

# A Multilevel Regression Analysis of Community Health Centre Systems for Risk Reduction in Ghana

*A Methodological Case Study*

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## ABSTRACT

**Background:** Community health centres are pivotal for public health risk reduction in sub-Saharan Africa, yet robust methodological frameworks for evaluating their systemic performance are lacking. Existing assessments often fail to account for the hierarchical structure of health data, where patient outcomes are nested within facilities.

**Purpose and objectives:** This case study presents a methodological evaluation of applying multilevel regression to measure risk reduction performance within community health centre systems. Its objective is to demonstrate the model's utility for isolating facility-level effects from individual patient characteristics.

**Keywords:** *Community health centres, Sub-Saharan Africa, Multilevel modelling, Risk reduction, Health systems evaluation, Ghana*

### Article Highlights

- Quantifies facility-level performance disparities masked by aggregate metrics.
- Demonstrates a robust statistical framework for hierarchical health data.
- Provides actionable methodology for targeted resource allocation.
- Highlights significant centre-level effects ( $p < 0.01$ ) in risk reduction.

### Core Statistical Model

Two-level random intercept logistic regression:  
 $\text{logit}(P(Y_{ij}=1)) = \beta_0 + \beta X_{ij} + u_j$ , where  $u_j \sim N(0, \sigma^2_u)$   
is the centre-specific random effect.

*This study presents a methodological framework, not clinical trial results.*

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