

## RESEARCH PAPER

# Examining the effect of interventions in emergency care for older people using a system dynamics decision support tool

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## Abstract

**Background:** Rising demand for Emergency and Urgent Care is a major international issue and outcomes for older people remain sub-optimal. Embarking upon large-scale service development is costly in terms of time, energy and resources with no guarantee of improved outcomes; computer simulation modelling offers an alternative, low risk and lower cost approach to explore possible interventions.

**Method:** A system dynamics computer simulation model was developed as a decision support tool for service planners. The model represents patient flow through the emergency care process from the point of calling for help through ED attendance, possible admission, and discharge or death. The model was validated against five different evidence-based interventions (geriatric emergency medicine, front door frailty, hospital at home, proactive care and acute frailty units) on patient outcomes such as hospital-related mortality, readmission and length of stay.

**Results:** The model output estimations are consistent with empirical evidence. Each intervention has different levels of effect on patient outcomes. Most of the interventions show potential reductions in hospital admissions, readmissions and hospital-related deaths.

**Conclusions:** System dynamics modelling can be used to support decisions on which emergency care interventions to implement to improve outcomes for older people.

**Keywords:** frailty, emergency and urgent care, interventions, system dynamics, older people

## Key Points

- Outcomes for older people attending Emergency and Urgent Care settings are poor.
- A range of emergency care frailty interventions have been shown to improve outcomes, but deciding which intervention to develop is not straightforward.
- System dynamics modelling offers a low-risk approach to exploring and providing evidence-based support to decisions on which emergency care interventions to implement.

# Emergency Care Dynamics

**Geoffrey C. Hazard, W. William Hodes**



## **Emergency Care Dynamics:**

**Emergency Care Dynamics** Steven M. Lewis,1984-01-01 *Current Catalog* National Library of Medicine (U.S.),

**Simulation and Modeling Methodologies, Technologies and Applications** Mohammad S. Obaidat,Janusz

Kacprzyk,Tuncer Ören,Joachim Filipe,2016-05-27 The present book includes a set of selected extended papers from the 5th International Conference on Simulation and Modeling Methodologies Technologies and Applications SIMULTECH 2015 held in Colmar France from 21 to 23 July 2015 The conference brought together researchers engineers and practitioners interested in methodologies and applications of modeling and simulation New and innovative solutions are reported in this book SIMULTECH 2015 received 102 submissions from 36 countries in all continents After a double blind paper review performed by the Program Committee 19% were accepted as full papers and thus selected for oral presentation Additional papers were accepted as short papers and posters A further selection was made after the Conference based also on the assessment of presentation quality and audience interest so that this book includes the extended and revised versions of the very best papers of SIMULTECH 2015 Commitment to high quality standards is a major concern of SIMULTECH that will be maintained in the next editions considering not only the stringent paper acceptance ratios but also the quality of the program committee keynote lectures participation level and logistics *National Library of Medicine Current Catalog* National Library of Medicine (U.S.),1984 **Trauma Team Dynamics** Lawrence M. Gillman,Sandy Widder,Michael Blaivas

MD,Dimitrios Karakitsos,2015-11-02 This is the first book exploring the unique dynamics created by a multidisciplinary trauma team and how crisis management strategies can improve teamwork and communication and potentially improve patient resuscitation outcomes Crisis resource management CRM is integral to the way that we manage ourselves team members and patients during emergency situations It is essentially the ability to translate knowledge of what needs to be done into effective actions during a crisis situation Building on the revolutionary American College of Surgeons Advanced Trauma Life Support ATLS course Trauma Team Dynamics illustrates the integration of the principles of CRM to team dynamics throughout the resuscitation from the scene through pre hospital care and transport to the trauma bay and finally to definitive care and beyond The editors and contributors are international experts in trauma critical care emergency medicine nursing respiratory therapy and pre hospital care and include NASA and United States military affiliated experts Trauma Team Dynamics is intended for use as both a day to day clinical resource and a reference text and includes self assessment questions as well as guidance on CRM curriculum design and implementation *Dynamics of Information Systems* Hossein Moosaei,Milan Hladik,Panos M. Pardalos,2023-12-27 This book constitutes the proceedings of the 6th International Conference on Dynamics of Information Systems DIS 2023 which took place in Prague Czech Republic in September 2023 The 18 full papers included in the book were carefully reviewed and selected from 43 submissions They deal with topics ranging from theoretical algorithmic and practical perspectives in information systems to offering readers

valuable information theories and techniques      **Trauma Team Dynamics** Lawrence Marshall Gillman, Sandy Widder, 2025-09-12 The majority of medical errors are non technical in nature stemming from faulty decision making asynchronous information gathering lack of situational awareness and ineffective communication and team leadership Reviews of accidents from other high risk industries including the airline industry have had similar findings This led the National Aeronautics and Space Administration NASA and the airline industry to develop crew now crisis resource management CRM training These team based training strategies address non technical skills to counteract human error and improve team and patient safety Medicine has begun adapting this training especially within the realms of anesthesia and critical care Trauma surgery has been slower to utilize this work however simulation based training is increasing in popularity The first edition of Trauma Team Dynamics was a revolutionary book in the field of trauma care It was the first text that integrated the complexities of trauma care but illustrated how these could be streamlined and improved through a team based focus and training CRM and team based training has grown substantially in the past six years since this text was conceived and there have been significant developments both in the breadth of the training as well as refinement in the topics covered teaching methods utilized and strategies employed to overcome the multitude of challenges still faced in this area The second edition of this text expands greatly on the initial CRM topics covered in the opening section of the book Hot topics in CRM training including the concepts of followership and conflict resolution and highlights strategies such as mindfulness and others to manage stress and reduce burnout are discussed The text also expands into novel areas of trauma care including less invasive bedside endovascular treatments such as REBOA Resuscitative Endovascular Balloon Occlusion of the Aorta and a more in depth discussion of teleresuscitation and trauma care in austere environments Featuring 28 new chapters the second edition of Trauma Team Dynamics is written by experts in trauma critical care emergency medicine nursing respiratory therapy and pre hospital care and include NASA and United States military affiliated experts It is intended for use as both a day to day clinical resource and a reference text and includes self assessment questions as well as guidance on CRM curriculum design and implementation      **Managing Patients' Organizations to Improve Healthcare: Emerging Research and Opportunities** Costanza, Francesca, 2020-01-10 In the last decades the importance of

performance management in healthcare organizations has progressively increased Patient organizations can play a strategic role by providing peer support and education filling service provision gaps within public healthcare As experts of their own pathologies organized patients can aid research and development projects and provide the policymakers with input from the patients perspectives Despite these advantages patient organizations still face criticalities including low political attention at a national and peripheral level scarce management skills planning control fundraising and professionalism Managing Patients Organizations to Improve Healthcare Emerging Research and Opportunities delivers emerging research that raises awareness about the contribution of patient organizations in the healthcare process within regulatory authorities public and

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*Handbook of Systems and Complexity in Health* Joachim P Sturmberg, Carmel Martin, 2013-01-09 This book is an introduction to health care as a complex adaptive system a system that feeds back on itself The first section introduces systems and complexity theory from a science historical epistemological and technical perspective describing the principles and mathematics Subsequent sections build on the health applications of systems science theory from human physiology to medical decision making population health and health services research The aim of the book is to introduce and expand on important population health issues from a systems and complexity perspective highlight current research developments and their implications for health care delivery consider their ethical implications and to suggest directions for and potential pitfalls in the future

*Healthcare Systems Engineering* Paul M. Griffin, Harriet B. Nembhard, Christopher J. DeFlitch, Nathaniel D. Bastian, Hyojung Kang, David A. Munoz, 2016-02-22 Apply engineering and design principles to revitalize the healthcare delivery system Healthcare Systems Engineering is the first engineering book to cover this emerging field offering comprehensive coverage of the healthcare system healthcare delivery and healthcare systems modeling Written by leading industrial engineering authorities and a medical doctor specializing in healthcare delivery systems this book provides a well rounded resource for readers of a variety of backgrounds Examples case studies and thoughtful learning activities are used to thoroughly explain the concepts presented including healthcare systems delivery quantification and design You ll learn how to approach the healthcare industry as a complex system and apply relevant design and engineering principles and processes to advance improvements Written with an eye toward practicality this book is designed to maximize your understanding and help you quickly apply toward solutions for a variety of healthcare challenges Healthcare systems engineering is a new and complex interdisciplinary field that has emerged to address the myriad challenges facing the healthcare industry in the wake of reform This book functions as both an introduction and a reference giving you the knowledge you need to move toward better healthcare delivery Understand the healthcare delivery context Use appropriate statistical and quantitative models Improve existing systems and design new ones Apply systems engineering to a variety of healthcare contexts Healthcare systems engineering overlaps with industrial engineering operations research and management science uniting the principles and

practices of these fields together in pursuit of optimal healthcare operations Although collaboration is focused on practitioners professionals in information technology policy and administration public health and law all play crucial roles in revamping health care systems Healthcare Systems Engineering is a complete and authoritative reference for stakeholders in any field *The Law of Lawyering* Geoffrey C. Hazard,W. William Hodes,2001 **Proceedings** ,1996 **Discrete-Event Simulation and System Dynamics for Management Decision Making** Sally Brailsford,Leonid Churilov,Brian Dangerfield,2014-03-31 In recent years there has been a growing debate particularly in the UK and Europe over the merits of using discrete event simulation DES and system dynamics SD there are now instances where both methodologies were employed on the same problem This book details each method comparing each in terms of both theory and their application to various problem situations It also provides a seamless treatment of various topics theory philosophy detailed mechanics practical implementation providing a systematic treatment of the methodologies of DES and SD which previously have been treated separately Proceedings of the 2nd International Conference on Nonlinear Dynamics and Applications (ICNDA 2024), Volume 3 Asit Saha,Santo Banerjee,2024-12-09 This book covers the latest advancements and applications of nonlinear dynamics in various fields of science and engineering presenting a curated selection of peer reviewed contributions at the 2nd International Conference on Nonlinear Dynamics and Applications ICNDA 2024 at Sikkim Manipal Institute of Technology SMIT Organized by the Department of Mathematics SMIT SMU this international conference provides a platform for scientists researchers and inventors to share their findings and exchange ideas in the ever evolving field of nonlinear dynamics This book comprises three volumes Volume 3 focuses on graphs networks and communications It covers topics such as optimization in control and neural systems machine learning for signal analysis and classification graph theory applications in science and engineering analysis of wavelets and transforms in signal processing and semiconductor devices and nanomaterials **Handbook of Healthcare Operations Management** Brian T. Denton,2013-02-28 From the Preface Collectively the chapters in this book address application domains including inpatient and outpatient services public health networks supply chain management and resource constrained settings in developing countries Many of the chapters provide specific examples or case studies illustrating the applications of operations research methods across the globe including Africa Australia Belgium Canada the United Kingdom and the United States Chapters 1 4 review operations research methods that are most commonly applied to health care operations management including queuing simulation and mathematical programming Chapters 5 7 address challenges related to inpatient services in hospitals such as surgery intensive care units and hospital wards Chapters 8 10 cover outpatient services the fastest growing part of many health systems and describe operations research models for primary and specialty care services and how to plan for patient no shows Chapters 12 16 cover topics related to the broader integration of health services in the context of public health including optimizing the location of emergency vehicles planning for mass vaccination events and the coordination among

different parts of a health system Chapters 17 18 address supply chain management within hospitals with a focus on pharmaceutical supply management and the challenges of managing inventory for nursing units Finally Chapters 19 20 provide examples of important and emerging research in the realm of humanitarian logistics     *Essentials of Nursing Research* Denise Polit, Cheryl Beck, 2020-12-30 Updated to reflect the latest innovations in research methods this worldwide bestseller helps students learn how to read and critically appraise research reports speak the language of nursing research and develop an appreciation of research to enhance nursing practice AJN award winning authors Denise Polit and Cheryl Beck clearly and concisely present research essentials dig into the research steps and explore quantitative and qualitative research to ignite student curiosity and encourage students to pursue a professional pathway that incorporates thoughtful and effective appraisals of evidence     *Modelling in Healthcare* ,2010 How many patients will require admission to my hospital in two days How widespread will influenza be in my community in two weeks What will the changing demographics of our community do to affect demand for medical services in our region in two years These and similar questions are the province of *Modelling in Healthcare* This new volume presented by the Complex Systems Modelling Group at Simon Fraser University in Canada uses plain language sophisticated mathematics and vivid examples to guide and instruct Sage advice on the benefits and limitations of the modeling process and model predictions is generously distributed so that the reader comes away with an understanding not only of the process but also on the practical uses and misuses of models Perhaps the most important aspect of this book is that the content and the logic are readily understandable by modelers administrators and clinicians alike This volume will surely serve as their common and thus preferred reference for modeling in healthcare for many years Timothy G Buchman Ph D M D FACS FCCM *Modelling in Healthcare* adds much needed breadth to the curriculum giving readers the introduction to simulation methods network analysis game theory and other essential modeling techniques that are rarely touched upon by traditional statistics texts Ben Klemens Ph D Mathematical and statistical modeling has tremendous potential for helping improve the quality and efficiency of health care delivery and as a tool for decision making by health care professionals This book provides many relevant and successful applications of modeling in health care and can serve as an important resource and guide for those working in this exciting new field Reinhard Laubenbacher Ph D

**Brazilian Socio-Economic Dynamics** Gilmar Masiero, 2025-04-25 This book presents a detailed study of Brazil's structural problems and offers suggestions for managing them It is organized into two parts The first part provides a foundation in Brazilian socio economic dynamics discussing regional diversity economic inequalities access to education and global commodity supplies from the country's agribusiness The second part describes contemporary realities in the business and management sector such as entrepreneurship small businesses and incubators the country's financial system its international presence and its present and future challenges The need for academic literature to support discussions on Brazilian issues is also addressed The original research presented here may be helpful as a supplementary text in

instructional settings      *Relational Concepts in Medicine* ,2020-05-18



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