Package ‘WRestimates’

January 20, 2025

Type Package

Title Sample Size, Power and CI for the Win Ratio

Version 0.1.0

Description Calculates non-parametric estimates of the sample size, power and confidence intervals for the win-ratio. For more detail on the theory behind the methodologies implemented see Yu, R. X. and Ganju, J. (2022) <doi:10.1002/sim.9297>.

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Encoding UTF-8

RoxygenNote 7.2.3

Suggests knitr, rmarkdown

Language en-US

VignetteBuilder knitr

NeedsCompilation no

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Repository CRAN

Date/Publication 2023-12-06 16:10:02 UTC

Contents

wr.ci — *Confidence Interval (CI) for Win Ratio*

Description

Calculate the confidence interval for a win ratio.

$$CI = exp((ln(WR) + / - Z\sqrt{var})$$

Where;

$ln(WR)$ = Natural log of the true or assumed win ratio.

Z = Z-score from normal distribution.

$\sqrt{var}$ = Standard deviation of the natural log of the win ratio.

Usage

```
wr.ci(WR = 1, Z = 1.96, var.ln.WR, N, sigma.sqr, k, p.tie)
```

Arguments

`WR`	Win ratio; Default: `WR` = 1 for an assumed true win ratio where H₀ is assumed true.
`Z`	Z-score from normal distribution; Default: `Z` = 1.96 for a 95% CI.
`var.ln.WR`	Variance of the natural log (ln) of the win ratio.
`N`	Sample size.
`sigma.sqr`	Population variance of the natural log (ln) of the win ratio.
`k`	The proportion of subjects allocated to one group i.e. the proportion of patients allocated to treatment.
`p.tie`	The proportion of ties.

Value

`wr.ci` returns an object of class `"list"` containing the following components:

`ci`	The confidence interval of a win ratio.
`WR`	The win ratio.
`Z`	Z-score from normal distribution.
`var.ln.WR`	Variance of the natural log (ln) of the win ratio.
`N`	Sample size.
`sigma.sqr`	Population variance of the natural log (ln) of the win ratio.
`k`	The proportion of subjects allocated to one group.
`p.tie`	The proportion of ties.

Author(s)

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References

Yu, R. X. and Ganju, J. (2022). Sample size formula for a win ratio endpoint. *Statistics in medicine*, *41*(6), 950-963. doi:10.1002/sim.9297.

See Also

`wr.sigma.sqr`; `wr.var`

Examples

```
## N = 100 patients, 1:1 allocation, one-sided alpha = 2.5%, power = 90%
## (beta = 10%), a small proportion of ties p.tie = 0.1, and 50% more wins
## on treatment than control.

### Calculation 95% CI
wr.ci(N = 100, WR = 1.5, k = 0.5, p.tie = 0.1)
```

`wr.power` *Power of a Win Ratio*

Description

Calculate the power of a win ratio.

$$Power = 1 - \Phi(Z[\alpha] - ln(WR[true])(\sqrt{N}/\sigma))$$

Usage

```
wr.power(N, alpha = 0.025, WR.true = 1, sigma.sqr, k, p.tie)
```

Arguments

`N`	Sample size.
`alpha`	Level of significance (Type I error rate); Default: α = 0.025.
`WR.true`	True or assumed win ratio; Default: `WR.true = 1` where H₀ is assumed true.
`sigma.sqr`	Population variance of the natural log (ln) of the win ratio.
`k`	The proportion of subjects allocated to one group i.e. the proportion of patients allocated to treatment.
`p.tie`	The proportion of ties.

Value

wr.power returns an object of class "list" containing the following components:

power	Power of the win ratio.
N	Sample size.
alpha	Level of significance.
WR.true	True or assumed win ratio.
sigma.sqr	Population variance of the natural log (ln) of the win ratio.
k	The proportion of subjects allocated to one group.
p.tie	The proportion of ties.

Author(s)

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References

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See Also

wr.sigma.sqr

Examples

```
## N = 100 patients, 1:1 allocation, one-sided alpha = 2.5%, small
## proportion of ties p.tie = 0.1, and 50% more wins on treatment
## than control.

### Calculate the Power
wr.power(N = 100, WR.true = 1.5, k = 0.5, p.tie = 0.1)
```

---

wr.sigma.sqr *Assumed Population Variance of a Win Ratio*

Description

Calculate the assumed population variance of a win ratio.

$$\sigma^2 = (4 * (1 + p[tie]))/(3 * k * (1 - k) * (1 - p[tie])$$

Where;

$$p[tie] = Theproportionofties.$$

$$k = Theproportionofsubjectsallocatedtoonegroup.$$

Usage

```
wr.sigma.sqr(k, p.tie)
```

Arguments

`k`	The proportion of subjects allocated to one group i.e. the proportion of patients allocated to treatment.
`p.tie`	The proportion of ties.

Value

`wr.sigma.sqr` returns an object of class `"list"` containing the following components:

`sigma.sqr`	Population variance of the natural log (ln) of the win ratio.
`k`	The proportion of subjects allocated to one group.
`p.tie`	The proportion of ties.

Author(s)

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References

Yu, R. X. and Ganju, J. (2022). Sample size formula for a win ratio endpoint. *Statistics in medicine*, *41*(6), 950-963. doi: 10.1002/sim.9297.

See Also

`wr.var`

`wr.ss` *Approximate Sample Size of a Win Ratio*

Description

Calculates the approximate required sample size of a win ratio.

$$N \quad (\sigma^2 * (Z[1-\alpha] + Z[1-\beta])^2)/(ln^2(WR[true]))$$

Usage

```
wr.ss(alpha = 0.025, beta = 0.1, WR.true = 1, k, p.tie, sigma.sqr)
```

Arguments

`alpha`	Level of significance (Type I error rate); Default: α = 0.025.
`beta`	Type II error rate; Default: β = 0.1.
`WR.true`	True or assumed win ratio; Default: `WR.true = 1` where H₀ is assumed true.
`k`	The proportion of subjects allocated to one group i.e. the proportion of patients allocated to treatment.
`p.tie`	The proportion of ties.
`sigma.sqr`	Population variance of the natural log (ln) of the win ratio.

Value

`wr.ss` returns an object of class `"list"` containing the following components:

`N`	Sample size.
`alpha`	Level of significance (Type I error rate).
`beta`	Type II error rate.
`WR.true`	True or assumed win ratio.
`k`	The proportion of subjects allocated to one group.
`p.tie`	The proportion of ties.
`sigma.sqr`	Population variance of the natural log (ln) of the win ratio.

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See Also

`wr.sigma.sqr`

Examples

```
## 1:1 allocation, one-sided alpha = 2.5%, power = 90% (beta = 10%),
## a small proportion of ties p.tie = 0.1, and 50% more wins on treatment
## than control

### Calculate Sample Size
wr.ss(WR.true = 1.5, k = 0.5, p.tie = 0.1)
```

wr.var — *Approximate Variance of the Natural Log (ln) of the Win Ratio.*

Description

Calculating the approximate variance of the natural log (ln) a win ratio.

$$Var(ln(WR))\ \ \sigma^2/N$$

Where;

$$\sigma^2 = (4 * (1 + p[tie]))/(3 * k * (1 - k) * (1 - p[tie])$$

Usage

```
wr.var(N, sigma.sqr, k, p.tie)
```

Arguments

`N`	Sample size.
`sigma.sqr`	Population variance of the natural log (ln) of the win ratio.
`k`	The proportion of subjects allocated to one group i.e. the proportion of patients allocated to treatment.
`p.tie`	The proportion of ties.

Value

`wr.var` returns an object of class `"list"` containing the following components:

`var.ln.WR`	Approximate variance of the natural log (ln) a win ratio.
`N`	Sample size.
`sigma.sqr`	Population variance of the natural log (ln) of the win ratio.
`k`	The proportion of subjects allocated to one group.
`p.tie`	The proportion of ties.

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References

Yu, R. X. and Ganju, J. (2022). Sample size formula for a win ratio endpoint. *Statistics in medicine*, *41*(6), 950-963. doi: 10.1002/sim.9297.

See Also

`wr.sigma.sqr`

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