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Assessing the Role of Digital Technologies for Health Financing (DTHF) in Strengthening Public Health Financing Systems in Nigeria

Emaraobhazi Christian Aquah
University of Ibadan
Ademola Marvellous Adeyemi
ademolaadeyemi719@gmail.com
University of Ibadan
Sunday Stephen Effiong
University of Ibadan
David Ayobami Adewole
University of Ibadan

Research Article

Keywords: digital health financing, health insurance, universal health coverage, Nigeria, qualitative study, mobile money

Posted Date: November 9th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-11210972/v1

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Additional Declarations: No competing interests reported.

Abstract

Background

Nigeria's health financing system remains heavily dependent on out-of-pocket payments, leaving large segments of the population, particularly those in rural and informal-sector settings, exposed to catastrophic health expenditure. The 2022 National Health Insurance Authority (NHIA) Act mandated universal health insurance enrollment, intensifying the need for financing mechanisms capable of reaching populations that traditional cash-based systems have struggled to serve. Digital Technologies for Health Financing (DTHF), including mobile money platforms, digital payment gateways, and API-driven interoperability between insurers, telecommunications providers, and FinTech companies, have emerged as a potentially transformative strategy, yet empirical evidence on their implementation and the operational, behavioural, and regulatory factors shaping their effectiveness in Nigeria remains limited.

Methods

This qualitative descriptive study used semi-structured Key Informant Interviews (KIIs) with 17 senior personnel and technical experts drawn from national and state health insurance agencies, Health Maintenance Organizations, FinTech companies, and payment service providers across Lagos, Oyo, Ondo, and the Federal Capital Territory. Data were analyzed using Braun and Clarke's six-phase reflexive thematic analysis framework, with trustworthiness established through Lincoln and Guba's criteria of credibility, dependability, confirmability, and transferability.

Results

Six themes emerged: digital transformation as an equity and revenue modernization vehicle; ecosystem interoperability and multi-sectoral integration; operational constraints and systemic enablers; trust, governance, and regulatory compliance architecture; reminder systems and automatic renewals; and scaling digital health financing for universal health coverage. Participants viewed DTHF as simultaneously expanding access for underserved populations and strengthening financial transparency, but implementation was constrained by infrastructural fragility, workforce turnover, fragmented interoperability standards, and an evolving regulatory landscape. Behavioural design of reminders and automatic renewals emerged as an important, underutilized lever for improving enrollee retention.

Conclusion

DTHF holds substantial promise for advancing Universal Health Coverage in Nigeria, but its impact is bounded by institutional, infrastructural, regulatory, and behavioural factors beyond the technology itself.

Strengthening these underlying systems, alongside continued technological investment, is essential for sustainable scale-up.

BACKGROUND

Access to affordable and equitable health care remains a central policy priority across low- and middle-income countries (LMICs), with Universal Health Coverage (UHC) positioned as a core target under the Sustainable Development Goals. Achieving UHC requires health financing systems that can mobilize resources efficiently, pool risk equitably, and purchase services in ways that protect populations from catastrophic health expenditure. In Nigeria, however, health financing remains heavily reliant on out-of-pocket payments, with health insurance coverage historically limited to a small proportion of the population, largely concentrated among formal-sector employees. This narrow coverage base has left large segments of the population, particularly those in rural and informal-sector settings, exposed to financial risk when seeking care [1, 2].

The passage of the National Health Insurance Authority (NHIA) Act of 2022 marked a significant policy shift in Nigeria's health financing landscape, making health insurance enrollment mandatory for all citizens and establishing a stronger legal and institutional framework for expanding coverage through both national and state-level health insurance schemes [3]. Translating this policy ambition into practice, however, requires financing systems capable of reaching populations that traditional, cash-based enrollment and premium collection models have struggled to serve. It is within this context that Digital Technologies for Health Financing (DTHF), encompassing mobile money platforms, digital payment gateways, electronic enrollment systems, and application programming interface (API)-driven interoperability between insurers, telecommunications providers, and financial technology (FinTech) companies, have emerged as a potentially transformative mechanism for strengthening health financing systems [4–6].

Globally, digital financial technologies have demonstrated capacity to expand access to formal financial services, including insurance, among previously underserved populations. Mobile money platforms are frequently cited as evidence that digital payment infrastructure can be leveraged to mobilize health financing resources at scale, even in settings with limited formal banking penetration [5, 7, 8]. In Nigeria, similar digital financing models are increasingly being adopted by state and national health insurance agencies, Health Maintenance Organizations (HMOs), and FinTech partners to facilitate enrollment, premium collection, renewal reminders, and automatic debit arrangements intended to reduce coverage lapses. Despite this growing uptake, empirical evidence on how DTHF is being implemented in practice, and on the operational, behavioural, and regulatory factors shaping its effectiveness, remains limited within the Nigerian context.

Existing literature on digital health financing in sub-Saharan Africa has tended to focus on the technical architecture of digital payment systems or on quantitative enrollment outcomes, with comparatively little qualitative inquiry into the lived experiences and perspectives of the multi-sectoral stakeholders

responsible for designing, implementing, and sustaining these systems [7, 9, 10]. Understanding these perspectives is critical, as the successful scaling of DTHF depends not only on technological readiness but also on infrastructural reliability, workforce capacity, regulatory compliance, inter-organizational collaboration, and the behavioural responsiveness of enrollees to digital engagement strategies such as reminders and automatic renewals.

This study therefore seeks to explore the implementation, operational realities, behavioural drivers, and policy implications of Digital Technologies for Health Financing within Nigeria's health insurance ecosystem, drawing on the perspectives of senior personnel and technical experts across public health insurance agencies, HMOs, FinTech companies, and payment service providers. By capturing insights from this diverse group of stakeholders, the study aims to generate contextually grounded evidence to inform the design, governance, and scale-up of digital health financing strategies in support of Nigeria's progress toward Universal Health Coverage.

METHODS

Study Design

This study employed a qualitative descriptive design using Key Informant Interviews (KIIs) to explore the implementation, operational realities, behavioural drivers, and policy implications of Digital Technologies for Health Financing (DTHF) within Nigeria's health insurance ecosystem. A qualitative approach was considered appropriate because it enabled an in-depth exploration of stakeholders' experiences, perceptions, and contextual factors influencing the adoption and implementation of digital health financing technologies.

Study Setting

The study was conducted across selected public and private organizations involved in health financing and digital health implementation in Nigeria. Participants were recruited from organizations located in Lagos State, Oyo State, Ondo State, and the Federal Capital Territory (Abuja), representing key stakeholders across the Nigerian health insurance landscape.

Study Population and Sampling

The study population comprised senior personnel and technical experts directly involved in health insurance administration, digital health financing, health technology development, financial technology (FinTech), and payment processing. Purposive sampling was used to identify information-rich participants with substantial knowledge and practical experience in the implementation and operation of digital technologies for health financing.

Seventeen key informants were interviewed, representing national and state health insurance agencies, Health Maintenance Organizations (HMOs), FinTech companies, payment service providers, and digital health solution developers. Participants occupied leadership and technical positions, including directors, executive secretaries, state coordinators, product leads, enrollment officers, ICT officers, and strategy managers.

Data Collection

Data were collected through semi-structured Key Informant Interviews using an interview guide developed from the study objectives and existing literature on digital health financing and universal health coverage. The interview guide explored participants' experiences regarding digital health financing implementation, system interoperability, operational challenges, governance and regulation, enrollee retention strategies, and policy recommendations for scaling digital health financing in Nigeria.

Interviews were conducted after obtaining informed consent from participants. All interviews were audio-recorded with participants' permission and supplemented with field notes. Audio recordings were transcribed verbatim for analysis.

Data Analysis

The interviews were transcribed verbatim and analyzed using Braun and Clarke's six-phase reflexive thematic analysis framework [11]. Analysis was conducted iteratively and manually on Excel to identify patterns and meanings across the dataset rather than summarizing responses to individual interview questions. The six phases included: (1) familiarization with the interview transcripts through repeated reading; (2) generation of initial codes capturing operational, technological, behavioral, and policy-related concepts; (3) searching for patterns and candidate themes across the multi-stakeholder dataset; (4) reviewing and refining themes against the coded extracts to ensure coherence and consistency; (5) defining and naming the final themes; and (6) producing an analytic narrative supported by representative verbatim quotations from participants.

Trustworthiness

The trustworthiness of the findings was established using Lincoln and Guba's framework of credibility, dependability, confirmability, and transferability. Credibility was enhanced through prolonged engagement with the data, iterative review of interview transcripts, peer debriefing, and triangulation of perspectives across stakeholders from public health insurance agencies, private Health Maintenance Organizations, and FinTech/payment service providers. Dependability was ensured through the maintenance of an audit trail documenting coding procedures, theme development, and analytical decisions throughout the analysis. Confirmability was strengthened through reflexive memo writing and by grounding all interpretations in verbatim participant quotations. Transferability was enhanced by providing rich descriptions of the study context, organizational settings, participants' professional roles,

and geographical locations to enable readers to determine the applicability of the findings to similar settings.

Ethical Considerations

Ethical approval

was obtained from the National Health Research Ethics Committee before commencement of the study. Written informed consent was obtained from all participants prior to data collection. Participants were informed of the purpose of the study, their right to withdraw at any time without consequence, and the measures taken to ensure confidentiality and anonymity. All interview transcripts were de-identified, and participants were assigned unique identification codes (KII 1–KII 17) to protect their identities.

RESULTS

Sample Characteristics & Comprehensive Demographic Profile

A total of 17 key informants participated in the study, representing diverse organizational tiers within Nigeria's health insurance ecosystem. Participants were drawn from both the public and private sectors to provide a comprehensive understanding of the implementation and use of digital technologies for health financing.

The participants ranged in age from 27 to 53 years. Males constituted the majority of the sample (64.7%, n = 11), while females accounted for 35.3% (n = 6). Public sector participants comprised 41.2% (n = 7) of all respondents. Among these, six participants (85.7%) were from state health insurance agencies, namely the Oyo State Health Insurance Agency (OYSHIA) and the Ondo State Contributory Health Commission (ODSCHC), while one participant (14.3%) represented the National Health Insurance Authority (NHIA). The remaining 58.8% (n = 10) were from the private sector and included representatives of Health Maintenance Organizations (HMOs), digital health technology companies, and payment service providers.

Participants had varied levels of professional experience within their respective organizations, ranging from seven months to more than seven years, with an average organizational tenure of approximately three years. This diversity in institutional affiliation, professional roles, and years of experience provided a broad range of perspectives on the implementation, operational challenges, governance, and future directions of digital technologies for health financing in Nigeria.

Table 1
Comprehensive Demographic Profiles and Institutional Roles of Informants

KII ID	Age (Yrs)	Gender	Institutional Organization	Tenure	Professional Role	Geographic Location
KII 1	40	Female	AXA Mansard Health Limited	7 months	Group Head, Medical Services	Ikeja, Lagos
KII 2	47	Male	AXA Mansard Health Limited	3 years	Group Head, Retail Partnership & Public Sector	Ikeja, Lagos
KII 3	32	Female	AXA Mansard Health Limited	4 years	Unit Head, Fraud Waste & Abuse Control	Ikeja, Lagos
KII 4	51	Male	Ondo State Contributory Health Commission	5 years	Director General	Ondo State
KII 5	43	Male	Instrat Global Health Solutions Limited	3 years	Director of Operations	Abuja
KII 6	35	Male	Reliance Health	4 years	Senior Vice President, Product & Data	Lagos
KII 7	48	Male	National Health Insurance Authority (NHIA)	3 years	State Coordinator	Ibadan, Oyo
KII 8	NR*	Male	PalmPay	1 year	Product Lead for Wallet Business	Lagos
KII 9	49	Female	Interswitch Financial Inclusion Services	2 years	Group Head, Business Dev & Sales	Lagos
KII 10	33	Female	Interswitch Financial Inclusion Services	7 years	Divisional Head of Product	Lagos
KII 11	40	Male	REMITA Payment Services Limited	1 year	Senior Manager, Head of Corporate Payment	Lagos
KII 12	39	Female	REMITA Payment Services Limited	23 months	Head of Strategy Management Office	Lagos
KII 13	53	Male	Oyo State Health Insurance Agency (OYSHIA)	4 + years	Executive Secretary	Ibadan, Oyo
KII 14	33	Male	Oyo State Health Insurance Agency (OYSHIA)	2 + years	Enrollment Officer	Ibadan, Oyo

KII ID	Age (Yrs)	Gender	Institutional Organization	Tenure	Professional Role	Geographic Location
KII 15	32	Female	Oyo State Health Insurance Agency (OYSHIA)	3 years	Enrollment Officer	Ibadan, Oyo
KII 16	27	Male	Oyo State Health Insurance Agency (OYSHIA)	2 years	ICT Officer	Ibadan, Oyo
KII 17	48	Male	Oyo State Health Insurance Agency (OYSHIA)	3 years	Deputy Director, Enrollment & Underwriting	Ibadan, Oyo

**NR: Refused to state.*

Theme 1: Digital Transformation as an Equity and Revenue Modernization Vehicle

Participants consistently described Digital Technologies for Health Financing (DTHF) as an important strategy for strengthening health financing by expanding insurance coverage and improving the efficiency of revenue collection. Rather than viewing digital technologies solely as technological innovations, participants perceived them as tools for improving equity in access to health insurance, particularly among underserved populations, while enhancing transparency and accountability in financial transactions.

Subtheme 1: Expanding Access to Underserved and Rural Populations

Participants highlighted the potential of digital technologies to overcome geographical barriers that limit enrollment into health insurance schemes. They noted that a substantial proportion of Nigeria's population resides in rural and underserved communities, where traditional cash-based enrollment processes are often difficult, costly, and inaccessible. Digital platforms were therefore viewed as mechanisms for extending insurance services to these populations through remote registration and electronic payment systems.

One participant explained:

"We decided to go ahead with developing a health insurance solution because... a lot of underserved areas in remote and rural areas will be able to... be onboarded... because we discovered that between 50 to 60 percent of Nigeria is still rural and the people living in these locations are underserved..." (KII 5, Male, Director of Operations, Instrat)

Similarly, participants involved in enrollment activities described the multiple digital pathways available for enrolling individuals across different population groups, illustrating how technology has broadened

access to health insurance services.

"On a daily basis, we do basically enrollment... We have different gateways... organized private sector... adopted into the scheme... walk in... specialized programs, pensioners... Safer Health. So, on a daily basis, I am in charge of all kinds of enrollments across all the zones." (KII 17, Male, Deputy Director, Enrollment and Underwriting, OYSHIA)

Subtheme 2: Enhancing Revenue Transparency and Accountability

Participants also emphasized that digital payment systems improve financial accountability by creating real-time transaction records that facilitate monitoring, auditing, and revenue tracking. Electronic payment platforms were perceived as reducing opportunities for fraud, minimizing financial leakages, and improving operational efficiency compared with manual cash-based systems.

As one participant explained:

"...we facilitate digital payments, it's easy to track payments, it's easy to know how much... came into the pool at a particular time, it is easy to know how much you have at a snapshot... That's why you're reducing wastages, that's why you're reducing leakages..." (KII 12, Female, Head of Strategy Management Office, Remita)

Another participant described their organization's role in designing and implementing digital health financing products that support these transparent payment systems.

"I lead Interswitch health tech product. I am responsible for strategy, responsible for the innovation and I'm responsible for the implementation of new and existing product." (KII 10, Female, Divisional Head of Product, Interswitch)

Theme 2: Ecosystem Interoperability and Multi-Sectoral Integration

DTHF systems cannot operate effectively in isolation. This theme addresses the collaborative ecosystem required to connect health maintenance organizations and state schemes with telecommunications networks, financial switches, and medical providers via secure Application Programming Interfaces (APIs).

Subtheme 1: Telecommunications and FinTech Commercial Alliances

Insurers leverage established commercial platforms (e.g., Airtel, MTN, PalmPay) to embed health micro-premiums into daily consumer micro-transactions.

"We have plans with telecommunication companies, with Airtel, with MTN, with Etisalat. So, they already have platforms. So, the people that maybe are buying airtime, once they're doing that, they're also using that to buy health insurance." — (KII 3, Female, Unit Head, AXA Mansard)

Subtheme 2: API-Driven Architecture and Interoperability Standards

Digital health platforms depend on secure endpoints that connect front-end payment systems directly to underwriting engines and clinical provider databases. Emerging operations are integrating international data standards like Fast Healthcare Interoperability Resources (FHIR).

"I have APIs... that the insurance company has exposed to me at Palmpay right... The insurance company has provided me with endpoints that I can use in accessing all of these functions. And I integrated them... at the end of the day, I settle to them." — (KII 8, Male, Product Lead for Wallet Business, PalmPay)

"We facilitate digital channels... enabling efficient aggregation of funds from multiple sources... digitally, the DTHF allows for the pooling of resources... enabling easy, fast, and convenient enrollment." — (KII 9, Female, Group Head Business Dev & Sales, Interswitch)

Theme 3: Operational Constraints and Systemic Enablers

Despite the speed and convenience of digital technology, DTHF rollouts face persistent structural obstacles. Technical execution relies on physical telecommunications infrastructure, server hosting capabilities, and workforce stability across health facilities.

Subtheme 1: Infrastructural Friction, App Hosting, and Dual-Record Resilience

Network outages, server delays, and platform app-store licensing present major implementation barriers. To maintain operations during power or network outages, public agencies maintain dual paper-and-digital backups.

"One of the challenges we had was hosting. When you create an app, you have to host on either Google, Playstore or the Apple Store. So in terms of getting license to host the app, there were a few challenges..." — (KII 16, Male, ICT Officer, OYSHIA)

"Yes, the power can shut down... but the beauty is that we have back-up. All our enrolees, we have paper back-up, and, we also have Excel back-up, and we have other ways we post their data. Otherwise, we are in trouble." — (KII 4, Male, Director General, ODSCHC)

Subtheme 2: Human Capital Instability and Organizational Resistance

High employee turnover among clinical providers disrupts digital entry workflows, requiring ongoing retraining programs.

"So, some of the systems developed internally. Some maybe got an external provider that has a system to build for us or they already have it..." — (KII 3, Female, Unit Head, AXA Mansard)

"...turnover of personnel, particularly among healthcare providers... continuous need for training due to staff changes posed a persistent challenge..." — (KII 15, Female, Enrollment Officer, OYSHIA)

Subtheme 3: Multi-Source Funding Models: Implementation relies on mixed funding streams spanning private capital, state appropriations, and international grant partners.

"We work with the government... at both at the state level, at the federal level, and international development, international funding partners." — (KII 5, Male, Director of Operations, Instrat)

Theme 4: Trust, Governance, and Regulatory Compliance Architecture

The long-term viability of DTHF relies on robust statutory regulation and data governance. Operational integrity requires strict compliance with statutory insurance legislation, financial guidelines, and national data protection regulations.

Subtheme 1: Statutory Frameworks (NHIA Act 2022) and Financial Regulation

The passage of the National Health Insurance Authority (NHIA) Act of 2022 provided the formal mandate defining stakeholder obligations and state scheme operations. Additionally, financial partnerships are overseen by central financial regulators like the Central Bank of Nigeria (CBN).

"Right from inception there always been legal and regulatory prescription out there... There's a new law that was passed, the NHIA law that was just passed in 2022 and practically states all the roles and responsibilities of every stakeholder." — (KII 7, Male, State Coordinator, NHIA)

Data Safeguarding, Audits, and Quality Control

Given the sensitivity of digital medical and financial data, stakeholders emphasize compliance with the Nigeria Data Protection Regulation (NDPR) to prevent data breaches and database tampering.

"I think it's mostly in terms of data and being able to protect data security mostly. Something that prevents the system from being hacked. Health information is very sensitive." — (KII 3, Female, Unit Head, AXA Mansard)

"Our daily work requires conducting audits and investigations to ensure the quality of healthcare services provided to enrollees..." — (KII 1, Female, Group Head Medical Services, AXA Mansard)

"Regular audits ensure protection... Enrollment is being monitored on a daily basis in terms of the number of gender disparity, age disparity, location-wise, education-wise, in terms of religion, in terms of tribe." — (KII 5, Male, Director of Operations, Instrat)

Theme 5: Reminder Systems and Automatic Renewals

Sustaining universal health coverage requires retaining enrollees over time. This theme examines behavioral interventions, specifically targeted renewal reminders and frictionless direct-debit automatic renewals, designed to prevent voluntary drop-offs and behavioral churn.

Subtheme 1: Optimal Timing and Multi-Channel Customization

Reminders are most effective when scheduled to match salary disbursement dates (e.g., between the 20th and 5th of the month). To overcome literacy barriers, systems utilize local languages and voice messaging.

"So, a reminder service should be tailored towards when you have an idea that a payment will be made... The notification should be sent between 20th to probably the 5th of the following month. And of course, email notification is sufficient..." — (KII 11, Male, Senior Manager Head Corporate Payment, Remita)

"A reminder that comes to them at least a week before and a reminder that comes to them around the pay period... worst-case scenario, you must remind them before the duration of the payment." — (KII 9, Female, Group Head Business Dev & Sales, Interswitch)

"I think that's something that might be interesting to end users... because it provides some form of flexible payments. If it's monthly, then you know that it's a factor of your salary that motivates." — (KII 6, Male, SVP Product & Data, Reliance Health)

Subtheme 2: Behavioural Factors and Individual Characteristics

Adoption of reminder and renewal services is shaped by individual user traits, including health status, income, education, and digital access.

"Age, education, gender, health status, yes, health status is still a... major factor because if the person has a health challenge already, he or she would want to keep that access running... majorly it will be willingness to keep the insurance active, availability of funds..." — (KII 5, Male, Director of Operations, Instrat)

"Access to phone, easy to use, stable and functional network, use of mobile wallet, automatic subscription functionality of network provider." — (KII 13, Male, Executive Secretary, OYSHIA)

"I see a combination... The education level of the subscriber... the knowledge and understanding of insurance or willingness to keep insurance active." — (KII 2, Male, Group Head Retail Partnership, AXA Mansard)

Subtheme 3: Automatic Renewal to Improve Continuous Enrollment

Participants believed that automatic renewal could improve continuous enrollment by reducing the burden of manual renewal for both health insurers and enrollees. They explained that automatic deductions simplify the renewal process, reduce the likelihood of missed renewals, and improve administrative efficiency. However, some participants noted that concerns about sharing banking information for automatic debit may discourage users from adopting the system.

One participant explained:

"It would reduce the administrative burden, for the health insurer... But for the user, it would also mean that they don't have to key in their information every time. It's automatically debited." (KII 3, Female, Unit Head, AXA Mansard)

Another participant observed that automatic renewal could help prevent lapses in insurance coverage caused by forgetfulness or the perception that insurance is unnecessary during periods of good health:

"Your renewal figures will surely go up... Not because... most people forget... but for some people it's like, 'ah, for the past three years I've been paying, I didn't fall sick. Let me just put a break for now...' That break may be the break that breaks the camel's back." (KII 17, Male, Deputy Director, Enrollment & Underwriting, OYSHIA)

Theme 6: Scaling Digital Health Financing for Universal Health Coverage

Participants viewed Digital Technologies for Health Financing (DTHF) as an important strategy for expanding health insurance coverage and supporting progress toward Universal Health Coverage (UHC). They emphasized that successfully scaling digital health financing requires strong political commitment, collaboration across government agencies, continuous improvement of digital systems, and learning from successful implementation models in other settings.

Subtheme 1: Political Support and Government Collaboration

Participants highlighted the importance of political commitment and collaboration among government stakeholders in expanding digital health financing initiatives. They explained that scaling digital health financing beyond pilot projects requires advocacy at the highest levels of government to secure policy support and coordinated implementation.

One participant stated:

"So, the scaling up will definitely have to involve some external stakeholders. It will also involve advocacy at the very high level, advocacy to political officeholders at the highest level of governance, and going as far as the federal executive council..." (KII 7, Male, State Coordinator, NHIA)

Another participant noted that expanding digital health financing could increase enrollment in health insurance schemes and contribute to achieving Universal Health Coverage.

"The changes will be positive in the sense that for universal health coverage under health insurance, many people will come on board in terms of population... which is the aim of universal health coverage." (KII 14, Male, Enrollment Officer, OYSHIA)

Subtheme 2: Continuous Improvement Through Feedback and Learning

Participants emphasized that digital health financing systems should be continuously improved based on feedback from users and other stakeholders. They also suggested that Nigeria could learn from successful digital payment systems implemented in other countries to strengthen health financing.

One participant stressed the importance of responding promptly to stakeholder feedback:

"I think it's quick response to feedback. Maybe quick response to feedback from everybody, the client, the staff, or anybody. Just quick response to feedback." (KII 2, Male, Group Head, Retail Partnership, AXA Mansard)

Another participant cited Kenya's mobile money platform as an example of how digital payment systems can facilitate health financing.

"I know that Kenya is very big on mobile money and that helps their own system to be very big. In terms of collecting money, paying money. They have M-Pesa. It's very easy to use. You don't have to carry cash around." (KII 3, Female, Unit Head, AXA Mansard)

Participants further expressed optimism that wider adoption of digital health financing would encourage more people to enroll in health insurance and contribute to long-term growth of the system.

"Because it solves a lot of problems, you may find that people who are not directly connected to health insurance may begin to embrace it. It's going to grow." (KII 17, Male, Deputy Director, Enrollment & Underwriting, OYSHIA)

DISCUSSION

This study explored the implementation, operational realities, behavioural drivers, and policy implications of Digital Technologies for Health Financing (DTHF) within Nigeria's health insurance ecosystem,

drawing on the perspectives of 17 key informants spanning public health insurance agencies, HMOs, FinTech companies, and payment service providers. The findings illustrate that DTHF is not a single intervention but a layered ecosystem of technologies, actors, and incentives that together shape whether digital tools translate into meaningfully expanded and sustained health insurance coverage.

Digital Technologies as an Equity and Efficiency Mechanism

Participants consistently framed DTHF as more than a technical upgrade to premium collection, describing it instead as a deliberate strategy for reaching rural and informal-sector populations who have historically been excluded from formal health insurance. This finding aligns with broader evidence that digital financial technologies can extend the reach of formal financial services, including insurance, into populations with limited access to conventional banking infrastructure [5, 7, 8, 12]. The similar emphasis on transparency and reduced financial leakage repeats global arguments that digitized transaction records strengthen accountability in health financing by generating auditable, real-time data rather than relying on manual reconciliation. Taken together, these findings suggest that DTHF, in the Nigerian context, is being positioned by stakeholders as simultaneously an equity tool and a governance tool, a dual framing that has implications for how success is measured: coverage expansion alone would be an incomplete indicator without corresponding gains in financial accountability.

Interoperability as a Precondition for Scale

The interoperability theme emphasizes that DTHF cannot function as a standalone innovation within any single organization; it depends on API-driven linkages between insurers, telecommunications companies, and payment processors. This is broadly consistent with health financing literature that identifies system-level digital architecture, rather than isolated digital tools, as the binding constraint on scaling innovative financing mechanisms [4, 6, 7, 10]. The commercial alliances described by participants, such as embedding health micro-premiums into airtime purchases, represent a pragmatic adaptation of existing FinTech and telecom infrastructure rather than the construction of parallel systems, which may partly explain the relatively rapid uptake described by private-sector informants. However, this reliance on multiple external platforms also introduces fragmentation risk: without harmonized standards such as FHIR, integration may remain bilateral and organization-specific rather than forming a truly interoperable national ecosystem.

Infrastructural and Human Resource Constraints

Despite the optimism expressed around digital transformation, participants were candid about the operational fragility underlying DTHF implementation, including app-hosting licensing delays, network and power outages, and high staff turnover requiring continuous retraining. These findings resonate with prior qualitative work on digital health implementation in sub-Saharan Africa, which similarly identifies infrastructural unreliability and workforce instability as persistent, unresolved barriers rather than

transitional teething problems [9, 10]. The continued reliance on parallel paper and Excel-based backup systems, described by public-sector informants, suggests that digital transformation in Nigeria's health insurance sector is currently additive rather than substitutive; digital systems are layered onto, rather than replacing, manual processes. While this hybrid approach provides resilience against outages, it may also limit the efficiency gains that DTHF is intended to deliver, and it raises questions about the true cost of maintaining dual systems over the long term.

Governance and Regulatory Architecture

The NHIA Act of 2022 emerged as a pivotal reference point for participants, particularly those in public agencies, who described it as formalizing stakeholder roles and providing legal backing for mandatory enrollment [3]. This suggests that the 2022 reform may be functioning as more than a coverage mandate; it appears to be shaping how implementers understand their institutional obligations around digital data handling and inter-agency coordination. At the same time, participants' emphasis on compliance with the Nigeria Data Protection Regulation reflects a growing awareness that DTHF systems handle sensitive medical and financial data whose mishandling carries both ethical and reputational risk. The coexistence of insurance-specific regulation (NHIA) and financial-sector regulation (CBN oversight of payment partnerships) also points to a regulatory architecture that is still maturing in its coordination across sectors, a gap that could become more consequential as digital health financing scales.

Behavioural Dimensions of Retention

The findings on reminder systems and automatic renewal highlight that technology adoption in health financing is not purely a matter of infrastructure but also of behavioural design. Participants' attention to the timing of reminders relative to salary cycles, and their recognition that automatic renewal can both prevent lapses caused by forgetfulness and simultaneously raise concerns about sharing banking details, reflects a nuanced, practice-based understanding of enrollee behaviour that is often absent from purely technical accounts of digital health financing. This suggests that behavioural design, rather than digital infrastructure alone, may be an underappreciated lever for improving retention, and that future DTHF interventions in Nigeria could benefit from more deliberate integration of behavioural science principles alongside technical system design.

Implications for Scaling Toward Universal Health Coverage

Participants' repeated references to political commitment, cross-agency collaboration, and international benchmarks such as Kenya's M-Pesa suggest that stakeholders view DTHF scale-up as contingent on factors beyond the health sector itself. This is consistent with Nigeria's broader UHC literature, which has long identified fragmented governance and inconsistent political prioritization, rather than technology availability per se, as central obstacles to expanding financial protection [1, 2, 13, 14]. The findings of this study extend that of literature by showing that even where digital tools are technically available and

being actively deployed by motivated private and public actors, their impact on national coverage targets remains bounded by the same structural and political factors that have historically constrained Nigeria's health financing reforms.

Strengths and Limitations

This study's principal strength lies in its multi-sectoral sampling, which captured perspectives from public insurance agencies, HMOs, FinTech companies, and payment service providers, allowing triangulation across actors who are rarely studied together despite occupying the same implementation ecosystem. However, several limitations should be noted. First, the purposive sampling of senior and technical personnel means the findings reflect an implementer-side perspective; enrollee and end-user experiences of DTHF were not directly captured and would benefit from complementary research. Second, participants were drawn from four states and the FCT, and while this provided useful geographic variation, findings may not fully generalize to Nigeria's remaining states, particularly those with more limited digital and telecommunications infrastructure. Third, as with all qualitative interview-based research, responses may be subject to social desirability bias, particularly among participants describing their own organizations' performance.

Conclusion

Digital Technologies for Health Financing are being actively deployed across Nigeria's public and private health insurance landscape as a mechanism for expanding coverage, improving financial transparency, and supporting progress toward Universal Health Coverage. However, their effectiveness is shaped by a constellation of factors extending well beyond the technology itself, including interoperability across sectors, infrastructural reliability, workforce stability, regulatory coherence, and the behavioural responsiveness of enrollees. Sustained progress will likely depend less on further technological innovation and more on strengthening the institutional, regulatory, and behavioural systems within which these technologies operate.

Declarations

Acknowledgements

The authors would like to acknowledge the efforts and time of respondents of this study

Ethical Approval

Ethical approval for this study was obtained from National Health Research Ethics Committee of Nigeria prior to commencement of the study NHREC Approval Number NHREC/01/01/2007-06/10/2023. The study was conducted in accordance with the Declaration of Helsinki and all applicable institutional and national guidelines governing research involving human participants.

Consent to Participate

Written informed consent was obtained from all participants prior to data collection. Participants were informed of the purpose of the study, the voluntary nature of their participation, their right to withdraw at any time without consequence, and the measures taken to ensure the confidentiality and anonymity of their responses. All interview transcripts were de-identified, and participants were assigned unique identification codes (KII 1–KII 17) to protect their identities.

Consent to Publish

Not applicable. This manuscript does not contain any individual person's data in any form (including individual details, images, or videos) that would require additional consent for publication. All participant quotations included in this manuscript are anonymized and reported using non-identifying codes (KII 1–KII 17).

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors

Competing Interests

The authors declare no conflict of interest.

Clinical Trial Number

Not applicable. This study is not a clinical trial.

Data Availability

The datasets generated and analyzed during the current study (de-identified interview transcripts) are not publicly available due to the sensitive nature of the qualitative data and the need to protect participant confidentiality, but are available from the corresponding author on reasonable request, subject to ethical approval and institutional data-sharing agreements.

Author Contributions

- Emaraobhazi Christian Aquah: Conceptualization, Methodology, Data curation, Formal analysis, Investigation, Writing – original draft.
- Ademola Marvellous Adeyemi: Conceptualization, Methodology, Formal analysis, Writing – original draft, Writing – review & editing.
- Sunday Stephen Effiong: Investigation, Data curation, Writing – review & editing.
- David Ayobami Adewole: Supervision, Conceptualization, Validation and Supervision.

All authors read and approved the final manuscript.

References

1. Alawode GO, Adewole DA. Assessment of the design and implementation challenges of the National Health Insurance Scheme in Nigeria: a qualitative study among sub-national level actors, healthcare and insurance providers. BMC Public Health. 2021;21:124. https://doi.org/10.1186/s12889-020-10133-5.
2. Essien NL. Financial risk protection and Nigeria's journey towards universal health coverage. Npj Health Syst. 2025;2:17. https://doi.org/10.1038/s44401-025-00021-8.
3. Ipinnimo TM, Durowade KA, Afolayan CA, Ajayi PO, Akande TM. The Nigeria National Health Insurance Authority Act and its Implications towards Achieving Universal Health Coverage. Nigerian Postgrad Med J. 2022;29:281–7. https://doi.org/10.4103/npmj.npmj_216_22.
4. Meessen B. The Role of Digital Strategies in Financing Health Care for Universal Health Coverage in Low- and Middle-Income Countries. Glob Health Sci Pract. 2018;6:S29–40. https://doi.org/10.9745/GHSP-D-18-00271.
5. Okuzu O, Malaga R, Okereafor K, Amos U, Dosunmu A, Oyeneyin A, Adeoye V, Sambo MN, Ebenso B. Role of digital health insurance management systems in scaling health insurance coverage in low- and Middle-Income Countries: A case study from Nigeria. Front Digit Health. 2022;4:1008458. https://doi.org/10.3389/fdgth.2022.1008458.
6. Oranje M, Mathauer I. Exploring the effects of digital technologies in health financing for universal health coverage: a synthesis of country experiences and lessons. Oxf Open Digit Health. 2024;2:oqae016. https://doi.org/10.1093/oodh/oqae016.
7. Awosiku OV, Gbemisola IN, Oyediran OT, Egbewande OM, Lami JH, Afolabi D, Okereke M, Effiong F. Role of digital health technologies in improving health financing and universal health coverage in Sub-Saharan Africa: a comprehensive narrative review. Front Digit Health. 2025;7:1391500. https://doi.org/10.3389/fdgth.2025.1391500.
8. Nsiah-Boateng E, Musah M, Akuamoah CD, Asenso-Boadi F, Andoh-Adjei F-X, Boye BO. Effect of mobile phone-based health insurance contribution payment system on retention of coverage in the National Health Insurance Scheme in Ghana: an evaluation study. BMC Health Serv Res. 2023;23:239. https://doi.org/10.1186/s12913-023-09236-7.
9. Kiberu VM, Namuhani N, Ekirapa E, Aweko J, Opio C, Kanobe F, Wakholi P, Abuya T, Mcconnell M, Hamani A, Jama IH, Ediau M, Bello S, Adewol D, Fawole OI, Acray-Zengbe P, Arhinful D, Bediang G, Faye A, Mohamed Mboup FZ, Ndiaye S, Niang K, Obotela N, Waiswa P. A landscape analysis of enablers and barriers to digital payments to health workers during large-scale immunisation campaigns in sub-Saharan Africa: a scoping review and in-depth interviews. Global Health Action. 2026;19:2675098. https://doi.org/10.1080/16549716.2026.2675098.
10. Schuetze L, Srivastava S, Missenye AM, Rwezaula EJ, Stoermer M, De Allegri M. Factors Affecting the Successful Implementation of a Digital Intervention for Health Financing in a Low-Resource Setting at Scale: Semistructured Interview Study With Health Care Workers and Management Staff. J Med Internet Res. 2023;25:e38818. https://doi.org/10.2196/38818.

11. Braun V, Clarke V. Using thematic analysis in psychology. Qualitative Res Psychol. 2006;3:77–101. https://doi.org/10.1191/1478088706qp063oa.
12. Pioch C, Struckmann V, Brikci N, De Allegri M, Emmrich JV, Knauss S, Mathauer I, Opoku D, Quentin W. Digital technologies for health financing in low-income and middle-income countries: a scoping review protocol. BMJ Open. 2024;14:e080132. https://doi.org/10.1136/bmjopen-2023-080132.
13. Adeoye MI, Obi FA, Adrion ER. Stakeholder perspectives on the governance and accountability of Nigeria's Basic Health Care Provision Fund. Health Policy Plann. 2024;39:1032–40. https://doi.org/10.1093/heapol/czae082.
14. Croke K, Ogbuoji O. Health reform in Nigeria: the politics of primary health care and universal health coverage. Health Policy Plann. 2024;39:22–31. https://doi.org/10.1093/heapol/czad107.