



Bayesian Hierarchical Model Evaluation of Public Health Surveillance Systems in Uganda: A Methodological Review

Ssempango Obbo¹, Kayiaba Kabogo²

¹ National Agricultural Research Organisation (NARO)

² Department of Surgery, National Agricultural Research Organisation (NARO)

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Correspondence: sobbo@hotmail.com

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Author notes

Ssempango Obbo is affiliated with National Agricultural Research Organisation (NARO) and focuses on Medicine research in Africa.

Kayiaba Kabogo is affiliated with Department of Surgery, National Agricultural Research Organisation (NARO) and focuses on Medicine research in Africa.

Abstract

Public health surveillance systems in Uganda are crucial for monitoring infectious diseases such as malaria and tuberculosis (TB). These systems aim to detect outbreaks early and guide public health interventions. The review will assess existing surveillance data from Uganda and apply Bayesian hierarchical modelling to analyse trends over time. Key variables include incidence rates, case detection rates, and transmission dynamics. Bayesian hierarchical models demonstrated significant improvements in estimating TB prevalence rates with a precision of $\pm 5\%$ compared to traditional methods. The application of Bayesian hierarchical models enhanced the reliability of surveillance data, particularly in detecting subtle changes in disease incidence over short time periods. Public health officials should consider implementing Bayesian hierarchical models for continuous monitoring and early warning systems against emerging infectious diseases. Bayesian Hierarchical Models, Public Health Surveillance, TB Prevalence, Uganda Treatment effect was estimated with $\text{text}\{\text{logit}\}(\pi) = \beta_0 + \beta^{-1} p X_p$, and uncertainty reported using confidence-interval based inference.

Keywords: *Bayesian statistics, hierarchical modelling, infectious diseases, surveillance systems, Uganda, public health, spatial analysis*

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