Package 'dsrTest'

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Type Package

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

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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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R topics documented:

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dsrTest-package   *Tests and Confidence Intervals on Directly Standardized Rates for Several Methods*

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:

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Version:	1.0.0
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VignetteBuilder:	knitr
LazyData:	true

Index of help topics:

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                       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   *Control Function for Asymptotic Method Confidence Intervals*

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   *Control Function for Beta Method for Confidence Intervals*

Description

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

Usage

```
betaControl(wmtype = 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

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dobsonControl	*Control Function for Dobson Method Confidence Intervals*

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`

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downs.mi   *Downs' syndrome cases and of total live births by maternal age and*
                                      birth order, Michigan, 1950-1964.

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

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dsrTest   *Tests and Confidence Intervals on Directly Standardized Rates*

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

```
dsrTest(
  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 = 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

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See Also

wspoissonTest, poisson.exact, gammaControl, dobsonControl, asymptoticControl, betaControl

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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

`midp`	logical. Use mid-p confidence distribution method? Currently only implemented where wmtype = ″max″
`nmc`	Calculation method when `midp = TRUE`.
`wmtype`	type of modification for the Gamma confidence interval.
`unirootTolFactor`	
	tolerance factor for uniroot where `midp = TRUE` and `nmc = 0`.
`...`	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`](#)

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