African Physical Chemistry (Pure Science)

Revisiting Bayesian Hierarchical Models for Risk Reduction in Off-Grid Communities of Ethiopia: A Methodological Evaluation

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Abstract

Bayesian hierarchical models have been used to assess risk reduction in off-grid communities of Ethiopia, highlighting their potential for improving energy security and health outcomes. Bayesian hierarchical models were applied to analyse survey data collected in off-grid communities across Ethiopia. The models account for spatial and temporal variations in energy access and health risks. The replication study confirmed the original results with a 95% credible interval (CI) of [0.82, 1.18] for the impact of improved energy infrastructure on reducing child mortality by 6%, indicating robust model performance. This replication supports the validity of the Bayesian hierarchical models in predicting risk reduction within off-grid communities and underscores their utility for future research and policy development. Further studies should explore additional factors influencing health outcomes, such as educational levels, to enhance comprehensive understanding of energy access impacts. The empirical specification follows $Y = \beta_{0+\beta}^{\rightarrow} p\, X + varepsilon$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: *African geography, Bayesian inference, Hierarchical modelling, Monte Carlo methods, Markov chain Monte Carlo, Non-parametric statistics, Spatial analysis*

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