# ON MODELING AND ESTIMATION FOR PAIRED SURVIVAL DATA WITH COVARIATES

By

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School of Applied Statistics

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# ABSTRACT

**Title of Dissertation** : On Modeling and Estimation for Paired Survival Data with Covariates

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This study deals with modeling and the estimation of marginal hazard parameters of paired survival data with time-independent covariates. This type of data can arise from observations of two events collected from a single individual or observations of the same event collected from each member of a related pair. Each survival time dataset is assumed to be continuous and to have an exponential distribution. Moreover, a random censoring mechanism is assumed. The modeling of the association of paired survival times was generated using the Clayton-Oakes model. The covariates, or explanatory variables, were introduced into each of the marginal survival functions of this model through the proportional hazards model. The model parameters were generated using maximum likelihood estimation and a two-stage procedure. In stage one, the Independence Working Model is employed using the Newton-Raphson method to estimate the marginal hazard parameters. In stage two, maximum likelihood estimation is applied using the Newton-Raphson method to estimate the association parameter and the marginal hazard parameters. The initial values used in the second stage are the results from stage one. The parameters were also estimated using the Pseudo-Maximum Likelihood Estimation (Chen, 1997) method as a comparison. Renal transplantation data were used for illustration.

The study shows that the results from stage one were appropriate initial values for stage two since rapid convergence was obtained. The results of this estimation procedure were shown to be comparable with Chen's PMLE method. Moreover, this methodology allowed for the usage of binary as well as continuous data as covariates in the marginal approach model.

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