The Role of Government Policies in Interoperability Standards for Laboratory Information Systems: A Bibliometric Analysis Literature Review

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Abstract

There are several benefits of interoperability in Laboratory Information Systems (LIS) in public health. They include enhanced data management, continuous data exchange, enhanced disease tracking, and better decision-making. Although Policies like the Kenya Health Act, the Data Protection Act, and the Kenya Health Information Systems Interoperability Framework have been developed by the Kenyan government to support LIS integration, there are areas such as inadequate execution procedures, disjointed health information systems, inadequate funding, and privacy concerns that still hinder advancement in execution. The study's approach focuses on the role government policies play in guiding LIS interoperability standards. More so, it assesses international top practices and points out the policy gaps that exist in Kenya and emphasizes any evolving challenges. This research includes a bibliometric analysis and literature review of the government policies that influence LIS interoperability between 2016 and 2024. Based on 82 peer-reviewed articles indexed in Scopus, Google Scholar, and PubMed, we examine publication trends, influential authors and institutions, citation networks, and regional scope. The analysis is informed by Data Management Theory (DMT), which calls for governance models to shape organizations. According to the findings, relevant policies exist; however, implementation and funding remain inadequate. The findings suggest increased scholarly interest in LIS interoperability, as well as a gradual shift from technical-oriented literature to policy-related debates. Nevertheless, Africa is underrepresented in high-impact papers, albeit with considerable innovations on a field level. The results further indicate inadequate empirical assessments of policy impact, weak public-private partnerships, and a lack of long-term policy evaluations. Further research ought to focus on fruitful case studies of LIS integration, customizing international standards to the Kenyan setting, and investigating the use of emerging technologies, for example, AI and blockchain, to boost interoperability standards in public health healthcare laboratory systems.

Keywords: Interoperability, Standards, LIS, Public Health, Government Policy, Health Systems, Digital Health

1. Introduction

According to Nyangena et al. (2021), healthcare systems should be able to integrate and share data across their networks for public health decision-making, disease tracking, and patient care. In this sense, Laboratory Information Management Systems (LIMSs) enable correct data capture, effective workflows, and appropriate reporting as confirmed by Turner et al. (2021). Nevertheless, interoperability challenges hinder the seamless exchange of laboratory data, particularly in low- and middle-income countries (LMICs) such as Kenya. As confirmed by Bagyendera et al. (2023), such challenges are due to disjointed Health Information Systems

(HIS), inadequate standardized data sharing protocols, plus weak policy implementation mechanisms. Chuma and Ngoepe (2024) indicate that Government policies play a key role in developing LIMS interoperability standards, influencing regulatory frameworks, resource allocation (such as funding), and system integration approaches.

Countries across the globe have developed interoperability policies together with regulatory frameworks for seamless health information exchange. In the United States of America (USA), frameworks FHIR and HL7 have been adopted by the Health Insurance Portability and Accountability Act (HIPAA) and the 21st Century Cures Act for standardized electronic health data sharing. Similarly, *OECD*, (2021) Confirms that the General Data Protection Regulation (GDPR) implements stringent data privacy and interoperability requirements in Europe. Further evidence given by Nzarama et al., (2024) Indicates that, in Africa, countries such as South Africa and Rwanda have successfully established national eHealth policies to promote LIS integration with larger health systems.

According to Kansiime et al., (2024) there are huge steps made in Kenya in developing health information policies to support its digital health change. Kenya Health Act 2017 approves the standardization of electronic health records, while the Kenya Data Protection Act 2019 provides a legal framework that guarantees health data security as well as sharing. Moreover, the Kenya Health Information Systems Interoperability Framework (KHISIF) provides technical guidelines for integrating LIS with national health systems. Musabi and Kipkebut (2024) confirm that while expressive policy efforts have been observed, challenges remain evident. They note that gaps persist, stressing inconsistent implementation, inadequate financial support for interoperability, and an uneven approach to system adoption that continues to impede progress. A number of public health laboratories still operate in poor conditions, thereby hindering the concurrent sharing of laboratory data and its integration into national health decision-making.

The literature on health information interoperability primarily discusses Electronic Medical Records (EMRs) and hospital management systems, with limited focus on laboratory data integration. Additionally, policies are in place to encourage digital health interoperability, but their implementation mechanisms are weak, and their impact on public health data management is not well documented, as confirmed by Allen (2023). According to Oluwole et al. (2022), it is essential to understand the role of government policies in shaping LIS interoperability and data governance to develop strategies that boost data sharing, enhance patient care, and

strengthen national health systems. This paper explores how government policies affect interoperability standards in LIS in the Kenyan public health sector. Precisely, it seeks to find to examine the theoretical foundations supporting interoperability and data governance in LIS, review and analyze prevailing government policies connected to LIS interoperability standards at international, regional, and national levels, detect gaps and challenges in LIS policy implementation in Kenya, compare Kenya's policy landscape with international top practices in LIMS interoperability with an opinion of suggesting recommendations for strengthening policy-driven LIS integration.

In order to attain this objective, the paper is organized as follows: Section 2 explores the theoretical framework supporting LIS interoperability and policy influence. Section 3 offers a comprehensive literature review and discussion, analyzing international and Kenyan policy frameworks, as well as their impact on LIS. Section 4 discusses the methodology for selecting and reviewing the available literature. In Section 5, the findings and discussion are presented, and Section 6 covers the conclusions and recommended future research tips. Finally, Section 7 outlines the study's inferences on solidification LIS interoperability.

2. Theoretical Underpinning of the Study

Theoretical frameworks form a basis for understanding how government policies shape interoperability standards and data management in LIS. The theory supports understanding the multifaceted connection between government policies and interoperability standards in public health laboratory systems. It is important to focus the discussion within the appropriate theoretical framework.

2.1 Data Management Theory

This study is founded on Data Management Theory (DMT), which offers us comprehensive guidance on how to effectively manage data in organizations. The core tenets of data governance, data quality, data security, and data interoperability from Data Management Theory (DMT) are vital to understanding the difficult challenges involved in integrating LIMS in Kenya's public health sector.

The cornerstone for contemporary data management is Edgar F. Codd's (1970) research on relational databases. From this perspective, his principles of data organization, normalization, and querying are fundamental to DMT. Building on Codd's idea, Richard Wang and Diane Strong (1996) introduced the concept of data quality (Wang et al., 2001). Building on this,

Thomas H. Davenport and Laurence Prusak (1998) and David Loshin (2001) extended the theory into knowledge management alongside enterprise data quality (Loshin, 2010).

This theory serves as the basis for evaluating the influence of government policy on LIS interoperability and data governance in Kenya's public health laboratories. It provides a contextual insight into the implications of policy-driven data management practices on laboratory data quality and on the potential implementation of interoperability standards that contribute to improved data integration across different health information systems and the difficulties encountered in carrying out data governance policies within decentralized health systems, making it relevant to this study.

2.2. Review of Related Literature

A well-structured Health Information System that adheres to approved standards supports patient care, disease tracking, and decision-making. Oluwole et al., (2022) maintain that, despite LIS's important role in the management and sharing of laboratory data, interoperability remains a major challenge. Government policies should guide LIS interoperability through data governance standards, enforcing compliance, and supporting system integration with adequate resources. This section examines the existing literature on policy-led LIS interoperability and identifies the main challenges, global best practices, and areas requiring further research.

In its quest to regulate health data exchange, many countries have established policies. The Health Insurance Portability and Accountability Act (HIPAA) in the U.S.A. also helps ensure data security and privacy by enabling interoperability between healthcare systems. As an example, the 21st Century Cures Act requires that formats of data sharing, such as HL7 FHIR, be standardized, supporting Ejaz and Gimah (2024). This has thus improved health sector data accessibility. In the EU, as seen too, we see in the General Data Protection Regulation (GDPR), which demands data protection rules, despite the encouragement to build standardized interoperability frameworks (OECD, 2019). In Africa, South Africa's National Digital Health Strategy (2020-2024) emphasizes OpenHIE and HL7-based standards for interoperability of the LIS and Rwanda's eHealth policy promotes inclusion of the LIS with national health records (Muinga et al., 2018).

Kenya has established policies designed to enhance LIS interoperability. Some of them include: Kenya Health Act 2017 (which acknowledges eHealth as a priority and requires standardization in the sharing of health information); Kenya Data Protection Act 2019, which provides legal foundations for data privacy, data security and ethical data sharing according to Nyangena et

al. (2021). Furthermore, the Kenya Health Information Systems Interoperability Framework (KHISIF) also guides the integration of the LIS with national health systems. Nevertheless, enforcement remains inconsistent, and adoption is slow (Inau et al., 2022). As noted by Barasa et al. (2017), despite Kenya's establishment of LIS interoperability policies, the problem is the weak implementation and compliance procedures. They further note that many public health laboratories continue to work in silos, thereby hindering active data exchange.

There is evidence that the country's healthcare system is underfunded, limiting investment in LIS infrastructure. Moreover, nations depend on state funding, and therefore interoperability initiatives often face budget constraints, which reduce system upgrades and policy implementation, as noted by McCollum et al. (2018). Numerous health information systems found in Kenya function autonomously, lacking an integrated framework. Muinga et al. (2018) posit that the lack of standardization results in data irregularities and integration difficulties across LIS and other healthcare platforms. Ndayikunda et al. (2024) argue that, although the Kenya Data Protection Act 2019 reinforces data security, strict compliance requirements can hamper real-time data exchange, as observed. Balancing privacy with interoperability remains a challenge that needs attention.

Comparison of Kenya's LIS interoperability policies with those of the United States of America (USA), Europe, and other African countries emphasizes significant differences: In the USA, for example, there is robust policy implementation through monetary incentives and consequences for non-compliance, which has executed standards virtually obligatory, as noted by Alonge (2025). In the European Union (EU), the General Data Protection Regulation (GDPR) ensures cross-border interoperability of health data through stringent privacy guidelines that place the burden of compliance directly on the data controller. According to Nguyen (2019), in Africa, South Africa appears to be among the countries that have taken steps to integrate OpenHIE standards into its digital health strategy, which has been implemented on a large scale in the country. Other local countries that have taken steps to ensure policies are in place and have followed up on their implementation include Rwanda and Uganda. In Rwanda, for example, there are national-level policies; however, they do not clearly encourage health Information exchange. In Uganda, interoperability standards have been developed. However, the implementation remains a challenge. Various health information systems implemented use an array of data formats without adhering to the set standards, hindering effective data exchange (Bagyendera et al., 2023). The situation in Rwanda and Uganda is similar to that in Kenya, where policies exist but have inadequate enforcement and stakeholder collaboration in

their implementation. This is further complicated by the fact that healthcare provision is a devolved function in Kenya's devolved form of governance.

3. Methods and Materials

A narrative literature review style was adopted to enable an exhaustive and flexible study of government policies on LIS interoperability and data management in Kenya. In addition, bibliometric analysis was used to systematically investigate trends, citation practices, and research gaps in the area of LIS policy, particularly in low- and middle-income countries such as Kenya.

Narrative review was the primary approach to synthesizing the literature. It allowed for a broad analysis of global and local analyses, providing a panoramic view of LIS interoperability and government policy. This approach allowed for a variety of views, from theoretical explanations to case studies and policy documents. To support our narrative literature review and ensure a comprehensive analysis of the existing academic literature, a bibliometric analysis of the available literature regarding LIS interoperability and government policy was conducted. Bibliometric analysis is research that uses a mathematical method and statistical analysis tool to analyze published research, detect trends, and analyze the impact of research within a given area quantitatively.

Bibliometric analysis further reinforced this method. It offered a comprehensive view of citation networks, the authors who are significant in them, and the interconnectedness among major research themes. The main objectives of this analysis were: Identify the most influential studies and authors in the field of LIS interoperability policies, predominantly those focusing on LMICs, examine the development of research topics over time and map the development of concepts related to LIS and government policies, emphasize emerging trends and gaps in the literature connected to LIS policy implementation, data governance, and interoperability frameworks and assess the geographic distribution of research, identifying regions with a robust focus on LIS interoperability and policy.

Bibliometric analytical tools such as R programming, RStudio, and the Bibliomatrix package were used to search for the relevant data from the Dimensions research database for peer-reviewed journals spanning from 2016 to 2024 for the generation of visualizations such as social networks, charts and graphs, providing insights into the most prominent research areas and uncovering under-explored topics. These tools helped identify influential works and researchers, as well as emerging issues at the intersection of policy and LIS interoperability.

3.1 Literature Search Strategy

A structured yet flexible approach was used to identify relevant literature from several reputable academic databases and policy repositories. The following sources were reviewed:

Table 1 : *Data Sources*

Database	Target information
PubMed	Health informatics
Google Scholar	Broad interdisciplinary research and policy documents
IEEE Xplore	Technical articles on interoperability standards and frameworks
ScienceDirect	Peer-reviewed journal articles on health information systems
Government and institutional websites	WHO, MoH Kenya, Africa CDC, US CDC

Search terms and Boolean operators included:

- "LIMS interoperability AND government policy AND Kenya"

- "Health information systems AND interoperability frameworks"

- "Public health laboratories AND data governance"

- "Kenya Health Act AND LIMS"

The search focused on literature published between 2016 and 2024 to capture recent developments in health information system policies.

3.2 Inclusion and Exclusion Criteria

To ensure the relevance and quality of the literature we selected, we applied specific inclusion and exclusion criteria to the review. Peer-reviewed journal articles, conference papers, and policy reports that were published between 2016 to 2024 and provide consistent and well-researched evidence informed much of the selection. We included studies focused on public health sector-specific LIS interoperability to ensure relevance to the research design. Besides, the government reports describing health information system policies in Kenya were also taken

into account, as they provide a perspective on national strategies and regulations. Studies exploring the obstacles to policy implementation in health informatics, including potential difficulties in its application, were also included, as they offer useful examples of practical problems and opportunities for improvement.

Additionally, some sources were not included in the paper. Non-English-language publications were excluded to improve accessibility and consistency in analysis. Other studies that did not address LIS or health data interoperability and were deemed beyond the scope of this research were excluded. Opinion pieces, blogs, and non-peer-reviewed data sources were ignored because they do not provide the rigorous validation necessary for academic and policy debates. In addition, papers that focused solely on LIS implementation and did not consider policy aspects were excluded, as they did not meet the study's objectives, which included examining policy-related issues and frameworks.

Table 2 : Inclusion and exclusion measure

Criteria	Inclusion Measure	Exclusion Measure
Source	Peer-reviewed journal articles, conference papers, and policy reports	Opinion pieces, blogs, and non-peer-reviewed sources
Focus	Studies on LIS interoperability in public health	Studies unrelated to LIS or health data interoperability
Geographic scope	Reports from Governments on health information system policies in Kenya	Papers focusing solely on LIS implementation without policy analysis
Research scope	Studies examining policy implementation challenges in health informatics	Publications that do not analyze policy aspects of LIS
Language	English-language publications	Non-English publications

3.3 Data Extraction and Analysis

In this process, data for visualization was downloaded in .csv files and data for narratives were qualitative. A narrative analysis approach was used to identify major trends, obstacles, and missing components pertaining to LIS interoperability policies. This process enabled a systematic examination of substantive themes, enabling a well-rounded view of the policy environment. In this method, the data extraction process is categorized into several important categories.

Global LIS interoperability policies were analyzed to understand best practices and identify potential opportunities for improvement. The Kenyan policy landscape was assessed by highlighting key legislative frameworks, including the Kenya Health Act, the Data Protection Act, and the Kenya Health Information System Interoperability Framework (KHISIF). Policy implementation challenges were also identified, highlighting common barriers to effective adoption such as weak enforcement measures and funding constraints. Finally, a comparative analysis was conducted to identify lessons from countries that have enacted successful LIS interoperability models and to examine how effective policies implemented at the governmental level have positively impacted interoperability across other healthcare systems.

The analysis was intended to provide a synthesis of previous studies, identify areas for further study, and influence policy directions. The study aimed to provide insights into the current LIS interoperability literature and to inform future policy efforts by identifying opportunities for further research and development. Government policies and enforcement in the future would be crucial to improving interoperability through enhanced workflows, efficiency, and data exchange across laboratory information systems in Kenya's public health sector.

4.0 Findings and Discussions

Laboratory Information Systems (LIS) interoperability is widely acknowledged as an important prerequisite to the effective delivery of health services, allowing the sharing and integration of information between clinical laboratories within institutions. Rasmussen's (2025) research on policy-informed systems for surveillance of infectious diseases using LIS in lower-resource settings underscores the necessity of legal context and data security protections as a foundation for an efficient LIS design process. Interoperability standards, including HL7 (Health Level Seven), FHIR (Fast Healthcare Interoperability Resources), and WHO guidelines regarding health data exchange, have set out the foundations for LIS frameworks worldwide, which are important to manage health data. Salemi's research in experimental pathology underscores the necessity of standardized data formats and structured interoperability protocols for improving laboratory integration (Rich et al., 2023). And countries like these (the USA and UK) have been successful in imposing mandatory implementation on the standards to better patient care and better disease surveillance.

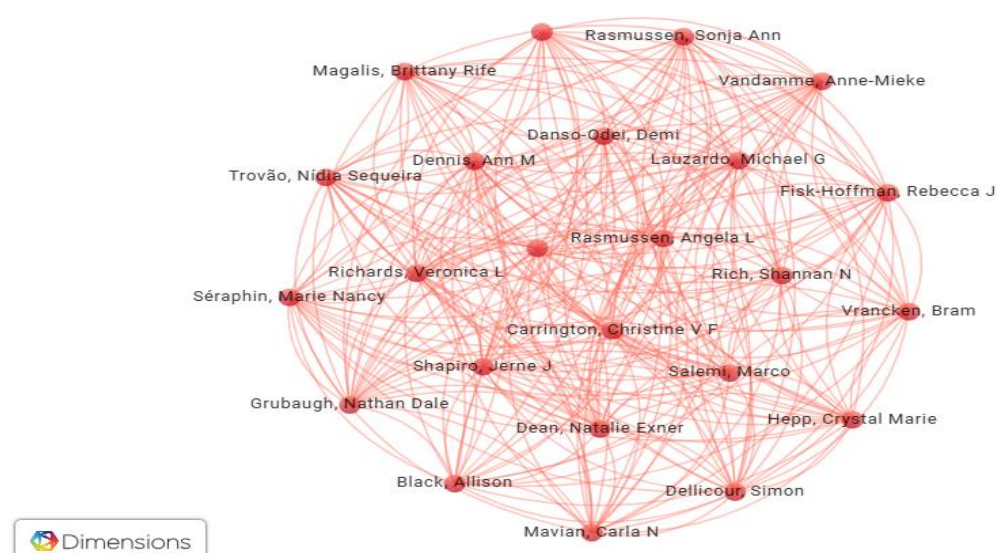Figure 1: *Network Analysis Diagram for Various Authors*

Figure 1 illustrates a publication network diagram of collaborations among researchers on key research themes in government policies and interoperability standards for LIMS. This network analysis diagram runs between the authors around the world. This means that LIMS has several interoperability standard issues. It confirms that, indeed, there is a problem here calling for urgent solutions. Sonja Ann Rasmussen, Anne-Mieke Vandamme and Marco Salemi were recognized as key researchers on LIS interoperability and policy implications for health systems integration. Sonja A. Rasmussen examines regulatory and ethical parameters of using lab data in the context of health emergencies. Her research helps to develop policies that support both the sharing of data and patient privacy. Anne-Mieke Vandamme, however, has developed the topic of health data integration in HIV research in particular, on the other hand. Her work focuses on why multidisciplinary work is needed for data standardization and what has to be achieved in the face of differing data formats across LIS platforms. Furthermore, Nathna Dale Grubaugh and Dennis Trovao are actively collaborating on studies on data security and privacy regulations, as can be seen from the network diagram. This fits nicely into the conversation on Kenya's data protection act. On the other hand, Carrington, Seraphin and Lauzardo featured prominently in policy enforcement studies with discussions about difficulties in LIS standardization and compliance. Their study highlights that robust policy frameworks support laboratory integration within national health systems.

As various scholars have observed, government policies play a significant role in how interoperability standards are integrated. For example, the U.S. The Health Information Technology for Economic and Clinical Health (HITECH) Act of 2009 offered wide-ranging financial incentives worth about $27 billion to encourage providers to adopt certified EHRs.

The participating providers had to install interoperable systems to securely share health information as part of the "Meaningful Use" program. By 2017, 96% of non-federal acute care hospitals, combined with 86% of office-based physicians, had adopted the system, a demonstration of widespread compliance propelled by HITECH's mix of benefits and penalties as highlighted by Anzalone et al. (2025). Similarly, the European Union's General Data Protection Regulation (GDPR) has also created stringent regulations on the security and privacy of health data. Such measures ensure that interoperability frameworks align with lawful protections. This produces both enabling and constraining circumstances for cross-border data exchange, predominantly apparent during public health emergencies like COVID-19. A survey on the application of GDPR during the pandemic established that, while GDPR did not hamper data sharing, its varied implementation across EU countries created legal uncertainty that affected collaborative health research, as Christofidou et al. (2021) confirmed. Qualitative studies further indicate that although GDPR improves confidence in privacy protections, it also introduces complexity and administrative challenges that hinder the secondary use of health data (Vukovic et al., 2022). Figure 2 shows the increasing trend between 2016 and 2024.

Figure 2: *Publication and Citation on Government Policies Influencing LIS Interoperability Standards Between 2016 and 2024.*
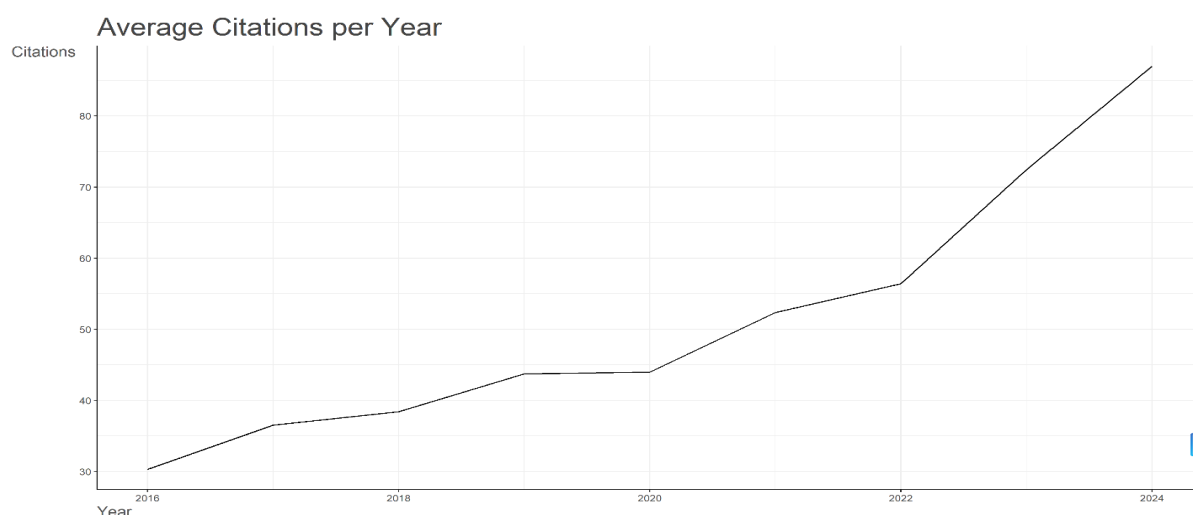

Figure 2 shows how various scholars have been citing different documents on government policies in shaping interoperability standards in laboratory information systems globally. This increasing trend establishes that more policies are required with the advances in use of ICT in public health laboratories. This implies that there are issues with the LIMS, and proper

government policies need to be put in place for better service and performance of the public health systems.

Kenya has some regulations in place, but there is little enforcement and incentive-led efforts, making it slow to come into use. Unlike the model-driven pathways evident in the U.S. and EU, Kenya's LIS interoperability is fragmented and operated in silos across health institutions. While the Kenya Health Act, Data Protection Act, and Kenya Health Information System Interoperability Framework (KHISIF) provide the groundwork for alignment and normalization of health data transfer, difficulties have arisen with implementation. Many laboratory information systems across public health institutions lack integration, which makes it difficult to share patient information efficiently. The lack of a centralized enforcement mechanism has led to an inconsistent deployment of interoperability standards, with institutions utilizing proprietary LIS not aligned with national standards. Weak enforcement mechanisms remain a major barrier to LIS interoperability in Kenya. There are regulations, yet non-standardized systems are still utilized by healthcare institutions without robust compliance monitoring. A significant challenge is also caused by funding, as designing, implementing, and maintaining such an interoperable LIS takes considerable budget. Health informatics has not received sufficient government funding, and many healthcare facilities are unable to upgrade their systems to realize this interoperability challenge. In addition to financial constraints, the implementation is further hampered by technical experience and capacity shortages. Not all healthcare professionals are well trained to manage interoperable LIS, and stakeholders have been resistant to change, so its adoption has been slow. Institutional inertia and legacy systems have made institutions reluctant to migrate to more standardized platforms, due to concerns about workflow impacts and breaches of information-handling standards.

Lessons from other nations give valuable guidelines for overcoming these obstacles. South Africa's National Health Laboratory Service (NHLS) has successfully integrated a centralized LIS framework that links laboratory data across public health institutions. This model of government-led interoperability has greatly refined surveillance capabilities for disease control and patient handling. Similarly, Estonia's e-Health system has achieved seamless interoperability by mandating compliance with national health IT standards, ensuring all healthcare providers adopt interoperable systems. These examples emphasize the importance of strong government leadership, adequate funding, and stakeholder collaboration in achieving

LIS interoperability. Figure 3 illustrates various journals where researchers have done their publications.

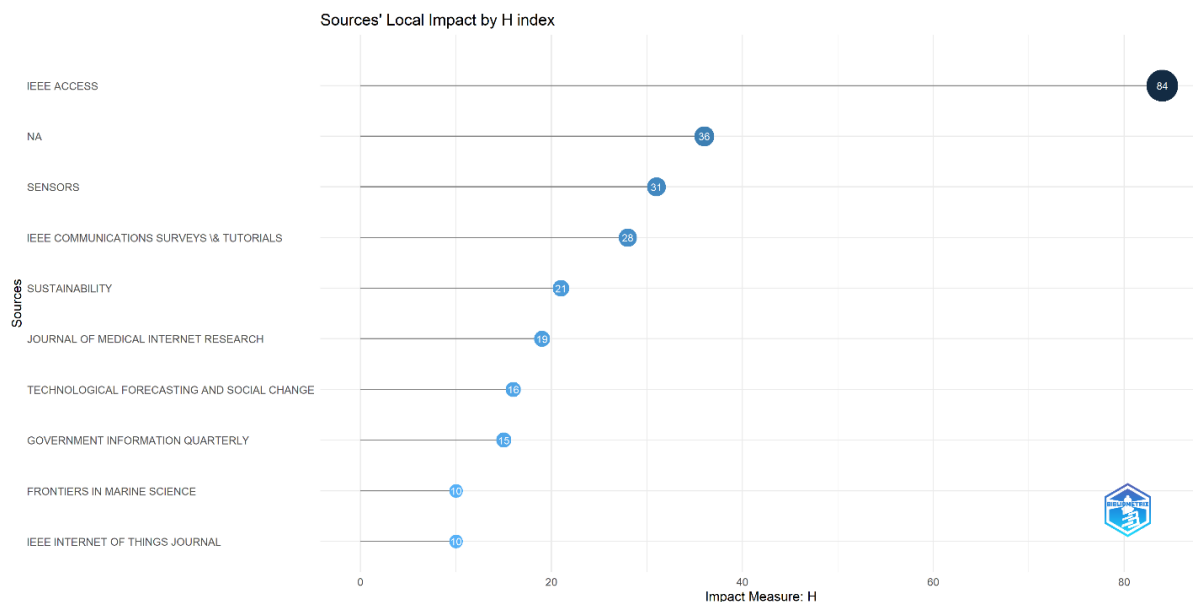Figure 3: *Journals Publishing in this Arena*

Figure 3 illustrates various journals where researchers have been publishing their works on government policies in interoperability standards in laboratory information systems globally. This confirmed that IEEE Access journal had the highest H index ($H = 84$), followed by NA journal ($H = 36$), Sensors journal ($H = 31$), IEEE communications surveys and tutorials journal ($H = 28$), Sustainability journal ($H = 21$) respectively and the least journal was IEE Internet of things journal ($H = 10$). All these journals could be attributed to their quality of publications, impact factors, time taken in their peer-review process, and feedback.

Kenya has policy frameworks in place; only implementation has been the major challenge. Without robust implementation mechanisms, adequate financial outlay, and technical capacity-building, LIS interoperability will continue to face hindrances. The government must take a more active role in guaranteeing compliance, offering incentives for healthcare institutions to adopt standardized LIS frameworks, and nurturing partnerships among stakeholders. Handling these gaps will be important in improving LIS interoperability, enhancing healthcare efficiency, and ensuring seamless data exchange across Kenya's public health sector.

5. Conclusions and Future Research Directions

This literature review has examined the role of government policies in the Laboratory Information System (LIS) interoperability norms. The analysis revealed that while Kenya has

enacted significant policies, implementation and enforcement remain a concern. These include the Kenya Health Act (2017), the Kenya Data Protection Act (2019), and the Kenya Health Information Systems Interoperability Framework (KHISIF). Such challenges lie behind the failure of multiple policy implementation systems, fragmented health information technologies, limited funding, and privacy-related problems, and remain as obstacles that hamper seamless integration of LIS across healthcare facilities. From high-level practice standards worldwide – the USA (HIPAA, 21st Century Cures Act), Europe (GDPR), South Africa's Digital Health Strategy – it is clear that strong regulatory oversight, combined with financial incentives and stakeholder partnerships, is necessary to actualize LIS interoperability. But in Kenya, unfavorable policy implementation, technical competence, and investment in LIS infrastructure were also factors that have hampered the progress in rolling out the LIS. In order to address these challenges, the country needs strategic policy reforms, sustained institutional development, and sustained commitment and investment in LIS development.

Despite the literature review, several challenges remain in filling gaps in knowledge about the nexus between state policy and LIS interoperability in Kenya. Future research should pursue empirical assessment of LIS policy, as it has been limited to the research literature on the actual practices of LIS policy implementation across the field in Kenya and on the practical influence of LIS policy on interoperability and data handling. Another area requiring further research is the financing models for LIS integration, which could explore sustainable financing mechanisms in contexts where resources remain scarce. The attention here should turn to support coming from governments (national and county), donor support, as well as public-private partnerships to improve the LIS infrastructure at large. Further research on the long-term policy effectiveness is also needed. Other studies mainly address implementation issues in the short term and relatively little in the way of policy sustainability in the long run. Research needs to examine the evolution of LIS policies, their effects on the efficiency of healthcare delivery and data security. Technological innovations for LIS interoperability also require study of new and transformative technologies, including artificial intelligence, blockchain, and cloud-based solutions that offer new ways to improve LIS data management, security, and integration. The relevance of such innovations to the Kenyan data space is an area for exploration.

A few limitations were noted regarding the decision to conduct an in-depth literature review. There was a bias in selecting a Database. Equally, the study relied on only certain academic and institutional databases. That may have unintentionally omitted relevant unpublished or

non-indexed research. Although the global coverage was comparable, the study primarily focused on Kenya, limiting the analysis's global scope. A great deal of literature, lacking explicit consideration of LIS interoperability policies in the Kenyan context, relies heavily on allied health information system research.

6. Implications of the Study

This study highlights the pivotal role of government policies, especially in LIS interoperability in Kenya's public health system, in addressing this policy gap. There are also important legislative frameworks, but their implementation in Kenya is often overlooked, limiting their effectiveness. Effective LIS integration takes time, but it is possible through sound compliance procedures, sustainable funding sources, and active partners. Best practices around the world recommend enforced interoperability standards, monetary incentives for healthcare providers to comply, and an independent regulatory oversight entity, which could substantially affect the implementation of LIS in Kenya. The implications of this study extend beyond policy-related themes for healthcare entities and IT professionals. Standardized LIS frameworks play a crucial role in providing effective data exchange, patient management and disease surveillance. By providing staff with technical training, investing efficiently in infrastructure, and promoting an LIS system upgrade driven by interoperability, LIS capabilities can be expanded. In addition, a public-private partnership is one option to support LIS implementation by ensuring integration between the government and the healthcare industry.

The research further contributes to the theoretical conversation by improving LIS interoperability. It emphasizes how policy, governance, and system integration are interlinked. While literature describes the technical features and attributes of LIS, this review takes a policy perspective. Thus, it ignites discussions around health information systems governance, especially in LMICs. Lastly, the study identifies several areas of research that need attention by further studies, together with empirical examination of LIS systems policies, innovative funding models, stakeholder interventions and new technologies that can enhance LIS integration. Comparative studies considering successful executions of LIS interoperability in other developing countries might provide valuable insights for Kenya's policy development. These inferences need to be addressed to strengthen LIS interoperability, improve healthcare efficacy, and ensure improved public health outcomes in Kenya.

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