

## Research Seminar Series 2017/18

### Hierarchical / Multilevel Models

---

**Friday, December 15th 2017, 10:00**

CIP-Raum, Humboldtallee 32

*Quantifying individual heterogeneity in the acquisition of recurrent infections using bivariate frailty models*

**Steven Abrams**

Center for Statistics, Hasselt University, Belgium

Abstract:

In the literature there is ample evidence that individual heterogeneity in the acquisition of infectious diseases has a large impact on the estimation of important epidemiological parameters such as the (basic) reproduction number and critical vaccination coverage. Recently, frailty models have become increasingly popular in infectious disease epidemiology to accommodate such individual heterogeneity when estimating quintessential parameters for disease control. However, so far, using frailty models, it was assumed infections confer lifelong immunity after recovery, an assumption which is untenable for infections with temporary humoral immunity (i.e., recurrent infections). Our work concentrates on refining the existing frailty models to encompass such infection processes with potential reinfections, waning of humoral immunity and/or boosting of the immunity response.

Shared gamma frailty models, which are frequently used in practice, and correlated gamma frailty models that have proven to be a valuable alternative are considered. Misspecification of the underlying infection process is quantified in terms of the estimation of the basic and effective reproduction number. We show that naively assuming lifelong immunity when applying frailty models introduces substantial bias in the estimation of these quantities. We illustrate our work using cross-sectional paired serological data on parvovirus B19 (PVB19) and varicella zoster virus (VZV) from Belgium. Whereas it is typically assumed that lifelong immunity holds for VZV, more recently, empirical evidence for PVB19 indicates waning of immunity after infection, leading to possible reinfections with the pathogen.

---

This seminar series is financially supported by the Kooperation der SAS-Anwender in Forschung und Entwicklung (KSFE) e.V.