

A Bayesian Hierarchical Modelling Intervention for Enhanced Clinical Outcome Surveillance in Ghana's Public Health Systems

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ABSTRACT

Background: Public health surveillance systems in Ghana often rely on aggregated, facility-level data, which can mask localised variations in clinical outcomes and hinder targeted interventions. This methodological limitation reduces the precision of health system evaluations.

Purpose and objectives: This study aimed to develop and evaluate a novel Bayesian hierarchical modelling intervention designed to improve the measurement and spatial understanding of clinical outcomes within the nation's public health infrastructure.

Keywords: *Bayesian hierarchical modelling, Clinical outcome surveillance, Public health systems, Sub-Saharan Africa, Ghana, Intervention study, Methodological evaluation*

Article Highlights

- Intervention model provided superior statistical fit over conventional aggregation methods
- Revealed substantial sub-national heterogeneity in clinical outcomes across districts
- Enables spatially precise inferences from existing routine health data streams
- Posterior probabilities identified priority districts for targeted interventions

Methodological Core

Bayesian hierarchical model with spatial random effects (u_i , v_i) and temporal component (γ_t) applied to routine HMIS data, enabling district-level probability estimates.

Presents a novel framework for extracting granular spatial insights from aggregated national health data.

ABSTRACT-ONLY PUBLICATION

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