

AI-Augmented Monitoring and Evaluation Systems: Redefining Data Use for Sustainable Health Systems in East Africa



Andrew Okello¹; Jannet Doe, PhD^{1,2}; Frederick Yukaham, MD, PhD^{1,3}; Brenda Zambrano, MD^{1,4}
¹MEARL Hub Afrika, ²Ministry of Health Rwanda, ³Ministry of Health Kenya, ⁴Ministry of Health Ethiopia



Background

Monitoring and Evaluation (M&E) systems are central to evidence-based health planning in Africa, yet many remain hindered by data incompleteness, delayed reporting, and limited analytical use, despite growing investment in digital health platforms. These gaps weaken health systems' ability to detect underperformance early and respond to emerging threats.

Artificial Intelligence (AI)—through machine learning, natural language processing, and predictive analytics—offers a new frontier for transforming M&E from reactive reporting to proactive, data-intelligent systems. AI can enhance data accuracy, timeliness, and foresight, driving more responsive and equitable decision-making.

Aligned with the AU Digital Health Strategy (2020–2030) and the WHO Global Digital Health Strategy (2020–2025), this study explores how AI integration within national M&E frameworks in Uganda (HIV), Rwanda (maternal health), and Ethiopia (malaria) can strengthen data-driven, adaptive, and sustainable health systems across Africa.

Results

Integration of AI tools into national M&E systems across Uganda, Rwanda, and Ethiopia led to substantial improvements in data accuracy, reporting timeliness, and predictive capacity. Comparative analysis of pre- and post-AI data (2019–2023) revealed consistent and statistically significant gains across all performance indicators ($p < 0.05$). (Table 1).

Across the three countries, predictive AI models consistently detected anomalies and performance risks 2–8 weeks earlier than routine manual reporting. (Fig. 1)

“a new layer of intelligence that turns data into foresight
 “a lifesaver for overworked district M&E teams.”
 algorithmic transparency, trust, and data sovereignty. digital literacy disparity

Methods and Materials

- A sequential mixed-methods, multi-country design (Jan 2020–Jun 2023) was implemented across three African health programs:
 - 12,680 records from DHIS2, EMRs, and partner project databases (2020–2024) covering 12 quarters were extracted & analyzed for pre- and post-AI integration changes in:
 - Data completeness and accuracy
 - Timeliness of reporting
 - Predictive detection of underperformance
 - 45 key informants (data managers, M&E officers, AI developers, and policymakers) were purposively selected for qualitative interviews.
 - AI applications embedded in M&E systems included:
 - Machine Learning (Random Forest, Gradient Boosting): anomaly detection, trend prediction, indicator classification.
 - Natural Language Processing (NLP): automated analysis of unstructured health reports, improving case classification and sentiment tracking.
 - Automated Dashboards (Power BI, Python): real-time visualization, alerts, and dynamic reporting.
 - Model validation used an 80:20 train-test split with 10-fold cross-validation. Quantitative analyses were performed in R (v4.3) and Stata (v19).
 - Semi-structured interviews explored perceived benefits, governance and ethical considerations, and system readiness. Data were thematically coded in NVivo v15 using grounded theory to identify cross-country patterns.

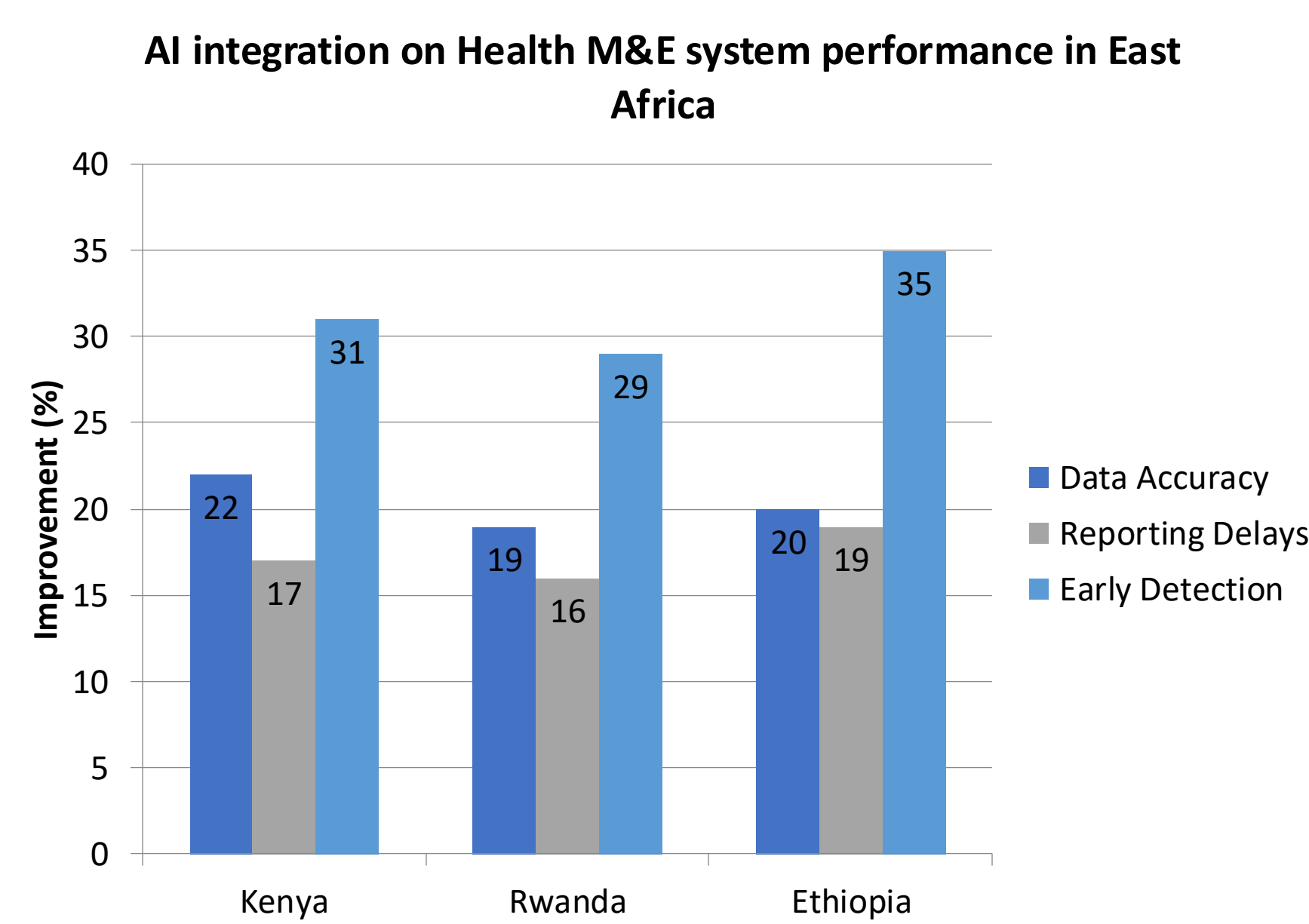
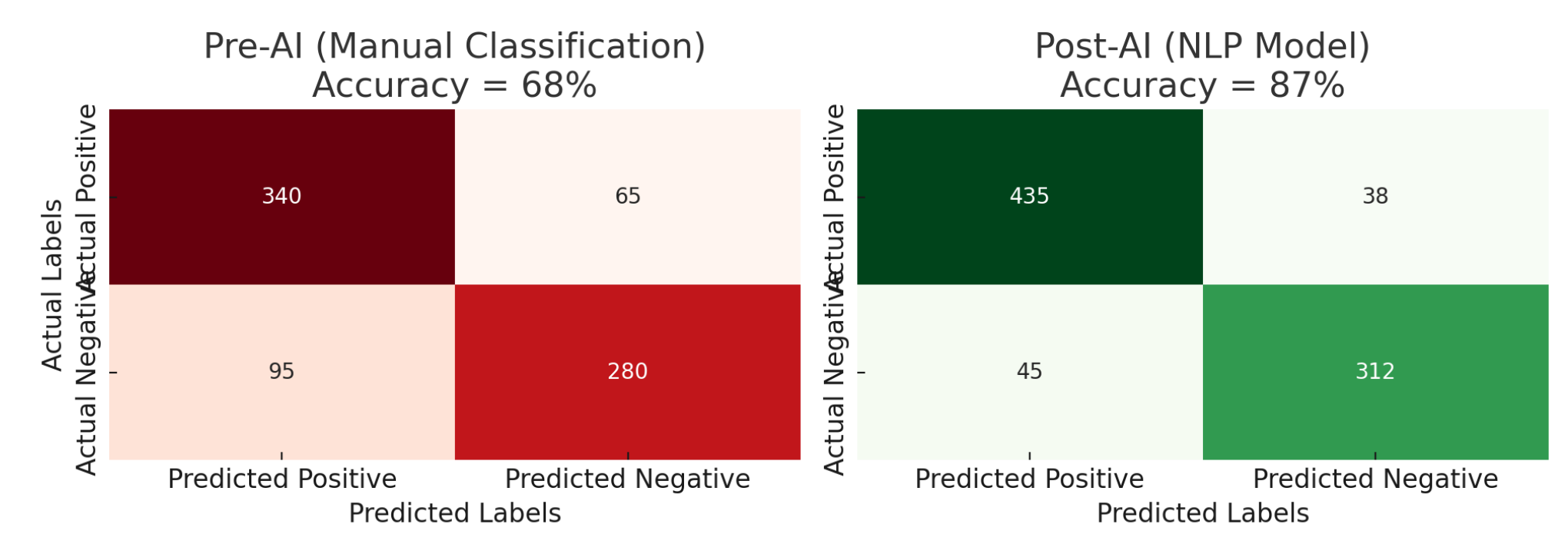


Chart 1. AI Models.

Table 1. Summary of M&E System Performance Pre and Post AI Integration

Performance Indicator	Baseline	Endline	Mean % Change
Data Accuracy	76%	92%	+22%
Reporting delays (average days per quarter)	47 days	30 days	-36% (-17 days)
Early detection of underperformance	-	+31%	+31%
Maternal case classification accuracy	68%	87%	+28%

Figure 2. NLP-Driven Maternal Health Case Classification Accuracy (Rwanda, 2020–2023)



Discussion

Integration of AI into M&E systems significantly improved data accuracy, timeliness, and predictive capabilities across the three pilot countries. These results demonstrate AI's potential to shift Africa's health monitoring from reactive reporting to proactive decision-making.

However, challenges persist—especially around algorithmic bias, data privacy, digital literacy, and governance frameworks. Strengthening ethical oversight and building local AI capacity will be critical to ensuring equitable benefits.

Overall, AI-augmented M&E systems offer a practical pathway toward **sustainable, data-driven, and inclusive health systems** in Africa.

Conclusions

This multi-country assessment demonstrates that integrating Artificial Intelligence (AI) into Monitoring and Evaluation (M&E) systems can significantly enhance the accuracy, timeliness, and responsiveness of health program monitoring in Sub-Saharan Africa. AI's predictive and analytic capabilities enable earlier detection of underperformance, reduce manual reporting burdens, and promote evidence-driven decision-making.

However, the study also underscores that technological innovation alone is insufficient. Without deliberate attention to ethical governance, institutional readiness, and digital inclusion, the benefits of AI risk deepening existing inequities. Human oversight, transparency, and accountability remain central pillars for trustworthy AI in public health.

Policy & Practice Implication

The integration of AI into national M&E systems represents a paradigm shift in health governance. Ministry of Health in Uganda can leverage these findings to institutionalize AI-assisted data review cycles, improve real-time decision dashboards, and develop ethical AI governance frameworks aligned with the African Union Digital Health Strategy.

Key Takeaway
 AI in Health is not just a technology shift — it's a governance reform opportunity.

Contact

Name: Andrew Okello
 Organization: MEARL Hub Afrika (MHA)
 Email: Andrew.Okello@mearlhubafrika.org
 Website: <https://mearlhubafrika.org>
 Phone: +256759170584

Acknowledgement

We gratefully acknowledge the contributions of participating Ministries of Health in Kenya, Rwanda, and Ethiopia, as well as the technical teams from MEARL Hub Afrika. Special thanks to data officers, AI developers, and program managers whose insights shaped this study.

References

