

# A Meta-Analysis of Randomised Field Trials for System Reliability in Ethiopian District Hospitals

*Methodological Evaluation, 2000–2026.*

**Alemayehu Bekele<sup>1</sup> | Yonas Tadesse<sup>2,3</sup> | Mekdes Tsegaye<sup>4,5</sup>  
Selamawit Girma<sup>6,7</sup>**

*Department of Clinical Research, Debre Markos University • Department of Epidemiology, Africa Centers for Disease Control and Prevention (Africa CDC), Addis Ababa • Department of Surgery, Jimma University • Ethiopian Institute of Agricultural Research (EIAR) • Department of Internal Medicine, Jimma University • Africa Centers for Disease Control and Prevention (Africa CDC), Addis Ababa • Department of Internal Medicine, Debre Markos University*

**Correspondence:** [abekele@gmail.com](mailto:abekele@gmail.com)

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## ABSTRACT

{ "background": "District hospitals in Ethiopia are critical nodes in the national health system, yet their operational reliability is often compromised. Randomised field trials (RFTs) have been increasingly employed to evaluate interventions aimed at improving system performance, but the methodological rigour and consistency of these studies have not been systematically appraised.", "purpose and objectives": "This meta-analysis aims to critically evaluate the methodological quality of RFTs assessing system reliability in Ethiopian district hospitals, identifying common design strengths, limitations, and reporting practices to inform future research standards.", "methodology": "We conducted a systematic search of multiple databases for published and grey literature. Eligible studies were RFTs with a primary outcome of system reliability (e.g., equipment uptime, protocol adherence, service continuity). Methodological quality was assessed using a modified Cochrane Risk of Bias tool and a bespoke checklist for field trial context. Quantitative synthesis used a random-effects meta-regression model:  $\theta_i = \mu + \beta \xi + \epsilon_i$ , where  $\theta_i$  is the standardised effect size and  $X_i$  a vector of methodological covariates. Inference was based on 95% confidence intervals derived from robust variance estimation.", "findings": "Of 37 included trials, a significant majority (78%, 95% CI: 68 to 86) exhibited high risk of bias in blinding of participants and personnel. Meta-regression indicated that trials employing a cluster-randomised design reported, on average, 0.35 standard deviations lower effect sizes ( $p < 0.05$ ) than individually randomised trials, suggesting potential for overestimation in the latter. Incomplete reporting of sample size calculations was a pervasive theme.", "conclusion": "The evidence base from RFTs on hospital system reliability is substantively limited by recurrent methodological weaknesses, particularly in blinding and statistical power, which may bias reported intervention effects.", "recommendations": "Future trials must prioritise explicit reporting of randomisation and blinding procedures, adopt cluster designs where appropriate, and

**Keywords:** *health systems research, Sub-Saharan Africa, randomised controlled trials, district hospitals, system reliability, methodological evaluation, Ethiopia*

### Article Highlights

- 78% of included trials exhibited high risk of bias in blinding procedures.

### Core Analytical Model

Random-effects meta-regression:  $\theta_i = \mu + \beta X_i + \epsilon_i$ , where  $\theta_i$  is the standardised effect size and  $X_i$  a vector of

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| <ul style="list-style-type: none"><li>• Cluster-randomised designs reported 0.35 SD lower effects than individual designs.</li><li>• Incomplete reporting of sample size calculations was pervasive across studies.</li><li>• Methodological weaknesses substantively limit the current evidence base.</li></ul> | <p>methodological covariates.</p> <p><i>This meta-analysis critically appraises the methodological rigour of 37 randomised field trials conducted between 2000–2026.</i></p> |
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This is an abstract-only publication. The complete research paper with full methodology, results, discussion, and references is available upon request.

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