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ENHANCING PRIMARY HEALTH CARE IN THE CONTEXT OF HEALTH SYSTEM DIGITALIZATION

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Abstract

This review article analyzes the process of developing primary health care through the implementation of digital technologies. The article focuses on examining the current state of practice, existing challenges in this area, and mechanisms for improving efficiency. Within the scope of the study, the theoretical foundations of digital transformation, the level of implementation in various countries and organizations, the functional capabilities of health information systems, and the factors influencing their adoption are systematically analyzed.

The results of the analysis indicate that digitalization trends vary globally: while comprehensive electronic health information systems are being actively implemented in developed countries, solutions in developing countries are predominantly based on mobile technologies. The main barriers include low levels of digital literacy, infrastructure deficiencies, interoperability issues between different systems, and security-related concerns. At the same time, factors such as strategic planning, active involvement of stakeholders, and organizational readiness contribute to the effective implementation of digitalization initiatives.

Scientific evidence suggests that the impact of digital technologies on the quality of health care services and their delivery to the population is complex and highly

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dependent on implementation strategies and contextual conditions. Significant gaps remain in research on long-term sustainability and effectiveness. The article emphasizes the importance of integrated approaches that combine technological, organizational, human, and social factors.

As a result, digital inclusion demonstrates transformative potential in preventing the exacerbation of health inequalities and in facilitating the transition from a reactive model of care to preventive, patient-centered services through health information systems.

Keywords: Primary health care; digitalization; health information systems; electronic health records; telemedicine; digital health; health system transformation.

Introduction

An analysis of contemporary scientific literature indicates that the digital transformation of primary health care is perceived by most researchers not as a standalone technological innovation, but rather as a process of systematic reorganization of healthcare delivery models. Global strategic documents define digital health as a broad field of knowledge and practice encompassing the development and application of digital technologies aimed at improving population health outcomes [1]. This conceptual approach emphasizes that digitalization is not limited to the automation of existing processes, but instead requires a fundamental rethinking of the organization of healthcare delivery through modern technologies.

As noted by researchers, primary health care possesses several distinctive characteristics that make it both a priority and one of the most complex targets for digital transformation. On the one hand, primary care represents the first point of contact between the population and the healthcare system, accounts for the largest share of medical consultations, and forms the basis for coordinating care

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for patients with multiple conditions [2]. On the other hand, it is precisely within primary care that challenges related to resource availability, workforce shortages, high levels of uncertainty, and the diversity of clinical situations are most acutely manifested [3].

The conceptual understanding of digital transformation also includes recognition of the need for a systemic approach to technology implementation. In their analysis of electronic health record adoption in primary care, Adedeji and colleagues applied change theory and demonstrated that the successful implementation of digital solutions requires the simultaneous influence of multiple interrelated factors, including technological infrastructure, organizational processes, workforce capacity, regulatory frameworks, and organizational culture [7]. Implementing technological innovations in isolation, without consideration of the broader system context, limits outcomes and complicates the achievement of anticipated benefits.

Digital health is also examined from the perspective of universal health coverage. Wilson and colleagues emphasize that digital technologies have the potential to overcome geographic, economic, and social barriers to accessing high-quality healthcare [5]. Telemedicine, mobile health applications, electronic health records, and remote monitoring systems enable the provision of services to populations in remote areas, individuals with limited mobility, and socially vulnerable groups. However, to fully realize this potential, it is essential to address digital inequalities and develop inclusive technological solutions.

A key element in the conceptual understanding of digital transformation is the principle of patient-centeredness. Contemporary research highlights that technological solutions should not be designed primarily for the convenience of healthcare systems, but rather should be oriented toward patients' needs and preferences, enhancing their active role in managing their health [4]. This approach entails the development of clinical decision support systems that do not replace physicians' professional judgment, but instead support it by providing

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personalized information at the point of clinical decision-making. At the same time, patient-centered systems should take into account patients' life contexts, social determinants of health, cultural characteristics, and levels of health literacy. Another important aspect of the conceptualization of digitalization is the recognition of the transformation of the continuum of care as a critical factor. Traditional primary health care models are largely based on episodic visits to physicians when health problems arise. In contrast, digital technologies enable the implementation of continuous collaborative care models that integrate health monitoring, preventive interventions, service delivery, and the management of chronic conditions [6]. This transformation is particularly significant in the field of maternal and child health, where continuous monitoring plays a decisive role in the timely detection and prevention of complications.

Empirical studies demonstrate that the level of digital technology adoption in primary health care systems varies considerably across countries and regions. A large-scale cross-sectional study involving 20 countries identified substantial differences in the characteristics and extent of electronic health record use in primary care settings [8]. These variations reflect not only differences in economic development, but also the organizational features of healthcare systems, priorities of digital health policies, and historical trajectories of health information system development.

In low- and middle-income countries, the trajectory of digital technology implementation differs. In these contexts, digitalization often begins not with the development of comprehensive electronic health records, but with mobile solutions aimed at addressing specific health challenges. Experience from African countries demonstrates that mobile health technologies can be effectively used to improve data collection, increase treatment adherence, support healthcare worker training, and facilitate care coordination, even in settings with limited infrastructure [10]. This approach, often referred to as "leapfrogging," enables resource-constrained countries to rapidly adopt modern digital solutions without

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replicating the gradual infrastructure evolution observed in high-income countries.

Pilot studies of electronic health record implementation in primary care in low- and middle-income countries have identified specific challenges and effective strategies. Evidence from the Philippines indicates that implementing electronic records under resource-constrained conditions requires adapting technologies to local contexts, involving healthcare workers in system design processes, and ensuring reliable technical support [11]. Experience from Nigeria underscores the importance of applying change theory to the planning and evaluation of implementation processes, enabling the identification of leverage points and the monitoring of intermediate outcomes toward long-term objectives [7].

Remote monitoring systems for patients with chronic conditions represent an emerging direction in primary care digitalization. Systematic reviews report an increasing variety of technological solutions for monitoring patients' health indicators at home and transmitting data to primary care providers [16]. These systems are particularly effective in the management of cardiovascular diseases, diabetes, chronic obstructive pulmonary disease, and other conditions requiring regular monitoring of physiological parameters. Experience with mobile applications for patients with type 2 diabetes suggests that digital tools can support self-management and improve clinical outcomes [17].

Artificial intelligence–based clinical decision support systems are of particular importance in the digitalization of primary care. Implementation studies indicate that these systems have the potential to improve diagnostic quality and the selection of therapeutic strategies [22]. By analyzing large volumes of data, AI-based systems identify patterns and provide relevant recommendations to physicians at the point of clinical decision-making. However, the integration of these systems into primary care practice remains at an early stage, and further research is required to assess their effectiveness, safety, and acceptance by healthcare professionals and patients alike [12].

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Telemedicine is another key component of primary health care digitalization and experienced rapid development during the COVID-19 pandemic. Studies examining the adoption and effectiveness of home-based teleconsultations have identified both significant advantages and notable limitations [13]. Telemedicine enhances access to care for individuals with limited mobility, residents of remote areas, and working populations, reduces waiting times for consultations, and lowers the risk of in-facility transmission. Evidence from Sweden suggests that chat-based consultation platforms in primary care can be well accepted by patients, particularly for addressing minor health concerns [14].

In countries with well-developed healthcare systems, electronic health records have been widely integrated into primary care practice; however, the functional capabilities and levels of utilization of these systems vary considerably [9]. Early-2000s concepts of electronic health records designed for primary care envisioned comprehensive systems integrating clinical documentation, decision support, prescription management, laboratory and diagnostic results, and communication functions with patients and other healthcare organizations [9]. In practice, however, the realization of full functionality has been constrained by technological and organizational barriers.

Nevertheless, telemedicine is not a universal solution and is limited by challenges related to the absence of physical examination, difficulties in assessing non-verbal cues, and issues in establishing therapeutic relationships. Experience from India during the COVID-19 pandemic highlighted technological barriers, patients' levels of digital literacy, as well as regulatory and reimbursement challenges associated with telemedicine implementation [15]. These findings emphasize the need to view telemedicine not as a replacement for traditional face-to-face consultations, but as an additional channel integrated into a hybrid service delivery model.

Electronic consultations (e-consults) between specialists and primary care physicians represent an innovative model for care coordination in digital

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environments. Research indicates that e-consult systems can reduce waiting times for specialist care, decrease specialist workload by resolving certain issues without patient referral, and enhance the knowledge base of primary care physicians [18]. E-consults also enable the identification of patients with special needs, such as those with frailty syndrome, and support the provision of personalized and proactive care [19].

In specific clinical domains, the implementation of digital clinical decision support systems has demonstrated encouraging results. Experience from Somalia shows that introducing a digital decision support system for monitoring children under five years of age improved care quality and promoted more rational antibiotic use [21]. Similarly, experience from Chad in developing and implementing a digital decision support system for primary care in refugee camp settings indicates that context-adapted technologies can enhance care quality and efficiency even in resource-limited and unstable environments [20].

Conclusion:

An analysis of scientific literature dedicated to the digitalization of primary health care confirms that this area is of strategic significance and represents a multidimensional process. Digital transformations are not limited to the mere implementation of information technologies but also necessitate the reorganization of the content of healthcare services, organizational mechanisms, and interactions between healthcare professionals and the population. Contemporary studies conceptualize digitalization not as a purely technological phenomenon but as a socio-technical transformation, emphasizing that its effectiveness is closely linked to human capital, managerial decision-making, and the institutional environment.

Furthermore, the application of digital solutions in primary care contributes to expanding access to healthcare services, improving the quality of clinical processes, and ensuring continuity of care. However, these positive outcomes

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depend on implementation conditions, interoperability between systems, the level of digital competencies, and organizational support. Therefore, preventing digital inequities, establishing an interoperable information environment, and developing evidence-based implementation strategies should be prioritized as key directions for the sustainable development of healthcare systems.

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