Package: gsMAMS (via r-universe)

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Title Group Sequential Designs of Multi-Arm Multi-Stage Trials

Version 0.7.2

Imports mvtnorm, stats, survival

Description It provides functions to generate operating characteristics and to calculate Sequential Conditional Probability Ratio Tests (SCPRT) efficacy and futility boundary values along with sample/event size of Multi-Arm Multi-Stage (MAMS) trials for different outcomes. The package is based on Jianrong Wu, Yimei Li, Liang Zhu (2023) <doi:10.1002/sim.9682>, Jianrong Wu, Yimei Li (2023) ``Group Sequential Multi-Arm Multi-Stage Survival Trial Design with Treatment Selection'' (Manuscript accepted for publication) and Jianrong Wu, Yimei Li, Shengping Yang (2023) ``Group Sequential Multi-Arm Multi-Stage Trial Design with Ordinal Endpoints'' (In preparation).

License GPL-3

Encoding UTF-8

Roxygen list(markdown = TRUE)

RoxygenNote 7.3.1

Suggests knitr, rmarkdown, testthat (>= 3.0.0)

Config/testthat/edition 3

VignetteBuilder knitr

URL https://github.com/Tpatni719/gsMAMS

BugReports https://github.com/Tpatni719/gsMAMS/issues

Repository https://tpatni719.r-universe.dev

RemoteUrl https://github.com/tpatni719/gsmams

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design_cont  Design the clinical trial for continuous outcome

Description

This function generates the design parameters of a clinical trial for continuous outcome.

Usage

design_cont(delta0, delta1, alpha, beta, k, frac)

Arguments

delta0           numeric Standardized effect size in ineffective arm.
delta1           numeric Standardized effect size in effective arm.
alpha            numeric Type I error.
beta             numeric Type II error.
k                numeric Number of treatment arms.
frac             numeric Vector of fractions for information time at each look.

Value

List of cumulative sample size for each stage of treatment and control groups along with maximum total sample size of the trial. It also provides efficacy and futility boundaries of the trial.

Examples

design_cont(delta0 = 0.178, delta1 = 0.545, alpha = 0.05, beta = 0.1, k = 4, frac = c(1 / 2, 1))
**Description**

This function generates the design parameters of a clinical trial for ordinal outcome.

**Usage**

```r
design_ord(alpha, beta, k, prob, or0, or, frac)
```

**Arguments**

- `alpha`: numeric Type I error.
- `beta`: numeric Type II error.
- `k`: numeric Number of treatment arms.
- `prob`: numeric Probability of ordinal outcomes in control group.
- `or0`: numeric Odds ratio of ineffective treatment group vs control.
- `or`: numeric Odds ratio of effective treatment group vs control.
- `frac`: numeric Vector of fractions for information time at each look.

**Value**

List of cumulative sample size for each stage of treatment and control groups along with maximum total sample size of the trial. It also provides efficacy and futility boundaries of the trial.

**Examples**

```r
design_ord(alpha = 0.05,
           beta = 0.1,
           k = 4,
           prob = c(0.075, 0.182, 0.319, 0.243, 0.015, 0.166),
           or = 3.06,
           or0 = 1.32,
           frac = c(1/2, 1))
```
design_surv

Design the clinical trial for survival outcome

Description

This function generates the design parameters of a clinical trial for survival outcome.

Usage

design_surv(m0, alpha, beta, k, hr0, hr1, ta, tf, kappa, eta, frac)

Arguments

m0 numeric Median survival time of control group.
alpha numeric Type I error.
beta numeric Type II error.
k numeric Number of treatment arms.
hr0 numeric Hazard ratio of ineffective treatment group vs control.
hr1 numeric Hazard ratio of effective treatment group vs control.
ta numeric Accrual time.
rf numeric Follow-up time.
kappa numeric Shape parameter (kappa=1 for exponential distribution).
eta numeric Rate of loss to follow-up.
frac numeric Vector of fractions for information time at each look.

Value

List of cumulative number of events for each stage of combined treatment and control groups along with total number of subjects and maximum total number of events for the trial. It also provides efficacy and futility boundaries of the trial.

Examples

design_surv(m0 = 20,
hr0 = 1,
hr1 = 0.65,
ta = 20,
tf = 40,
alpha = 0.05,
beta = 0.1,
k = 3,
kappa = 1,
eta = 0,
frac = c(1 / 2, 1))
**op_fwer_cont**

*Provides operating characteristics of group sequential MAMS trial for continuous outcome under null hypothesis*

**Description**

Computes FWER and other characteristics for group-sequential MAMS trial for continuous outcome.

**Usage**

```r
op_fwer_cont(alpha, beta, p, frac, delta0, delta1, nsim, seed)
```

**Arguments**

- `alpha` numeric Type I error.
- `beta` numeric Type II error.
- `p` numeric Number of treatment arms.
- `frac` numeric vector of fractions for information time at each look.
- `delta0` numeric Standardized effect size in ineffective arm.
- `delta1` numeric Standardized effect size in effective arm.
- `nsim` numeric Number of simulations.
- `seed` numeric Random seed number.

**Value**

A list of FWER, stage-wise type I error, average sample size used per arm, stopping probability, probability of futility.

**Examples**

```r
op_fwer_cont(alpha=0.05, beta=0.1, p=2, frac=c(0.5, 1), delta0=0.178, delta1=0.545, nsim=15, seed=1)
```

---

**op_fwer_ord**

*Provides operating characteristics of group sequential MAMS trial for ordinal outcome under null hypothesis*

**Description**

Computes FWER and other characteristics for group-sequential MAMS trial for ordinal outcome.

**Usage**

```r
op_fwer_ord(alpha, beta, p, frac, or0, or, nsim, prob, seed)
```
Arguments

- **alpha**: numeric Type I error.
- **beta**: numeric Type II error.
- **p**: numeric Number of treatment arms.
- **frac**: numeric vector of fractions for information time at each look.
- **or0**: numeric Odds ratio of ineffective treatment group vs control.
- **or**: numeric Odds ratio of effective treatment group vs control.
- **nsim**: numeric Number of simulations.
- **prob**: numeric Probability of ordinal outcomes in control group.
- **seed**: numeric Random seed number.

Value

A list of FWER, stage-wise type I error, average sample size used per arm, stopping probability, probability of futility.

Examples

```r
op_fwer_ord(alpha = 0.05,
            beta = 0.1,
            p = 4,
            frac = c(0.5, 1),
            or0 = 1.32,
            or = 3.06,
            nsim = 15,
            prob = c(0.075, 0.182, 0.319, 0.243, 0.015, 0.166),
            seed = 13)
```

---

**op_fwer_surv**

*Provides operating characteristics of group sequential MAMS trial for survival outcome under null hypothesis*

Description

Computes FWER and other characteristics for group-sequential MAMS trial for survival outcome.

Usage

```r
op_fwer_surv(m0,  
             alpha,  
             beta,  
             p,  
             frac,  
             hr0,  
```
Arguments

- `m0` numeric Median survival time in control group.
- `alpha` numeric Type I error.
- `beta` numeric Type II error.
- `p` numeric Number of treatment arms.
- `frac` numeric Vector of fractions for information time at each look.
- `hr0` numeric Hazard ratio of ineffective treatment group vs control.
- `hr1` numeric Hazard ratio of effective treatment group vs control.
- `nsim` numeric Number of simulations.
- `ta` numeric Accrual time.
- `tf` numeric Follow-up time.
- `kappa` numeric Shape parameter (Kappa=1 for exponential distribution).
- `eta` numeric Rate of loss to follow-up.
- `seed` numeric Random seed number.

Value

A list of FWER, stage-wise type I error, stopping probability, probability of futility, average number of events happened per arm, average duration of trial.

Examples

```r
op_fwer_surv(m0 = 20, alpha = 0.05, beta = 0.1, p = 4, frac = c(1/2, 1), hr0 = 1, hr1 = 0.75, nsim = 12, ta = 40, tf = 20, kappa = 1, eta = 0, seed = 12)
```
op_power_cont

Provides operating characteristics of group sequential MAMS trial for continuous outcome

Description
Computes power and other characteristics for group-sequential MAMS trial for continuous outcome.

Usage
op_power_cont(alpha, beta, p, frac, delta0, delta1, nsim, seed)

Arguments
- alpha: numeric Type I error.
- beta: numeric Type II error.
- p: numeric Number of treatment arms.
- frac: numeric Vector of fractions for information time at each look.
- delta0: numeric Standardized effect size in ineffective arm.
- delta1: numeric Standardized effect size in effective arm.
- nsim: numeric Number of simulations.
- seed: numeric Random seed number.

Value
A list of power, stage-wise probability of success, average sample size used per arm, stopping probability, probability of futility.

Examples
op_power_cont(alpha = 0.05,  
               beta = 0.1, 
               p = 4, 
               frac = c(1 / 5, 2 / 5, 3 / 5, 4 / 5, 1), 
               delta0 = 0.178, 
               delta1 = 0.545, 
               nsim = 12, 
               seed = 12)
op_power_ord

Provides operating characteristics of group sequential MAMS trial for ordinal outcome

Description
Computes power and other characteristics for group-sequential MAMS trial for ordinal outcome.

Usage
op_power_ord(alpha, beta, p, frac, or0, or, nsim, prob, seed)

Arguments
- alpha: numeric Type I error.
- beta: numeric Type II error.
- p: numeric Number of treatment arms.
- frac: numeric Vector of fractions for information time at each look.
- or0: numeric Odds ratio of ineffective treatment group vs control.
- or: numeric Odds ratio of effective treatment group vs control.
- nsim: numeric Number of simulations.
- prob: numeric Probability of ordinal outcomes in control group.
- seed: numeric Random seed number.

Value
A list of power, stage-wise probability of success, average sample size used per arm, stopping probability, probability of futility.

Examples
op_power_ord(alpha = 0.05,
beta = 0.1,
p = 4,
frac = c(0.5, 1),
or0 = 1.32,
or = 3.06,
nsim = 12,
prob = c(0.075, 0.182, 0.319, 0.243, 0.015, 0.166),
seed = 13)
op_power_surv  Provides operating characteristics of group sequential MAMS trial for survival outcome

Description

Computes power and other characteristics for group-sequential MAMS trial for survival outcome.

Usage

op_power_surv(
    m0, alpha, beta, p, frac, hr0, hr1, nsim, ta, tf, kappa, eta, seed
)

Arguments

m0  numeric Median survival time of control group.
alpha  numeric Type I error.
beta  numeric Type II error.
p  numeric Number of treatment arms.
frac  numeric Vector of fractions for information time at each look.
hr0  numeric Hazard ratio of ineffective treatment group vs control.
hr1  numeric Hazard ratio of effective treatment group vs control.
nsim  numeric Number of simulations.
ta  numeric Accrual time.
 tf  numeric Follow-up time.
kappa  numeric Shape parameter (kappa=1 for exponential distribution).
eta  numeric Rate of loss to follow-up.
seed  numeric Random seed number.
Value

A list of power, stage-wise probability of success, stopping probability, probability of futility, average number of events happened per arm, average duration of trial.

Examples

```r
op_power_surv(m0 = 20,
    alpha = 0.05,
    beta = 0.1,
    p = 4,
    frac = c(1 / 2, 1),
    hr0 = 1,
    hr1 = 0.74,
    ta = 12,
    tf = 40,
    nsim = 20,
    kappa = 1,
    eta = 0,
    seed = 12)
```
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