Forecasting Mortality in Developed Countries
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Forecasting Mortality in Developed Countries

Insights from a Statistical, Demographic and Epidemiological Perspective

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NEW YORK, BOSTON, DORDRECHT, LONDON, MOSCOW
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Foreword

Forecasting is a hazardous yet essential enterprise, in demography as in other fields. This volume contains contributions to the theory and practice of forecasting of mortality in the relatively favourable circumstances in developed countries; that is, when extensive historical data are available, at least in aggregate form, and when the economic, epidemiological and social contexts are understood to the extent that current knowledge permits. In this case it is possible to focus on the central problem of first finding an apt description of the past and then combining this historical knowledge with a variety of considerations, many subjective, to make a forecast. An apt description of the past is increasingly coming to mean a quantitative summary as given by a statistical model in the form of a regression or time series. The subjective considerations are essentially judgemental factors based on more or less expert opinion.

Even though circumstances are relatively favourable in low-mortality developed countries, the advantages are only relative, and there remain serious impediments to the process of formulating a forecast. To an extent, this is due to difficulties in finding a generally acceptable methodological approach, and dilemmas in formulating assumptions for models, and partly due to deficiencies in the data such as a lack of generation and cause-of-death or longitudinal survey data on linked mortality and disability. It is therefore useful to discuss the experience collected by scientific institutes and statistical practice with a view to developing improved forecasting techniques. Considerations such as these prompted the organisation of the workshop 'Forecasting of mortality in developed countries: searching for better methods and realistic assumptions'.

The workshop was an initiative of the Netherlands Interdisciplinary Demographic Institute, and took place at its premises on 5 September 1997. The participants included representatives of several Dutch and European organisations, which have done much of the work on forecasting of mortality:
the Netherlands Interdisciplinary Demographic Institute (NIDI), the French National Demographic Institute (INED), the National Institute for Public Health and the Environment (RIVM, the Netherlands), some departments of the Erasmus University in Rotterdam, the Population Research Centre of Groningen University (PRC RUG), Statistics Netherlands (NCBS), and the Statistical Office of the European Communities (Eurostat). By inviting experts, we hoped to benefit from a range of experience in the field. Three invited speakers were present: professor Nicolas Brouard (the French National Demographic Institute (INED), Paris, France), professor Christopher Heathcote (the Australian National University, Canberra, Australia) and Harri Crujsen (Eurostat, Luxembourg). The two first guests are statisticians, both oriented theoretically in their work on mortality and health. The third guest, a mathematician, represents the statistical practice in Europe and has a deep interest in demographic projections.

The workshop was a platform where we summarised and shared relevant experience, as well as explored future directions in making forecasts of mortality in low-mortality countries in Europe, in particular in the Netherlands. Our discussions were creative and constructive, inventive and stimulating. They were also well structured and complete, meaning they were carefully prepared, so that we decided to put our thoughts on paper. The workshop was apparently a strong incentive to many of us, as today we are able to present a coherent collection of 12 papers written in response to what we talked about at that time. In this way, the reader gets a book with a state-of-the-art overview of the works done recently on mortality forecasting in developed countries of western Europe, especially in the Netherlands, and of prospects for mortality forecasting in these countries.

Our book is meant for all scientists interested in forecasting mortality and aims to bring together contributions not only from demography but also from official and mathematical statistics and epidemiology. Our belief is that an interdisciplinary approach has much to offer. Techniques from mathematical statistics and econometrics can provide useful descriptions of past mortality. The naive forecast obtained by extrapolating a fitted model may give as good a forecast as any but forecasting by extrapolation requires careful justification since it assumes the prolongation of historical conditions. That is, stationarity is assumed. On the other hand, whilst it is generally accepted that scientific and other advances will continue to impact on mortality, perhaps dramatically so, it is impossible to quantify more than the outline of future consequences.
with a strong degree of confidence. The decision to modify an extrapolation of a model fitted to historical data (or conversely choosing not to modify it) to obtain a forecast must therefore be strongly influenced by subjective and judgemental elements, with the quality of the latter dependent on demographic, epidemiological and indeed perhaps more general considerations. Thus the thread running through the book reflects the necessity of integrating demographic, epidemiological and statistical factors to obtain an improvement in the prediction of mortality. Included are the following issues: statistical models in both the descriptive and predictive senses, assumptions about changes in future mortality and making explicit judgmental and subjective considerations, and satisfying the needs of users by incorporating issues such as health and morbidity into forecasting.

There are four parts to the book: an introduction (Part 1), theoretical perspectives on the forecasting of mortality (Part 2), from theory to practice (Part 3), and issues for the future (Part 4).

Part 1 consists of two review contributions. Of these, Chapter 1 reviews demographic methods of forecasting mortality and includes a discussion of time series and other parametric models that have developed a substantial literature in recent years. Chapter 2 describes epidemiological models which incorporate consideration of disease processes and related risk factors and their use in forecasting mortality.

The material in Part 2 is more mathematical in nature. Chapters 3 and 4 deal with regression modelling of what are called mortality surfaces. These surfaces are functions of time and age that are measures of mortality and that can be estimated by known statistical methods. Chapter 5 brings together facts about the Gompertz distribution and related matters. Chapter 6 treats the problems of modelling mortality at the oldest old ages, again using regression techniques, and including a comparison of demographic models for mortality over age 80.

The focus of the contributions in Part 3 is on practical matters. Chapter 7 discusses the role of period, cohort and cause-of-death effects in the forecasting of mortality. Chapter 8 adopts an epidemiological approach in which mortality is considered from the point of view of combining risk factor prevalence and related disease risks. Models used for official forecasts of Dutch mortality are presented in Chapter 9, and Chapter 10 is a critical review
of the methods and assumptions used in obtaining the latest mortality forecasts in the countries of the European Union.

Chapter 11 in Part 4, Issues for the future, reviews mortality models formulated using concepts belonging to various theories of human ageing. Hopefully, some of the models representing this new line of research will be used in forecasting mortality in the years to come. Finally, Chapter 12 in Part 4 summarises the content of this book and focuses on the requirements of mortality forecasting from the perspective of assumptions, models and data. The discussion is influenced by keeping in mind various forms of the demand for information on future levels of mortality, that is, demand due to population forecasting, health forecasting and scientific analyses. This chapter ends by stressing the necessity of integrating the tools and perspectives of the disciplines of demography, epidemiology, and statistics in order to achieve improved forecasts of mortality.

The editors
Preface

This book is the result of several activities related to forecasting mortality and health in low mortality countries of Europe in the 1990s. Many of these activities were completed with the financial support of the European Commissions’ Directorate-General V (Employment, Industrial Relations and Social Affairs), the Netherlands Interdisciplinary Demographic Institute (NIDI), and the Dutch Institute of Public Health and the Environment (RIVM).

Several people helped us at different stages of this project contributing to the completion of this book. First of all, thanks are due to all those whose views and ideas inspired a great deal of the works completed in this project and who also enabled us to gather the necessary data for the analyses presented here: France Mesle, Jacques Vallin and Nicolas Brouard in France, Graziella Caselli and Valerio Terra Abrami in Italy, Jens-Kristian Borgan in Norway, James Vaupel in Germany, and Harri Cruijsen in the Netherlands (previously at Eurostat in Luxembourg). We thank Kirill Andreev (Germany) who prepared the oldest-old data and Jeroen Berkien (the Netherlands) who helped us restructure certain data. Our greatest debt is to an anonymous referee who reviewed the manuscript on behalf of ESPO and in a handful of priceless remarks and suggestions guided the authors in their revisions and the editors in editing this volume. We received invaluable support from Evert van Imhoff (the Netherlands) who read and commented on several chapters. Leo van Wissen (the Netherlands) helped us with the organisational aspects of this project. Many thanks are due to Willemien Kneppelhout and Anne Mark for their professional approach and creativity in editing our English. We thank Tonny Nieuwstraten who with devotion and passion prepared the final lay-out of this volume, Leon Vermeulen who invented the electronic procedures for this publication, and Jacqueline van der Helm who had the final responsibility for the ESPO style of this volume.
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