Package 'gsMAMS'

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

Version 0.7.1

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).

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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`	Standardized effect size in ineffective arm.
`delta1`	Standardized effect size in effective arm.
`alpha`	Type I error.
`beta`	Type II error.
`K`	Number of treatment arms.
`frac`	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))
```

`design_ord` *Design the clinical trial for ordinal outcome*

Description

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

Usage

```
design_ord(alpha, beta, K, prob, or0, or, frac)
```

Arguments

alpha	Type I error.
beta	Type II error.
K	Number of treatment arms.
prob	Probability of ordinal outcomes in control group.
or0	Odds ratio of ineffective treatment group vs control.
or	Odds ratio of effective treatment group vs control.
frac	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_ord(0.05,0.1,K=4,c(0.075, 0.182, 0.319, 0.243, 0.015, 0.166),or=3.06,or0=1.32,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	Median survival time of control group.
alpha	Type I error.
beta	Type II error.
K	Number of treatment arms.
HR0	Hazard ratio of ineffective treatment group vs control.
HR1	Hazard ratio of effective treatment group vs control.
ta	Accrual time.
tf	Follow-up time.
kappa	Shape parameter (kappa=1 for exponential distribution).
eta	Rate of loss to follow-up.
frac	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

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

Arguments

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

```
op_fwer_cont(0.05,0.1,2,c(0.5,1),0.178,0.545,15,1)
```

`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

```
op_fwer_ord(alpha, beta, K, frac, or0, or, nsim, prob, seed)
```

Arguments

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

```
op_fwer_ord(0.05,0.1,4,c(0.5,1),1.32,3.06,15,c(0.075, 0.182, 0.319, 0.243, 0.015, 0.166),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

```
op_fwer_surv(
  m0,
  alpha,
  beta,
  K,
  frac,
  HR0,
  HR1,
  nsim,
  ta,
  tf,
  kappa,
  eta,
  seed
)
```

Arguments

m0	Median survival time in control group.
alpha	Type I error.
beta	Type II error.
K	Number of treatment arms.
frac	Vector of fractions for information time at each look.
HR0	Hazard ratio of ineffective treatment group vs control.
HR1	Hazard ratio of effective treatment group vs control.
nsim	Number of simulations.
ta	Accrual time.
tf	Follow-up time.
kappa	Shape parameter (Kappa=1 for exponential distribution).
eta	Rate of loss to follow-up.
seed	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

```
op_fwer_surv(20,0.05,0.1,4,c(1/2,1),1,0.75,12,40,20,1,0,12)
```

`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, K, frac, delta0, delta1, nsim, seed)
```

Arguments

`alpha`	Type I error.
`beta`	Type II error.
`K`	Number of treatment arms.
`frac`	Vector of fractions for information time at each look.
`delta0`	Standardized effect size in ineffective arm.
`delta1`	Standardized effect size in effective arm.
`nsim`	Number of simulations.
`seed`	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(0.05,0.1,4,c(1/5,2/5,3/5,4/5,1),0.178,0.545,12,12)
```

`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, K, frac, or0, or, nsim, prob, seed)
```

Arguments

alpha	Type I error.
beta	Type II error.
K	Number of treatment arms.
frac	Vector of fractions for information time at each look.
or0	Odds ratio of ineffective treatment group vs control.
or	Odds ratio of effective treatment group vs control.
nsim	Number of simulations.
prob	Probability of ordinal outcomes in control group.
seed	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(0.05,0.1,4,c(0.5,1),1.32,3.06,12,c(0.075, 0.182, 0.319, 0.243, 0.015, 0.166),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,
  K,
  frac,
  HR0,
  HR1,
  nsim,
  ta,
  tf,
  kappa,
  eta,
  seed
)
```

Arguments

m0	Median survival time of control group.
alpha	Type I error.
beta	Type II error.
K	Number of treatment arms.
frac	Vector of fractions for information time at each look.
HR0	Hazard ratio of ineffective treatment group vs control.
HR1	Hazard ratio of effective treatment group vs control.
nsim	Number of simulations.
ta	Accrual time.
tf	Follow-up time.
kappa	Shape parameter (kappa=1 for exponential distribution).
eta	Rate of loss to follow-up.
seed	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

```
op_power_surv(20,0.05,0.1,4,c(1/2,1),1,0.74,12,40,20,1,0,12)
```

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