

Stages and prospects for the development of information technologies in medicine

Yaqubov Ne'matjon Khiva Medical College. Teacher of information technologies in medicine.

Sobirova Tabassum Khiva Medical College. Teacher of medical chemistry and biochemistry.

Abstract: The development of information technologies (IT) in medicine has transformed healthcare delivery from paper-based systems to advanced digital ecosystems. This article examines the historical stages of IT adoption in medicine, including early digitization, integration of electronic health records (EHR), and the current era dominated by artificial intelligence (AI), telemedicine, Internet of Medical Things (IoMT), and blockchain. Future prospects for 2026 and beyond highlight trends such as 5G-enabled real-time monitoring, quantum computing for drug discovery, and personalized precision medicine. Special attention is given to Uzbekistan's progress in digital health reforms, including the implementation of unified platforms like DMED and telemedicine initiatives. IT enhances diagnostic accuracy, patient access, and operational efficiency while addressing challenges like cybersecurity and interoperability.

Keywords: Information technologies in medicine, digital health, electronic health records, artificial intelligence, telemedicine, IoMT, blockchain, precision medicine, Uzbekistan digital healthcare, healthcare trends 2026.

Абстрактный: Развитие информационных технологий в медицине преобразовало систему здравоохранения от бумажных носителей к передовым цифровым экосистемам. Статья анализирует исторические этапы внедрения ИТ в медицине, включая раннюю цифровизацию, интеграцию электронных медицинских карт и современную эру, доминируемую искусственным интеллектом, телемедициной, IoMT и блокчейном. Перспективы на 2026 год и далее подчеркивают тенденции, такие как мониторинг в реальном времени на базе 5G, квантовые вычисления для открытия лекарств и персонализированная прецизионная медицина. Особое внимание уделено прогрессу Узбекистана в цифровых реформах здравоохранения, включая внедрение унифицированных платформ вроде DMED и инициативы телемедицины.

Ключевые слова Информационные технологии в медицине, цифровое здравоохранение, электронные медицинские карты, искусственный интеллект, телемедицина, IoMT, блокчейн, прецизионная медицина, цифровое здравоохранение Узбекистана, тенденции здравоохранения 2026.

Abstract The evolution of information technologies in medicine has shifted healthcare from traditional paper systems to sophisticated digital frameworks. This paper analyzes the historical stages of IT integration in medicine, from initial digitization and EHR implementation to the contemporary dominance of AI, telemedicine, IoMT, and blockchain. Prospects for 2026 and beyond emphasize emerging trends like 5G real-time monitoring, quantum computing in drug discovery, and personalized precision medicine. Uzbekistan's advancements in digital health reforms, including the DMED unified platform and telemedicine projects, are highlighted

Keywords (English) Information technologies in medicine, digital health, electronic health records, artificial intelligence, telemedicine, IoMT, blockchain, precision medicine, Uzbekistan digital healthcare, healthcare trends 2026.

Introduction Information technologies have revolutionized medicine since the mid-20th century, evolving from basic data storage to intelligent systems supporting diagnostics, treatment, and patient management. The integration of IT addresses global challenges such as rising chronic diseases, aging populations, and healthcare disparities [10; 12]. In Uzbekistan, digital transformation aligns with national strategies like "Digital Uzbekistan 2030," promoting telemedicine and unified electronic systems to improve access in rural areas [20; 27]. This article explores the stages of development and future prospects, emphasizing both global and local contexts.

Relevance of the Work The relevance stems from the post-pandemic acceleration of digital health adoption. Telemedicine usage surged over 70%, and AI tools now assist in diagnostics with high accuracy [1; 3]. In Uzbekistan, initiatives like the Digital Healthcare Center and DMED platform (covering 36+ million citizens' records) demonstrate rapid progress, yet challenges in infrastructure and cybersecurity persist [27; 29]. Globally, the digital healthcare market is projected to exceed \$500 billion by 2025-2026, underscoring the need for ongoing research [1; 2].

Purpose The purpose is to analyze the historical stages of IT development in medicine, evaluate current applications, and forecast prospects for 2026 and beyond, with a focus on Uzbekistan's contributions and global trends.

Materials and Methods of Research The study employs a systematic literature review of sources from PMC, JMIR, ScienceDirect, and Uzbekistan Ministry of Health reports. Methods include historical analysis, trend forecasting based on market projections, and comparative evaluation of global and national implementations. Data from 1960s to 2026 trends were synthesized [10; 11; 30].

Results and Discussion

Development Stages

The evolution of IT in medicine can be divided into distinct stages:

1. **Early Birth Stage (1960s-1991):** Initial introduction of computers for data processing and basic medical records. Limited adoption due to hardware constraints [10; 14].
2. **Early Development Stage (1992-2009):** Linear growth in publications and systems; shift to EHRs and departmental systems. In the US, HITECH Act (2009) accelerated certified EHR adoption [11].
3. **Rapid/Fast Development Stage (2010-present):** Exponential growth driven by big data, AI, and cloud computing. Key milestones include telemedicine expansion and IoMT [10; 17].

Table 1: Stages of IT Development in Medicine

Stage	Period	Key Technologies	Main Achievements	Global Impact	Uzbekistan Context
Early Birth	1960s-1991	Basic computers, databases	Initial digitization of records	Limited adoption	Minimal, post-Soviet transition

Stage	Period	Key Technologies	Main Achievements	Global Impact	Uzbekistan Context
Early Development	1992-2009	EHR, hospital information systems	Linear growth, standardization	HITECH Act in US	Initial infrastructure buildup
Rapid Development	2010-2025+	AI, telemedicine, IoMT, blockchain	Exponential growth, predictive analytics	Post-COVID surge in telehealth	DMED platform, Digital Healthcare Center

[Source: Adapted from [10; 11; 27]]

Current Applications

- **AI and ML:** Used in diagnostics (e.g., imaging with 97%+ accuracy) and predictive models in 71% of US hospitals [1; 35].
- **Telemedicine:** Reduces admissions by 25%; in Uzbekistan, saves lives in rural neonatology [21; 3].
- **IoMT and Wearables:** Market projected at \$176-254 billion by 2026; real-time monitoring [30; 2].
- **Blockchain:** Ensures secure data sharing; projected \$5.61 billion market [2].

Future Prospects (2026 and Beyond) 2026 trends include:

- Enterprise-grade AI agents for autonomous patient management [31; 30].
- 5G for real-time surgery and remote monitoring [30].
- Quantum computing accelerating drug discovery (e.g., protein folding simulations) [31; 30].
- Expanded IoMT with smart implants and nanomedicine [30].

In Uzbekistan, full implementation of "Electronic Polyclinic" and robotic surgery by 2026 will enhance equity [28; 27].

Challenges and Discussion Interoperability, cybersecurity, and ethical issues remain barriers. Uzbekistan needs further infrastructure investment [20; 5]. However, integration promises reduced errors and costs [3].

Conclusion IT in medicine has progressed through birth, development, and rapid growth stages, now entering an AI-driven era. Prospects for 2026 promise transformative changes via AI, 5G, and quantum tech. Uzbekistan's reforms position it as a regional leader, but sustained efforts in training and security are essential for equitable benefits.

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