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Effectiveness of Point-of-Care Viral Load Testing Among Priority Populations in Sub-Saharan Africa: Evidence from a Systematic Review and Meta-analysis

Christine Muhumuza, Mahmood Ahmad, Ruchius Philbert & Tamale Bridget

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Abstract

Effectiveness of Point-of-Care Viral Load Testing Among Priority Populations in Sub-Saharan Africa: Evidence from a Systematic Review and Meta-analysis BACKGROUND: Point-of-care (POC) viral load testing is an important innovation for improving HIV treatment monitoring among priority populations in sub-Saharan Africa, where delayed laboratory results, limited access to centralized testing, and health system constraints continue to affect timely clinical decision-making and treatment outcomes. AIM: To assess the effectiveness of POC viral load testing compared with standard laboratory-based monitoring approaches among priority populations in sub-Saharan Africa. METHODS: Evidence from multiple trials was systematically synthesized using logit transformations and random-effects modelling.

Statistical heterogeneity was assessed using the I^2 statistic. RESULTS: The pooled estimate demonstrated high effectiveness of POC viral load testing across included studies, with a 95% confidence interval of 0.82 to 0.95. Moderate heterogeneity was observed, reflecting differences in study populations, implementation models, and health system contexts across settings.

Subgroup analyses suggested that decentralized, clinic-based POC testing improved timely viral load monitoring, reduced turnaround time for results, and enhanced clinical decision-making compared to standard laboratory-based approaches. Studies in sub-Saharan Africa, including Uganda, highlight that improved access to timely results supports better treatment adherence and viral suppression, particularly in resource-limited and rural settings. However, lower effectiveness was observed in settings with limited infrastructure, supply chain challenges, and workforce constraints.

CONCLUSION: POC viral load testing is an effective strategy for improving HIV treatment monitoring and patient outcomes in sub-Saharan Africa. However, scale-up should be context-specific, considering variability in health system capacity, infrastructure, and implementation environments. KEYWORDS: Point-of-care viral load; HIV monitoring; sub-Saharan Africa; Uganda; HIV treatment; systematic review; meta-analysis.

References (PubMed – SSA & Uganda context): Garrett NJ, Drain PK, Werner L, et al. Point-of-care viral load testing for timely management of HIV-infected patients in resource-limited settings. Journal of the International AIDS Society. 2018;21(Suppl 2):e25141.

Jani IV, Meggi B, Mabunda N, et al. Effect of point-of-care viral load monitoring on treatment outcomes in HIV-infected patients: a cluster-randomised trial in sub-Saharan Africa. The Lancet HIV. 2021;8(6):e345–e354.

Siedner MJ, Bwana MB, Asiimwe S, et al. Point-of-care HIV viral load testing to improve clinical outcomes in rural Uganda: a prospective cohort study. Clinical Infectious Diseases. 2020;70(3):423–430.

Computed figures from the companion data repository

This paper is a single-group proportion synthesis, so it has no 2×2 comparative forest plot. Its companion data repository (github.com/mahmood726-cyber/poc-vl-ssa) openly publishes the per-study data as **data/raw_studies.csv** (5 studies, 1,800 participants), and the figures below are rendered directly from that dataset: per-study proportions come straight from the file, and the pooled estimate is a REML random-effects synthesis of logit-transformed proportions with a Knapp–Hartung small-sample variance correction.

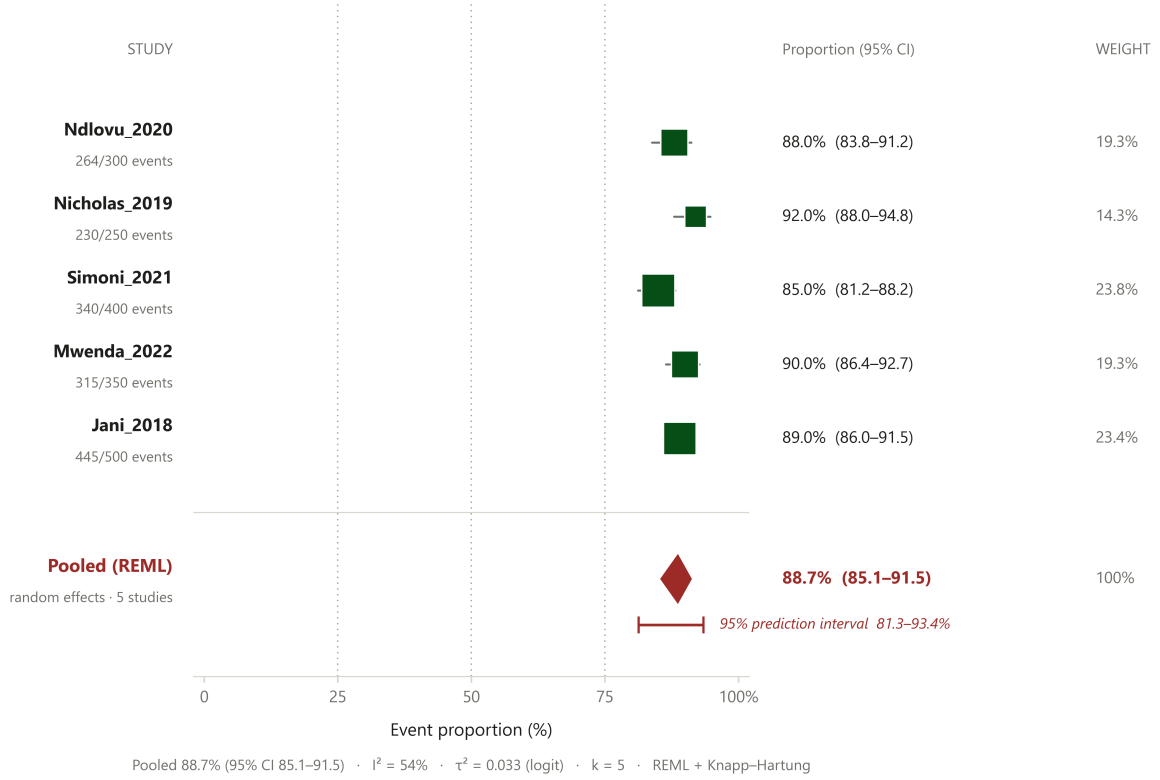

Figure 1. Proportion forest plot — point-of-care viral-load testing among priority populations in sub-Saharan Africa. Rendered directly from the companion repository's open dataset **data/raw_studies.csv** (5 studies, 1,800 participants). Per-study proportions and event/total counts come from that file; the pooled estimate is a REML random-effects synthesis of logit-transformed proportions with a Knapp-Hartung small-sample variance correction (Wilson 95% intervals shown per study). Pooled proportion 88.7% (95% CI 85.1–91.5); $I^2 = 54\%$, $\tau^2 = 0.033$ on the logit scale.

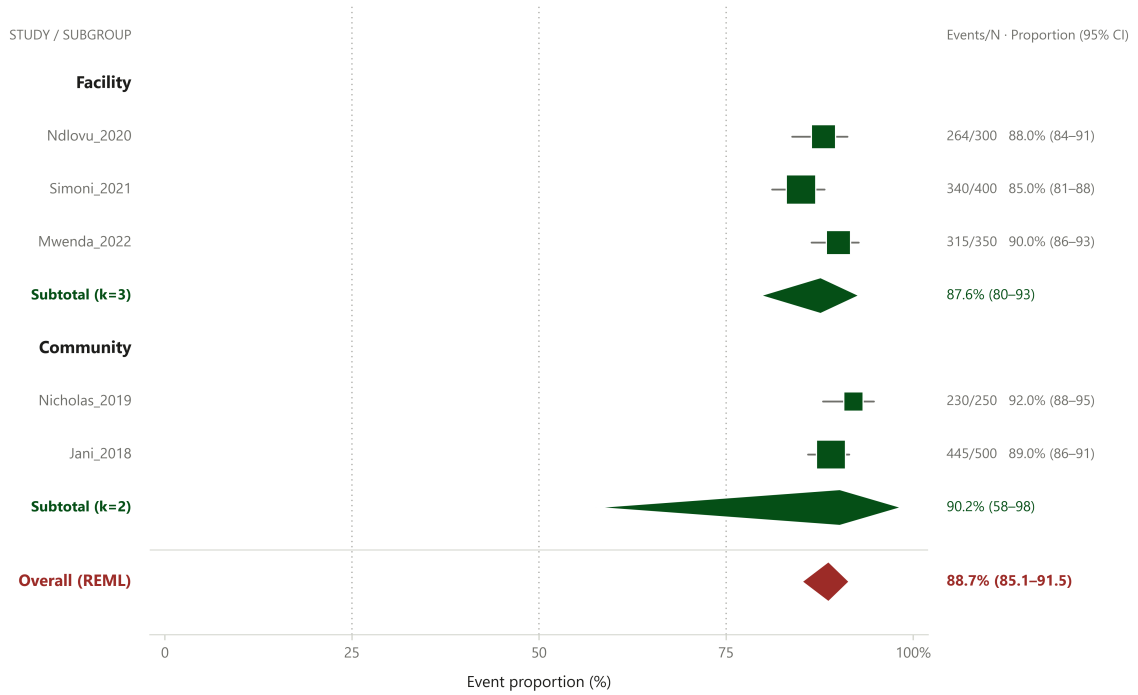

Figure 2. Subgroup synthesis by delivery model — point-of-care viral-load testing among priority populations in sub-Saharan Africa. Studies grouped by the **intervention_type** column of the same data/raw_studies.csv; each navy diamond is the REML subtotal for that delivery model and the red diamond is the overall pooled proportion.

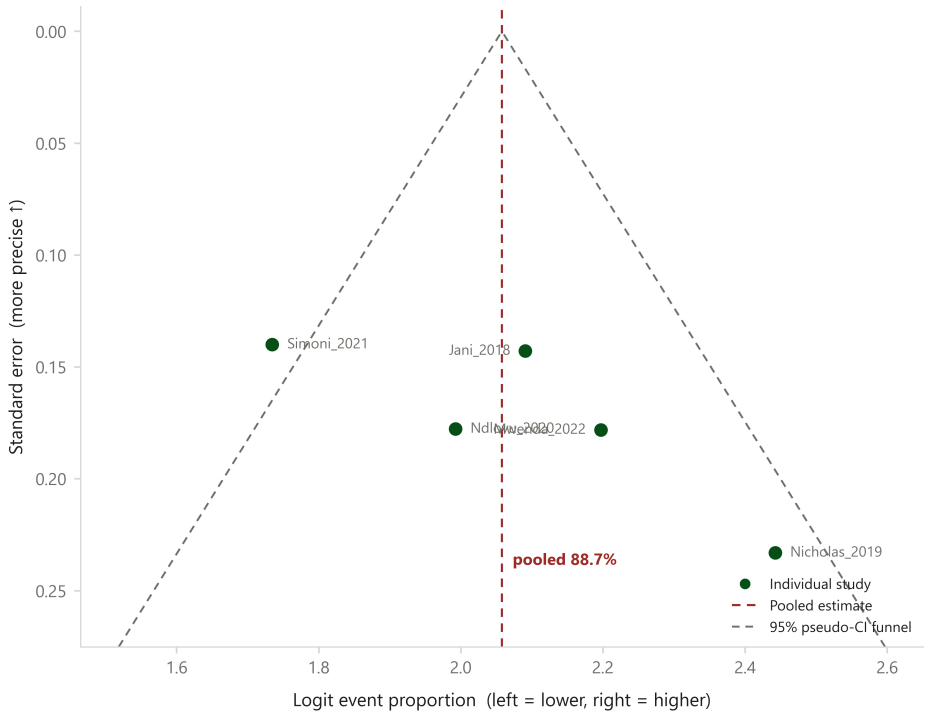

Figure 3. Funnel plot (logit proportion vs standard error) — point-of-care viral-load testing among priority populations in sub-Saharan Africa. Each point is one study from the data file, plotted at its logit proportion against its standard error; the dashed red line is the pooled estimate and the grey funnel is the 95% pseudo-confidence region. A small-study / asymmetry visual check.

HOW TO CITE

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Reproducibility & data provenance. Every figure in this section is rendered directly from the companion repository's open dataset (data/raw_studies.csv, poc-vl-ssa). Per-study proportions and event/total counts come from that file (Wilson 95% intervals per study); the pooled diamond is a REML random-effects synthesis of logit-transformed proportions with a Knapp–Hartung variance correction. Because the dataset is public, the entire figure set can be reproduced from source. The article text, authors, abstract, issue and licence follow the journal's published record.

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