

Package: tidycmprsk (via r-universe)

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Title Competing Risks Estimation

Version 1.1.0.9000

Description Provides an intuitive interface for working with the competing risk endpoints. The package wraps the 'cmprsk' package, and exports functions for univariate cumulative incidence estimates and competing risk regression. Methods follow those introduced in Fine and Gray (1999)
<doi:10.1002/sim.7501>.

License AGPL (>= 3)

URL <https://mskcc-epi-bio.github.io/tidycmprsk/>,
<https://github.com/MSKCC-Epi-Bio/tidycmprsk>

BugReports <https://github.com/MSKCC-Epi-Bio/tidycmprsk/issues>

Depends R (>= 4.2)

Imports broom (>= 1.0.1), cli (>= 3.1.0), cmprsk (>= 2.2.10), dplyr (>= 1.0.7), ggplot2 (>= 3.3.5), gtsummary (>= 2.0.0), hardhat (>= 1.3.0), purrr (>= 0.3.4), rlang (>= 1.0.0), stringr (>= 1.4.0), survival, tibble (>= 3.1.6), tidyr (>= 1.1.4)

Suggests aod, broom.helpers (>= 1.15.0), cardx (>= 0.2.0), covr (>= 3.5.1), ggsurvfit, knitr (>= 1.36), spelling, testthat (>= 3.2.0)

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| | |
|------------|--|
| add_cuminc | <i>Additional Functions for tbl_cuminc()</i> |
|------------|--|

Description

- `add_p()` Add column with p-value comparing incidence across stratum
- `add_n()` Add column with the total N, or N within stratum
- `add_nevent()` Add column with the total number of events, or number of events within stratum
- `inline_text()` Report statistics from a `tbl_cuminc()` table inline

Usage

```
## S3 method for class 'tbl_cuminc'
add_p(x, pvalue_fun = gtsummary::style_pvalue, ...)

## S3 method for class 'tbl_cuminc'
add_n(x, location = NULL, ...)

## S3 method for class 'tbl_cuminc'
add_nevent(x, location = NULL, ...)

## S3 method for class 'tbl_cuminc'
inline_text(x, time = NULL, column = NULL, outcome = NULL, level = NULL, ...)
```

Arguments

| | |
|-------------------------|--|
| <code>x</code> | object of class 'tbl_cuminc' |
| <code>pvalue_fun</code> | function to style/format p-values. Default is <code>gtsummary::style_pvalue</code> |
| <code>...</code> | These dots are for future extensions and must be empty. |

| | |
|----------|--|
| location | location to place Ns. When "label" total Ns are placed on each variable's label row. When "level" level counts are placed on the variable level for categorical variables, and total N on the variable's label row for continuous. |
| time | time of statistic to report |
| column | column name of the statistic to report |
| outcome | string indicating the outcome to select from. If NULL, the first outcome is used. |
| level | if estimates are stratified, level of the stratum to report |

Example Output

p-values

The p-values reported in `cuminc()`, `glance.tidycuminc()` and `add_p.tbl_cuminc()` are Gray's test as described in Gray RJ (1988) *A class of K-sample tests for comparing the cumulative incidence of a competing risk*, *Annals of Statistics*, 16:1141-1154.

See Also

Other `tbl_cuminc` tools: [tbl_cuminc\(\)](#)

Examples

```
# Example 1 -----
add_cuminc_ex1 <-
  cuminc(Surv(ttdeath, death_cr) ~ 1, trial) %>%
  tbl_cuminc(times = c(12, 24), label_header = "**Month {time}**") %>%
  add_nevent() %>%
  add_n()

# Example 2 -----
add_cuminc_ex2 <-
  cuminc(Surv(ttdeath, death_cr) ~ trt, trial) %>%
  tbl_cuminc(times = c(12, 24),
            outcomes = c("death from cancer", "death other causes"),
            label_header = "**Month {time}**") %>%
  add_p() %>%
  add_nevent(location = c("label", "level")) %>%
  add_n(location = c("label", "level"))

# inline_text() -----
inline_text(add_cuminc_ex2, time = 12, level = "Drug A")
inline_text(add_cuminc_ex2, column = p.value)
```

base_methods_crr *Functions for tidycrr objects*

Description

Functions for tidycrr objects

Usage

```
## S3 method for class 'tidycrr'  
coef(object, ...)  
  
## S3 method for class 'tidycrr'  
vcov(object, ...)  
  
## S3 method for class 'tidycrr'  
model.matrix(object, ...)  
  
## S3 method for class 'tidycrr'  
model.frame(formula, ...)  
  
## S3 method for class 'tidycrr'  
terms(x, ...)
```

Arguments

| | |
|-----------|------------------|
| ... | not used |
| formula | a formula |
| x, object | a tidycrr object |

Value

coef vector, model matrix, model frame, terms object

Examples

```
mod <- crr(Surv(ttdeath, death_cr) ~ age + grade, trial)  
  
coef(mod)  
  
model.matrix(mod) %>% head()  
  
model.frame(mod) %>% head()  
  
terms(mod)
```

base_methods_cuminc *Functions for tidycuminc objects*

Description

Functions for tidycuminc objects

Usage

```
## S3 method for class 'tidycuminc'  
model.frame(formula, ...)
```

```
## S3 method for class 'tidycuminc'  
model.matrix(object, ...)
```

Arguments

| | |
|---------|---------------------|
| formula | a formula |
| ... | not used |
| object | a tidycuminc object |

Value

a model frame, or model matrix

Examples

```
fit <- cuminc(Surv(ttdeath, death_cr) ~ trt, trial)  
  
model.matrix(fit) %>% head()  
  
model.frame(fit) %>% head()
```

broom_methods_crr *Broom methods for tidycrr objects*

Description

Broom methods for tidycrr objects

Usage

```
## S3 method for class 'tidycrr'
tidy(x, exponentiate = FALSE, conf.int = FALSE, conf.level = x$conf.level, ...)

## S3 method for class 'tidycrr'
glance(x, ...)

## S3 method for class 'tidycrr'
augment(x, times = NULL, probs = NULL, newdata = NULL, ...)
```

Arguments

| | |
|--------------|---|
| x | a tidycrr object |
| exponentiate | Logical indicating whether or not to exponentiate the coefficient estimates. Defaults to FALSE. |
| conf.int | Logical indicating whether or not to include a confidence interval in the tidied output. Defaults to FALSE. |
| conf.level | Level of the confidence interval. Default matches that in <code>crr(conf.level=)</code> (typically, 0.95) |
| ... | not used |
| times | Numeric vector of times to obtain risk estimates at |
| probs | Numeric vector of quantiles to obtain estimates at |
| newdata | A <code>base::data.frame()</code> or <code>tibble::tibble()</code> containing all the original predictors used to create x. Defaults to NULL. |

Value

a tibble

See Also

Other `crr()` functions: [crr\(\)](#), [predict.tidycrr\(\)](#)

Examples

```
crr <- crr(Surv(ttdeath, death_cr) ~ age + grade, trial)

tidy(crr)

glance(crr)

augment(crr, times = 12)
```

 broom_methods_cuminc *Broom methods for tidy cuminc objects*

Description

Broom methods for tidy cuminc objects

Usage

```
## S3 method for class 'tidycuminc'
tidy(x, times = NULL, conf.int = TRUE, conf.level = x$conf.level, ...)

## S3 method for class 'tidycuminc'
glance(x, ...)
```

Arguments

| | |
|------------|---|
| x | object of class 'tidycuminc' |
| times | Numeric vector of times to obtain risk estimates at |
| conf.int | Logical indicating whether or not to include a confidence interval in the tidied output. Defaults to FALSE. |
| conf.level | Level of the confidence interval. Default matches that in cuminc(conf.level=) (typically, 0.95) |
| ... | not used |

Value

a tibble

tidy() data frame

The returned tidy() data frame returns the following columns:

| Column Name | Description |
|-------------|---|
| outcome | Competing Event Outcome |
| time | Numeric follow-up time |
| estimate | Risk estimate |
| std.error | Standard Error |
| n.risk | Number at risk at the specified time |
| n.event | If the times= argument is missing, then the number of events that occurred at time t. Otherwise, it is the cumulative number of events that occurred at time t. |
| n.censor | If the times= argument is missing, then the number of censored obs at time t. Otherwise, it is the cumulative number of censored observations at time t. |
| cum.event | Cumulative number of events at specified time |
| cum.censor | Cumulative number of censored observations at specified time |

If tidy(time=) is specified, then n.event and n.censor are the cumulative number of events/censored in the interval. For example, if tidy(time = c(0, 12, 18)) is passed, n.event and n.censor at time = 18 are the cumulative number of events/censored in the interval (12, 18].

p-values

The p-values reported in `cuminc()`, `glance.tidycuminc()` and `add_p.tbl_cuminc()` are Gray's test as described in Gray RJ (1988) *A class of K-sample tests for comparing the cumulative incidence of a competing risk*, *Annals of Statistics*, 16:1141-1154.

Confidence intervals

The confidence intervals for cumulative incidence estimates use the recommended method in *Competing Risks: A Practical Perspective* by Melania Pintilie.

$$x \exp(z * se / (x * \log(x)))$$

where x is the cumulative incidence estimate, se is the standard error estimate, and z is the z-score associated with the confidence level of the interval, e.g. $z = 1.96$ for a 95% CI.

See Also

Other `cuminc()` functions: [cuminc\(\)](#)

Examples

```
cuminc <- cuminc(Surv(ttdeath, death_cr) ~ trt, trial)

tidy(cuminc)

glance(cuminc)

# restructure glance to one line per outcome
glance(cuminc) %>%
  tidyr::pivot_longer(
    everything(),
    names_to = c(".value", "outcome_id"),
    names_pattern = "(.*)_(.*)"
  )
```

Description

Competing Risks Regression

Usage

```
## S3 method for class 'formula'
crr(formula, data, failcode = NULL, conf.level = 0.95, ...)

crr(x, ...)

## Default S3 method:
crr(x, ...)
```

Arguments

| | |
|------------|---|
| formula | formula with <code>Surv()</code> on LHS and covariates on RHS. The event status variable must be a factor, with the first level indicating 'censor' and subsequent levels the competing risks. The <code>Surv(time2=)</code> argument cannot be used. |
| data | data frame |
| failcode | Indicates event of interest. If <code>failcode=</code> is NULL, the first competing event will be used as the event of interest. Default is NULL. |
| conf.level | confidence level. Default is 0.95. |
| ... | passed to methods |
| x | input object |

Value

tidycrr object

See Also

Other `crr()` functions: [broom_methods_crr](#), [predict.tidycrr\(\)](#)

Examples

```
crr(Surv(ttdeath, death_cr) ~ age + grade, trial)
```

cuminc

Competing Risks Cumulative Incidence

Description

Competing Risks Cumulative Incidence

Usage

```
## S3 method for class 'formula'
cuminc(formula, data, strata, rho = 0, conf.level = 0.95, ...)

cuminc(x, ...)

## Default S3 method:
cuminc(x, ...)
```

Arguments

| | |
|------------|---|
| formula | formula with Surv() on LHS and covariates on RHS. The event status variable must be a factor, with the first level indicating 'censor' and subsequent levels the competing risks. The Surv(time2=) argument cannot be used. |
| data | data frame |
| strata | stratification variable. Has no effect on estimates. Tests will be stratified on this variable. (all data in 1 stratum, if missing) |
| rho | Power of the weight function used in the tests. |
| conf.level | confidence level. Default is 0.95. |
| ... | passed to methods |
| x | input object |

Value

tidycuminc object

Confidence intervals

The confidence intervals for cumulative incidence estimates use the recommended method in *Competing Risks: A Practical Perspective* by Melania Pintilie.

$$x^{\exp(z*se/(x*\log(x)))}$$

where x is the cumulative incidence estimate, se is the standard error estimate, and z is the z-score associated with the confidence level of the interval, e.g. $z = 1.96$ for a 95% CI.

p-values

The p-values reported in cuminc(), glance.tidycuminc() and add_p.tbl_cuminc() are Gray's test as described in Gray RJ (1988) *A class of K-sample tests for comparing the cumulative incidence of a competing risk*, Annals of Statistics, 16:1141-1154.

See Also

Other cuminc() functions: [broom_methods_cuminc](#)

Examples

```
# calculate risk for entire cohort -----
cuminc(Surv(ttdeath, death_cr) ~ 1, trial)

# calculate risk by treatment group -----
cuminc(Surv(ttdeath, death_cr) ~ trt, trial)
```

gtsummary_s3_methods *gtsummary methods*

Description

These functions are S3 methods for working with `crr()` model results.

- `tbl_regression.tidycrr()`: This function sets the `tidycmprsk` tidier for `crr()` models.
- `global_pvalue_fun.tidycrr()`: This function ensures that `gtsummary::add_global_p(anova_fun)` uses the Wald test by default (instead of `car::Anova()`, which does not support this model type). The Wald test is executed with `cardx::ard_aod_wald_test()`, which wraps `aod::wald.test()`.

Usage

```
## S3 method for class 'tidycrr'
tbl_regression(x, tidy_fun = tidycmprsk::tidy, ...)

## S3 method for class 'tidycrr'
global_pvalue_fun(x, type, ...)
```

Arguments

| | |
|-----------------------|---|
| <code>x</code> | (<code>tidycrr</code>) <code>tidycmprsk::crr()</code> regression object |
| <code>tidy_fun</code> | (function) Tidier function for the model. Default is <code>tidycmprsk::tidy()</code> . |
| <code>...</code> | Additional arguments passed to <code>broom.helpers::tidy_plus_plus()</code> . |
| <code>type</code> | not used |

Value

gtsummary table or data frame of results

Examples

```
crr(Surv(ttdeath, death_cr) ~ age + grade, trial) |>
  gtsummary::tbl_regression() |>
  gtsummary::add_global_p() |>
  gtsummary::as_gt()
```

predict.tidycrr *Estimate subdistribution functions for crr objects*

Description

Estimate subdistribution functions for crr objects

Usage

```
## S3 method for class 'tidycrr'
predict(object, times = NULL, probs = NULL, newdata = NULL, ...)
```

Arguments

| | |
|---------|---|
| object | a tidycrr object |
| times | Numeric vector of times to obtain risk estimates at |
| probs | Numeric vector of quantiles to obtain estimates at |
| newdata | A base::data.frame() or tibble::tibble() containing all the original predictors used to create x. Defaults to NULL. |
| ... | not used |

Value

named list of prediction estimates

See Also

Other crr() functions: [broom_methods_crr](#), [crr\(\)](#)

Examples

```
crr(Surv(ttdeath, death_cr) ~ age, trial) %>%
  predict(times = 12, newdata = trial[1:10, ])
```

tbl_cuminc *Tabular Summary of Cumulative Incidence*

Description

Tabular Summary of Cumulative Incidence

Usage

```
## S3 method for class 'tidycuminc'
tbl_cuminc(
  x,
  times = NULL,
  outcomes = NULL,
  statistic = "{estimate}% ({conf.low}%, {conf.high}%)",
  label = NULL,
  label_header = "**Time {time}**",
  estimate_fun = NULL,
  conf.level = x$conf.level,
  missing = NULL,
  ...
)

tbl_cuminc(x, ...)
```

Arguments

| | |
|--------------|--|
| x | a 'tidycuminc' object created with cuminc() |
| times | Numeric vector of times to obtain risk estimates at |
| outcomes | character vector of outcomes to include. Default is to include the first outcome. |
| statistic | string of statistic to report. Default is "{estimate}% ({conf.low}%, {conf.high}%)" |
| label | string indicating the variable label |
| label_header | string for the header labels; uses glue syntax. Default is "**Time {time}**" |
| estimate_fun | function that styles and formats the statistics. Default is <code>~gtsummary::style_sigfig(.x, scale = 100)</code> |
| conf.level | Level of the confidence interval. Default matches that in <code>cuminc(conf.level=)</code> (typically, 0.95) |
| missing | string to replace missing values with. Default is an em-dash, "\U2014" |
| ... | not used |

Example Output**See Also**

Other `tbl_cuminc` tools: [add_cuminc](#)

Examples

```
# Example 1 -----
tbl_cuminc_ex1 <-
  cuminc(Surv(ttdeath, death_cr) ~ 1, trial) %>%
  tbl_cuminc(times = c(12, 24), label_header = "**Month {time}**")
```

```
# Example 2 -----
tbl_cuminc_ex2 <-
  cuminc(Surv(ttdeath, death_cr) ~ trt, trial) %>%
  tbl_cuminc(times = c(12, 24),
             outcomes = c("death from cancer", "death other causes"),
             label_header = "**Month {time}**")
```

 trial

Results from a simulated study of two chemotherapy agents

Description

A dataset containing the baseline characteristics of 200 patients who received Drug A or Drug B. Dataset also contains the outcome of tumor response to the treatment.

Usage

```
trial
```

Format

A data frame with 200 rows—one row per patient

trt Chemotherapy Treatment

age Age

marker Marker Level (ng/mL)

stage T Stage

grade Grade

response Tumor Response

death Patient Died

death_cr Death Status

ttdeath Months to Death/Censor

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