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***Bayesian Methods for Repeated Measures*. L. D. Broemeling (2015). Boca Raton: Chapman & Hall/CRC Press, 568 pages, ISBN 978-1-4822-4819-7**

This book provides an introduction to Bayesian applications in repeated measures analysis with a particular focus on medical and epidemiological applications. A repeated measure is a variable measured more than once on the same subject, and repeated measures analysis is often used to evaluate interventions, so that measures are taken before and after the intervention. A more generic term is longitudinal analysis, where an outcome is measured at several time points for each subject, often over a relatively long period of time.

Chapter 1 of *Bayesian Methods for Repeated Measures* starts with a three- page section on what repeated measures analysis is and mentions some of the potential missing data issues. It then moves on to provide a brief overview of the principles of Bayesian inference. Bayesian methods have particular utility in facilitating analysis and estimation of random effects that frequently are needed in repeated measures analysis, and in permitting a broad range of inferences without involving the asymptotic assumptions often present in classical analysis.

Chapter 1 then provides examples of key densities (binomial, Normal, Poisson, multinomial), and introduces the BUGS program, which is the computational context for the codes supplied through the book. The BUGS program was the first widely applicable computer package to offer Bayesian estimation. Most new developments of Bayesian computing focus on an R environment, but BUGS codes can be readily translated to code suitable for R routines for Bayesian estimation (e.g. rjags, R2WinBUGS). Chapter 2 overviews some major regression methods: normal linear, logistic, and nonlinear regression. Chapter 3 discusses some of the principles of repeated measures analysis, including graphical methods, in conjunction with three applications using BUGS.

Chapters 4 to 7 consider continuous data. The fourth chapter considers the normal linear repeated measures model, allowing for both varying numbers of repetitions for each subject and varying times at which measures are taken. Historic approaches such as multivariate analysis of variance are contrasted with Bayesian methods. These use a Wishart prior on an unstructured inverse covariance matrix for errors correlated within subjects. The compound symmetry covariance option is also discussed. Chapter 5 considers methods for modelling the changing mean response through time, whether in terms of a linear function, quadratic function, or a linear shift point model (linear spline). As elsewhere in the book, graphical confirmation and representation of results are emphasized (e.g. through loess plots for the groups being compared). Chapter 6 describes different approaches for modelling error covariation through time in normal linear models: unstructured, autoregressive, Toeplitz, and compound symmetry. BUGS code for these options is presented and applied to an exercise therapy dataset, with fit comparisons made using the DIC criterion. Chapter 7 sets out the linear mixed model framework for continuous data and includes more specialised diagnostic tools, such as Cholesky transformed residuals.

The remaining chapters consider other issues in longitudinal analysis. Chapter 8 discusses repeated measures for categorical data, including multinomial, ordinal, binary, and count data, including a

Bayesian adaptation of the GEE procedure, and application of generalized linear mixed models. Chapter 9 considers models (e.g. pharmacokinetic) with means nonlinear in time or covariates and with error covariation modelled as unstructured, autoregressive, or Toeplitz. The final chapter discusses and illustrates the analysis of missing longitudinal data under a missing at random assumption.

The book will be especially useful for clinical researchers, epidemiologists, and other researchers focussed on data analysis and seeking to apply Bayesian methods. Useful computer codes and worked examples are provided. Moreover, the book also has utility as a general exposition of data and graph analytic approaches to longitudinal data.

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