

OPERATIONS RESEARCH AND HEALTH CARE

A HANDBOOK OF METHODS
AND APPLICATIONS

Recent titles in the

INTERNATIONAL SERIES IN

OPERATIONS RESEARCH & MANAGEMENT SCIENCE

Frederick S. Hillier, Series Editor, Stanford University

Zhu, J. / *QUANTITATIVE MODELS FOR PERFORMANCE EVALUATION AND BENCHMARKING*
Ehrgott, M. & Gandibleux, X. / *MULTIPLE CRITERIA OPTIMIZATION: State of the Art Annotated Bibliographical Surveys*

Bienstock, D. / *Potential Function Methods for Approx. Solving Linear Programming Problems*

Matsatsinis, N.F. & Siskos, Y. / *INTELLIGENT SUPPORT SYSTEMS FOR MARKETING DECISIONS*

Alpern, S. & Gal, S. / *THE THEORY OF SEARCH GAMES AND RENDEZVOUS*

Hall, R.W. / *HANDBOOK OF TRANSPORTATION SCIENCE - 2nd Ed.*

Glover, F. & Kochenberger, G. A. / *HANDBOOK OF METAHEURISTICS*

Graves, S.B. & Ringuest, J.L. / *MODELS AND METHODS FOR PROJECT SELECTION: Concepts from Management Science, Finance and Information Technology*

Hassin, R. & Haviv, M. / *TO QUEUE OR NOT TO QUEUE: Equilibrium Behavior in Queueing Systems*

Gershwin, S.B. et al / *ANALYSIS & MODELING OF MANUFACTURING SYSTEMS*

Maros, I. / *COMPUTATIONAL TECHNIQUES OF THE SIMPLEX METHOD*

Harrison, T., Lee, H. & Neale, J. / *THE PRACTICE OF SUPPLY CHAIN MANAGEMENT: Where Theory And Application Converge*

Shanthikumar, J.G., Yao, D. & Zijm, W.H. / *STOCHASTIC MODELING AND OPTIMIZATION OF MANUFACTURING SYSTEMS AND SUPPLY CHAINS*

Nabrzyski, J., Schopf, J.M., **Weglarz, J.** / *GRID RESOURCE MANAGEMENT: State of the Art and Future Trends*

Thissen, W. A.H. & Herder, P.M. / *CRITICAL INFRASTRUCTURES: State of the Art in Research and Application*

Carlsson, C., Fedrizzi, M., & Fullér, R. / *FUZZY LOGIC IN MANAGEMENT*

Soyer, R., Mazzuchi, T.A., & Singpurwalla, N.D. / *MATHEMATICAL RELIABILITY: An Expository Perspective*

Chakravarty, A.K. & Eliashberg, J. / *MANAGING BUSINESS INTERFACES: Marketing, Engineering, and Manufacturing Perspectives*

Talluri, K. & van Ryzin, G. / *THE THEORY AND PRACTICE OF REVENUE MANAGEMENT*

Kavadias, S. & Loch, C.H. / *PROJECT SELECTION UNDER UNCERTAINTY: Dynamically Allocating Resources to Maximize Value*

Brandeau, M.L., Sainfort, F., Pierskalla, W.P. / *OPERATIONS RESEARCH AND HEALTH CARE: A Handbook of Methods and Applications*

Cooper, W.W., Seiford, L.M., Zhu, J. / *HANDBOOK OF DATA ENVELOPMENT ANALYSIS: Models and Methods*

Luenberger, D.G. / *LINEAR AND NONLINEAR PROGRAMMING, 2nd Ed.*

Sherbrooke, C.C. / *OPTIMAL INVENTORY MODELING OF SYSTEMS: Multi-Echelon Techniques, Second Edition*

Chu, S.-C., Leung, L.C., Hui, Y. V., Cheung, W. / *4th PARTY CYBER LOGISTICS FOR AIR CARGO*

Simchi-Levi, Wu, Shen / *HANDBOOK OF QUANTITATIVE SUPPLY CHAIN ANALYSIS: Modeling in the E-Business Era*

Gass, S.I. & Assad, A.A. / *AN ANNOTATED TIMELINE OF OPERATIONS RESEARCH: An Informal History*

*** A list of the early publications in the series is at the end of the book ***

OPERATIONS RESEARCH AND HEALTH CARE

A HANDBOOK OF METHODS AND APPLICATIONS

Edited by

Margaret L. Brandeau

Stanford University

François Sainfort

Georgia Institute of Technology

William P. Pierskalla

University of California at Los Angeles

KLUWER ACADEMIC PUBLISHERS

NEW YORK, BOSTON, DORDRECHT, LONDON, MOSCOW

eBook ISBN: 1-4020-8066-2
Print ISBN: 1-4020-7629-0

©2005 Springer Science + Business Media, Inc.

Print ©2004 Kluwer Academic Publishers
Boston

All rights reserved

No part of this eBook may be reproduced or transmitted in any form or by any means, electronic, mechanical, recording, or otherwise, without written consent from the Publisher

Created in the United States of America

Visit Springer's eBookstore at:
and the Springer Global Website Online at:

<http://ebooks.kluweronline.com>
<http://www.springeronline.com>

CONTENTS

INTRODUCTION

- 1 Health Care Delivery: Current Problems and Future Challenges** 1
Margaret L. Brandeau, François Sainfort, and William P. Pierskalla

HEALTH CARE OPERATIONS MANAGEMENT

- 2 Capacity Planning and Management in Hospitals** 15
Linda V. Green
- 3 Location of Health Care Facilities** 43
Mark S. Daskin and Latoya K. Dean
- 4 Ambulance Service Planning: Simulation and Data Visualization** 77
Shane G. Henderson and Andrew J. Mason
- 5 Supply Chain Management of Blood Banks** 103
William P. Pierskalla
- 6 Evaluating the Efficiency of Hospitals' Perioperative Services Using DEA** 147
Liam O'Neill and Franklin Dexter
- 7 Benchmarking Using DEA: The Case of Mental Health Organizations** 169
Yasar A. Ozcan, Elizabeth Merwin, Kwangsoo Lee, and Joseph P. Morrissey
- 8 Using Simulation in an Acute-Care Hospital: Easier Said Than Done** 191
Michael W. Carter and John T. Blake

PUBLIC POLICY AND ECONOMIC ANALYSIS

- | | | |
|-----------|---|-----|
| 9 | Estimating Risks to the Public Health
Rose Baker | 217 |
| 10 | Modeling Health Outcomes for Economic Analysis
Thitima Kongnakorn and François Sainfort | 255 |
| 11 | Duct Tape for Decision Makers: The Use of OR Models in Pharmacoeconomics
Anke Richter | 275 |
| 12 | Drug Policy: Insights from Mathematical Analysis
Jonathan P. Caulkins | 297 |
| 13 | Modeling the Costs and Effects of Maintenance Treatment for Opiate Addiction
Gregory S. Zaric | 333 |
| 14 | Harm Reduction in the Control of Infectious Diseases Among Injection Drug Users
Harold Pollack | 363 |
| 15 | The Cost Effectiveness of Partially Effective HIV Vaccines
Douglas K. Owens, Donna M. Edwards,
John F. Cavallaro, and Ross D. Shachter | 403 |
| 16 | Designing Pediatric Formularies for Childhood Immunization Using Integer Programming Models
Sheldon H. Jacobson and Edward C. Sewell | 419 |
| 17 | Allocating Resources to Control Infectious Diseases
Margaret L. Brandeau | 443 |
| 18 | Microbial Risk Assessment for Drinking Water
Stephen E. Chick, Sada Soorapanth, and
James S. Koopman | 465 |

19	Screening for Diabetic Retinopathy Ruth Davies and Sally C. Brailsford	493
20	Decision Making for Bioterror Preparedness: Examples from Smallpox Vaccination Policy Edward H. Kaplan and Lawrence M. Wein	519
21	Models for Kidney Allocation Stefanos A. Zenios	537
22	Planning in the Face of Politics: Reshaping Children's Health Services in Inner London Mike Cushman and Jonathan Rosenhead	555
CLINICAL APPLICATIONS		
23	Modeling Medical Treatment Using Markov Decision Processes Andrew J. Schaefer, Matthew D. Bailey, Steven M. Shechter, and Mark S. Roberts	593
24	Dynamic Influence Diagrams: Applications to Medical Decision Modeling Gordon B. Hazen	613
25	Assessment of the Benefits of Anesthesia Patient Risk Reduction Measures M. Elisabeth Paté-Cornell	639
26	An Asthma Policy Model A. David Paltiel, Karen M. Kuntz, Scott T. Weiss, and Anne L. Fuhlbrigge	659
27	A Bayesian Network to Assist Mammography Interpretation Daniel L. Rubin, Elizabeth S. Burnside, and Ross Shachter	695
28	Optimization and Decision Support in Brachytherapy Treatment Planning Eva K. Lee and Marco Zaider	721

29	Radiotherapy Treatment Design and Linear Programming Allen Holder	741
30	Optimization Tools for Radiation Treatment Planning in Matlab Michael C. Ferris, Jinho Lim, and David M. Shepard	775
31	Transmission Model Analysis of Non-Typeable Haemophilus Influenzae James S. Koopman, Ximin Lin, Stephen E. Chick, and Janet R. Gilsdorf	807
32	The Impact of Novel Treatments on Aβ Burden in Alzheimer's Disease: Insights from a Mathematical Model David L. Craft, Lawrence M. Wein, and Dennis J. Selkoe	839
	Index	867