

# A Randomised Field Trial for the Diagnostic Evaluation of Water Treatment System Efficiency in Ethiopia

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## ABSTRACT

**Background:** Access to safe drinking water remains a critical challenge in many regions, with existing water treatment systems often operating below design specifications. There is a recognised need for robust, field-based diagnostic methodologies to evaluate the operational efficiency of such infrastructure, particularly in resource-constrained settings.

**Purpose and objectives:** This case study aimed to develop and implement a randomised field trial protocol to diagnostically evaluate the functional efficiency of communal water treatment systems. The objective was to quantify efficiency gains and identify key engineering parameters influencing performance under real-world operating conditions.

**Keywords:** *Randomised controlled trial, Water treatment efficiency, Sub-Saharan Africa, Process evaluation, Point-of-use systems, Drinking water quality, Developing countries*

### Article Highlights

- Stratified randomised field trial conducted across multiple communal water treatment facilities.
- Diagnostic intervention demonstrated a mean 42% reduction in outlet turbidity versus control.
- Operational cycle length and filter media condition were key predictors of efficiency loss.
- Provides a rigorous framework for evaluating real-world water treatment system performance.

### Methodological Insight

The study employed a mixed-effects regression model to analyse log-transformed effluent quality, accounting for facility-level random effects to isolate the impact of the diagnostic intervention.

*This study presents a concrete protocol for field-based performance evaluation in resource-constrained settings.*

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