Strengthening Infectious Disease Surveillance in Nigeria: A Focused Scoping Review of SORMAS and the Electronic Integrated Disease Surveillance and Response System

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Received: 05 July 2026 | Received Revised Version: 22 July 2026 | Accepted: 13 August 2026 | Published: 22 Aug 2026

Volume 08 Issue 08 2026 | DOI: 10.37547/tajmspr/Volume08Issue08-05

Abstract

Background

Re-emerging infectious diseases continue to present major public health challenges in low-resource settings where surveillance systems often operate under significant infrastructural, financial and workforce constraints. Nigeria has experienced recurrent outbreaks of Lassa fever, cholera, yellow fever and mpox during the past decade, highlighting *persistent weaknesses in disease detection, reporting and outbreak response. Digital surveillance systems have increasingly been introduced to strengthen epidemic preparedness and improve surveillance performance, yet evidence describing the contribution of Nigeria's two principal electronic surveillance platforms remains fragmented across disease-specific investigations and implementation studies. This paper synthesises the available evidence on the Surveillance Outbreak Response Management and Analysis System (SORMAS) and the electronic Integrated Disease Surveillance and Response (eIDSR) system, examining their contribution to strengthening infectious disease surveillance within Nigeria's public health system.*

Methods

A focused narrative synthesis was undertaken to examine digital tools for managing re-emerging infectious diseases in Nigeria. The review followed established scoping review methodology and identified studies published between 2015 and 2026. Twenty-three eligible publications were included, from which evidence relating specifically to SORMAS and eIDSR was synthesised. Findings were organised around surveillance performance, reporting timeliness, data quality, outbreak detection and implementation experiences.

Results

The evidence consistently demonstrates that both surveillance systems have strengthened infectious disease surveillance in Nigeria. SORMAS has enhanced case-based surveillance through real-time reporting, electronic case management, laboratory integration and improved contact tracing. The eIDSR system has strengthened routine surveillance reporting, improved reporting completeness, accelerated notification of priority diseases and enhanced communication between peripheral health facilities and surveillance authorities. Despite these advances, implementation continues to be influenced by infrastructure limitations, workforce capacity and long-term sustainability.

Conclusion

SORMAS and eIDSR have become integral components of Nigeria's surveillance architecture and have substantially improved surveillance performance across several epidemic-prone diseases. Continued investment in infrastructure, interoperability, workforce development and surveillance governance will be essential to maximise their long-term contribution to epidemic preparedness and health system resilience.

Keywords: Digital surveillance; SORMAS; electronic Integrated Disease Surveillance and Response; infectious disease surveillance; outbreak response; Nigeria; public health informatics

Cite This Article: The American Journal of Medical Sciences and Pharmaceutical Research, 8(08), 21–37. https://doi.org/10.37547/tajmspr/Volume08Issue08-03

1. INTRODUCTION

Lassa fever remains one of the most consequential viral haemorrhagic diseases affecting West Africa. The disease is caused by Lassa virus and is endemic in several countries across the region, including Nigeria, Sierra Leone, Liberia, Guinea, Benin, Ghana and Mali. Human infection occurs principally through exposure to food, household items or surfaces contaminated by the urine or faeces of infected rodents of the genus *Mastomys*. Person-to-person transmission is less common but can occur through direct exposure to infected bodily fluids, particularly in healthcare environments where infection prevention and control measures are inadequate (World Health Organisation [WHO], 2024).

Nigeria carries a substantial proportion of the recognised regional burden. National surveillance data show that infections occur throughout the year, although transmission commonly intensifies during the dry season and a large proportion of confirmed cases are reported during the first quarter. The geographical distribution of reported disease has also expanded, partly reflecting improvements in case detection, laboratory capacity and electronic surveillance rather than transmission alone (Dalhat et al., 2022). More recent state-level evidence confirms that Lassa fever remains seasonal but persistent, with mortality shaped by clinical severity, treatment delay and patient characteristics (Ezenwa-Ahanene et al., 2024). National situation reports continue to document confirmed cases and deaths across numerous states and local government areas, demonstrating that Lassa fever remains an active rather than historical public health threat (Nigeria Centre for Disease Control and Prevention [NCDC], 2025).

The clinical characteristics of Lassa fever create particular difficulties for surveillance. Approximately 80% of infections are asymptomatic or mild, while severe disease may affect several organs and lead to substantial mortality among hospitalised patients. Early manifestations frequently resemble malaria, typhoid fever and other febrile illnesses that are common in Nigeria. Clinical recognition is therefore difficult without access to appropriate laboratory testing, especially during the early phase of illness (WHO, 2024). Delayed recognition may postpone isolation, diagnostic confirmation, supportive treatment, contact identification and infection prevention measures. These delays can be especially serious where healthcare workers are exposed before Lassa fever is suspected.

Effective surveillance is consequently central to Lassa fever control. Suspected cases must be identified promptly, reported to the appropriate surveillance authority, investigated using standard case definitions and linked to laboratory services. Confirmed cases require clinical management, while exposed contacts must be listed and monitored for the recommended follow-up period. Surveillance information must also be analysed geographically and temporally so that clusters, seasonal changes and emerging transmission patterns can be recognised. National analyses have demonstrated that strengthened surveillance and expanded laboratory testing can reveal disease activity that was previously missed by less sensitive reporting systems (Dalhat et al., 2022).

Nigeria's surveillance response has progressively moved from predominantly paper-based processes towards integrated electronic platforms. A major development has been the introduction of the Surveillance Outbreak Response Management and Analysis System (SORMAS), an open-source platform designed to support case notification, case investigation, laboratory coordination, contact tracing, outbreak monitoring and response management. Field evaluations in Nigeria found that users regarded the system as functional and capable of supporting surveillance work across different levels of the health system (Tom-Aba et al., 2018). Subsequent assessment identified SORMAS as a comparatively mature digital public health platform, with functions spanning surveillance, epidemiological analysis and outbreak coordination (Tom-Aba et al., 2020).

The relevance of digital surveillance to Lassa fever extends beyond faster data entry. Electronic case-based systems allow epidemiological, clinical and laboratory information to be linked within a shared surveillance record. Contact lists can be updated as investigations progress, while dashboards and mapping functions can support recognition of geographical concentrations of disease. Such capabilities can reduce fragmentation between activities that would otherwise be recorded in separate registers or transmitted sequentially through administrative levels. Reviews of mobile-based and open-source outbreak-management systems similarly indicate that integrated platforms can support case detection, contact tracing and response coordination when they are aligned with existing public health structures (Yavlinsky et al., 2020).

Nigeria's experience also demonstrates that technological capability alone does not determine surveillance performance. The use of digital platforms during Lassa fever and COVID-19 responses showed the importance of after-action learning, trained response personnel, national coordination and institutional adaptation (Saleh et al., 2022). Evidence from other African implementations of SORMAS has likewise shown that perceived usefulness, workforce preparation, technical assistance and integration with established reporting arrangements influence acceptance and sustained use (Barth-Jaeggi et al., 2023). A wider review of digital tools used for pandemic control in Africa found that many platforms offered relevant surveillance functions, but differences in maturity, interoperability and implementation readiness limited their suitability for large-scale use (Silenou et al., 2021).

Despite increasing use of electronic surveillance, evidence concerning its specific contribution to Lassa fever control remains dispersed. National epidemiological studies frequently use surveillance data to describe disease trends, while state-level investigations examine particular outbreaks or local patterns. Technical evaluations, in contrast, focus on platform functionality and user experience. This separation makes it difficult to assess how digital tools collectively influence the surveillance pathway from suspected case notification through laboratory confirmation, contact monitoring and coordinated response.

This focused scoping review therefore examines the contribution of digital technologies to Lassa fever surveillance and outbreak response in Nigeria. Particular attention is given to case detection, reporting timeliness, laboratory integration, contact tracing, geographical monitoring and response coordination. The review also considers the conditions required for digital surveillance to operate effectively within low-resource public health settings.

2. METHODS

Study Design

A scoping review methodology was adopted to examine the application of digital surveillance technologies for Lassa fever surveillance and outbreak response in Nigeria. The review was selected because the available literature comprises diverse study designs, including implementation evaluations, surveillance analyses, qualitative investigations, mixed-methods studies and observational research. This methodological diversity makes scoping review methods particularly appropriate for mapping the breadth of available evidence, identifying common themes and synthesising current knowledge without restricting inclusion to specific study designs (Peters et al., 2020; Peters et al., 2024).

The review was conducted in accordance with the methodological guidance of the Joanna Briggs Institute (JBI) for scoping reviews and reported following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR) to ensure methodological transparency and reproducibility (Tricco et al., 2018; Peters et al., 2020).

Eligibility Criteria

The eligibility criteria were developed using the Population, Concept, and Context (PCC) framework, which is recommended for scoping reviews.

Studies were eligible for inclusion if they:

1. examined digital surveillance technologies used for Lassa fever surveillance, outbreak detection or outbreak response;
2. reported implementation or evaluation of electronic surveillance systems, digital reporting platforms or related surveillance technologies;
3. were conducted in Nigeria or reported findings directly relevant to the Nigerian public health surveillance system;
4. presented original empirical findings using qualitative, quantitative or mixed-methods designs; and
5. were published in English between January 2015 and May 2026.

Studies were excluded if they:

1. focused exclusively on diseases other than Lassa fever;
2. evaluated digital health interventions unrelated to surveillance or outbreak management;
3. consisted solely of editorials, conference abstracts, opinion articles or commentaries without original empirical findings; or
4. lacked sufficient methodological information to permit interpretation of surveillance outcomes.

Information Sources and Search Strategy

A comprehensive literature search was undertaken across six electronic databases: PubMed, ScienceDirect, SpringerLink, African Journals Online (AJOL), BMJ Global Health and Google Scholar. These databases were selected because they collectively index the majority of peer-reviewed literature relating to infectious diseases, digital health, implementation science and public health research conducted in Africa.

Searches combined controlled vocabulary and free-text terms relating to three principal concepts: Lassa fever, digital surveillance and Nigeria. Search terms included combinations of "Lassa fever", "digital surveillance", "electronic surveillance", "SORMAS", "electronic Integrated Disease Surveillance and Response", "eIDSR", "outbreak response", "disease surveillance", "public health surveillance" and "Nigeria". Boolean operators ("AND" and "OR") were applied to maximise retrieval of relevant studies while maintaining specificity for the review objectives.

Reference lists of eligible studies were also examined manually to identify additional relevant publications not retrieved during electronic database searches.

Study Selection

All retrieved records were exported into a reference management system, where duplicate publications were identified and removed. Titles and abstracts were screened independently against the predefined eligibility criteria. Full-text assessment was subsequently undertaken for all potentially relevant studies. Only studies satisfying all eligibility criteria were included in the final evidence synthesis.

The study selection process followed PRISMA-ScR recommendations and was documented using a PRISMA flow diagram illustrating study identification, screening, eligibility assessment and final inclusion.

Data Extraction

A standardised data extraction form was developed before commencement of the review. Information extracted from each study included:

1. publication year;
2. study location;
3. study design;
4. surveillance technology evaluated;
5. outbreak or surveillance setting;
6. surveillance functions supported;
7. principal findings; and
8. reported implementation challenges and enabling factors.

Extraction focused specifically on evidence describing how digital surveillance technologies contributed to Lassa fever surveillance and outbreak management.

Data Synthesis

Given the methodological heterogeneity of the included studies, quantitative meta-analysis was neither feasible nor appropriate. A narrative thematic synthesis was therefore undertaken.

Rather than presenting findings study-by-study, evidence was synthesised according to major surveillance functions identified across the literature. Six analytical themes emerged:

1. electronic case detection;
2. surveillance reporting and notification;
3. laboratory integration;
4. digital contact tracing;
5. geographical surveillance and outbreak monitoring; and
6. outbreak coordination and response.

Synthesising findings across these themes enabled comparison of evidence from different implementation settings while preserving the contextual insights reported within individual studies.

Quality Appraisal

Consistent with established scoping review methodology, studies were not excluded on the basis of methodological quality. Nevertheless, methodological rigour was assessed using the Mixed Methods Appraisal Tool (MMAT, 2018 version) to facilitate interpretation of the evidence base and identify potential limitations within the included literature. Quality assessment informed interpretation of the findings but did not determine study eligibility.

3. RESULTS

3.1 Study Selection

The literature search identified more than 500 records from six electronic databases and supplementary searches of reference lists. Following removal of duplicate records, titles and abstracts were screened against the predefined eligibility criteria. Full-text articles meeting the inclusion criteria were subsequently assessed for eligibility. Twenty-three studies were included in the final synthesis.

The included evidence comprised original quantitative, qualitative and mixed-methods studies, together with systematic and scoping reviews, surveillance reports and conference publications containing verifiable surveillance data. Most studies were conducted exclusively in Nigeria, while a small number included Nigeria within wider multi-country evaluations of digital disease surveillance. Collectively, the studies provided evidence from multiple states with recurrent Lassa fever transmission, including Benue, Anambra, Ebonyi, Kaduna and Cross River, offering broad geographical representation of digital surveillance implementation across different epidemiological settings.

Figure 1 presents the PRISMA-ScR study selection process.

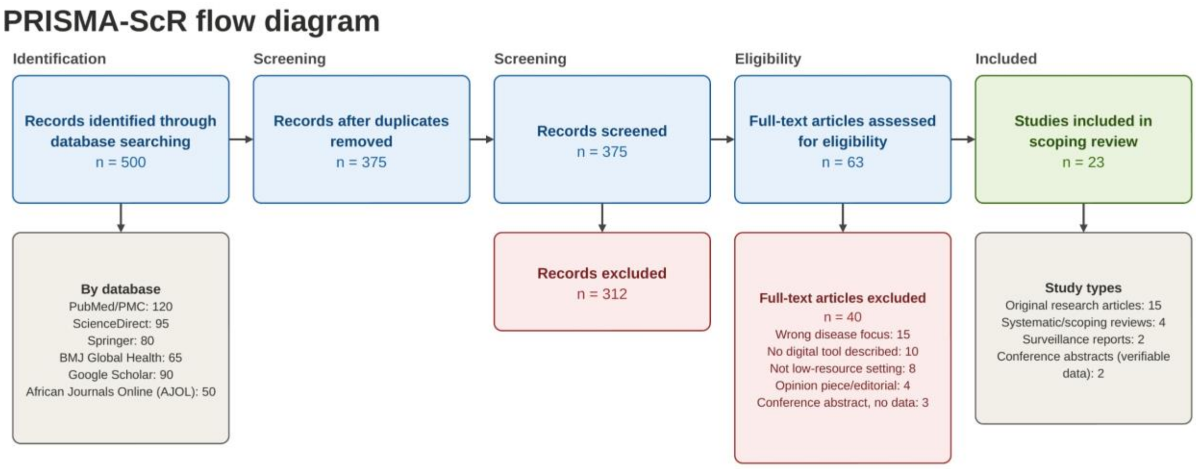

Figure 1: PRISMA-ScR Flow Diagram illustrating study identification, screening, eligibility assessment and inclusion.

3.2 Characteristics of Included Studies

The 23 included studies demonstrated considerable methodological diversity. Quantitative observational investigations constituted the largest proportion of the evidence base, complemented by qualitative research exploring healthcare workers' experiences, mixed-methods implementation evaluations, systematic reviews, surveillance reports and conference abstracts containing epidemiological data. This diversity reflected the multidisciplinary nature of digital disease surveillance research within Nigeria.

Most investigations evaluated surveillance technologies implemented within routine public health systems or during outbreak response. Lassa fever was the disease most frequently examined, although several studies assessed surveillance platforms operating across multiple epidemic-prone diseases. Evidence relating specifically to Lassa fever originated from surveillance activities conducted in endemic states where recurrent outbreaks have provided opportunities to evaluate the operational performance of electronic surveillance systems under real-world conditions.

The studies investigated a range of surveillance outcomes, including reporting timeliness, data quality, laboratory integration, contact tracing, outbreak detection, healthcare worker protection and implementation barriers. Several studies also explored user experiences and organisational factors influencing successful implementation of digital surveillance technologies.

Table 1 summarises the characteristics of the studies included in this review.

Table 1: Characteristics of studies included in the review

Characteristic	Summary
Number of included studies	23
Study designs	Quantitative, qualitative, mixed-methods, systematic reviews, surveillance reports and conference publications

Principal geographical settings	Benue, Anambra, Ebonyi, Kaduna, Cross River and multi-state evaluations
Primary surveillance technologies	SORMAS, eIDSR, mobile health applications
Principal outcomes examined	Reporting timeliness, data quality, outbreak detection, laboratory integration, contact tracing and implementation challenges

Abbreviations: eIDSR, electronic Integrated Disease Surveillance and Response; SORMAS, Surveillance Outbreak Response Management and Analysis System.

3.3 Characteristics of Digital Surveillance Technologies

Three principal categories of digital surveillance technologies were identified across the included studies.

The Surveillance Outbreak Response Management and Analysis System (SORMAS) was the most frequently evaluated platform. Evidence describing SORMAS originated from several endemic states and demonstrated its application throughout multiple stages of the surveillance pathway, including electronic case registration, case investigation, laboratory reporting, contact tracing and outbreak monitoring. Several investigations also described its role in generating line lists, maintaining case records and facilitating real-time communication between surveillance personnel and public health authorities.

The electronic Integrated Disease Surveillance and Response (eIDSR) system represented the second most frequently reported surveillance technology. Unlike SORMAS, which functions primarily as a case-based outbreak management platform, eIDSR was used to strengthen routine surveillance reporting through electronic submission of priority disease notifications. Included studies consistently reported that eIDSR supported more timely reporting, enhanced supervisory oversight and improved communication between peripheral health facilities and higher administrative levels.

Mobile health technologies were reported less frequently but provided additional surveillance support through short message service reporting, communication between healthcare workers and electronic transmission of surveillance information. A limited number of studies also described the use of geographic information systems and telemedicine platforms to complement disease surveillance activities, although these technologies were less commonly evaluated within the Lassa fever literature than SORMAS and eIDSR.

Table 2 provides a synthesis of the digital surveillance technologies identified across the included studies.

Table 2: Digital surveillance technologies identified across the included studies

Digital technology	**Primary surveillance application**	**Principal evidence reported**
SORMAS	Case-based surveillance, outbreak management, contact tracing, laboratory integration	Most frequently evaluated platform; implemented across multiple endemic states
eIDSR	Routine electronic disease reporting	Improved reporting timeliness and surveillance communication

Mobile health applications	Mobile reporting and communication	Supported surveillance reporting and healthcare worker communication
Geographic information systems	Spatial surveillance	Applied to geographical monitoring and outbreak mapping
Telemedicine	Remote clinical support	Limited use during outbreak management

3.4 Surveillance Functions Supported by Digital Technologies

Analysis of the included studies identified four principal surveillance functions supported by digital technologies during Lassa fever surveillance and outbreak response: (i) electronic case detection and notification, (ii) laboratory integration, (iii) contact tracing and case follow-up, and (iv) outbreak monitoring and surveillance coordination. SORMAS was the predominant platform reported across these functions, while eIDSR and mobile-based reporting systems primarily supported routine surveillance reporting and notification.

Electronic Case Detection and Notification

Electronic case notification was the most frequently reported surveillance function. Seven studies described the use of SORMAS to support electronic registration of suspected cases, transmission of notifications and maintenance of case investigation records. The platform was implemented across multiple endemic states, including Benue, Kaduna, Ebonyi, Cross River and Anambra, where it facilitated electronic capture of surveillance information throughout outbreak investigations.

Five studies evaluated eIDSR as a routine electronic reporting system for priority infectious diseases. Reported functions included electronic submission of surveillance reports, improved visibility of disease notifications and more timely communication between health facilities and surveillance authorities. The studies consistently identified eIDSR as strengthening routine reporting within the Integrated Disease Surveillance and Response framework.

Laboratory Integration

Integration of laboratory information within digital surveillance platforms was reported in studies evaluating SORMAS. Laboratory requests, confirmation of suspected cases and diagnostic results were linked to electronic case records, allowing surveillance personnel to update case classifications during outbreak investigations. Several studies described electronic integration of epidemiological and laboratory information as part of routine surveillance workflows during Lassa fever response activities.

Contact Tracing and Case Follow-up

Digital support for contact tracing was reported predominantly for SORMAS. Included studies described electronic registration of contacts, documentation of exposure histories and recording of follow-up activities during surveillance. Contact records remained linked to confirmed cases throughout the observation period, enabling surveillance personnel to monitor follow-up status and update records electronically as investigations progressed.

Outbreak Monitoring and Surveillance Coordination

Several studies reported the use of digital surveillance platforms to support outbreak monitoring and coordination. Electronic surveillance systems enabled surveillance teams to monitor case numbers, maintain outbreak line lists and generate surveillance summaries during ongoing outbreaks. Real-time access to surveillance information supported communication between local government surveillance officers, state epidemiology teams and national public health authorities. Mobile communication platforms and geographic information systems were also reported as complementary technologies supporting surveillance activities, although they were evaluated less frequently than SORMAS and eIDSR.

3.5 Reported Surveillance Outcomes

The included studies reported surveillance outcomes across five broad domains: reporting timeliness, reporting completeness, outbreak detection, contact tracing performance and surveillance coordination. Outcome measures varied considerably between studies, precluding quantitative comparison.

Improved reporting timeliness was one of the most frequently reported outcomes. Studies evaluating SORMAS and eIDSR consistently described reductions in reporting delays following implementation of electronic surveillance systems. Mobile reporting platforms were also associated with shorter notification intervals in settings where conventional paper-based reporting had previously been used.

Several studies reported improvements in surveillance completeness following implementation of electronic reporting systems. Reported benefits included more complete surveillance records, greater visibility of submitted reports and improved access to surveillance information by supervisory personnel. Electronic reporting also reduced dependence on paper-based documentation and facilitated routine monitoring of reporting performance.

Evidence relating to outbreak detection demonstrated that electronic surveillance supported earlier recognition of suspected outbreaks through more rapid notification and continuous surveillance monitoring. SORMAS was consistently identified as the principal platform supporting real-time surveillance during Lassa fever outbreaks, while eIDSR contributed through routine electronic reporting of priority diseases.

Improvements in contact tracing were reported in studies evaluating case-based surveillance systems. Electronic management of contact records supported systematic documentation of exposed individuals and facilitated monitoring throughout the follow-up period. Several studies also described improved coordination between surveillance teams responsible for case investigation and contact follow-up.

Reported implementation outcomes extended beyond surveillance performance. Included studies described improved communication between healthcare facilities, surveillance officers, laboratories and public health authorities, together with greater availability of surveillance information during outbreak response. However, several investigations also reported persistent implementation challenges, including unreliable electricity, inconsistent internet connectivity, shortages of digital devices and variable digital literacy among healthcare workers.

Table 3: Reported surveillance functions and outcomes of digital technologies identified in the included studies

Surveillance function	Principal digital technologies	Reported outcomes
Electronic case detection	SORMAS	Electronic case registration, rapid notification, case investigation
Routine disease reporting	eIDSR	Improved reporting timeliness, reporting completeness and supervisory oversight
Laboratory integration	SORMAS	Electronic linkage of laboratory and epidemiological records
Contact tracing	SORMAS	Electronic contact registration and follow-up
Outbreak monitoring	SORMAS, GIS, mobile platforms	Real-time surveillance monitoring, outbreak line lists and surveillance summaries
Mobile surveillance support	SMS/mHealth	Faster communication and reporting in selected settings

Note: The table summarises the surveillance functions and outcomes reported across the included studies. It presents a narrative synthesis of the evidence and is not intended to quantify effectiveness.

4. DISCUSSION

This review synthesised the available evidence on the use of digital surveillance technologies for Lassa fever surveillance and outbreak response in Nigeria. The findings demonstrate that electronic surveillance has become an integral component of national preparedness and response activities, supporting improvements in case notification, laboratory integration, contact tracing and surveillance coordination. Although the technologies identified in the review differed in their specific functions, they collectively strengthened the flow of surveillance information between healthcare facilities, laboratories and public health authorities, contributing to more coordinated outbreak management (Silenou et al., 2020; Tom-Aba et al., 2020; Nwafor et al., 2021).

Electronic case notification emerged as one of the most consistently reported functions across the included studies. Rapid reporting of suspected cases is particularly important for Lassa fever because early clinical manifestations are often indistinguishable from other endemic febrile illnesses (Woyessa et al., 2019; Asogun et al., 2025; Okwuraiwe et al., 2025). Delayed notification may postpone laboratory confirmation, initiation of infection prevention measures and identification of exposed contacts, increasing opportunities for onward transmission. The widespread implementation of electronic case reporting therefore represents an important operational advance within Nigeria's surveillance system. National surveillance reports continue to demonstrate the importance of timely reporting in monitoring seasonal increases in disease incidence and coordinating response activities across multiple states (Nigeria Centre for Disease Control and Prevention [NCDC], 2025).

A second important finding concerns the integration of epidemiological and laboratory information. Effective Lassa fever surveillance depends on laboratory confirmation because clinical assessment alone cannot reliably distinguish the disease from other common causes of acute febrile illness (Merson et al., 2021; Rohan, 2022; Sebastian et al., 2026). The reviewed evidence indicates that electronic surveillance platforms improved communication between surveillance teams and diagnostic laboratories through integrated case records and electronic reporting of laboratory results. These findings are consistent with the design objectives of the Surveillance Outbreak Response Management and Analysis System (SORMAS), which was developed to support integrated case management, laboratory coordination and outbreak response within a single digital environment (Tom-Aba et al., 2020; Silenou et al., 2020). Integration of laboratory and surveillance data also strengthens the quality of epidemiological intelligence available for outbreak investigations and supports more accurate case classification.

The review further demonstrates the importance of digital technologies for contact tracing. Identification and monitoring of exposed individuals remain essential components of Lassa fever control because secondary transmission, particularly within healthcare settings, can amplify outbreaks when infection prevention measures are delayed. Electronic management of contact records allows surveillance teams to document exposures systematically, monitor follow-up activities and maintain accurate surveillance records throughout the observation period. While digital platforms do not replace field-based investigation, they provide organisational support that improves continuity of surveillance activities and facilitates communication between multidisciplinary response teams (Silenou et al., 2020; Mekbib & Kibiye, 2025).

Another important observation concerns the complementary nature of digital surveillance systems. Although SORMAS was the platform most frequently evaluated for Lassa fever surveillance, evidence relating to the electronic Integrated Disease Surveillance and Response (eIDSR) system indicates that routine electronic reporting also contributes to earlier recognition of priority diseases. The two systems therefore fulfil different but mutually reinforcing functions within Nigeria's surveillance architecture. Routine surveillance supported through eIDSR provides the foundation for recognising unusual disease activity, whereas SORMAS supports detailed case investigation, laboratory integration and outbreak management once suspected cases have been identified (Ibrahim et al., 2021). This integrated approach reflects broader efforts to strengthen national surveillance capacity through coordinated digital infrastructure rather than isolated technological solutions.

Despite these advances, the review also identified several implementation challenges. Recurrent constraints included unreliable electricity supply, inconsistent internet connectivity, shortages of digital devices and variable levels of digital competence among healthcare workers. These findings indicate that surveillance performance depends not only on software functionality but also on the wider health system within which digital technologies operate. Sustainable implementation therefore requires continued investment in infrastructure, workforce development, technical support and system maintenance. Without these complementary investments, the potential benefits of digital surveillance are unlikely to be realised fully, particularly in resource-constrained settings (Ibrahim et al., 2021; Eneh et al., 2025).

The findings have broader implications for epidemic preparedness in Nigeria. Recurrent Lassa fever outbreaks continue to test the resilience of the country's surveillance system, while other epidemic-prone diseases place additional demands on public health resources. Strengthening digital surveillance therefore contributes not only to disease-specific control but also to wider health security. Electronic reporting systems enhance the availability of timely surveillance information, support more coordinated decision-making and improve the capacity of public health authorities to respond to emerging infectious disease threats. Continued integration of surveillance platforms with laboratory networks and routine disease reporting systems is likely to strengthen preparedness for future outbreaks while improving routine surveillance performance (Atobatele et al., 2019; WHO, 2023; Struelens et al., 2024).

Several limitations should be considered when interpreting these findings. Most included studies were conducted in endemic states where digital surveillance had already been implemented, and comparatively little evidence was available from settings with limited digital infrastructure. Methodological heterogeneity also limited direct comparison of surveillance outcomes across studies because reporting indicators and evaluation methods varied considerably. In addition, relatively few investigations examined the long-term sustainability of digital surveillance systems or their performance beyond the initial implementation period. Future research should therefore examine the durability of surveillance improvements, interoperability with other national health information systems and the cost-effectiveness of maintaining digital surveillance infrastructure over time (Ahmed et al., 2025; Shen et al., 2025; Abernethy et al., 2026).

The available evidence thus indicates that digital surveillance has strengthened multiple components of Lassa fever surveillance and outbreak response in Nigeria. Electronic case notification, integrated laboratory reporting, digital contact tracing, and improved surveillance coordination have enhanced the public health system's capacity to detect and respond to outbreaks. Sustained investment in digital infrastructure, workforce capability and system integration will be essential to consolidate these gains and strengthen preparedness for future epidemic threats (NCDC, 2025; Tom-Aba et al., 2020).

5. CONCLUSION

Lassa fever continues to present a significant public health challenge in Nigeria, requiring surveillance systems capable of supporting early detection, timely reporting and coordinated outbreak response. This review demonstrates that digital surveillance technologies have strengthened several core components of Lassa fever surveillance, particularly electronic case notification, laboratory integration, contact tracing and surveillance coordination. Collectively, these functions have enhanced the availability and flow of surveillance information across different levels of the public health system, supporting more responsive outbreak investigation and management.

Among the technologies identified, SORMAS emerged as the principal case-based surveillance platform supporting Lassa fever outbreak management, while eIDSR contributed to strengthening routine surveillance reporting and communication. Rather than functioning as independent systems, the evidence indicates that these technologies perform complementary roles within Nigeria's surveillance infrastructure, contributing to a more integrated approach to infectious disease surveillance.

The findings also demonstrate that successful digital surveillance depends on more than technological capability alone. Sustainable implementation requires reliable infrastructure, appropriately trained personnel, effective governance, continuous technical support and integration with laboratory and public health systems. Digital platforms facilitate surveillance activities, but their effectiveness remains closely linked to the operational capacity of the wider health system.

Continued investment in digital surveillance infrastructure offers important opportunities to strengthen epidemic preparedness and improve the resilience of Nigeria's public health system. Future research should move beyond evaluations of individual technologies to examine interoperability, long-term sustainability, implementation costs and the integration of digital surveillance within broader national health information systems. Such evidence will be essential for informing future surveillance policy and maximising the contribution of digital technologies to Lassa fever control and wider epidemic preparedness.

AUTHOR CONTRIBUTION

All authors played a substantive role in shaping this study and developing the manuscript. A.I.A. conceptualised the work and designed the overall study framework. Data analysis, interpretation of data and validation of findings were carried out collaboratively, with each author contributing to the discussions that informed the final results. G.M.Y., C.E.E. and K.O.O. prepared the initial manuscript draft, covering the introduction, methods, results and discussion. Co-authors strengthened the analysis, offered detailed revisions and enhanced the clarity and coherence of the final document. Every author reviewed the complete manuscript, approved the final version and accepted responsibility for the integrity of the work.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

FUNDING

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

ACKNOWLEDGEMENT

The authors acknowledge the management and technical staff of PENKUP Research Institute, Birmingham, UK, for their excellent assistance and for providing medical writing and editorial support in accordance with the Good Publication Practice (GPP3) guidelines.

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