *Statistics in Medicine**. **16**: 791–801. doi:10.1002/(sici)10970258(19970415)16:7<791::aid-sim500>3.0.co;2#
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See Also

[wspoissonTest](#), [poisson.exact](#), [gammaControl](#), [dobsonControl](#), [asymptoticControl](#), [betaControl](#)

gammaControl

Control Function for Gamma Method Confidence Intervals

Description

Provides a list of arguments to pass to [wspoissonTest](#).

Usage

```
gammaControl(
  midp = FALSE,
  nmc = 0,
  wmtype = c("max", "mean", "minmaxavg", "tcz"),
  unirootTolFactor = 1e-06,
  ...
)
```

Arguments

| | |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------|
| <code>midp</code> | logical. Use mid-p confidence distribution method? Currently only implemented where <code>wmtype = "max"</code> |
| <code>nmc</code> | Calculation method when <code>midp = TRUE</code> . |
| <code>wmtype</code> | type of modification for the Gamma confidence interval. |
| <code>unirootTolFactor</code> | tolerance factor for <code>uniroot</code> where <code>midp = TRUE</code> and <code>nmc = 0</code> . |
| <code>...</code> | Currently ignored. |

Value

A list of arguments to pass to [wspoissonTest](#).

If `midp = TRUE`, with values

`midp`
`nmc`
`unirootTolFactor`

If `midp = FALSE`, with values:

`wmtype`

See Also

[wspoissonTest](#)

Index

* **datasets**

downs.mi, 6

* **package**

dsrTest-package, 2

asymptoticControl, 4, 7, 8

betaControl, 4, 7, 8

dobsonControl, 5, 7, 8

downs.mi, 6

dsrTest, 6

dsrTest-package, 2

gammaControl, 4, 7, 8, 8

poisson.exact, 5, 7, 8

wspoissonTest, 3, 6–9