

Effective Institutional and Technological Factors for integration and linkage of Health Records in Tertiary Health Care Delivery

*Abubakar Alhassan, Best Odinioha, Femi Macaulay, Muhammad B. Muhammad, Mustapha Abubakr Madaki

Department of information Technology and Health Informatics Federal University of Health Science Azare, Bauchi State, School of Health Information Management Abubakar Tafawa Balewa University Teaching Hospital Bauchi

Correspondence: abubakar.alhassan@fuhhsa.edu.ng

Abstract

Background

Health records linkage has become essential components of modern health care delivery enabling seamless access to patient information, improved decision-making, and enhanced continuity of care. Adoption of digital health technologies face significant challenges to achieving effective health records linkage. Institutional policy support, adequate funding and strong ICT governance were identified as facilitators of successful integration. A need for a standardized framework for electronic health records linkage, capacity building of personnel, and improved collaboration between health record and IT departments is required.

Methodology

This study employed a descriptive research design, because it allows the researcher to collect data from a large population, describing the existing of conditions, perceptions, and practices by the use of questionnaires and interviews to about 118 respondents from health information officers, medical practitioners, and IT professionals across selected tertiary hospitals in Bauchi State.

Results

Findings provide insights for policymakers, hospital administrators and health informatics experts toward achieving a unified, efficient, and effective patient-centered health information management system. Its reveal that technical infrastructure limitations, lack of interoperability, inadequate staff training, data privacy concerns and organizational resistance to change are major factors hindering effective health records linkage.

Conclusion

Health records linkage is combined the technical, organizational, and human factors that requires not only modern infrastructure but the commitment of institutional leadership, skilled personnel, and adequate financial resources. Implementing these measures will improve service delivery, patient safety, and the overall quality of healthcare outcomes.

Keywords: Health Records Integration, Health Records Linkage, Tertiary Health Facilities, Health Information Systems, Interoperability.

INTRODUCTION

In modern healthcare, the ability to effectively link health records serves as a cornerstone for operational success and patient safety. Health record linkage is the systematic process of connecting disparate patient data points often scattered across various departments, specialized clinics, and external facilities to synthesize a comprehensive and

continuous longitudinal medical history (Kharrazi et al., 2021).

In the tertiary institutions, where clinical complexity is high, this integration is particularly vital. by consolidating fragmented data to facilitate coordinated care, minimize diagnostic redundancies, and ensure that high-quality medical services are

delivered based on a holistic view of the patient's journey (Sayeed et al., 2020).

In recent years, the global transition toward Electronic Health Records (EHRs) has redefined the landscape of health data management, offering a mix of transformative opportunities and systemic hurdles. In developed nations, health record linkage is often underpinned by sophisticated health information infrastructures and the implementation of National Health Identifiers (NHIs), which facilitate the seamless integration and real-time accessibility of patient data across the care continuum (Hersch et al., 2022).

The landscape in many developing regions, particularly in Nigeria, reflects a fragmented digital evolution, where the transition from traditional paper-based archives to digital systems has been characterized by inconsistency and a lack of standardized protocols (Adeleke et al., 2021). This digitization often results in significant record fragmentation, data duplication, and the intermittent loss of vital patient information, which can compromise clinical decision-making and longitudinal care (Ojo & Adebayo, 2023).

In Nigeria's major referral centers and medical training institutions share a volume of clinical complex of patient data present for the management challenge. These often serve thousands of patients monthly across a diverse spectrum of specialized medical services (Adebayo et al., 2022). In such environments, the precise linkage of patient records is not merely a logistical goal but a clinical imperative, underpinning medical education, research, and institutional administrative efficiency (Bello & Oyekunle, 2023).

Despite its importance, the realization of a unified patient health record in these settings is frequently obstructed by systemic barriers. Research indicates that inadequate IT infrastructure and a lack of interoperability between disparate departmental systems create "data silos" (Esan et al., 2021). While the absence of standardized patient identifiers and insufficient specialized training for healthcare staff continue to undermine the accuracy and reliability of record linkage efforts (Jimoh et al., 2024).

Benefits of Health Record Linkage on clinical accuracy that reduces the risk of medication errors by providing a full history of prescriptions and allergies. Operational Efficiency eliminates the need for duplicative testing, saving both time and institutional resources. Enhanced Research and supports large-scale epidemiological studies by providing high-fidelity data sets (O'Keefe et al., 2023).

Barriers to Effective Health Records Linkage Identify Infrastructure Deficits, Frequent power instabilities and limited hardware availability hinder consistent digital entry. The Interoperability Gaps in different departments (e.g., Radiology vs. Laboratory) often utilize software that cannot "talk" to one another. Standardization Issues dependence on manual name-based searches rather than biometric or universal identifiers leads to high rates of duplication (Esan et al., 2021). Lot of Human Factors ranging from resistance to change and a lack of ongoing technical support for frontline clinicians. The failure to link patient health records carries significant clinical and economic risks often results in a poor view of patient history, which directly contributes to unnecessary repetition of diagnostic tests, and critical delays in treatment (Gullifer et al., 2022). The inefficiencies compromise patient safety through potential medication errors and overlooked contraindications and drive up the overall cost of healthcare delivery within the system (World Health Organization [WHO], 2021).

Beyond the individual patient, the absence of a unified health record system has broader public health implications ranging from incomplete data sets that obstruct a robust disease surveillance and limit the accuracy of health planning and policy development (Abubakar et al., 2023). Without integrated records, healthcare administrators struggle to identify epidemiological trends, making it difficult to allocate resources effectively during health crises.

These challenge numerous healthcare institutions to begun initiating digital transformation strategies which remains remarkably uneven across different regions and facilities (Ojo & Adebayo, 2023). The theoretical benefits of health records digitization are

well-understood while the practical transition is often stalled by localized socio-technical factors.

It is essential to investigate the specific barriers to effective health record linkage and identify the source of unique hurdle that are prerequisite for designing targeted interventions and meaningful policy reforms that can actually bridge the gap between fragmented data and integrated care (Jimoh et al., 2024).

Requirements for Digital Transformation: digital transformation need assessment and evaluating existing digital literacy and infrastructure readiness. **Localization** tailoring health information systems to fit the specific workflow of the institution. By developing policy alignment and ensuring local practices meet national health data standards to facilitate future interoperability. **Data Consolidation** merging health records from pharmacy, radiology, and clinical notes. **Unique Identification** utilizing consistent identifiers to ensure data belongs to the correct individual. **Real-Time Accessibility:** Ensuring the unified record is available at the point of care.

In the contemporary healthcare landscape, the accurate and timely exchange of patient data among practitioners is a fundamental prerequisite for efficient service delivery. Health Record Linkage (HRL) systematically integrate patient information from sources into a comprehensive view (Kharrazi et al., 2021).

This process is critical within the clinical environment that characterized by high-acuity cases and multidisciplinary care teams of specialists and primary clinicians who need to have access to a single "source of truth" regarding a patient's medical history essential for reducing diagnostic errors and streamlining complex treatment pathways (Sayeed et al., 2020).

Digital health advanced globally, healthcare systems in developing nations like Nigeria, continue to struggle with sustainability of robust health record linkage (HRL) systems. This gap is often attributed to the "digital divide," where resource-constrained environments lack the necessary infrastructure to maintain consistent data integration (Hersch et al., 2022).

The failure to establish effective health records linkage mechanisms leads to systemic inefficiencies, inability to bridge disparate data sources results in fragmented care, as clinicians lack a holistic view of the patient's history. This triggers a cascade of negative outcomes, escalated healthcare expenditures, and diminished clinical results (Ojo & Adebayo, 2023).

In Nigeria, major referral centers and teaching hospitals manage an immense volume of patients complex medical data, where health record system is a direct determinant of clinical outcomes (Adebayo et al., 2022). Despite their central role in the healthcare hierarchy, these institutions often struggle to maintain cohesive patients data streams. The optimization of health record linkage is consistently undermined by a constellation of systemic issues which complicate the matching of patient identities (Sean et al., 2021). Limited technical capacity among staff and persistent administrative bottlenecks create an environment where patient information remains siloes rather than integrated (Jimoh et al., 2024).

Consequences of Ineffective Linkage in Developing Systems in Clinical Inefficiency and fragmented care leads to "information gaps" where critical data like allergies or previous surgeries are missed, **Economic Burden** Duplicate testing places an unnecessary financial strain on both the patient and the overstretched public health budget (World Health Organization [WHO], 2021). **Outcome Disparity:** Poor data continuity is directly linked to higher rates of medical errors and delayed interventions.

METHODOLOGY

Research Design

The study is a descriptive survey research design. This is appropriate because it allows the researcher to collect data 118 respondents using a simple random sampling method from a large group of individuals to analyze their opinions, experiences, and perceptions regarding the implementation and effectiveness of health record linkage a questionnaire is use to collect data and identify patterns, relationships, and factors that influence the

process of linking patient health records in a tertiary hospital setting.

RESULT

Questionnaire was distributed for Data collection to support this study one hundred and eighteen (118)

respondents were selected to respond to the structure interview, out of 118 eight (8) questionnaires were missing making the number of respondents to one hundred and ten (110) completed and returned back for analysis.

Table 1. Demographic Characteristics of Respondents

Variable	Category	Frequency	Percentage (%)
Gender	Male	65	59.1%
	Female	45	40.9%
	Total	110	100%
Age	20–30 years	24	21.8%
	31–40 years	53	48.2%
	41–50 years	25	22.7%
	51+ years	8	7.3%
	Total	110	100%
Department	Medical	25	22.7%
	Records	30	27.3%
	Administration	20	18.2%
	Nursing	25	22.7%
	IT	10	9.1%
	Total	110	100%
Years of Experience	1–5 years	34	30.9%
	6–10 years	41	37.3%
	11+ years	35	31.8%
	Total	110	100%

Field survey 2025

Table 2. Knowledge of Health Record professional toward Health Record Linkage

Statement	SA	A	D	SD	Total	Mean	Interpretation
I am aware of the concept of health record linkage	50	40	12	8	110	3.20	High Awareness
has initiatives aimed at linking patient health records	38	30	24	18	110	2.71	Moderate Awareness
I have received training on health information systems	29	25	30	26	110	2.50	Fair Awareness

Field survey 2025. Interpretation: The findings show that awareness is relatively high, awareness, knowledge of respondents on health records linkage indicates that, 38% of the respondents strongly agreed they have initiated the concept of linking health record, 29% from the respondents also strongly agreed that they have received training on health information linkage.

Table 3. Barrier of Health Record professional toward health record Linkage

Factor	SA	A	D	SD	Total	Mean	Interpretation
Lack of unique patient identifiers	52	39	10	9	110	3.22	Strong Agreement
Incompatible software systems	44	38	17	11	110	3.05	Agreement
Inadequate infrastructure (electricity, internet)	56	36	11	7	110	3.28	Strong Agreement
Insufficient training of staff	41	40	18	11	110	3.01	Agreement
Resistance to change from staff	30	35	30	15	110	2.75	Moderate Agreement

Field survey 2025. Interpretation: The most commonly cited barriers are lack of unique patient identifiers with 52% of responses, 44 admit that incompatible software system is the barriers that hinder implementation, 56% strongly agreed that infrastructure inadequacy hinder it implementation, 41% insufficient training of staff affect the system of health record linkage, only 30% of the respondents strongly followed resistance to change as a barrier to health records linkage.

DISCUSSION

The findings of this study highlight that health record linkage is not merely a technical upgrade but a transformative socio-technical intervention essential for the modernization of health care delivery system. The transition from fragmented, hybrid systems to an integrated data environment offers a pathway to clinical excellence, though it remains hindered by deep-seated structural challenges.

As observe, health records linkage serves as a necessary bridge toward full digitization. While these systems allow for a gradual transition, this study confirms often introduce data resynchronization risks "dual-entry" burden where staff must update both physical folders and digital portals not only increases the workload but also heightens the probability of medical errors due to conflicting information

The study reinforces on success of health record linkage as contingent upon the harmony between Human, Organizational, and Technical factors. This reveals that even the most sophisticated EHR platforms fail in the absence of leadership commitment and staff digital literacy, infrastructural deficits specifically erratic power supply act as a "hard ceiling" on the reliability of linked records. Without a stable foundation of electricity and ICT infrastructure, the clinical benefits of linkage, such as reduced duplicate testing and improved emergency response, remain intermittent at best.

The potential of health record linkage enhance continuity of care is perhaps significantly contribute to medical practices. By enabling a "single source of truth," linkage ensures that a patient's medical history follows them across departmental silos, which is crucial in multidisciplinary teaching hospitals Furthermore, for research-intensive

institutions, the ability to conduct studies through linked data is a game-changer for evidence-based medicine in West Africa, moving beyond anecdotal clinical observations to high-fidelity population health data.

CONCLUSION

Health record linkage offers significant benefits for healthcare delivery, various challenges must be addressed for it to be successfully implemented in health care institutions, adopting the recommended strategies will improve health record systems, leading to enhanced patient care, better management of healthcare resources, and effective healthcare service delivery. Findings of this research reveal that health record linkage is currently hindered by multiple factors, including technical, financial, and organizational barriers. Despite these challenges, the benefits of linking health records are clear, with improvements in care quality, reduced errors, and better resource allocation. without addressing key issues such as infrastructure, standardization, and adequate training, the full potential of health record linkage cannot be realized in healthcare institutions. It is evident from the study that a holistic approach involving the adoption of compatible systems, comprehensive staff training, and adequate funding is needed to enhance the success of health record linkage efforts in Nigeria's healthcare system.

REFERENCES

- Adebayo, O., et al. (2022). Managing complex patient data in Nigerian teaching hospitals: A review of current practices. *Nigerian Journal of Clinical Practice*.
- Esan, O., et al. (2021). Challenges of implementing electronic health records in tertiary hospitals in Nigeria. *Health Information Management Journal*.
- Gullifer, J., et al. (2022). The cost of disconnection: Patient safety risks in fragmented healthcare systems. *Journal of Patient Safety and Quality Improvement*.
- Hersch, W. R., et al. (2022). Global EHR implementation: A comparative analysis of high-income and low-income countries. *International Journal of Medical Informatics*.
- Jimoh, L., et al. (2024). Human and technical barriers to data integration in African referral centers. *International Journal of Digital Health*.
- Kharrazi, H., et al. (2021). The role of data linkage in improving health outcomes. *Journal of Medical Systems*.
- Ojo, O. I., & Adebayo, T. T. (2023). Barriers to electronic health record adoption in West African clinical settings. *Journal of Health Informatics in Developing Countries*.
- Sayeed, S., et al. (2020). Interoperability and patient record linkage in modern medicine. *Digital Health Review*.
- WHO. (2021). *Global strategy on digital health 2020–2025*. World Health Organization.