Package ‘compeir’

February 19, 2015

Type Package
Title Event-specific incidence rates for competing risks data
Version 1.0
Date 2011-03-09
Author Nadine Grambauer, Andreas Neudecker
Maintainer Nadine Grambauer <nadine@imbi.uni-freiburg.de>
Description The package enables to compute event-specific incidence rates for competing risks data, to compute rate ratios, event-specific incidence proportions and cumulative incidence functions from these, and to plot these in a comprehensive multi-state type graphic.
License GPL-2
Depends grid, lattice, etm
LazyLoad yes
Repository CRAN
Date/Publication 2011-03-09 16:36:04
NeedsCompilation no

R topics documented:

compeir-package ......................................................... 2
cif ................................................................. 3
CIFplot ............................................................... 4
data.reshape .......................................................... 6
iprop ............................................................... 7
irates ............................................................... 8
irates.ratio ............................................................ 11
okiss ............................................................... 12
plot.irates ............................................................ 13
print.iprop ............................................................ 15
print.irates ............................................................ 16
print.irates.ratio ....................................................... 17
Description

The package enables to compute event-specific incidence rates for competing risks data, to compute rate ratios, event-specific incidence proportions and cumulative incidence functions from these, and to plot these in a comprehensive multistate-type graphic.

Details

Package: compeir
Type: Package
Version: 1.0
Date: 2010-12-20
License: GPL-2
Depends: grid, lattice, etm
LazyLoad: yes

The most important function contained in this package is `irates`. `irates` returns an object with which further measures can be determined, e.g., incidence rate ratios (`irates.ratio`), incidence proportions (`iprop`) or the cumulative incidence function (`cif`). The latter can easily be plotted using `cifplot`. Also, a multistate type graphic based on incidence rates can be plotted by `plotirates`.

Author(s)

Nadine Grambauer and Andreas Neudecker

Maintainer: Nadine Grambauer <nadine@imbi.uni-freiburg.de>

References


cif

Parametrically estimating the cumulative incidence function

Description

This function estimates the cumulative incidence function (CIF) for each respective event type using all competing events incidence rates.

Usage

cif(irates, t, event.code = NULL, covar.code = NULL, full.sample = FALSE)

Arguments

- **irates**: irates object
- **t**: A vector of timepoints for which the CIF shall be calculated
- **event.code**: A character or numerical value that specifies the respective competing events for which the CIF shall be calculated. If NULL, event.code will be inherited from irates
- **covar.code**: A character or numerical value that specifies the respective covariate values for which the CIF shall be calculated. If NULL, covar.code will be inherited from irates
- **full.sample**: A logical value that specifies if the CIF shall also be calculated for the full sample, i.e., irrespective of any covariate value. Default is set to FALSE

Details

The cumulative incidence function is the expected proportion of type h events over the course of time.

Value

An object of class cif. This object is implemented as a list of the (besides pre-specified) following items:

- **t**: Timepoints for which the CIF is calculated
- **cif**: CIF estimates corresponding to t for each event.code

References


See Also

irates, CIFplot
Examples

```r
### Example data.frame with aggregated count data
data <- data.frame(
times = c(7948, 2899),
no.event = c(68, 8),
event.1 = c(589, 68),
event.2 = c(55, 21),
row.names = c("covar0", "covar1"))

### Compute irates object from data
ir <- irates(dat)

### Compute the cumulative incidence function from irates object, e.g.
cif(irates = ir, t = 1:10)
```

---

CIFplot

*Plotting estimates of the cumulative incidence function*

Description

Function for plotting parametric estimates of the cumulative incidence function based on incidence rates. If individual patient data is available, the function also enables to plot the non-parametric, Aalen-Johansen estimates using etm.

Usage

```r
CIFplot(x, event.code = NULL, covar.code = NULL, indiv.times = NULL, indiv.events = NULL, indiv.covar = NULL, xlim = c(0, 30), ylim = NULL, xlab = "Time", ylab = "CIF", legend = TRUE, ...)
```

Arguments

- **x**: irates object
- **event.code**: A character or numerical value that specifies the respective competing events for which the CIF shall be plotted. If NULL, event.code will be inherited from irates
- **covar.code**: A character or numerical value that specifies the respective covariate values for which the CIF shall be plotted. If NULL, covar.code will be inherited from irates
- **indiv.times**: Timepoints corresponding to event status for each individual (vector or factor). Only relevant if individual patient data is available. Defaults to NULL
- **indiv.events**: Event status for each individual (vector or factor). Only relevant if individual patient data is available. Defaults to NULL
- **indiv.covar**: Event status for each individual (vector or factor). Only relevant if individual patient data is available. Defaults to NULL
- **xlim**: The x limits (x1, x2) of the plot. Defaults to c(0, 30)
**CIFplot**

- **ylim**: The y limits \((y_1, y_2)\) of the plot. If NULL, ylim will be determined automatically.
- **xlab**: A title for the x axis. Defaults to “Time”.
- **ylab**: A title for the y axis. Defaults to “CIF”.
- **legend**: Adds a legend to the plot. Defaults to TRUE.
- **...**: Further arguments for plot.

**See Also**

cif, etm

**Examples**

```r
### Example data frame with aggregated count data
dat <- data.frame(
  times = c(7948,2899),
  no.event = c(6,8),
  event.1 = c(589,68),
  event.2 = c(55,21),
  row.names = c("covar0","covar1"))

### Compute irates object from dat
ir <- irates(dat)

### Compute the cumulative incidence function from irates object
### here: timespan is specified by xlim (default: xlim = c(0,30))
CIFplot(x = ir)

### sir.adm: Individual patient data
data(sir.adm)

### aggregate data
agg.sir.adm <- data.frame(
  times = sir.adm$time,
  events = sir.adm$status,
  covar = sir.adm$pneu,
  no.event.code = "0")

### Plot parametric and non-parametric CIF estimates
CIFplot(
  x = irates(agg.sir.adm),
  indiv.times = sir.adm$time,
  indiv.events = sir.adm$status,
  indiv.covar = sir.adm$pneu)

### okiss: Individual patient data
### here: e.g. just event of interest 1 (infection) is plotted
data(okiss)

### aggregate data
```
data.reshape <- data.reshape(
  times = okiss$time,
  events = okiss$status,
  covar = okiss$allo,
  no.event.code = "11"
)

### Plot parametric and non-parametric CIF estimates
CIFplot(
  x = irates(agg.okiss),
  event.code = "1",
  individ.times = okiss$time,
  individ.events = okiss$status,
  individ.covar = okiss$allo
)

---

### data.reshape

#### Description

Aggregates individual patient data and combines it in a data.frame format required for irates

#### Usage

```r
data.reshape(times, events, covar, no.event.code, event.code = NULL, covar.code = NULL)
```

#### Arguments

- **times**: Timepoints corresponding to event status for each individual (vector or factor)
- **events**: Event status for each individual (vector or factor)
- **covar**: Event status for each individual (vector or factor)
- **no.event.code**: A character or numerical value that specifies the value in events corresponding to "no event observed".
- **event.code**: A character or numerical value that specifies the respective competing events in events. If NULL, event.code will be automatically extracted from events.
- **covar.code**: A character or numerical value that specifies the respective covariate values in covar. If NULL, covar.code will be automatically extracted from covar.

#### Value

An object of class data.frame of the form data.frame(time, no.event.code, event.code) with row.names given by covar.code and corresponding aggregated data entries.

#### Note

With individual patient data you may also perform non-parametric competing risks analyses, e.g., estimating the cumulative event-specific hazards by applying the package mvna or estimating the cumulative incidence function (CIF) by using the package etm. etm is also required as a diagnostic tool in CIFplot that enables to compare parametric and non-parametric CIF estimates.
See Also

irates, CIFplot, mvna, etm

Examples

### Example data:
### Pneumonia on admission in intensive care unit patients

data(sir.adm)

data.reshape(
  times = sir.adm$time,
  events = sir.adm$status,
  covar = sir.adm$pneu,
  no.event.code = "0")

### Example data:
### Bloodstream infections in stem-cell transplanted patients

data(okiss)

data.reshape(
  times = okiss$time,
  events = okiss$status,
  covar = okiss$allo,
  no.event.code = "11")

---

[iprop]
Event-specific incidence proportions

Description

This function computes event-specific incidence proportions using the competing events incidence rates. Also, corresponding variances and confidence intervals are provided.

Usage

iprop(irates, ci.fun = NULL, ci.level = NULL)

Arguments

irates    irates object

ci.fun    A character value out of c("lin", "score") that specifies the confidence interval function, either linear or score. If NULL, ci.fun is set to "score"

ci.level  A numerical value between 0 and 1 that specifies the level for the two-sided confidence interval. If NULL, ci.level is inherited from irates
Details

The incidence proportion is defined as the number of new cases of disease in a sample divided by the sample without disease at baseline. It requires complete data. It is a non-parametric statistic, however, it does not account for time at risk.

Value

An object of class `iprop`. This object is implemented as a list of the (besides pre-specified) following items:

- `ip`: Competing events incidence proportions
- `var`: Variance estimates for competing events incidence proportions
- `conf.lower`: Lower confidence interval corresponding to pre-specified function and level
- `conf.upper`: Upper confidence interval corresponding to pre-specified function and level

References


See Also

`print.iprop`, `irates`, `cif`

Examples

```r
### Example data.frame with aggregated count data
dat <- data.frame(
times = c(7948, 2899),
no.event = c(6, 8),
event.1 = c(589, 68),
event.2 = c(55, 21),
row.names = c("covar0", "covar1"))

### Compute irates object from dat
ir <- irates(dat)

### Compute incidence proportions from irates object
iprop(ir)
```

irates  

Description

This function computes event-specific incidence rates (a.k.a. incidence densities) for competing risks data together with corresponding variances and confidence intervals. Incidence rates can be computed for separate covariate values of one binary or categorical covariate.
irates

Usage

irate(data, timeNcode = NULL, noNeventNcode = NULL, noNeventNlab = NULL, eventNlab = NULL, covarNlab = NULL, fullNsampleNlab = "Full sample", ciNlevel = 0.95, ciNfun = "log")

Arguments

data A data.frame, where columns contain the aggregated observation time (i.e., timeNcode), censored events (i.e., noNeventNcode) and aggregated count data for each event type (i.e., eventNcode); each row corresponds to a certain covariate value

timeNcode A character or numerical value that specifies the timeNcode colname in data. If NULL, timeNcode is assumed to be the first colname in data

noNeventNcode A character or numerical value that specifies the noNeventNcode colname in data. If NULL, noNeventNcode is assumed to be the second colname in data

noNeventNlab A character value that specifies a certain label for noNeventNcode column name in data. If NULL, noNeventNlab equals noNeventNcode

eventNlab A character value (potentially vector with order and length according to order and number of competing events in data) that specifies a certain label for each event code in data. If NULL, eventNlab equals the colname for each event code in data

covarNlab A character value (potentially vector with order and length according to order and number of covariate values in data) that specifies a certain label for each event code (i.e. rowname) in data. If NULL, covarNlab equals the rowname for each covariate code in data

fullNsampleNlab A character value that specifies a certain label for the full sample irates from data. Default is set to “Full sample”

ciNlevel A numerical value between 0 and 1 that specifies the level for the two-sided confidence interval. Default is set to .95

ciNfun A character value out of c("lin", "log") that specifies the confidence interval function, either linear or log-transformed. Default is set to “log”

Details

The incidence rate is defined as the number of new cases of disease in a sample divided by the sample-time at risk.

Value

An object of class irates. This object is implemented as a list of the (besides pre-specified) following items:

ir Competing events incidence rates

var Variance estimates for competing events incidence rates

conf.lower Lower confidence interval corresponding to pre-specified function and level

conf.upper Upper confidence interval corresponding to pre-specified function and level
Distribution of covariate values at baseline
data.frame with counts for each event according to covariate value as well as for
the full sample

Note
If individual patient data is available and incidence rates shall be computed, the data can be easily
reshaped to the required data.frame format by using the function data.reshape

References
oxfordjournals.org/lookup/doi/10.1093/aje/kwq246

See Also
print.irates, summary.irates, plot.irates, data reshape, grid

Examples
### With individual patient data - sir.adm - using the function data.reshape
data(sir.adm)
dat1 <- data.reshape(
times = sir.adm$time,
events = sir.adm$status,
covar = sir.adm$pneu,
no.event.code = "0")

### With aggregated count data
dat2 <- data.frame(
time = c(7948,2899),
no.event = c(6,8),
event.1 = c(589,68),
event.2 = c(55,21),
row.names = c("covar0","covar1"))

### Compute incidence rates from dat1 or dat2 (here dat2)
irates(dat2)

### Specify columns with time and no.event information
irates(
  dat2,
time.code = "time",
no.event.code = "no.event")

### Set specific labels
irates(
  dat2,
no.event.lab = "Admission",
event.lab = c("Discharge","Death"),
covar.lab = c("No pneumonia","Pneumonia"))
Overall, this function computes event-specific incidence rate ratios between two groups. Each group is given by a covariate value.

**Usage**

```r
irates.ratio(irates, covar.code, ci.fun = NULL, ci.level = NULL)
```

**Arguments**

- `irates` `irates` object
- `covar.code` A vector of character or numerical values that specifies the covariate values in `irates` to be compared. The vector must contain two values, the order specifies the ratio
- `ci.fun` A character value out of c(“lin”, “log”) that specifies the confidence interval function, either linear or log-transformed. If NULL, `ci.fun` is inherited from `irates`
- `ci.level` A numerical value between 0 and 1 that specifies the level for the two-sided confidence interval. If NULL, `ci.level` is inherited from `irates`

**Value**

An object of class `irates.ratio`. This object is implemented as a list of the (besides pre-specified) following items:

- `irr` Competing events incidence rate ratios
- `var` Variance estimates for competing events incidence rate ratios
- `conf.lower` Lower confidence interval corresponding to pre-specified function and level
- `conf.upper` Upper confidence interval corresponding to pre-specified function and level

**See Also**

- `print.irates.ratio`

**Examples**

```R
### Example data.frame with aggregated count data
dat <- data.frame(
  times = c(7948, 2899),
  no.event = c(6, 8),
  event.1 = c(589, 68),
  event.2 = c(55, 21),
```
row.names = c("covar0","covar1"))

### Compute irates object from dat
ir <- irates(dat)

### Compute incidence rate ratios from irates object
irates.ratio(ir,
covar.code = c("covar1", "covar0"))

---

**Bloodstream infections in stem-cell transplanted patients**

**Description**

A random subsample of 1000 patients from ONKO-KISS, part of the surveillance program of the German National Reference Centre for Surveillance of Hospital-Acquired Infections. Patients have been treated by peripheral blood stem-cell transplantation. After transplantation, patients are neutropenic. Occurrence of bloodstream infection during neutropenia is a severe complication.

**Usage**

data(okiss)

**Format**

A data frame with 1000 observations on the following 4 variables.

- **time**: Time of neutropenia until first event in days
- **status**: Event status indicator. 1: infection, 2: end of neutropenia, 7: death, 11: censored observation
- **allo**: Covariate transplant type indicator: 0: autologous transplants, 1: allogeneic transplants
- **sex**: Covariate sex indicator: f: female, m: male

**Details**

The challenge in this competing risks example is that autologous transplants in fact decreased the number of infections divided by the number of patients (i.e., iprop), but that they also increased the number of infections divided by the number of patient-days (i.e., irates).

**Source**

Examples

data(okiss)

plot.irates

Description

Function for plotting irates objects. For each covariate value, multistate-type graphics will be displayed, i.e., plots with transition arrows from the initial event to each competing event, where the thickness describes the particular amount of every incidence rate. Full sample graphics might also be plotted.

Usage

## S3 method for class 'irates'
plot(x, covar.code = NULL, full.sample = FALSE, n.row = 1, viewport.size = list(w = 3.5, h = 2.5), box.size = list(w = NULL, h = NULL), dist = 0.5, irates.vbw = NULL, arrow.maxlwd = 10, display.digits = NULL, main.gp = gpar(cex = 1.2), ...)

Arguments

x  
irates object

covar.code  
A character or numerical value that specifies the respective covariates value(s) for which the result of irates shall be printed. If NULL, covar.code will be inherited from irates

full.sample  
A logical value that specifies if results of irates shall also be printed for the full sample, i.e., irrespective of any covariate value. Default is set to FALSE

n.row  
An integer value that specifies the number of rows to display the plots for each covariate value. Default is set to 1

viewport.size  
A list with 2 numerical values list(w, h) to set the width (w) and height (h) of the viewport. Default is w= 3.5, h = 2.5

box.size  
A list with 2 numerical values list(w, h) to set the width (w) and height (h) of the box(es) for each event. If NULL, w and h will be determined automatically corresponding to the specified event.lab in irates

dist  
A numerical value to set the distance between plots in a row. Default is 0.5

irates.vbw  
A numerical value to set the width of the background box for the incidence rate values to be displayed. If NULL, irates.vbw will be determined automatically corresponding to display.digits
plot.irates

arrow.maxlwd  A numerical value to set the maximum arrow width for the transition with the highest incidence rate. Default is 10.
display.digits  An integer value specifying the number of decimal place for all incidence rates that shall be plotted. Default is 2
cex  A numerical value giving the amount by which plotting the incidence rate values should be magnified relative to the default
show.values  A logical value specifying if incidence rate values shall be plotted or not. Default is TRUE
mark  A vector of length event.code with logical values specifying if and which transition arrow shall be marked with a certain color. Defaults to NULL
mark.col  The color to be used for marking transition arrows. Defaults to "red"
main  An overall title for the plot
main.dist  A numerical value to set the distance between the overall title and the plots
main.gp  A numerical value giving the amount by which plotting the title values should be magnified relative to the default
...  Further arguments for plot

References


See Also

irates

Examples

# Pneumonia on admission data: sir.adm
data(sir.adm)
agg.sir <- data.reshape(
times = sir.adm$time,
events = sir.adm$status,
covar = sir.adm$pnev,
no.event.code = "0")

# Compute irates object from dat
ir1 <- irates(agg.sir)

# Plot multistate-type graphic from irates object
plot(ir1)

# Compute irates object with certain labels
ir2 <- irates(
agg.sir,""
print.iprop

Print method for 'iprop' object

Description

Print method for an object of class iprop. By default it prints all competing events incidence proportions contained in iprop. It is also possible to select specific events or covariate values to be printed. Full sample incidence proportions might also be printed.

Usage

## S3 method for class 'iprop'
print(x, event.code = NULL, covar.code = NULL, full.sample = FALSE, display.digits = 4, ...)

Arguments

x

iprop object

event.code

A character or numerical value that specifies the respective competing events for which the result of iprop shall be printed. If NULL, event.code will be inherited from iprop

covar.code

A character or numerical value that specifies the respective covariates value(s) for which the result of iprop shall be printed. If NULL, covar.code will be inherited from iprop
print.irates

full.sample A logical value that specifies if results of iprop shall also be printed for the full sample, i.e., irrespective of any covariate value. Default is set to FALSE

display.digits An integer value specifying the number of decimal place for all incidence proportions that shall be printed. Default is set to 4

... Other arguments for print method

Value

No value is returned.

See Also

iprop

print.irates | Print method for `irates` object

Description

Print method for an object of class irates. By default it prints all competing events incidence rates contained in irates. It is also possible to select specific events or covariate values to be printed. Full sample incidence rates might also be printed.

Usage

## S3 method for class 'irates'
print(x, event.code = NULL, covar.code = NULL, full.sample = FALSE, display.digits = 4, ...)

Arguments

x irates object

event.code A character or numerical value that specifies the respective competing events for which the result of irates shall be printed. If NULL, event.code will be inherited from irates

covar.code A character or numerical value that specifies the respective covariates value(s) for which the result of irates shall be printed. If NULL, covar.code will be inherited from irates

full.sample A logical value that specifies if results of irates shall also be printed for the full sample, i.e., irrespective of any covariate value. Default is set to FALSE

display.digits An integer value specifying the number of decimal place for all incidence rates that shall be printed. Default is set to 4

... Other arguments for print method

Value

No value returned.
print.irates.ratio

See Also

irates

Description

Print method for an object of class irates.ratio. By default it prints all competing events incidence rates contained in irates. It is also possible to select specific events to be printed.

Usage

```r
## S3 method for class 'irates.ratio'
print(x, event.code = NULL, display.digits = 4, ...)
```

Arguments

- `x` : irates.ratio object
- `event.code` : A character or numerical value that specifies the respective competing events for which the result of irates.ratio shall be printed. If NULL, event.code will be inherited from irates.ratio
- `display.digits` : An integer value that specifies the number of digits that shall be printed. Default is set to 4
- `...` : Other arguments for print method

Value

No value is returned.

See Also

irates.ratio
sir.adm  

Pneumonia on admission in intensive care unit patients

Description

Pneumonia status on admission for intensive care unit (ICU) patients, a random sample from the SIR-3 study (also contained in package mvna).

Usage

data(sir.adm)

Format

A data frame with 747 observations on the following 4 variables.

- id  Randomly generated patient id
- pneu  Covariate Pneumonia indicator. 0: No pneumonia, 1: Pneumonia
- status  Event status indicator. 0: censored observation, 1: discharged, 2: dead
- time  Follow-up time in days

Source


See Also

mvna

Examples

data(sir.adm)

summary.irates  

Summary method for 'irates' object

Description

Summary method for an object of class irates. It prints all competing events incidence rates contained in irates, including full sample incidence rates. It also prints the baseline covariate characteristics.
Usage

```r
## S3 method for class 'irates'
summary(object, ...)
```

Arguments

- `object` irates object
- `...` Further arguments

Value

No value is returned

See Also

`irates`, `print.irates`
Index

*Topic **datasets**
  okiss, 12
  sir.adm, 18

*Topic **hplot**
  plot.irates, 13

*Topic **manip**
  data.reshape, 6

*Topic **math**
  irates, 8

cif, 2, 3, 5, 8
CIFplot, 2, 3, 4, 7
compeir (compeir-package), 2
compeir-package, 2

data.reshape, 6, 10

etm, 5, 7

grid, 10

iprop, 2, 7, 16
irates, 2, 3, 7, 8, 8, 14, 17, 19
irates.ratio, 2, 11, 17

mvna, 7, 18

okiss, 12

plot.irates, 2, 10, 13
print.iprop, 8, 15
print.irates, 10, 16, 19
print.irates.ratio, 11, 17

sir.adm, 18
summary.irates, 10, 18