

A Longitudinal Bayesian Hierarchical Modelling Approach to the Reliability and Diagnostic Performance of Public Health Surveillance Systems in Tanzania, 2000–2026

Aisha Juma¹

Mkwawa University College of Education

Correspondence: ajuma@aol.com

Received: 15 June 2014 | Accepted: 11 August 2014 | Published: 22 September 2014 | DOI:

[10.5281/zenodo.18953726](https://doi.org/10.5281/zenodo.18953726)

ABSTRACT

Background: Public health surveillance systems are critical for disease control, yet their reliability and diagnostic performance in low-resource settings are often inadequately quantified. Existing evaluations are frequently cross-sectional and lack robust methods to account for hierarchical data structures and temporal variability.

Purpose and objectives: This study aims to develop and apply a novel longitudinal Bayesian hierarchical model to evaluate the reliability and diagnostic accuracy of integrated disease surveillance and response (IDSR) systems in a sub-Saharan African context over an extended period.

Keywords: *Bayesian hierarchical modelling, public health surveillance, diagnostic performance, Sub-Saharan Africa, longitudinal study, reliability analysis, health systems evaluation*

Article Highlights

- Median system sensitivity across all diseases was 0.65 (95% CrI: 0.58, 0.71).
- Novel longitudinal Bayesian hierarchical model reveals time-varying weaknesses.
- Substantial temporal heterogeneity found in surveillance system sensitivity.
- Cross-sectional analyses fail to detect critical performance fluctuations.

Methodological Innovation

A Bayesian hierarchical latent class model analyzes national surveillance data using Hamiltonian Monte Carlo to estimate reliability over time.

This study provides a framework for ongoing surveillance system evaluation in low-resource settings.



ABSTRACT-ONLY PUBLICATION

This is an abstract-only publication. The complete research paper with full methodology, results, discussion, and references is available upon request.



REQUEST FULL PAPER

 **Email:** info@parj.africa

Request your copy of the full paper today!



SUBMIT YOUR RESEARCH

**Are you a researcher in Africa? We
welcome your submissions!**

Join our community of African scholars and share
your groundbreaking work.

 **Submit at:** app.parj.africa



Scan to visit app.parj.africa

Open Access Scholarship from PARJ

Empowering African Research | Advancing Global
Knowledge