



OR RESEARCH PAPER IN HEALTHCARE SECTOR

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ABSTRACT

It has become very challenging for governments, particularly those in developing nations, to provide their inhabitants with high-quality health services as a result of the limited resources and growing population. As a result, cutting-edge Operations Research (OR) approaches have been created for a variety of healthcare applications, including planning for the operating room, staffing the emergency room, screening for breast cancer, arranging radiation treatments, long-term care, and home healthcare. In addition to assisting hospitals in better patient management, medical research can also help these facilities deliver better care while maximising efficiency. In this research paper, applications of operations research in healthcare are discussed globally, with a focus on India.

KEYWORDS : *Healthcare; Operations Research; Decision making; Optimisation; Disaster management; Risk pooling; Scheduling.*

INTRODUCTION

Operations research and management science communities have been paying close attention to the healthcare management issues. In order to face the problems of an ageing population along with increased quality expectations due to technology advancements and a desire to cap or reduce budgets, the health care sector needs to employ resources more effectively and improve the quality of services. In this paper, we examine contemporary operational management studies of healthcare issues. In light of implications for management, we categorize the healthcare problems in the operations management literature from top to bottom management: strategic, tactical and operational. We explore past, present, and future directions for research in the healthcare sector as we draw to a close. Regarding the current trend in increased healthcare, healthcare providers have to consult operations management tools to make operations faster and cheaper. A wide-spread application of such tools will increase efficiency at hospitals and patients will experience more streamlined coordination of activities, improved predictability and regularity—getting a higher service levels and ultimately better quality of health care services.

LITERATURE REVIEW

Beverly D. Bradley and others in their research paper “Operations research in global health: a scoping review with a focus on the themes of health equity and impact” highlight a global overview of 1099 studies that talk about the geographic distribution of OR and common OR methods used. A narrative description of the use of OR across four main application areas of global health is also presented. We identify three key drivers for success in bridging the gap between OR and global health policy.

In the research paper, “Healthcare Management: Operations and Strategy” Ismail Civelek discusses the current literature and practice in healthcare problems, implications for management, future research opportunities and limitations. Healthcare decision-makers need more and more operations tools to cope with increasing costs in each step of providing health services. Almost all healthcare studies in the literature use a heuristic approach than providing an exact solution to an existing healthcare problem. The reason behind this approach is the intrinsic uncertainty of demand structure in the healthcare industry. Moreover, such policies dictated by the current studies by researchers and practitioners in the healthcare industry should be based on the evidence of its potential to tackle stochastic problems associated with demands and outcomes in such complex healthcare problems.

In the research paper “Empirical Research in Healthcare Operations: Past Research, Present Understanding, and Future Opportunities” by Diwas Singh KC and others, examines the published empirical literature in healthcare operations management over the last 20 years. It highlights the several unique characteristics of the research in healthcare operations, including a focus on operational and organizational variables, an interest in the underlying mechanisms that explain operational causal pathways, and an interest in economic and managerial implications. The study also identifies several key areas of future research, including personalized medicine, value-based healthcare, and connected health.



In the study “Models, algorithms and performance analysis for adaptive operating room scheduling” by Guanlian Xiao and others, we consider the scarcely researched common practice of making adaptations to the surgical schedule from the perspective of the operating room scheduling classification scheme of Cardoen, Demeulemeester, and research to better cope with uncertainty is provided by Tang and Wang (2015) who consider the tactical planning problem. Tang, and Fung (2014) consider a chance-constrained model for a closely related problem with multiple operating rooms. scheduling literature, a general analytic approach towards adaptivity in operating room schedules is lacking in the scientific operating room scheduling problems and present theoretical results on their relative performance.

The study “Healthcare operations management: a structured literature review” by R. K. Jha and others, reviewed research papers on healthcare operations management from reputed operations management and service management journals from 2000. The objective of the literature review was to identify key dimensions of healthcare operations management, highlight the present trend in research on healthcare operations management, and suggest areas for future research. The study found that a large proportion of empirical studies in the area of health-care operations management have been conducted in developed nations. This calls for more research in developing and underdeveloped nations because the management challenges of healthcare industry in developing and underdeveloped nations are quite different from those in developed nations.

In the research study “Introduction: Applications of Management Science and Operations Research Models and Methods to Problems in Health Care” by Michael W. Carter and various others, states that over the last decade or so, the health-care industry has started to solve important problems using traditional management science and operations research (MS/OR) methods. Results of modeling efforts have been significant and have begun to positively affect the delivery of health care. This special issue documents eight successful applications of MS/OR methods to solving actual problems in healthcare.

The paper “Using Operations Research to Reduce Delays for Healthcare” by Linda V. Green, describes the areas in which patients routinely experience significant delays and presents operations research models that have been developed to help reduce these delays. Discuss the opportunities, large and small, for using OR methodologies to significantly impact practices and policies that will affect timely access to healthcare.

METHODOLOGY

In this section, we explain the reasoning behind our search strategy. The exclusion criteria are also motivated, and we conclude the section that shows how we obtained the 25 articles that were analyzed.

We conducted a systematic search and review, which combines the strengths of critical review with a comprehensive search process. In order to determine how the literature describes waiting time and access time in healthcare, we conducted a preliminary journal article search by combining waiting time and healthcare search terms.

The research methodology-based classification used in the literature review is mainly based on the works of Meredith et al., Malhotra and Grover, Forza, Bertrand and Fransoo, Spens and Kovács, and Cooper et al. These papers were used for enlisting all major types of research methodologies relevant in the field of service OM relevant to healthcare operation management. During the literature review, selected articles were classified into research methodologies given below. In case of articles with two or more research methodologies, the primary research methodology used was considered.

- Empirical;
- Modelling/analytical;
- Simulation;
- Field research/action research;
- Qualitative research;
- Theoretical/conceptual.

S.No.	Research Paper	Authors	Methodology
1.	A predictive model for the post-pandemic delay in elective treatment	Romy Nehme, Alena Puchkova, Ajith Parlikad	Analytical methodologies; discrete time simulation
2.	Applications of Operations Research Techniques in Healthcare	Mehak Jain, Mudita Shah, Naman Sadh, Naomi Marfatia, Nishit Khandelwal	Demand Forecasting, proper; proper allocation
3.	Operations research in global health: a scoping review with a focus on the themes of health equity and impact	Beverly D. Bradley, Tiffany Jung, Ananya Tandon-Verma.	OR modelling, charting, Enhanced Two-Step Floating Catchment Area method, DES-optimisation model, HERMES (Highly Extensible Resource for Modeling Event-Driven Supply Chains) software
4.	Operational Research to improve Health Services	Desmond Tutu TB Centre	Tony Buzan’s mind mapping methodology



5.	Operations Research and Healthcare	Erwin Hans, Joris van de Klundert	Surgery sequencing, scheduling, Instrument tray optimization, Optimization of the reverse logistics chain of instrument sterilization (inventory locations), etc.
6.	The Healthcare sector needs more Operational Research	Tomas Eric Nordlander	Simulation for decision support; optimisation
7.	Using Operations Research to Reduce Delays for Healthcare	Linda V.Green	Queueing analysis, Stationary independent period by period(SIPP) approach, physician practice appointment system
8.	Practical Operations Research Applications for Healthcare Managers	Kiok Liang Teow	Resource utilization, bed management, Queueing Theory
9.	Operations research in healthcare	Xiaolan Xie & Mark A. Lawley	Operating room planning, emergency department staffing, radiotherapy treatment planning, home healthcare planning, long-term care planning and scheduling
10.	Operations research: A valuable resource for improving quality, costs, access and satisfaction in health care delivery	William P. Pierskalla	Mathematical programming, stochastic processes, data envelopment analysis (DEA)
11.	A Review of the Healthcare-Management (Modeling) Literature Published in Manufacturing & Service Operations Management	Pinar Keskinocak, Nicos Savva	Triage decisions (prioritization protocols), Operating room scheduling, Queueing model
12.	Healthcare operations management: a structured literature review	R. K. Jha, B. S. Sahay, P. Charan	Service scheduling, surgical scheduling, appointment scheduling, Management by walking around (MBWA) technique
13.	Healthcare Management : Operations and Strategy	Ismail Civelek	Geographical location-allocation simulation model, capacity allocation, patient assignment
14.	Empirical Research in Healthcare Operations: Past Research, Present Understanding, and Future Opportunities	Diwas Singh KC, Stefan Scholtes, Christian Terwiesch	Capacity sizing, patient scheduling, operational variables
15.	Exploring risk pooling in hospitals to reduce demand and lead time uncertainty	Gerald Oeser and Pietro Romano	Risk pooling (inventory pooling, virtual pooling, capacity pooling transshipments, etc.)
16.	Reducing Wait Times through Operations Research: Optimizing the use of surge capacity	Jonathan Patrick and Martin L. Puterman	Queueing theory, capacity planning, surge capacity management, Markov Decision Process (MDP) scheduling model, Approximate Dynamic Programming (ADP)
17.	Strengthening Health Research Capacity from within Samoa	Tamasailau Suaalii-Saun	Social research methods and epidemiological methods
18.	Managing Risks in the UK Healthcare Sector	M.I. Okorohy, P.P. Gombera and AM. Alani	Alexander's model of risk management, compulsory competitive tendering (CCT), market testing (MT) and private finance initiative (PFI)
19.	Introduction: Applications of Management Science and Operations	Michael W. Carter, Bruce L. Golden, Edward A. Wasil	Mathematical programming, decision analysis and simulation

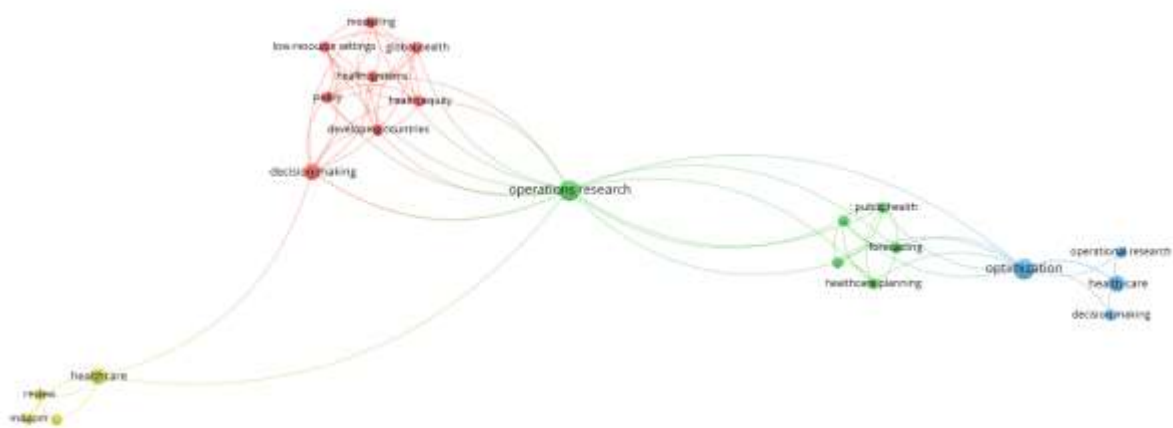


	Research Models and Methods to Problems in Health Care		
20.	Models, algorithm and performance analysis for adaptive operating room scheduling	Guanlian Xiao, Willem van Jaarsveld, Ming Dong and Joris van de Klundert	Combinatorial methods, stochastic OR scheduling, pseudo-polynomial algorithm for the static stochastic knapsack problem
21.	Optimizing vaccine distribution via mobile clinics: a case study on COVID-19 vaccine distribution to long-term care facilities	Samta Shukla, Francois Fressin, Michelle Un, Henriette Coetzer, Sreekanth K. Chagaturu	Assignment, scheduling, distance minimization

CRITICAL ANALYSIS

How much radiation is enough for a cancer patient? What is the best contract structure between blood banks and hospitals to minimize obsolescence of blood resources? When should elective surgeries be postponed to accommodate emergency surgeries? There are many articles that try to answer these questions in the operations management literature. it has imp elements such location selection, capacity planning, capacity planning, appointment Scheduling, Patient Assignment, Resource Scheduling they all play important role in making effective and calculated decision.

BIBLIOMETRIC ANALYSIS



- In the above given image, we can see that there are 3 colors which represents which are red green and blue.
- Red represents the areas in which the research had been done, for example – health equity, global health, health systems etc.
- Blue represents the areas in which the optimization needed to be done after the research, for example – Operational research, Health care, Decision making.
- Green represents the factors which we needed to consider for making those optimizations based on the researches which were conducted, for example – public health, forecasting, healthcare planning.

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