

Assessing Risk Reduction in Kenyan Water Treatment Systems

A Difference-in-Differences Methodological Evaluation

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ABSTRACT

Background: Waterborne diseases remain a significant public health challenge in many regions, with infrastructure resilience being a critical engineering concern. Systematic evaluation of structural and operational interventions in water treatment systems is required to quantify their effectiveness in mitigating public health risks.

Purpose and objectives: This case study aims to methodologically evaluate the application of a quasi-experimental difference-in-differences (DiD) model to assess the risk reduction achieved by a major rehabilitation programme applied to a subset of water treatment facilities. The objective is to demonstrate the model's utility for isolating the causal effect of engineering interventions from secular trends.

Keywords: *Waterborne diseases, Infrastructure resilience, Sub-Saharan Africa, Difference-in-differences, Risk assessment, Water treatment systems, Public health engineering*

Article Highlights

- Difference-in-differences model isolates causal effect of engineering interventions.
- Rehabilitation programme linked to ~16% reduction in waterborne disease incidence.
- Quasi-experimental design provides robust framework for post-hoc project evaluation.
- Longitudinal data from control facilities is critical for causal inference.

Core Model Specification

$Y_{it} = \beta_0 + \beta_1 \text{Treat}_i + \beta_2 \text{Post}_t + \delta (\text{Treat}_i \times \text{Post}_t) + \varepsilon_{it}$, where Y_{it} is log-transformed disease incidence. Inference uses cluster-robust standard errors.

This study demonstrates the application of econometric causal inference methods to structural engineering evaluation.

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