

Statistical Modelling for Real-time Epidemiology

Peter J Diggle

(Lancaster University School of Health and Medicine
and
Johns Hopkins University School of Public Health)

February 11, 2009

Large volumes of data on a range of health outcomes are now collected routinely by many health care organisations but, at least in the UK, are often not analysed other than for retrospective audit purposes. Each data-record will typically be referenced both in time and in space; for example, in the UK the temporal reference will be a date, and in some cases a time of day, whilst the spatial reference will usually be the individual's post-code which, in urban settings, corresponds to a spatial resolution of the order of 100 metres.

By real-time epidemiology, I mean the analysis of data-sets of this kind *as they accrue*, to inform clinical or public health decision-making. Such analyses would be triggered and the results posted automatically, for example on a web-site, by the arrival of new data.

In this talk I will review work in spatial, temporal and spatio-temporal modelling that seems especially relevant to this general task, and will describe a number of applications, including some or all of:

- real-time syndromic surveillance (Diggle, Rowlingson and Su, 2005);
- tropical disease prevalence mapping (Crainiceanu, Diggle and Rowlingson, 2008);
- early warning of incipient renal failure in primary care patients (Diggle and Sousa, 2009).

CRAINICEANU, C., DIGGLE, P.J. and ROWLINGSON, B.S. (2008) Bivariate modelling and prediction of spatial variation in Loa loa prevalence in tropical Africa (with Discussion). *Journal of the American Statistical Association*, **103**, 21–43.

DIGGLE, P.J., ROWLINGSON, B. and SU, T-L. (2005). Point process methodology for on-line spatio-temporal disease surveillance. *Environmetrics*, **16**, 423–34.

DIGGLE, P.J. and SOUSA, I. (2009). Real-time detection of incipient renal failure in primary care patients using a dynamic time series model. (in preparation)