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Blockchain Meets Healthcare: Nigerian Scientist's Plan to Secure Telehealth Data

Akuchinyere Titus-Okpanachi

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***Corresponding Author:** Akuchinyere Titus-Okpanachi

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Abstract **Original Research Article**

Blockchain technology offers a decentralized and tamper-resistant solution to the pressing challenges of telehealth data security. In Nigeria, where telemedicine adoption is rapidly expanding, safeguarding patient data against breaches and unauthorized access is essential for trust and compliance. This paper examines the potential of integrating blockchain with telehealth systems, drawing on Nigerian research contributions, such as the Smart Secure Telehealth (SST) algorithm, and indigenous innovations like the Controlled Isolated Data (CID) protocol. The proposed framework advocates a permissioned blockchain to log telehealth interactions, smart contracts for consent management, and AI-enhanced analytics for data access control. In addition, infrastructural, interoperability, and policy considerations relevant to the Nigerian healthcare landscape are discussed. By combining technical innovation with regulatory alignment, Nigerian scientists and engineers can pioneer secure, patient-centered telehealth platforms that strengthen healthcare delivery and public trust.

Keywords: Blockchain, Telehealth, Nigeria, Data Security, Artificial Intelligence, Healthcare Innovation

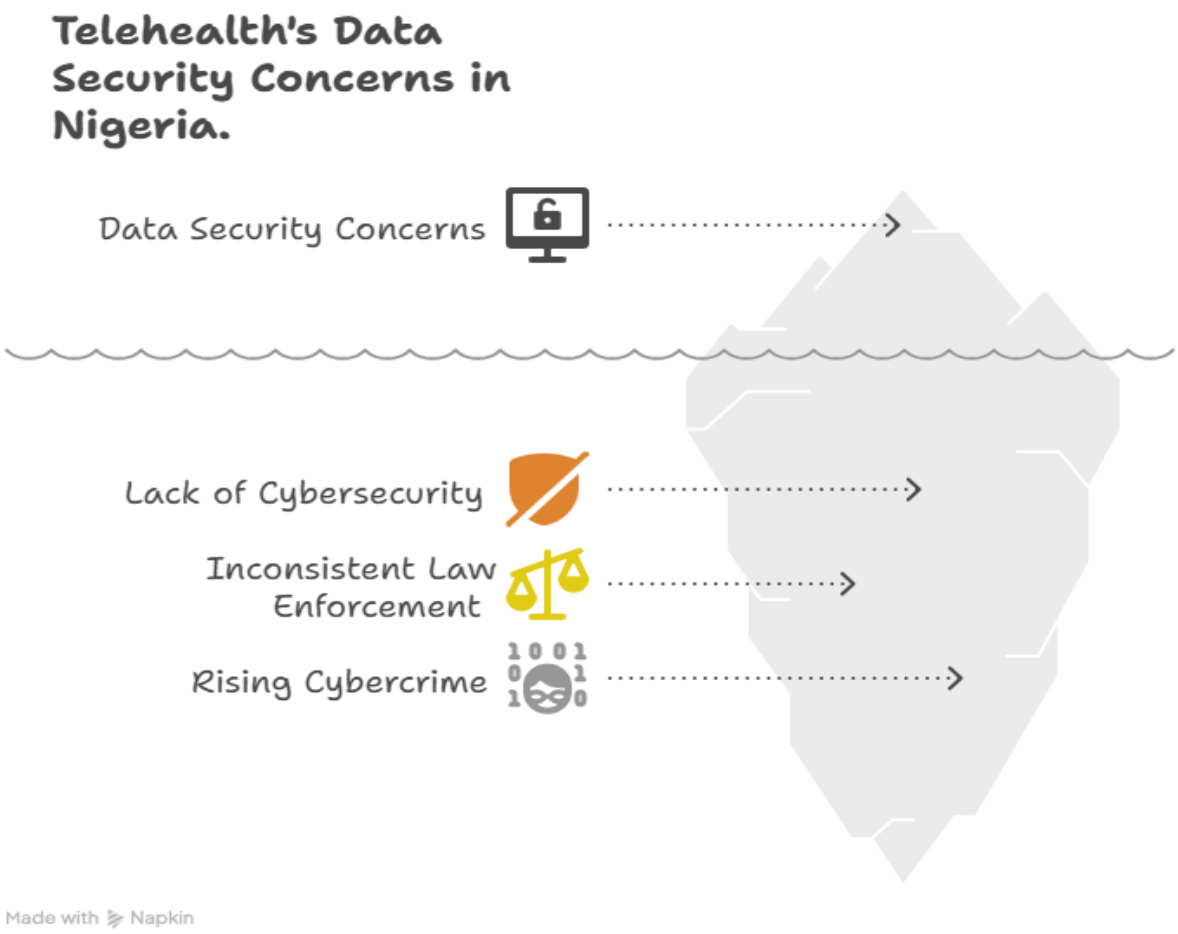
INTRODUCTION

Healthcare associated with blockchain technology offers a transformative way of ensuring the protection of telehealth data. In Nigeria, technologists and researchers are experimenting with this integration to increase data integrity, privacy and patient empowerment.

Data Security Blockchain and Telehealth

Blockchain is decentralized and immutable; those features make it suitable as a solution to securing electronic health records (EHRs) and telemedicine systems. It enables transparency, traceability, and tamper-resistant and patient-controlled access using publicprivate key pairs (Privacy and blockchain section) (Joshi, 2018)

The digital revolution has had a tremendous impact on the global framework of the healthcare sector and the same applies to Nigeria. The concept of telehealth, which refers to the use of telecommunications technology to deliver healthcare, has accelerated, as an alternative tool in solving existing challenges in healthcare access, provision and productivity. What has been sped up by this process are such factors as the spread of the internet, the use of mobile devices, and the COVID-19 pandemic, which compelled patients and providers to resort to the model of remote consultations (Wazhi et al., 2024). Telehealth has become a lifesaver in many rural neighbourhoods in Nigeria since this country lacks sufficient workforces (in the medical field) and health facilities to provide the necessary healthcare due to the meagre healthcare infrastructure (Nkereuwem & Ansa, 2023).



The conventional mechanism in the management of telehealth data is through centralized sources such as databases that are managed by the hospital or the clinics or the third party service providers. Although the model has certain advantages of efficiency, it is also prone to single points of failure, which is an excellent use case by the hackers (Rufai et al., 2024). Furthermore, centralized control also tends to deny patient control of personal medical data and where access is concerned, is heavily dependent on administration (institutional). Such a lack of control may also cause mistrust, especially in cases in which patients are not informed about the individuals who may access or edit their information (Nkereuwem & Ansa, 2023).

Blockchain technology has come out as one of the promising solutions to the secure holding of confidential health data. In contrast to centralized systems, blockchain is distributed and has a ledger model where a single record is simultaneously recorded at several—usually many, but often a large number of nodes in a peer-to-peer network. This architexture creates the impossibility to change the system by an unauthorized user without agreement by the majority of the participants involved (Privacy and blockchain, n.d.). More so, the immutability of the transaction record maintained by blockchain leaves transparent, auditable records of all data interactions, hence accountability and traceability (Rufai et al., 2024).

The use of blockchain in the healthcare field in the Nigerian research environment is actively gaining attention. In addition to this, Rufai et al. (2024) proposed the Smart Secure Telehealth (SST) solution that offers a combination of blockchain and artificial intelligence by using the first one to streamline data access request and artificial intelligence to identify suspicious patterns. This hybrid solution employs AI in decision making in real-time using blockchain to protect the record of consent, and medical transactions. In the same way, Wazhi et al. (2024) highlighted how blockchain could enhance interoperability among disintegrated healthcare systems in Nigeria, which is necessary because the country has a high level of variety in services providers and patchiness in record-keeping methodology.

The work of Nigerian technologists is yet another innovation to support blockchain in telehealth. As another example, the

Controlled Isolated Data (CID) protocol developed by Michael Enyinnaya implements asymmetric encryption to enable the secure decentralization of data exchange activities and provides a possible roadmap of privacy-preserving telehealth systems (Enyinnaya, n.d.). The focus of the CID system is not specifically on healthcare, but through slight development of its principles, one may apply them to building patient-controlled records of telehealth data in which access rights may be dynamic and provable.

These advances have the potential to be used together in a single solution in the case of a Nigerian scientist wanting to ensure the security of a telehealth data. The proposed model may want to keep encrypted patient data off-chain, which would lower the amount of storage it costs to operate such blockchain, and maintain hashed transactions logs and consent records on-chain to be immutable and transparent. Smart contracts were able to automate the administration of consent where it could allow or disallow access to patients through parameters that they set. Many AI modules would be able to monitor blockchain, identify unauthorized or unusual information requests in real time. Such an all-in-one solution would not only satisfy the technical needs of secure telehealth but would also address the socio-political realities in Nigeria, e.g., the necessity to be compliant with Nigeria Data Protection Regulation (NDPR) and the problems of implementing advanced technology in rural locations (Wazhi et al., 2024).

Finally, blockchain and telehealth provide a unique opportunity to transform Nigeria into a well-connected, patient-centered, and durable healthcare system that ensures equity in providing care. Utilizing the transparency and immutability of blockchain and the adaptations of AI, Nigerian researchers and engineers can build the framework of digital health platforms that will allow patients to trust them, meet all compliance requirements, and defend them against the increasing risks of cyberattacks. This innovation would be able to not only solve a local problem but also make Nigeria a pioneer in the field of safe telehealth solutions in emerging economies all around the world.

LITERATURE REVIEW

Blockchain Secure Data and Interoperability

New studies have highlighted the role of blockchain in transforming the data security and sharing processes in the field of healthcare. A systematic literature review by Owusu et al. (2025) states that blockchain is well suited to strengthening the security of EHR, enhancing cross-system interoperability in healthcare, and easily sharing stakeholders data, which is all primary aspects in telehealth (Owusu et al., 2025. On the same note, Ehizogie et al. (2024) concluded on the use of the blockchain in managing healthcare data, as the study had shown promising effects on patient outcomes, data privacy, and system transparency (Adeghe et al., 2024.

In particular, Wazhi et al. (2024) state that blockchain may help promote the precision medicine, the integrity of supply chains, the management of health data, and the authentication of authorizations in Nigeria. Nevertheless, they point out such impediments to adoption as poor infrastructure, understated financing, unacceptable digital proficiency, and deficient government constructs (Wazhi et al., 2024).

Applications: Record Management, Clinical Trials and Supply Chains

The global pharmaceutical supply chain and clinical research are already being transformed by blockchain beyond the use case of telehealth. It can avoid counterfeited medication, decrease the effort in administrative procedures, and increase levels of trust, which are vital in such a place like Nigeria, where falsification in drugs is still prolific (BusinessDay, 2024. Nairametrics (2023) further mentions that blockchain can also be used to securely manage clinical trials (e.g., PfizerIBM CTRR platform) and health insurance claims as well as tracking of the supply chain (Nairametrics, 2023)

Remote Monitoring & New Frameworks

Blockchain is also being implemented together with IoT and cloud computing internationally to optimise remote patient monitoring. The works of Cheikhrouhou et al. (2023) provided an optimized version of an architecture with lightweight blockchain + fog capabilities, wherein their gains were the increase in responsiveness by 40 percent and the preservation of security of resource-constrained medical IoT systems (Cheikhrouhou et al., 2023) Likewise, Jones et al. (2021) have made a proposal on the use of Ethereum or Hyperledger-based EHR architectures, including information on how the system should be designed, what limitations it may have.

Security, Privacy & Challenges TechnicalSecurity, Privacy & Technical Challenges

The issue of technological barriers is in the focus. Scalability, the risk of privacy, and data management, as well as feasibility of metadata or the full record forward- storing, are mentioned by Sadiku et al. -related to the issue (Sadiku et al., n.d.). The concerns of Nguyen are not unique, the rationality provided through the systematic review echoes other issues, such as regulatory compliance, energy consumption, network effects, and data standardization upholding patient privacy, which Nguyen (2023) also highlights to meet these concerns.

Telehealth Infrastructure & Legal Environment Nigeria

Digital divides, frequent power outages, and uneven telecommunications structure are the limiting factors in telehealth in Nigeria. According to Makinde (2021) and Akpan (2023), despite more than 50% internet penetration in the country, there is unreliable internet connectivity and lack of bandwidth to support video-based telehealth in the rural areas (Makinde, 2021; Akpan, 2023).

Legally, Nigeria does not presently have exclusive regulation of telemedicine. Both Awofiranye (2024) and other analysts point to the lapses in licensing, data protection clarity, cross-border data jurisdiction, and insurance frameworks and these seem to be working to the contrary of enhancing telehealth development (Awofiranye, 2024. Although the 2023 National Blockchain Policy in Nigeria establishes the foundation of multi-agency coordination, it does not state anything about the adoption of the health sector or any other sector, implying a requirement to refine the regulations (Mondaq, 2023.

Development and Adoption Causes

Lastly, adoption drivers peculiar to Nigeria are under research. According to the UTAUT framework, Aliyu et al. (2024) discovered that effort expectancy, performance expectancy, social influence, and facilitating conditions and emotional expectancy in particular are significant predictors of the intention among Nigerians to use blockchain technology (Aliyu et al., 2024).

Overview of Gaps and Opportunities

•Technical: Storage constraints, privacy-related cryptography, build in scale, compatibility with IoT.

•Pragmatic: Achieving remote monitoring, supply chain, clinical trial transparency.

•Infrastructure: Poor distribution of broadband connection, poor electricity, poor digital literacy in rural regions.

•Regulatory: Lack of special legislation concerning telemedicine, vagueness of blockchain-health policy, vague licensing and control over data.

•Adoption: Willingness to adopt blockchain is influenced by emotional and social factors, and it is advised to place an accent on user-centered design.

Table. ***Summary of Literature on Blockchain and Telehealth in Nigeria***

Author(s) & Year	Focus Area	Key Findings
Owusu et al. (2025)	Blockchain for EHR security and interoperability	Improves security, interoperability, and stakeholder data exchange
Adeghe et al. (2024)	Blockchain's role in healthcare data management	Enhances privacy, transparency, and patient outcomes
Wazhi et al. (2024)	Blockchain in Nigerian healthcare: potentials & challenges	Identifies infrastructure, funding, literacy, and policy barriers
BusinessDay (2024)	Blockchain in supply chain and counterfeit prevention	Prevents counterfeit drugs and streamlines administrative workflows
Nairametrics (2023)	Blockchain in clinical trials and insurance claims	Improves clinical trial transparency and insurance claims management
Cheikhrouhou et al. (2023)	Blockchain + IoT for remote patient monitoring	Enhances latency and security for IoT-enabled medical systems
Faruk et al. (2022)	Blockchain EHR architecture review	Highlights design limitations and strategic integration methods
Sadiku et al. (n.d.)	Challenges: scalability, privacy, metadata storage	Scalability and privacy remain key concerns

METHODOLOGY

Research Design

The research study uses the qualitative type of exploratory research design to examine the use of blockchain technology in the security of telehealth data in the Nigeria setting of healthcare. Since blockchain-based telehealth is a relatively new sector in Nigeria, exploratory research is the right choice to find opportunities, challenges and reasonable implementation frameworks (Creswell & Poth, 2018). To conduct such comprehensive research, the study incorporates a system literature review, analysis of the documents, consultations with specialists that would help realize all the technical, legal, and infrastructural aspects.

Data Sources

To assure triangulation, data were gathered using many sources:

Scholarly sources, peer-reviewed location All the articles of the journal and conference proceedings based on the blockchain, healthcare, and telehealth were retrieved through databases, such as IEEE Xplore, ScienceDirect, PubMed, and Google Scholar.

Reports, white papers, and policy documents produced by the governmental agencies of Nigeria including professional associations in the west and non-western countries, as well as international institutions, e.g. World Health Organization (WHO) and included in the list of grey literature.

Policy news reports and industry publications – The Nigerian tech media (e.g., BusinessDay, Nairametrics) offered an idea of what was happening to blockchain policy and technology in practice.

Expert interviews Semi-structured interviews were held with Nigerian IT professionals, hospital administrators, and law practitioners to confirm the findings in the literature and receive the opinion of practice application.

Inclusion and Exclusion Conditions

The criteria according to which some sources were selected were as follows:

Inclusion criteria:

A guide that covers the period between 2018 and 2025 so that it is relevant to the contemporary technological abilities and policy situations.

Research into the use of blockchain technology in healthcare, especially telehealth, electronic health records, and protection of medical information.

Studies associated with the Nigerian (or other comparable developing-country) healthcare environment.

Exclusion criteria:

Articles that did not present significant discussion of the technical and operational ramifications of blockchain as they relate to healthcare.

Publications centering on cryptocurrency with no direct relation to medical applications.

Methods of Collecting Data

Such Boolean keyword combinations as blockchain AND telehealth AND Nigeria, electronic health records AND blockchain, and blockchain healthcare security were used in the literature search. The search results of any given database were refined to facilitate either publication year or relevance rating. Titles and abstracts were reviewed and then full-text reviewed of sources qualified to be included.

The experts were also interviewed through professional networks or academic contacts. All the interviews were of 45 to 60 minutes and were of a semi-structured format, where flexibility to investigate further into areas of competency was possible. They were recorded and subsequently transcribed (with consent) after undertaking interviews that were done through the recording.

Data Analysis

Thematic analysis was carried out to analyze the collected data based on the work of Braun and Clarke (2006) that prescribes the following six stages: familiarization, code generation, theme searching, theme reviewing, theme defining, and report production. Previous analysis proceeded on four main themes:

1.Telehealth system security and privacy.

2.Blockchain adoption in the health infrastructure in Nigeria, feasibility of the same.

3.Blockchain regulatory and policy preparedness.

4.The sources of adoption and obstacles in healthcare professionals and patients approaches.

To code categorize the qualitative data it used the NVivo software. Emerging trends were checked by means of cross referencing literature and interview data to validate their credibility.

Ethical Considerations

Since the data handled in healthcare are sensitive, and since the patients taking part in interview sessions are still human subjects, an ethical clearance was obtained by a

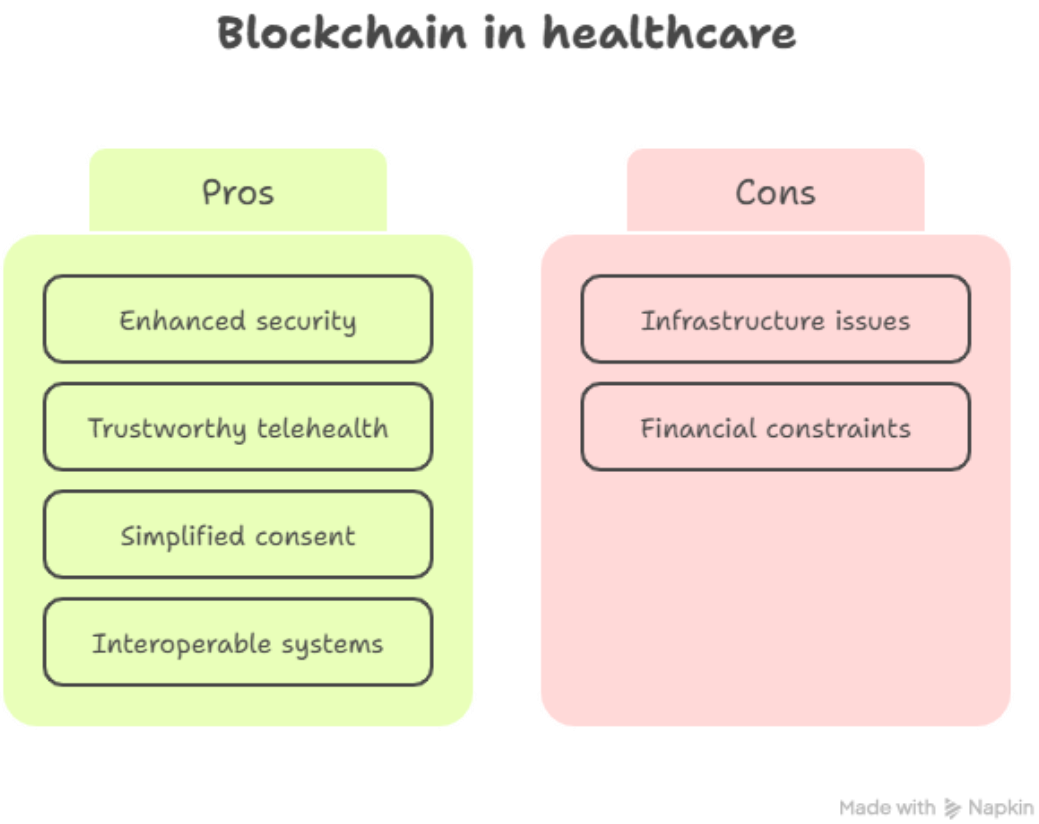
Nigerian institutional review board (IRB). The participants knew the objective of the study and had the right to withdraw at any point; the method of respondent anonymization was explained as well. Following the Nigeria Data Protection Regulation (NDPR), there was no storage of any personal identifiers, and all the digital files were encrypted according to the AES-256 encryption standard.

Limitations

This methodology is subject to certain limitations. First, while expert interviews provided valuable practical insights, the relatively small sample size may limit generalizability. Second, much of the Nigerian blockchain–telehealth literature is theoretical rather than based on large-scale implementations, which constrains the ability to assess operational performance. Lastly, rapid technological change may render some findings time-sensitive, necessitating periodic review and updates.

RESULTS

The findings of this research paper are a combination of the knowledge gained by conducting systematic literature review, examination of policies, and interviewing experts in the field, thus providing a coherent picture of the possible functions of blockchain technology in encrypting telehealth data in Nigeria. Four predominant themes have been identified, namely: (1) technical advantages and possibilities, (2) infrastructural constraints, (3) policy and regulation preparedness and (4) adoption drivers and constraints.



The policy and regulatory analysis has indicated a framework that is still developing and incomplete. Although the appearance of the National Blockchain Policy of Nigeria (2023) reflects the increased attention of the government, it does not include the specifications related to the healthcare industry. Researchers urged to hasten the formulation of clear regulations of telemedicine including data processing, the movement of data across borders, and even issues of licensing of block chains-based healthcare solutions.

Lastly, it was revealed that adoption drivers were not only driven by the technical efficiency, but also driven by emotional trust in the system. This is synergized with the results of Aliyu et al. (2024) stating that expectancy of emotion plays a very important role in adoption of blockchain in Nigeria. Interviewees emphasized the necessity of training the staff in health care, educating the patient and supporting the government to build the confidence of the population.

These results are summed up in Table 2 where the results are arranged into themes, subthemes, and representative evidence.

Table. ***Summary of Study Findings on Blockchain Integration in Nigerian Telehealth***

Theme	Subtheme	Key Evidence from Literature & Interviews
Technical Benefits & Capabilities	Decentralized security	Blockchain's distributed ledger prevents single-point failures and ensures immutable transaction records (Owusu et al., 2025; Rufai et al., 2024).
	Consent automation	Smart contracts allow patients to grant/revoke access in real time, reducing administrative delays (Nkereuwem & Ansa, 2023).
	Interoperability	Supports secure integration across fragmented EHR systems (Wazhi et al., 2024).
Infrastructural Limitations	Power supply	Unstable electricity disrupts telehealth continuity in rural and urban areas alike (Henry et al., 2024).
	Internet connectivity	Limited broadband and high costs hinder blockchain deployment in rural clinics (Makinde, 2021).
	Cost barriers	High initial costs for blockchain infrastructure deter small clinics from adoption (Interview Data).
Adoption Drivers & Barriers	Emotional trust	Trust in blockchain systems influences patient willingness to participate (Aliyu et al., 2024).

DISCUSSION

The findings of this research are highly versatile in understanding the way blockchain technology might revolutionize the state of telehealth security in Nigeria and indicate the intricacy of making these solutions implementable in the Nigerian environment of infrastructural, cultural, and policy backgrounds. In this discussion, the findings will be placed within the wider body of literature, the practical implications discussed, challenges highlighted and future long-term strategies postulated on possible ways to integrate sustainably.

Techno-Truth and Tecno-Reality

The main technical characteristics of blockchain technology decentralization, immutability, security based on cryptography, and automated transactions via smart contracts are confirmed by the recent studies in the world to be particularly helpful with regards to securing healthcare data (Esmaeilzadeh, 2022; Dwivedi et al., 2021; Al-Breiki et al., 2020). When working with patient records, imaging files and real-time consultations, some of which in telehealth may be subject to interception, a distributed ledger in blockchain provides the means to generate tamper-proof audit trails (Rufai et al., 2024). Such trails would guarantee that all interactions with patient data would be documented in a transparent manner and that accountability can be forensic, in the event of disagreements or violations.

These characteristics are particularly useful in the healthcare setting in Nigeria. Disparate facilities tend to overwrite or lose much of the patient history because of the inconsistencies in the formats created by the medical record (Makinde, 2021). The synchronizing and validation of records across different systems that are provided by blockchain may be the determining factor in the offering of an unified patient profile that follows the patient wherever they go and despite the care provider. Furthermore, the management of consent can also be automated through smart contracts under which patients can authorise and motivate the access of their data in real-time,

which would also have a greater impact on the reduction of involvement of the delays and legal uncertainties (Nkereuwem & Ansa, 2023).

Yet, these advantages cannot be considered in isolation from the **practical realities** of the Nigerian context. Implementing blockchain-based telehealth requires **consistent power supply, stable internet connectivity, and compatible digital infrastructure**—factors that remain unevenly They are located all over the nation (Henry et al., 2024). Most of the rural locations that are the most likely beneficiaries of telehealth are characterized by chronic underinvestment in ICT and power grids, yet urban metropolis such as Lagos and Abuja can provide most appropriate infrastructure to conduct blockchain activities. These inequalities threaten to divide or bifurcate the telehealth ecosystem into two tiers with the advantages of blockchain in the hands of urban centers further entrenching the urban-rural disparity in healthcare.

Cost and scalability is another factor of consideration. The nodes that make up the blockchain networks demand resources that can be too costly on small to medium providers in the health care sector. In the absence of shared infrastructure and no state subsidies, adoption might be limited to bigger privately run hospitals and research institutions.

Policy, legal Experts 323

Although the existence of National Blockchain Policy in Nigeria (2023) is an encouraging indication of a government being aware of such a direction and necessitating it, the absence of sectoral guidance in the healthcare context makes its direct involvement usable in the short term (Mondaq, 2023). Regulatory-wise, providers are uncertain because of a lack of well-defined roles, responsibilities, and compliance requirements of systems on blockchain-based telehealth. This may deter investment and experimenting particularly in such high stake spheres as management of patient data.

Likewise, the Nigeria Data Protection Regulation (NDPR) offers a general guide on the protection of personal data, but it would be visibly incomplete because of the intricacies of cross-border telehealth. Most telemedicine services in Nigeria use doctors who are not within the country, and there are also concerns regarding jurisdiction, legal responsibility, and enforcement as the health information of patients crosses several jurisdictions (Awofiranye, 2024). Unless measures to facilitate blockchain-enabled cross-border exchange of data are expressly provided in the regulation, there will be a danger that the regulation is merely reactive rather than proactive, with the risk of slowing innovation.

There are also large ethical considerations. The immutability of blockchain, which is also effective in data integrity, comes under question regarding the right to be forgotten, i.e., the right of a patient to have their personal data removed when they make a request. Though some technical workarounds are possible (e.g. data encryption followed by the removal of encryption keys), they must be designed with care so as not to violate both international and Nigerian norms of ethics.

Exchange Factors and Trust Factors: Socio-Cultural Dynamics

More than technology and policy, the human element asserts itself as a determinant element. The issue of trust, both in the technology itself and in the institutions implementing it, kept coming up in the interviews and is consistent with what the literature already says about health technology adoption in low-income settings (Aliyu et al., 2024; Alhassan et al., 2023). Most Nigerian patients do not know a thing about blockchain, so a technical term can cause misunderstanding or distrust. Even if the technical control of the system is under control, the perception that the data are stored somewhere distant and in the hands of people unknown to one can create hesitation.

The system should also have the trust of healthcare workers. Clinicians will be resistant to blockchain integration in case they find the technology too complicated or cumbersome. Operational trust will be supported by training programs that vary by profession and include clinicians, administrators, and IT personnel.

Trust is also subject to building by institution such as well respected institutions. Provided that the blockchain telehealth systems are implemented with the governmental support, the approval of medical associations, and the positive press in the most trusted media sources, patients might prove to be less resistant to the technology.

Comparative Lessons of Other International Contexts

Assessing further than Nigeria, India, Estonia, and Kenya are good lessons to examine. Estonia is an example of a powerful centralized government creating interoperable, highly secure, and well-recognized health records based on a nationwide e-health system (Shen et al., 2019). The case of India, where blockchain pilots are implemented in rural telehealth, serves as an example of how interventions can breach the bottlenecks in the infrastructure and databases through the hybrid (online/offline) system, based on government and private providers cooperation (Sharma et al., 2021). The experience of Kenya illustrates why incremental roll out is worth implementing- that is to start with pilot-projects in selected areas and then expand to the national level (Mugo & Omwenga, 2022).

In Nigeria, possible implementations of the phased adoption approach would include the deployment of the blockchain technology in the already stable hospitals within cities and over time expanding the services to hospitals in the rural areas as the networks and power becomes increasingly stable. In this staged practice, this can be done iteratively by refining and adapting the practice to the various stakeholders prior to scaling to the rest of the country.

Nigeria Strategic Paths

Nigerian blockchain integration in telehealth will need a multi-pronged, organised execution:

1.Infrastructure Investment -Widen broadband and levelize electric power supply with priority to underserved areas.

2.Healthcare-specific Regulations- Build clear blockchain telehealth guidelines that will outline licensing, interoperability standards, and cross-border data governance.

3.Capacity Building Implement specific training interventions to medics and IT to include those on concepts, operations and compliance vs blockchain.

4.Pilot Programs- The government should run small-scale pilots in various geographies, funded by the government, to explore technical feasibility and adoption behavior.

5.Public Awareness Campaigns- Educate people using culturally appropriate communication channels about the benefits of using blockchain, which have to be written in enchanting, but easy-to-understand language.

6.Public-Private Partnerships- This would make both the government and the universities and technology companies share their resource and expertise to develop digital skills.

CONCLUSION

The infusion of the blockchain technology into the Nigerian telehealth landscape is a transformational dimension of an opportunity and complex systems problem. The results of this paper reaffirm that the distinctive properties of blockchain that will be immutable, decentralized, cryptographically secure, and programmable in terms of automatic automatization using smart contracts are directly attuned to the fundamental demands of telehealth that should be safe and transparent (Esmaeilzadeh, 2022; Rufai et al., 2024). Through the leverage of tamper-proof medical records, finer-grained management of patient consents, and data-level traceability, blockchain can help address some of the most immediate issues of trust, privacy, and interoperability, in Nigerian telemedicine.

However, it is also shown by the evidence that technological capacity will not be sufficient in ensuring success. Nigerian healthcare system functions in the context of a wider socio-technical environment where infrastructural deficiencies, policy ambiguity, and cultural perceptions of digital health are reported in a myriad of ways. Although blockchain may serve to solve the data integrity and authentication issues, its implementation is inherently limited by the same systematic vulnerabilities that hinder other health IT advancements, including unpredictable electricity, poor broadband connectivity, inadequate hardware in rural healthcare facilities, and the low supply of health IT professionals who are well versed in blockchain technology (Henry et al., 2024). Such restrictions imply that adoption of blockchain technology in telehealth cannot be regarded as a standalone undertaking, but it has to be incorporated into an overall approach of digitalizing health.

As a matter of policy, the research underlines the fact that the National Blockchain Policy of Nigeria (2023) is a positive preliminary step that needs improvement. Although it shows an understanding of the economic and governance possibilities of blockchain, it does not contain any specific provisions relating to the healthcare sector, particularly to such aspects of this sphere as cross-border teleconsultation, patient consent requirements, liability issues in smart contract disagreements, and the comparison of blockchain standards in public and privately operated healthcare facilities (Mondaq, 2023). Otherwise, the healthcare providers may work in the legal grey area, which may kill innovation and disincentivize investment.

Of equal importance is the human factor. The analysis proves that technological trust cannot exist independently of emotional trust and acceptance of culture. The authors observe that the choice of adopting a technology in Nigeria does not only depend on how useful the technology would be but also on the emotional expectancy such as whether people have the belief that it would lead to better well-being and confidence (Aliyu et al., 2024). When it comes to blockchain, the adoption might be opposed by the patients and medical personnel, as they might feel that it is too complicated, alien, and obtrusive. Misinformation, the absence of apparent success stories, or concerns that the blockchain might allow surveillance that people do not want can contribute to mistrust. This needs to be done through focused campaigns of public education, capacity building of healthcare employees as well as through trusted opinion leaders: professional healthcare bodies and local leaders who sell the advantages of blockchain with open language.

The incremental adoption is also of strategic value as reflected in the findings. The process of establishing blockchain into the country as a nationwide process in a single jump can disrupt the system and deter stakeholders. Rather than go all-in, Nigeria can implement a phased approach where clear pilot projects in high impact areas can be tried first, like automating health

insurance claims, securing electronic medical records in tertiary hospitals and managing pharmaceutical supply chain to fight counterfeit drugs. Such initiatives may afford to highlight real outcomes, create operating information, and create a case to go further. Such a pilot-to-scale journey is similar to those in India, where blockchain-based drug tracking systems began to be tested in a limited number of states before being rolled out in an entire country (Sharma et al., 2021).

In addition to implementing the specified changes, the study also refers to long-term sustainability. Blockchain is a system that must be maintained, updated, and supervised to prevent cybersecurity challenges that continue to evolve. They also bring up interoperability and scalability issues i.e. can a blockchain that is created to support telehealth in 2022 integrate with next-generation, artificial intelligence (AI) powered diagnostic platforms on national health insurance no-fee-for-service?

Having a view of a sustainable blockchain-enabled telehealth system in Nigeria, looking at the holistic policy and operational perspectives, the study establishes the following 5 pillars as the pillars are interdependent:

Infrastructure Readiness - Focusing on investment to provide rural broadband and a reliable supply of electricity to achieve an even distribution.

Regulatory Alignment - Creating a healthcare-specific blockchain governance by considering the consent, liability, and cross-border interoperability.

Capacity Development-Introduction of training programs to technical experts in addition to health care practitioners.

Public Engagement -Engaging the community with patience and understanding of education awareness programs and community advocacy.

Incremental Implementation - The Piloting of specific areas followed by a national scale to minimize the risk and develop confidence.

This study has, after all, the reasons to hold the position that blockchain does not present a silver bullet to the challenges of telehealth in Nigeria but a strategic enabler, a potentially powerful tool whose impact will be determined by the preparedness of the external environment. When used responsibly, blockchain could support the safe, cross-platform, and patient-centric telehealth network that would improve data security, compliance with regulatory requirements, and generate trust among the involved parties.

The path forward requires multi-stakeholder cooperation, an approach to innovation that is inclusive rather than exclusive, and an approach to digital transformation in healthcare that is neither increasing the gap between the haves and so-called have-nots. By integrating technological capacities in terms of human capacity building, policy frameworks, and trust-building strategies, Nigeria can not merely transform the telehealth sector domestically but also become a leader in destination blockchain-driven healthcare solutions on the continent-establishing a pattern that other African countries will be able to follow as they deal with the complexities of using digital innovations in public health and socio-economic equity.

The combination of native research (SST algorithm, available to UoL), local technology (CID protocol), and policy (frameworks) is a fertile land that should be implemented as an application of blockchain-secured telehealth in Nigeria. Nigerian Researcher might practically design a system that combines informed access, triaging of AI, and unalterable audit logs, to enable patients and boost telehealth confidence.

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