



AI in Healthcare

A Transparent Approach
to Informatics

Edited by Philip Eappen,
Virginia Gunn, Dimitrios Zikos,
and Narasimha Rao Vajjhala



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AI in Healthcare

This book addresses the urgent need for AI healthcare insights in a post-pandemic and swiftly progressing world in which the use of advanced health technologies is becoming the norm. It explores the rapidly evolving AI landscape affecting health systems and provides practical, evidence-informed guidance drawn from practice, theory, and research.

Covering a wide range of topics—from digital health technologies to data analytics and interoperability—it offers a thorough examination of advancements in these areas, giving readers a comprehensive understanding of the health sector's transformation. The book goes beyond theory, showcasing practical applications of AI solutions, discussing both advantages and possible disadvantages. Real-world case studies and expert perspectives drawn from recent developments equip readers with actionable insights for implementation in various healthcare settings. With a holistic approach, the book explores not only technological aspects but also ethical considerations, regulatory challenges, and the human impact of digital transformation.

This invaluable resource is essential for academics, practitioners, and policymakers in healthcare management, information systems management, healthcare policy, and public health.



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Dedication

*To my treasured dad, **Eappen**—a gentle spirit whose steadfast guidance, immense resilience, and limitless kindness continue to light my journey even though he has departed. He existed with a sincere heart that welcomed all people without bias or animosity, recognizing only the goodness within humanity. While his physical presence is no longer among us, his precious principles of unconditional affection and embrace give meaning to every chapter of this endeavor.*

*May his heritage of dedication and compassion
continue to motivate coming generations!*

Dr Philip Eappen



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Preface

The rapid advancement of artificial intelligence (AI) in healthcare has reached a critical inflection point. While AI technologies promise unprecedented improvements in diagnostic accuracy, treatment personalization, and operational efficiency, their implementation raises fundamental questions about transparency, accountability, and the preservation of human-centered care. This book emerges from the urgent need to bridge the gap between AI's technical capabilities and the ethical frameworks necessary for its responsible deployment in healthcare settings.

Healthcare systems worldwide face mounting pressures from aging populations, chronic disease burdens, and resource constraints. Simultaneously, algorithmic management systems are increasingly replacing human decision-making processes across healthcare organizations, from staff scheduling to clinical protocols. The confluence of these trends demands careful examination of how AI technologies can enhance rather than compromise the quality, equity, and humanity of healthcare delivery.

The concept of transparency in healthcare AI extends far beyond technical explainability. As demonstrated throughout this volume, transparency encompasses accountability in algorithmic scheduling decisions, fairness in resource allocation, clarity in clinical decision support systems, and openness about the limitations and biases inherent in AI models. When algorithmic scheduling systems operate as “black boxes,” they may obscure critical questions about staff-to-patient ratios and worker well-being. When AI diagnostic tools lack transparency, they risk undermining the trust essential to effective patient-provider relationships.

This book presents a comprehensive examination of AI applications across the healthcare spectrum, from foundational ethical considerations to cutting-edge technical implementations. The contributing authors—spanning clinical practice, academic research, and technological innovation—bring diverse perspectives to the challenge of developing AI systems that are not only technically sophisticated but also ethically sound and practically beneficial.

Part I, “Transparency and Accountability in Healthcare AI” establishes the critical foundation by examining how algorithmic management affects healthcare workers and exploring the ethical frameworks necessary for responsible AI implementation. These chapters reveal that algorithmic scheduling, while offering efficiency gains, may contribute to deteriorating job quality for health workers when implemented without sufficient transparency or consideration of employment conditions. The ethical implications discussed here—encompassing patient privacy, data security, algorithmic bias, and fair access—provide essential guidance for healthcare professionals, administrators, technologists, and policymakers.

Part II, “Transformative Technologies and Patient-Centered Care” explores how emerging technologies can advance patient-centered care while maintaining the foundational principles of respect for patient preferences, needs, and values. These chapters examine the transformative potential of artificial intelligence, blockchain,

Internet of Things devices, wearable technologies, robotics, and telehealth in creating more personalized, responsive, and data-driven care models. Critically, they also address the challenges of privacy concerns, equity issues, cybersecurity risks, and algorithmic bias that must be navigated to ensure inclusive technological adoption.

Part III, “AI Applications in Healthcare Practice” provides concrete examples of AI implementation across diverse healthcare contexts. From disease preparedness strategies that leverage AI for pandemic response to personalized healthcare applications that predict disease and enable early detection, these chapters demonstrate both the remarkable potential and inherent limitations of AI systems. The emphasis on data quality, privacy concerns, and the need for human interaction underscores that effective AI implementation requires careful attention to both technical and human factors.

Part IV, “Advanced AI Technologies and Clinical Applications” showcases sophisticated technical implementations while maintaining focus on transparency and accountability. The deep learning approaches to abdominal trauma diagnosis, transparent drug classification systems using neural networks with explainability analysis, and wearable IoT applications for patient monitoring represent the cutting edge of AI healthcare technology. Importantly, these chapters demonstrate how advanced technical capabilities can be developed with built-in transparency mechanisms, such as SHAP analysis for understanding model decisions.

Throughout this volume, several critical themes emerge that define responsible AI implementation in healthcare. The preservation of human oversight remains paramount—AI systems must serve as enablers rather than replacements for clinical judgment. The imperative for transparency extends beyond technical explanations to encompass clear communication about system limitations, potential biases, and decision-making processes. Equity considerations must be embedded from the outset, ensuring that AI advances do not exacerbate existing healthcare disparities but instead promote more inclusive and accessible care.

The global perspective represented in these chapters—from pandemic preparedness strategies for low- and middle-income countries to advanced diagnostic technologies—reflects the universal nature of both healthcare challenges and AI opportunities. The authors consistently emphasize that while AI can provide valuable insights and recommendations, the accuracy and reliability of these systems depend fundamentally on data quality, ethical implementation, and ongoing human oversight.

Perhaps most importantly, this book argues that transparency in healthcare AI is not merely a technical requirement but a moral imperative. As AI systems become increasingly integrated into clinical workflows, understanding their mechanisms, acknowledging their limitations, and maintaining accountability for their decisions becomes essential for preserving the trust that forms the foundation of effective healthcare delivery.

The COVID-19 pandemic has demonstrated both the potential of AI technologies to accelerate medical discovery and the critical importance of robust, transparent systems for health emergency preparedness. The lessons learned during this global health crisis inform many of the perspectives presented in this volume, emphasizing

the need for AI systems that can rapidly adapt to emerging challenges while maintaining ethical standards and transparency.

Looking toward the future, we envision a healthcare landscape where AI technologies are seamlessly integrated with patient-centered values, creating systems that are not only efficient and predictive but also compassionate, inclusive, and empowering. Achieving this vision requires the thoughtful integration of technical innovation with ethical frameworks, robust governance structures, and meaningful stakeholder collaboration.

This book serves multiple audiences: healthcare professionals seeking to understand AI's role in clinical practice, administrators evaluating AI implementation strategies, technologists developing healthcare AI systems, policymakers crafting regulatory frameworks, and students preparing for careers in an AI-enhanced healthcare environment. Each chapter provides both theoretical foundations and practical guidance for navigating the complex landscape of healthcare AI implementation.

We extend our gratitude to Professor William Bertrand for his thoughtful foreword and to all contributing authors who have shared their expertise across this interdisciplinary landscape. Their collective wisdom illuminates pathways toward AI implementations that enhance rather than compromise the fundamental values of healthcare: healing, caring, and serving the needs of all patients with dignity and respect.

The future of healthcare will undoubtedly be shaped by artificial intelligence. Our responsibility is to ensure that this transformation strengthens rather than weakens the human connections that define quality care, promotes rather than hinders equity in health outcomes, and maintains the transparency necessary for accountability and trust.

Dr Philip Eappen
Dr Virginia Gunn
Dr Dimitrios Zikos
Dr Narasimha Rao Vajjhala

Foreword

The information technology revolution of recent decades has brought unprecedented transformation to healthcare. In the wake of the global pandemic, one truth has crystallized: traditional care and research models alone cannot bear the weight of the complex, interconnected challenges we face. It is within this moment of uncertainty and urgency that Artificial Intelligence (AI) has emerged—not as a distant promise, but as a practical and powerful tool fundamentally reshaping how we understand, deliver, and experience prevention and care.

This book, *AI in Healthcare: A Transparent Approach to Informatics*, arrives at precisely the right moment. It avoids the trap of celebrating technology for technology's sake. Instead, it adopts a measured, thoughtful approach—balancing enthusiasm with critique and possibility with responsibility. Through its comprehensive case studies, global perspectives, and concrete examples, the book illustrates not merely what AI can accomplish, but how it is already being applied to enhance diagnostics, personalize treatment, optimize resource management, and even anticipate outbreaks before they spread.

What distinguishes this work is its recognition that the story of AI in healthcare encompasses not only algorithms and data, but also people—patients, practitioners, policymakers, and communities. The book addresses the essential ethical questions: How do we safeguard privacy in an era of digital medicine? How do we ensure equity and prevent the replication of bias in machine learning systems? How do we prepare a workforce to collaborate with, rather than compete against, intelligent technologies?

By skillfully weaving together foundational knowledge with practical guidance, **Dr Eappen** and his colleagues as editors have assembled a work that provides both clarity and direction. They remind us that AI is not a panacea, but rather a sophisticated set of tools that, when deployed transparently and humanely, can extend the reach and compassion of medicine itself.

As you explore the pages ahead, I invite you to approach this book not only as a guide to emerging technologies, but also as a roadmap to the future of healthcare—a future in which innovation and humanity advance hand in hand.

Prof. William Bertrand

*Emeritus Wisner Professor of Public Health
Tulane School of Public Health and Tropical Medicine*

Acknowledgments

We are privileged to introduce *AI in Healthcare: A Transparent Approach to Informatics*, a unified endeavor forged through the combined knowledge, commitment, and forward-thinking perspective of a global network of researchers, clinicians, and pioneers. This publication embodies both technological progress and our collective dedication to establishing a more open, responsible, and fair healthcare framework for tomorrow.

I wish to extend my profound appreciation to everyone who contributed to making this initiative a reality. To my co-editors—**Dr Virginia Gunn**, **Dr Dimitrios Zikos**, and **Dr Narasimha Rao Vajjhala**—I am grateful for your collaboration, insightful contributions, and steadfast encouragement throughout this endeavor. Your guidance and varied specializations have enhanced this work beyond measure, ensuring its applicability across the intricate terrain of healthcare AI deployment.

We want to convey our sincere thanks to **Professor William Bertrand** from **Tulane University** for your perceptive foreword, which establishes crucial background for the challenges and possibilities we examine within these pages. Your knowledge and viewpoint have deepened our comprehension of AI's transformative potential in healthcare delivery.

Our appreciation goes to all contributing authors, whose varied viewpoints—encompassing clinical expertise, scholarly investigation, technological advancement, and policy formulation—have produced an extensive resource that connects the technical and moral aspects of healthcare AI. Your dedication to openness, responsibility, and patient-focused care shines through this work and establishes a standard for ethical AI development in healthcare settings.

We offer sincere thanks to the institutions and organizations globally that endorsed this project. The worldwide reach of this partnership mirrors the universal character of healthcare obstacles and AI possibilities, and we appreciate the institutional backing that enabled this international academic collaboration.

To the medical professionals, patients, and communities whose real-world experiences shape the practical implementations discussed in this publication, we recognize that your everyday challenges fuel our determination to create AI systems that genuinely address human requirements. The transparency and responsibility principles we champion ultimately aim to enhance your experiences and results.

We acknowledge the trailblazing researchers and ethicists whose groundbreaking contributions in AI transparency, algorithmic responsibility, and healthcare informatics have laid the groundwork for the conversations presented here. Your work in the field has created the scholarly foundation that supports this publication.

Above all, I express deep gratitude to my family for their affection, understanding, and encouragement sustained us during this process. To my cherished wife **Figgi** and dear son **Evan**, whose patience through numerous hours of writing and cooperation enabled this achievement. To beloved mum **Baby**, whose prayers and support

provided continual inspiration, and to my extended family and friends whose backing remained constant.

This publication is affectionately dedicated to honoring my treasured dad **Eappen**, whose deep wisdom, steadfast principles, and caring nature continue to guide our journey. His conviction that learning should benefit humanity and his commitment to assisting others have influenced not only the core of this work but also our shared mission to ensure human worth, advance fairness, and maintain the confidence vital to therapeutic relationships.

Within these chapters, we pay tribute to all who have enhanced our knowledge of how technology can fulfill humanity's greatest hopes for health and wellness. Their influence motivates us to keep developing healthcare AI that is not merely technically advanced but also transparent, responsible, and genuinely focused on human needs.

Dr Philip Eappen

Editors

Dr Philip Eappen is an accomplished Healthcare Executive, Academic, and Researcher currently serving as Assistant Professor in the Department of Professional Studies, School of Nursing; Director, Research in Medicine | CBMC | Dalhousie University Adjunct Faculty in Healthcare Management, Shannon School of Business at Cape Breton University; and Associate Scientist with the Maritime SPOR SUPPORT Unit. With over a decade of experience spanning hospital operations, healthcare education, and strategic leadership, he has consistently advanced innovation and excellence across diverse healthcare systems in Canada, the United States, and internationally.

Dr Eappen's clinical leadership experience includes progressive roles at the Breton Ability Centre in Sydney, Nova Scotia, where he advanced to Director of Clinical Services and Transition to Community, leading person-centered care initiatives and community transition services. His academic career encompasses appointments at the University of Toronto, Southern Alberta Institute of Technology, and Fanshawe College. Internationally, he served as Director of Health Services and Chief Administrator of Healthcare Operations at the American University of Nigeria, where he spearheaded clinical transformation, emergency preparedness, and inclusive health initiatives, including programs supporting survivors of Boko Haram abductions.

Dr Eappen holds a Doctorate in Healthcare Administration and Post-Graduate Certificate in International Health from Central Michigan University, complemented by an MBA in Healthcare Management and Bachelor of Nursing. He has developed and taught curricula across undergraduate and graduate levels in healthcare leadership, innovation, and health systems analytics, while leading the program development of Cape Breton University's Master of Healthcare Innovation and Leadership program.

An active contributor to national and global health dialogues, Dr Eappen serves on the boards of the American College of Healthcare Executives, Myeloma Canada, Aplastic Anemia and Myelodysplasia Canada, and the Network of Rare Blood Disorder Organizations (NRBDO). He chairs research and ethics committees, reflecting his commitment to governance, evidence-based practice, and health equity.

Dr Eappen has published extensively on artificial intelligence in healthcare, digital health transformation, and health workforce development. His recent editorial work includes *Healthcare Informatics Innovation Post COVID-19 Pandemic* (Taylor & Francis). He has presented at major international conferences including ICN 2025, ICIMTH, and INTED. As a Certified Health Executive (CHE) through the Canadian College of Health Leaders and Fellow candidate of the American College of Healthcare Executives (FACHE), Dr Eappen continues pursuing the highest standards of professional excellence in healthcare leadership. His research agenda focuses on digital innovation, rare diseases, and global workforce integration, continuing to shape policy, practice, and pedagogy in healthcare management.

Dr Virginia Gunn is an Associate Professor in the School of Nursing at Cape Breton University and an Affiliate Researcher at the Unit of Occupational Medicine, Institute of Environmental Medicine, Karolinska Institute, Sweden. As a public health researcher with interdisciplinary training in health and social sciences, Dr Gunn earned her doctoral and master's degrees from the Lawrence Bloomberg Faculty of Nursing and completed a Collaborative Doctoral Specialization in Global Health from the Dalla Lana School of Public Health, University of Toronto.

Dr Gunn combines her academic background with extensive professional experience as a health practitioner, with expertise spanning public health, acute care, and long-term care settings. She has assumed various leadership roles—including project lead, committee chair, board director, finance officer, and co-founder of interest groups—through which she has spearheaded initiatives to improve health systems and promote evidence-informed decision-making.

As a dedicated researcher, Dr Gunn maintains an active record of engagement in international, national, and regional projects and collaborations. Her established research program examines the intersection of advanced technologies, including artificial intelligence, with social determinants of health—particularly employment, migration, and gender—and their role in shaping health inequities. Through this work, she contributes to understanding how technological advancement can address or exacerbate existing health disparities in diverse populations.

Dr Dimitrios Zikos is an Associate Professor in the Department of Healthcare Management and Leadership at Texas Tech University Health Sciences Center (TTUHSC). He is a core faculty member in the Master of Science in Healthcare Administration (MSHA) program, where he teaches graduate-level courses in health informatics, research methods, and statistics. Dr Zikos brings extensive academic and leadership experience, having previously served as Director of the Health Administration Division and Interim Program Director of the Master of Health Administration at Central Michigan University. During his tenure there, he led the program's successful accreditation by the Commission on Accreditation of Healthcare Management Education (CAHME).

Dr Zikos holds a Ph.D. in Health Informatics from the National and Kapodistrian University of Athens in Greece and a Bachelor's degree in Nursing. His professional background spans both Europe and the United States, with applied research and academic contributions focused on the intersection of health data, workforce management, and patient safety.

His research is centered on leveraging data analytics to improve clinical and administrative decision-making in healthcare. He specializes in the secondary analysis of medical claims data, comorbidity modeling, and the evaluation of inpatient outcomes such as mortality and length of stay. Dr Zikos is particularly interested in the use of digital tools to enhance healthcare access for underserved populations, and the development of data-driven systems to support evidence-based care and decision-making. He is also active in the field of medical education technology, working on simulation-based tools that enhance the accessibility and usability of health information for both clinicians and patients.

A dedicated mentor, Dr Zikos has chaired over twenty doctoral dissertations, supporting students who aim to apply informatics and analytics to solve complex, real-world healthcare challenges. He has authored numerous peer-reviewed articles, book chapters, and conference presentations in health informatics, healthcare management, and digital health systems.

Dr Narasimha Rao Vajjhala is a distinguished Academic and Researcher currently serving as Professor and Chair of the Department of Computer Science at the American University in Bulgaria (AUBG). With over two decades of experience in higher education, Dr Vajjhala has held senior academic leadership positions, including Dean of the Faculty of Engineering and Architecture at the University of New York Tirana (UNYT), Albania, and Chair of Computer Science and Software Engineering programs at the American University of Nigeria (AUN).

Throughout his career, Dr Vajjhala has taught a comprehensive range of undergraduate and graduate courses in computer science, database systems, and programming across institutions in Europe and Africa. He serves as Editor-in-Chief of the *International Journal of Risk and Contingency Management* (IJRCM) and maintains active membership as a Senior Member of both the Association for Computing Machinery (ACM) and the Institute of Electrical and Electronics Engineers (IEEE), as well as membership in the Project Management Institute (PMI).

Beyond academia, Dr Vajjhala has provided technology consulting services for various European firms and participated in numerous EU-funded research and innovation projects. He holds a Doctorate in Information Systems and Technology from the United States, an M.Sc. in Computer Science and Applications from India, and an MBA with specialization in Information Systems from Switzerland. His interdisciplinary expertise spans computer science, information systems, and project management, with significant contributions to research, education, and industry practice across international contexts.

Part I

Transparency and Accountability in Healthcare AI



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1 The Rise of AI in Healthcare

A Transparent Approach to Implementation

Philip Eappen, Virginia Gunn, Dimitrios Zikos, and Narasimha Rao Vajjhala

1.1 INTRODUCTION

Healthcare operations reached a new era of technological revolution. As we continue forging ahead into the 21st century, artificial intelligence (AI) has emerged as one of the most transformative forces reshaping the ways in which we conceptualize, deliver, or manage healthcare. This chapter examines the complex and evolving intersections between healthcare and AI.

The integration of AI into healthcare represents a massive technological upgrade (Apell & Eriksson, 2023; Shimonski, 2020) and it signifies a fundamental shift in the ways in which healthcare workers will approach patient care, decision-making, and health system management in the years to come (Shimonski, 2020). While significant changes brought forth by the adoption of AI in healthcare are underway across the world, we recognize that the pace of change regarding the integration of AI in the health system or other economic sectors is unequally distributed within and between countries (Goralski & Tan, 2020). Collectively, AI technologies are changing the boundaries of possibilities in healthcare (Alowais et al, 2023; Cheng et al., 2024). While AI integration is widespread across clinical areas, it could take multiple and diverse forms, ranging from deep neural networks enabling quicker abdominal trauma diagnosis to transparent drug classification systems using molecular property analysis (Alowais et al., 2023; Cheng et al., 2024). Other examples of advanced applications include AI-enabled bidirectional healthcare systems that facilitate intelligent device-provider communication, wearable Internet of Things (IoT) technologies transforming patient monitoring and chronic care, and adaptive technologies that strengthen clinical decision-making capabilities (Taherdoost, 2024).

In recent years, the use of AI in the healthcare sector has started to mark a significant shift in the ways in which medical practices are managed, emphasizing efficiency, accuracy, and patient-centered care (Faiyazuddin et al., 2025). AI technologies are increasingly being utilized with the intent of optimizing a variety of processes within

healthcare, including diagnostics, treatment planning, and administrative tasks such as scheduling (Faiyazuddin et al., 2025). Nevertheless, these advancements are accompanied by a series of ethical, legal, and social challenges that must be carefully navigated to fully realize the expected benefits of AI technologies while safeguarding public trust and maintaining high standards of care (Al-Hwsali et al., 2023; Gerke, Minssen, & Cohen, 2020; Cohen, Amarasingham et al., 2014).

1.2 NEED FOR AI IN MODERN HEALTHCARE

The healthcare industry faces increasing pressures globally and traditional approaches alone cannot adequately address ongoing challenges related to aging populations, increasing prevalence of chronic diseases, healthcare workforce shortages, and escalating costs, which have created a perfect storm of challenges requiring innovative solutions. The COVID-19 pandemic further exposed critical vulnerabilities in healthcare systems worldwide, accelerating the urgent need for technological interventions that can enhance resilience, efficiency, and accessibility (Filip et al., 2022).

As summarized in this chapter and throughout the book, the rapid advancement of AI in healthcare has reached a critical point, creating extensive debate among actors from various fields. The ability of AI technologies to enhance diagnostic accuracy, personalize treatment options, and improve operational efficiencies presents a great promise for the future of healthcare (Asonganyi et al., 2025). However, realizing this promise is contingent upon addressing several fundamental questions revolving around transparency, accountability, and the preservation of person-centered care. The present landscape suggests that while AI can significantly improve healthcare delivery systems, it is critical to include ethical considerations deeply in the design, implementation, and governance of AI technologies to prevent potential harms (Al-Hashimi & Hamdan, 2021; Aldosari & Alanazi, 2024) to both patients and health workers.

As global healthcare systems are currently grappling with intense pressures affecting their capacity to deliver care that appropriately responds to the increased needs of aging populations, a higher burden of chronic diseases, and both human and financial resource constraints, the search for increased efficiencies has intensified. As a result, a range of AI-based innovations are gradually adopted. For example, management systems driven by algorithms are increasingly supplementing or replacing traditional human decision-making processes across healthcare organizations, in hopes that this approach increases operational efficiencies. Such AI decision systems are applied to various administrative and clinical processes including staff scheduling, aiming to optimize it, or to clinical protocols to capitalize on findings from existing successful approaches to reduce errors and identify potential problems early on based on pattern identification. However, despite their great promise, these applications require careful examination of the ways in which AI technologies can augment, rather than compromise, the quality, equity, and compassion inherent in healthcare delivery (Janssen et al., 2024; Turchioe et al., 2024). While the incorporation of AI into administrative and clinical health systems aims to enhance efficiency, it could inadvertently introduce additional layers of complexity that must be managed with sensitivity to ethical, equity, and legal implications (Subías-Beltrán et al., 2024).