A SAS ACRO FOR THE POSITIVE STABLE FRAILTY ODEL

Youyi S u and Jo n P. Kl in, M dical Coll g of Wisconsin
Youyi S u, Biostatistics, 87 1 Wat rto n Plank Road, Mil auk , WI 53226

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Abstract:

A SAS macro to extend the Cox proportional hazards regression model to allow for positive stable frailties is presented. This macro computes, using a modified EM algorithm, estimates of the model parameters and their respective standard errors. The likelihood ratio test of the independence assumption is also provided. An example data set is used to illustrate the macro.

1 Introduction

Frailty or random effects models are useful in survival analysis for modeling associations between individuals in certain groups. For example, if one is interested in studying risk factors for a particular disease outcome or the effectiveness of some treatment, it is reasonable to believe that siblings who share a common genetic code and early environmental exposure will have event times more closely related than non-siblings. In human (or animal) studies, the family (or litter) forms natural groupings, and th

among subgroup members. The strength of association bet

times); $d_{(k)}$ is the number of deaths at $T_{(k)}$; $R(T_{(k)})$ is the set of individuals at risk at time $T_{(k)}$; $\hat{W}$

maximum likelihood estimate, standard error, ald test p-value, and relative risk (both within group and between group). Also reported are Kendall's τ and the last computed value of the log full likelihood. The likelihood ratio test of the independence assumption that $= 1$ is performed automatically and the degrees of freedom, chi-square statistic and the corresponding p-value are printed.

Note that, for comparison's sake, the analysis of variance table and the log partial/full likelihood from the usual Cox independence model are printed first in the summary report of the final results.

To make the best use of the macro, there are several printing and output data set options that the user may wish to specify. The printing options include the report of grouping information, the iteration history and/or a summary table from it, the estimated variance-covariance matrix of $\hat{}$ and $\hat{\boldsymbol{\beta}}$, and confidence limits for the relative risks (it's also possible to change the confidence coefficient for the relative risks). The output data set options are: (1) a data set containing $\hat{}$, $\hat{\boldsymbol{\beta}}$, the estimated variance-covariance matrix of $\hat{}$ and $\hat{\boldsymbol{\beta}}$, and the last computed value of the log full likelihood; (2) a data set containing ordered event times, baseline hazard rates, standard

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          /*****************************************/
          /*      Po itive Stable Frailty Model      */
          /*****************************************/
   De endence Parameter: THETA= 0.9497
   Kendall'  TAU = 0.0503
   Log full likelihood = -22 .7531

       Likelihood Ratio Te t of Inde endence Model (H0: THETA=1)
                    DF     Chi-  uare        -value
                     1         0.3912        0.5317

                  Analy i  of Maximum Likelihood E timate

EFFECT       DF   E timate     Stderr      _Wald  RR_within  RR_between
De end Parm   1     0.9497     0.0 76     0.5663          .           .
DRUG          1     0. 023     0.3146     0.010      2.2306      2.1425
SEX           1    -3.1 0      0.7973     0.0001     0.0416      0.04
```

5 Discussion

The positive stable frailty model is gaining popularity in survival analysis. This SAS macro has made the model more accessible and certainly many people will take advantage of it. The macro calculates the model parameter estimates and respective standard errors and the

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