

Evaluating System Reliability in Senegalese Community Health Centres

A Quasi-Experimental Methodological Assessment

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ABSTRACT

{ "background": "Community health centres are critical nodes in primary healthcare systems, yet robust methodological frameworks for assessing their operational reliability in low-resource settings are lacking. Existing evaluations often rely on cross-sectional data, which cannot adequately capture system dynamics or attribute changes to specific interventions.", "purpose and objectives": "This study aimed to develop and apply a novel quasi-experimental design to quantitatively evaluate the reliability of systems within community health centres, focusing on the consistency of service delivery and supply chain integrity.", "methodology": "We employed a controlled interrupted time series design across a matched sample of 24 centres. System reliability was operationalised as the probability of key service and supply indicators being within specified control limits. The primary analysis used a segmented regression model: $Y_t = \beta_0 + \beta_1 T_t + \beta_2 X_t + \beta_3 T_t X_t + \epsilon_t$, where Y_t is the reliability metric, T_t is time, and X_t marks the intervention period. Inference was based on Newey-West robust standard errors to account for autocorrelation.", "findings": "The methodological application revealed a significant post-intervention increase in mean system reliability score ($\beta_3 = 0.18$, 95% CI: 0.07 to 0.29). A key concrete result is that the intervention was associated with a 22% reduction in the incidence of essential drug stock-outs. The quasi-experimental design proved feasible for isolating the effect of systemic improvements from secular trends.", "conclusion": "The proposed methodological approach provides a rigorous, field-applicable framework for assessing health system reliability. It moves beyond descriptive snapshots to enable causal inference regarding interventions aimed at strengthening community-level healthcare infrastructure.", "recommendations": "Health systems researchers should adopt quasi-experimental designs for evaluating operational reliability in real-world settings. Policymakers should mandate the collection of longitudinal, high-frequency routine data to facilitate such analyses for continuous quality improvement.", "key

Keywords: health systems research, sub-Saharan Africa, quasi-experimental design, primary healthcare, community health centres, system reliability, Senegal

Article Highlights

- A 22% reduction in essential drug stock-outs was associated with the intervention.
- Segmented regression with robust errors quantified a significant reliability increase ($\beta_3 = 0.18$).
- The study demonstrates a field-applicable framework for

Core Method

Controlled interrupted time series design across 24 matched centres, using segmented regression with Newey-West robust standard errors to model system reliability.

This study provides a replicable methodological template for evaluating health system interventions.

<p>causal assessment in low-resource settings.</p> <ul style="list-style-type: none">• Longitudinal, high-frequency data collection is critical for evaluating system dynamics.	
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