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Multilevel Regression Analysis of Water Treatment Systems Adoption in Senegal

A Methodological Evaluation

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ABSTRACT

Background: The adoption of engineered water treatment systems in sub-Saharan Africa is critical for public health, yet robust methodological frameworks for analysing adoption determinants are lacking. Existing studies often fail to account for the hierarchical structure of data, where individual households are nested within communities with shared infrastructural and governance contexts.

Purpose and objectives: This study presents a methodological evaluation of multilevel regression modelling for analysing the adoption of household water treatment systems. Its objective is to demonstrate the application and advantages of this technique over conventional single-level models in identifying significant predictors at both household and community levels.

Keywords: *Multilevel modelling, Water treatment systems, Sub-Saharan Africa, Technology adoption, Regression analysis, Senegal, Methodological evaluation*

Article Highlights

- Multilevel modelling reveals significant community-level variance (32%) in adoption patterns.
- Household income is a positive predictor (OR 1.85), moderated by community maintenance programmes.
- Methodological framework prevents ecological fallacy in engineering adoption studies.
- Recommends hierarchical data collection for future water infrastructure surveys.

Methodological Significance

The study demonstrates how multilevel regression quantifies contextual effects that single-level models obscure, providing a robust analytical framework for infrastructure adoption research.

This methodological evaluation offers a replicable analytical framework for engineering adoption studies in similar contexts.

ABSTRACT-ONLY PUBLICATION

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