



A Methodological Evaluation of District Hospital Systems in South Africa

Panel-Data Estimation for Risk Reduction in Healthcare Delivery

Pieter van der Merwe^{1,2}, Kagiso Mokoena^{3,4}

Annette Botha⁵, Thandiwe Nkosi^{3,6}

¹ Department of Clinical Research, University of Pretoria

² University of the Free State

³ University of Pretoria

⁴ Council for Geoscience

⁵ Department of Internal Medicine, University of the Free State

⁶ Department of Public Health, Agricultural Research Council (ARC)

Correspondence: pmerwe@aol.com

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Author notes

Pieter van der Merwe is affiliated with Department of Clinical Research, University of Pretoria and focuses on Medicine research in Africa.

Kagiso Mokoena is affiliated with University of Pretoria and focuses on Medicine research in Africa.

Annette Botha is affiliated with Department of Internal Medicine, University of the Free State and focuses on Medicine research in Africa.

Thandiwe Nkosi is affiliated with Department of Public Health, Agricultural Research Council (ARC) and focuses on Medicine research in Africa.

ABSTRACT

Background: District hospitals are critical nodes in South Africa's healthcare system, yet systematic, quantitative evaluations of their operational performance and risk factors are limited. Existing assessments often lack longitudinal rigour, hindering the identification of systemic vulnerabilities and the measurement of intervention efficacy over time.

Purpose and objectives: This case study aims to develop and apply a panel-data econometric framework to evaluate systemic performance and quantify risk reduction in district hospital operations. The primary objective is to demonstrate a replicable methodology for measuring the impact of operational changes on key delivery outcomes.

Keywords: *District hospitals, South Africa, Panel-data estimation, Healthcare delivery, Risk reduction, Health systems evaluation, Sub-Saharan Africa*

Article Highlights

- Panel-data econometrics isolates causal effects of operational inputs on hospital outcomes.
- Clinical staffing ratios show a significant negative

Core Analytical Framework

Two-way fixed effects model: $Y_{it} = \beta_0 + \beta_1 X_{it} + \mu_i + \lambda_t + \varepsilon_{it}$, with cluster-robust inference for hospital-level heterogeneity.

<p>association with adverse event rates.</p> <ul style="list-style-type: none">• Methodology enables longitudinal tracking of intervention efficacy for system planners.• Identifies non-linear resource allocation effects critical for maximising risk reduction.	<p><i>This study provides a replicable econometric framework for longitudinal health system evaluation.</i></p>
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