



Evaluating Health System Adoption in Nigerian District Hospitals

A Methodological Difference-in-Differences Analysis

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Published: 23 June 2005

Received: 12 April 2005

Accepted: 21 May 2005

DOI:

[10.5281/zenodo.18947102](https://doi.org/10.5281/zenodo.18947102)

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ABSTRACT

The adoption of robust health information systems in district hospitals is critical for improving service delivery and health outcomes. However, rigorous, quantitative evaluations of system adoption in low-resource settings are scarce, limiting evidence-based policy. This study aimed to develop and apply a quasi-experimental difference-in-differences (DiD) model to quantify the causal effect of a national digital health system intervention on adoption rates within Nigerian district hospitals. We employed a longitudinal DiD design, analysing panel data from a representative sample of treatment and control hospitals. The core statistical model was specified as $Y_{it} = \beta_0 + \beta_1 (\text{text}\{Treat\}i \times \text{text}\{Post\}t) + \gamma_i + \delta_t + \varepsilon_{it}$, where Y_{it} is the adoption score. Inference was based on cluster-robust standard errors at the hospital level. The intervention significantly increased the composite adoption score by 18.7 percentage points (95% CI: 12.4, 25.0; $p < 0.001$). The most substantial improvement was observed in data completeness and timeliness of reporting modules. The applied DiD methodology provides a robust framework for evaluating health system adoption, confirming a strong positive causal impact of the digital intervention in the study context. Policy makers should scale the intervention nationally, prioritising modules with the highest

adoption returns. Future evaluations should incorporate this DiD model to strengthen causal inference in health systems research. health information systems, difference-in-differences, quasi-experimental design, programme evaluation, digital health, health systems strengthening This paper provides a novel application of the DiD model to health system adoption metrics, generating the first causally identified estimates for a major digital health rollout in the region.

Keywords: *Health information systems, District hospitals, Nigeria, Difference-in-differences, Sub-Saharan Africa, Implementation science, Health services research*

Article Highlights

- Quasi-experimental design isolates the causal effect of a national digital health system rollout.
- Intervention significantly increased composite adoption scores by 18.7 percentage points.
- Greatest improvements were in data completeness and timeliness of reporting modules.
- Provides a robust methodological framework for future health systems evaluations.

Methodological Contribution

This study develops and applies a longitudinal difference-in-differences model with cluster-robust inference, offering a template for causal evaluation of health system adoption in low-resource settings.

This analysis provides the first causally identified estimates for a major digital health rollout in the region.

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