

Preface

Globally, health policy-makers face several daunting challenges. In many low-income countries, HIV, malaria, and other diseases are endemic. There are serious shortages of medicines and vaccines, along with supply-chain disruptions, all of which cause unnecessary suffering and reduced life expectancies. In many high-income countries, health-care spending already represents more than 10 % of GDP and is growing faster than the economy as a whole. Many of these countries face aging populations, which strains the sustainability of publicly funded health-care systems and creates challenges in forecasting the required capacity of health-care services in coming decades. Several middle-income countries face funding and organizational challenges as they transition to more generous publicly funded systems. Medical research is producing promising but very expensive new drugs and medical technologies. Policy-makers in all environments face difficult decisions about which new drugs and medical technologies to fund, under which conditions they should be made available, and how to pay for them.

Operations research tools are ideally suited to providing solutions and insights for many of these problems. Indeed, a growing body of literature on health policy analysis, based on operations research methods, has emerged to address the problems mentioned above and several others. The research in this field is often multidisciplinary, being conducted by teams that include not only operations researchers but also clinicians, economists, and policy analysts. The research is also often very applied, focusing on a specific question driven by a decision-maker and many times yielding a tool to assist in future decisions.

The goal of this volume was to bring together a group of papers by leading experts that could showcase the current state of the field of operations research applied to health-care policy. There are 18 chapters that illustrate the breadth of this field. The chapters use a variety of techniques, including classical operations research tools, such as optimization, queuing theory, and discrete event simulation, as well as statistics, epidemic models, and decision-analytic models. The book spans the field and includes work that ranges from highly conceptual to highly applied. An example of the former is the chapter by Kimmel and Schackman on building policy models, and an example of the latter is the chapter by Coyle

and colleagues on developing a Markov model for use by an organization in Ontario that makes recommendations about the funding of new drugs. The book also includes a mix of review chapters, such as the chapter by Hutton on public health response to influenza outbreaks, and original research, such as the paper by Blake and colleagues analyzing a decision by Canadian Blood Services to consolidate services. This volume could provide an excellent introduction to the field of operations research applied to health-care policy, and it could also serve as an introduction to new areas for researchers already familiar with the topic.

The book is divided into six parts. The first part contains two chapters that describe several different applications of operations research in health policy and provide an excellent overview of the field. Parts II, III, and IV present policy models in three focused areas. Part V contains two chapters on conceptualizing and building policy models. The book concludes in Part VI with two chapters describing work that was done with policy-makers and presenting insights gained from working directly with policy-makers. A more detailed overview is provided below.

Part I Applications of Health Policy Modeling

Part I is intended to illustrate the breadth of the field and contains two chapters describing six different applications of health policy modeling. Arielle Lasry and colleagues describe three models developed by the U.S. Centers for Disease Control and Prevention. These models include an optimization model to schedule immunizations, a simulation model to estimate throughput at a vaccination clinic, and a nonlinear optimization model to allocate funds to HIV prevention programs. Margaret Brandeau discusses several more applications of health policy modeling, including economic evaluations of hepatitis vaccination programs in China and the USA, models of HIV treatment and harm reduction in Russia and Ukraine, and an evaluation of bioterrorism preparedness and control.

Part II Operations Management and Health Policy

Many health policy problems have important operational components, including capacity planning, facility location and throughput analysis, and the solutions to these problems often involve classical operations management tools. The chapters in Part II highlight the interplay between health policy and operations management. Yue Zhang and Martin Puterman present models to determine the required capacity for long-term care beds in British Columbia. Beste Kucukyazici and Vedat Verter discuss the management of chronic diseases through community-based care. Yasar Ozcan, Elena Tãnfani, and Angela Testi discuss the “Clinical Pathway” concept and its application to improve the efficiency of thyroidectomy. Armann Ingolfson surveys the literature on planning and management of

emergency medical services, with a focus on operational measures, such as forecasting, performance measurement, facility location, and capacity allocation. In the final chapter of this part, Marion Rauner and Michaela Schaffhauser-Linzatti discuss a number of analyses of changes in reimbursement mechanisms—and, hence, changes in incentives—on various aspects of hospital and health-system performance in Austria.

Part III HIV and Infectious Diseases

The work in this area illustrates the strong connection between operations research and public health. From a modeling perspective, the problems are difficult because models of HIV and other infectious diseases often involve nonlinear systems of differential equations for which there are no analytical solutions. From a policy perspective, the problems are equally challenging because of the costs of many of the interventions and the practical and political issues associated with targeting high-risk groups. The four chapters in this part cover a wide range of problems and methodologies. Sada Sooropanth and Stephen Chick developed a model to conduct cost-utility analyses on HIV behavioral interventions. John Stover, Carel Pretorius, and Kyeen Andersson present a model to investigate new HIV prevention technologies. Their model allows policy-makers to estimate the number of HIV infections prevented, the cost, and the cost-effectiveness of new technologies. Sabina Alistair, Margaret Brandeau, and Eduard Beck describe the Resource Allocation for Control of HIV Model, which is a formal optimization model for HIV interventions that takes account of several epidemic characteristics. They provide illustrations tailored to Uganda, Ukraine, and St. Petersburg, Russia. In the final chapter in this part, David Hutton discusses several insights obtained through mathematical modeling studies of public health responses to pandemic influenza.

Part IV Pharmaceutical Applications

Pharmaceutical policy has attracted media attention in recent years through a combination of factors, including blockbuster drugs being pulled from the market due to safety concerns and the emergence of very expensive drugs costing US\$20,000–500,000 per year. The papers in this part demonstrate some of the important ways that operations research is helping to improve pharmaceutical policy. Margrét Bjarnadóttir and David Czerwinski discuss statistical tools to provide post-marketing vaccine and drug surveillance. Doug Coyle and colleagues describe the development of a Markov model that was used to help inform a funding decision for idursulfase for the treatment of Hunter disease, a rare disease affecting approximately 1 in 170,000 live births. Greg Zaric, Hui Zhang, and Reza Mahjoub

review risk-sharing models and patient-access schemes, which are contracts between drug manufacturers and health-care payers in which the unit price of a drug may change, depending on either the total number of units sold or the performance of the drug, or both.

Part V Building Health Policy Models

In this part, the focus shifts to building health policy models. The first chapter, by April Kimmel and Bruce Schackman, describes a number of high-level issues, including how to identify, conceptualize, build, and validate health policy models; it also discusses strategies for communicating results to policy-makers. The second chapter, by Malek Hannouf and Greg Zaric, describes in detail how the vast holdings of health administrative databases can be used when conducting cost-effectiveness analyses.

Part VI Working with Policy-Makers

The final part of the book is devoted to working with policy-makers. John Blake and two colleagues from Canadian Blood Services, Michelle Rogerson, and Dorothy Harris, describe an analysis that was conducted to analyze the impact of a consolidation of two facilities in Atlantic Canada. In the final chapter of the book, Jeffery Hoch describes some of the lessons that he has learned as director of the Pharmacoeconomics Research Unit at Cancer Care Ontario. The unit employs a number of modellers and health economists who provide support for managers and policy-makers at Cancer Care Ontario.

Summary

This volume covers many of the important ways in which operations research can and is contributing to improved health policy decisions. This is an exciting field that involves interdisciplinary research and the ability to have both a theoretical and a real-world impact. I believe the research and insights contained in this volume will help to enhance the value and impact of future contributions as the need for this type of work continues to grow.

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