



# Bayesian Hierarchical Model for Evaluating Cost-Effectiveness of Community Health Centers in Ghana

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## Abstract

Community health centers (CHCs) in Ghana play a critical role in primary healthcare delivery. Despite their importance, the cost-effectiveness of these services has not been systematically evaluated. A Bayesian hierarchical regression model was employed to analyse data on service utilization, costs, and outcomes across multiple CHCs. This approach allows for the estimation of parameters at different levels (e.g., individual patient-level variables and aggregate centre-level effects). The analysis revealed significant cost savings per capita in areas served by high-performing CHCs compared to low-performing ones, with a proportion reduction of approximately 20%. Bayesian hierarchical modelling offers a robust framework for assessing the cost-effectiveness of community health centers and highlights the importance of standardised service delivery across different regions. Implementing this model can inform policy decisions aimed at optimising resource allocation and improving healthcare efficiency in Ghanaian CHCs. Treatment effect was estimated with  $\text{logit}(\pi) = \beta_0 + \beta_1 X_i$ , and uncertainty reported using confidence-interval based inference.

**Keywords:** Ghana, Hierarchical Models, Bayesian Methods, Cost-Effectiveness Analysis, Community Health Centers, Random Effects, Meta-Analytic Techniques

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