BLOCKCHAIN® IN HEALTHCARE TODAY
PLATFORM APPROACHES IN HEALTHCARE
EDITORIAL/DISCUSSION

Predictions for 2025: Artificial Intelligence in Modern Drug Development, Quantum-Proof Encryption, and Health Data Monetization

Ingrid Vasiliu-Feltes, MD, EMBA[1,2], Jennifer Hinkel, MSc, CHW, FRSA[3] and Olga Kubassova, PhD[4]

[1]Institute for Science, Entrepreneurship and Investments, and Faculty, University of Miami, Miami, FL, USA; [2]Softhread, Catonsville, MD, USA; [3]The Data Economics Company, Los Angeles, CA, USA; [4]Image Analysis Group, London, United Kingdom

DOI: https://doi.org/10.30953/bhty.v7.361

Corresponding Author: Ingrid Vasiliu-Feltes, Email: ivfeltes@miami.edu

Keywords: AI, artificial technology, drug development, health data monetization, healthcare, healthcare finance, quantum-proof encryption

Abstract

We are witnessing an unprecedented convergence of scientific discoveries, technology innovations, exponential adoption of technology, and remarkable population demographic shifts towards a digitally native society. The Nobel Prizes in medicine, chemistry, and physics awarded this year further validate the profound impact of technology on healthcare and life sciences. For 2025, designated by the United Nations as The Year of Quantum Technology, we envision further technology-driven innovations in all domains, triggering the transition to a novel health ecosystem. The role of artificial technology in modern drug development, the demand for quantum-proof encryption, and the opportunities of blockchain in health data monetization are all trends that can be disruptive for pharma, healthcare, and healthcare finance.

Received: October 15, 2024; Accepted: November 13, 2024; Published: December 16, 2024

Ingrid Vasiliu-Feltes, MD, EMBA

In 2025, blockchain technology will be uniquely positioned to become a fundamental component of healthcare's digital infrastructure, with the integration of quantum-proof encryption becoming imperative due to rapid advancements in quantum computing and quantum simulation. Blockchain's decentralized and immutable ledger capabilities will play a crucial role in safeguarding sensitive health data, especially as the risk of quantum computing's ability to break traditional cryptographic methods increases. Quantum-proof encryption, such as lattice-based cryptography or post-quantum algorithms, will be essential to secure healthcare data exchanges.

Integrating blockchain with data mesh and data fabric architectures could further augment the scalability and flexibility of healthcare data ecosystems.

Data mesh decentralizes data ownership by enabling different healthcare entities (e.g., payers, hospitals, or research institutions) to manage and maintain their data autonomously. This ensures that data are stored at the source, enhancing both security and accessibility.

Data fabric provides an overarching data integration layer that enables seamless, real-time access to this distributed data, bridging various healthcare systems and platforms. The combination of blockchain, data mesh, and data fabric could create a robust decentralized architecture that optimizes interoperability and ensures data consistency across the healthcare ecosystem.

Decentralized identity management powered by blockchain will grant patients greater control over their health data. This patient-centric approach can restore trust, increase transparency, and enforce accountability.

With the rapid development of quantum computing, the cryptographic protocols underpinning traditional blockchain solutions must be fortified. The ability of blockchain to adopt quantum-resistant cryptography, such as lattice-based cryptography or hash-based signatures, will be

crucial in ensuring the security and longevity of healthcare data. These advanced cryptographic techniques are designed to withstand the immense computational power of quantum computers, ensuring optimal privacy and security.

Jennifer Hinkel, MSc, CHW, FRSA

In the next 1–2 years, patients will own their health data in the form of data assets that they will be able to monetize more directly with researchers and life sciences companies through decentralized markets. Patients will also have access to "digital twins" of themselves, allowing them to simulate the outcome or impact of various interventions and health behaviors. Across the healthcare system, payments and financing will increasingly align with the value of outcomes delivered.

More data will be discovered by translational teams, passed through clinical development and real-world evidence, and then returned to translational, powering new developments or optimizations of pharmaceutical assets.

Olga Kubassova, PhD

The year 2024 was challenging for biotechnology companies, with many folding their operations due to a lack of funding and the market being dominated by opportunistic mergers and acquisitions that combine two or more companies into one entity.[1] We finally see the performance and capabilities of the groundbreaking advancements (e.g., large-scale artificial intelligence (AI) models such as large language models, blockchain-powered security, quantum computing, and effective use of cloud platforms to support global data management of decentralized trial infrastructure) significantly impact the life sciences industry.

For years, AI promised to revolutionize drug discovery by automating laborious tasks. In 2024, the first data on the success of AI-discovered drug candidates were published to show that the success rate of AI-discovered drug candidates is doubled compared to the non-AI discovered molecules.[2,3] The success here is defined as the probability of a molecule to succeed across all clinical phases end-to-end.

We are observing that the new drug categories, like metabolic modulation via GLP-1s/GIPs (glucagon-like peptide-1 agonists/gastric inhibitory polypeptides), have shown financial potential of innovation at scale.[4] Assuming that AI can be used to either increase productivity of drug discovery or reduce the costs of development, it will make discovery precise and focus development efforts on retrieving early go-no-go decisions that will ultimately reduce the costs and risk of clinical research and development.

Generally, it is recommended to view AI through the lens of business capabilities rather than available technologies. This leads us to use industry-acceptable technologies to deliver expected results with added improvements in quality of automation. However, the use of modern data management infrastructure, as well as deploying technology powers from other industries, can deliver beyond expectations.

Data interoperability or the ability of different systems and applications to access, exchange, and utilize data seamlessly, will impact drug development at scale. Data interoperability has emerged as a critical component of modern clinical trial operations.

To unlock the full potential of pharmaceutical data assets and the ability to utilize modern technologies in clinical trials, organizations will adopt comprehensive strategies that address these obstacles. Looking into 2025, we predict that AI will power the change in mindset in clinical drug development and clinical operations, with greater reliance on technological platforms.

Modern data interoperability approaches and use of surrogate endpoints and companion biomarkers in clinical trials will finally be part of a circular data flow and the creation of company-wide knowledge base systems.

While AI remains a powerful tool for reshaping data value in real-world evidence studies, engagement with treating physicians, and most importantly, patients, we will witness more pharma companies using AI to engage with patients and physicians, offering them tools and systems to assess drug impact and predict if a patient is the right candidate for a particular treatment. This will dictate that the government set new standards for privacy, collection, and retention of data. Once adopted, these predictive tools will become the norm in personalized medicine and a key differentiator for companies that want to prove the value of their drugs to secure nation-wide or state-wide adoption of their therapies.

The rise of AI-driven biotech companies and powerful collaborations between pharma and tech players will change risk profiles and investment strategies into pharmaceutical research and development.

Conclusion

These trends illustrate the exceptional dual power of scientific and technological advancements, with the potential to redefine, recalibrate, and reconfigure the global healthcare and life sciences industry, as well as the economy and society. The year 2025 can mark the onset of a new era, where deep tech such as blockchain, AI, quantum, satellite internet, and 6G will lead the development of novel healthcare standards, as well as revised healthcare best practices, new healthcare delivery models, new healthcare financing instruments, and the evolution of a secure, trustworthy, precision healthcare ecosystem.

Citation: Blockchain in Healthcare Today 2024, **7**: 361 - https://doi.org/10.30953/bhty.v7.361

Funding

None.

Financial and non-financial relationships and activities

Jennifer Hinkel is co-Editor-in-Chief, BHTY Editorial Board. Ingrid Vasiliu-Feltes is a member of the BHTY Editorial Board.

Contributors

The authors contributed their sections, development, and approval of the final content of this article.

Data availability statement (DAS), data sharing, reproducibility, and data repositories

None were used in the development of this article.

Application of AI-generated text or related technology

None were used in the development of this article.

References

1. Bookbinder, M. (2017, September 29). The intelligent trial: AI comes to clinical trials. [cited 2018 Apr 11]. Available from: http://www.clinicalinformaticsnews.com/2017/09/29/the-intelligent-trial-ai-comes-to-clinical-trials.aspx
2. Brynjolfsson, E, Mcafee, A. (2018, February 01). The business of artificial intelligence. [cited 2018 Apr 12]. Available from: https://hbr.org/cover-story/2017/07/the-business-of-artificial-intelligence
3. Ronanki, R, Davenport, TH. Artificial intelligence for the real world. Harvard Business Review. 2018;108–116.
4. Collins L, Costello RA. Glucagon-like peptide-1 receptor agonists. [Updated 2024 Feb 29]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; [cited 2018 Apr 12]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK551568/