

Package ‘frequentistSSD’

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Type Package

Title Screened Selection Design with Survival Endpoints

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Description A study based on the screened selection design (SSD) is an exploratory phase II randomized trial with two or more arms but without concurrent control. The primary aim of the SSD trial is to pick a desirable treatment arm (e.g., in terms of the median survival time) to recommend to the subsequent randomized phase IIb (with the concurrent control) or phase III. Though The survival endpoint is often encountered in phase II trials, the existing SSD methods cannot deal with the survival endpoint. Furthermore, the existing SSD won't control the type I error rate. The proposed designs can “partially” control or provide the empirical type I error/false positive rate by an optimal algorithm (implemented by the `optimal()` function) for each arm. All the design needed components (sample size, operating characteristics) are supported.

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Depends survival

NeedsCompilation no

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get_oc	<i>Generate operating characteristics for Two-Stage Screened Selection Design for Randomized Phase II Trials with Time-to-Event Endpoints</i>
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Description

Obtain the operating characteristics of Two-Stage Screened Selection Design for Randomized Phase II Trials with Time-to-Event Endpoints. The arguments for this function are from outputs of the functions of `optimal()` and `sample_size()`

Usage

```
get_oc(shape, m0, mA, hr, frac, ta, tf, c1, c,
       diff, n, nsim, seed = 2483)
```

Arguments

shape	the shape parameter of weibull distribution
m0	the median survival time of historical data
mA	the median survival time of arm A
hr	the hazard ratio of arm B to arm A
frac	the ratio of sample size in stage 1 compared to total sample size (e.g., n1/n)
ta	the accrual duration
tf	the follow-up duration
c1	the critical value at stage 1
c	the critical value at stage 2
diff	the equivalence margin
n	the total sample size for each arm
nsim	the number of simulated trials
seed	the seed. The default value is seed = 2483

Value

`get_oc()` returns: (1) n: total sample size for each arm (2) SSD.Arm.A: selection probability of Arm A (3) SSD.Arm.B: selection probability of Arm B (4) SSD.No.Arm: the probability of no arms selected (5) diff: the equivalence margin (6) Mean.N.Arm.A: the average number of patients allocated to Arm A (7) Mean.N.Arm.B: the average number of patients allocated to Arm B

Author(s)

Chia-Wei Hsu, Haitao Pan, Jianrong Wu

References

Jianrong Wu, Haitao Pan, Chia-Wei Hsu (2021). "Two-Stage Screened Selection Designs for Randomized Phase II Trials with Time-to-Event Endpoints." Submitted

Examples

```
## c1, n, c they all come from optimal function. Details are shown as follows:
## Not run: optimal(shape = 1, m0 = 1, ms = 2.4, tf = 3,
                    ta = 24, tot_size = 19, dist = "WB")
| alpha | beta | n1 | c1 | n | c | t1 | MTSL | ESS | PS
| 0.05 | 0.08 | 15 | 0.0508 | 19 | 1.6434 | 17.9751 | 27 | 16.5183 | 0.5203

## End(Not run)

get_oc(shape = 1, m0 = 1, mA = 2.4, hr = 0.6, frac = 15/19,
        ta = 24, tf = 3, c1 = 0.0508, c = 1.6434,
        diff = 0.25, n = 19, nsim = 10000)
```

get_oc_3arm	<i>Generate operating characteristics for Two-Stage Screened Selection Design for Randomized Phase II Trials with Time-to-Event Endpoints for 3 arms</i>
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Description

Obtain the operating characteristics of Two-Stage Screened Selection Design for Randomized Phase II Trials with Time-to-Event Endpoints for 3 arms. The arguments for this function are from outputs of the functions of `optimal()` and `sample_size_3arm()`

Usage

```
get_oc_3arm(shape, m0, mA, hr2, hr3, frac, ta, tf, c1, c,
            diff, n, nsim, seed = 2483)
```

Arguments

shape	the shape parameter of weibull distribution
m0	the median survival time of historical data
mA	the median survival time of arm A
hr2	the hazard ratio of arm B to arm A
hr3	the hazard ratio of arm C to arm A
frac	the ratio of sample size in stage 1 compared to total sample size (e.g., n_1/n)
ta	the accrual duration
tf	the follow-up duration
c1	the critical value at stage 1

c	the critical value at stage 2
diff	the equivalence margin
n	the total sample size for each arm
nsim	the number of simulated trials
seed	the seed. The default value is seed = 2483

Value

get_oc_3arm() returns: (1) n: total sample size for each arm (2) SSD.Arm.A: selection probability of Arm A (3) SSD.Arm.B: selection probability of Arm B (4) SSD.Arm.C: selection probability of Arm C (5) SSD.No.Arm: the probability of no arms selected (6) diff: the equivalence margin (7) Mean.N.Arm.A: the average number of patients allocated to Arm A (8) Mean.N.Arm.B: the average number of patients allocated to Arm B (9) Mean.N.Arm.C: the average number of patients allocated to Arm C

Author(s)

Chia-Wei Hsu, Haitao Pan, Jianrong Wu

References

Jianrong Wu, Haitao Pan, Chia-Wei Hsu (2021). "Two-Stage Screened Selection Designs for Randomized Phase II Trials with Time-to-Event Endpoints." Submitted

Examples

```
## c1, n, c they all come from optimal function. Details are shown as follows:
## Not run: optimal(shape = 1, m0 = 1, ms = 2, tf = 3,
##              ta = 24, tot_size = 21, dist = "WB")
| alpha | beta | n1 |   c1   | n |   c   | t1   | MTSL | ESS   | PS
| 0.05 | 0.14 | 16 | -0.0463 | 21 | 1.644 | 17.8248 | 27 | 18.3983 | 0.4815

## End(Not run)

get_oc_3arm(shape = 1, m0 = 1, mA = 2, hr2 = 1, hr3 = 0.6,
            frac = 16/21, ta = 24, tf = 3, c1 = -0.0463,
            c = 1.644, diff = 0, n = 21, nsim = 10000,
            seed = 2483)
```

optimal

Find optimal parameters

Description

Find the optimal parameters used in the get_oc() function

Usage

```
optimal(shape, m0, ms, tf, ta,
        tot_size, dist)
```

Arguments

shape	the shape parameter of weibull distribution
m0	the median survival time of historical data
ms	the minimal clinical meaningful median survival time
tf	the follow-up duration
ta	the accrual duration
tot_size	the required sample size for each arm
dist	the distribution

Value

optimal() returns a list containing two blocks:

\$param: (1) S0: historical survival probability at the landmark time point x0 (2) hr: hazard ratio of the hypothetical arm with “minimal clinical meaningful median survival time” to the historical arm (3) rate: accrual rate (calculated as tot_size/ta)

\$Two_stage: (1) alpha: type I error (2) beta: type II error (3) n1: the required sample size for the first stage (4) c1: the cutoff point at the first stage (5) n: the required sample size for each arm (is equal to tot_size) (6) c: the cutoff point at the final stage (7) t1: the expected time of interim analysis (first stage) (8) MTSL: the maximum total study length (ta + tf) (9) ESS: the expected sample size for each arm (10) PS: the probability of early stopping

Note

(1) For optimal() function, if the ms is set to be equal to the less effective arm (e.g., say, the arm A is less effective than the arm B), with the rationale, by this way, the computed boundaries, c1, n1, c, would control the pre-specified type I (since both arms A and B are all under the same null case) while the power for the better arm B, would have at least pre-specified power 1-beta

(2) optimal() function will be applied to either two or three-arm cases to find the optimal cutoff boundaries, c1, n1, c

Author(s)

Chia-Wei Hsu, Haitao Pan, Jianrong Wu

References

Jianrong Wu, Haitao Pan, Chia-Wei Hsu (2021). "Two-Stage Screened Selection Designs for Randomized Phase II Trials with Time-to-Event Endpoints." Submitted

Examples

```
## For 2 arms
## Not run:
shape <- 1
m0 <- 1
ms <- 2.4
tf <- 3
ta <- 24
tot_size <- 19
dist <- "WB"

optimal(shape = shape, m0 = m0, ms = ms, tf = tf,
        ta = ta, tot_size = tot_size, dist = dist)

## End(Not run)

## For 3 arms
## Not run:
shape <- 1
m0 <- 1
ms <- 2
tf <- 3
ta <- 24
tot_size <- 21
dist <- "WB"

optimal(shape = shape, m0 = m0, ms = ms, tf = tf,
        ta = ta, tot_size = tot_size, dist = dist)

## End(Not run)
```

sample_size	<i>Calculate the sample size for each arm</i>
-------------	---

Description

Calculate the sample size for each arm in a two-arm trial

Usage

```
sample_size(kappa, mA, hr, ta, tf, diff, P)
```

Arguments

- kappa the shape parameter of weibull distribution
- mA the median survival time of arm A
- hr the hazard ratio of arm B to arm A
- ta the accrual duration

tf	the follow-up duration
diff	the equivalence margin
P	the chance of correctly selecting the superior arm

Value

sample_size() returns required sample size for each arm

Author(s)

Chia-Wei Hsu, Haitao Pan, Jianrong Wu

References

Jianrong Wu, Haitao Pan, Chia-Wei Hsu (2021). "Two-Stage Screened Selection Designs for Randomized Phase II Trials with Time-to-Event Endpoints." Submitted

Examples

```
sample_size(kappa = 1, mA = 2.4, hr = 0.60, ta = 24,
            tf = 3, diff = 0.25, P = 0.9)
```

sample_size_3arm	<i>Calculate the sample size for each arm</i>
------------------	---

Description

Calculate the sample size for each arm in a three-arm trial

Usage

```
sample_size_3arm(kappa, m0, mA, mB, delta, ta, tf, P, diff)
```

Arguments

kappa	the shape parameter of weibull distribution
m0	the median survival time of historical control with respect to both arm A, B and C
mA	the median survival time of arm A
mB	the median survival time of arm B
delta	the hazard ratio of arm C to arm A
ta	the accrual duration
tf	the follow-up duration
P	the chance of correctly selecting the superior arm
diff	the equivalence margin

Value

sample_size_3arm() returns required sample size for each arm

Author(s)

Chia-Wei Hsu, Haitao Pan, Jianrong Wu

References

Jianrong Wu, Haitao Pan, Chia-Wei Hsu (2021). "Two-Stage Screened Selection Designs for Randomized Phase II Trials with Time-to-Event Endpoints." Submitted

Examples

```
sample_size_3arm(kappa = 1, m0 = 1, mA = 2, mB = 2, delta = 0.6,
                 ta = 24, tf = 3, P = 0.90, diff = 0)
```

```
sample_size_3arm(kappa = 1, m0 = 1, mA = 2, mB = 2, delta = 0.6,
                 ta = 24, tf = 3, P = 0.90, diff = 0.25)
```

sampsiz_1stage_2arm *Calculate the sample size for each arm*

Description

Provide the required sample size (per arm) based on the one-stage selection design given the type I error rate and power. Details see the reference paper

Usage

```
sampsiz_1stage_2arm(kappa, alpha, beta, m0, m1, ta, tf, delta)
```

Arguments

kappa	the shape parameter of weibull distribution
alpha	type I error rate
beta	type II error rate
m0	the median survival time of historical control with respect to both arm A and B
m1	the median survival time of arm A
ta	the accrual duration
tf	the follow-up duration
delta	the hazard ratio of arm B to arm A

Value

sampsiz_1stage_2arm() returns required sample size for each arm

Author(s)

Chia-Wei Hsu, Haitao Pan, Jianrong Wu

References

Jianrong Wu, Haitao Pan, Chia-Wei Hsu (2021). "Two-Stage Screened Selection Designs for Randomized Phase II Trials with Time-to-Event Endpoints." Submitted

Examples

```
sampsize_1stage_2arm(kappa = 1, alpha = 0.05, beta = 0.1, m0 = 1,  
                     m1 = 2.5, delta = 0.65, ta = 24, tf = 9)
```

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