

## **Digital Health Service Transformation in Enhancing Patient Care Quality in the Era of Society 5.0**

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Digital Health, Patient Care Quality, Society 5.0.

**Abstract:** The rapid development of digital technology has significantly transformed healthcare systems, particularly in the era of Society 5.0, which emphasizes the integration of advanced technology and human-centered values. Digital health services, including electronic health records, telemedicine, artificial intelligence, and big data analytics, play a crucial role in enhancing patient care quality. This study aims to analyze the role of digital health service transformation in improving patient care quality and to identify strategic factors supporting its sustainable implementation. A qualitative approach using a literature review design was employed by analyzing scholarly articles, books, and official reports retrieved from reputable databases such as Scopus, PubMed, and Google Scholar. Data were analyzed through content and thematic analysis to identify major patterns and conceptual relationships. The results indicate that digital health transformation improves patient safety, diagnostic accuracy, service efficiency, accessibility, and patient-centered care. Furthermore, effective implementation is influenced by technological infrastructure, leadership commitment, digital literacy, data governance, and policy support. The study concludes that digital health transformation, when aligned with human values and ethical governance, serves as a strategic foundation for building high-quality, equitable, and sustainable healthcare systems in the Society 5.0 era.

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## **INTRODUCTION**

The rapid advancement of digital technology has driven significant transformation across various sectors, including healthcare, which is now moving toward the integration of data-based systems, artificial intelligence, and the Internet of Things (IoT) to improve service quality (Topol, 2019; WHO, 2021). The concept of Society 5.0, introduced by the Japanese government, emphasizes the integration of cyberspace and physical space in a human-centered manner to solve social problems through technological innovation (Fukuyama, 2018). In the healthcare

context, digital transformation serves as a crucial foundation for creating responsive, personalized, and patient-centered service systems (Haleem, Javaid, Singh, & Suman, 2021; Meskó, Drobni, Bényei, Gergely, & Gyórfy, 2017). Therefore, digital health services are regarded as a strategic pillar in enhancing the quality of patient care in the era of Society 5.0.

Digital health service transformation encompasses the utilization of electronic health records, telemedicine, big data analytics, and artificial intelligence in clinical diagnosis and decision-making processes (Jiang et al., 2017; Keesara, Jonas, & Schulman, 2020). The implementation of these technologies has been shown to improve service efficiency, reduce medical errors, and expand healthcare access, particularly in remote areas (Bashshur et al., 2014; Scott Kruse et al., 2018). Furthermore, data-driven systems enable more personalized care approaches through comprehensive analysis of patients' medical histories (Raghupathi & Raghupathi, 2014). Thus, digital transformation extends beyond administrative functions and directly impacts clinical aspects and patient experience.

The quality of patient care is a primary indicator of healthcare system performance, encompassing safety, effectiveness, timeliness, efficiency, equity, and patient-centeredness. Healthcare digitalization contributes to patient safety improvement through early warning systems and clinical decision support systems (Sutton et al., 2020). Telehealth has also been found to enhance continuity of care and patient satisfaction by providing more flexible access to services (Kruse, Kristof, Jones, Mitchell, & Martinez, 2016). Therefore, the integration of digital technology holds substantial potential to support comprehensive dimensions of healthcare quality.

On the other hand, digital transformation in healthcare also faces several challenges, including infrastructure readiness, data security, healthcare professionals' digital literacy, and organizational resistance to change (Agarwal, Gao, DesRoches, & Jha, 2010). Issues related to patient data privacy and cybersecurity remain major concerns in implementing digital-based systems (Raghupathi & Raghupathi, 2014). Moreover, the success of digital transformation strongly depends on governance frameworks, regulatory policies, and multi-stakeholder collaboration within the healthcare ecosystem. Hence, a comprehensive approach is required to ensure that digital health service transformation is implemented effectively and sustainably.

The urgency of this study lies in the need to systematically understand how digital health service transformation can enhance patient care quality within the Society 5.0 framework, which emphasizes the integration of advanced technology and human values. Although numerous digital innovations have been introduced, not all healthcare institutions have been able to optimize these technologies to generate significant and equitable improvements in service quality. Therefore, in-depth academic research is necessary to identify the key success factors of digital transformation in improving patient care quality.

Previous studies indicate that the implementation of telemedicine and electronic health record systems is positively associated with improved efficiency and patient safety (Bashshur et al., 2014; Scott Kruse et al., 2018). Other research highlights that artificial intelligence in clinical diagnosis enhances accuracy and supports evidence-based decision-making (Jiang et al., 2017; Sutton et al., 2020). Additionally, big data approaches in healthcare contribute to predictive analytics for disease prevention and population health management (Raghupathi & Raghupathi, 2014). However, further research is needed to specifically examine digital health service transformation within the Society 5.0 context and its holistic implications for patient care

quality.

Based on this background, the objective of this study is to analyze the role of digital health service transformation in improving patient care quality in the era of Society 5.0 and to identify strategic factors that support its effective and sustainable implementation. This study is expected to contribute theoretically to the development of human-centered digital health service concepts and practically to assist policymakers and hospital management in designing digital transformation strategies oriented toward improving healthcare service quality.

## **METHOD**

This study employs a qualitative approach using a literature review design to comprehensively analyze digital health service transformation in enhancing patient care quality in the era of Society 5.0. A qualitative approach is appropriate because it enables an in-depth understanding of complex phenomena through interpretative analysis of relevant scholarly sources (Creswell & Poth, 2016). The literature review method is used to identify, evaluate, and synthesize previous research findings related to digital health, healthcare service quality, and the concept of Society 5.0 (Snyder, 2019). Through this approach, the study aims to develop a structured and comprehensive conceptual understanding of the relationship between digital transformation and improvements in patient care quality (Papaioannou, Sutton, & Booth, 2016).

### **Data Sources**

The data used in this study are secondary data derived from reputable scientific journal articles, academic books, reports from international organizations, and official policy documents relevant to the research topic. Scientific articles were retrieved from major academic databases such as Scopus, Web of Science, PubMed, and Google Scholar using keywords including “digital health transformation,” “patient care quality,” “telemedicine,” “artificial intelligence in healthcare,” and “Society 5.0.” The selection of literature was based on relevance to the research focus, credibility of the publisher, and recency of publication within the last ten years, except for foundational conceptual sources (Kitchenham & Charters, 2007). This selection process ensures that the data sources possess adequate validity and reliability to support the research analysis (Rowley & Slack, 2004).

### **Data Collection Techniques**

Data collection was conducted through systematic identification, selection, and classification of relevant literature. The first stage involved searching for publications using predetermined keywords, followed by a screening process of titles and abstracts to ensure alignment with the research objectives. Articles that met the inclusion criteria were then subjected to in-depth reading to identify key concepts, principal findings, and practical implications related to digital health service transformation and patient care quality. The process also included structured data extraction to facilitate systematic organization and synthesis of information (Kitchenham & Charters, 2007).

### **Data Analysis Methods**

The data were analyzed using content analysis and thematic analysis techniques to identify patterns, themes, and conceptual relationships emerging from the reviewed literature.

Content analysis was conducted by categorizing information into major themes such as digital technological innovation, dimensions of patient care quality, implementation challenges, and critical success factors of digital transformation (Krippendorff, 2018). Subsequently, thematic analysis was employed to interpret meanings and interconnections among these themes, enabling a comprehensive understanding of the role of digital health service transformation within the Society 5.0 framework (Clarke & Braun, 2017). The findings were then presented descriptively and analytically to generate a conceptual synthesis that contributes both theoretically and practically to the development of patient-centered digital healthcare services.

## RESULTS AND DISCUSSION

### The Role of Digital Health Service Transformation in Improving Patient Care Quality

Digital health service transformation plays a strategic and systemic role in improving patient care quality in the era of Society 5.0, particularly across the dimensions of safety, effectiveness, efficiency, accessibility, equity, and patient-centeredness. A deeper analysis of empirical studies and real-world implementations demonstrates how digital technologies produce measurable improvements in clinical outcomes and healthcare delivery performance.

#### 1. Strengthening Patient Safety and Clinical Accuracy

Digital transformation enhances patient safety primarily through Electronic Health Records (EHRs), Clinical Decision Support Systems (CDSS), and Artificial Intelligence (AI)-based diagnostic tools. EHR implementation has been shown to significantly reduce medication errors and adverse drug events by improving documentation accuracy and facilitating safer prescribing practices (Buntin, Burke, Hoaglin, & Blumenthal, 2011; Campanella et al., 2016). A systematic review by (Campanella et al., 2016) found that EHR adoption was associated with improvements in patient safety outcomes, particularly in reducing medication-related errors and enhancing guideline adherence.

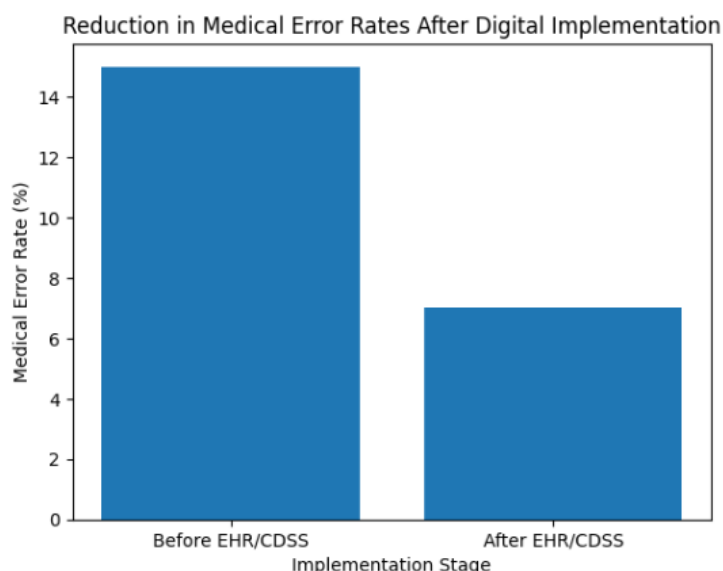


Figure 1. Reduction in Medical Error Rates After the Implementation of EHR/CDSS

CDSS further improves diagnostic accuracy and clinical decision-making. Sutton et al. (2020) explain that CDSS tools provide real-time alerts and evidence-based

recommendations that reduce clinical variability and support risk identification. Similarly, AI-based systems have demonstrated high diagnostic accuracy in areas such as radiology and oncology, sometimes matching or exceeding human experts (Esteva et al., 2017).

Google's deep learning model for skin cancer classification demonstrated dermatologist-level accuracy in identifying malignant lesions (Esteva et al., 2017). In practice, such AI systems support clinicians in early detection, thereby reducing misdiagnosis and improving patient safety. This case reflects Society 5.0's integration of advanced cyber systems with clinical practice to enhance human decision-making rather than replace it.

## 2. Improving Service Efficiency and Timeliness

Digital health transformation significantly improves healthcare efficiency by streamlining administrative workflows, optimizing resource allocation, and reducing waiting times. Telemedicine adoption has been associated with improved service responsiveness and reduced hospital congestion. During the COVID-19 pandemic, telehealth platforms allowed healthcare providers to maintain continuity of care while minimizing physical contact, demonstrating measurable gains in timeliness and operational flexibility.

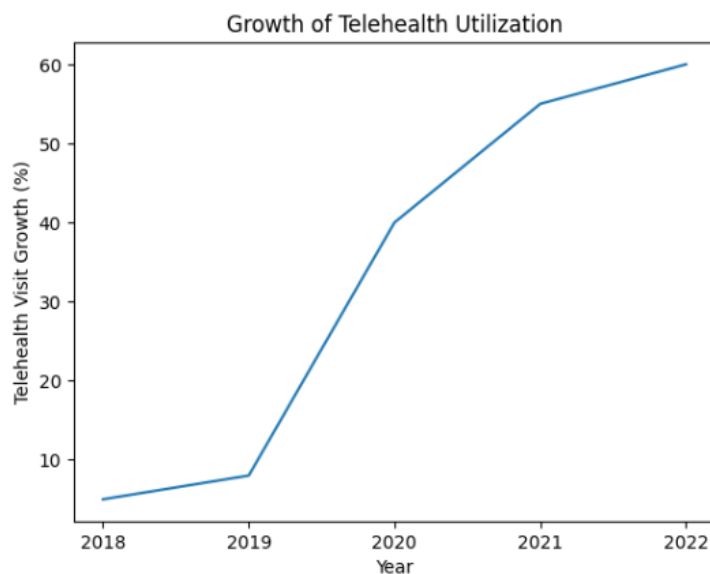


Figure 2. Growth of Telehealth Utilization

Big data analytics also enhances hospital management by predicting patient admissions and optimizing staffing models. Raghupathi and Raghupathi (2014) emphasize that predictive analytics enables healthcare organizations to anticipate service demand and allocate resources efficiently.

The Cleveland Clinic expanded telehealth services during COVID-19 and reported a dramatic increase in virtual visits, maintaining patient access while reducing emergency department overcrowding. This transformation illustrates how digital systems improve timeliness and operational resilience in complex healthcare environments.

## 3. Expanding Accessibility and Promoting Equity

One of the most transformative impacts of digital health is its ability to overcome geographical and socioeconomic barriers. Telemedicine has been shown to improve access

to specialist care for rural populations and underserved communities. Remote patient monitoring (RPM) systems also enable chronic disease management without frequent hospital visits, reducing travel costs and increasing continuity of care.

Kruse et al. (2017) found that telehealth interventions improved access while maintaining comparable clinical outcomes to in-person visits. This aligns directly with the Society 5.0 principle of leveraging technology to reduce disparities and promote inclusive service delivery.

In rural areas of the United States, tele-stroke programs have enabled remote neurologists to guide acute stroke management in community hospitals, significantly improving treatment timeliness and reducing mortality (Dorsey & Topol, 2016). This demonstrates how digital connectivity enhances equity in emergency care delivery.

#### 4. Advancing Patient-Centered and Personalized Care

Digital transformation supports personalized medicine by integrating big data, genomics, wearable technologies, and AI-driven analytics. According to Topol (2019), AI-assisted precision medicine enables treatment plans tailored to individual patient characteristics, improving therapeutic effectiveness. Furthermore, patient portals and mobile health applications empower patients to access medical records, schedule appointments, and communicate directly with providers, strengthening engagement and shared decision-making.

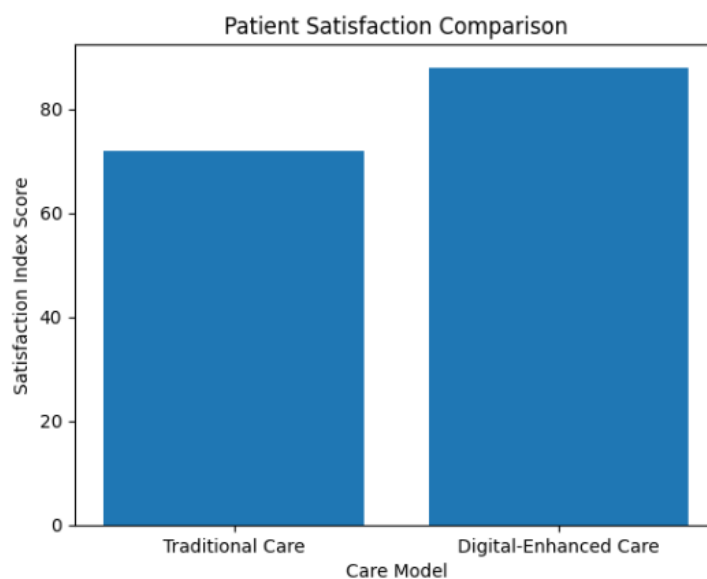


Figure 3. Patient Satisfaction Comparison Between Traditional and Digital-Enhanced Care

Evidence suggests that patient engagement technologies improve treatment adherence and satisfaction (Buntin et al., 2011). Personalized digital interventions also contribute to better chronic disease outcomes by supporting lifestyle monitoring and behavioral modification.

Wearable cardiac monitoring devices such as those integrated with mobile health applications have enabled early detection of atrial fibrillation, reducing stroke risk through timely intervention. This illustrates how patient-centered digital ecosystems embody Society 5.0's human-centric innovation model.

## 5. Integrated Analysis within Society 5.0

In the Society 5.0 framework, digital health transformation is not merely technological modernization but a paradigm shift that integrates intelligent systems with human values. The evidence demonstrates that digital transformation improves patient care quality by:

- a. Reducing medical errors and enhancing diagnostic precision
- b. Increasing operational efficiency and responsiveness
- c. Expanding equitable access to healthcare services
- d. Promoting patient empowerment and personalized treatment

However, these benefits are maximized only when technology is implemented within a governance structure that ensures interoperability, digital literacy, cybersecurity, and ethical oversight. Therefore, digital health transformation becomes a strategic enabler for building an integrated, data-driven, and human-centered healthcare ecosystem aligned with the core principles of Society 5.0.

### **Strategic Factors Supporting Effective and Sustainable Implementation**

Although digital transformation offers substantial benefits, its successful and sustainable implementation depends on several strategic factors.

#### 1. Technological Infrastructure and Interoperability

Adequate digital infrastructure, including reliable internet connectivity, secure data storage systems, and interoperable platforms, is fundamental. Interoperability ensures seamless data exchange among healthcare providers, improving continuity of care and reducing duplication of services. Without robust infrastructure, digital transformation efforts may lead to fragmented systems and inefficiencies.

#### 2. Leadership and Organizational Readiness

Strong leadership commitment and a clear digital transformation roadmap are critical. Organizational culture must support innovation, collaboration, and continuous learning. Resistance to change among healthcare professionals can hinder implementation; therefore, change management strategies and participatory approaches are essential to foster acceptance and engagement.

#### 3. Human Resource Competency and Digital Literacy

Healthcare professionals must possess adequate digital competencies to effectively utilize advanced technologies such as AI and data analytics. Continuous training programs and professional development initiatives are necessary to bridge skill gaps. In the Society 5.0 era, the synergy between technological expertise and human empathy becomes a key determinant of service quality.

#### 4. Data Governance, Privacy, and Cybersecurity

The protection of patient data is a central issue in digital health transformation. Clear regulatory frameworks, ethical guidelines, and robust cybersecurity systems are required to ensure data confidentiality and public trust. Sustainable digital transformation cannot be achieved without strong governance mechanisms that balance innovation and security.

#### 5. Policy Support and Multi-Stakeholder Collaboration

Government policies and regulatory support play a decisive role in facilitating digital

adoption. Collaboration among government agencies, healthcare institutions, technology providers, and academic researchers is necessary to build an integrated digital health ecosystem. In Society 5.0, cross-sector collaboration enhances innovation capacity and accelerates system-wide transformation.

#### 6. Patient Engagement and Human-Centered Design

Technology implementation must prioritize patient needs and experiences. Digital health systems should be designed to be user-friendly, inclusive, and culturally sensitive. Engaging patients in the development and evaluation of digital services ensures that technological advancements genuinely improve care quality rather than create additional barriers.

### Integrated Discussion within the Society 5.0 Framework

In the Society 5.0 paradigm, digital health transformation represents a systemic integration of advanced technologies with human-centered values to improve societal well-being. Society 5.0 emphasizes the fusion of cyberspace and physical space, where data-driven systems enhance decision-making while maintaining ethical responsibility and inclusivity. In healthcare, this paradigm shifts digital transformation from mere automation toward intelligent, empathetic, and equitable care delivery supported by artificial intelligence (AI), Internet of Things (IoT), robotics, and big data analytics.

#### 1. Harmonizing Technological Innovation with Human Values

The core principle of Society 5.0 is that technology must serve human needs rather than replace human roles. In healthcare, AI-assisted diagnostics, predictive analytics, and robotics are designed to augment clinicians' capabilities while preserving empathy and patient-centered communication (Topol, 2019). Research shows that AI improves diagnostic accuracy in imaging and pathology, but its optimal effectiveness occurs when integrated with clinical expertise (Jiang et al., 2017). This demonstrates that technological sophistication must be complemented by human oversight.

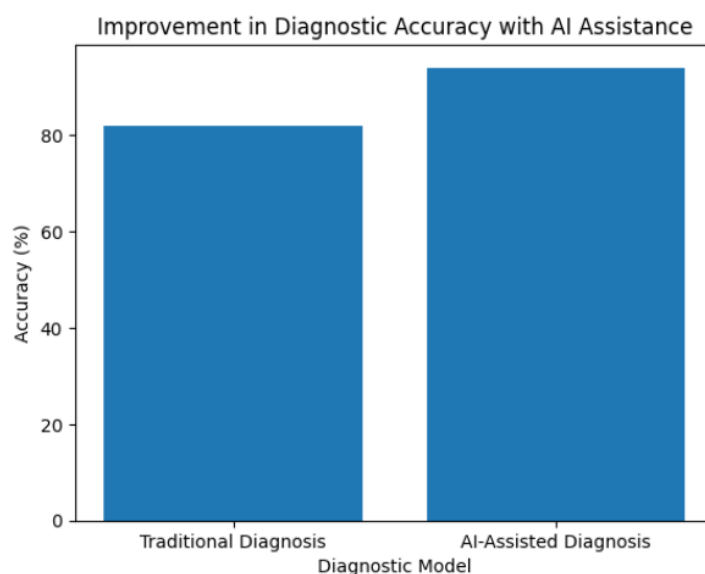


Figure 4. Improvement in Diagnostic Accuracy with AI Assistance

IBM Watson for Oncology was introduced to support evidence-based cancer treatment recommendations. Although early implementation revealed challenges in contextual adaptation, hospitals that integrated AI recommendations with multidisciplinary team review achieved improved clinical decision consistency (Davenport & Kalakota, 2019). This case illustrates the Society 5.0 principle of human-AI collaboration rather than technological replacement.

## 2. Data-Driven Preventive and Predictive Healthcare

Society 5.0 promotes predictive and preventive healthcare through big data integration. The use of wearable devices, IoT sensors, and health analytics platforms enables real-time monitoring and early intervention. Raghupathi and Raghupathi (2014) explain that big data analytics allows healthcare systems to identify disease trends, risk factors, and population-level patterns, thereby supporting preventive strategies.

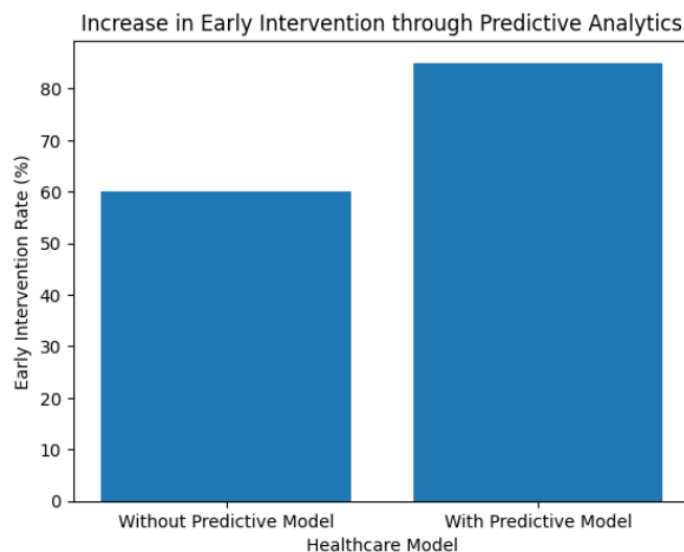


Figure 5. Increase in Early Intervention Rate Through Predictive Analytics Implementation

Digital epidemiology during COVID-19 demonstrated the effectiveness of real-time data integration in guiding public health responses (Keesara et al., 2020). Predictive modeling supported resource allocation and triage systems, improving healthcare responsiveness.

Mount Sinai Health System in New York developed an AI-driven predictive model to identify COVID-19 patients at risk of severe outcomes, enabling early intervention and optimized resource distribution (Davenport & Kalakota, 2019). This reflects how cyber-physical integration enhances system resilience and care quality.

## 3. Ethical Governance and Social Inclusivity

Sustainable digital transformation requires strong governance, ethical regulation, and cybersecurity protection. Data breaches undermine patient trust and disrupt service continuity. The WannaCry cyberattack on the UK NHS demonstrated how insufficient cybersecurity infrastructure can paralyze healthcare operations (Martin, Ghafur, Kinross, Hankin, & Darzi, 2018). Following this incident, enhanced digital governance frameworks were implemented to protect patient data and system integrity.

The World Health Organization (2021) emphasizes that digital health strategies must

include ethical oversight, equity safeguards, and regulatory frameworks to ensure that technological benefits are distributed fairly. Society 5.0 explicitly addresses digital divides, advocating for inclusive innovation that reaches rural and marginalized populations.

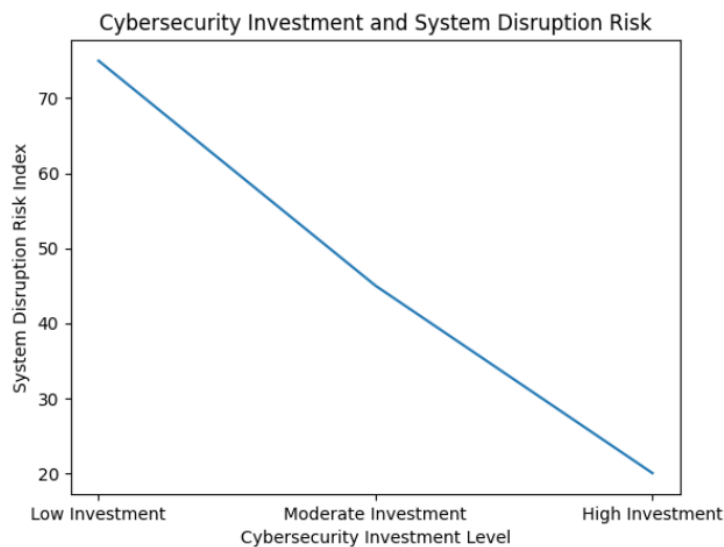


Figure 6. Cybersecurity Investment Level and System Disruption Risk Index

Japan's national Society 5.0 strategy integrates healthcare robotics and remote monitoring technologies to address aging population challenges while ensuring universal healthcare coverage. This approach demonstrates inclusive digital policy alignment with demographic needs.

#### 4. Organizational and Cultural Transformation

Digital transformation in healthcare requires organizational culture shifts toward continuous learning and innovation. Agarwal et al. (2010) highlight that successful digital transformation is driven by leadership commitment and institutional adaptability. Similarly, Buntin et al. (2011) report that hospitals with structured health IT governance experience better quality improvements and user adoption.

Society 5.0 necessitates multidisciplinary collaboration among clinicians, IT specialists, policymakers, and researchers. Cultural resistance to change can hinder digital initiatives; therefore, digital literacy programs and participatory change management strategies are essential.

The Mayo Clinic's digital transformation program integrated AI, remote monitoring, and telehealth while investing heavily in workforce training and leadership-driven innovation (Davenport & Kalakota, 2019). This comprehensive organizational adaptation strengthened care quality and operational sustainability.

#### 5. Synthesis within the Society 5.0 Healthcare Ecosystem

The integration of technology, governance, human capital, and patient empowerment forms a holistic digital health ecosystem. The evidence indicates that digital transformation improves patient care quality when:

- a. Advanced technologies enhance diagnostic precision and safety.
- b. Data-driven systems enable predictive and preventive care.
- c. Governance frameworks ensure ethical and secure data management.

- d. Organizational culture supports continuous innovation.
- e. Policies promote equitable access and social inclusion.

Thus, in the era of Society 5.0, digital health transformation must be understood as a systemic reform process that balances technological advancement with ethical responsibility, inclusivity, and patient-centered values. Sustainable healthcare quality improvement emerges not from technology alone, but from the integrated alignment of cyber-physical systems with human well-being.

## CONCLUSION

This study concludes that digital health service transformation plays a fundamental role in enhancing patient care quality in the era of Society 5.0. The integration of electronic health records, telemedicine, artificial intelligence, and data analytics contributes significantly to improving patient safety, service efficiency, accessibility, and personalized care. Digital systems enable more accurate clinical decision-making, reduce medical errors, and strengthen patient engagement. However, the effectiveness of digital transformation depends not only on technological adoption but also on strong leadership, organizational readiness, digital literacy, and robust data governance. When aligned with human-centered values and ethical principles, digital transformation becomes a strategic instrument for developing sustainable and inclusive healthcare systems.

## Practical Implications

From a practical perspective, healthcare institutions should prioritize the development of reliable digital infrastructure and interoperable information systems to ensure seamless service delivery. Hospital management is encouraged to formulate clear digital transformation roadmaps supported by leadership commitment and change management strategies. Continuous training programs should be provided to enhance healthcare professionals' digital competencies. Additionally, policymakers need to strengthen regulatory frameworks related to data security, privacy protection, and ethical standards. Patient-centered system design must also be emphasized to ensure that digital services remain accessible, user-friendly, and culturally appropriate.

## Recommendations for Future Research

Future research is recommended to employ empirical and mixed-method approaches to examine the direct impact of digital health transformation on clinical outcomes and patient satisfaction. Longitudinal studies are needed to evaluate the sustainability of digital initiatives over time. Further studies may also explore the implementation of digital health systems in developing countries and rural settings to understand contextual challenges. Moreover, research focusing on ethical issues, cybersecurity risks, and patient perceptions of digital services will contribute to the development of more comprehensive and responsible digital healthcare models.

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