

A Bayesian Hierarchical Model for Yield Optimisation in Nigerian Community Health Centres

A Methodological Case Study

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Received: 29 May 2015 | Accepted: 15 July 2015 | Published: 17 August 2015 | DOI: [10.5281/zenodo.18955883](https://doi.org/10.5281/zenodo.18955883)

ABSTRACT

Background: Community health centres in Nigeria face persistent challenges in optimising the yield of medical services and interventions from limited resources. Existing evaluation frameworks often lack the statistical rigour to account for hierarchical data structures and inherent uncertainty in performance measurement.

Purpose and objectives: This case study presents and methodologically evaluates a Bayesian hierarchical model designed to measure and optimise service yield within these centres. The primary objective is to demonstrate the model's utility for robust inference and its capacity to inform resource allocation.

Keywords: *Bayesian hierarchical modelling, health systems evaluation, Sub-Saharan Africa, resource optimisation, community health centres, service delivery, Nigeria*

Article Highlights

- Bayesian hierarchical model quantifies uncertainty in health service yield estimates
- Method accounts for centre-level clustering in Nigerian community health data
- Posterior predictions inform resource reallocation strategies
- Framework enables pilot testing of interventions before implementation

Methodological Contribution

Introduces a Bayesian hierarchical model ($\log(y) = \alpha + \beta X + u_j + \epsilon_{ij}$) specifically adapted for analysing clustered health systems yield data, with centre-level random effects $u_j \sim N(0, \sigma_u^2)$.

This case study demonstrates a methodological framework rather than reporting empirical field trial results.

ABSTRACT-ONLY PUBLICATION

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