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On the correlated frailty model for bivariate current status data with applications in infectious disease epidemiology.

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Individual heterogeneity (Coutinho et al., 1999) comprises the differences among individuals' susceptibility to acquire infections, often referred to as `frailties'. In its origin, studying individual differences was done in the context of susceptibility to death. In epidemic theory, Coutinho et al. (1999) were the first to systematically treat heterogeneity in the acquisition of infections. Individuals are dissimilar in the way they acquire infections. Some individuals are more susceptible than others and will experience infection earlier. These frailties can be partly explained (e.g. by differences in social contacts), but in most cases constitute an 'unexplained residual' component. Gaining insight in the frailty to acquire an infection has an important impact on the design and implementation of control strategies (see e.g. Farrington et al., 2001).

The instantaneous per capita rate at which a susceptible person acquires infection, the so-called force of infection (hazard of infection), has been shown to be age-dependent and can be derived through various techniques based on serological sample data (Anderson, 1982). Because of computational ease, Farrington et al.(2001) used a shared gamma frailty to model bivariate serological data, i.e. bivariate current status data. We will show how this model connects to time-to-event data and correlated frailty models. A first result is the un/identifiability of the correlated/shared frailty model for current status data. Insight is gained in the identifiability result for time to even data in the setting of Yashin et al. (1995) and Giard et al. (2002). Secondly, we will show the effect on the estimated heterogeneity and FOI (marginal) parameters using different frailty distributions in a generalized linear mixed model framework.

References
- Coutinho, F.; Massad, E.; Lopez, L.; Burattini, M.; Struchiner, C. & Azevedo-Neto, R. Modelling Heterogeneities in Individual Frailties in Epidemic Models. *Mathematial and Computer Modelling,* 1999*, 30*, 97-115
- Farrington, C.P.; Kanaan, M.N. & Gay, N.J. Estimation of the basic reproduction number for infectious diseases from age-stratified serological survey data (with discussion).
  Applied Statistics, 2001*, 50*, 251-292
- R. M. Anderson. Population dynamics of infectious diseases, theory and applications. Chapman and Hall., London, 1982.
- Yashin, A.; Vaupel, J. & Iachine, I. Correlated Individual Frailty: An Advantageous Approach to Survival Analysis of Bivariate data *Mathematical Population Studies,* 1995*, 5*, 145-159
- Giard, N.; Lichtenstein, P. & Yashin, A. A multistate model for the genetic analysis of the ageing process *Statistics in Medicine,* 2002*, 21*, 2511-2526