Epidemics Models And Data Using R Use R

MIDDLETON MATHEWS

Modeling and Dynamics of Infectious Diseases Springer
Mathematical and Statistical Estimation Approaches in Epidemiology compiles t- oretical and practical contributions of experts in the analysis of infectious disease epidemics in a single volume. Recent collections have focused in the analyses and simulation of deterministic and stochastic models whose aim is to identify and rank epidemiological and social mechanisms responsible for disease transmission. The contributions in this volume focus on the connections between models and disease data with emphasis on the application of mathematical and statistical approaches that quantify model and data uncertainty. The book is aimed at public health experts, applied mathematicians and sci- tists in the life and social sciences, particularly graduate or advanced undergraduate students, who are interested not only in building and connecting models to data but also in applying and developing methods that quantify uncertainty in the context of infectious diseases. Chowell and Brauer open this volume with an overview of the classical disease transmission models of Kermack-McKendrick including extensions that account for increased levels of epidemiological heterogeneity. Their theoretical tour is followed by the introduction of a simple methodology for the estimation of, the basic reproduction number,R . The use of this methodology 0 is illustrated, using regional data for 1918–1919 and 1968 in uenza pandemics.
Charting the Next Pandemic CRC Press
This book provides an introduction to the computational and complex systems modeling of the global spreading of infectious diseases. The latest developments in the area of contagion processes modeling are discussed, and readers are exposed to real world examples of data-model integration impacting the decision-making process. Recent advances in computational science and the increasing availability of real-world data are making it possible to develop realistic scenarios and real-time forecasts of the global spreading of emerging health threats. The first part of the book guides the reader through sophisticated complex systems modeling techniques with a non-technical and visual approach, explaining and illustrating the construction of the modern framework used to project the spread of pandemics and epidemics. Models can be used to transform data to knowledge that is intuitively communicated by powerful infographics and for this reason, the second part of the book focuses on a set of charts that illustrate possible scenarios of future pandemics. The visual atlas contained allows the reader to identify commonalities and patterns in emerging health threats, as well as explore the wide range of models and data that can be used by policy makers to anticipate trends, evaluate risks and eventually manage future events. Charting the Next Pandemic puts the reader in the position to explore different pandemic scenarios and to understand the potential impact of available containment and prevention strategies. This book emphasizes the importance of a global perspective in the assessment of emerging health threats and captures the possible evolution of the next pandemic, while at the same time providing the intelligence needed to fight it. The text will appeal to a wide range of audiences with diverse technical backgrounds.
The Geographic Spread of Infectious Diseases Springer Nature
The contributions by epidemic modeling experts describe how mathematical models and statistical forecasting are created to capture the most important aspects of an emerging epidemic.Readers will discover a broad range of approaches to address questions, such as Can we control Ebola via ring vaccination strategies? How quickly should we detect Ebola cases to ensure epidemic control? What is the likelihood that an Ebola epidemic in West Africa leads to secondary outbreaks in other parts of the world? When does it matter to incorporate the role of disease-induced mortality on epidemic models? What is the role of behavior changes on Ebola dynamics? How can we better understand the control of cholera or Ebola using optimal control theory? How should a population be structured in order to mimic the transmission dynamics of diseases such as chlamydia, Ebola, or cholera? How can we objectively determine the end of an epidemic? How can we use metapopulation models to understand the role of movement restrictions and migration patterns on the spread of infectious diseases? How can we capture the impact of household transmission using compartmental epidemic models? How could behavior-dependent vaccination affect the dynamical outcomes of epidemic models? The derivation and analysis of the mathematical models addressing these questions provides a wide-ranging overview of the new approaches being created to better forecast and mitigate emerging epidemics. This book will be of interest to researchers in the field of mathematical epidemiology, as well as public health workers.
World Bank Publications
From a mathematical point of view, physiologically structured population models are an underdeveloped branch of the theory of infinite dimensional dynamical systems. We have called attention to four aspects: (i) A choice has to be made about the kind of equations one extracts from the predominantly verbal arguments about the basic assumptions, and subsequently uses as a starting point for a rigorous mathematical analysis. Though differential equations are easy to formulate (different mechanisms don't interact in infinites imal time intervals and so end up as separate terms in the equations) they may be hard to interpret rigorously as infinitesimal generators. Integral equations constitute an attractive alternative. (ii) The ability of physiologically structured population models to increase our un derstanding of the relation between mechanisms at the i-level and phenomena at the p-level will depend strongly on the development of dynamical systems lab facilities which are applicable to this class of models. (iii) Physiologically structured population models are ideally suited for the for mulation of evolutionary questions. Apart from the special case of age (see Charlesworth 1980, Yodzis 1989, Caswell 1989, and the references given there) hardly any theory exists at the moment. This will, hopefully, change rapidly in the coming years. Again the development of appropriate software may turn out to be crucial.
Epidemics IGI Global
Pandemics are disruptive. Thus, there is a need to prepare and plan actions in advance for identifying, assessing, and responding to such events to manage uncertainty and support sustainable livelihood and wellbeing. A detailed assessment of a continuously evolving situation needs to take place, and several aspects must be brought together and examined before the declaration of a pandemic even happens. Various health organizations; crisis management bodies; and authorities at local, national, and international levels are involved in the management of pandemics. There is no better time to revisit current approaches to cope with these new and unforeseen threats. As countries must strike a fine balance between protecting health, minimizing economic and social disruption, and respecting human rights, there has been an emerging interest in lessons learned and specifically in revisiting past and current pandemic approaches. Such approaches involve strategies and practices from several disciplines and fields including healthcare, management, IT, mathematical modeling, and data science. Using data science to advance in-situ practices and prompt future directions could help alleviate or even prevent human, financial, and environmental compromise, and loss and social interruption via state-of-the-art technologies and frameworks. Data Science Advancements in Pandemic and Outbreak Management demonstrates how strategies and state-of-the-art IT have and/or could be applied to serve as the vehicle to advance pandemic and outbreak management. The chapters will introduce both technical and non-technical details of management strategies and advanced IT, data science, and mathematical modelling and demonstrate their applications and their potential utilization within the identification and management of pandemics and outbreaks. It also prompts revisiting and critically reviewing past and current approaches, identifying good and bad practices, and further developing the area for future adaptation. This book is ideal for data scientists, data analysts, infectious disease experts, researchers studying pandemics and outbreaks, IT, crisis and disaster management, academics, practitioners, government officials, and students interested in applicable theories and practices in

data science to mitigate, prepare for, respond to, and recover from future pandemics and outbreaks.
Building a Platform for Data-Driven Pandemic Prediction Springer
This timely book covers the basic concepts of the dynamics of epidemic disease, presenting various kinds of models as well as typical research methods and results. It introduces the latest results in the current literature, especially those obtained by highly rated Chinese scholars. A lot of attention is paid to the qualitative analysis of models, the sheer variety of models, and the frontiers of mathematical epidemiology. The process and key steps in epidemiological modeling and prediction are highlighted, using transmission models of HIV/AIDS, SARS, and tuberculosis as application examples.
Infectious Disease Epidemiology World Scientific
This volume presents infectious diseases modeled mathematically, taking seasonality and changes in population behavior into account, using a switched and hybrid systems framework. The scope of coverage includes background on mathematical epidemiology, including classical formulations and results; a motivation for seasonal effects and changes in population behavior, an investigation into term-time forced epidemic models with switching parameters, and a detailed account of several different control strategies. The main goal is to study these models theoretically and to establish conditions under which eradication or persistence of the disease is guaranteed. In doing so, the long-term behavior of the models is determined through mathematical techniques from switched systems theory. Numerical simulations are also given to augment and illustrate the theoretical results and to help study the efficacy of the control schemes.
Modern Infectious Disease Epidemiology Princeton University Press
This book introduces advanced mathematical methods and techniques for analysis and simulation of models in mathematical epidemiology. Chronological age and class-age play an important role in the description of infectious diseases and this text provides the tools for the analysis of this type of partial differential equation models. This book presents general theoretical tools as well as large number of specific examples to guide the reader to develop their own tools that they may then apply to study structured models in mathematical epidemiology. The book will be a valuable addition to the arsenal of all researchers interested in developing theory or studying specific models with age structure.
Modeling to Inform Infectious Disease Control Springer Nature
Effectively Assess Intervention Options for Controlling Infectious DiseasesOur experiences with the human immunodeficiency virus (HIV), severe acute respiratory syndrome (SARS), and Ebola virus disease (EVD) remind us of the continuing need to be vigilant against the emergence of new infectious diseases. Mathematical modeling is increasingly used i
Mathematics of Epidemics on Networks Springer
Mathematical models are increasingly used to guide public health policy decisions and explore questions in infectious disease control. Written for readers without advanced mathematical skills, this book provides an introduction to this area.
Mathematical and Statistical Estimation Approaches in Epidemiology Springer
Mathematical models can be very helpful to understand the transmission dynamics of infectious diseases. This book presents examples of epidemiological models and modeling tools that can assist policymakers to assess and evaluate disease control strategies. Contents: Development and Analysis of Models for Infectious Diseases; Application of Models to Real Disease Data; User-Friendly Modeling Tools for Public Health Policymakers. Readership: Researchers in mathematical biology, mathematical modeling, infectious diseases and complex systems.
Infectious Disease Modeling Springer Science & Business Media
The present lecture notes describe stochastic epidemic models and methods for their statistical analysis. Our aim is to present ideas for such models, and methods for their analysis; along the way we make practical use of several probabilistic and statistical techniques. This will be done without focusing on any specific disease, and instead rigorously analyzing rather simple models. The reader of these lecture notes could thus have a two-fold purpose in mind: to learn about epidemic models and their statistical analysis, and/or to learn and apply techniques in probability and statistics. The lecture notes require an early graduate level knowledge of probability and They introduce several techniques which might be new to students, but our statistics. intention is to present these keeping the technical level at a minlmum. Techniques that are explained and applied in the lecture notes are, for example: coupling, diffusion approximation, random graphs, likelihood theory for counting processes, martingales, the EM-algorithm and MCMC methods. The aim is to introduce and apply these techniques, thus hopefully motivating their further theoretical treatment. A few sections, mainly in Chapter 5, assume some knowledge of weak convergence; we hope that readers not familiar with this theory can understand the these parts at a heuristic level. The text is divided into two distinct but related parts: modelling and estimation.
Frontiers in Mathematical Biology Oxford University Press
This fully updated edition of Infectious Disease Surveillance is for frontline public health practitioners, epidemiologists, and clinical microbiologists who are engaged in communicable disease control. It is also a foundational text for trainees in public health, applied epidemiology, postgraduate medicine and nursing programs. The second edition portrays both the conceptual framework and practical aspects of infectious disease surveillance. It is a comprehensive resource designed to improve the tracking of infectious diseases and to serve as a starting point in the development of new surveillance systems. Infectious Disease Surveillance includes over 45 chapters from over 100 contributors, and topics organized into six sections based on major themes. Section One highlights the critical role surveillance plays in public health and it provides an overview of the current International Health Regulations (2005) in addition to successes and challenges in infectious disease eradication. Section Two describes surveillance systems based on logical program areas such as foodborne illnesses, vector-borne diseases, sexually transmitted diseases, viral hepatitis healthcare and transplantation associated infections. Attention is devoted to programs for monitoring unexplained deaths, agents of bioterrorism, mass gatherings, and disease associated with international travel. Sections Three and Four explore the uses of the Internet and wireless technologies to advance infectious disease surveillance in various settings with emphasis on best practices based on deployed systems. They also address molecular laboratory methods, and statistical and geospatial analysis, and evaluation of systems for early epidemic detection. Sections Five and Six discuss legal and ethical considerations, communication strategies and applied epidemiology-training programs. The rest of the chapters offer public-private partnerships, as well lessons from the 2009-2010 H1N1 influenza pandemic and future directions for infectious disease surveillance.
Quantitative Methods for Investigating Infectious Disease Outbreaks CRC Press
The Second Autumn Course on Mathematical Ecology was held at the Intern ational Centre for Theoretical Physics in Trieste, Italy in November and December of 1986. During the four year period that had elapsed since the First Autumn Course on Mathematical Ecology, sufficient progress had been made in applied mathemat ical ecology to merit tilting the balance maintained between theoretical aspects and applications in the 1982 Course toward applications. The course format, while similar to that of the first Autumn Course on Mathematical Ecology, consequently focused upon applications of mathematical ecology. Current areas of application are almost as diverse as the spectrum covered by ecology. The topiys of this book reflect this diversity and were chosen because of perceived interest and utility to developing countries. Topical lectures began with foundational material mostly derived from Math ematical Ecology: An Introduction (a compilation of the lectures of the 1982 course published by Springer-Verlag in this series, Volume 17) and, when possible, progressed to the frontiers of research. In addition to the course lectures, workshops were arranged for small groups to supplement and enhance the learning experience. Other perspectives were provided through presentations by course participants and speakers at the associated Research Conference. Many of the research papers are in a companion volume, Mathematical Ecology: Proceedings Trieste 1986, published by World Scientific Press in 1988. This book is structured primarily by application area. Part II provides an introduction to mathematical and statistical applications in resource management.
Mathematical Models in Epidemiology Springer Science & Business Media
Mathematical Epidemiology of Infectious Diseases Model Building, Analysis and Interpretation O. Diekmann University of Utrecht, The Netherlands J. A. P. Heesterbeek Centre for Biometry Wageningen, The Netherlands The mathematical modelling of epidemics in populations is a vast and important area of study. It is about translating biological assumptions into mathematics, about mathematical analysis aided by interpretation and about obtaining insight into epidemic phenomena when translating mathematical results back into population biology. Model assumptions are formulated in terms of, usually stochastic, behaviour of individuals and then the resulting phenomena, at the population level, are unravelled. Conceptual clarity is attained, assumptions are stated clearly, hidden working hypotheses are attained and mechanistic links between different observables are exposed. Features: * Model construction, analysis and interpretation receive detailed attention * Uniquely covers both deterministic and stochastic viewpoints * Examples of applications given throughout * Extensive coverage of the latest research into the mathematical modelling of epidemics of infectious diseases * Provides a solid foundation of modelling skills The reader will learn to translate, model, analyse and interpret, with the help of the numerous exercises. In literally working through this text, the reader acquires modelling skills that are also valuable outside of epidemiology, certainly within population dynamics, but even beyond that. In addition, the reader receives training in mathematical argumentation. The text is aimed at applied mathematicians with an interest in population biology and epidemiology, at theoretical biologists and epidemiologists. Previous exposure to epidemic concepts is not required, as all background information is given. The book is primarily aimed at self-study and ideally suited for small discussion groups, or for use as a course text.
An Introduction to Mathematical Modeling of Infectious Diseases Springer
This is a general introduction to the mathematical modelling of diseases.
Dynamical Modeling and Analysis of Epidemics Springer
Based on lecture notes of two summer schools with a mixed audience from mathematical sciences, epidemiology and public health, this volume offers a comprehensive introduction to basic ideas and techniques in modeling infectious diseases, for the comparison of strategies to plan for an anticipated epidemic or pandemic, and to deal with a disease outbreak in real time. It covers detailed case studies for diseases including pandemic influenza, West Nile virus, and childhood diseases. Models for other diseases including Severe Acute Respiratory Syndrome, fox rabies, and sexually transmitted infections are included as applications. Its chapters are coherent and complementary independent units. In order to accustom students to look at the current literature and to experience different perspectives, no attempt has been made to achieve united writing style or unified notation. Notes on some mathematical background (calculus, matrix algebra, differential equations, and probability) have been prepared and may be downloaded at the web site of the Centre for Disease Modeling (www.cdm.yorku.ca).
An Introduction to Mathematical Epidemiology Springer Science & Business Media
For epidemiologists, evolutionary biologists, and health-care professionals, real-time and predictive modeling of infectious disease is of growing importance. This book provides a timely and comprehensive introduction to the modeling of infectious diseases in humans and animals, focusing on recent developments as well as more traditional approaches. Matt Keeling and Pejman Rohani move from modeling with simple differential equations to more recent, complex models, where spatial structure, seasonal "forcing," or stochasticity influence the dynamics, and where computer simulation needs to be used to generate theory. In each of the eight chapters, they deal with a specific modeling approach or set of techniques designed to capture a particular biological factor. They illustrate the methodology used with examples from recent research literature on human and infectious disease modeling, showing how such techniques can be used in practice. Diseases considered include BSE, foot-and-mouth, HIV, measles, rubella, smallpox, and West Nile virus, among others. Particular attention is given throughout the book to the development of practical models, useful both as predictive tools and as a means to understand fundamental epidemiological processes. To emphasize this approach, the last chapter is dedicated to modeling and understanding the control of diseases through vaccination, quarantine, or culling. Comprehensive, practical introduction to infectious disease modeling Builds from simple to complex predictive models Models and methodology fully supported by examples drawn from research literature Practical models aid students' understanding of fundamental epidemiological processes For many of the models presented, the authors provide accompanying programs written in Java, C, Fortran, and MATLAB In-depth treatment of role of modeling in understanding disease control
Mathematical and Statistical Modeling for Emerging and Re-emerging Infectious Diseases John Wiley & Sons
This text provides essential modeling skills and methodology for the study of infectious diseases through a one-semester modeling course or directed individual studies. The book includes mathematical descriptions of epidemiological concepts, and uses classic epidemic models to introduce different mathematical methods in model analysis. Matlab codes are also included for numerical implementations. It is primarily written for upper undergraduate and beginning graduate students in mathematical sciences who have an interest in mathematical modeling of infectious diseases. Although written in a rigorous mathematical manner, the style is not unfriendly to non-mathematicians.
Microbial Threats to Health Springer Science & Business Media
The book is a comprehensive, self-contained introduction to the mathematical modeling and analysis of disease transmission models. It includes (i) an introduction to the main concepts of compartmental models including models with heterogeneous mixing of individuals and models for vector-transmitted diseases, (ii) a detailed analysis of models for important specific diseases, including tuberculosis, HIV/AIDS, influenza, Ebola virus disease, malaria, dengue fever and the Zika virus, (iii) an introduction to more advanced mathematical topics, including age structure, spatial structure, and mobility, and (iv) some challenges and opportunities for the future. There are exercises of varying degrees of difficulty, and projects leading to new research directions. For the benefit of public health professionals whose contact with mathematics may not be recent, there is an appendix covering the necessary mathematical background. There are indications which sections require a strong mathematical background so that the book can be useful for both mathematical modelers and public health professionals.