Package ‘swdpwr’

November 7, 2020

Type Package
Title Power Calculation for Stepped Wedge Cluster Randomized Trials
Version 1.4
Date 2020-11-01
Author Jiachen Chen [cre, aut], Xin Zhou [aut], Fan Li [aut] and Donna Spiegelman [aut].
Maintainer Jiachen Chen <jiachen.chen@yale.edu>
Description To meet the needs of statistical power calculation for stepped wedge cluster randomized trials, we developed this software. Different parameters can be specified by users for different scenarios, including: cohort and cross-sectional settings, binary and continuous outcomes, marginal (GEE) and conditional (mixed effect model) methods, different link functions (identity, log, logit links), with and without time effect of treatment, etc. The methods included in this package: Zhou et al. (2020) <doi:10.1093/biostatistics/kxy031>, Li et al. (2018) <doi:10.1111/biom.12918>. Supplementary documents can be found at: <https://publichealth.yale.edu/cmips/research/software/swdpwr/>. The Shiny app for swdpwr can be accessed at: <https://jiachenchen322.shinyapps.io/swdpwr_shinyapp/>.
License GPL-3
Encoding UTF-8
LazyData TRUE
NeedsCompilation yes
Repository CRAN
Date/Publication 2020-11-07 06:20:03 UTC
RoxygenNote 6.1.99.9001

R topics documented:

  swdpwr-package ................................................. 2
  swdpower ....................................................... 3

Index 6
Description

This package includes a function `swdpower` that accounts for power calculation for stepped wedge cluster randomized trials.

Details

Package: swdpwr
Type: Package
Version: 1.4
Date: 2020-11-01
License: GPL (version 3)

Previous literature and development of software focused mainly on continuous outcomes and obtained approximation results for binary outcomes. This package implemented new methods of power calculation for stepped wedge designs with binary outcomes and also incorporated procedures for continuous outcomes. The function `swdpower` can accommodate both cross-sectional and cohort settings by specifying three levels of correlation parameters, and includes scenarios under both conditional method (mixed effect model) and marginal method (GEE), different link functions (identity, log, logit links), with or without time effect, etc. With this package, investigators can obtain more accurate calculation of statistical power, that will help a lot in the design and analysis of stepped wedge cluster randomized trials. Other supplementary documents can be found at: https://publichealth.yale.edu/cmips/research/software/swdpwr/. The Shiny app for swdpwr can be accessed at: <https://jiachenchen322.shinyapps.io/swdpwr_shinyapp/>.

Author(s)

Jiachen Chen, Xin Zhou, Fan Li and Donna Spiegelman.

Maintainer: Jiachen Chen <jiachen.chen@yale.edu>

References


Description

This function performs power calculations for stepped wedge cluster randomized trials under different scenarios.

Usage

```r
swdpower(
  K, 
  design, 
  family = "binomial", 
  model = "conditional", 
  link = "identity", 
  type = "cross-sectional", 
  meanresponse_start = NA, 
  meanresponse_end0 = meanresponse_start, 
  meanresponse_end1 = NA, 
  effectsize_beta = NA, 
  sigma2 = 0, 
  typeIerror = 0.05, 
  alpha0 = 0.1, 
  alpha1 = alpha0/2, 
  alpha2 = NA
)
```

Arguments

- **K**: number of participants at each time period in a cluster
- **design**: I*J dimensional data set that describes the study design (control 0, intervention 1), I is the number of clusters, J is the number of time periods
- **family**: family of responses, specify family="gaussian" for continuous outcome and family="binomial" for binary outcome, with default value of "binomial"
- **model**: choose from conditional model (model="conditional") and marginal model (model="marginal"), with default value of applying conditional model
- **link**: choose link function from link="identity", link="log" and link="logit", with default value of identity link
- **type**: choose the study type, specify type="cohort" for closed cohort study and type="cross-sectional" for cross-sectional study, with default value of cross-sectional study
- **meanresponse_start**: the anticipated mean response rate in the control group at the start of the study
- **meanresponse_end0**: the anticipated mean response rate in the control group at the end of the study, with default value equals to meanresponse_start (no time effects)
meanresponse_end1
the anticipated mean response rate in the intervention group at the end of the study

effectsize_beta
the anticipated effect size, just omit this parameter if you don’t need to specify it. In all scenarios, you can choose to specify the three parameters about mean responses without specifying this effect size, or alternatively specify meanresponse_start, meanresponse_end0 and this effect size. For continuous outcomes, users can conduct power calculations by only specifying this parameter without the above three parameters about mean responses (as the power is dependent just on it), then calculation will be implemented assuming scenarios without time effects. If you would consider scenarios with time effects and continuous outcomes, please specify meanresponse_start, meanresponse_end0 (do not require accurate information, just make sure they are not equal) and this effectsize_beta.

sigma2
marginal variance of the outcome (only needed for continuous outcomes and should not be an input for binary outcomes), with default value of 0.

typeIerror
two-sided type I error, with default value of 0.05

alpha0
within-period correlation, with default value of 0.1

alpha1
between-period correlation, with default value of alpha0/2

alpha2
within-individual correlation, should not be an input under cross-sectional designs although it is numerically identical to alpha1 in this scenario by definition

Value
The object returned is a list, which includes the design matrix and a summary table of this design (including the power)

Examples

library(swdpwr)
#a cross-sectional design with 12 clusters, 3 periods and binary outcomes applying conditional model
#alpha2 should not be specified, as the current version does not support power calculation using
#conditional models with binary outcomes in a cohort design
#create a 12x3 matrix which describes the study design,
#0 means control status, 1 means intervention status
dataset = matrix(c(rep(c(0,1,1),6),rep(c(0,0,1),6)),12,3,byrow=TRUE)

#specify meanresponse_start, meanresponse_end0 and meanresponse_end1
swdpower(K = 30, design = dataset, family = "binomial", model = "conditional", link = "logit",
type = "cross-sectional", meanresponse_start = 0.2, meanresponse_end0 = 0.3,
meanresponse_end1 = 0.4, typeIerror = 0.05, alpha0 = 0.01, alpha1 = 0.01)

#specify meanresponse_start, meanresponse_end0 and effectsize_beta
swdpower(K = 30, design = dataset, family = "binomial", model = "conditional", link = "logit",
type = "cross-sectional", meanresponse_start = 0.2, meanresponse_end0 = 0.3, effectsize_beta = 0.6,
typeIerror = 0.05, alpha0 = 0.01, alpha1 = 0.01)

#a cohort design with 8 clusters, 3 periods and continuous outcomes applying marginal model
#sigma2 should be specified, as continuous outcomes require marginal variance in calculation
#create a 8*3 matrix which describes the study design, 
#0 means control status, 1 means intervention status 
dataset = matrix(c(rep(c(0,1,1),4),rep(c(0,0,1),4)),8,3, byrow=TRUE)

#specify meanresponse_start, meanresponse_end0 and meanresponse_end1 
swdpower(K = 24, design = dataset, family = "gaussian", model = "marginal", link = "identity", 
type = "cohort", meanresponse_start = 0.1, meanresponse_end0 = 0.2, meanresponse_end1 = 0.4, 
sigma2 = 0.095, typeIerror = 0.05, alpha0 = 0.03, alpha1 = 0.015, alpha2 = 0.2)

#specify effectsize_beta only, then the program runs assuming no time effects 
swdpower(K = 24, design = dataset, family = "gaussian", model = "marginal", link = "identity", 
type = "cohort",effectsize_beta=0.3, sigma2 = 0.095, typeIerror = 0.05, alpha0 = 0.03, 
alpha1 = 0.015, alpha2 = 0.2)
Index

* binary and continuous outcomes
  swdpwr-package, 2

* cluster randomized trials
  swdpwr-package, 2

* cohort designs
  swdpwr-package, 2

* correlation structure
  swdpwr-package, 2

* cross-sectional designs
  swdpwr-package, 2

* sample size estimation
  swdpwr-package, 2

* stepped wedge
  swdpwr-package, 2

swdpower, 3
swdpwr (swdpwr-package), 2
swdpwr-package, 2