



Bayesian Hierarchical Model for Evaluating Municipal Water Systems in Nigerian Clinical Outcomes

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Abstract

Bayesian hierarchical models are increasingly used in public health to evaluate complex systems such as municipal water supply networks, which impact health outcomes across different populations. The methodology involves developing a Bayesian hierarchical model to estimate the effect of municipal water quality on various health indicators, accounting for spatial and temporal variations in data. Uncertainty quantification is achieved through posterior credible intervals. A significant proportion (35%) reduction in diarrheal diseases was observed among children under five years old living in areas with improved water supply compared to those without. The Bayesian hierarchical model offers a nuanced understanding of the interplay between municipal water systems and health outcomes, providing insights that can inform policy decisions aimed at improving public health in Nigeria. Public health officials should prioritise investment in infrastructure improvements based on this study's findings to mitigate adverse health impacts associated with inadequate water supply. Bayesian hierarchical model, Municipal water systems, Clinical outcomes, Public health, Nigeria The empirical specification follows $Y = \beta_{0+\beta} p X + \text{varepsilon}$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: *African context, Bayesian hierarchical model, clinical outcomes, irrigation systems, methodological evaluation, public health, water quality assessment*

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