A Multi-quarter Assessment Of Sample Rejection And Cold Chain Deviations In Lassa Fever Surveillance In Nigeria, 2024–2025

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Background

Lassa fever is endemic in Nigeria, where prompt, accurate laboratory confirmation is critical for outbreak containment. Sample integrity is threatened by cold chain failures and documentation gaps, potentially undermining diagnostic accuracy and response speed.

This is the first multi-quarter national analysis (Q1 2024–Q1 2025) examining sample rejection patterns, their causes, and temperature deviations from WHO standards, with direct relevance to Lassa fever and broader emerging infectious disease surveillance.

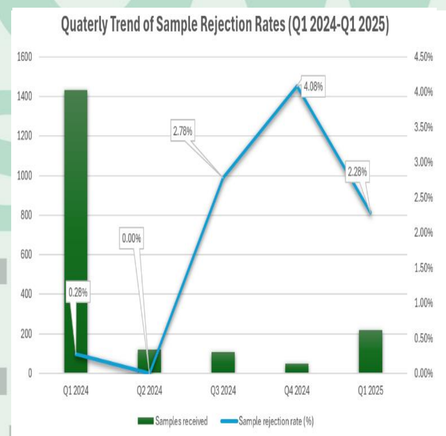
Methods

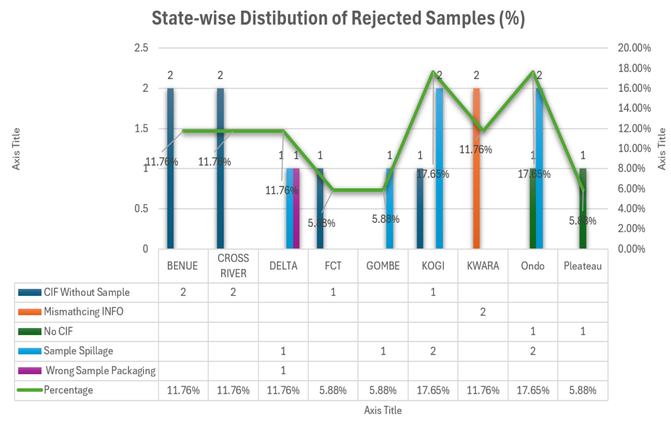
Study design: Retrospective review.
Data source: 1,929 Lassa fever diagnostic samples received at the National Reference Laboratory (NRL).
Analysis: Epi Info for descriptive statistics.
Variables: Rejection rate, rejection causes, state distribution, mean reception temperature compared to WHO-recommended 2–8°C.

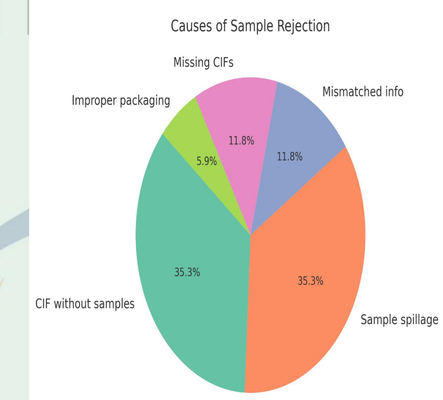
Results

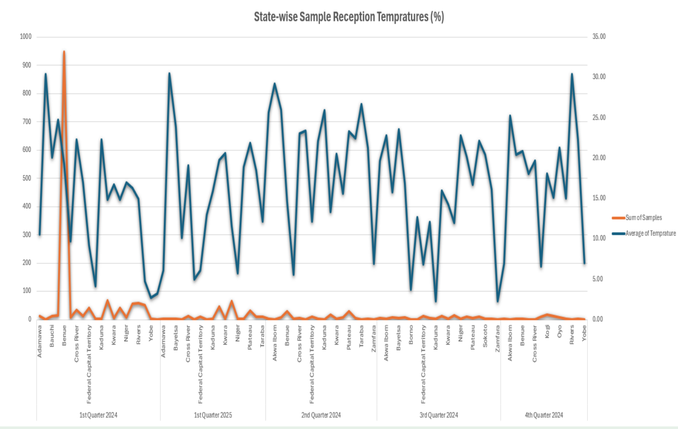
Overall rejection rate: 0.73% (Q1 2024: 0.28% → peak Q4 2024: 4.08% → Q1 2025: 2.28%).
Geographic trends: Kogi & Ondo — highest rejection proportions (17.65% each). Benue — 11.76% of rejections, >50% of samples.
Primary causes:
- Missing samples with CIF — 35.29%
- Sample spillage — 35.29%
- Mismatched information — 11.76%
- Missing CIF — 11.76%
- Improper packaging — 5.88%

Cold chain performance:
- Mean reception temp: 17.68°C (above WHO limit).
- Q2 2024 highest mean: 18.74°C; Q3 2024 lowest: 15.58°C.
- Zamfara maintained optimal 3.2°C; coastal states (Rivers, Akwa Ibom) had elevated rainy-season temps.









Conclusions and Recommendations

The study highlights significant cold chain challenges affecting sample quality for Lassa fever diagnosis.
While rejection rates are low, temperature instability and documentation deficiencies threaten diagnostic reliability.
These gaps could delay outbreak detection and weaken national Lassa fever response capacity.
Cold chain lapses and incomplete documentation continue to undermine Lassa fever sample integrity, compromising diagnostic accuracy and delaying outbreak response. Although overall rejection rates remain low, recurring temperature deviations and data gaps expose systemic weaknesses that demand urgent attention. Tackling these challenges is vital to protect diagnostic reliability and strengthen epidemic preparedness.
Ongoing actions: Refresher trainings for couriers, stricter packaging protocols, **regular feedback communications to states**, and improved documentation processes are already being implemented to stabilize the system and minimize errors.
Transformative next steps:
Smart tools: IoT temperature loggers with real-time SMS/WhatsApp alerts.
Digital systems: QR/barcode-enabled e-CIFs, automated dashboards, and blockchain-based traceability.
Proactive intelligence: AI-driven analytics to predict and prevent sample rejection.
Innovative logistics: Drone-enabled delivery to overcome distance and climate barriers.
Culture of excellence: Embedding rapid feedback loops and accountability mechanisms to sustain compliance.
By combining current corrective measures with frontier innovations, Nigeria can reduce sample rejection, safeguard surveillance accuracy, and set a new **regional standard for technology-driven epidemic preparedness and response**.

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