

# Digitalizing Healthcare Operations: A Conceptual Framework for Balancing Efficiency and Patient-Centered Care

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## ABSTRACT

Digital transformation is reshaping healthcare through technologies such as electronic health records (EHRs), telemedicine, artificial intelligence (AI), big data analytics, and the Internet of Things (IoT). These innovations improve efficiency by reducing waiting times, optimizing resource use, and streamlining workflows, while also promoting patient-centered care through personalized treatment, improved access, and stronger patient engagement. This paper presents a conceptual review of studies and industry reports published between 2020 and 2025 to examine how digitalization advances both operational efficiency and patient-centeredness. Findings highlight that digital solutions contribute to significant gains in coordination, cost savings, and service quality, while empowering patients via mobile health applications, wearable devices, and virtual platforms. However, persistent challenges in digitalization such as interoperability gaps, data privacy risks, and uneven digital readiness among professionals and patients have continued to limit their potential. Guided by Service-Dominant Logic (SDL) as the underpinning theory, this paper underscores digitalization as both a strategic enabler of efficiency and a platform for value co-creation with patients. The paper concludes with recommendations and identifies future research opportunities in areas such as longitudinal outcomes, cross-cultural adoption, digital equity, and the potential of emerging technologies.

**Keywords:** Digital Healthcare, Healthcare Digitalization, Operational Efficiency, Patient-Centered Care, Service-Dominant Logic (SDL)

## INTRODUCTION

Healthcare systems worldwide are undergoing profound transformation as digital technologies become deeply embedded in operational processes and clinical practices. The growing adoption of tools such as electronic health records (EHRs), telemedicine, mobile health applications, artificial intelligence (AI), and data-driven platforms has fundamentally reshaped how healthcare services are delivered, managed, and experienced (Lee & Park, 2023). The COVID-19 pandemic further accelerated digital adoption by forcing health systems to reconfigure their operations to maintain continuity of care while managing increased demand and limited resources (Chen et al., 2022). This shift has intensified scholarly and policy debates on the role of digitalization in enhancing efficiency while ensuring that healthcare remains patient centered. Operational efficiency has long been a priority in healthcare management due to rising costs, resource constraints, and growing patient populations. Inefficient operations lead to longer waiting times, duplication of services, and increased risk of medical errors. Digitalization is often positioned as a solution to these inefficiencies. For example, AI-enabled scheduling systems optimize patient appointments, predictive analytics forecast hospital bed demand, and robotic process automation reduce administrative burdens (Gupta & Singh, 2024). These tools allow healthcare providers to achieve more with fewer resources, directly contributing to cost savings and service quality improvements.

At the same time, healthcare systems are increasingly embracing a patient-centered paradigm. Patient-centered care emphasizes responsiveness to individual preferences, needs, and values, ensuring that clinical decisions

respect patient autonomy (Institute of Medicine, 2020). Digital technologies contribute to this shift by facilitating patient engagement, enabling remote monitoring, and providing patients with access to their health data. Mobile applications and wearable devices empower individuals to track their conditions and communicate with healthcare providers in real time (Khan et al., 2023). Telemedicine, once considered supplementary, is now a core element of patient-centered care, especially in remote and underserved communities (Rahman et al., 2022).

Despite these benefits, challenges persist. Interoperability among health information systems remains limited, leading to fragmented data and inefficiencies (WHO, 2022). Data privacy and security concerns are heightened as sensitive health information moves into cloud-based platforms (Miller, 2024). Moreover, the digital divide poses risks of exclusion, as patients with lower digital literacy or limited access to technology may not fully benefit from digital health solutions (Omar & Lim, 2025). Healthcare workers also face pressures to adapt to new digital tools, requiring ongoing training and organizational support (Tan & Aziz, 2023). These barriers highlight the tension between achieving efficiency and delivering truly patient-centered care. Even though digitalization in healthcare has been widely studied, most research examines its impact on efficiency and patient-centered care in isolation. Efficiency-focused studies emphasize cost savings, workflow optimization, and operational performance, while patient-centered research highlights empowerment, personalization, and engagement. However, the intersection of these two dimensions is less understood. There is a lack of integrative reviews that explain how digitalization simultaneously enhances efficiency and patient-centeredness, as well as how persistent challenges, such as interoperability gaps, cybersecurity risks, and the digital divide which moderate these outcomes. Addressing this gap is essential because healthcare organizations must not only streamline operations but also safeguard humanistic values.

Given this context, the aim of this paper is to explore how digitalization in healthcare operations simultaneously advances both organizational efficiency and patient-centeredness, while also identifying the challenges that may hinder these outcomes. By reviewing literature published between 2020 and 2025, this study synthesizes the dual impact of digitalization and outlines strategies for healthcare organizations to align operational objectives with patient needs. This paper contributes to the growing field of healthcare operations management in three keyways. First, it advances the theoretical understanding of digitalization by framing it as a dual-force mechanism that influences both efficiency and patient-centeredness. Second, it highlights the practical implications of adopting digital tools, including their role in resource optimization, patient engagement, and service delivery innovation. Third, it identifies areas for future research, particularly regarding long-term outcomes of digital healthcare, cross-cultural adoption patterns, and the role of emerging technologies such as blockchain, augmented reality, and digital twins.

## LITERATURE REVIEW

### Digital Capabilities

Digital capability is defined as the organizational ability to deploy, integrate, and adapt digital technologies, such as electronic health records, analytics, artificial intelligence, and telemedicine. This is done through the enhancement of operational efficiency while enabling value co-creation with patients through personalization, engagement, and empowerment (Gupta & Singh, 2024; Lee & Park, 2023; Omar & Lim, 2025). Within the framework of the Resource-Based View (RBV), digital capability is considered a strategic resource that enables hospitals and health systems to achieve sustainable advantages in efficiency and service delivery. Core elements of digital capability include robust electronic health record (EHR) systems, advanced data analytics, artificial intelligence (AI) applications, interoperability across platforms, and the organizational capacity to adopt and adapt new technologies. In the context of operational efficiency, digital capability allows institutions to optimize workflows, reduce redundancies, and enhance decision-making. For instance, predictive analytics can anticipate patient demand and resource needs, while robotic process automation reduces administrative burden. Strong digital infrastructures also ensure that clinical data is accessible in real time, reducing medical errors and duplication of services. Equally important, digital capability supports patient-centered care by enabling personalization and engagement. Telemedicine platforms, mobile health applications, and wearable devices empower patients to participate actively in their care. Healthcare organizations with high digital capability can provide patients with seamless access to health records, interactive communication with providers, and tailored treatment pathways. This strengthens trust and fosters value co-creation between patients and providers, as

emphasized by Service-Dominant Logic (SDL).

However, digital capability is not solely technological, it is also organizational. Effective use requires skilled personnel, supportive leadership, a culture of innovation, and adequate governance structures to address issues such as data privacy and cybersecurity. Without these elements, investments in technology may fail to translate into meaningful outcomes. Building digital capability, therefore, represents both a technical and strategic priority for healthcare organizations seeking to balance efficiency with patient-centeredness in the digital era.

### **Operational Efficiency**

The pursuit of operational efficiency has long been a central goal in healthcare management, given the rising costs of medical care, increasing patient demand, and persistent resource constraints. Digitalization has emerged as a transformative driver of efficiency, offering solutions that optimize workflows, reduce redundancies, and enhance decision-making. From 2020 to 2025, research has increasingly focused on the role of electronic health records (EHRs), artificial intelligence (AI), big data analytics, telemedicine, and robotic process automation in streamlining healthcare operations. One of the most significant efficiency gains stems from the widespread adoption of EHRs, which enable real-time access to patient data, reduce duplication of tests, and improve coordination among healthcare providers. Studies have shown that digitized medical records not only cut administrative workload but also reduce medical errors by facilitating information sharing across departments and institutions (Chen et al., 2022). Beyond EHRs, AI-based scheduling systems have been introduced to optimize appointment allocation, thereby minimizing patient waiting times and maximizing the utilization of healthcare staff and infrastructure (Lee & Park, 2023). Predictive analytics and big data applications are equally critical for enhancing efficiency. By analyzing historical patient data, hospitals can forecast demand for beds, emergency services, and medical supplies, thereby improving resource allocation (Gupta & Singh, 2024). Similarly, predictive algorithms support proactive interventions in chronic disease management, reducing hospital readmissions and lowering long-term costs. During the COVID-19 pandemic, such tools proved invaluable for demand forecasting, enabling hospitals to prepare for surges in-patient admissions (Rahman et al., 2022).

Another area of operational efficiency lies in healthcare supply chain management. Digital platforms integrated with blockchain and IoT have improved the traceability of pharmaceuticals, vaccines, and medical equipment, ensured timely delivery while reduced waste and fraud (Miller, 2024). For example, blockchain-enabled systems provide immutable records of transactions, which enhance trust and accountability among suppliers, regulators, and healthcare providers. Robotic process automation (RPA) has further reduced administrative burdens by automating repetitive tasks such as billing, claim processing, and patient registration. This allows healthcare professionals to devote more time to clinical work, thereby improving both efficiency and service quality (Tan & Aziz, 2023). Similarly, telemedicine has lowered operational costs by minimizing in-person visits for routine consultations, reducing hospital congestion, and enabling healthcare providers to reach larger populations without proportionately increasing resources (Omar & Lim, 2025). Cooperatively, these advancements demonstrate how digitalization contributes to healthcare efficiency by reducing costs, optimizing workflows, and improving the allocation of scarce resources. However, the efficiency gains are not uniform across all settings. Studies indicate that implementation success often depends on organizational readiness, technological infrastructure, and policy support (WHO, 2022). As such, while digitalization offers substantial potential, full realization requires careful alignment with institutional strategies and national health policies.

### **Patient-Centered Care in The Digital Era**

While operational efficiency is a crucial objective for healthcare systems, the concept of patient-centered care has increasingly gained importance as a guiding principle in modern healthcare. Patient-centered care emphasizes treating patients with dignity, involving them in decision-making, and tailoring healthcare services to their individual needs and preferences (Institute of Medicine, 2020). Digitalization provides a powerful platform to advance this paradigm by enabling greater personalization, accessibility, and patient engagement. One of the most visible impacts of digitalization is the rapid adoption of telemedicine, which became mainstream during the COVID-19 pandemic. Telemedicine platforms allow patients to access healthcare professionals remotely, reducing the need for travel, minimizing waiting times, and improving access for individuals in

underserved or rural areas. Recent studies demonstrate that telemedicine not only enhances access but also improves patient satisfaction by providing more convenient and flexible care options (Rahman et al., 2022). In addition to telemedicine, wearable devices and mobile health (mHealth) applications play an important role in promoting patient-centered care. Devices such as smartwatches and glucose monitors allow patients to monitor their health conditions in real time and share data directly with healthcare providers. This fosters personalized treatment plans and enables early detection of complications, particularly for chronic diseases such as diabetes and cardiovascular conditions (Khan et al., 2023). Such tools empower patients to become active participants in their healthcare journeys, moving from passive recipients to informed decision-makers. Digital platforms also contribute to improved patient engagement and communication. Patient portals integrated with EHRs give individuals access to their medical records, laboratory results, and treatment histories. This transparency allows patients to better understand their health conditions and make informed decisions about their care (Ali & Hussain, 2021). Furthermore, secure messaging platforms enable continuous communication between patients and providers, strengthening trust and enhancing the overall care experience.

Another significant contribution of digitalization to patient-centered care lies in personalized medicine. AI algorithms analyze large datasets to identify treatment options tailored to individual genetic, environmental, and lifestyle factors. For example, precision oncology platforms are increasingly used to match cancer patients with the most effective therapies, improving treatment outcomes while minimizing side effects (Lee & Park, 2023). Such personalization aligns directly with the principles of patient-centered care, as it acknowledges the uniqueness of each patient. Despite these benefits, challenges remain in ensuring that digital healthcare solutions truly serve all patients. A key concern is the digital divide, where patients with limited digital literacy, poor internet access, or socioeconomic disadvantages may not fully benefit from digital services (Omar & Lim, 2025). This raises questions about equity and inclusiveness, as digitalization has the potential to widen disparities in healthcare access if not carefully managed. Similarly, some patients may feel overwhelmed by complex health apps or distrustful of digital platforms, reducing their willingness to engage (Miller, 2024).

Finally, patient-centered care must also consider the human element in healthcare interactions. While digital tools enhance convenience and personalization, there is a risk of depersonalization if technology replaces rather than complementing human relationships. Studies indicate that while patients appreciate efficiency, they still value empathy, compassion, and human connection in their interactions with healthcare providers (Tan & Aziz, 2023). Thus, healthcare organizations must strike a balance between leveraging digital innovations and maintaining human-centered values.

## **Challenges And Barriers of Digitalization in Healthcare**

While digitalization offers substantial benefits for efficiency and patient-centered care, healthcare organizations face several barriers that complicate adoption and limit impact. Between 2020 and 2025, researchers have highlighted four main categories of challenges: interoperability, data privacy and cybersecurity, workforce readiness, and equity issues related to the digital divide.

### **Interoperability Issues**

One of the most persistent barriers is the lack of interoperability between different health information systems. Many hospitals and clinics adopt distinct electronic health record (EHR) platforms that are not fully compatible, resulting in fragmented data and inefficiencies (WHO, 2022). For example, a patient receiving care across multiple institutions may have medical information stored in separate systems, limiting providers' ability to access complete records. This can lead to delays, duplications of tests, and even misdiagnoses. Efforts to create standardized health information exchanges are ongoing, but adoption remains inconsistent across regions and institutions (Chen et al., 2022).

### **Data Privacy and Cybersecurity Risks**

As healthcare organizations transition toward cloud-based platforms and digital storage, data privacy and cybersecurity have become pressing concerns. Sensitive patient data, if compromised, can lead to identity theft, financial fraud, and loss of trust in healthcare systems. Cyberattacks targeting hospitals have increased in recent

years, with ransomware incidents disrupting services and endangering patient safety (Miller, 2024). Balancing efficiency gains with robust cybersecurity measures is a key challenge for healthcare leaders. Regulations such as the General Data Protection Regulation (GDPR) in Europe and the Health Insurance Portability and Accountability Act (HIPAA) in the United States provide frameworks, but global variations in enforcement complicate cross-border healthcare operations (Lee & Park, 2023).

### **Workforce Readiness and Resistance to Change**

Healthcare workers are at the center of digital transformation, yet workforce readiness remains a critical barrier. Many professionals lack the necessary training to use advanced digital tools effectively, leading to resistance, errors, or underutilization of available technologies (Tan & Aziz, 2023). Nurses and physicians often report feeling overwhelmed by new digital requirements such as extensive data entry in EHRs, which can reduce the time available for direct patient care (Omar & Lim, 2025). Organizational culture also plays a role, as successful adoption requires not only technical training but also leadership support and change management strategies.

### **Digital Divide and Equity Concerns**

The digital divide represents another major challenge, particularly in ensuring equitable access to healthcare services. Patients in rural areas, low-income populations, and older adults often face difficulties accessing telemedicine or mobile health applications due to limited internet connectivity, low digital literacy, or financial barriers (Khan et al., 2023). This creates the risk of exacerbating health disparities rather than reducing them. Inclusive digital health strategies must therefore prioritize accessibility, affordability, and patient education to prevent inequality in care outcomes (Rahman et al., 2022).

### **Balancing Efficiency and Human-Centeredness**

Finally, a subtle but important challenge lies in balancing the drive for efficiency with the need for human connection in healthcare. While automation and AI-driven systems enhance speed and accuracy, patients may feel depersonalized if digital interfaces replace meaningful human interactions. A study by Ali and Hussain (2021) found that patients valued digital tools for convenience but continued to emphasize the importance of empathy and compassion in provider interactions. Healthcare leaders must therefore ensure that digitalization complements rather than replaces the human aspects of care.

### **Theoretical Foundation**

This study adopts Service-Dominant Logic (SDL) as its underpinning theory to explain the dual impact of digitalization on efficiency and patient-centered care. Proposed by Vargo and Lusch (2004), SDL shifts the focus from goods and transactions toward service and value co-creation. Within healthcare, SDL emphasizes that value is jointly created by providers and patients, rather than delivered unilaterally by institutions. Digital platforms such as telemedicine, electronic health records, wearable devices, and mobile health applications enable patients to play an active role in monitoring their health, participating in decision-making, and engaging with providers. In this sense, SDL aligns closely with the principles of patient-centered care, as it highlights empowerment, personalization, and collaboration as essential outcomes of digital transformation.

At the same time, SDL provides a useful lens for understanding operational efficiency. By framing digital tools as enablers of co-created value, SDL suggests that efficiency is not achieved solely through automation or process optimization, but through improved coordination, information exchange, and collaboration between providers and patients. For example, electronic health records reduce duplication of tests while also giving patients greater transparency into their medical history. Similarly, telemedicine reduces hospital congestion while simultaneously expanding access for underserved populations. Thus, SDL captures the integrative nature of digitalization, where efficiency and patient-centeredness reinforce rather than contradict each other. To complement this perspective, insights from the Resource-Based View (RBV) and the Unified Theory of Acceptance and Use of Technology (UTAUT) are incorporated. RBV positions digital platforms and analytics capabilities as strategic resources that generate competitive and operational advantages when effectively deployed (Barney, 1991). Meanwhile, UTAUT (Venkatesh et al., 2003) explains the adoption dynamics that

influence whether healthcare professionals and patients embrace digital innovations, highlighting performance expectancy, effort expectancy, social influence, and facilitating conditions. Together, these frameworks enrich the SDL foundation by clarifying how digitalization operates both as a strategic enabler of efficiency and as a platform for patient-centered value co-creation.

## Conceptual Framework

This study proposes a conceptual review that examines the dual role of digitalization in shaping healthcare operations, with particular attention to both operational efficiency and patient-centered care. Healthcare systems worldwide are increasingly investing in technologies such as electronic health records (EHRs), telemedicine platforms, artificial intelligence (AI), predictive analytics, and mobile health applications. While these innovations are often celebrated for their ability to reduce costs and streamline workflows, they also raise critical questions about how technology can maintain or even strengthen human values central to healthcare delivery. Drawing on Service-Dominant Logic (SDL) as the underpinning theory, the study positions digital healthcare as a collaborative process where providers and patients jointly create value through engagement, empowerment, and personalization. Supporting perspectives from the Resource-Based View (RBV) and the Unified Theory of Acceptance and Use of Technology (UTAUT) help explain how digital tools act as strategic resources for efficiency and how adoption dynamics among professionals and patients shape actual outcomes. This review contributes conceptually by integrating two dimensions—efficiency and patient-centeredness—that are often studied separately. Literature suggests that digitalization influences healthcare operations through two interconnected pathways:

1. Efficiency Pathway – where technologies (EHRs, AI, predictive analytics, RPA) reduce costs, optimize workflows, and improve resource utilization.
2. Patient-Centered Pathway – where technologies (telemedicine, mHealth, patient portals, personalized medicine) empower patients, improve access, and enhance engagement.

The intersection of these pathways represents the point where digitalization achieves both operational efficiency and patient-centered care. Challenges (interoperability, data privacy, workforce readiness, equity) act as moderating factors that determine the success of this dual alignment.

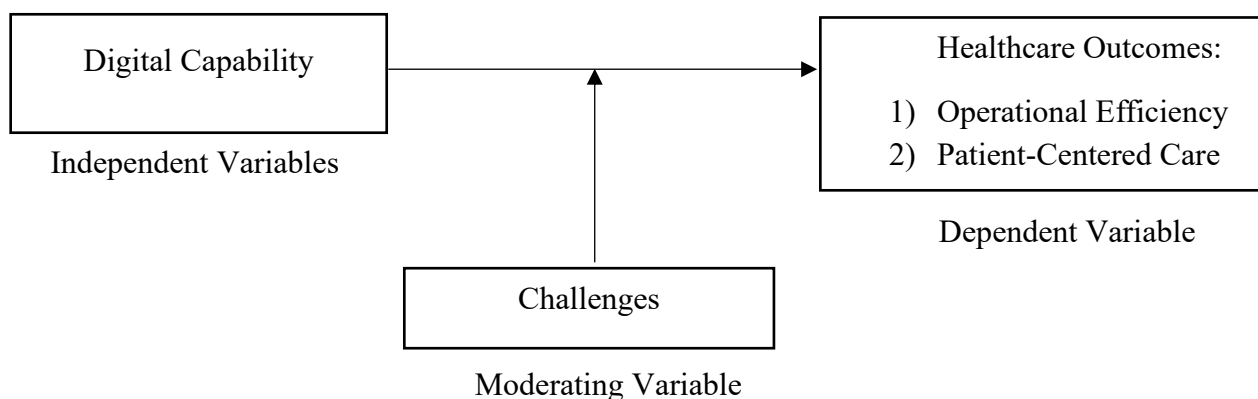


Figure 1.0: Conceptual Framework

## DISCUSSION

The findings of this review suggest that digitalization exerts a dual influence on healthcare operations: it enhances efficiency while simultaneously reshaping patient-centered care. Yet, these two dimensions are not always fully aligned, and tensions emerge when efficiency goals overshadow patient priorities. To better explain these dynamics, this study grounds the discussion in Service-Dominant Logic (SDL), supported by insights from the Resource-Based View (RBV) and the Unified Theory of Acceptance and Use of Technology (UTAUT).

From the SDL perspective, digital healthcare innovations are best understood as platforms for value co-creation

between providers and patients. Tools such as patient portals, wearable devices, and telemedicine services enable patients to actively participate in monitoring, decision-making, and communication. This reinforces the principle of patient-centeredness by positioning individuals not as passive recipients of care, but as empowered collaborators. However, SDL also highlights that technology must complement, rather than replace human interaction. Efficiency gains must therefore be carefully balanced with the empathy, compassion, and trust that remain central to healthcare relationships. Insights from the RBV further reveal that efficiency is achieved when digital capabilities are treated as strategic organizational resources. Hospitals with advanced EHR systems, predictive analytics, and robotic process automation are better positioned to optimize workflows, reduce costs, and increase resource utilization. However, RBV also suggests that these resources must be supported by organizational culture and policies to ensure long-term sustainability. Efficiency is not the result of technology alone but of its strategic integration into healthcare operations.

Finally, UTAUT explains why digitalization does not always translate into intended outcomes. Adoption dynamics among both healthcare professionals and patients determine the actual impact of digital tools. For instance, physicians are more likely to embrace AI-assisted diagnostic systems when performance expectancy is high and when adequate support structures are in place. Similarly, patients' willingness to engage with mobile health apps often depends on ease of use and encouragement from peers or providers. Without adoption, the potential of digitalization remains underutilized. By linking SDL, RBV, and UTAUT, this study shows that digitalization in healthcare is not simply a technological upgrade but a socio-technical transformation. SDL emphasizes value co-creation and patient empowerment, RBV highlights efficiency through strategic resources, and UTAUT clarifies adoption dynamics. Together, these perspectives underscore that successful digital transformation requires not only investment in technology but also organizational alignment, user readiness, and a commitment to maintaining human-centered care.

### **Balancing Efficiency and Patient-Centered Care**

The findings from the literature review indicate that digitalization exerts a dual influence on healthcare operations: it significantly enhances efficiency while also reshaping the delivery of patient-centered care. However, these two goals are not always fully aligned. In practice, healthcare organizations must carefully balance operational optimization with the humanistic values central to patient care. From the efficiency perspective, digital tools such as electronic health records (EHRs), predictive analytics, and robotic process automation have reduced administrative burden, minimized medical errors, and improved resource allocation (Gupta & Singh, 2024). These advances free up staff time, reduce costs, and increase organizational capacity. For example, AI-enabled triage systems accelerate decision-making in emergency departments, improving throughput and reducing overcrowding (Lee & Park, 2023).

At the same time, digitalization strengthens patient-centeredness by empowering patients with access to their health information, enabling remote consultations, and fostering personalized treatments. Wearable devices and mobile health apps allow patients to actively monitor their health, facilitating a shift toward shared decision-making (Khan et al., 2023). Telemedicine platforms have become critical tools for expanding access to underserved populations (Rahman et al., 2022). Despite these synergies, tensions arise when efficiency goals overshadow patient-centered priorities. For instance, the automation of administrative tasks may increase productivity but also risk depersonalizing interactions if patients perceive reduced opportunities for human connection. Similarly, while telemedicine offers convenience, some patients report dissatisfaction with the lack of physical examination and face-to-face communication, which they associate with empathetic care (Ali & Hussain, 2021).

Another trade-off relates to data-driven decision-making. Predictive analytics can improve outcomes by identifying high-risk patients early, yet reliance on algorithmic outputs may reduce the nuanced judgment of clinicians. Concerns also arise regarding algorithmic bias, where AI systems trained on incomplete or unrepresentative datasets may inadvertently reinforce healthcare disparities (Miller, 2024). Thus, while digitalization enhances efficiency, unchecked reliance on automation can compromise equity and personalization. Organizational strategies play a critical role in resolving these tensions. Research suggests that when digitalization is implemented with a patient-first philosophy, technology becomes a complement rather than a substitute for human care (Omar & Lim, 2025). For example, integrating AI-driven scheduling with patient

preference data allows hospitals to optimize efficiency while respecting patient convenience. Similarly, combining telemedicine with periodic in-person visits ensures that remote care does not replace essential physical interactions.

While Service-Dominant Logic (SDL) views digital healthcare as a platform for value co-creation, but its practical implementation is shaped by clinical and institutional realities. In acute or emergency scenarios, clinical decision-making is often constrained by time pressures and the high-risk nature of conditions, which limits the scope for patient involvement in shared decision-making. Consequently, SDL may be more effectively applied in contexts such as chronic disease management, rehabilitation, or preventive care, where there is greater opportunity for thoughtful deliberation and sustained patient engagement.

Moreover, institutional policies and standardized treatment protocols present additional constraints. Hospitals and national health authorities regulate clinical practices through consent procedures, clinical guidelines, and data governance frameworks. While these regulations are essential for ensuring equity and safety, they can restrict the flexibility necessary to customize care according to individual preferences. Thus, it is essential to contextualize SDL in healthcare: while value co-creation is important, it must occur within the parameters established by clinical protocols and policy frameworks.

On the other hand, an important distinction that enhances this framework lies in the contrast between short-term operational efficiency and long-term patient outcomes. Digitalization often provides immediate, measurable gains in efficiency, including reduced waiting times, streamlined administrative processes, and cost savings. These operational advantages are particularly invaluable for healthcare managers and policymakers, especially in resource-constrained settings where efficiency is essential for maintaining service delivery. However, the effectiveness of digital healthcare cannot be fully evaluated based solely on operational metrics. Long-term patient outcomes—such as improved quality of life, lower readmission rates, enhanced continuity of care, and better management of chronic diseases—serve as the ultimate indicators of the impact of digital transformation.

For instance, while predictive analytics may generate short-term savings by optimizing resource allocation, its lasting value is found in reducing preventable hospitalizations and facilitating proactive care. Similarly, telemedicine might immediately decrease operational costs, but its long-term significance hinges on its ability to mitigate disparities in access and strengthen population health. By distinguishing these two dimensions, we can avoid conflating managerial efficiency with clinical effectiveness, ensuring that digital healthcare is assessed not merely as a cost-saving strategy but as a transformative avenue towards sustainable improvements in health outcomes.

In addition to considerations of efficiency and patient-centered care, equity and inclusivity play essential roles in the evaluation of digital healthcare transformation. It is important to recognize that digitalization does not uniformly benefit all populations; rather, there is a risk of exacerbating disparities if vulnerable groups are excluded from its advantages (Omar & Lim, 2025; World Health Organization [WHO], 2022). Older adults may experience difficulties with digital literacy, rural communities may lack consistent internet access, and low-income patients may encounter affordability challenges in accessing devices or services (Khan et al., 2023; Tan & Aziz, 2023). Such inequities undermine the potential of patient-centered care and underscore the necessity for intentional strategies that foster inclusivity.

For instance, the development of user-friendly mobile health applications, provision of subsidies for digital tools aimed at disadvantaged populations, and the expansion of broadband infrastructure in under-resourced areas are crucial measures to ensure that digital transformation does not exacerbate existing health disparities (Chen et al., 2022; Rahman et al., 2022). By embedding equity into digital healthcare frameworks, the focus can shift from efficiency alone towards ensuring that innovations contribute to fairness, accessibility, and universal health coverage (Miller, 2024; WHO, 2022).

## Directions For Future Research

This review highlights several opportunities for future research that can advance understanding of digitalization in healthcare. First, longitudinal studies are needed to assess whether digital hospitals and smart health systems



achieve sustainable improvements in efficiency, cost-effectiveness, and patient outcomes over time, as most existing evidence remains short-term. Second, comparative studies across different cultural and policy contexts would offer insights into how adoption varies between developed and developing countries, as well as between urban and rural populations. Such studies could help explain why some healthcare systems achieve greater balance between efficiency and patient-centeredness than others. Third, more attention should be given to the psychological and ethical dimensions of digital healthcare, particularly patients' trust, perceived empathy, and overall experience in digital environments. Fourth, research on equity and inclusion is essential, especially in addressing the digital divide affecting older adults, rural communities, and disadvantaged groups. Finally, future studies should explore the role of governance, organizational readiness, and disruptive technologies such as blockchain, digital twins, and augmented reality in shaping the next phase of healthcare transformation. Collectively, these research directions underscore the need for a more holistic approach that integrates technological, human, and institutional perspectives to ensure that digital healthcare delivers both efficiency and meaningful patient-centered care.

A forward-looking perspective underscores the transformative potential of emerging technologies, including blockchain, digital twins, and augmented/virtual reality (AR/VR). Blockchain enables immutable and secure health records, effectively addressing ongoing concerns related to data privacy and interoperability. It also facilitates transparent transactions among providers, insurers, and regulators (Khezzar et al., 2019; Miller, 2024). Digital twins—virtual replicas of patients or healthcare systems—offer the ability to conduct predictive simulations of treatment outcomes, tailor personalized care pathways, and optimize hospital operations prior to real-world implementation (Bruynseels et al., 2018; Voigt et al., 2023). Simultaneously, AR/VR technologies are revolutionizing clinical training and patient rehabilitation by providing immersive environments for surgical simulations, pain management, and remote physiotherapy (Mantovani et al., 2020; Singh et al., 2022). Collectively, these innovations broaden the scope of digital healthcare, advancing beyond mere incremental efficiency gains toward a more intelligent, adaptive, and personalized model of care. Engaging deeply with these technologies not only enhances future prospects but also positions the framework as a comprehensive roadmap for guiding healthcare organizations through the next phase of digital transformation (Lee & Park, 2023; Omar & Lim, 2025).

## CONCLUSION

This study highlights how digitalization is reshaping healthcare by improving operational efficiency while advancing patient-centered care. Guided by Service-Dominant Logic (SDL), the findings emphasize that digital technologies are not only tools for process optimization but also platforms for co-creating value between providers and patients. Efficiency gains are achieved through strategic digital resources such as electronic health records, predictive analytics, and automation, as explained by the Resource-Based View (RBV). At the same time, the actual realization of these benefits depends on the adoption behaviors of healthcare professionals and patients, which are shaped by factors outlined in the Unified Theory of Acceptance and Use of Technology (UTAUT). The central implication is that digital transformation in healthcare must be understood as a socio-technical process, not merely a technical upgrade. While technologies can streamline operations and expand access, their impact depends on how they are strategically integrated and how patients and providers engage with them. To maximize outcomes, healthcare organizations should adopt digital strategies that balance efficiency with human-centered values, ensuring that innovation complements, rather than replaces empathy and professional judgment. Future research should continue to explore the long-term effects of digital healthcare, cross-cultural differences in adoption, and the role of emerging technologies such as blockchain and digital twins in reinforcing both efficiency and patient-centeredness.

The rapid advance of digital technologies is transforming the foundations of healthcare, reshaping how medical services are organized, delivered, and experienced. Rather than simply improving existing practices, digitalization represents a structural shift that opens new possibilities for efficiency in operations while simultaneously advancing a more patient-centered model of care. Tools such as electronic health records, artificial intelligence, predictive analytics, telemedicine platforms, and mobile health applications are enabling hospitals and clinics to streamline administrative processes, improve coordination among professionals, and optimize the use of limited resources. At the same time, these technologies are empowering patients by

expanding access to health information, strengthening communication with providers, and supporting more personalized approaches to treatment and prevention. However, the transformative potential of digitalization is not without its challenges. Technology alone cannot guarantee meaningful improvements in healthcare outcomes unless it is guided by ethical considerations, inclusive policies, and a commitment to protecting human values. The responsibility of healthcare organizations is therefore twofold: to adopt technological innovations in a timely manner, and to ensure that such innovations are integrated in ways that uphold patient dignity, reduce inequalities, and enrich the overall experience of care. Digital transformation must be viewed not merely as a technical upgrade but as a cultural shift that requires attention to issues of trust, transparency, and social responsibility.

If poorly managed, digitalization could inadvertently exacerbate disparities in access or erode the human connection that lies at the heart of care. Concerns around data privacy, system interoperability, and workforce readiness highlight the importance of approaching digital adoption as a complex socio-technical process. Success depends not only on technical competence but also on leadership, regulation, and professional values that prioritize equity and patient well-being. In this sense, digitalization should not be regarded as a substitute for human empathy or professional judgment. Instead, it should be seen as a supportive instrument that enables healthcare providers to concentrate more fully on what is essential delivering safe, equitable, and personalized care in an increasingly complex world. By balancing efficiency with compassion, technology with ethics, and innovation with inclusivity, digital healthcare can achieve its most important objective: improving the quality of life and health outcomes for all members of society.

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