Macro Risk_Est_PH_reg_comp_risk User Guide

29 April 2022

Macro Risk_Est_PH_reg_time_dep computes risk estimates from a proportional regression of cause-specific hazards using the methods described in Crager and Braun (2022). Weighted analyses for cohort sampling, "external" time-dependent covariates (that is, covariate for which the time-dependence is fixed) and multiple censoring mechanisms are accommodated. Different covariates may be used for the various event types.

The macro is called as follows:

```
%Risk_Est_PH_reg_comp_risk(
    /* Input Specification */  indsn=, byvar=,
                    vars_main=, time_main=, censor_main=, censorlist_main=0,
                    vars_cr=, time_cr=, censor_cr=, censorlist_cr=0,
                    vars_cr2=, time_cr2=, censor_cr2=, censorlist_cr2=0,
                    vars_cr3=, time_cr3=, censor_cr3=, censorlist_cr3=0,
                    vars_cr4=, time_cr4=, censor_cr4=, censorlist_cr4=0,
                    vars_cr5=, time_cr5=, censor_cr5=, censorlist_cr5=0,
                    vars_cr6=, time_cr6=, censor_cr6=, censorlist_cr6=0,
                    vars_cr7=, time_cr7=, censor_cr7=, censorlist_cr7=0,
                    vars_cr8=, time_cr8=, censor_cr8=, censorlist_cr8=0,
                    vars_cr9=, time_cr9=, censor_cr9=, censorlist_cr9=0,
                    weight=,
                    covariate_dsn=,
                    programming_statements=%str(), programming_time=, calc_vars=,
    /* Analysis Parameters */  risk_time=, robust=no, print=yes, alpha=0.05, strata=,
                    CI_method=loglog, window_main=,
    /* Output Specification */ outdsn=, Risk=Risk, Risk_LCL=Risk_LCL, Risk_UCL=Risk_UCL
            );
```

The macro parameters are defined in Table 1. The time dependence of the covariates, if any, is defined using programming statements (as are used for PROC PHREG). It is assumed that these programming statements, when applied to the input data set (and the covariate data set, if specified), will uniquely determine the covariate values at the time specified by the input data set variable given by the macro parameter time. Note the programming statements will need to be enclosed in %str() so that the semicolon(s) will not cause a syntax error.

Table 1. Macro Risk_Est_PH_reg_comp_risk Parameters

Parameter	Type	Required?	Default Value	Description
indsn	$	Yes	(at temporary library)	(Libname reference and) file name containing input data set.
byvar	$	No	—	Optional list of variables to do the analysis by.
vars_main	$	Yes	—	List of input data set variables to be used as the covariate in the Cox model for the event of interest. If the programming statements create the variables that are to be included in the model, list the variables thus created.
time_main	#	Yes	—	Input data set variable containing the time to event of interest (or censoring).
censor_main	#	Yes	—	Input data set variable indicating whether the observed time to event of interest was censored.
censorlist_main	#	No	0	List of values of variable censor that indicate a censored observation for the event of interest. Default is the single value 0.
vars_cr	$	Yes	—	List of input data set variables to be used as the covariate in the Cox model for the competing risk event. If the programming statements create the variables that are to be included in the model, list the variables thus created.
vars_crK, K=2,3,…,9	#	No	—	List of input data set variables to be used as the covariate in the Cox model for additional competing risk event types. If the programming statements create the variables that are to be included in the model, list the variables thus created.
time_cr	#	Yes	—	Input data set variable containing the time to competing risk event (or censoring).

Table 1. Macro Risk_Est_PH_reg_comp_risk Parameters

Parameter	Type	Required?	Default Value	Description
censor_cr	#	Yes	—	Input data set variable indicating whether the observed time to competing risk event was censored.
censorlist_cr	#	No	0	List of values of variable censor that indicate a censored observation for the competing risk event. Default is the single value 0.
time_crK, K=2,3,…,9	#	No	—	Input data set variable containing the time to additional competing risk event types (or censoring).
censor_crK, K=2,3,…,9	#	No	—	Input data set variable indicating whether the observed time to additional competing risk event was censored.
censorlist_crK, K=2,3,…,9	#	No	0	List of values of variable censor that indicate a censored observation for the additional competing risk event. Default is the single value 0.
weight	#	No	—	Input data set variable giving the observation's weight in the analysis. If this parameter is set, it is assumed that cohort sampling was used and resulted in the specified weights.
programming_ statements	$	No	—	%str()-enclosed text string including programming statements that will be inserted into proc PHREG and various data steps to compute the time-dependent covariate values for both the event of interest and competing risk event. For example: programming_statements = %str(if time <= 3 then x_3 = 0; else x_3 = x;) If no programming statements are entered, the risk calculations will be made for covariates that are constant over time.
Programming_tim e	$	Yes, if programm ing_state ments is specified	—	Variable that represents time in the programming statements.

Table 1. Macro Risk_Est_PH_reg_comp_risk Parameters

Parameter	Type	Required?	Default Value	Description
calc_vars	$	Yes, if time-dependent covariates are used	—	List of variables that are used in the calculation of the time-dependent covariate values for the event of interest.and the competing risk event. Be sure to include the non-time-dependent variables in the list. Leave the calc_vars parameter blank if time dependent variables are not used..
covariate_dsn	$	No	(input data set)	(Libname reference and) the name of a data set that contains the covariate values for both the event of interest and the competing risk event for which the risk is to be estimated. The data set must have all the variables included in the model, or that are required to derive these variables if the model has time-dependent covariates derived using programming statements. The data set must also include the stratification variable if the model is stratified. If no covariate data set is specified, the risk will be estimated for every patient in the main input data set.
risk_time	#	Yes	—	This is the time at which the risk is assessed for each patient. That is, the risk is defined as the probability that the patient will have the event on or before risk_time.
robust	$	No	no	If this parameter is set to yes and cohort sampling is NOT used (parameter "weight" is not specified), the Lin-Wei robust estimate of variance will be used in the Cox proportional hazards models. This parameter has no effect when the parameter "weight" is specified.
print	$	No	yes	If this parameter is set to no, the PROC PHREG output will not be printed.
alpha	#	No	0.05	The macro will compute a 100(1-alpha)% confidence interval for the risk (cumulative incidence function) and cumulative hazard.
strata	$/#	No	—	Character string giving input data set variable by which the proportional hazards regression analysis will be stratified.

Table 1. Macro Risk_Est_PH_reg_comp_risk Parameters

Parameter	Type	Required?	Default Value	Description
CI_method	$	No	Loglog	Character string giving the method for computing the confidence interval. If linear is specified the confidence interval is computed on the risk scale. If log is specified, the confidence interval is computed on the cumulative hazard scale and back-transformed to the risk scale. If loglog is specified, the confidence interval is computed on the log cumulative hazard scale and back-transformed to the CIF scale. The default method is loglog.
window_main	#	Yes	—	Constant giving a time window after censoring for the event of interest within which competing risk events will be counted. The planned time interval of follow-up for the main event or a value slightly larger is a reasonable window.
outdsn	$	Yes	(at temporary library)	(Libname reference and) the output data set name. This data set will contain all the records and variables of the covariate data set (or the input data set if no separate coavariate data set is specified) plus the variables named by the following macro parameters.
Risk	#	No	Risk	Name of output data set variable that will contain the risk estimate.
Risk_LCL	#	No	Risk_LCL	Name of output data set variable will contain the lower limit of a 1-alpha confidence interval for the risk.
Risk_UCL	#	No	Risk_UCL	Name of output data set variable will contain the upper limit of a 1-alpha confidence interval for the risk.

Reference

Crager MR, Braun JV (2022). Interval estimation of the absolute risk of an event with competing risks using proportional regression of cause-specific hazards. *American Journal of Applied Mathematics* **10**:59–85.