

**Advances in
Digital Technology
and Data-Driven
Business Practices**

Digital Transformation and Artificial Intelligence for Operational Excellence in Healthcare

Edited by

**Anand Jaiswal, Vinaytosh Mishra
& Nripendra Singh**

Digital Transformation and Artificial Intelligence for Operational Excellence in Healthcare

ADVANCES IN DIGITAL TECHNOLOGY AND DATA-DRIVEN BUSINESS PRACTICES

Series Editor: Nripendra Singh – Pennsylvania Western University, USA

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Digital Transformation and Artificial Intelligence for Operational Excellence in Healthcare

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Emerald Publishing Limited
Emerald Publishing, Floor 5, Northspring, 21-23 Wellington Street, Leeds LS1 4DL

First edition 2026

Editorial matter and selection © 2026 Anand Jaiswal, Vinaytosh Mishra, and Nripendra Singh.
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British Library Cataloguing in Publication Data

A catalogue record for this book is available from the British Library

ISBN: 978-1-83662-315-1 (Print)

ISBN: 978-1-83662-314-4 (Online)

ISBN: 978-1-83662-316-8 (Epub)



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Editorial: Digital Transformation and AI Innovation Redefining Healthcare Excellence

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The healthcare industry is on the verge of a transformative era in which digital technologies and artificial intelligence (AI) are fundamentally changing how care is delivered, managed, and experienced. This convergence of digital transformation and AI innovation has enormous potential for achieving operational excellence and improving patient outcomes, but it also presents significant challenges that must be managed with caution. As editors of this volume, we intend to investigate the complex impact of these technologies on healthcare, drawing on latest research and real-world applications to provide a comprehensive overview.

Digital transformation in healthcare refers to the integration of digital technologies into all domains of healthcare delivery, from clinical care to administrative processes. This transformation is driven by the need to address longstanding inefficiencies, rising costs, and the growing demand for personalized, patient-centric care. Electronic Health Records (EHRs), telemedicine, wearable devices, and the Internet of Medical Things (IoMT) are just a few examples of how digital tools are reshaping the healthcare landscape. According to a study by [Topol \(2019\)](#), the digitization of healthcare data has enabled more accurate diagnoses, reduced medical errors, and improved coordination among care providers. For example, the adoption of EHRs has been shown to improve the patient safety surveillance, as highlighted by [Adler-Milstein et al. \(2017\)](#).

The COVID-19 pandemic served as a catalyst for digital transformation, accelerating the adoption of telemedicine and remote monitoring technologies. A study by [Hollander and Carr \(2020\)](#) found that telemedicine visits increased by 154% in the United States during the early months of the pandemic, demonstrating its potential to enhance access to care, particularly in underserved areas. Similarly, IoMT devices, such as wearable glucose monitors and remote cardiac monitors, have enabled continuous patient monitoring, reducing the need for

in-person visits and improving chronic disease management. These advancements underscore the transformative potential of digital technologies in addressing some of healthcare's most pressing challenges.

However, the true power of digital transformation lies in its synergy with AI. AI, particularly machine learning and deep learning, is revolutionizing healthcare by enabling faster, more accurate diagnostics, personalized treatment plans, and predictive analytics. AI algorithms can analyze vast amounts of medical data, identifying patterns and insights that would be impossible for humans to discern. For example, [Esteva et al. \(2017\)](#) demonstrated that a deep learning algorithm could classify skin cancer with a level of accuracy comparable to board-certified dermatologists. Similarly, AI-powered diagnostic tools have shown remarkable success in radiology, with studies indicating that AI can detect abnormalities in medical images with accuracy rates exceeding 90% ([McKinney et al., 2020](#)).

AI is also transforming drug discovery, a traditionally time-consuming and costly process. Companies, like Insilico Medicine, are leveraging AI to identify potential drug candidates in a fraction of the time required by conventional methods. A study by [Stokes et al. \(2020\)](#) highlighted how an AI model identified a novel antibiotic compound, halicin, which was effective against drug-resistant bacteria. This breakthrough underscores the potential of AI to address global health challenges, such as antimicrobial resistance, by accelerating the development of new therapies.

In addition to diagnostics and drug discovery, AI is enhancing operational efficiency in healthcare. Predictive analytics, powered by AI, is being used to optimize hospital resource allocation, reduce wait times, and improve patient flow. For instance, a study by [Shickel et al. \(2017\)](#) demonstrated how AI algorithms could predict patient deterioration in intensive care units, enabling early interventions and reducing mortality rates. Similarly, AI-driven supply chain management systems are helping hospitals reduce waste and ensure the timely availability of critical medical supplies.

Despite these advancements, the integration of digital transformation and AI in healthcare is not without challenges. Data privacy and security remain paramount concerns, as healthcare data are highly sensitive and vulnerable to breaches. The implementation of robust data protection frameworks, such as the General Data Protection Regulation (GDPR) in Europe and the Health Insurance Portability and Accountability Act (HIPAA) in the United States, is essential to safeguarding patient information. However, compliance with these regulations can be complex and resource-intensive, particularly for smaller healthcare providers.

Another significant barrier is the resistance to change among healthcare professionals. The adoption of new technologies often requires a cultural shift, as well as training and upskilling of the workforce. A study by [Sittig and Singh \(2016\)](#) highlighted the importance of addressing these human factors to ensure the successful implementation of digital health solutions. Additionally, regulatory hurdles can slow down the deployment of innovative technologies, particularly in highly regulated fields like healthcare.

Ethical considerations also play a critical role in the adoption of AI in healthcare. Bias in AI algorithms, for example, can lead to inequitable outcomes, particularly for marginalized populations. A study by Obermeyer et al. (2019) revealed that a widely used healthcare algorithm exhibited racial bias, resulting in Black patients receiving less care than White patients with similar health conditions. Addressing these ethical challenges requires a multidisciplinary approach, involving not only technologists but also ethicists, policymakers, and healthcare providers.

Looking ahead, the future of healthcare lies in the continued integration of digital transformation and AI. Emerging technologies, such as blockchain, 5G networks, and quantum computing, hold the potential to further enhance data security, interoperability, and computational power. Blockchain, for instance, can provide a secure and transparent framework for managing healthcare data while 5G networks can enable faster and more reliable telemedicine services. Quantum computing, though still in its infancy, promises to solve complex medical problems that are currently beyond the reach of classical computers.

AI will also play a critical role in pandemic preparedness and response. During the COVID-19 pandemic, AI was used to track the spread of the virus, develop vaccines, and optimize resource allocation. A study by Naudé (2020) highlighted how AI models were instrumental in predicting the spread of the virus and identifying high-risk areas. As the world continues to grapple with the aftermath of the pandemic, the lessons learned from these applications will be invaluable in shaping future responses to global health crises.

Global collaboration will be key to harnessing the full potential of digital transformation and AI in healthcare. Initiatives like the Global Partnership on Artificial Intelligence (GPAI) and the World Health Organization's (WHO) Digital Health Technical Advisory Group are fostering international cooperation to address common challenges and share best practices. By working together, stakeholders can ensure that the benefits of these technologies are equitably distributed and that no one is left behind.

In conclusion, the convergence of digital transformation and AI innovation is reshaping the healthcare landscape, offering unprecedented opportunities for enhanced patient care and operational excellence. However, realizing this potential requires addressing challenges related to data privacy, workforce adaptation, and ethical considerations. As editors of this volume, we hope to inspire and inform stakeholders – policymakers, healthcare providers, technologists, and researchers – to collaborate in creating a future where technology and healthcare are seamlessly integrated. The possibilities are limitless, and the impact on global health will be profound.

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Chapter 1

Digital Transformation in Healthcare: Analysing the Current State, Challenges and Future Research Agenda

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Abstract

More and more people in the healthcare industry and academia are considering how digital transformation (DT) can impact patient care. The demand for chronic disease management is rising due to an ageing population, new technologies and individuals more involved in healthcare decisions. In this chapter, the author aimed to investigate the literature on the ubiquity of digital technology in healthcare and to pinpoint how the COVID-19 epidemic compelled all systems to adopt new digital technology in a manner that was both disruptive and influential for management and business. To gain an understanding of the role of digital technology in the healthcare sector and how it is being revived as a result of the pandemic, the authors conducted a structured literature study on the current level of DT in healthcare. To achieve this objective, the underlying information technologies must be adaptable to each organisation's digitalisation maturity level while being secure, dependable, reasonably priced and easily expandable. Researchers should focus on three main topics: the impact of DT on healthcare stakeholders, the role of digital technology in enabling digital healthcare services and how stakeholders can participate in digital healthcare services. They bridge the gap between the many domains, illuminating how digital technology facilitates the delivery of digital services, the improvement of operational efficiency and the production of value within the healthcare system. At the end of this chapter, the authors outline some potential avenues for further study, together with inevitable consequences for management and practice.

Keywords: Digital transformation; healthcare; digitalisation; COVID-19; AI; technology

Introduction

Since March 2020, the first wave of the COVID-19 pandemic has begun to affect economies and enterprises worldwide. These impacts are predicted to last for decades (Miao et al., 2020; Saarikko et al., 2020). The pandemic has caused significant changes in the healthcare sector. Agarwal et al. (2010), Raimo et al. (2023) and Kraus et al. (2021) all note that COVID-19 has generated a great deal of interest in the healthcare sector. While medical and technological progress is improving healthcare globally, governments, healthcare providers and citizens are concerned about growing prices (Dieleman et al., 2017). The traditional doctor–patient relationship and its associated private environment are becoming less commonplace in modern medicine. A vast web of human and nonhuman entities is involved in healthcare distribution. Examples include databases, hospital information systems, electronic medical records, digital health cards, online patient communities, health-related applications and smart homes with ambient assisted living technology. When networks adhere to standards like authenticity, transparency, participation, flow of information and connectedness, they function most efficiently. These standards govern the creation and application of health-related knowledge. Belliger and Krieger (2018) define how health-related knowledge might improve care quality and efficiency. Patients' increasing need for accessible point-of-care alternatives and added services such as remote testing and health information exchange motivates them to take a more active role in treatment decisions. This further strains the healthcare system (Cordina et al., 2018). Regulations and compliance requirements heavily influence the research and treatment of drugs due to the high stakes involved in human life. However, there is an added expense and effort associated with these standards, which could slow down the digitisation of healthcare (Dissanayake et al., 2018).

Kraus et al. (2021) and others have studied all healthcare ecosystems for potential solutions that involve the unprecedented adoption of digital technologies. The widespread adoption of technology is mainly driven by the hope that state-of-the-art resources, like as Electronic Health Records, e-health platforms, blockchain and Internet of Things (IoT) sensors, can simplify the incredibly intricate healthcare industry (Massaro, 2023; Ritala & Karhu, 2023; Spanò et al., 2021). Many fresh prospects have emerged for scientists and medical professionals due to digital technologies, which can enhance diagnostic and therapeutic procedures (such as telemedicine systems for patient consultations and monitoring, Artificial Intelligence [AI] for diagnostic tasks, surgical decision-making, etc.). These technologies also improve administrative and organisational processes, leading to more cost-effective services through redesign (Biancone et al., 2023; Loftus et al., 2020).

There is a trend toward more secure and high-quality healthcare that can be described as digital transformation (DT), which encompasses all of these factors (Haggerty, 2017). The widespread usage of digital technology has given rise to

several new issues since the beginning of the epidemic (Xiang et al., 2020). For instance, social media platforms like Twitter and WeChat, which are digital technologies (Massaro, 2023; Wang et al., 2020), can improve public health communication and education (Nadkarni & Prügl, 2021). Modern operating robots and other instruments have improved surgical planning and safety, benefiting everyone involved: the patient, the surgeon, the healthcare facility and society (Dal Mas et al., 2023). The advent of 3D printing and automation has brought new tools to the medical field, and the utilisation of big data has made it possible to gather helpful information that can be utilised for medical education purposes as well as to improve current healthcare methods in the face of the COVID-19 pandemic (Balch et al., 2023). To address the current and future healthcare sector challenges, as well as those caused by the pandemic, researchers and practitioners must work together to comprehend the capabilities of the sector and to determine how these capabilities define the dynamics, determinants, processes and possible outcomes. Considerations of sector dynamics include figuring out how to maximise the use of these cutting-edge innovations, which have both immediate and distant benefits, the latter of which could call for a significant shift in organisational strategy (Cobianchi et al., 2020). This chapter examines DT's efficacy, issues and healthcare applications. The research questions addressed here concern the evolution of the theme, its uses, benefits, drawbacks, prospects and hazards faced by the health sector. Additionally, we hope to study how these ubiquitous technologies might enhance and revolutionise healthcare sector operations, management and performance after a pandemic by bringing together the literature on DT and healthcare.

Methodology

A structured literature review (SRL) was employed in this section by the author. According to Massaro et al. (2023), SLRs are best used to help “experienced scholars [in developing] new and interesting research paths by accessing and analysing a considerable volume of scholarly work”. They also contribute to developing “research paths and questions by providing a foundation” for future research avenues. This SLR was conducted by analysing research from a variety of reputable sources, including Taylor & Francis, the World Economic Forum, Elsevier B.V., Springer, Nature, Wiley, BMJ, Edward Elgar Publishing, Pew Research Center, Emerald, MIT and MDPI. The review focused on literature from the last 10 years, covering key themes related to DT in healthcare. The selection criteria included studies that addressed topics such as transformation, healthcare innovation, DT, the health sector, digital technology and AI. The strategic importance of pre-existing digital technologies has been the focus of multiple research assessments. Research in this area has included studies that have examined healthcare organisations' DT (van Velthoven et al., 2019). This chapter's overarching goal is to forward a research agenda that, drawing from disciplines as diverse as sociology, psychology, engineering, business management and marketing, presents a fresh

perspective on the potential uses of digital technology in healthcare. In this chapter, the author examines articles published in different scholarly journals using content analysis.

Digital Transformation

When an entity's qualities are improved by using various forms of information, computers, collaboration and networking technology, it can be said to have undergone DT (Vial, 2021). DT has far-reaching effects on businesses, influencing internal organisational structure changes, metric and target development, digital resource acquisition and digital growth strategy creation (Verhoef et al., 2021). Information, computers, communication and networking technologies are all part of DT, a process that tries to make something better by altering its qualities significantly (Hermes et al., 2020).

Information systems, marketing and strategy are just a few of the business fields that have made this phenomenon a popular topic of study because of its profound impact on the corporate sector. The healthcare industry has been a long-standing site of DT. Health Care includes all the services doctors and other medical professionals offer to keep people physically and mentally healthy (Marques & Ferreira, 2020). In medical practice and value generation, new business opportunities and models are rising due to the digital revolution in healthcare. This transformation assists in resolving numerous societal problems, such as those related to the ageing population (Elton & O'Riordan, 2016; Kraus et al., 2021). Shukla et al. (2022) referred to healthcare systems as the "fundamental weave in the fabric of human society" since they enable all populations to stay healthy through the efforts of medical professionals, support staff, hospitals and other related entities. Modern technologies like AI, big data and the creation of more efficient algorithms – all made possible by ever-increasing computer capacity – are causing a massive upheaval in the Healthcare sector 4.0 (Piccialli et al., 2021).

Digital Transformation Insights for the Healthcare Sector

The healthcare industry is experiencing a significant shift due to DT, which profoundly impact the industry. Despite this, there needs to be more empirical data on the efficacy, issues and uses of digital healthcare advances in the existing literature, which is surprising given the rapid development and widespread acceptance of these technologies. There has yet to be a comprehensive study of DT in healthcare systems even though there's a lot of literature on healthcare IT in general (Dionisio et al., 2023). Several businesses have instituted remote work practices (COVID-19) to contain the coronavirus epidemic, which has just broken out globally. Customers' buying habits have swiftly shifted to online media as they avoid face-to-face interaction. This means several sectors have been able to speed up their digital infrastructure development due to the pandemic (Kim, 2020). Businesses have created cloud-based IT systems to experiment with new methods for delivering seamless, contact-free services through mobile apps, video