

A Multilevel Regression Analysis of Water Treatment System Performance and Risk Reduction in Tanzania

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ABSTRACT

Background: Inadequate access to safe drinking water remains a critical public health challenge in many regions. The performance of centralised water treatment systems is a key determinant of health risk reduction, yet comprehensive, system-level evaluations linking technical performance to quantified risk are limited.

Purpose and objectives: This study aimed to develop and apply a multilevel regression framework to evaluate the technical performance of urban water treatment systems and quantify its association with microbial risk reduction.

Keywords: *Water treatment, Multilevel modelling, Sub-Saharan Africa, Public health engineering, Risk assessment, Infrastructure performance, Drinking water quality*

Article Highlights

- Final turbidity control is a significant, modifiable predictor of microbial risk.
- Approximately 35% of risk variance stems from facility-level management factors.
- Study applies a two-level hierarchical model to urban treatment systems in Tanzania.
- Recommends final turbidity as a key performance indicator for routine monitoring.

Core Analytical Framework

A two-level hierarchical regression model was fitted with sampling points nested within facilities to quantify the association between technical performance (turbidity, chlorine) and microbial risk reduction.

This analysis quantifies the link between technical performance metrics and health outcomes in critical infrastructure.



ABSTRACT-ONLY PUBLICATION

This is an abstract-only publication. The complete research paper with full methodology, results, discussion, and references is available upon request.



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