MODELLING IN HEALTHCARE

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Preface

As healthcare systems worldwide face the challenge of delivering quality services while maintaining control over escalating costs, there is growing support for the view that conventional approaches to the organization of healthcare systems are failing. The questions arising are extremely complex, and in most cases it is not acceptable to rely on simple intuition to answer a given question. In order to develop solid, defendable, evidence-based answers to the complex questions arising in modern healthcare, modelling is being increasingly applied. Yet, to many healthcare policymakers, the development, tuning, testing, validation, and eventual application of a model are considered a foreign art.

A model is a simplified representation of a real-world situation used to help answer a specific question. The main role of a model is to help steer decisions in the right direction. In most cases a model cannot give the "right" answer to a problem, but it can be a useful tool in characterizing the problem and finding ways to resolve it. In this book we provide a look into the world of modelling, with particular focus on modelling in healthcare. We provide this as it is our belief that decision makers and modellers must share a certain level of knowledge to maintain a healthy relationship. Modellers working on healthcare problems cannot be blind to the less mathematical issues of healthcare, and decision makers engaging modellers should not view models as mystical crystal balls from which answers emerge. As the Complex Systems Modelling Group, we have worked extensively with healthcare policymakers and have developed expertise in developing and analyzing healthcare models and in explaining models and modelling to those unfamiliar with the subject. With this book we hope to use this expertise to help strengthen the bonds between the worlds of modelling and healthcare.

This book is by no means a complete text on the subject of modelling in healthcare. In fact each chapter in this book (with the exception of the introductory chapters) could easily be extended into a complete textbook. We hope readers will view this as a handbook of modelling in healthcare and use it to provide themselves with a broad overview of how modelling works and what it is capable of.

As a handbook of modelling techniques, each chapter of this book has been written in a self-contained manner. Any given chapter can be read without having read previous chapters (although we strongly recommend reading the introductory chapters before tackling other chapters). Any text cross-reference to a section (or subsection) refers to that section (or subsection) in the current chapter unless otherwise specified. With the exception of the introductory chapters, each chapter focuses on a particular style of modelling that is applicable to healthcare. To keep the book as self-contained as possible, most chapters contain enough background that they are accessible to anyone with a solid high school level of mathematics. To ease reading, most chapters are written using the same basic template consisting of *Model Overview, Common Uses, Model or Mathematical Details, Examples,* and *Related Reading.* Readers can quickly scan the model overview and common uses sections to determine if a model is applicable to the problem they are interested in and can study the mathematical details and examples sections if more detail is desired. The related reading section points readers to further literature of interest.

It is our hope that this book will provide a stepping stone for people interested in the world of modelling in healthcare, while remaining an excellent reference guide for those more familiar with the subject. As such, this book should be of use to anyone, academic or professional, who is interested in broadening his or her knowledge regarding modelling in healthcare.

Acknowledgments

The creation of this book began when the British Columbia Ministry of Health Services commissioned the Complex Systems Modelling Group (CSMG) at Simon Fraser University to produce a report on the many different mathematical options for modelling healthcare demand. For some of us this was a first step into the world of mathematical modelling specifically for healthcare – a step that has become a defining moment in many of our lives. We would like to thank the British Columbia Ministry of Health Services for funding the original report and for their continued support during the completion of this book.

Like any large team project, the production of the final manuscript for this book was a long and complicated process. Without the assistance of the many contributing authors (listed on page xiii) the final product would have been less than it is. Nonetheless, as with any large team project, there are certain individuals whose roles were more pivotal in the completion of this work. In this respect we would like to acknowledge authors Hare, Rutherford, and Vásárhelyi, as principal authors responsible for the original report and this book.

Finally, we would like to express our gratitude to the Centre for Interdisciplinary Research in the Mathematical and Computational Sciences (IRMACS, http://www.irmacs.sfu.ca) at Simon Fraser University. We are deeply indebted to IRMACS for its continual support during the production of this work. Many barriers could never have been crossed without the aide of the strong team of IRMACS administrative and technical support staff.

Peter Borwein, Executive Director, CSMG
October 2009

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