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Methodological Evaluation and Risk Reduction Diagnostics for Ugandan Water Treatment Facilities

A Difference-in-Differences Model, 2000–2026

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ABSTRACT

Background: The operational integrity of centralised water treatment infrastructure is critical for public health, yet systematic, longitudinal evaluations of intervention efficacy in sub-Saharan contexts are scarce. Existing assessments often lack robust counterfactual frameworks to isolate the causal effect of infrastructure upgrades from secular trends.

Purpose and objectives: This Data Descriptor presents a structured methodological framework and associated dataset designed to quantify the causal impact of technical and managerial interventions on facility performance and associated public health risks. The primary objective is to provide a replicable model for engineering diagnostics and policy evaluation.

Keywords: *water treatment infrastructure, sub-Saharan Africa, difference-in-differences, risk reduction, operational integrity, Uganda, longitudinal evaluation*

Article Highlights

- Quasi-experimental DiD model quantifies causal impact of interventions.
- Dataset enables longitudinal analysis of engineering performance and water quality.
- Methodology supports evidence-based asset management and policy evaluation.
- Framework is replicable for infrastructure diagnostics in similar contexts.

Core Estimating Equation

$Y_{it} = \alpha + \beta (Treatment_{it}) + \gamma_i + \delta_t + \epsilon_{it}$, where Y_{it} is a composite risk index. Inference uses cluster-robust standard errors at facility level.

This Data Descriptor provides a methodological template and validated dataset for causal evaluation of water treatment interventions.