



**Blockchain in
Healthcare**

Turkish Informatics Foundation (TBV)
Blockchain Technology in Healthcare Research Review
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FOREW

ORD ***Digitalization** is creating a significant transformation in the healthcare sector in terms of both service delivery and information management. Issues such as the increasing volume of data and the secure storage, sharing, and verification of patient information constitute the most critical areas in healthcare.*

***In recent years,** blockchain technology, which has gained prominence particularly in the financial sector, has emerged as a noteworthy solution in high-sensitivity areas such as healthcare, thanks to its decentralized, reliable, and transparent data management system.*

***Blockchain technology** offers innovative solutions in many areas, such as the management of electronic health records, medical supply chain tracking, verification of clinical trials, and transparency in health insurance processes, thanks to its decentralized structure, immutable record system, and high data security.*

*The aim of our work under **the TBV BCTR Health Group** is to evaluate the role of blockchain technology in the digital transformation process in healthcare from a multidisciplinary perspective, shed light on its benefits as well as the technical, ethical, and legal challenges encountered, and contribute to future work in this area.*

***This study** examines the place of blockchain technology in healthcare, how it can be used, the innovative solutions it provides, and its future applications.*

We hope it will serve as a guide for healthcare professionals and lay the groundwork for more in-depth studies.



MAIN HEADINGS



**Key Issues in
Healthcare**



Ethical Issues



**Future
Outlook**



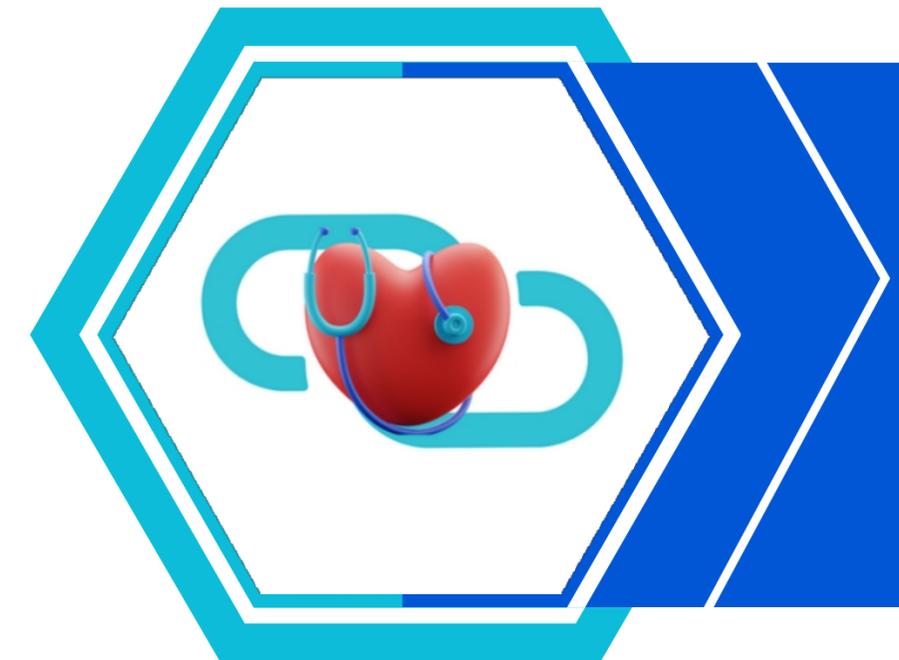
**Blockchain
Application Areas
in Healthcare**



**Law and
Regulation**



Opinions and Recommendations





BASIC ISSUES IN HEALTHCARE



TWO MAJOR CHALLENGES IN THE HEALTHCARE FIELD

1. Data security - Problems encountered in data transfer and protection

- Zhu & Yu (2023) "*After transferring data to general network servers, **it is difficult to guarantee that the data will not be destroyed, altered, or even lost...*** (p. 269)"

2. Secure data sharing - Problems in data flow and sharing in health records

- Chronic diseases, multidisciplinary treatments such as radiotherapy and chemotherapy, along with When it comes to healthcare-related situations, it is essential that systems work together to ensure **easy access to health records** and provide secure, transparent data sharing. (European Union Blockchain Observatory and Forum, 2022)

APPLICATION AREAS

"THE GOAL IS TO INCREASE THE PATIENT-CENTERED APPROACH AND ENABLE PATIENTS TO ACCESS SERVICES AND RESOURCES EFFECTIVELY, QUICKLY, AND WITH HIGH QUALITY."

- **What is blockchain?**

Blockchain is a technology that provides an infrastructure enabling data to be stored and transferred without alteration, based on various cryptography methods. Focusing on data governance, this technology is defined as "a technology that provides a secure, transparent digital transaction ledger that enables data to be recorded and transferred in a time-stamped, distributed structure over the internet, encrypted and in an unalterable manner." (Gül Şenkardeş, 2022) Blockchain technology attracts attention in the healthcare ecosystem with its decentralized structure, enabling the secure and transparent digitization and management of data belonging to stakeholders and used by all stakeholders for different purposes.

DIGITALIZATION OF DATA SHARING IN HEALTHCARE

- **Basic concepts**

- *Facilitating data transfer (peer-2-peer communication)*
- *Data security and privacy in protecting health data*
- *Creating immutable data records*
- *Ensuring data accuracy (transparency)*
- *Tracking data (traceability)*

(Özdenizci Köse, 2021)

FOUR MAIN FOCUS POINTS

HEALTH DATA

Blockchain technology enhances data security and provides an accessible transmission system for obtaining Electronic Health Records (EHRs). It ensures that patient records are kept secure in clinical studies.

MEDICAL SUPPLY CHAINS

Blockchain technology increases the traceability of the medical supply chain and prevents counterfeit/unregistered drug/medical device suppliers.

MEDICAL IDENTITY VERIFICATION

Blockchain technology facilitates the verification of the qualifications and areas of expertise of healthcare professionals.

INSURANCE AND PAYMENT SYSTEMS

Challenges such as misuse, fraudulent claims, inefficient billing processes, and data security issues can be addressed with this technology.

(European Union Blockchain Observatory and Forum, 2022)

(Özdenizci Köse, 2021)

1. HEALTH DATA

CASE STUDY: APPLICATION OF BLOCKCHAIN IN TREATMENT

- **Improves patient recovery during treatment**
 - *"To meet the patient's needs between centers, the network system defined as the Internet of Things can be connected to each other through blockchain technology... This enables users to work in a comprehensive collaboration that includes patient referrals, medical consultations, team conferences across different disciplines, and remote equipment quality control." (Zhu & Yu, 2023, p. 270)*
- **Ensures regular monitoring in treatment and healthcare processes**
 - *"By leveraging a series of potential network entry points, blockchain provides a comprehensive connection system between users, while also enabling the intelligent detection, recognition, and management of treatment processes." (Zhu & Yu, 2023, p. 270)*
- **RTBC assists with medical diagnoses using the "Image Chain" system**
 - *"RTBC and the network technology called 'image chain' is a system that aims to share diagnostic images. It is a blockchain system that benefits patients undergoing long-term treatment, facilitates the sharing of medical resources, and supports the development of related medical industries." (Zhu & Yu, 2023, p. 270)*

2. MEDICAL SUPPLY CHAINS

CASE STUDY: ENSURING TRACKABILITY OF THE DRUG SUPPLY CHAIN WITH BLOCKCHAIN

- **Pharmaceutical supply chain tracking and transparency**

- *"Blockchain technology enables the recording and tracking of drugs at every stage. A unique digital identity is created for each drug box, making all stages of the supply chain transparent. This significantly reduces the risk of counterfeiting and fraud."*
- This prevents
 - **drug detection and counterfeiting are prevented**
 - **data security and privacy are ensured**
 - **stock management is enabled**
 - **improvements in prescription management are achieved.**

(IBM Blockchain for Healthcare, World Health Organization, 2020)

3. IDENTITY VERIFICATION AND DATA SECURITY

ENSURING IDENTITY VERIFICATION AND DATA SECURITY IN THE HEALTHCARE FIELD

- **Secure patient data flow and reduced risk of incorrect treatment**

- *Any error in a patient's medical history can lead to incorrect treatment. Thanks to blockchain, health data is stored accurately and up-to-date. Any information update is recorded on the blockchain and can be traced back. This enables healthcare professionals to administer treatment based on the most accurate data.*

(How is Blockchain Technology Used in Healthcare in Turkey? - Traveling Writer)

- **Improvements in prescription management**

- *Doctors can send prescriptions directly to pharmacies via blockchain, and pharmacies can process these prescriptions instantly. This reduces errors and speeds up processes.*

(Integration of Blockchain Technology into Pharmacies: Revolution in Healthcare – Pharmacists Here Platform)

- **Verification of healthcare professionals' identities**

- *Information such as a doctor's diploma, area of expertise, and institutions where they work, as well as the certificates and training they have received, can be stored on the blockchain. This allows patients to quickly verify whether their doctor is truly authorized. At the same time, healthcare institutions can use this information in their hiring processes to make a more secure and transparent assessment.*

(Blockchain and healthcare: Data security and transparency - World Newspaper)

4. INSURANCE AND PAYMENT SYSTEMS

CASE STUDY: THE ROLE OF BLOCKCHAIN IN INSURANCE AND PAYMENT SYSTEMS

Automation of Production and Compensation Processes

- Automating production processes speeds up administrative processes and saves costs.
- Insurance claims become faster and more reliable with blockchain. Data flow between hospitals, insurance companies, and patients becomes transparent, and payment processes are automated with smart contracts.
- Smart contracts, which have a decentralized structure, are programmable protocols that operate on blockchain technology and automate transaction processes. Operating according to coded rules, they enable processes between parties to be automated without compromising data security, as transactions are recorded in an immutable manner.

Health Insurance Product Development and Customization

- Blockchain enables the development of personalized policies through big data analysis.
- Flexible and dynamic policies can be designed using real-time data.
- Insurance companies can access historical health data to perform more accurate and personalized analyses in premium calculations.

Data Security, Accuracy, and Fraud Prevention

- Health history and risk profiles are securely stored on the blockchain. The immutability of the data increases the accuracy of risk assessment.
- The accuracy of payment transactions and service provider payments can be easily verified.
- Detecting fraudulent insurance claims and fraudulent transactions is made easier.



ETHICAL ISSUES



INCLUSIVE ACCESSIBILITY

Blockchain technology should provide inclusive and digital accessibility so that all segments of the population can benefit from medical advances.

DATA PRIVACY AND SECURITY REGULATIONS

The immutability and transparency of data in the use of blockchain technology must be compliant with the privacy regulations of the Personal Data Protection Law (KVKK).

DEVELOPERS' CONCERN: DESIGN ETHICS IN ARTIFICIAL INTELLIGENCE TECHNOLOGY

The technology design process must be produced in accordance with ethical principles covering the fairness, accountability, and transparency of artificial intelligence and blockchain systems.

INFORMING PATIENTS AND OBTAINING CONSENT FORMS

It is necessary to ensure that patients understand how the data collected will be used in subsequent stages and/or archiving and to obtain their consent.

SAFE PARTICIPATION OF PATIENTS IN CLINICAL RESEARCH

It must be guaranteed that the data of patients participating in clinical trials will only be used for the purposes for which they have given their consent.

The use of patient data in clinical trials must be strictly limited to the purposes for which consent was given.

LAW AND REGULATION

LEGAL INFRASTRUCTURE FOR BLOCKCHAIN APPLICATIONS IN THE HEALTHCARE SECTOR

RELEVANT INSTITUTIONS AND REGULATIONS

Ministry of Health

- Regulation on Personal Health Data
- Patient Rights Regulation
- Regulation on Health Information Management Systems

Personal Data Protection Authority

- Law No. 6698 on the Protection of Personal Data ("KVKK") and Secondary Legislation
- Personal Health Data is evaluated under the definition of Special Category Personal Data within the scope of the KVKK.
- Special Category Personal Data: Data concerning an individual's race, ethnic origin, political opinions, philosophical beliefs, religion, denomination, or other beliefs, attire, membership in associations, foundations, or unions, health, sexual life, criminal convictions, and security measures, as well as biometric and genetic data.
- "Sufficient Measures to be Taken by Data Controllers in the Processing of Special Category Personal Data"
Decision No. 2018/10 dated 31/01/2018
- Regulation on Procedures and Principles Regarding the Transfer of Personal Data Abroad

LAW AND REGULATION

EVALUATION OF BLOCKCHAIN APPLICATIONS IN THE HEALTH SECTOR UNDER THE KVKK

Use of Blockchain Technology in Systems Used for the Protection and Storage of Personal Health Data

In examples such as the following health systems:

- e-nabız, cloud computing, hospital information management systems ("HBYS") - Minimum Data Model
- Medula, health-net, e-prescription, and e-nabız system
- Electronic Health Record ("ESK") / Personal Electronic Health Records ("KESK")

By adhering to the following data processing principles, the use of blockchain technology enables the lawful processing of health data, which is considered special category personal data; patient-controlled health data management and interoperable healthcare services can be provided.

Data Processing Principles (KVKK Article 4)

When processing special category personal data, the following principles must be observed:

- Compliance with the law and principles of good faith,
- Processing for specific, explicit, and legitimate purposes,
- Processing that is relevant, limited, and proportionate to the purpose for which it is processed,
- Retention for the period required by the relevant legislation or necessary for the purpose for which they are processed.

LAW AND REGULATION

ASSESSMENT OF THE LEGALITY CONDITIONS FOR THE PROCESSING OF PERSONAL DATA IN BLOCKCHAIN APPLICATIONS IN THE HEALTH SECTOR UNDER THE KVKK EVALUATION

The processing of personal health data, which is considered special category personal data, will be involved in blockchain applications in the healthcare sector.

As a rule, the processing of special category personal data is prohibited. **(KVKK Article 6)**

Special category personal data may be processed in the use of blockchain technology in healthcare under the limited conditions of lawfulness specified in the KVKK **(KVKK Article 6)**.

Considering the distributed structure of the blockchain, blockchain applications in the healthcare sector will also involve the processing of personal health data due to its transfer within and outside the country.

For the transfer of personal health data **abroad**, the legal processing conditions set out in the KVKK must be met as a priority: (i) adequacy decision, (ii) appropriate safeguards such as binding corporate rules, standard contracts, or letters of commitment; or (iii) conditions for incidental/one-time transfers. **(KVKK Article 9)**

LAW AND REGULATION

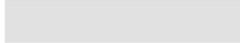
"DECISION OF THE KVK BOARD ON "SUFFICIENT MEASURES TO BE TAKEN BY DATA CONTROLLERS IN THE PROCESSING OF SPECIAL CATEGORIES OF PERSONAL DATA" DATED 31/01/2018 AND NUMBERED 2018/10

Data controllers processing personal health data, which constitutes special category personal data, using blockchain applications in the healthcare sector must take the following measures:

- **Policies and procedures regarding the processing of special category data** must be established.
- **Employee training and confidentiality agreements** must be implemented.
- **Authorization management and log records** must be maintained.
- **Encryption** should be used **in electronic environments, and security** measures should be taken **in physical environments**.
- Data should be stored using cryptographic methods, and cryptographic keys should be kept secure and in separate environments.
- **If remote access to data in electronic environments is required**, at least a two-step authentication system should be provided.
- **Data transfer** should be **encrypted or performed using secure protocols** (KEP, VPN, sFTP, etc.).



LAW AND REGULATION



REGULATION ON PERSONAL HEALTH DATA

- All principles regarding the processing of special category personal data as stipulated in the KVKK are adhered to.
- Open health data is defined as data that is made available to everyone free of charge or at a cost not exceeding the cost of preparation via the internet, that is free of any intellectual property rights, that can be freely used for any purpose, that is machine-readable and thus interoperable with other data and systems, and that has been anonymized.
- The open health data regulation aims to support scientific research in the health sector and facilitate the development of health-related products and services by making such data accessible to everyone.
- It provides access to the data sets necessary for conducting scientific research in the field of health and developing blockchain applications in the health sector.
- It regulates that persons responsible for providing healthcare services may only access the health data of the relevant person to the extent necessary for the provision of healthcare services.
service.



LAW AND REGULATION



PATIENT RIGHTS REGULATION

Respect for Patient Privacy (Article 21)

- Confidentiality of Information (Article 23)
- Information obtained in the course of providing healthcare services may not be disclosed under any circumstances except as permitted by law.
- Even with the person's consent, disclosures that excessively restrict or transfer personal rights do not eliminate legal liability.
- Sharing information that could harm the patient as a result of disclosure **without legal and ethical justification gives rise to legal and criminal liability.**
- In research and educational activities, the patient's **identity information cannot be disclosed without explicit consent.**

LAW AND REGULATION

ASSESSMENTS REGARDING COMPLIANCE WITH THE PROTECTION OF PERSONAL DATA IN THE USE OF BLOCKCHAIN TECHNOLOGY IN HEALTH INFORMATION SYSTEMS

Advantages

- **Data Security:**
 - Data is encrypted and becomes immutable.
 - Transactions can only be performed with private keys.
- **Access Control:**
 - Healthcare providers can only access data with permission.
- **Cyber Resilience:**
 - Blockchain networks are resistant to cyber attacks.
- **Anonymity:**
 - Identity privacy can be ensured with a Hash ID.
- **No Intermediaries Required:**
 - Transactions can be performed directly.
 - By providing a decentralized platform, interoperability can be increased.
 - Automation and transaction costs are reduced.

Disadvantages and Risks - Legal Vulnerabilities

- **Data Ownership and Responsibility:**
 - Identifying the data controller in a distributed structure is difficult (especially in open blockchains).
 - It may prevent the data owner from exercising their rights.
- **Right to be forgotten:**
 - The inability to delete data may conflict with the KVKK.
- **Limitations of Anonymity:**
 - User identity can be guessed in open chains.
- **Cross-Border Transfer:**

Cross-border transfers may be restricted by regulations requiring specific conditions.
- **Jurisdiction Issues:** Blockchain infrastructures mostly operate through servers in various countries. This may force the use of in an use of



LAW AND REGULATION



ASSESSMENTS REGARDING THE USE OF BLOCKCHAIN TECHNOLOGY IN HEALTH INFORMATION SYSTEMS

Blockchain **presents both opportunities and risks** in terms of protecting personal data in the healthcare sector.

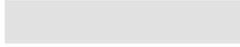
- The type of blockchain used (open/closed/hybrid) directly affects the advantages and risks.

GDPR Compliance According to Blockchain Types

- **Closed blockchain:** The data controller is known, access is granted with permission or authorization, and compliance is easier.
- **Open blockchain:** Being open to everyone and allowing access without permission using a pseudonym can make it difficult to determine data responsibility.
- **Permissioned/Permissionless blockchain:** Blockchains can be either open or closed, depending on whether adding data to the blockchain requires permission.
- **Hybrid blockchain:** Control and transparency balance → the most suitable model.



LAW AND REGULATION



ASSESSMENTS REGARDING THE USE OF BLOCKCHAIN TECHNOLOGY IN HEALTH INFORMATION SYSTEMS

Blockchain Usage Recommendations for Compliance with KVKK

- **A hybrid blockchain** should be preferred.
- **Legal Compliance in Data Processing Design** (Privacy by Design) The protection of personal data should be integrated into the system design from the outset.
- Data **should be anonymized and encrypted.**
- **Roles and responsibilities** should be clarified within a contractual framework.
- **Explicit consent** should be obtained and should be withdrawable—it should be manageable with smart contracts.
- Off-chain data storage should be implemented for **the right to be forgotten.**
- Ensuring safeguards **for data transfers abroad**
- Advanced encryption: **homomorphic/attribute-based**
- **A Data Impact Assessment Test** should be performed.

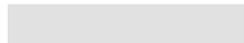


FUTURE OUTLOOK



ADVANCED MULTIPLE MEDICAL DATA WORKABILITY

It is anticipated that electronic health records will be globally shareable between institutions, ensuring data consistency and accessibility.



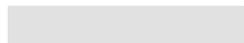
ADVANCED CLINICAL RESEARCH

Blockchain can facilitate the tracking and transparency of clinical trials that will assist in medical diagnosis and treatment.



MEDICAL IDENTITY VERIFICATION SYSTEM: TELEMEDICINE

Blockchain-based identity verification systems can verify the identity of healthcare professionals and increase trust among healthcare practitioners.



INTERNET OF THINGS AND INTEGRATION WITH EMERGING TECHNOLOGIES

When combined with artificial intelligence and the Internet of Things, blockchain is expected to enable self-diagnosis, personalized medication, and real-time health monitoring.

(European Union Blockchain Observatory and Forum, 2022)

OPINIONS AND RECOMMENDATIONS

The icon features two interlocking hexagons, one in a darker blue and one in a lighter teal.

Blockchain Applications in Healthcare

- Secure data sharing
- Organizations, interoperability among healthcare professionals
- Tracking and traceability

The icon features two interlocking hexagons, one in a darker blue and one in a lighter teal.

Application Areas

- Management of medical conditions
- Accessibility to multiple medical records
- Assistance in medical diagnosis
- Tracking in medical supply chains

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Ethical Considerations

- Accessibility for all segments of the population
- Advancing the design process with ethical principles
- Compliance of data and privacy with KVKK rules

The icon features two interlocking hexagons, one in a darker blue and one in a lighter teal.

Legal Regulation

- Requirement for explicit consent in blockchain use
- Compliance and secure storage of data processing
- Various methods for ensuring compliance with KVKK in blockchain usage

The icon features two interlocking hexagons, one in a darker blue and one in a lighter teal.

Future Potential

- Reliable health record archiving
- e clinical trials
- Medical identity verification
- Medical data verification and transparency

REFERENCES

- Attaran, M. (2020). Blockchain technology in healthcare: Challenges and opportunities. *International Journal of Healthcare Management*. <https://doi.org/10.1080/20479700.2020.1843887/>
- Aydar, M., & Çetin, S. C. (2020). The use of blockchain technology in healthcare information systems. *European Journal of Science and Technology*, 19, 533–538. <https://doi.org/10.31590/ejosat.735052>
- Corrales Compagnucci, M., Dahi, A., & Davis, P. A. E. (2023). Conducting a Data Protection Impact Assessment in Health Science: A Comprehensive Guide. Preprint available at SSRN: <https://ssrn.com/abstract=4651993>
- Eşelioğlu, A. (2024, August 11). Blockchain and Healthcare Services: Data Security and Transparency. *Dünya Gazetesi*. <https://www.dunya.com/koseyazisi/blockchain-and-healthcare-hizmetleri-verinin-guvenligi-ve-seffafligi/740922>
- European Union Blockchain Observatory and Forum. (2022). *Blockchain applications in the healthcare sector*.
- Gezgin. (2025, January 5). How is Blockchain Technology Used in the Health Sector in Turkey? Gezgin Author. <https://www.gezgin.com/turkiyede-saglik-alaninda-blockchain-teknolojisi-nasil-kullaniliyor/>
- Gül Şenkardeş, Ç. (2022). *Blockchain technology and NFTs*. Ceres Publications.
- Guler, T. (2024, August 29). Integration of Blockchain Technology into Pharmacies: A Revolution in Healthcare. *Pharmacists Here Platform*. <https://eczacilarburada.com/blockchain-teknolojisi-saglikta-devrim/>
- IBM Blockchain for Healthcare. (2022), *World Health Organization*. Access link: https://www.ibm.com/cs/digital-health#tab=tab_3
- Opan Gündal, R. P. (2024). Protection of personal data in blockchain technology. *Journal of Personal Data Protection*, 6(1), 28–47. <https://www.kvkk.gov.tr>
- Özdenizci Köse, B. (2021). Blockchain in Healthcare. *Medical Informatics*, 367–397. <https://doi.org/10.26650/b/et07.2021.003.19>
- Zhu, J., & Yu, J. (2023). Blockchain + radiotherapy: The scenarios of the 5G-enabled Smart Radiotherapy Era. *Precision Radiation Oncology*, 7(4), 268–272. <https://doi.org/10.1002/pro6.1211>

CONTACT

ADDRESS

Kemankeş Karamustafa Paşa Mah.
Alipaşa Değirmeni Sok. No:3 34560
Karaköy – İstanbul

+90 (212) 244 11 69

info@bctr.org

@BlockchainTurkiyePlatformu

@bctrorg

Blockchain Turkey Platform Blockchain

Turkey





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THANK YOU



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