

# Package ‘cmprskcoxmsm’

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**Type** Package

**Title** Use IPW to Estimate Treatment Effect under Competing Risks

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**Description** Uses inverse probability weighting methods to estimate treatment effect under marginal structure model for the cause-specific hazard of competing risk events. Estimates also the cumulative incidence function (i.e. risk) of the potential outcomes, and provides inference on risk difference and risk ratio. Reference: Kalbfleisch & Prentice (2002)<[doi:10.1002/9781118032985](https://doi.org/10.1002/9781118032985)>; Hernan et al (2001)<[doi:10.1198/016214501753168154](https://doi.org/10.1198/016214501753168154)>.

**License** GPL (>= 2)

**Imports** ggplot2, survival, stats, twang, graphics, sandwich

**Suggests** knitr, rmarkdown

**VignetteBuilder** knitr

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cif_est	<i>Estimated cumulative incidence function</i>
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### Description

cif\_est estimates the cumulative incidence function (CIF, i.e.risk) based on the cause-specific regression results with 95% confidence intervals, it also calculates the risk ratio and risk difference for the specific time point.

### Usage

```
cif_est(data=,
        time, time2 = NULL,
        Event.var, Events, cif.event,
        weight.type,
        ties = NULL,
        risktab = TRUE, risk.time = NULL)
```

### Arguments

data	The dataset, output of doPS
time	See weight_cause_cox.
time2	See weight_cause_cox.
Event.var	The variable name for the event indicator which typically has at least 3 levels.
Events	The vector of all the event name, the rest of levels in the Event.var will be treated as loss to follow up (i.e. right censoring).
cif.event	Value of event of interest for the CIF.
weight.type	See weight_cause_cox.
ties	See weight_cause_cox.
risktab	Indicator whether the risk ratio and risk difference table should be returned.
risk.time	If risktab, the specific time point for calculating the risk ratio and risk difference.

### Details

After estimating the parameters in the cause-specific hazard  $\lambda_j^a$  using IPW, we could estimate the corresponding CIF:

$$\hat{P}(T^a < t, J^a = j) = \int_0^t \hat{S}^a(u) d\hat{\Lambda}_j^a(u),$$

where  $\hat{S}^a$  is the estimated overall survival function for  $T^a$ ,  $\hat{S}^a(u) = e^{-\sum_j \hat{\Lambda}_j^a(u)}$ ,  $\hat{\Lambda}_j^a(u) = \hat{\Lambda}_{0j}(u)e^{\hat{\beta}^*a}$ , and  $\hat{\Lambda}_{0j}(u)$  is a Breslow-type estimator of the baseline cumulative hazard.

**Value**

Returns a table containing the estimated CIF for the event of interest for control and treated group and their 95% confidence intervals.

If `risktab`, will return the risk ratio and risk difference at time `risk.time`, and their 95% confidence intervals.

**References**

Hou, J., Paravati, A., Hou, J., Xu, R., & Murphy, J. (2018). "High-dimensional variable selection and prediction under competing risks with application to SEER-Medicare linked data," *Statistics in Medicine* 37(24), 3486-3502.

doPS

*Generate the Inverse Probability Treatment Weights***Description**

doPS calculates the unstabilized and stabilized inverse probability treatment weights (IPW) for average treatment effect using propensity score. The propensity score is calculated by `twang` package using the boosted logistic regression.

**Usage**

```
doPS(data, Trt, Trt.name, VARS.)
```

**Arguments**

<code>data</code>	The dataset, includes treatment assignment as well as covariates
<code>Trt</code>	The name of the treatment variable in the dataset.
<code>Trt.name</code>	The treated group name of the treatment variable in the dataset.
<code>VARS.</code>	The vector of the name of potential confounding variables in the dataset.

**Details**

The treatment variable should only contain 2 levels of treatment, and one should be viewed as treated group and another is control group.

For stabilized weights:

For the treated individuals, we assign the IPW:  $w = \Pr(T=1)/\Pr(T=1|X=x)$ , for control individuals, the stabilized weight is:  $w = (1-\Pr(T=1))/(1-\Pr(T=1|X=x))$ .

**Value**

doPS returns an object of class "PS". An object of class "PS" is a list containing the following components:

Data	A new dataset which excludes all the missing value on the potential confounders from input data, add the propensity score and IPW into the new dataset. <b>ps_ate</b> The estimated propensity scores with estimand of interest as ATE <b>ipw_ate_unstab</b> Unstabilized ipw calculated from ps_ate <b>ipw_ate_stab</b> Stabilized ipw calculated from ps_ate
ps	an object of class ps, See the help for <a href="#">ps</a> for details of the ps class.

**See Also**

[ps](#)

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follic	<i>Follicular cell lymphoma study</i>
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**Description**

Competing risk data set involving follicular cell lymphoma from Pintilie (2007)

**Usage**

```
data(follic)
```

**Format**

A data frame containing:

age age

hgb hemoglobin (g/l)

clinstg clinical stage: 1=stage I, 2=stage II

ch chemotherapy

rt radiotherapy

time first failure time

status Reason of failure: 1: Relapse, 2: Death, 0: No response

**References**

Pintilie M., (2006) Competing Risks: A Practical Perspective. West Sussex: John Wiley and Sons.

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plot.PS	<i>Plotting histogram of propensity score and balancing plot for covariates in the propensity score model</i>
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### Description

Displays a the histogram plots for the propensity score, stratified by treated and control group and a graph of standardized mean difference of potential confounders before and after weighing.

### Usage

```
## S3 method for class 'PS'  
plot(x,...)
```

### Arguments

x	The results of doPS function
...	the other arguments you want to put in the built-in plot function

### Details

The standardized mean difference (SMD), defined as the (weighted) treatment group mean minus the (weighted) control group mean divided by the (weighted) pooled sample (treatment and control) standard deviation. SMD between -0.1 and 0.1 typically indicates good balance.

### Value

Histogram of propensity score and balancing plot for covariates in the propensity score model corresponding to the output from doPS.

### See Also

[bal.table](#)

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plot_est_cif	<i>ggplot method for cif_est objects</i>
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### Description

This function produces a CIF plots for cif\_est objects.

### Usage

```
plot_est_cif(cif.data, color = color, ci.cif = FALSE)
```

**Arguments**

<code>cif.data</code>	The dataset, output of <code>cif_est</code>
<code>color</code>	Color for control and treatment group, has to be a vector of length 2.
<code>ci.cif</code>	Indicator whether to plot the 95% confidence interval area for the CIF.

**Value**

A cumulative incidence function plot (with 95% confidence interval area) corresponding to the output from `cif_est`.

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<code>pvalFormat</code>	<i>Adjust p-value format</i>
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**Description**

Formats p-values for reports, can report adjusted pvalues

**Usage**

```
pvalFormat(p.values, method = 'none', replace = FALSE)
```

**Arguments**

<code>p.values</code>	p-value
<code>method</code>	pvalue adjustment, passed to <code>p.adjust.methods</code>
<code>replace</code>	if TRUE, replaces p-values with their adjusted value

**Value**

Return the formatted p-value: round the p-value, assign the significance sign to the p-value based on the significant level. Can be used directly to the LaTeX report.

**Examples**

```
p <- 0.002354
print(p.1 <- pvalFormat(p))
```

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weight_cause_cox	<i>Inverse probability weighted proportional cause-specific hazards model</i>
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## Description

weight\_cause\_cox fits the marginal structural proportional cause-specific hazards model using the inverse probability treatment weights.

## Usage

```
weight_cause_cox(data=,
                  time, time2 = NULL,
                  Event.var, Event,
                  weight.type,
                  ties = NULL)
```

## Arguments

data	The dataset, output of doPS
time	See also <a href="#">Surv</a> , for right censored data, this is the follow up time. For interval data, the first argument is the starting time for the interval.
time2	See also <a href="#">Surv</a> , ending time of the interval for interval censored or counting process data only. Intervals are assumed to be open on the left and closed on the right, (start, end]. For counting process data, event indicates whether an event occurred at the end of the interval.
Event.var	The variable name for the event indicator which typically has at least 3 levels.
Event	Event of interest, the rest of the event are treating as competing event.
weight.type	Type of inverse probability weights. Possible values are "Unstabilized" and "Stabilized".
ties	See also <a href="#">coxph</a> , a character string specifying the method for tie handling. If there are no tied death times all the methods are equivalent.

## Details

The marginal structural cause-specific Cox model for cause j usually has the form:

$$\lambda_j^a(t) \equiv \lambda_{T^a, J^a=j}(t) = \lambda_{0j} e^{\beta * a},$$

where  $T^a$ ,  $J^a$  is the counterfactual survival time and cause for treatment  $a (= 0, 1)$ ,  $\lambda_{0j}$  is the unspecified baseline cause-specific hazard for cause j, and  $\beta$  is the treatment effect.

## Value

Returns a table containing the estimated coefficient of the treatment effect, the robust standard error of the coefficient, estimated hazard ratio and 95% CI for the hazard ratio.

**See Also**

[coxph](#)

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