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Postscript

No scientific methodology stands still and statistical modelling is no exception. In this book we have deliberately restricted our attention to well-established methods which have become a routine part of modern epidemiology, and omitted newer developments, even though some of these will undoubtedly make important contributions to epidemiology in the future. Two areas in particular are worth mentioning. The first is the extension of the models discussed in this book to deal with errors of measurement of explanatory variables (see Chapter 27). The second concerns the extension of these models to *longitudinal studies* in which the response is measured on several different occasions for each subject.

The methods we have described concentrate on the analysis of response at the level of the individual subject. Even when these analyses have been carried out using frequency records this has been purely for computational convenience and parameters still refer to the effects upon the response for an individual subject. However, some epidemiological research is based upon the behaviour of aggregated groups of individuals, for example the inhabitants of a country, region, or town. Statistical analysis then concentrates on description and 'explanation' of differences in the aggregate responses of such groups in time and space. By analogy with the discipline of economics, such activity could be termed *macro-epidemiology*. We have not dealt with it in this book, firstly because this field is currently undergoing active development, and secondly because new likelihoods and fitting procedures become necessary as a result of the more complicated probability models which are a necessary response to lack of data at the subject level.

Some further reading

A good elementary introduction to statistical modelling using the computer program GLIM is:

Healy, M. (1988) *GLIM. An Introduction.* Oxford Science Publications, Oxford University Press, Oxford.

The reader who requires more mathematical details can find them in a

number of statistical texts. General treatments of regression model, including Poisson and logistic regression, are given by the following authors.

Aitkin, M., Anderson, D., Francis, B., and Hinde, J. (1989) *Statistical modelling in GLIM.* Oxford Science Publications, Oxford University Press, Oxford.

McCullagh, M. and Nelder, J.A. (1989) *Generalized linear models* (2nd edn). Chapman and Hall, London.

Descriptions of modern statistical approaches to the analysis of life tables and survival data are given by the following authors.

Cox, D.R. and Oakes, D. (1984) *The analysis of survival data.* Chapman and Hall, London.

Kalbfleisch, J.D. and Prentice, R.L. (1980) *The statistical analysis of failure time data.* Wiley, New York.

A detailed exposition of a more general mathematical approach to modelling event occurrence in time is to be found in:

Andersen, P.K., Borgan, Ø., Gill, R.D., and Keiding, N. (1993) *Statistical models based on counting processes.* Springer, New York.

Intermediate in technical level between these purely statistical texts and this book are:

Breslow, N.E. and Day, N. (1980) *Statistical methods in cancer epidemiology. Vol. I – The analysis of case-control studies.* IARC Scientific Publications No. 32. International Agency for Research on Cancer, Lyon.

Breslow, N.E. and Day, N. (1987) *Statistical methods in cancer epidemiology. Vol. II – The design and analysis of cohort studies.* IARC Scientific Publications No. 82. International Agency for Research on Cancer, Lyon.

A collection of papers dealing with very recent research in epidemiological modelling is:

Moolgavkar, S.H. and Prentice, R.L. (ed.) (1986) *Modern statistical methods in chronic disease epidemiology.* Wiley, New York.

An extensive review of the more recent statistical literature is:

Gail, M.H. (1991) A bibliography and comments on the use of statistical models in epidemiology in the 1980s. *Statistics in Medicine*, **10**, 1819–95.