ጤና ሚኒስቴር - ኢትዮጵያ
MINISTRY OF HEALTH - ETHIOPIA

SPECIAL BULLETIN

28ኛው የጤና ዘርፍ ዓመታዊ የግምገማ ጉባዔ

The 28th Annual Review Meeting of the Health Sector

እመርታዊ ሪፎርም ለሉዓላዊና የማይበገር የጤና ሥርዓት!

Transformative Reform for a Sovereign and Resilient Health System!

October, 2026

ጤና ሚኒስቴር - ኢትዮጵያ
MINISTRY OF HEALTH - ETHIOPIA

SPECIAL BULLETIN

28ኛው የጤና ዘርፍ ዓመታዊ የግምገማ ጉባዔ

The 28th Annual Review Meeting of the Health Sector

እመርታዊ ሪፎርም ለሉዓላዊና
የማይበገር የጤና ሥርዓት!

Transformative Reform for a Sovereign and Resilient Health System!

October, 2026

Contents

Editorial Board members and Reviewers V

Reviewers V

Foreword VI

Editorial VII

Section One: Research Articles 1

Dynamic Adaptation, Sustained Fidelity: Unlocking Ethiopia's Health Extension Program Potential Through Embedded Implementation Research 2

Digital Connectivity, Machine Learning, and Incomplete Antenatal Care in Ethiopia 6

Magnitude of Patient Mortality and Its Determinants among Admitted Patients at Tirunesh Beijing General Hospital, Addis Ababa, Ethiopia, 2025: A Cross-Sectional Study 10

Health Professional and Organizational Readiness for Electronic Medical Record Implementation in Primary Healthcare Units in Gondar Town, Northwest Ethiopia: Cross-sectional study 15

Information Revolution Model Woredas and Primary Health Care Performance: Longitudinal Evidence from Ethiopia 20

Integrating Pharmacy Services into National Supply Chain Maturity Assessment: The Ethiopia NSCPSA Experience 25

EOHAQ-AMR: A One Health framework integrating Tri-Sector AMR Competency, and the Environmental Antibiotic Pressure Index 30

Designing a Clinical Decision Support System for Antenatal Risk Detection in Public Health Centers of Addis Ababa, Ethiopia 34

From Duplication to Synergy: Partner Collaboration in Woreda Health System Transformation under Ethiopia's HSDIP, A Mixed-Methods Case Study 39

Availability of minimum adolescent and youth health service packages at service delivery points in Ethiopia 44

Investing in Essential Care Versus Advanced Critical Care for COVID-19 Patients: A Cost-Effectiveness Analysis from a Resource-Scarce Area in Ethiopia. 48

A Mid-Term Evaluation of the Cervical Cancer Screening Initiative: A Longitudinal Quasi-Experimental Study, 2019–2023 52

Machine Learning Algorithms Application in WaSH Prediction using DHS Data in Sub-Saharan Africa 56

Essential Emergency and Critical Care (EECC) in Ethiopia 61

Intimate Partner Violence Among Infertile Women Attending Health Facilities in West Arsi and Bale Zones, Ethiopia 65

People's Voice and Health System Response: A Population-Based Assessment in Ethiopia 69

Spatial Distribution of Severe Acute Malnutrition and Associated Factors among Under-Five Children in Central Ethiopia Region 76

Spatial Distribution of Malaria in Central Ethiopia Region: A Bayesian conditional autoregressive model 81

Adherence to Medical Oxygen Therapy Clinical Standards in Ethiopian Public Hospitals: A Four-Cycle Cyclic Clinical Audit 87

Implementation outcomes of immediate kangaroo mother care in a resource-limited settings: A 19 months study 92

Section Two: Best Practice Articles 96

From Pilot to Policy: Institutionalizing Networks of Care to Strengthen Primary Health Care in Ethiopia 97

From Data to Transformation: Lessons from the Information Revolution in Tehuledrie Woreda, Ethiopia 100

Sustaining Last-Mile Delivery of Health Products in Conflict-Affected Settings in Ethiopia via Third-Party Logistics 103

Elevating Adolescent and Youth Engagement in Health Through Youth-Led Community Scorecards: Experience from four AYFHS facilities, Addis Ababa, Ethiopia . 108

Expansion of Emergency Surgery and Obstetric Ultrasound Services at Primary Health Care Units 112

From Summit to Action for Evidence Informed Decision Making in Ethiopia 114

In-Hospital Production of Infection Prevention and Control Supplies to Ensure Reliable Access 118

Making HDSS Online: Real-Time Dashboard for Data Visualization and Field Worker Monitoring at Wonago-HDSS 120

Predicting eLearning CPD Adoption among Healthcare Professionals in Ethiopia Using a Modified UTAUT-2 Model 124

Strengthening Community Cause of Death Data Through Verbal Autopsy: Lessons and Best Practices. 127

Innovation Journey from Field testing to National Guidelines: Institutionalizing the Combined Community–Facility Quality Improvement in Ethiopia's Primary Health Care . . . 131

Blended Learning as a Solution for Scaling Health Workforce Capacity in Primary Healthcare Settings of Ethiopia . . . 135

Making EMR and eCHIS Adoption Work: Practical Lessons from Ethiopia . . . 137

Bridging Gaps in Industrial Parks: Best Practices for Enhancing Sexual and Reproductive Health among Young Workers in Ethiopia . . . 141

Health Extension Program Optimization: Implementation Lessons, Challenges, and Future Direction . . . 144

Glycemic Control among Children and Young Adults with Type 1 Diabetes: Following Enrollment into PEN-Plus Clinics . . . 148

Unlocking Access to Life-saving Health Products: Lessons from the National Supply Base Analysis . . . 152

Electronic Medical Record Implementation in a Teaching Hospital: Experience from the University of Gondar Comprehensive and Specialized Hospital, Ethiopia . 156

Health Information Revolution in Practice: Lessons from Hulbareg Woreda Using the Health Information Revolution Army Approach—Hawassa University CBMP 160

From Paper to Real-Time Action: Digitizing Routine Data Quality Assessment in Amhara Region . . . 165

Strengthening Routine Immunization Data Quality and Coverage Estimation Through the Ethiopia AHEAD Initiative: Advancing Equity and Reaching Zero-Dose Children . . . 168

Availability of health insurance, medicine list, benefit package and its associated factors among public health facilities in Ethiopia, 2026: Multi-center cross-sectional study . . . 176

Integrating Family Planning into RMNCH Services at the Primary Health Care Level: Addressing Missed Opportunities in Ethiopia. . . . 182

Institutional Transformation of Ethiopia's Public Health Logistics: A Legal, Operational, and Policy Synthesis under Proclamation No. 1354/2024 and Directive No. 1066/2025 . . . 185

Embedding Government-Owned Quality Standards to Strengthen Family Planning Services in Humanitarian Settings: Transitioning to Ethiopia's National Family Planning Quality Standards. . . . 191

Impact of Catchment Based Clinical Mentorship (CBCM) on Immediate Postpartum Family Planning Uptake in Ethiopia, Lessons from Smart Pathways Program by PSI . . . 195

Building Digital Workforce Intelligence: Institutionalizing Competency Management for Health Supply Chain Workforce Development in Ethiopia . . . 198

Section Three: New Initiatives, programs or services . . . 201

Committed Demand and Supply System: National Model for Accountable Pharmaceutical Supply Chains, One-Year Implementation Results. . . . 202

Digitizing Performance Monitoring Tool: The ePMT+ Innovation for Strengthening Health System Performance in Ethiopia . . . 208

Transforming a Paper-Based PMT Logbook into a Digital System: Development of the PMT eBook . . . 211

Expanding Access and Equity: Integrating HPV Vaccination into Community-Based Health Platforms in Ethiopia. . . . 215

Strengthening Pharmaceutical Supply Chains and Pharmacy Services: Findings from Ethiopia's First Community Commodity Monitoring Model . . . 218

Cultivating Care Beyond the Health Service: Integrating Vegetable Gardening into Adolescents and Youth-Friendly Health Facilities for Climate Resilience . . . 222

Operationalizing Effective Coverage Measurement (ECM) in Tehuledrie Woreda, Amhara Region . . . 224

CHOICE: Scaling Health AI Innovation Through Ethics-by-Design . . . 228

Effective Coverage Measurement and Improvement System (ECMS) in Ethiopia: A National Quality Improvement Approach . . . 231

Five Birr for My Health: A Community-Led Approach to Improve CBHI Enrollment and Renewal . . . 234

Operationalizing AHRI's Bioequivalence Center as a National and Regional Contract Research Organization (CRO) . . . 237

From Vision to Action: Establishing Human Vaccine Manufacturing in Ethiopia . . . 241

H-STIL initiative: A new Collaborative Model for Woreda Health System Transformation in Sidama Region. . . . 245

Point-of-Use Water Flow Optimization for Groundwater and Wastewater Resilience. . . . 249

Elevating Adolescent and Youth Engagement in Health Through Youth-Led Community Scorecards: Experience from four AYFHS facilities, Addis Ababa, Ethiopia. 252

Ethiopia's Private Sector Engagement Strategy for Health (2026–2030): From Fragmented Projects to a National System: A Framework for Engagement . . . 255

Introducing Ethiopia's Amniotic Membrane Graft Service for Ocular Surface Reconstruction . . . 259

Editorial Board members and Reviewers

Editor-in-Chief

Dr. Muluken Argaw (MD, MA), Executive Officer, Strategic Affairs Executive Office (SAEO)

Co-editor-in-Chief

Kedir Seid (MD, MPH), Senior HIS Governance Specialist, SAEO

Coordinator

Mesoud Mohammed: Statistics and Information Team Lead/SAEO

Editorial Board Members

Abebaw Gebeyehu (PhD): Senior Health Systems Strategic Advisor, Data Use Partnership/JSI

Alemnesh Mirkuzie (PhD): Project Director, ImapctHDSS, Ethiopia

Bantalem Yeshanew (MSc) Deputy Project Director, Impact HDSS, Ethiopia

Biniam Kefyalew (PhD): Statistics and Information Professional

Belete Getahun (PhD): Senior Projects Coordinator, Strategic Affairs Executive Office

Chaluma Kumela (MSc): Senior Health Information Systems /M&E Specialist

Fentahun Bikale (MSc): M&E Manager, Strategic Affairs Executive Office

Mohammed Aliye (PhD): Policy, Strategy and Research Analyst

Ousman Esleman (MPH): Senior Health Specialist

Solomon Kassahun (MPH): Senior HIS and M&E Advisor

Tewabe Manaye (MPH): Senior HMIS Advisor, Strategic Affairs Executive Office

Tsedeke Matheows (MPH): Senior M&E Advisor: Strategic Affairs Executive Office

Wubetish Asnake (MPH): Country Program Manager for Vital Strategies/SAEO

Reviewers

Abdulhalik Workicho (PhD), Afework Mulugeta (Prof.), Alemtsehay Mekonnen (PhD), Amare Tadesse (PhD), Ashenafi Beza (MD), Belachew Etana, Birhanu Seyoum (PhD), Colin Baynes (PhD), Daniel Gebremichael (MD,MPH), Degu Abate (Asst. Prof.), Desalegn Admasu (PhD), Dessalegn Tamiru (PhD), Eshetu Ejeta (PhD), Fekadu Elias (PhD), Fikadu Assefa (MD), Fentabil Getnet (PhD), Fitsum Belay (Assoc. Prof.) Gemeda Abebe (Prof.), Girmay Dinsa (PhD), Girum Taye (MSc), Habtamu Endeshaw (MSc), Kassu Ketema (PHD), Kibrom Gebreselassie (Assoc. Prof.), Lelisa Sena (PhD), Melkamu Berhane (Assoc. Prof.) , Mengistu Abate (Asst. Prof.) , Mideksa Adugna (PhD) Mirkuzie Woldie (Prof.), Mitike Molla (Prof.), Muluemebet Abera (Prof.), Nega Assefa (Prof.), Osman Ahmed (Asst. Prof.), Samson Kastro (Asst. Prof.) Semira Hussien (PhD), Shiferaw Letta (PhD), Simegnew Handebo (Asst. Prof.), Sultan Suleman (Prof.), Tariku Tesfaye (Asst. Prof.), Tesfaye Getachew (PhD), Tigist Shumet (PhD), Wondimagegn Kumma (Asso. Prof.) Yibeltal Kifle (PhD), Yohammes Kebede (Prof.), Yibeltal Mekonnen (PhD), Zenebu Begna (PhD),

Contact Information: The editorial team is glad to receive comments and questions regarding the bulletin. For further information, please contact us @: specialbulletin.moh@gmail.com (MOH/SAEO) and/or contact Dr. Kedir Seid @: kedir.seida@moh.gov.et

Foreword

It is with immense pleasure that I extend my warmest welcome to all participants of the 28th Annual Review Meeting (ARM), the premier annual forum for reflection, learning, accountability, and collective action in Ethiopia's health sector. The ARM provides an important opportunity to assess our progress, learn from our experiences, identify persistent challenges, and renew our collective commitment to improving the health and well-being of all Ethiopians.

In conjunction with this important event, I am pleased to present the 15th edition of the Special Bulletin. Over the years, this publication has become an important platform for documenting and disseminating research findings, new initiatives, best practices and implementation experiences from across the health sector. By making this evidence accessible to policymakers, health leaders, researchers, program managers, and health professionals, the bulletin contributes to strengthening a culture of learning and evidence-informed decision-making.

This edition is particularly timely as the health sector transitions from HSDIP I to HSDIP II, the final strategic plan in the current strategic planning trajectory of Ethiopia's health sector and an important instrument for accelerating progress toward the Sustainable Development Goals (SDGs), particularly Universal Health Coverage (UHC). The transition calls for us to reflect on achievements and challenges, consolidate lessons learned, and ensure that evidence generated through implementation is translated into effective policies, strategies, and actions.

The health sector is also advancing the Health Intelligence agenda, moving beyond the generation and reporting of health information toward the systematic integration, analysis, interpretation, and use of diverse data and evidence to generate timely and actionable intelligence. The evidence compiled in this Special Bulletin provides an important foundation for this agenda by expanding our knowledge base, highlighting what works and where gaps remain, and supporting better understanding of emerging opportunities and challenges. Ultimately, such evidence should help strengthen the link between evidence, intelligence, decision-making, action, and improved health outcomes.

I therefore encourage all readers to use the knowledge and lessons presented in this edition to inform the implementation of HSDIP II, accelerate progress toward UHC and the SDGs, strengthen accountability and continuous improvement, and advance the country's Health Intelligence agenda.

I extend my sincere appreciation to the editorial board members, reviewers, and staff of the Strategic Affairs Executive Office for their dedication and contribution to this publication. I also gratefully acknowledge the researchers, health leaders, professionals, academic institutions, regional health bureaus, agencies, and partners whose valuable contributions have enriched this edition.

Let us continue to generate, share, and use evidence to make better decisions and take more effective action toward building a resilient, equitable, responsive, and high-quality health system for all Ethiopians.

Dr. Muluken Argaw
Executive Officer, Strategic Affairs Executive Office
Federal Ministry of Health

Editorial

Transformative Reform for a Sovereign and Resilient Health System!

As Ethiopia's health sector convenes for its 28th Annual Review Meeting, we stand at a defining juncture. The sector is transitioning from the first Health Sector Investment Plan (HSDIP I) to HSDIP II, the final strategic plan designed to meet the Sustainable Development Goals (SDGs) and achieve Universal Health Coverage (UHC). This transition positions the 28th ARM as a critical moment to assess progress, address persistent gaps, and align the next phase of reform with the goal of a sovereign, resilient and self-reliant health system.

HSDIP II provides the strategic framework for this transformation and organizes it around seven mutually reinforcing strategic objectives: Improve equitable access to quality, integrated health services across the life course through Primary Health Care; Enhance regulation within the health system; Enhance Health intelligence, research, innovation and knowledge management; Improve Pharmaceutical and Medical Device Management and manufacturing; Enhance public health emergency and disaster risk management; Improve health system capacities; and Improve Health financing and private health sector engagement. These objectives provide the main reference points for aligning reform across the health system.

The health sector has been in continual reform for decades, following national agendas and evolving priorities. This reform trajectory has now entered a new phase. Since 2023, the country has been implementing a public service and administration reform as part of the Home-Grown Economic Reforms (HGER). The health sector was selected as one of six pilot sectors for this reform due to its unique characteristics: it is one of the largest and most complex public-service delivery systems, it has a direct and measurable impact on citizens, it already has a long history of system reform, it is a major employer and human-capital system, and it is strategically important to economic transformation.

This health service and administration reform, which has been carried out at the Ministry of Health (MOH), its agencies, and federal hospitals, has now reached an important milestone, transitioning from rigorous planning and preparatory phases into the implementation phase. The reform is now moving to the regions, allowing them to benefit from the ample experience of the MOH and its agencies. This cascading of reform is essential for creating a unified, efficient, and responsive health system across the entire country.

Reform becomes transformative when these institutional shifts lead to tangible improvements in effective coverage, quality, equity, continuity, and health outcomes.

A central test will be how Ethiopia manages less predictable external financing while strengthening health sovereignty. Recent reductions and shifts in external development assistance show how external changes can affect essential services and planned investments.[1] International cooperation remains important, but reliance on a narrow external financing base creates vulnerability when priorities change. A more sovereign health system must mobilize additional domestic resources, use available funds efficiently, diversify financing, govern partnerships around nationally determined priorities, and protect essential services during funding transitions. This is why the theme of sovereignty must be at the heart of our reform agenda. Sovereignty in health means moving away from donor dependency and enhancing domestic and innovative financing mechanisms.

Health sovereignty extends beyond financing. It encompasses institutional, infrastructural, technological, data, and knowledge sovereignty. It means building robust national institutions capable of leading and managing the health system. It means investing in infrastructure that serves the needs of our people. It means harnessing technology and data for national decision-making, not just for reporting to external partners. And it means fostering a knowledge economy where research, innovation, and local manufacturing—from pharmaceuticals to vaccines—are driven by and for Ethiopians.

Sovereignty and resilience are closely related but distinct. Resilience is the capacity of the health system to anticipate and prepare for shocks, maintain essential services during disruption, adapt when existing arrangements no longer work, and apply lessons to improve future performance. In Ethiopia, resilience must be embedded in routine service delivery because workforce shortages, supply disruptions, conflict, climate-related events, disease outbreaks, and economic pressures can occur simultaneously.[1] Financial buffers, emergency preparedness, decentralized leadership, reliable supply chains, functioning information systems, and clear institutional responsibilities are core conditions for continuity and quality of care.

A cornerstone of this reform agenda is the introduction and advancement of the Health Intelligence agenda in the health sector. Health Intelligence provides a practical bridge among transformative reform, sovereignty, and resilience. Its role extends beyond digitizing existing reports. Ethiopia needs to move from fragmented information systems and retrospective reporting toward well-governed, interoperable data systems that enable timely analysis, predictive analytics, modeling, and forecasting while generating evidence that directly answers policy and service-delivery questions.[1] They should support decisions at all levels, detect emerging problems earlier, guide resource allocation, and strengthen accountability. Sustained investment in data quality, interoperability, privacy and security, analytic capacity, and the information workforce will determine how effectively these capabilities are developed and used.

HSDIP II will be judged by changes experienced by people and communities. According to the 2019/20 National Health Accounts, out-of-pocket spending accounted for 30.5% of total health expenditure, exposing households to substantial financial burden.2 Workforce shortages and uneven distribution continue to constrain access and service quality, particularly in rural, pastoralist, and conflict-affected settings.1 Progress will be evident if reform reduces household financial burden, improves the availability and distribution of competent health workers, protects service continuity, and narrows avoidable inequalities. Clear responsibilities, realistic budgets, regional adaptation, and routine monitoring will be essential for delivering on strategic commitments.

The 28th ARM can serve both as a review of performance and a point of collective commitment to the next phase of reform. As we convene for this 28th Annual Review Meeting, let us recognize that the path to a sovereign health system is neither short nor easy. It requires a fundamental shift in mindset, from a sector that receives aid to a sector that commands its own destiny. It requires a collective resolve to strengthen domestic financing, to harness the power of data and intelligence, to build institutions that endure, and to place the health and well-being of every Ethiopian at the center of our national development agenda. The reforms we are undertaking today are not just about improving health outcomes; they are about affirming our nation's sovereignty and securing a healthier, more prosperous future for generations to come.



Section One: Research Articles

Dynamic Adaptation, Sustained Fidelity: Unlocking Ethiopia's Health Extension Program Potential Through Embedded Implementation Research

Biruk Bogale[1*], Gizachew Tadele Tiruneh[1,2*], Mesele Damte Argaw[3], Agumasie Semahegn[3], Nebreed Fesseha[1], Shegaw Mulu Tarekegn[3], Chala Tesfaye[1], Mikiyas Teferi[3], Hillina Tadesse[1], Mebrie Belete[3], Addis Girma[3], Temesgen Ayehu[3], Yibeltal Siraneh[4], Yibeltal Kifle[4], Bezawit Mesfin Hunegnaw[1] and Dessalew Emaway[1]

[1] JSI, Addis Ababa, Ethiopia

[2] University of Global Health Equity (UGHE), Kigali, Rwanda

[3]Amref Health Africa, Addis Ababa, Ethiopia

[4] MERQ Consultancy PLC, Addis Ababa, Ethiopia

Corresponding author: biruk.bogale@jsi.org

Abstract

Background: Optimizing Ethiopia's Health Extension Program (HEP) is essential for achieving universal health coverage. However, balancing intervention fidelity with local contextual adaptations remains an implementation challenge.

Objective: To evaluate implementation fidelity, document contextual adaptations, and synthesize lessons learned from balancing fidelity and adaptation during the pressure-testing phase of the Improving Primay Health Care Service Delivery (IPHCSD) project.

Methods: A pragmatic embedded implementation research design was conducted across 14 woredas (agrarian and pastoralist) from April 2022 to September 2024. Implementation strategies mapped to Expert Recommendations for Implementing Change (ERIC) and Effective Practice and Organization of Care (EPOC) taxonomies were co-designed and monitored. Adaptations were tracked using the FRAME-IS framework. Quantitative monitoring data and qualitative findings were analyzed using descriptive statistics and framework analysis.

Results: Core strategies were executed with high fidelity. Health Extension Program modalities were operationalized across 273 health posts, and 72 Community Health Program Units were established. Village Health Leader functionality reached 90% in agrarian settings, while Networks of Care (NoCs) functionality improved from 56% to 89% (agrarian) and 38% to 60% (pastoral). Key adaptations included re-categorizing health posts, contextualizing community engagement structures, simplifying NoCs objectives, and introducing mobile health service models. Some strategies (performance-based incentives, governance restructuring) were deprioritized. The project contributed to improved maternal and reproductive health services, with contraceptive acceptance increasing from 71% to 83% in agrarian and 40.5% to 46.5% in pastoral settings, alongside improvements in obstetric complication management, ANC visits, and skilled birth attendance.

Conclusion: Adaptive embedded implementation science effectively optimizes health programs in complex and dynamic contexts. Participatory co-design, stakeholder engagement, and systematic frameworks facilitated the development and refinement of strategies that improved service quality, access, and accountability in diverse PHC settings.

Keywords: Adaptation, Fidelity, Primary Healthcare, Ethiopia

Background

Ethiopia's Primary Health Care (PHC) system, anchored by the Health Extension Program (HEP) launched in 2003, has significantly advanced equitable access to essential maternal and child health care across rural areas (1). Despite historical gains, the system faces structural bottlenecks, including service fragmentation, infrastructure deficiencies, suboptimal care quality, and weak governance. Core HEP components were frequently implemented with low fidelity to original guidelines, limiting progress toward universal health coverage (2){Assefa, 2020 #99}.

To address these challenges, the Ethiopian Ministry of Health (MOH) launched the HEP Optimization Roadmap (2020–2035) (3). Since April 2022, the Improving Primary Health Care Service Delivery (IPHCSD) project—implemented by JSI and Amref Health Africa in collaboration with MOH—has operationalized selected roadmap objectives. Embedded implementation research (EIR) and Networks of Care (NoCs) were integrated to strengthen health facility linkages and accountability (4).

Objective

This study aimed to examine how implementation fidelity and contextual adaptation were balanced during the pressure-testing phase of the IPHCSD project, evaluate program fidelity and service outcomes, and synthesize actionable lessons for scaling complex PHC interventions.

Methods

Context and Design: A participatory pragmatic EIR design was conducted from April 2022 to September 2024 across 14 pressure-test woredas in nine regions, representing agrarian and pastoralist settings.

Interventions and Co-Design: Implementation strategies were co-designed with national, regional, and woreda stakeholders using ERIC and EPOC taxonomies. Strategies included health post restructuring, Community Health Program Units (CHPUs), Village Health Leaders (VHLs), NoCs, Quality Improvement collaboratives, and social accountability tools.

Adaptation and Measurement: FRAME-IS guided prospective tracking of adaptations. Routine facility, project monitoring, and service data (October 2021–March 2024) were analyzed, focusing on CHPU, VHL, and NoC functionality and service indicators including CAR, ANC4+, ANC8, and SBA. Qualitative data from reflection meetings, supervision reports, and review workshops were analyzed using framework synthesis.

Ethical Approval: Ethical clearance was obtained from the Ethiopian Public Health Association IRB (Ref: EPHA/OG/159/24). Facility-level consent was obtained, and all data were anonymized.

Results and Discussion

Implementation Fidelity and Operational Gains

Core strategies were implemented with high fidelity across agrarian and pastoralist settings. A total of 273 health posts (15 comprehensive, 207 basic, and 51 merged into health centers/primary hospitals) were restructured, 72 CHPUs established, and 3,790 VHLs deployed. CHPU functionality increased from 72% to 79% in agrarian and 37% to 62% in pastoralist settings. VHL functionality reached 90% in agrarian areas, with 84% household coverage and over 30,000 women linked to family planning services. NoC functionality improved from 56% to 89% in agrarian and 38% to 60% in pastoralist settings. Mobile health services reached 40,495 people across 59 hard-to-reach sites.

Table 1: Implementation fidelity of strategies, April 2022-March 2024

Strategies	Implementation fidelity and Key Performance Outcomes
HEP Service Package Restructuring	• 273 HPs operationalized (15 CHPs, 207 basic, 51 merged); 921 HEWs/ providers trained
CHPU Operationalization	• 72 CHPUs established; Functionality rose to 79% (agrarian) and 62% (pastoral)
Mobile Health Services (MHS)	• 22 rounds across 59 hard-to-reach sites reaching 40,495 individuals
Community Engagement (VHLs)	• 3,790 VHLs active; 84% household coverage; 90% functionality in agrarian areas
Networks of Care (NoCs)	• 66 PHCUs, 6 hospitals, 53 private facilities linked; Functionality reached 89% (agrarian). Management of obstetric complications increased by 18.4% (coefficient = 1.71; p = 0.050), with a 43% overall increase. Perinatal mortality decreased by 34%, from 31.3 to 20.1 per 1,000 births (t = 2.12; p = 0.040)
Accountability (CSC & MAPs)	• CSC mean score rose from 74% to 80% (agrarian) and 75% (pastoral); 42 managers trained on MAPs
Deprioritized Strategies	• Performance-based incentives and PHCU governance restructuring dropped due to financial sustainability constraints and jurisdictional overlaps between local government bodies and regional health bureaus

HEP: Health Extension Program; CHPU: Community Health Program Unit; NoCs: networks of Care; QI: quality improvement; MAPs: Managerial Accountability for Primary Health Care System; CSC: community scorecard; PHCU: Primary Health Care Unit

Patterns of Adaptation

Adaptations focused on four areas: (1) contextualizing health post categorization and mobile service delivery; (2) adapting VHL structures to local pastoralist social systems; (3) simplifying QI and integrating NoC reviews into routine PHCU platforms; and (4) digitizing and aligning accountability tools with existing health structures. Performance-based incentives and PHCU governance restructuring were deprioritized due to measurement, policy, and sustainability challenges.

Health Service Delivery Outcomes

The interventions contributed for improved maternal health service indicators during implementation. CAR increased from 71% to 83% in agrarian settings and from 40.5% to 46.5% in pastoralist areas. ANC 8+ coverage expanded substantially, rising from 2% to 18% in agrarian settings and from 1% to 15% in pastoralist areas. Similarly, ANC 4+ coverage in the agrarian setting remained relatively stable (shifting from approximately 70% to 67.5%), whereas coverage in the pastoral setting experienced a substantial increase from 66.5% to 89.2% Moreover, SBA improved from 58% to 65% in agrarian settings and from 50% to 54% in pastoralist zones.

Balancing Fidelity and Adaptation

The findings demonstrate that fidelity and adaptation can be complementary. Maintaining core functions—such as referral, QI, and community engagement—preserved program integrity, while adapting delivery models and community structures improved contextual fit. Participatory co-design, stakeholder engagement, and real-time monitoring supported adaptation without compromising core functions.

Conclusion and Recommendation

Balancing fidelity with contextual adaptation is critical for optimizing primary healthcare in diverse, resource-limited settings. Embedded implementation research supported continuous learning and refinement of scalable strategies. The Ministry of Health and Regional Health Bureaus should institutionalize effective HEP optimization approaches, including NoCs and context-specific community engagement, while integrating adaptive learning, digital accountability, and cluster-based twinning into routine health system management.

References

1. Mengistu TS, Endalamaw A, Zewdie A, Wolka E, Assefa Y. Strengthening primary health care in Ethiopia: a scoping review of successes, challenges, and pathways towards universal health coverage using the WHO monitoring framework. PLOS Global Public Health. 2025;5(4):e0004470. doi:10.1371/journal.pgph.0004470.

2. Assefa Y, Gelaw YA, Hill PS, Taye BW, Van Damme W. Community health extension program of Ethiopia, 2003–2018: successes and challenges toward universal coverage for primary healthcare services. *Globalization and Health*. 2019;15(1):24. doi:10.1186/s12992-019-0470-1.

3. Ethiopian Ministry of Health. *Realizing Universal Health Coverage Through Primary Healthcare: A Roadmap for Optimizing the Ethiopian Health Extension Program 2020–2035*. Addis Ababa, Ethiopia: Ethiopian Ministry of Health; 2020.

4. Tiruneh GT, Fesseha N, Ayehu T, Chitashvili T, Argaw MD, Shiferaw BB, et al. Networks of care for optimizing primary health care service delivery in Ethiopia: enhancing relational linkages and care coordination. *PLOS One*. 2025;20(1):e0314807. doi:10.1371/journal.pone.0314807.

Digital Connectivity, Machine Learning, and Incomplete Antenatal Care in Ethiopia

Jenberu Mekurianew Kelkay[1*], Andualem Enyew Gedefaw[2], Fentahun Bikale Kebede[3], Abraham Keffale Mengistu[4]

[1] Department of Public Health, Debark University, Debark, Ethiopia

[2] Department of Health Informatics, University of Gondar, Gondar, Ethiopia

[3] Strategic Affairs Executive Office, Ministry of Health, Addis Ababa, Ethiopia

[4] Department of Health Informatics, Debre Markos University, Debre Markos, Ethiopia

[*]**Corresponding author:** Jenberu Mekurianew Kelkay, jenberu.uog11@gmail.com, 0919592835

Abstract

Introduction: Antenatal care (ANC) is a critical component of maternal health services, enabling the early identification and management of pregnancy-related complications. Despite improvements in service availability, incomplete ANC utilization remains a major challenge in Ethiopia, particularly among women facing socioeconomic and access-related barriers. Digital connectivity may improve access to health information and services; however, its contribution to ANC completion requires further investigation.

Objective: This study aimed to estimate the effect of digital connectivity on incomplete ANC utilization and develop an explainable machine learning model to predict the risk of incomplete ANC among women in Ethiopia.

Methods: A secondary analysis was conducted using data from 6,893 women included in the Ethiopian Demographic and Health Survey 2024/25. Propensity Score Matching was used to estimate the effect of digital connectivity on incomplete ANC utilization. Multiple machine learning algorithms were developed and compared, and the best-performing model was interpreted using SHAP (SHapley Additive exPlanations).

Results: Most women (82.98%) had incomplete ANC utilization. After matching, digital connectivity was associated with an **8.34-percentage-point reduction** in incomplete ANC utilization (Average Treatment Effect on the Treated = −0.0834; 95% CI: −0.1323 to −0.0345). As a complementary indicator, timing of the first ANC visit was examined. The explainable ensemble machine learning model demonstrated excellent predictive performance, with an accuracy of 95.07% and an area under the receiver operating characteristic curve of 0.984. Place of residence, household characteristics, reproductive factors, and digital connectivity were among the most influential predictors.

Conclusion and recommendations: Digital connectivity was associated with improved ANC completion among women in Ethiopia. Integrating digital health interventions and predictive analytics into maternal health programs could support targeted interventions and promote more equitable utilization of ANC services. Digital maternal health interventions should be scaled up through primary healthcare platforms, with predictive models integrated into health information systems to support targeted ANC outreach

Keywords: Antenatal care; digital connectivity; machine learning; Ethiopia; maternal health

Introduction

Antenatal care (ANC) improves maternal and newborn outcomes through the early detection of complications, preventive care, health education, and timely referral (1). Although the World Health Organization recommends at least eight ANC contacts, incomplete utilization remains common in Ethiopia, particularly among rural and socioeconomically disadvantaged women (2).

Digital connectivity, including mobile phone and internet access, can improve ANC utilization through health education, appointment reminders, and communication with providers (3). However, its independent contribution remains unclear (4). Therefore, this study combined causal inference and explainable machine learning to assess the association between digital connectivity and incomplete ANC utilization and identify women at higher risk in Ethiopia.

Objective

1. Estimate the effect of digital connectivity on incomplete ANC utilization among Ethiopian women.

2. Identify key predictors associated with incomplete ANC, and develop and interpret an explainable machine learning model for predicting incomplete ANC risk.

Methods

Study Design and Data Source

A secondary analysis was conducted using data from the Ethiopian Demographic and Health Survey (EDHS). The EDHS is a nationally representative household survey that applies a stratified two-stage cluster sampling design to collect population-level information on maternal and child health indicators. The analysis included women aged 15–49 years who had a live birth within the five years preceding the survey and had complete information on antenatal care (ANC) contacts. After applying sampling weights, the final analytical sample included 6,893 women.

Study Variables

The outcome variable was incomplete ANC utilization. Based on the World Health Organization recommendation of eight or more ANC contacts, ANC utilization was categorized as: Complete ANC utilization: ≥8 ANC contacts and incomplete ANC utilization: <8 ANC contacts

The primary exposure was digital connectivity, operationalized as access to at least one digital communication channel. Women were classified as digitally connected if they either owned a mobile phone or reported using the internet, whereas women who reported neither were classified as not digitally connected. The composite measure was conceptually intended to capture basic access to digital communication and information resources rather than equivalent levels of digital engagement. Mobile phone ownership represents access to a basic communication technology, whereas internet use represents access to a broader range of digital information and services. Because these indicators capture related but distinct dimensions of digital access, sensitivity analyses separately examined mobile phone ownership and internet use using the same propensity-score specification and matching procedure as the primary analysis.

Potential predictors included sociodemographic, socioeconomic, household, reproductive, and healthcare access-related characteristics.

Statistical and Machine Learning Analysis

Data management and statistical analyses were performed using Stata version 17 and Python-based machine learning libraries.

Descriptive analyses were conducted to summarize participant characteristics and ANC utilization patterns. The effect of digital connectivity on incomplete ANC utilization was estimated using propensity score matching (PSM). Propensity scores were estimated using residency, household-head characteristics, wealth, mass-media exposure, age, education, employment, household size, marital status, age at first birth, and number of children. A 1:1 nearest-neighbor matching approach with a 0.05 caliper and common-support restriction was applied, and sampling weights were incorporated as appropriate for the complex

EDHS survey design. Covariate balance before and after matching was assessed using standardized mean differences (SMDs).

For predictive modeling, the dataset was divided into training and testing datasets. To address class imbalance, the SMOTETomek resampling technique was applied to the training dataset. Multiple machine learning algorithms, including logistic regression, random forest, gradient boosting, XGBoost, LightGBM, AdaBoost, and CatBoost, were developed and compared.

Model performance was assessed using accuracy, precision, recall, F1-score, and area under the receiver operating characteristic curve (AUC-ROC). The best-performing model was interpreted using SHAP (SHapley Additive exPlanations) to identify the contribution and direction of key predictors.

Results

Characteristics of Study Participants

Among 6,893 women included in the analysis, 82.98% had incomplete ANC utilization. The majority of participants lived in rural areas (70.84%), and 40.27% had no formal education. Digital connectivity was reported among 42.94% of women (Table 1).

Table 1. Characteristics of Study Participants

Variable	Category	Weighted %
Residence	Urban	29.16
	Rural	70.84
Education	No formal education	40.27
	Primary	36.31
	Secondary or above	23.42
Digital connectivity	No	57.06
	Yes	42.94

Effect of Digital Connectivity on Incomplete ANC

Before matching, incomplete ANC utilization was higher among women without digital connectivity compared with digitally connected women. After propensity score matching, digital connectivity remained significantly associated with reduced incomplete ANC utilization. Digital connectivity was associated with an 8.34 percentage-point lower probability of incomplete ANC utilization among matched women (ATT = −0.0834; 95% CI: −0.1323 to −0.0345) (Table 2).

Table 2. Effect of Digital Connectivity on Incomplete ANC After Matching

Effect estimate	Difference	95% CI	p-value
ATT	−0.0834	−0.1323 to −0.0345	0.001

Machine Learning Model Performance

The ensemble machine learning model combining XGBoost, LightGBM, Gradient Boosting, AdaBoost, and CatBoost achieved the best predictive performance. These findings indicate excellent discrimination between women at risk and not at risk of incomplete ANC utilization (Table 3).

Table 3. Performance of the Best Performing Ensemble Model

Accuracy	Precision	Recall	F1-score	AUC
95.07%	95.47%	94.54%	95.00%	0.984

Important Predictors of Incomplete ANC

SHAP analysis showed that place of residence was the strongest predictor of incomplete ANC utilization. However, SHAP values represent the contribution of each predictor to the model's predictions and should not be interpreted as causal effects or as evidence that the predictor is an independent risk factor for incomplete ANC utilization. Other important predictors included household characteristics, number of children, maternal employment status, marital characteristics, and digital connectivity.

Discussion

This study found that digital connectivity was associated with improved ANC completion among Ethiopian women, potentially through better access to health information, provider communication, and appointment reminders. Rural residence was the strongest predictor of incomplete ANC, highlighting persistent geographic and resource-related barriers (3, 5). The explainable ensemble model showed potential for identifying high-risk women and supporting targeted outreach. However, digital interventions should be combined with improvements in health infrastructure, digital literacy, and service accessibility to promote equity (3).

Although the model demonstrated good predictive performance in the EDHS dataset, its prospective, external, and real-world utility remains unestablished. Therefore, external validation and prospective implementation studies are needed before integration into routine health information systems. Furthermore, digital interventions should be implemented alongside improvements in health infrastructure, digital literacy, connectivity, and service access. Equity-sensitive approaches, including low-bandwidth/offline options and complementary non-digital services, are important to prevent the digital divide from widening existing inequalities in ANC utilization.

Limitation of the study

A limitation of this study is that ANC utilization was primarily assessed based on the number of contacts and did not fully capture the content and quality of care received during these visits. Future studies incorporating more detailed measures of ANC content and quality could provide a more comprehensive assessment of ANC service adequacy beyond the number of contacts alone.

Conclusion and Recommendations

Digital connectivity was associated with reduced incomplete ANC utilization among Ethiopian women. The explainable ensemble machine learning model demonstrated strong potential for predicting women at risk of inadequate ANC completion.

The Ministry of Health and relevant stakeholders should consider integrating digital health interventions and predictive analytics into maternal health programs to improve targeted service delivery. Expanding digital access, especially among rural and disadvantaged populations, could contribute to achieving equitable maternal healthcare coverage in Ethiopia.

Digital maternal health interventions should be considered for scale-up through primary healthcare platforms, with predictive models potentially integrated into health information systems following external validation and prospective evaluation of their clinical and public-health utility. Maternal health programs should prioritize rural and digitally underserved populations while strengthening digital literacy alongside the expansion of digital health services.

References

1. Tegegne TK, Chojenta C, Getachew T, Smith R, Loxton D. Antenatal care use in Ethiopia: a spatial and multilevel analysis. BMC pregnancy and childbirth. 2019;19(1):399.

2. Organization WH. WHO antenatal care recommendations for a positive pregnancy experience. Nutritional interventions update: Multiple micronutrient supplements during pregnancy: World Health Organization; 2020.

3. Kibret GD, Demant D, Hayen A. The effect of distance to health facility on neonatal mortality in Ethiopia. BMC Health Services Research. 2023;23(1):114.

4. Rono J, Kamau L, Mangwana J, Waruguru J, Aluoch P, Njoroge M. A policy analysis of policies and strategic plans on Maternal, Newborn and Child Health in Ethiopia. International journal for equity in health. 2022;21(1):73.

5. Dusabe-Richards JN, Tesfaye HT, Mekonnen J, Kea A, Theobald S, Datiko DG. Women health extension workers: capacities, opportunities and challenges to use eHealth to strengthen equitable health systems in Southern Ethiopia. Canadian Journal of Public Health. 2016;107(4):e355-e61.

Magnitude of Patient Mortality and Its Determinants among Admitted Patients at Tirunesh Beijing General Hospital, Addis Ababa, Ethiopia, 2025: A Cross-Sectional Study

Rediet Mathewos[1*], Enyew Belay[1], Beri Daba[1], Eshetu Tadele[2], Tadelech Kelilie[1]

[1]*Department of Research and Training, Tirunesh Beijing General Hospital, Addis Ababa, Ethiopia*

[2]*Department of Obstetrics and Gynecology, Tirunesh Beijing General Hospital, Addis Ababa, Ethiopia*

Corresponding author: Enyew belay, enyewadress@gmail.com, +251920328158]

ABSTRACT

Background: Mortality is a key indicator of population health and health-system performance, guiding resource allocation and policy. Globally, inpatient mortality remains disproportionately high in low- and middle-income countries, yet the magnitude and determinants of mortality among admitted patients at Tirunesh Beijing General Hospital (TBGH), Addis Ababa, Ethiopia, are not well documented.

Objective: To assess the magnitude of patient mortality and its determinants among admitted patients at TBGH, Addis Ababa, Ethiopia, 2025.

Methods: An institution-based retrospective cross-sectional study was conducted among 384 admitted patients selected through systematic random sampling from all wards except pediatrics, using data collected from April 10 to May 10, 2025. Data were entered into Epi Info version 7 and analyzed with SPSS version 26. Bivariate and multivariable logistic regression identified predictors of mortality; variables with $p<0.25$ in bivariate analysis were entered into the multivariable model, with significance set at $p<0.05$.

Results: Of the 384 patients, 316 (82.3%) improved and 68 (17.7%) died. Most patients (68.6%) had a length of stay of 1–4 days, 66.1% were admitted through the emergency department, and 66.9% were referred from health centers. In the multivariable model, age ≥60 years (AOR=2.17, 95% CI: 1.01–4.69), emergency admission (AOR=5.57, 95% CI: 1.89–16.43), respiratory rate >20 breaths/minute (AOR=4.18, 95% CI: 2.17–8.07), and a Glasgow Coma Scale score of 13–15 (AOR=0.03, 95% CI: 0.01–0.15) were significantly associated with mortality.

Conclusion: Nearly one in five admitted patients died, with older age, emergency admission, elevated respiratory rate, and reduced level of consciousness as key drivers. Strengthening emergency triage, geriatric care, and vital-sign monitoring could reduce preventable inpatient deaths.

Keywords: Mortality; Determinants; Admitted patients; Ethiopia; Cross-sectional study

INTRODUCTION

Mortality is a critical indicator of public health and health-system performance, informing resource allocation, intervention design, and evaluation of care quality [1]. Inpatient mortality specifically reflects the effectiveness of hospital care and the adequacy of clinical resources. Globally, an estimated eight million deaths each

year are amenable to high-quality health care, 96% of them in low- and middle-income countries (LMICs), with an associated projected economic loss of US$11.2 trillion by 2030 [2]. Non-communicable diseases now account for a growing share of these deaths, compounding the burden already carried by infectious diseases and outbreaks such as COVID-19 in resource-constrained settings.

In Ethiopia, inpatient mortality remains high and is shaped by disease severity, delayed presentation, and limited healthcare infrastructure [3]. Adult mortality in particular is often under-documented because of weak vital statistics systems, despite adults constituting the economically productive segment of society [4]. Hospital-based studies from Debre Berhan and Ayder hospitals have reported mortality proportions of 35.9% and 14.9%, respectively, underscoring wide variation across facilities and the need for setting-specific evidence [5,6].

Tirunesh Beijing General Hospital (TBGH), a regional referral hospital in Addis Ababa serving roughly 850,000 people annually, recorded 218 inpatient deaths in 2023 and 140 in 2024 amid rising admission volumes. Despite this burden, the magnitude of inpatient mortality and its determinants at TBGH remain underexplored, limiting evidence-based interventions to improve patient outcomes. This study assessed the magnitude and determinants of mortality among patients admitted to TBGH in 2025, generating locally relevant evidence to inform quality-improvement and policy decisions consistent with the Health Sector Medium-Term Development and Investment Plan (HSDIP).

OBJECTIVE

General objective: To assess the magnitude of patient mortality and its determinants among admitted patients at TBGH, Addis Ababa, Ethiopia, 2025.

Specific objectives:

- To determine the magnitude of patient mortality among admitted patients at TBGH.
- To identify factors associated with patient mortality among admitted patients at TBGH.

METHODS

Study design and setting: An institution-based retrospective cross-sectional study was conducted at TBGH, Akaki-Kality Sub-City, Addis Ababa — a regional hospital with 217 beds and 655 health professionals. Data were collected from all inpatient wards except pediatrics between April 10 and May 10, 2025.

Population and sampling: The source population comprised all adult patients admitted to TBGH. A sample size of 384 was calculated using the single-population proportion formula, based on a prior mortality proportion of 35.9%, a 95% confidence level, and a 5% margin of error. Proportional allocation distributed the sample across wards according to two-month client-flow data, and participants were selected by systematic random sampling within each ward.

Variables: The outcome variable was patient mortality (died/improved). Independent variables included socio-demographic characteristics (age, sex, marital status, residence), clinical variables (admission diagnosis, vital signs, Glasgow Coma Scale [GCS], comorbidities), interventions received, and length and source of admission.

Data collection and quality assurance: Data were abstracted from electronic medical records using a structured checklist adapted from previous studies. Data collectors were trained, and 10% of records were re-checked for consistency.

Data analysis: Data were entered into Epi Info version 7 and exported to SPSS version 26 for analysis. Bivariate logistic regression identified candidate predictors ($p<0.25$), entered into a multivariable model; the Hosmer–Lemeshow test confirmed adequate fit ($p=0.598$). Significance was set at $p<0.05$, with AOR and 95% CI reported.

Ethical consideration: Ethical clearance was obtained from the Addis Ababa Regional Health

Bureau IRB and the TBGH ethical review committee. Data were extracted without personal identifiers.

RESULT AND DISCUSSION

Socio-demographic and clinical characteristics: Of the 384 admitted patients, 244 (63.5%) were female and 322 (83.9%) were aged 16–59 years. Most patients (94.0%) resided in urban areas, and 71.4% were married. Regarding clinical profile, 66.1% were admitted through the emergency department, 66.9% were referred from health centers, and 68.6% had a length of stay of 1–4 days. Non-communicable diseases accounted for 87.0% of admissions; maternal-related conditions (22.7%) and gastrointestinal disorders (20.1%) were the leading disease categories. On admission, 32.6% of patients had a respiratory rate above 20 breaths/minute, and 89.8% had a mild GCS score (13–15) (Table 1).

Table 1. Socio-demographic and clinical characteristics of patients admitted to TBGH, Addis Ababa, Ethiopia, 2025 (N=384)

Variable	Category	Frequency (%)
Sex	Male	140 (36.5)
	Female	244 (63.5)
Age group	16–59 yrs	322 (83.9)
	≥60 yrs	62 (16.1)
Residence	Urban	361 (94.0)
	Rural	23 (6.0)
Marital status	Married	274 (71.4)
	Single	82 (21.4)
	Widowed	19 (4.9)
	Divorced	9 (2.3)
Type of admission	Emergency	254 (66.1)
	Elective	130 (33.9)
Length of stay	1–4 days	264 (68.6)
	5–9 days	81 (21.1)
	>9 days	39 (10.2)
Disease category	Non-	334 (87.0)
	Communicable	50 (13.0)
GCS at admission	Mild (13–15)	345 (89.8)
	Moderate (9–12)	23 (6.0)
	Severe (3–8)	16 (4.2)
Respiratory rate	12–20 bpm	259 (67.4)
	>20 bpm	125 (32.6)
Patient outcome	Improved	316 (82.3)
	Died	68 (17.7)

Magnitude of mortality and its determinants: Overall, 316 (82.3%) patients improved and 68 (17.7%) died. In the multivariable logistic regression model, four factors remained independently associated with mortality: age ≥60 years, emergency admission, respiratory rate >20 breaths/minute, and GCS score of 13–15 versus 3–8 (Table 2).

Table 2. Factors independently associated with patient mortality among admitted patients at TBGH, Addis Ababa, Ethiopia, 2025 (multivariable logistic regression)

Variable	Category	AOR (95% CI)	P
Age group	16–59 yrs (Ref)	1	-
	≥60 years	2.17 (1.01–4.69)	0.048
Type of admission	Elective (Ref)	1	-
	Emergency	5.57 (1.89–16.43)	0.002
Respiratory rate	12–20 bpm (Ref)	1	-
	>20 bpm	4.18 (2.17–8.07)	<0.001
GCS at admission	3–8 Severe (Ref)	1	-
	9–12 Moderate	0.15 (0.03–0.95)	0.043
	13–15 Mild	0.03 (0.01–0.15)	<0.001

Discussion

The 17.7% inpatient mortality found in this study is broadly consistent with Ethiopian hospital-based studies but lower than the 35.9% at Debre Berhan Hospital and higher than the 14.9% at Ayder Hospital, reflecting case-mix and referral differences [5,6]. Comparable variability has been reported regionally, including 17.1% inpatient mortality in Uganda and differing rates in Sudan [7].

Older age was strongly associated with mortality, consistent with evidence that physiological reserve and comorbidity burden decline with advancing age [8]. Emergency admission carried more than five-fold higher odds of death, likely reflecting greater illness severity and less opportunity for pre-admission stabilization than elective admissions [9]. Elevated respiratory rate — a marker of physiological decompensation — was similarly predictive of mortality [10]. Conversely, a higher GCS score, indicating preserved consciousness, was strongly protective, corroborating its role as a bedside prognostic marker in acutely ill patients [11].

Although comorbidity burden, disease severity, ICU admission, and treatment interventions were captured during data abstraction, as noted in the Methods, these variables were not carried through to the regression analysis and are therefore not reflected in Tables 1 and 2. A recent retrospective study of two government hospitals in Addis Ababa found that hospital-acquired infection, Charlson comorbidity index score, and mechanical ventilation at admission were independently associated with ICU mortality [12], underscoring the added explanatory value these variables could provide. Incorporating comorbidity, severity, and ICU-admission indicators into future analyses at TBGH, alongside consideration of referral pathway, may sharpen the predictive model and better characterize which patients are at greatest risk. Because data collection at TBGH spanned only April–May 2025, the findings reflect a single two-month window; determinants of mortality can vary seasonally and over time, so comparison with other recent Ethiopian studies conducted in different periods, and repeat surveillance across seasons, would help confirm whether these predictors hold consistently.

These findings suggest that strengthening early recognition of deteriorating patients could meaningfully reduce preventable inpatient deaths at TBGH.

CONCLUSION AND RECOMMENDATION

Conclusion: Nearly one in five patients admitted to TBGH died, with older age, emergency admission, elevated respiratory rate, and reduced level of consciousness identified as independent predictors of mortality. These findings highlight the need for improved patient outcomes through collaboration among health professionals, hospital management, and partners.

Limitations:

As a retrospective record review, this study depended on the completeness of existing documentation. Although data collectors were trained and 10% of records were re-checked for consistency, the analysis did not separately quantify how many records had missing or incomplete entries, nor describe how such gaps were handled during analysis, which may have introduced bias if missingness was related to illness severity. Similarly, the medical records reviewed did not consistently document the immediate and underlying causes of death, limiting the ability to corroborate the identified determinants against clinical cause-of-death data. Future studies should formally report missing-data patterns and strengthen cause-of-death documentation to support more definitive conclusions.

Recommendations:

1. Strengthen triage and rapid-response protocols for emergency admissions.

2. Institute routine, standardized vital-sign and GCS monitoring at admission to flag high-risk patients early.

3. Develop tailored care pathways for patients aged 60 and above, including comprehensive geriatric assessment.

4. Build staff capacity in early warning-score use and escalation of care for deteriorating patients.

5. Conduct prospective, multi-site studies to validate these determinants and guide quality improvement.

REFERENCES

1. World Mortality 2019. World Mortality 2019. 2019.

2. Alkire BC, Peters AW, Shrime MG, Meara JG. The economic consequences of mortality amenable to high-quality health care in low- and middle-income countries. Health Aff. 2018;37(6):988–96.

3. Messelu MA, Amlak BT, Mekonnen GB, Belayneh AG, Tamre S, Adal O, et al. Mortality and its determinants among patients attending in emergency departments. BMC Emerg Med. 2024;24(1):1–13.

4. Meles GG, Ayele G, Gutema BT, Kondale M, Zerdo Z, Merdekios B, et al. Causes and trends of adult mortality in southern Ethiopia: an eight-year follow-up database study. 2023;1–9.

5. Melaku E, Urgie B, Dessie F, Seid A, Abebe Z, Tefera A. Determinants of mortality of patients admitted to the intensive care unit at Debre Berhan Comprehensive Specialized Hospital: a retrospective cohort study. Patient Relat Outcome Meas. 2024;15:61–70.

6. Hailu A, Gidey K, Ebrahim MM, Berhane Y, Gebrehawaria T, Hailemariam T, et al. Patterns of medical admissions and predictors of mortality in Ayder Comprehensive Specialized Hospital, Northern Ethiopia: a prospective observational study. Int J Gen Med. 2023;16:243–57.

7. Omar SM, Osman OS, Gasim GI, Adam I. Pattern and trends in adult hospitalization/admission and mortality among medical ward inpatients at Gadarif Hospital in Eastern Sudan: a four-year retrospective study. Int J Gen Med. 2022;15:5879–89.

8. Harris KM, Majmundar MK, Becker T. High and rising mortality rates among working-age adults.

9. Jones S, Moulton C, Swift S, Molyneux P, Black S, Mason N, et al. Association between delays to patient admission from the emergency department and all-cause 30-day mortality. 2022;168–73.

10. Hall MJ, Levant S, DeFrances CJ. Trends in inpatient hospital deaths: National Hospital Discharge Survey, 2000-2010. NCHS Data Brief. 2013;(118):1–8.

11. Tegegne NG, Fentie DY. Mortality predictors among traumatic brain injury patients, Gondar, Ethiopia: retrospective study. 2023;73–85.

12. Predictors of adult ICU mortality: a retrospective study at two government hospitals in Ethiopia. Sci Rep. 2026.

Health Professional and Organizational Readiness for Electronic Medical Record Implementation in Primary Healthcare Units in Gondar Town, Northwest Ethiopia: Cross-sectional study

Eliyas Addisu Taye[1], Berhanu Fekadie Endehabtu[1,2], Araya Mesfin Nigatu[1,2], Selamsew Tesfaye[1], Rahel Derbew[1], Shegaw Marrie[1], Gedu woldesellassie Tewolde[4], Tajebew Zeyede[1,3], Binyam Tilahun[1,2] and Tesfahun Melese Yilma[1,2]

[1]Center for Digital Health and Implementation Science, University of Gondar, Ethiopia

[2]Department of Health informatics, College of Medicine and Health Science, University of Gondar Comprehensive Specialized Hospital, Gondar, Ethiopia

[3]Department of Health Systems and Policy, Institute of Public Health, College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia

[4]Gondar city Health Department

Corresponding Author: Eliyas Addisu Taye, eliyasaddisu12@gmail.com

Abstract

Background: Electronic Medical Record (EMR) adoption improves healthcare quality, efficiency, and continuity of care; however, implementation remains limited in low-resource settings due to infrastructure gaps, low digital literacy, professional resistance, and inadequate organizational preparedness.

Objective: To assess health professional and organizational readiness and digital literacy for the implementation of Electronic Medical Record Systems and identify associated factors in primary health care units in Gondar town in 2025.

Method: A facility-based cross-sectional study was conducted in seven primary health care units in Gondar town from June 15 to June 30, 2025. Data were analyzed using STATA version 17. Binary logistic regression was employed to identify associated factors. Model fitness was assessed using the Hosmer-Lemeshow goodness-of-fit test. Variables with a p-value < 0.2 in bivariable analysis were included in the multivariable model to control the effect of confounders. Adjusted odds ratios with 95% confidence intervals were reported, and statistical significance was declared at a p-value < 0.05.

Result: Among the 225 healthcare professionals who participated in the study, 89 (39.6%; 95% CI: 33.2%–46.2%) were classified as ready to implement an EMR system. Organizational readiness was assessed across four domains: clinical quality and standards, technical capacity, operational maturity, and project management orientation. Readiness was limited across all four domains, with the largest gaps observed in project management orientation (31.6%), followed by technical capacity (35.4%), operational maturity (35.4%), and clinical quality and standards (61%). In the multivariable analysis, female sex (AOR 3.15, 95% CI: 1.42–6.99), low attitude toward EMR (AOR 2.88, 95% CI: 1.50–5.56), and inadequate digital literacy (AOR 4.43, 95% CI: 2.26–8.70) were significantly associated with lack of readiness for EMR implementation.

Conclusion: Most organizational readiness domains for EMR implementation were inadequate, particularly project management and technical capacity. Healthcare professionals also demonstrated low readiness, representing a major challenge for digital health transformation. Strengthening management, financial, and technical capacity, along with improving digital literacy, EMR knowledge, and attitudes, especially among female health professionals, is essential for successful EMR adoption in primary healthcare settings

Introduction

Patient documentation has undergone substantial evolution, transitioning from early medical records documented on papyrus, clay tablets, and other materials to structured paper-based clinical records and, more recently, Electronic Medical Records (EMRs) [1, 2]. Since their conceptualization in the 1960s, EMRs have become fundamental components of modern healthcare systems by enhancing clinical decision-making, improving care quality and efficiency, and strengthening public health information systems Although EMR adoption is widespread in high-income countries, with many health systems achieving high levels of implementation, adoption remains limited in sub-Saharan Africa due to persistent challenges, including inadequate digital infrastructure, financial constraints, healthcare provider resistance, data security concerns, and insufficient digital literacy among end users [3-7].

The EMRs implementation requires comprehensive organizational and user readiness, as inadequate preparation, limited acceptance, and insufficient resources are major contributors to implementation failure [8, 9]. Successful EMR adoption depends on multiple factors, including leadership support, infrastructure, healthcare professionals' digital literacy, training, user attitudes, and system usability [10-12].

While high-income countries commonly assess organizational and workforce readiness before implementation, such evaluations remain limited in low- and middle-income countries, particularly in sub-Saharan Africa, contributing to unsuccessful EMR initiatives[13]. In Ethiopia, despite strong commitment to digital health transformation, EMR implementation remains challenged by resource limitations, competing priorities, and gaps in organizational and workforce preparedness [13-15]. Therefore, assessing organizational readiness, healthcare professionals' readiness, and digital health literacy is essential to guide effective EMR implementation and sustainable digital health transformation.

Objective

Objective: To assess health professionals and organizational readiness and digital literacy for the implementation of Electronic Medical Record Systems and identify associated factors in primary health care units in Gondar town in 2025.

Methods

Study setting, design, and period

A facility-based cross-sectional study was conducted from June 15 to June 30, 2025, in seven primary healthcare units (PHCUs) located in Gondar town, Northwest Ethiopia. Gondar is the capital of the Central Gondar Zone and is located approximately 175 km from Bahir Dar and 725 km from Addis Ababa. The city has an estimated population of more than 454,446 residents and is administratively divided into six sub-cities and 36 kebeles. The healthcare system consists of primary healthcare facilities and hospitals that provide services to urban residents and surrounding communities. This study included seven health centers: Maraki, Gebreal, Gondar, Azezo, Bilajig, Weleka, and Mintwab Health Centers, which represent key primary healthcare service delivery points and potential sites for EMR implementation [16, 17].

Study participants and eligibility criteria

The study included healthcare professionals and managers working in the selected PHCUs. All permanently employed health professionals who were available during the data collection period were eligible.

Sample size and sampling procedure

The sample size was initially calculated assuming a 50% prevalence of EMR readiness, a 95% confidence level, a 5% margin of error, and a 10% non-response rate, resulting in a required sample size of 423 participants. However, the total number of eligible health professionals in the selected Primary Health Care Units (PHCUs) was 285; therefore, a census approach was applied, and all eligible professionals were invited to participate. Eligible participants included nurses, midwives, health officers, laboratory personnel, pharmacy staff, and other professionals involved in

clinical care or health information management with at least six months of experience. Up to three follow-up visits were conducted to minimize non-response. A total of 225 participants completed the survey, yielding a response rate of 78.9%. Facility managers and relevant administrative personnel were purposively selected for organizational readiness assessment.

Study variables and operational definitions

The main outcome variables were organizational readiness and healthcare professionals' readiness for EMR implementation. Independent variables included sociodemographic characteristics, organizational and technological factors, EMR knowledge, attitudes toward EMR, and digital health literacy. Organizational readiness was assessed using 39 items across five domains: leadership and structure, clinical quality and standards, operational maturity, technical capacity, and project management orientation. Responses were measured using a three-point Likert scale, and facilities with an average score ≥2 were classified as ready for EMR implementation. Healthcare professionals' readiness was assessed using 23 items covering core readiness, engagement readiness, technological readiness, and societal readiness. Participants achieving ≥50% of the domain score were categorized as ready in the respective domain. Digital health literacy was measured using a 10-item Likert-scale instrument adapted from the HLS19 Digital Health Literacy Survey. Participants scoring ≥50% were classified as having good digital health literacy. EMR knowledge and attitudes were categorized using a 50% cutoff, where scores ≥50% indicated good knowledge and favorable attitudes, respectively [18-23].

Data management and analysis

Data were collected using a structured interviewer administered questionnaire adapted from validated instruments and contextualized to the Ethiopian primary healthcare setting. The questionnaire was translated into Amharic, reviewed by experts, and pretested outside the study sites. Five trained data collectors conducted the interviews under the supervision of two public health informatics experts. Continuous supervision and data quality checks were conducted to ensure completeness and consistency. Data were exported from KoboToolbox and analyzed using STATA version 17. Descriptive statistics were computed using frequencies and percentages. Binary logistic regression was performed to identify factors associated with EMR readiness. Variables with $p < 0.20$ in bivariable analysis were included in the multivariable model. Model fitness was assessed using the Hosmer Lemeshow goodness of fit test. Results were presented using adjusted odds ratios with 95% confidence intervals, with statistical significance set at $p < 0.05$.

Ethical considerations

Ethical approval was obtained from the Institutional Research Ethics Review Committee of the University of Gondar.

Results and Discussion

The majority of study participants were female (69.8%), and nurses represented the largest professional group (42.2%), followed by midwives (20.4%). Most participants had a bachelor's degree (68.4%). However, access to digital resources was limited, with 80% reporting no computer access at the workplace, 82.2% lacking computer access at home, and 65.8% having no internet access. Most healthcare professionals had poor knowledge of EMR implementation (78.7%), half demonstrated low attitudes toward EMR adoption (50.2%), and 62.2% had inadequate digital literacy. Overall, only 39.6% of healthcare professionals were classified as ready for EMR implementation.

Overall, 61% of managers reported that their facilities were not ready for EMR implementation. Although clinical quality and standards showed relatively higher readiness (61%), substantial gaps were observed in technical capacity (35.4%), operational maturity (35.4%), and project management orientation (31.6%).

Multivariable logistic regression analysis identified sex, attitude toward EMR, and digital health literacy as factors associated with EMR readiness. Female healthcare professionals had higher odds of being unready compared with males (AOR = 3.155; 95% CI: 1.421–6.993). Participants with unfavorable attitudes toward EMR had nearly three times higher odds of being unready (AOR = 2.882; 95% CI: 1.499–5.556). Furthermore, healthcare professionals with inadequate digital literacy had more than four times higher odds of being unready (AOR = 4.425; 95% CI: 2.257–8.696). The dependent variable was EMR readiness status, categorized as ready or not ready, with the analysis focusing on factors associated with being not ready.

The overall readiness level observed in this study was lower than previous Ethiopian studies reporting readiness levels above 50%. This difference may be explained by variations in study settings and assessment approaches. Previous studies were mainly conducted in hospitals with better technological infrastructure and resources, whereas this study focused on primary healthcare units, where resource limitations are more pronounced. Additionally, this study used a comprehensive readiness framework incorporating technical and societal dimensions, providing a broader assessment of EMR preparedness. The low technical readiness observed is consistent with the limited availability of digital resources among healthcare professionals.

Conclusion and Recommendation

This study demonstrates that readiness for EMR implementation among healthcare professionals and primary healthcare facilities in Gondar town is limited. Inadequate digital literacy, unfavorable attitudes toward EMR, insufficient infrastructure, and weak organizational preparedness represent major barriers to successful implementation.

To enhance EMR adoption, healthcare authorities should prioritize pre-implementation digital literacy training and capacity-building programs for healthcare professionals, with particular attention to groups with lower readiness. Structured change management interventions should be introduced to improve attitudes and increase acceptance of EMR systems. Additionally, investments in essential infrastructure, including computer availability, internet connectivity, technical support, and project management capacity, are necessary.

Reference

1. Hu, S., A contribution to our knowledge of Leonurus L., i-mu-ts'ao, the Chinese motherwort. Am J Chin Med (Gard City N Y), 1976. 4(3): p. 219-37.
2. Lorkowski, J. and M. Pokorski, Medical Records: A Historical Narrative. Biomedicines, 2022. 10(10).
3. Evans, R.S., Electronic Health Records: Then, Now, and in the Future. Yearb Med Inform, 2016. Suppl 1(Suppl 1): p. S48-61.
4. Birkhead, G.S., M. Klompas, and N.R. Shah, Uses of electronic health records for public health surveillance to advance public health. Annual review of public health, 2015. 36(1): p. 345-359.
5. Uslu, A. and J. Stausberg, Value of the electronic medical record for hospital care: update from the literature. Journal of medical Internet research, 2021. 23(12): p. e26323.
6. Kruse, C.S., et al., The use of electronic health records to support population health: a systematic review of the literature. Journal of medical systems, 2018. 42(11): p. 214.
7. Shen, Y., et al., Twenty-Five Years of Evolution and Hurdles in Electronic Health Records and Interoperability in Medical Research: Comprehensive Review. Journal of Medical Internet Research, 2025. 27: p. e59024.
8. Sligo, J., et al., A literature review for large-scale health information system project planning, implementation and evaluation. International journal of medical informatics, 2017. 97: p. 86-97.
9. Kaplan, B. and K.D. Harris-Salamone, Health IT success and failure: recommendations from literature and an AMIA workshop. Journal of the American Medical Informatics Association, 2009. 16(3): p. 291-299.
10. Alzghaibi, H., et al., Assessing primary health care readiness for large-scale electronic health record system implementation: Project team perspective. Health Informatics J, 2023. 29(1): p. 14604582231152790.
11. Afrizal, S.H., et al., Narrative Review for Exploring Barriers to Readiness of Electronic Health Record Implementation in Primary Health Care. Healthc Inform Res, 2019. 25(3): p. 141-152.
12. Kabukye, J.K., N. de Keizer, and R. Cornet, Assessment of organizational readiness to implement an electronic health record system in a low-resource settings cancer hospital: A cross-sectional survey. PLOS ONE, 2020. 15(6): p. e0234711.

13. Yehualashet, D.E., et al., Barriers to the Adoption of Electronic Medical Record System in Ethiopia: A Systematic Review. J Multidiscip Healthc, 2021. 14: p. 2597-2603.
14. Ethiopia, M.o.h., Health Sector Transformation Plan II 2020/21-2024/25. February 2021.
15. Asemahagn, M.A., Health professionals' Challenge in using ICTs to manage their Patients: the case of Hospitals in Addis Ababa, Ethiopia. Online Journal of Nursing Informatics (OJNI), 2016. 20(2).
16. Demoze, L., et al., Under five children diarrhea prevalence and associated factors in slum areas of Gondar City Northwest Ethiopia: a community based cross-sectional study. Scientific Reports, 2024. 14(1): p. 19095.
17. UoG. The University of Gondar Specialized hospitals 2021 [cited 2022 October 3]; Available from: https://www.uog.edu.et/.
18. CAFP. Health Information Technology Toolkit for Family Physicians. 2011 [cited 2022 October 2]; Available from: https://www.healthit.gov/resource/health-information-technology-toolkit-physician-offices.
19. Yilma, T.M., et al., Organizational and health professional readiness for the implementation of electronic medical record system: an implication for the current EMR implementation in northwest Ethiopia. BMJ Health Care Inform, 2023. 30(1).
20. Ajami, S., et al., Readiness assessment of electronic health records implementation. Acta Inform Med, 2011. 19(4): p. 224-7.
21. Health, C. EHR Readiness Assessment Tool. Available from: https://comagine.org/resource/1223.
22. Mekonnen, Z.A., Kassahun Alemu Were, Martin C Tilahun, Binyam, Mothers intention and preference to use mobile phone text message reminders for child vaccination in Northwest Ethiopia. BMJ Health & Care Informatics, 2021. 28(1).
23. Tegegne, M.D., et al., Health professionals' attitude towards the use of social media for COVID-19 related information in Northwest Ethiopia: A cross-sectional study. Frontiers in Public Health, 2022: p. 1736.

Information Revolution Model Woredas and Primary Health Care Performance: Longitudinal Evidence from Ethiopia

Biniam Taye[1], Mesoud Mohammed[1], Asfaw Benti[1], Solomon Kassahun[1], Belete Temtim[1], Birehanu Taye[1], Kedir Seid[2], Berhane Mengistu[1], Dule Tagesu[1], Ketema Muluneh[1], Mekdelawit Mengesha[1], Mulugeta Asefa[1], Roman Gebreyes[1], Tamrat Awell[1], Tewabe Manaye[1], Usman Usleman[1], Yakob Wondarad[1], Yosef Zeru[1], Shegaw Mulu[1], Alemnesh Mirkuze[1], Zewetr Azeze[1]

[1] Ministry of Health, Statistics and information department, Addis Ababa, Ethiopia

Corresponding author: Biniam Kefiyalew Taye, bini.bhi2013@gmail.com

Abstract

Introduction: Ethiopia's Information Revolution promotes data quality, information use, and accountability, but evidence linking Model woreda designation with primary health care performance remains limited.

Objective: To examine longitudinal differences in primary health care performance between Information Revolution Model and geographically paired non-Model woredas over 36 months.

Methods: We analyzed routine DHIS2 data from 153 public facilities in five geographically adjacent Model and non-Model woreda pairs. Woreda-level outcomes were estimated using pair- and time-adjusted Gaussian generalized estimating equations (GEEs). Facility counts were analyzed using Poisson GEEs with service-entry counts as offsets. Sensitivity analyses examined outliers, low denominators, logically inconsistent ratios, and overdispersion.

Results: Model woredas had higher adjusted average full immunization coverage (+41.48 percentage points [pp]; 95% CI: 15.32 to 67.64), measles coverage (+42.18 pp; 16.44 to 67.92), Penta 3 coverage (+44.22 pp; 16.96 to 71.47), contraceptive acceptance (+9.57 pp; 4.95 to 14.20), and outpatient utilization (+0.97 visits per capita; 0.58 to 1.37). Baseline-to-endline improvements were greater for skilled birth attendance (+29.16 pp) and early postnatal care (+37.25 pp). Health centers located in Model areas had higher ANC4 completion relative to ANC1 (IRR: 1.107; 95% CI: 1.015 to 1.208). Timely ANC initiation was higher in rural Model areas (IRR: 1.626; 1.373 to 1.925) but lower in urban Model areas (IRR: 0.644; 0.515 to 0.805). Health posts in Model areas had modestly higher measles and Penta 3 completion relative to Penta 1. Some facility-level associations weakened after data-quality restrictions, and stillbirth estimates were sparse and setting-specific.

Conclusion: Model status was associated with better overall primary health care performance, but advantages were not consistent across facility-level indicators and settings. The observed associations do not establish the effect of the Information Revolution itself. Future evaluations should use robust comparative designs and measure key confounders.

Keywords: Information Revolution; Model woreda; primary health care; DHIS2; Ethiopia

Introduction

Routine health information systems are expected to do more than generate reports. They should enable health managers to identify service gaps, allocate resources, monitor improvement, and translate data into better primary health care. Ethiopia's Information Revolution agenda was introduced to strengthen this role by improving data quality, digitalization, information use, and accountability throughout the health system [1,2].

Model woreda recognition represents a key component of this agenda, indicating progress in routine health information system performance and the institutional use of information for decision-making. Previous assessments have reported improvements in selected dimensions of data quality, information use, and system maturity following Information Revolution initiatives [3,4]. However, most available evidence has focused on information-system performance rather than whether Model woredas also demonstrate better health service performance.

Evidence on this relationship is important for determining whether Model woreda recognition reflects improvements beyond information-system performance and for guiding the future refinement of the Information Revolution initiative.

Objective

To compare primary health care coverage, utilization, and facility-level continuity between Information Revolution Model and geographically paired non-Model woredas over three Ethiopian fiscal years, while testing the stability of findings under alternative data-quality assumptions.

Methods

We conducted a geographically paired comparative longitudinal panel study using thirty-six consecutive months of routine DHIS2 data, from Hamle 2014 to Sene 2017 Ethiopian Fiscal Year. Model status was defined using the Ministry of Health's 2017 EFY recognition of five Information Revolution Model woredas or sub-cities. Five non-Model woredas or sub-cities were purposively selected from areas adjacent to the five Model woredas or sub-cities, forming five geographic comparison pairs. After excluding 11 closed facilities and three facilities with structural non-reporting, the analytic sample included 153 public facilities. Of these, sixty-seven were in Model woredas or sub-cities, comprising twenty-seven health centers and forty health posts, while eighty-six were in non-Model woredas or sub-cities, comprising thirty-five health centers and fifty-one health posts. These facilities contributed 5,508 facility-month observations, while the ten woredas or sub-cities contributed 360 woreda-month observations.

We analyzed indicators at woreda and facility levels. At woreda level, contraceptive acceptance, skilled birth attendance, timely ANC initiation, ANC4, early postnatal care, full immunization, measles, and Penta 3 coverage were calculated by dividing the reported service counts by their corresponding target-population denominators in DHIS2 and expressing the results as percentages. Penta 1 to Penta 3 dropout was calculated as the difference between Penta 1 and Penta 3 divided by Penta 1, while outpatient utilization was calculated as outpatient visits per capita. Stillbirths were expressed per 1,000 reported births. At facility level, monthly service counts were analyzed using related service-entry counts as denominators: ANC1 for timely ANC and ANC4, total facility births for early postnatal care and stillbirth, and Penta 1 for immunization completion. Facility analyses were further stratified by facility type and urban-rural setting.

Descriptive summaries across the 36-month period and baseline-to-endline changes were examined before conducting the adjusted analyses. Woreda-level DHIS2 outputs provided both service numerators and corresponding target-population denominators, allowing calculation of coverage indicators. Comparable target-population denominators were unavailable at facility level; therefore, facility performance was assessed using monthly service counts and related service-entry denominators. Woreda-level indicators were analyzed using pair- and month-adjusted Gaussian GEEs and reported as adjusted mean differences. Facility-level numerator counts were analyzed using pair- and month-adjusted Poisson GEEs, with facility clustering and ANC1, total facility

births or Penta 1 as log offsets. The resulting incidence rate ratios compared denominator-adjusted service rates between facilities located in Model and non-Model woredas or sub-cities.

Sensitivity analyses examined extreme observations, logically high service ratios, sparse denominators, and overdispersion. Checks excluded outliers; applied logical-ratio restrictions, for example excluding facility-months in which ANC4 exceeded ANC1; applied denominator thresholds by repeating analyses after excluding months with very small service-entry counts; and used alternative model specifications. Estimates were interpreted alongside magnitude, precision, longitudinal patterns, and sensitivity results. The study used secondary, de-identified aggregate data obtained with Ministry of Health administrative authorization.

Results

Across 36 months, model woredas had higher average child immunization coverage: full immunization by 41.48 pp (95% CI: 15.32 to 67.64), measles by 42.18 pp (16.44 to 67.92), and Penta 3 by 44.22 pp (16.96 to 71.47). Contraceptive acceptance was 9.57 pp higher (4.95 to 14.20), and outpatient use was higher by 0.97 visits per capita (0.58 to 1.37). These population-reach findings remained stable after outlier exclusion.

Average adjusted differences were not statistically conclusive for skilled birth attendance, ANC4 coverage, early postnatal care, or stillbirth. However, model woredas improved more from baseline to endline for skilled birth attendance (+29.16 pp) and early postnatal care (+37.25 pp), suggesting faster progress despite imprecise average differences (Table 1).

Table 1. Adjusted woreda-level differences between Model and non-Model areas over 36 months.

Indicator	2015 mean, Model	2015 mean, non-Model	Adjusted mean difference (95% CI)	p-value
Contraceptive acceptance (%)	68.1	61.4	9.57 (4.95 to 14.20)	<0.001
Skilled birth attendance (%)	69.8	68.9	16.52 (-10.74 to 43.78)	0.235
ANC4 coverage (%)	129.5	88.6	26.75 (-8.70 to 62.20)	0.139
Timely ANC initiation (%)	33.8	29.6	6.73 (-3.58 to 17.04)	0.201
Early postnatal care (%)	62.5	61.9	17.72 (-1.63 to 37.07)	0.073
Stillbirths per 1,000 births	2.2	1.6	-0.82 (-2.52 to 0.87)	0.341
Full immunization coverage (%)	123.4	97.4	41.48 (15.32 to 67.64)	0.002
Measles coverage (%)	126.6	98.5	42.18 (16.44 to 67.92)	0.001
Penta 3 coverage (%)	131.2	103.2	44.22 (16.96 to 71.47)	0.001
Penta 1 to Penta 3 dropout (%)	1.4	0.8	-0.10 (-2.02 to 1.82)	0.920
Outpatient visits per capita	1.65	1.54	0.97 (0.58 to 1.37)	<0.001

Note. 2015 values are annual means for Ethiopian Fiscal Year 2015, covering Hamle 2014 to Sene 2015. Estimates are adjusted Model minus non-Model differences across the 36-month panel from Gaussian GEEs with woreda-level clustering and month and geographic comparison-pair fixed effects. Differences are percentage points except for stillbirths and outpatient visits. CI, confidence interval; GEE, generalized estimating equations.

Table 2. Key facility-level associations between Model status and service performance

Indicator	Analytic stratum	Facilities (facility-months)	IRR (95% CI)	p-value
ANC4 relative to ANC1	Overall health canters	62 (2,213)	1.107 (1.015 to 1.208)	0.022
Timely ANC relative to ANC1	Overall health centers	62 (2,214)	1.152 (0.849 to 1.562)	0.363
Timely ANC relative to ANC1	Urban health centers	34 (1,222)	0.644 (0.515 to 0.805)	<0.001
Timely ANC relative to ANC1	Rural health centers	28 (992)	1.626 (1.373 to 1.925)	<0.001
Early PNC relative to births	Overall health canters	62 (2,172)	0.988 (0.942 to 1.036)	0.610
Stillbirth rate	Overall health canters	62 (2,178)	0.904 (0.543 to 1.505)	0.697
Stillbirth rate	Urban health canters	34 (1,206)	1.565 (1.054 to 2.322)	0.026
Stillbirth rate	Rural health canters	28 (972)	0.384 (0.151 to 0.976)	0.044
Full immunization relative to Penta 1	Overall facilities	153 (5,353)	0.955 (0.923 to 0.989)	0.010
Measles relative to Penta 1	Overall facilities	153 (5,350)	0.966 (0.933 to 0.999)	0.047
Measles relative to Penta 1	Health posts	91 (3,216)	1.026 (1.014 to 1.038)	<0.001
Penta 3 relative to Penta 1	Overall facilities	153 (5,358)	1.004 (0.988 to 1.020)	0.612
Penta 3 relative to Penta 1	Health posts	91 (3,224)	1.010 (1.000 to 1.019)	0.046

Note. Model indicates facilities located in Model woredas or sub-cities, not facilities individually designated as Model. Estimates are from Poisson GEEs adjusted for geographic comparison pair and month, with facility clustering and denominator-based log offsets. CI, confidence interval; GEE, generalized estimating equations; IRR, incidence rate ratio.

At facility level, health centers located in Model woredas or sub-cities had higher ANC4 completion relative to ANC1 (IRR 1.107; 95% CI: 1.015 to 1.208). Timely ANC initiation differed by setting: it was higher in rural health centers located in Model areas (IRR 1.626; 1.373 to 1.925) but lower in urban health centers located in Model areas (IRR 0.644; 0.515 to 0.805). Stillbirth estimates also diverged, with a lower rate in rural health centers (IRR 0.384; 0.151 to 0.976) and a higher rate in urban health centers (IRR 1.565; 1.054 to 2.322).

Health posts showed modestly higher immunization continuity in Model settings for measles relative to Penta 1 (IRR 1.026; 95% CI: 1.014 to 1.038) and Penta 3 relative to Penta 1 (IRR 1.010; 1.000 to 1.019) (**Table 2**). Apparent health-center immunization disadvantages weakened after excluding low-volume months and disappeared under the strictest logical-ratio restriction, which excluded months when completion counts exceeded entry counts. Pooled maternal-continuity findings were similarly sensitive to sparse denominators and setting.

Discussion

The most coherent signal was stronger population reach in Model woredas, particularly for immunization, contraception, and outpatient utilization. These outcomes depend on routine planning, follow-up, and monitoring, making them plausible benefits of stronger information-use practices. Nevertheless, Model designation is not a randomly assigned intervention, so the estimates are associations rather than causal effects.

Facility results show why averages should not be treated as uniform effects. Rural health centers located in Model areas performed better for timely ANC initiation, whereas urban health centers located in Model areas performed worse. Health posts showed small but consistent immunization-continuity advantages, while health-center immunization findings depended on data-quality restrictions. The setting-specific direction of stillbirth estimates may reflect referral patterns, case mix, service volume, or reporting practices as much as care quality.

Some limitations shape interpretation. The observational design, non-random Model designation, absence of a common implementation date, and unmeasured confounders preclude causal attribution. Only five geographic comparison pairs limited precision and generalizability. Routine aggregate DHIS2 data may contain incomplete reporting, denominator errors, reporting delays, and client movement. Facility ratios used service-entry counts rather than tracking individuals. Geographic pairing, time adjustment, stratification, and sensitivity analyses reduced concerns but could not eliminate residual confounding or measurement error; unstable estimates therefore require cautious interpretation and validation.

Conclusion and recommendations

Information Revolution Model status was associated with better overall primary health care performance, although advantages were not consistent across facility-level indicators and settings. These findings suggest potential value in strengthening how information use is translated into service delivery, while recognizing that the observed associations do not establish the effect of the Information Revolution itself. Considering these findings and limitations, priorities for practice and further evaluation include:

- Maintain attention to child immunization, contraception, outpatient utilization, ANC4 completion, and health-post immunization continuity.
- Document and evaluate the management, data-use, outreach, and follow-up practices in better-performing Model settings before wider adaptation.
- Investigate maternal and newborn service differences between rural and urban health centers, considering referral patterns, client mobility, private-sector use, and reporting practices.
- Integrate automated RHIS checks for implausible ratios, small denominators, outliers, and persistent zero reporting.
- Use robust comparative designs with larger samples and measured confounders to determine the contribution of the Information Revolution to improved service performance.

References

1. World Health Organization. Analysis and use of health facility data. Geneva: WHO; 2020. https://www.who.int/data/data-collection-tools/analysis-use-health-facility-data

2. Federal Ministry of Health. Information Revolution Implementation Guideline. Addis Ababa: Ministry of Health; 2021.

3. Biru A, Birhan D, Melkamu G, Gebeyehu A, Omer AM. Pathways to improve health information systems in Ethiopia: current maturity status and implications. Health Res Policy Syst. 2022; 20:78. doi:10.1186/s12961-022-00860-z.

4. Knittel B, Marlow HM, Mohammedsanni A, Gebeyehu A, Belay H, Denboba W. Early effects of Information Revolution interventions on health information system performance in Ethiopia. Glob Health Sci Pract. 2024;12(6).

Integrating Pharmacy Services into National Supply Chain Maturity Assessment: The Ethiopia NSCPSA Experience

Elias Geremew[2], Edessa Diriba[1], Regasa Bayisa[1], Hora Bekele[1], Fikru Worku[2], Edmealem Ejigu[2], Andualem Oumer[3], Habtamu Tesfaye[2], Kristin Johnson[3], Hailu Tadeg[4], Biniyam Tadesse[4]**:**

[1]Pharmaceutical and Medical Device Lead Executive Office, Ministry of Health, Addis Ababa, Ethiopia

[2]USG SCS Project, Management Sciences for Health (MSH), Addis Ababa, Ethiopia

[3]Management Sciences for Health (MSH), Arlington, VA, USA

[4]Fenot Associates Social Services PLC, Addis Ababa, Ethiopia.

Corresponding author: Fikru Worku,faltaye@msh.org ,+251 921 878528

Abstract

Introduction: While supply chain investments have strengthened medicine availability in Ethiopia, comprehensive evidence on pharmacy service maturity, the interface where medicines are translated into safe, effective, patient-centered care, has remained limited.

Objective: This assessment aimed to measure pharmacy service maturity and performance across Ethiopia's public health system using a customized capability maturity framework, integrated into the national supply chain assessment.

Methods: Ethiopia adapted the National Supply Chain Assessment (NSCA) 2.0 into the National Supply Chain and Pharmacy Services Assessment (NSCPSA) by incorporating a dedicated Pharmacy Services module, developed through a nationally led, multi-stakeholder process. A national cross-sectional mixed-methods assessment was conducted between November 2025 and April 2026 across 117 hospitals and 142 health centers selected using probability-based sampling (90% confidence level, 10% margin of error). Data were collected through document review, direct observation, and key informant interviews, and analyzed using descriptive statistics, capability maturity scoring, and thematic analysis was qualitative data.

Results: Overall, pharmacy service maturity was 49.0%, with most facilities operating at Basic or Intermediate levels and limited progression toward Advanced or State-of-the-Art capabilities. Hospitals scored higher (49.6%) than health centers (43.1%). Foundational structures such as Drug and Therapeutics Committees were widely established, while antimicrobial stewardship and drug information services were the least mature domains.

Conclusion: Ethiopia has established foundational pharmacy service structures, but these have not yet consistently translated into advanced, data-driven pharmaceutical care. The NSCPSA provides Ethiopia's first national baseline for pharmacy service maturity and offers a practical, transferable model for integrating pharmacy services into supply chain assessment frameworks in other low- and middle-income countries.

Key words: Maturity; Pharmacy service; NSCA; Capability Maturity Model

Introduction

While ensuring access to quality-assured medicines is essential, improved health outcomes also depend on whether medicines are appropriately prescribed, dispensed, monitored, and used safely. Pharmacy services represent the critical interface between pharmaceutical supply chains and patient outcomes, translating investments in forecasting, procurement, warehousing, distribution, and inventory management into desired health outcomes. Although many low- and middle-income countries have improved medicine availability, persistent challenges in rational medicine use, medication safety, antimicrobial resistance (AMR), and pharmaceutical care quality highlight the continued need to strengthen downstream pharmacy services. [1-4]

Maturity-based assessment frameworks are increasingly used to measure health supply chain capabilities and prioritize and guide continuous improvement to strengthen core supply chain domains including quantification, procurement, warehousing, inventory management, distribution, and information systems. These frameworks, however, have overlooked pharmacy services, leaving a gap in understanding capability and progression toward advanced, patient-centered practice. [5-6]

Ethiopia has made significant investments in strengthening its pharmaceutical system, including both pharmaceutical supply chain and pharmacy service; however, comprehensive evidence on pharmacy service maturity across hospitals and health centers had remained limited, as previous assessments focused primarily on supply chain functions. To address this gap, the Ethiopian Ministry of Health (MOH), in collaboration with the United States Government Supply Chain Strengthening (USG SCS) Project, led a consultative process to adapt the globally accepted National Supply Chain Assessment (NSCA) 2.0 into the National Supply Chain and Pharmacy Services Assessment (NSCPSA), by incorporating pharmacy services as a dedicated capability domain and extending performance measurement beyond commodity availability to the full continuum of pharmaceutical care. [7] The assessment generated Ethiopia's first national evidence on pharmacy service maturity, identifying capability gaps and informing system-strengthening priorities, and offers a practical model for other low- and middle-income countries seeking to strengthen resilient, patient-centered pharmaceutical systems.

Objective

The primary objective was to assess the maturity and performance of pharmacy services and supply chain across Ethiopia's public hospitals and health centers using the customized NSCPSA capability maturity framework.

The secondary objectives were to:

- Measure pharmacy service maturity across hospitals and health centers.
- Identify strengths, capacity gaps, and systemic barriers affecting pharmacy service performance.
- Generate evidence to inform policy, prioritize investments, and guide maturity-based strategies for strengthening pharmaceutical care and supply chain performance.

Methods

Ethiopia adapted the NSCA 2.0 into NSCPSA, incorporating a dedicated Pharmacy Services module within the national capability maturity framework. The Pharmacy Services module was developed through a nationally led, multi-stakeholder process coordinated by the MOH Pharmaceuticals and Medical Devices Lead Executive Office (PMD LEO), in collaboration with the National Supply Chain and Pharmacy Services Maturity Coordination Forum, the Maturity Technical Working Group, an independent assessment firm, and the USG SCS Project. The collaborative process defined the pharmacy service domain, capability assessment questions, indicators, and four progressive maturity levels: Basic, Intermediate, Advanced, and State-of-the-Art.[7-8]

The customized NSCPSA tool was implemented as a national cross-sectional mixed-methods assessment between November 2025 and April 2026. A nationally representative sampling design was employed. The sampling strategy used probability-based sampling, using a 90% confidence level and a 10% margin of error. Probability-based sampling included hypergeometric and woreda-based hypergeometric cluster sampling approaches to ensure representation across all levels of the health system. The sampling resulted in the selection of 117 hospitals, and 142 health centers spread across 14 RHBs, 41 Zonal Health Departments, and 57 Woreda Health Offices. The results of this abstract focus on hospitals and health centers.

The NSCPSA obtained formal ethical clearance from Ethiopian Public Health Association (EPHA) Institutional Research Ethics Review Committee (IRERC) Data were collected through document reviews, direct observation, a facility-based survey, and key informant interviews. Quantitative data were analyzed using descriptive statistics and capability maturity scoring, while qualitative data were analyzed thematically to identify system-level barriers and improvement opportunities. [9-10]

Results and Discussions

The overall pharmacy service maturity was 49.0%, with most assessed entities operating at the basic and intermediate maturity levels and limited progression toward advanced and state-of-the-art (SOA) practices. Hospitals achieved higher maturity (49.6%) than health centers (43.1%). Overall maturity scores varied across pharmacy service submodules and were consistently higher in hospitals than health centers (Table 1). The findings indicate that foundational pharmacy service structures are widely established, while advanced, patient-centered, and data-driven practices remain inconsistently implemented.

Table 1. Selected Pharmacy service sub-module and their overall maturity scores.

Functionality of Pharmacy Service Submodule	Score % (#) Hospital	Score % (#) Health center
Drug and Therapeutics Committees (DTC)	45.7% (116)	31.6% (136)
Clinical Pharmacy Services (CPS)	55.0% (84)	N/A
Drug Information Services (DIS)	40.9% (55)	16.3% (16)
Auditable Pharmaceutical Transactions and Services (APTS)	56.8% (97)	18.4% (42)

Pharmacy Governance and Clinical Services: Drug and Therapeutics Committees (DTCs) were established in 99.1% of hospitals and 95.8% of health centers. However, implementation of core DTC functions varied across accessed facilities. Medicines use evaluations, formulary management, pharmaceutical value analysis, and prioritization methods such as ABC/VEN analysis, and systematic prescribing reviews were inconsistently implemented, resulting in lower DTC maturity scores compared with DTC availability.

Among the 117 hospitals assessed, 71.8% established clinical pharmacy services. Nearly all implementing hospitals had pharmacists assigned to inpatient wards (97.6%) and participating in multidisciplinary ward rounds (95.2%), while documentation of clinical interventions (88.1%) and discharge counseling (91.7%) were routinely practiced. Nevertheless, advanced pharmaceutical care activities, including medication therapy management, therapeutic drug monitoring, and individualized pharmacotherapy optimization, were not consistently institutionalized.

Drug Information Services (DIS) were available in only 47.0% of hospitals and 11.3% of health centers. Technical functions remained limited, with fewer than half of hospitals routinely responding to structured therapeutic information requests (46.2%) or providing poison information services (42.7%), indicating substantial opportunities to strengthen evidence-based clinical decision support.

Implementation of Auditable Pharmaceutical Transactions and Services (APTS) also varied across levels of care. APTS was implemented in 83.0% of study hospitals compared with 30.0% of health centers. Although foundational accountability systems, including standardized documentation, pharmacy accounting, inventory recording, and routine reporting, were widely practiced, implementation of electronic APTS remained limited (47.4% of hospitals and 31.0% of health centers).

Antimicrobial stewardship program (ASP) was among the least mature domains. At central level, Ethiopia has an updated national AMR prevention and containment strategy. Functional AMS teams were reported by 81.2% of hospitals but only 26.1% of health centers, while stewardship implementation plans existed in 66.7% and 15.5%, respectively. National implementation of antimicrobial use policies (35.4%) and WHO AWaRe classification (32.7%) remained low. Furthermore, only

24.4% of facilities conducted routine antimicrobial use or resistance reviews, and just 15.4% incorporated microbiological evidence into prescribing decisions.

Key pharmacy service performance indicators:

Overall, 81.4% of prescribed medicines were dispensed, 83.4% of patients correctly understood dosage instructions, and 86.4% of medicines were prescribed from the Essential Medicines List or Facility-Specific Medicines List. However, antibiotic prescribing remained higher at health centers (67.0%) than tertiary hospitals (34.1%), underscoring persistent antimicrobial stewardship challenges.

The NSCPSA established Ethiopia's first national baseline for pharmacy service maturity The findings demonstrate that Ethiopia has established many of the foundational structures required for pharmacy service delivery. However, predominance of Basic and Intermediate maturity levels indicates that these foundational capabilities have not yet been consistently translated into advanced, patient-centered, and data-driven pharmaceutical care.

The findings reinforce a growing body of global evidence that medicine availability alone is insufficient to achieve desired health outcomes. Although Ethiopia has made substantial investments in pharmaceutical supply chain systems, persistent gaps in downstream pharmacy service capabilities remain critical determinants of supply chain effectiveness. Strengthening these functions will enhance rational medicine use, improve patient safety, optimize antimicrobial use, and maximize the return on investments made across the supply chain.

The collaborative development of the Pharmacy Services module through the MOH, national technical working groups, and the USG SCS Project further illustrates the importance of nationally led independent assessment and consensus-based approaches to such health system assessment. Such ownership enhances alignment of priorities, relevance, acceptability of capability and performance measurement as well as continuous improvements.

Conclusion and Recommendation

Beyond Ethiopia, the NSCPSA provides a practical model for integrating pharmacy service maturity into national supply chain assessments. As countries pursue resilient pharmaceutical systems and universal health coverage, assessing pharmacy service capabilities alongside the supply chain functions offers a more comprehensive measure of pharmaceutical system performance and strengthens the linkage between medicine availability, quality of care, and health outcomes.

Moreover, the NSCPSA findings provide a robust evidence base for informing strategic decision-making, guiding policy and programmatic priorities, allocating resources efficiently, and prioritizing investments to strengthen pharmaceutical pharmacy services. The findings also support the development of targeted performance improvement plans at national and facility levels and provide a baseline for monitoring maturity progression over time, enabling continuous tracking of improvements and the effectiveness of interventions.

References

1. World Health Organization. Promoting rational use of medicines: core components. WHO Policy Perspectives on Medicines, No. 5. Geneva: World Health Organization; 2002.
2. World Health Organization. Medication without harm: Policy brief. Geneva: World Health Organization; 2024.
3. International Pharmaceutical Federation (FIP). (2025). FIP Statement of Policy: People-centered pharmaceutical care.
4. World Health Organization. Global action plan on antimicrobial resistance. Geneva: World Health Organization; 2016.
5. USAID Global Health Supply Chain Program. National Supply Chain Assessment (NSCA) Toolkit. Washington, DC: U.S. Agency for International Development.
6. USAID Global Health Supply Chain Program-Procurement and Supply Management (GHSC-PSM). Supply Chain Information Systems Maturity Model. USAID GHSC-PSM.
7. Management Sciences for Health. (2025). Locally Led, Data Driven: Ethiopia Endorses NSCA 2.0 to Institutionalize Health Supply Chain Maturity.
8. Federal Ministry of Health and US Government Supply Chain Strengthening (SCS) Project implemented by Management Sciences for Health (MSH). (2026). Ethiopia national supply chain and pharmacy services assessment (NSCPSA) report, Addis Ababa, Ethiopia.
9. World Health Organization. Harmonized Health Facility Assessment (HHFA): Comprehensive Guide. Geneva: World Health Organization; 2023.
10. Creswell JW, Plano Clark VL. Designing and Conducting Mixed Methods Research. 3rd ed. Thousand Oaks, CA: SAGE Publications; 2018.

EOHAQ-AMR: A One Health framework integrating Tri-Sector AMR Competency, and the Environmental Antibiotic Pressure Index

Samson Tarekegn[1]

[1]Hawela Tula General Hospital, Health Service Quality Directorate, Hawassa, Ethiopia.

Corresponding author: Samson Tarekegn Samvodt@gmail.com ,+251-0926065500.

ABSTRACT

INTRODUCTION: In low- and middle-income countries, including Ethiopia, antimicrobial stewardship implementation remains inconsistent due to limited surveillance systems, inadequate laboratory capacity, weak environmental monitoring mechanisms, fragmented veterinary integration, insufficient governance structures linking human, animal, and environmental health sectors. Globally, multi sector investment on IPC and environment could avert over 110 million deaths and 1trilion economic gain from 2025-2050. However, the existing AMR monitoring systems measure isolated indicators like antibiotic encounters but rarely quantify the broader ecological antibiotic pressure contributing to AMR emergence. The objective of this study is therefore to adopt a One Health policy framework that integrates human, animal, and environmental sectors to strengthen antimicrobial stewardship program through continuous quality improvement approaches.

METHODS: The study analyzed relevant documents using deductive qualitative content analysis guided by the Walt and Gilson Health policy triangle. Policy content, context process and actors were coded and compared across human, animal and environmental sectors.

RESULTS: The proposed EHAQ-AMR framework produced five governance pillars: EHAQ-AMR expansion, Tri-sector AMR competency, traditional medicine engagement, EAPI development and integrated human animal-animal and environmental surveillance.

CONCLUSTIONS: The framework addresses an important gap in fragmented AMR governance system through combining tri sector competency, traditional medicine engagement, coordinated surveillance, quality improvement, and EAPI.

KEYWORDS: Antimicrobial resistance, One Health, quality improvement and Pressure.

INTRODUCTION

WHO estimates that 61% of all human diseases originate from vertebrate animals, including 75% of new diseases discovered in the last decade. About 75%-90% of antimicrobials used by humans and animals are execrated unchanged (1, 2). Antimicrobial resistance (AMR) is an increasing public health threat driven by inappropriate antimicrobial use in humans and animals, and further environmental contamination.

In Ethiopia, AMR contributes an estimated 21,200 direct and more than 85,300 associated deaths annually and evidence showed that only 15.8% of health care professionals showed adequate competency. While antimicrobial stewardship programs have traditionally focused on rational antibiotic use in healthcare settings, increasing evidence demonstrates that AMR is also strongly driven by veterinary antimicrobial misuse, pharmaceutical waste management system, environmental contamination, and weak multi sectorial governance (1,2,7).

There is no composite indicator and well-functioning coordination methods which measure the amount of antibiotics exerted into the environment through One Health approach by integrating continuous quality improvement, so this study would become pioneer for the upcoming study in similar area (3, 4, 6)

In Ethiopia introducing the Environmental Antibiotic Pressure Index (EAPI), a composite One Health indicator designed to estimate cumulative ecological antimicrobial pressure using standardized and scalable indicators could have scientific and practical contribution (6).

This study develops a One Health policy framework that integrates human, animal, and environmental sectors to strengthen antimicrobial stewardship program through continuous quality improvement approaches.

METHODS

STUDY AREA: The framework was conceptually developed at Hawela Tula General Hospital in Hawassa, Sidama Region, Ethiopia.

STUDY PERIOD: The conceptual framework development, policy review, and indicator modeling process were conducted between October 2025 and April 2026.

STUDY DESIGN: A conceptual policy framework designed using One Health systems modeling, literature review, and policy analysis was employed.

Quality improvement approaches and composite indicator development methodologies was included. (6, 7,9).

The framework was aligned with global AMR guidance and stewardship principles from the WHO, FAO, World Organization for Animal Health and United Nations Environment Program.

This study used a qualitative policy analysis design to develop a conceptual One Health AMR resistance governance framework for Ethiopia. The analysis was guided by the Walt and Gilson health policy triangle, which examines policy content, context and process, and actors. The proposed indicators were assessed against six pre-defined criterions. Indicators were subsequently grouped as direct pressure and system capacity domains (8, 9).

Table1. Analytical framework used for developing the EOHAQ-AMR framework and EAPI.

Analytical activities	Method	Output
Policy review	Document analysis	Policy content and implementation gaps
Policy interpretation	Walt-Gilson policy triangle	Context, content, process, and actors
Evidence synthesis	Deductive content analysis	One Health themes and priority areas
System integration	One Health system Mapping	Human -animal -environmental linkages
Indicator design	Criteria based selection	EAPI domains and indicator
Score development	Normalization and weighting	Proposed EAPI scoring model

The conceptual framework was developed through an iterative process of policy, literature synthesis, and One Health system mapping and indicator development.

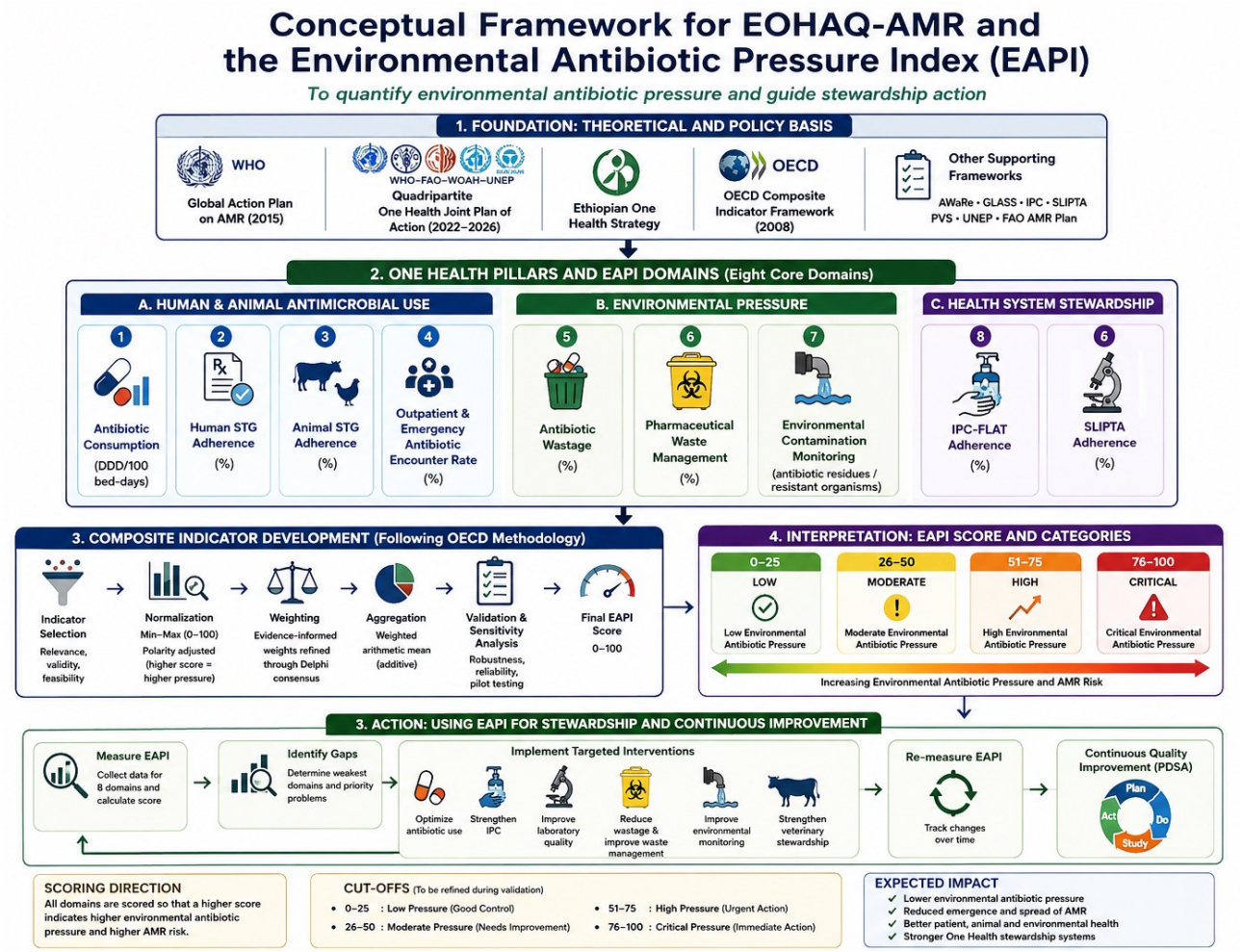


Image 1: Conceptual framework

RESULTS: The proposed framework introduces five pillars for integrated antimicrobial stewardship program. The key collaborators were hospital experts and veterinary professionals nearby study area.

Pillar: 1 Environmental Antibiotic Pressure Index (EAPI): The EAPI is a composite One Health antimicrobial stewardship program indicator designed to quantify the level of antibiotic **"pressure"** exerted on the environment by integrating human, animal and environmental sectors. This indicator includes antibiotic consumption, antibiotic wastage rate, and pharmaceutical wastage management practice, standard treatment guideline adherences of both human and animal sector, The Stepwise Laboratory Improvement Process towards Accreditation (SLIPTA) of ISO 15189 standards, National IPC-FLAT standards adherence and antibiotic encounter. (5,7). **Pillar -2-Tiered Certification Levels:** This pillar is essential because quality improvement is usually taught and practiced as a stepwise maturity pathway. **Pillar 3: Traditional Medicine- AMR Engagements:** This is the major community access point because in many countries including Ethiopia people first seek care from traditional practitioners before reaching formal facilities so they can influence when antibiotics started, delayed or misused (WHO). **Pillar 4: Ethiopian One Health Alliance for Quality (EOHAQ):** This is the expansion of existing EHAQ platform which primarily working on human aspect of One Health**.** The proposed alliance has AMR assessment tool and facilitates coordination of three sectors.

Pillar 5: Human-animal antimicrobial surveillance collaboration Network: This pillar measure cross-sector stewardship intervention coverage, environmental antibiotic pressure reduction score, support detection and prevention of AMR.

ETHICAL CLEARANCE: Hawela Tula General Hospital was informed of the framework development.

CONCLUSTION: The EOHAQ-AMR framework introduces a scalable and practical One Health governance framework integrating EAPI, tri-sector competency systems, and cross-sector surveillance.

RECOMMENDATIONS: Expansion of existing Ethiopian healthcare quality alliance structures into One Health antimicrobial stewardship governance platforms and piloting implementation of the Environmental Antibiotic Pressure Index should be initiated in selected hospitals and veterinary institutions to assess feasibility, applicability, and scalability. Future studies should externally validate the EAPI indicator using pilot implementation data and research should assess correlations between EAPI scores and antimicrobial resistance prevalence.

REFERENCES

1. World Health Organization. *Safe management of pharmaceutical waste from health care facilities: global best practices*. Geneva: World Health Organization; 2025.
2. World Health Organization. *Infection Prevention and Control Program Facility Level Assessment Tool (IPC FLAT)*. Updated June 2023. Geneva: World Health Organization; 2023.
3. Ministry of Health Ethiopia. *National HSPMI manual: implementation manual*. Addis Ababa: Ministry of Health; 2024.
4. World Health Organization. *Draft updated global action plan on antimicrobial resistance: report by the Director-General*. Geneva: World Health Organization; 2026 Jan.
5. Food and Agriculture Organization of the United Nations. *Ethiopia's One Health AMR surveillance: challenges, opportunities, and future prospects*. Rome: FAO.
6. Ministry of Health Ethiopia. *Trends in antimicrobial consumption in Ethiopia: a surveillance report 2020–2022*. Addis Ababa: Ministry of Health; 2024 Aug.
7. World Health Organization, Food and Agriculture Organization of the United Nations, World Organization for Animal Health. *Monitoring and evaluation of the global action plan on antimicrobial resistance: framework and recommended indicators*. Geneva: World Health Organization; 2019.
8. Ministry of Health Ethiopia, Ministry of Agriculture, Environmental Protection and Forest Authority. *Antimicrobial resistance prevention and containment strategic plan: the One Health approach 2021–2025*. 3rd ed. Addis Ababa: Ministry of Health; 2021.
9. European Commission, Joint Research Centre. *Handbook on constructing composite indicators: methodology and user guide*. Paris: Organization for Economic Co-operation and Development; 2008.

Designing a Clinical Decision Support System for Antenatal Risk Detection in Public Health Centers of Addis Ababa, Ethiopia

Betelhem Ashenafi[1,3], Dr. Girma Taye[1,3], Dr Million Meshesha[2]

[1]School of Public Health AAU

[2]School of Information Science, AAU

[3]AAU CBMP

Corresponding author: Betelhem Ashenafi, betelhemashenafi99@gmail.com

Abstract

Background: Antenatal Care (ANC) is critical for preventing maternal and neonatal complications. Although Ethiopia has standardized ANC guidelines, several studies conducted in health centers report weaknesses in the early detection of maternal risks. Integrating Clinical Decision Support System (CDSS) into Electronic Medical Records (EMR)s allows for the enhancement of timely and accurate ANC risk detection.

Objectives: This study aims to assess the gaps in antenatal risk detection to design a CDSS prototype in public health centers of Addis Ababa, 2026

Methods: Design Science Research methodology was employed, with problem identification using a sequential mixed-methods design. Quantitative data were collected from 415 ANC charts from 25 health centers using a structured checklist based on national guidelines. Logistic regression identified factors associated with adequate risk detection, while in-depth interviews explored barriers of risk detection among health professionals. Findings informed the development of a CDSS prototype using Python and Flask, which was deployed on the Render cloud platform and tested using sample EMR data.

Results: From 415 ANC charts, 33.01% of records showed adequate antenatal risk detection. Early ANC initiation (AOR=3.04, 95% CI: 1.72-5.3, p<0.001) and good documentation quality practices (AOR = 2.02, 95% CI: 1.10-3.69, p=0.022) were significantly associated with adequate risk detection. Qualitative findings revealed that workload, communication barriers, and inconsistent guideline use contributed to missed or delayed identification of risks. A CDSS prototype was developed from these findings, which demonstrated high usability and an accuracy of 80%.

Conclusion: To fill the gaps in antenatal risk detection, which is associated with poor documentation quality, the study came up with a CDSS prototype that registers good accuracy.

Keywords: Public Health, Antenatal, Clinical Decision Support System, CDSS

Introduction

Maternal mortality remains a major public health issue worldwide, and particularly in low and middle-income countries like Ethiopia (1). Antenatal risk detection identifies factors that could endanger the health of the mother or fetus during pregnancy, and it is done through routine ANC visits using history-taking, physical examinations, and basic investigations to identify early warning signs(2). Poor identification and management of risks in the ANC are the primary reasons for preventable maternal and perinatal death(3). A Clinical Decision Support System (CDSS) is a digital tool used to support healthcare professionals with evidence-based clinical choices(4). CDSS is evidenced to improve the quality of maternal health services, for instance, a systematic review of studies across 35 countries worldwide showed that using CDSS for maternal health care services was associated with better health outcomes with an odds ratio of 1.69 (5). Most of the previous research in Ethiopia and other low-resource settings has been Focused on ANC coverage, timing of the first ANC visit, and the number of ANC visits, and on maternal outcomes. While CDSS have demonstrated effectiveness globally in improving maternal health outcomes (4,5), their application in antenatal risk detection within Ethiopia remains limited(6), reflecting a clear gap in research and practice. This study, therefore, seeks to examine gaps in antenatal risk detection and design CDSS prototype for public health centers of Addis Ababa.

Objectives

1. To assess gaps and challenges in antenatal risk detection.
2. To identify factors associated with inadequate antenatal risk detection.
3. To design, develop, and evaluate a prototype CDSS for antenatal risk detection.

Methods

This study employed Design Science Research (DSR) to design, develop, and evaluate a CDSS prototype for antenatal risk detection, following the six iterative phases proposed by Peffers et al.: problem identification, solution objectives, design and development, demonstration, evaluation, and communication (7)

Phase 1: Problem Identification

A sequential mixed-methods design was used to assess gaps and challenges in antenatal risk detection in public health centers of Addis Ababa from February 15 to April 20, 2026. The quantitative component involved a retrospective review of 415 EMR-based ANC charts, while the qualitative component included in-depth interviews with 10 healthcare professionals including midwives, nurses and physicians providing ANC services.

The 25 public health centers were selected using simple random sampling, followed by proportional allocation and systematic random sampling of the previous month's ANC charts. The sample size of 415 was calculated using a 43% prevalence of adequate risk detection (4), 95% confidence level, 5% margin of error, and 10% non-response rate added to account for potentially incomplete or unavailable ANC records. Healthcare professionals were selected purposively until thematic saturation was reached.

Adequate documentation of antenatal risk assessment was defined as complete documentation of the required history, physical examination, and laboratory assessments according to the national ANC guidelines. Inadequate detection referred to missing assessments, incomplete documentation, or failure to document identified risks. Key independent variables included ANC initiation timing, documentation quality, and follow-up adherence.

Quantitative data was collected using a structured checklist adapted from Ethiopian National ANC Guidelines and WHO ANC risk assessment tools. Data were entered into KoboToolbox and analyzed using Stata. Descriptive statistics and bivariate and multivariable logistic regression were performed, with variables having $p<0.25$ in bivariate analysis were included in the multivariable model and statistical significance set at $p<0.05$. Qualitative data were collected through semi-structured interviews and analyzed thematically using MAXQDA.

Phase 2: Objectives of the Solution

The study aimed to develop a CDSS to improve antenatal risk detection and support timely, guideline-based decision-making.

Phase 3: Design and Development

A rule-based CDSS was developed using Python and Flask to detect maternal and fetal risks using routine ANC data and national guidelines.

Phase 4: Demonstration and Evaluation

The CDSS was demonstrated using simulated ANC cases. Usability was assessed among 10 healthcare professionals using a Likert scale questionnaire, and accuracy was evaluated using 10 predefined cases against expected guideline-based outputs.

Ethical Consideration

Ethical clearance was obtained from the Ethical Clearance Committee of Addis Ababa University, School of Public Health, and permission to access patient records was obtained from the Addis Ababa City Administration Health Bureau. No personal identifiers were collected from the reviewed records to maintain patient confidentiality.

Results and Discussion

A total of 415 ANC charts were reviewed. Documentation of patient information was generally high, with age (98.07%), gravidity (99.52%), parity (98.55%), and first ANC visit date (99.76%) recorded in most charts. However, documentation of clinical measurements varied considerably. Blood pressure was recorded in 98.55% of charts, while temperature (73.98%) and height (66.51%) were less consistently documented. Among laboratory investigations, HIV testing (98.31%), hemoglobin (95.42%), and blood group/Rh (95.18%) were highly documented, whereas blood sugar was recorded in only 66.75% of charts. Documentation of obstetric and medical history was generally above 85%, although anemia history (82.17%) and antepartum hemorrhage (84.58%) were less consistently documented.

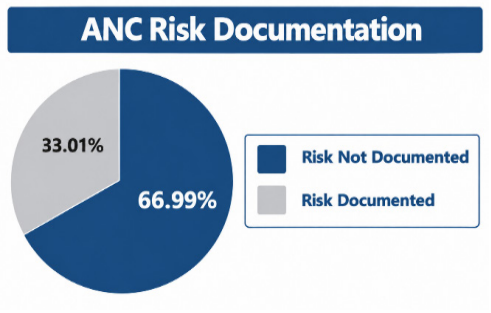


Fig 1: Antenatal Risk Documentation

Among 415 charts, 278 (66.99%) demonstrated inadequate antenatal risk documentation, compared with 137 (33.01%) with adequate documentation. Similar gaps were reported at Debark Health Center, where nearly one-quarter of women with high-risk factors were not correctly identified (6).

Early ANC initiation was associated with higher odds of adequate documentation of antenatal risk assessment (AOR=3.04, 95% CI: 1.72–5.36, p<0.001), while good documentation quality was also significantly associated with adequate documentation of antenatal risk assessment (AOR=2.02, 95% CI: 1.10–3.69, p=0.022). ANC adherence was not independently significant (AOR=1.58, 95% CI: 0.88–2.84, p=0.119). These findings are consistent with evidence linking late ANC initiation to missed early screening opportunities (8) and incomplete documentation to poor-quality ANC (9).

Qualitative interviews with 10 healthcare professionals identified five themes: knowledge and skills, communication, workload, inconsistent guideline use and gaps in antenatal risk assessment and documentation. Participants reported difficulty with complex cases and emphasized continuous practical training. High workload and limited consultation time contributed to rushed assessments and incomplete documentation, with clinical experience being relied upon instead of guideline use. Patient and inter professional communication barriers were also reported. These findings align with evidence that workload and staffing constraints compromise ANC assessment and documentation (10), while provider knowledge gaps and inconsistent guideline application have been reported in Rwanda and rural India (11,12).

CDSS Requirements, Design and Evaluation The main functional requirements were structured data entry for initial and follow-up ANC visits, automated rule-based risk assessment, identification of maternal and fetal risks and generation of guideline-based recommendations.

Non-functional requirements included usability, rapid response, and consistency of outputs, browser accessibility, and scalability.

A lightweight, rule-based web-based CDSS was developed in Python 3.14 using Flask version 3.1.3. The system consists of a presentation layer providing structured initial and follow-up ANC forms and a backend logic layer that validates and processes entered clinical data using predefined rules derived from national ANC guidelines and WHO recommendations. The system identifies risks and provides corresponding recommendations, supporting standardized assessment and reducing incomplete documentation. A sequence diagram illustrating the system workflow is presented in Figure below.

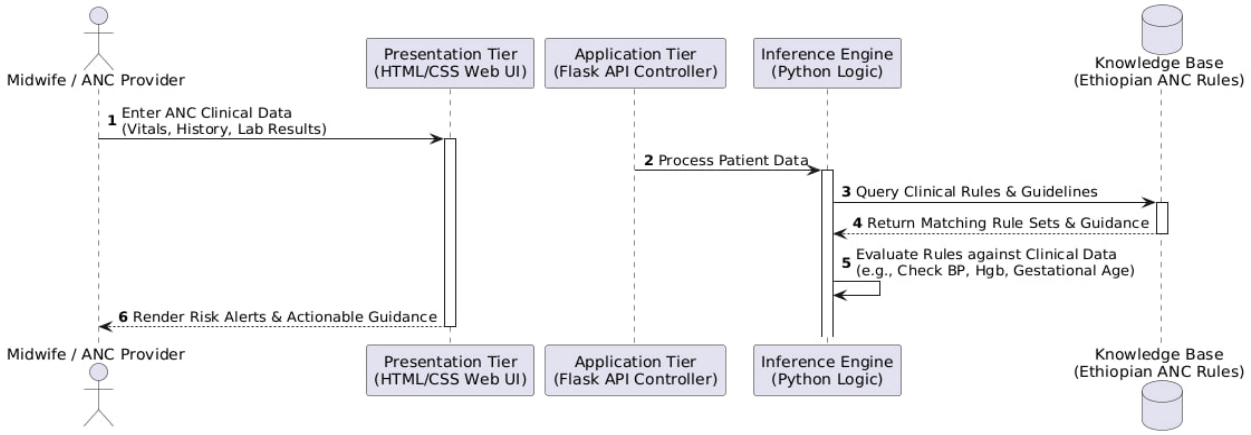


Fig 4: Sequence Diagram

CDSS Evaluation

The prototype was demonstrated using simulated ANC scenarios. The system generated risk assessments and corresponding guideline-based recommendations and was able to identify multiple concurrent risks.

Usability was assessed among 10 purposively selected healthcare professionals, including midwives, nurses, and a physician with experience in antenatal care, as a small-scale evaluation of the CDSS prototype. 10-item Likert-scale questionnaire was used. The prototype received above average ratings, with mean scores ranging from 3.90 to 4.70 out of 5. The highest-rated item was the perceived usefulness of the system (mean=4.70±0.48), followed by task efficiency and response time (mean=4.60±0.52). Output clarity received the lowest mean score (3.90±1.10), although it remained positively rated. Overall satisfaction was high (mean=4.50±0.71). Studies from Ghana and Tanzania have demonstrated improvements in pregnancy complication detection, ANC process quality, and guideline adherence following CDSS implementation (12,13).

Accuracy was evaluated using 10 simulated ANC scenarios developed from Ethiopian National ANC Guidelines. The prototype correctly identified 8 of 10 predefined simulated cases, indicating its potential to support antenatal risk assessment.

Conclusion and Recommendation

The study identified substantial gaps in the documentation of antenatal risk assessment and developed a context-specific CDSS prototype to support more consistent antenatal risk assessment in public health centers. The prototype correctly identified 8 of 10 predefined simulated cases, demonstrating its potential as a decision-support tool.

The study recommended for

- Health care workers need to adhere strictly to ANC guidelines, maintain proper documentation, and conduct thorough risk assessments on all women at each antenatal clinic visit.
- Health care workers should improve communication skills with patients.
- Future research should focus on advancing the CDSS prototype by implementing it using interoperable APIs to enable actual integration with existing EMR.

References

1. Firoz T, Donnay F, Al-Sheyab NA, Syed U, Int S. A Composite Framework for Evaluating Maternal and Child Mortality in Low-Income Countries: An International Comparison. 2022.
2. Vos AA, Van Veen MJ, Birnie E, Denktaș S, Steegers EAP, Bonsel GJ. An instrument for broadened risk assessment in antenatal health care including non-medical issues [Internet]. 2020. Available from: http://www.ijic.org/
3. Birhane BM, Assefa Y, Belay DM, Nibret G, Munye Aytenew T, Liyeh TM, et al. Interventions to improve the quality of maternal care in Ethiopia: a scoping review. Frontiers in Global Women's Health. Frontiers Media SA; 2024. doi:10.3389/fgwh.2024.1289835
4. Thorakkattil SA, Sridhar SB, Abdulsalim S, Karattuthodi MS, Chandra P, Unnikrishnan MK. Clinical Decision Support Systems in Indian Healthcare Settings: Benefits, Barriers, and Future Implications. Healthcare (Switzerland). Multidisciplinary Digital Publishing Institute (MDPI); 2025. doi:10.3390/healthcare13172220
5. Cockburn N, Osborne C, Withana S, Elsmore A, Nanjappa R, South M, et al. Clinical decision support systems for maternity care: a systematic review and meta-analysis. EClinicalMedicine. 2024 Oct 1;76. doi:10.1016/j.eclinm.2024.102822
6. Tegenaw GS, Amenu D, Ketema G, Verbeke F, Cornelis J, Jansen B. Evaluating a clinical decision support point of care instrument in low resource setting. BMC Med Inform Decis Mak. 2023 Dec 1;23(1). doi:10.1186/s12911-023-02144-0 PubMed PMID: 36998074.
7. Peffers K, Tuunanen T, Rothenberger MA, Chatterjee S. A design science research methodology for information systems research. Journal of Management Information Systems. 2007 Dec;24(3):45–77. doi:10.2753/MIS0742-1222240302
8. Tegenaw GS, Amenu D, Ketema G, Verbeke F, Cornelis J, Jansen B. Evaluating a clinical decision support point of care instrument in low resource setting. BMC Med Inform Decis Mak. 2023 Dec 1;23(1). doi:10.1186/s12911-023-02144-0 PubMed PMID: 36998074.
9. Yeoh PL, Hornetz K, Dahlui M. Antenatal care utilisation and content between low-risk and high-risk pregnant women. PLoS One. 2016 Mar 1;11(3). doi:10.1371/journal.pone.0152167 PubMed PMID: 27010482
10. Khatri RB, Mengistu TS, Assefa Y. Input, process, and output factors contributing to quality of antenatal care services: a scoping review of evidence. BMC Pregnancy Childbirth. 2022 Dec 1;22(1). doi:10.1186/s12884-022-05331-5 PubMed PMID: 36577961.
11. Radovich E, Das S, Karki S, Bottomley C, McCarthy OL, Shrestha A, et al. Workload in antenatal care before and after implementation of an electronic decision support system: an observed time-motion study of healthcare providers in Nepal. BMC Med Inform Decis Mak. 2025 Dec 1;25(1). doi:10.1186/s12911-025-02868-1 PubMed PMID: 39966864.
12. Rurangirwa AA, Mogren I, Ntaganira J, Govender K, Krantz G. Quality of antenatal care services in Rwanda: Assessing practices of health care providers. BMC Health Serv Res. 2018 Nov 19;18(1). doi:10.1186/s12913-018-3694-5 PubMed PMID: 30453996.
13. Singh S, Doyle P, Campbell OMR, Murthy GVS. Management and referral for high-risk conditions and complications during the antenatal period: Knowledge, practice and attitude survey of providers in rural public healthcare in two states of India. Reprod Health. 2019 Jul 10;16(1). doi:10.1186/s12978-019-0765-y PubMed PMID: 31291968.

From Duplication to Synergy: Partner Collaboration in Woreda Health System Transformation under Ethiopia's HSDIP, A Mixed-Methods Case Study

Keneni Gutema[1,2], Tsion Tekle[2]*, Desalegn Tsegaw[1,2], Birhanu Bifato[2], Alemu Tamiso[1,2], Rekiku Fikre[1,2], Emela Lamacha[3] Yohannes[3], Asfaw Benti[4], Yakob Wondirad[4], Mesoud Mohammed[4], Belayneh Bekele[3]

[1]*Hawassa University, College of Medicine and Health Sciences, Hawassa, Ethiopia*

[2]*ThinkPlace Ethiopia, Addis Ababa, Ethiopia*

[3]Sidama Regional Health Bureau, Hawassa, Ethiopia

[4]Federal Ministry of Health, Addis Ababa, Ethiopia

***Corresponding author: Tsion** Tekle, Email: tsitekleaab@gmail.com

Abstract

Introduction: Decentralized health systems are central to Ethiopia's HSTP-II and Universal Health Coverage agenda, with Woreda Health System Transformation (HST) as the operational backbone. The Health Sector Medium-Term Development and Investment Plan (HSDIP, 2016–2018 EFY) positions Woreda Transformation as the bridge between national policy and primary healthcare delivery. Weak partner alignment produces duplication and fragmentation that undermine the "One Plan, One Budget, One Report" mandate, while also presenting an opportunity for synergy.

Objective: This study examines how transitioning partner collaboration from duplication to synergy advances woreda health system transformation under HSDIP in Wondogenet Woreda and Town Administration, Sidama Region.

Methods: A convergent parallel mixed-methods case study was conducted using 12 key informant interviews, 3 focus group discussions (n=24), an organizational survey (n=6), and retrospective DHIS2/LQAS data (2021/22–2025/26). Analysis integrated the Collective Impact Framework (CIF) with an Input–Process–Output (IPO) logic model. Data were analyzed using EpiData, SPSS, and NVivo.

Results: Six partners operated in the woreda. Qualitative respondent's revealed duplication and early signs of synergy coexisted. Duplication was evident: two-thirds reported parallel data-collection tools, one-third noted overlapping trainings, and parallel supervision with redundant resource use was common. Investments were skewed, with 62.5% directed to health centers excluding health posts. Weak coordination persisted, as only one-third confirmed a clear coordination body and MoUs were maintained by half of the partners at woreda. This drove inefficiency in HSDIP. Yet, when partners aligned through harmonized supervision and shared training calendars, synergy emerged: DHIS2 timeliness rose from 55% to 88%, LQAS accuracy from 70% to 95% and these gains elevated the woreda to model IR status, recognized by MOH in 2018.

Conclusion & Recommendation: Synergy in Wondogenet Woreda is achievable but fragile, with duplication persisting alongside early gains. Joint operational integration—through local backbone leadership, unified monitoring, and pooled supervision and training—is essential to transform duplication into sustainable synergy and advance Ethiopia's HSDIP.

Keywords: Duplication, Synergy, Woreda transformation; partner collaboration; HSDIP; health information system; Collective Impact, logic model

Introduction

Decentralization of health systems is a key strategy for improving access, equity, and efficiency in low- and middle-income countries (1,2). In Ethiopia, the Woreda Health Office is the primary administrative unit for primary healthcare, and Woreda Health System Transformation (HST) anchors the Health Sector Transformation Plans (HSTP I and II) (3–6). The Health Information System (HIS) underpins this transformation by promoting data quality, digitization through DHIS2 and eCHIS, and evidence-based decision-making (7,8).

HSTP-II implementation has been disrupted by conflict, climate shocks, and post-COVID-19 economic pressures (5,6). The Health Sector Medium-Term Development and Investment Plan (HSDIP, 2016–2018 EFY) complements HSTP-II as an operational investment framework, repositioning Woreda Transformation as the bridge between national policy and district-level resilience (4,6).

Local implementation, however, remains constrained by fragmented partner interventions. Multiple partners often operate in silos, duplicating trainings, supervisions, and reporting systems, and unevenly allocating resources (9–13). This undermines the "One Plan, One Budget, One Report" principle and burdens district health offices. In Wondogenet Woreda, partners contribute across maternal and child health, disease prevention, and HIS, yet their collective impact on transformation is limited and poorly documented (11,12). Fragmentation is both a challenge and an opportunity: strategically aligned collaboration could pool resources and strengthen the HIS backbone (14). Empirical evidence on how partner collaboration shapes woreda transformation at the grassroots level remains scarce (6,10).

Objective

This study examined how transitioning partner collaboration from fragmented duplication toward institutionalized synergy contributes to woreda health system transformation under the HSDIP, in Wondogenet Woreda and its Town Administration, Sidama Region.

Methods

A single-case study design with embedded units of analysis was used (17), treating Wondogenet Woreda and its Town Administration as one bounded primary healthcare ecosystem. The site was purposefully selected for its concentration of implementing partners and its status as a national Information Revolution partners' pilot woreda.

A convergent parallel mixed-methods design (18) integrated the Collective Impact Framework (CIF) (15) with an Input–Process–Output (IPO) logic model (16), mapping CIF's five core conditions common agenda, shared measurement, mutually reinforcing activities, continuous communication, and backbone infrastructure onto IPO stages.

Quantitative data comprised an organizational survey of facility and district leads (N=6: 4 Health Center Directors, 1 Primary Hospital Lead, 1 Woreda HIS/M&E Officer) and retrospective DHIS2 and Lot Quality Assurance Sampling (LQAS) records from six health facilities and their attached health posts, spanning 2021/22–2025/26 (EFY 2014–2018). Qualitative data comprised 12 key informant interviews with health system leaders and partner coordinators, and 3 focus group discussions (n=24) with frontline health workers, Health Extension Workers, and Performance Monitoring Teams (Table 1).

Quantitative data were entered in EpiData and analyzed in SPSS v26 (descriptive, cross-tabulation, trend analysis). Qualitative data were transcribed, translated, and analyzed in NVivo using hybrid inductive–deductive thematic analysis framed around CIF–IPO dimensions. Validity was strengthened through tool pre-testing in a neighboring non-study district and triangulation across data sources. Ethical approval was obtained from [Institutional Review Board of Hawassa University College of Medicine and Health sciences, Ref No IRB/577/25 on 05/10/25, and written informed consent was obtained from all participants.

Table 1. Study Participants and Profiles, Wondogenet,2026

Variable / Data Source	Category	n	%
Organizational survey	Health Center leads	4	66.7
	Hospital lead	1	16.7
	Woreda HIS/M&E officer	1	16.7
Key informant interviews (KII)	Sex: Male	12	100.0
	Age <30	2	16.7
	Age 30–39	8	66.7
	Age 40–49	1	8.3
	Age ≥50	1	8.3
Educational level **Total**	Diploma/Health Officer	3	25.0
	BSc/Degree	1	8.3
	MD	1	8.3
	Postgraduate-level	7	58.3
Focus group discussions (FGD)	FGD1: Health Extension Workers	8	33.3
	FGD2: OPD/MCH providers	8	33.3
	FGD3: HC heads/coordinators	8	33.3

Table 2 woreda transformation composite score (19)

Transformation agenda	Health post	Health center	Woreda
Quality and equity	50%	45%	30%
MCCP	-		
Leadership and governance	30%	25%	35%
Health care financing	-	5%	10%
Information revolution	20%	15%	15%

Scores represent the maximum weighted percentage per domain toward a 100% composite total at each level, calculated using direct proportions, inverse logic for dropout metrics, and cut-off thresholds.

Result and Discussion

A total of six partners operate in the woreda majority focusing on RH and HIS (Table 1). The study drew on 6 organizational-survey respondents, 12 KII participants, and 24 FGD participants across health centers, the Woreda Health Office, and partner organizations (Table 2).

Table 3, Partners operating in Wondogenet woreda, 2017

No.	Partner	Project Title / Focus Area	Start Year
1	L10K (Last Ten Kilometers)	eCHIS, Health post	2015
2	SDA / JSI	PHC strengthening	2017
3	Think Place with Hawassa University CBMP	HIS	2016
4	IPAS	Reproductive Health (RH)	2016
5	Reach Ethiopia	TB Elimination	2017
6	Hawassa University community engagement	Woreda transformation	2017

SDA = Sidama development Association, HIS= Health Information System,eCHIS= electronic Community Health Informationsystem

Duplication and fragmentation

Partners' visions were formally aligned with government-led agendas, but frontline respondents described no jointly developed shared vision *("There would have been shared vision when they do have joint discussion…" – KII, frontline level).* All respondents (100%, n=6) reported partner support to MNCH programs, and 83.3% (n=5) reported concentrated partner involvement in HIS training and data-quality audits, producing overlapping trainings and supervision *("We receive three different trainings on the same HIS topic within a few months… Staff are exhausted" – KII, WoHO HIS focal person).* Resource allocation was similarly uneven: partners concentrated on RMNCH and health centers, leaving OPD services and peripheral health posts under-resourced. Only 50% of woredas maintained partner MoUs, and only 33.3% confirmed a clear coordination body; coordination operated vertically, with limited partner-to-partner dialogue. Two-thirds (66.7%) of respondents reported operational problems from parallel data-collection tools (e.g., Kobo Collect vs. DHIS2), and partners frequently maintained proprietary databases to satisfy donor mandates, violating the "One Plan, One Budget, One Report" principle. These patterns mirror donor-driven aid fragmentation documented elsewhere in Ethiopia and other LMICs (9,11,13,14), and reflect governance rather than purely technical failure (5,6,11,13).

Emerging synergy

Where partners aligned in areas such as HIS, and leadership and coordination improved through harmonized supervision and a shared training calendar, measurable gains followed (Table 3). Between 2014 and 2018, DHIS2 reporting timeliness rose from 55% to 88%, completeness from 92% to 100%, and LQAS data-accuracy from 70% to 95%. Over the same period, skilled birth attendance rose from 73.2% to 90.8%, contraceptive acceptance from 81.3% to 98.8%, and PMT meetings nearly doubled (6 to 11 annually); immunization coverage exceeded 100% for key antigens and OPD visits nearly quadrupled. A 2024 pilot of joint integrated supportive supervision improved reporting accuracy *("When partners agreed to use one checklist and one calendar, the workload reduced, and data quality improved" – KII, WoHO Deputy Head).* These internal gains drove the Woreda Transformation Composite Score from Moderate (54.1%) to High-Performing (76.8%). Moreover, this gain elevated the woreda to model IR status, recognized by MOH in 2018.

Table 4. Trends in HIS data-quality indicators, Wondogenet Woreda, 2014–2018 (EFY)

Year (EFY)	Timeliness (%)	Completeness (%)	Accuracy (LQAS) (%)
2014	55	92	70
2015	58	98	75
2016	60	100	75
2017	75	100	85
2018	88	100	95

Internal versus external synergy

Table 4 contrasts internal synergy (facility/woreda level) with persistent external collaboration gaps (partner/donor level): digitalization and accountability improved internally, while partners still maintain parallel tools, an irregular Regional Partner Forum, and RMNCH-skewed investment externally. This internal–external contrast is consistent with the Collective Impact Framework's emphasis on shared measurement, mutually reinforcing activities, and continuous communication (15), and extends prior work (1,12) by providing empirical evidence, from a single case, that CIF principles can convert duplication into measurable operational gains though the design does not establish causation and findings may not generalize to pastoralist or conflict-affected woredas.

Table 5. Internal vs. external synergy indicators, Wondogenet Woreda

Dimension	Internal (facility/ woreda)	External (partner/ donor)
Digitalisation	Paper→digital reporting; e-card rooms; Telegram bots	Parallel partner tools cause duplication
Data quality	Timeliness 55%→88%; Accuracy 70%→95%	Joint supervision pilot promising but limited reach
Accountability	PMT meetings 6→11/yr	Partner Forum irregular; report clear body
Coverage	SBA, CAR, immunisation, OPD all improved	RMNCH- and HC skewed; OPD/ under-5 neglected

Limitation

This single-case study in Wondogenet Woreda limits generalizability to other contexts. The qualitative sample was gender-imbalanced, with all KII respondent's male, though women's perspectives were partly captured in FGDs. Reliance on retrospective HIS data may affect reporting quality, and the short observation window may not reflect longer-term reforms

Conclusion and Recommendation

Operational synergy in Wondogenet Woreda is achievable but fragile: internal gains in digitalization, accountability, and service coverage are not yet matched by external partner coordination. Synergy is best understood as a governance transformation requiring backbone leadership, shared measurement, and aligned resources rather than a purely technical fix. Four actions are recommended:

1. Strengthen backbone/leadership, coordination support: Formally empowers the Woreda Health Office to enforce "One Plan, One Budget, One Report" and coordinate donor alignment locally.

2. Institutionalize shared measurement: Mandate sole monitoring evaluation and reporting mechanism, eliminating parallel databases and dual data-entry burdens.

3. Scale joint operational mechanisms: Require integrated supportive supervision and pooled training calendars, with Regional Health Bureau enforcement to address workforce turnover and infrastructure gaps.

4. Lessons from Wondogenet should be utilized as a replicable model for other comparable woredas, showing how partner duplication can be systematically transformed into measurable and sustained health system gains under HSDIP

References

1. World Health Organization. Everybody's business: strengthening health systems to improve health outcomes. Geneva: WHO; 2007.
2. Travis P, et al. Overcoming health-systems constraints to achieve the MDGs. Lancet. 2004;364(9437):900–6.
3. Banteyerga H. Ethiopia's health extension program. MEDICC Rev. 2011;13(3):46–9.
4. FMOH. Health Sector Woreda Transformation Coordination and Monitoring Manual. Addis Ababa: MOH; 2023.
5. FMOH. Health Sector Transformation Plan II (HSTP-II): 2020/21–2024/25. Addis Ababa: MOH; 2021.
6. MOH. Health Sector Medium-Term Development and Investment Plan (HSDIP): 2016–2018 EFY. Addis Ababa: MOH; 2023.
7. FMOH. Information Revolution Implementation Guideline. Addis Ababa: MOH; 2021.
8. Teklegiorgis K, Tadesse K, Mirutse G, Terefe W. Level of data quality from health management information systems in a resources limited setting, eastern Ethiopia. S Afr J Inf Manag. 2016;18(1):a612.
9. Adane A, Adege TM, Ahmed MM, Anteneh HA, Ayalew ES, Berhanu D, et al. Exploring data quality and use of the routine health information system in Ethiopia: a mixed-methods study. BMJ Open. 2021;11(12):e050356.
10. Tilahun B, Derseh L, Atinafu A, Mamuye A, Mariam TH, Mohammed M, et al. Level and contributing factors of health data quality and information use in two districts in Northwest Ethiopia: social-ecological perspective. BMC Med Inform Decis Mak. 2021;21:1–14.
11. Spicer N, et al. 'Our hands are tied': donor-driven aid fragmentation. Global Health. 2020;16(1):34.
12. Tadesse AW, Gurmu KK, Kebede ST, Habtemariam MK. Analyzing efforts to synergize the global health agenda of universal health coverage, health security and health promotion: a case-study from Ethiopia. Global Health. 2021;17(1):53.
13. Bossert TJ, Mitchell AD. Health sector decentralization and local decision-making. Soc Sci Med. 2011;72(1):39–48.
14. Edwards S, Barker C. Decentralization and donor coordination in health sector reform. Int J Health Plann Manage. 2018;33(2):e451–62.
15. Kania J, Kramer M. Collective impact. Stanford Soc Innov Rev. 2011;9(1):36–41.
16. McGrath JE. Methodology matters. In: Readings in Organizational Behavior. Englewood Cliffs: Prentice Hall; 1981. p.45–68.
17. Yin RK. Case Study Research and Applications. 6th ed. Thousand Oaks: SAGE; 2018.
18. Creswell JW, Plano Clark VL. Designing and Conducting Mixed Methods Research. 3rd ed. Thousand Oaks: SAGE; 2018.
19. Woreda transformation implementation manual, ministry of health Ethiopia,2017

Availability of minimum adolescent and youth health service packages at service delivery points in Ethiopia

Yefru Berhan (Professor), Abebe Kassa, Sintayehu Abebe, Teshager Mersha, Tariku Nigatu

[1] MS Public Health and Development Consultancy Service plc, Addis Ababa, Ethiopia

[2] Pathfinder International Ethiopia, Addis Ababa, Ethiopia

[3] MS Public Health and Development Consultancy Service plc, Addis Ababa, Ethiopia

[4] MS Public Health and Development Consultancy Service plc, Addis Ababa, Ethiopia

[5] MS Public Health and Development Consultancy Service plc, Addis Ababa, Ethiopia?

Corresponding author: Teshager Mersha, teshager.mersha@pathfinder.org.et

Abstract

Background: Despite established national strategies for adolescent and youth health, the extent to which minimum service packages are available at service delivery points remains poorly understood. This study assessed the availability of minimum adolescent and youth-friendly health service packages and necessary resources across diverse service delivery models in Ethiopia.

Methods: A descriptive study was conducted in November 2024 across five Ethiopian regions. A total of 466 healthcare providers from public and private health facilities were interviewed. Data were collected via the KOBO Collect platform and analyzed using descriptive statistics and chi-square tests, with a significance threshold of $P < 0.05$.

Results: From the provider perspectives only 9.7% of health facilities provided the full minimum adolescent and youth-friendly health service package. Availability was significantly higher in separate space models compared to mainstream models (13.8% versus 6.2%, $P = 0.006$). Amhara and Oromia regions reported the highest availability, while Gambella, Somali, and South Ethiopia regions reported limited capacity to provide the full package. Overall, 56.9% of providers had received specific training on adolescent and youth-friendly health services, with significant regional disparities ($P < 0.001$). Furthermore, only 35.8% of facilities were adequately stocked with essential health commodities.

Conclusions: The availability of the full minimum service package is suboptimal, characterized by severe gaps in provider training and essential resource stocks. Dedicated separate space models demonstrate better service integration and comprehensiveness than mainstreamed approaches. Urgent policy action is required to standardize service availability, invest in comprehensive provider training, and ensure consistent supply chains across all regions.

Keywords: Adolescent health, Youth health, Health services accessibility, Service delivery models, Ethiopia.

Introduction

Ethiopian adolescents and youth face high unmet health service needs, prompting the Ministry of Health (MoH) to develop a dedicated national strategy. In collaboration with Pathfinder Ethiopia, the MoH introduced Adolescent and Youth-Friendly Health Services (AYFHS) in 2006 to align with national strategies and standards. The overarching goal is to make health services appropriate, affordable, acceptable, and accessible to adolescents and youth in terms of time, place, choice, and approach, as young people frequently encounter structural barriers, a lack of confidentiality, and provider bias.

In 2022, aligned with World Health Organization (WHO) recommendations, the MoH formulated seven minimum service packages and nine standards for adolescent and youth health. These packages encompass information and counselling, comprehensive sexual and reproductive health (SRH) services, nutrition screening, psychosocial support, gender-based violence (GBV) prevention and management, prevention and management of injuries and non-communicable diseases, and the prevention and control of communicable disease outbreaks.

Although the WHO outlines multiple service delivery models, primarily only separate spaces co-located within health facilities (model 2) and mainstreamed/ integrated services (model 3) have been implemented across Ethiopian health facilities. Despite decades of implementation, system-wide evaluations demonstrate that overall service quality and utilization remain suboptimal, with pooled national utilization estimated at 42.7% and profound variations across regions. While national reports suggest widespread institutionalization, no prior study has investigated the actual facility-level availability of the comprehensive minimum service packages across distinct healthcare delivery models. This study addresses this critical gap by assessing the availability of minimum AYFHS packages and required resources across public and private health facilities in five Ethiopian regions from the providers perspectives.

Methods

Study Design, Setting and Sample size

The assessment utilized a quantitative survey. Accordingly, 466 adolescent and youth-friendly health service (AYFHS) providers to evaluate their characteristics, training, experience, and the availability of AYFHS components and facility-level readiness.

The study was conducted in five purposively selected Ethiopian regions (Amhara, Oromia, Gambella, Somali, and South Ethiopia) to capture diverse geographic, socioeconomic, livelihood, and health-service contexts, including urban, rural, agrarian, and pastoralist settings. Woredas and health facilities were sampled based on location, setting, facility type/ownership, and AYFHS availability. Because the regions were purposively selected, the study is not nationally representative. Findings describe only the sampled facilities and providers within the five regions and should not be statistically generalized to all health facilities or AYFHS providers across Ethiopia.

The sampling frame for the provider survey was compiled from lists of adolescent- and youth-friendly health service (AYFHS) facilities obtained from the Ministry of Health (MoH) and respective Regional Health Bureaus (RHBs), and was supplemented by the DHS Service Provision Assessment (SPA) area frame. This frame accounted for variations in facility ownership, facility type, geographic setting, and livelihood context to capture diverse service delivery arrangements. Five regions—Amhara, Oromia, Gambella, Somali, and South Ethiopia—were purposively selected, with woredas serving as primary sampling units and stratified by geographic and contextual characteristics to select appropriate health centers, hospitals, and clinics.

The sample size calculation for the provider survey was based on facilities (using health facility size and distribution), but the sampling framework also factored provider distributions.

The provider survey ultimately included 466 AYFHS providers across the five regions, consisting of 228 from Oromia, 166 from Amhara, 38 from South Ethiopia, 18 from Somali, and 16 from Gambella. This sample comprised personnel working in separate AYFHS units (210; 45.1%) and mainstream service-

delivery arrangements (256; 54.9%). Furthermore, 357 providers (76.6%) came from public facilities while 109 (23.4%) were from private/NGO facilities, spanning health centers (314; 67.4%), clinics (113; 24.2%), and hospitals (39; 8.4%).

Study Population and Sample Size: The study population comprised healthcare workers delivering AYFHS at selected facilities. Sample size estimation utilized a single population proportion formula based on a prior facility-readiness proportion of 35.7%, a 95% confidence level, and a 5% margin of error, yielding a minimum required sample of 466 providers/facilities.

Unit of Analysis, and Clustering: The assessment included 466 AYFHS providers across five purposively selected regions. The primary facility-level outcomes, such as service package and readiness criteria has been made at the facility level rather than individual provider counts. Because multiple providers within the same facility share an environment.

Data Collection

Data collection was executed electronically using the KOBO Collect platform on tablet computers. Rigorous quality control measures included tool translation and back-translation, pretesting, daily field supervision, and real-time electronic monitoring supported by Pathfinder project staff.

Data Analysis and Ethics: Data were cleaned, validated, and analyzed using Stata/Excel to generate descriptive statistics (frequencies and percentages). Bivariate analyses were performed using Pearson's chi-square tests, with statistical significance established at $P < 0.05$. Ethical approval was secured from the Ethiopian Midwives Association, alongside support letters from federal and regional health bureaus and written informed consent from all participants.

Results

1. Availability of Minimum AYFHS Packages

Only **9.7%** of health facilities provided the full minimum AYFHS package according to MoH standards. Comprehensive package availability was significantly higher in separate space models (13.8%) compared to mainstream models (6.2%) (). Furthermore, 63.8% of separate model facilities scored at or above mean performance metrics, whereas mainstream models had a higher proportion scoring below the mean (46.5%).

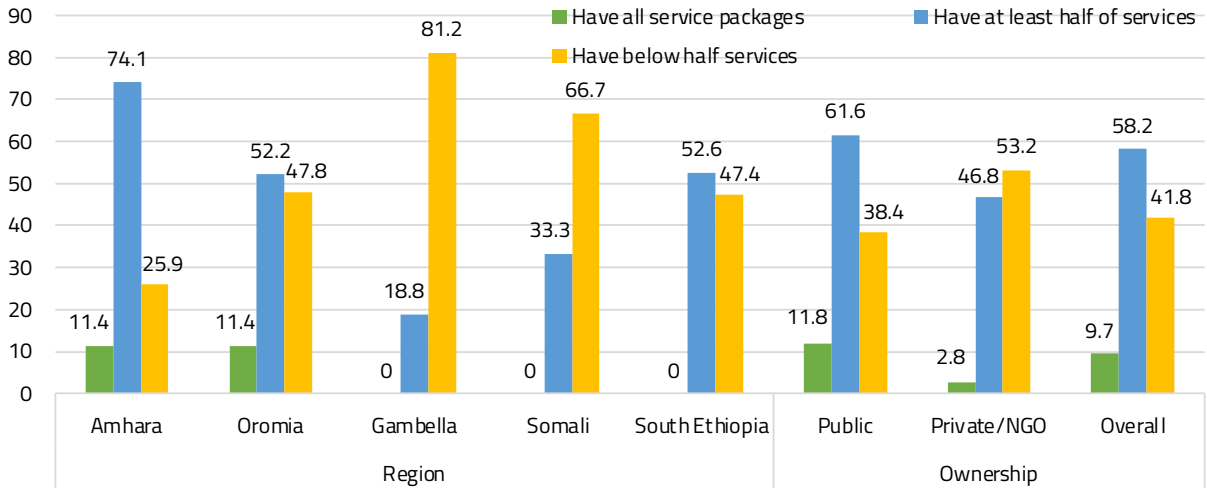


Figure 2: Availability of minimum adolescent and youth friendly health service package mean score in percent by region and ownership, Ethiopia, November 2024.

Full package availability varied geographically. Amhara and Oromia reported the highest availability (11.4% each), whereas Gambella, Somali, and South Ethiopia lacked facilities providing the complete package. Public facilities outperformed private/NGO facilities in full package provision (11.8% vs. 2.8%). Specific service parameters showed high availability for communicable diseases (80%) and SRH (77.9%), but minimal availability for industrial park outreach (13.7%).

3. Provider Training and Health Commodity Readiness

Only **56.9%** of providers had received specialized training on AYFHS, displaying stark regional disparities () ranging from 66.2% in Oromia to 44.4% in Somali (where 66.7% of facilities were newly established within the past year). Despite structural gaps, according the perception of the providers 79.4**%** of facilities reported an increase in adolescent and youth visits over the prior two years. Regarding supply chains, only **35.8%** of facilities were adequately stocked with essential health commodities, and essential laboratory test kits were adequate in only 38.0% of facilities.

Discussion

This study provides critical empirical evidence demonstrating that the availability of comprehensive minimum AYFHS packages in Ethiopia is highly suboptimal, with only 10% of facilities delivering the complete package. This aligns with broader sub-Saharan African findings indicating that program implementation often disproportionately focuses on isolated sexual and reproductive health components while failing to institutionalize multi-sectoral WHO standards.

The findings indicate that separate service approaches tend to exceed mainstreamed approaches in delivering comprehensive service packages and achieving higher performance metrics. Separate spaces alleviate resource competition with adult care and offer environments more conducive to client-provider interaction. However, severe systemic bottlenecks—namely that over 40% of providers lack specialized training and roughly two-thirds of facilities suffer from commodity and equipment shortages—undermine service delivery across all regions.

Conclusion

In conclusion, while adolescent and youth health visits are rising, actual service comprehensiveness remains severely constrained by training gaps and supply chain deficiencies. Dedicated separate space models offer a viable pathway for better service integration, though these observed performance differences may partly reflect underlying variations in facility characteristics, resource allocation, or institutional capacities rather than the delivery model itself. Urgent policy actions are necessary to standardize service packages, institutionalize continuous provider training, and secure robust supply chain logistics across all regional states.

References

- **MoH. National Adolescent Youth Reproductive Health Strategy 2006–2015:** Federal Democratic Republic of Ethiopia, Ministry of Health, July 2006, Addis Ababa. *(Establishes the foundational national policy context for adolescent and youth reproductive health in Ethiopia).*
- **Kereta W, Belayihun B, Hagos K, Molla Y, Pirzadeh M, Asnake M. Youth-Friendly Health Services in Ethiopia: What Has Been Achieved in 15 Years and What Remains to be Done:** *Ethiop. J. Health Dev.* 2021; 35 (SI-5). *(Provides historical tracking and milestones of AYFHS implementation in Ethiopia over a 15-year span).*
- **MoH. Standards on Youth Friendly Reproductive Health Services service delivery guideline & Minimum service delivery package on YFRH services:** 2007. *(Outlines the early standards and minimum service packages established by the Ministry of Health).*
- **Simon C, Benevides R, Hainsworth G, Morgan G, Chau K. Thinking Outside the Separate Space: A Decision-making Tool for Designing Youth-Friendly Services:** Washington, DC: Evidence to Action Project/Pathfinder International; 2015. *(Defines the core service delivery models—specifically separate spaces versus mainstreamed models—utilized for adolescent health services).*
- **Zenebe GA, Ewunie TM, Belay MM, Abose AM. Quality of adolescent and youth-friendly sexual and reproductive health services and associated factors in Ethiopia: a systematic review and meta-analysis:** *Front. Public Health*, 2023; 11:1191676. *(Provides comparative pooled data on service quality and gaps relative to WHO standards in Ethiopia).*
- **Belay HG, Arage G, Degu A, et al. Youth-friendly sexual and reproductive health services utilization and its determinants in Ethiopia: A systematic review and meta-analysis:** *Heliyon*, 2021; 7(12): e08526. *(Offers comprehensive empirical context regarding national AYFHS utilization rates and variations).*
- **Embleton L, Boal A, Sawarkar S, et al. Characterizing models of adolescent and youth-friendly health services in sub-Saharan Africa: a scoping review:** *Int J Adolesc Med Health*, 2024; 36(3): 203-236. *(Supplies broader sub-Saharan African regional evidence regarding the heavy focus on SRH and limited application of comprehensive WHO standards).*

Investing in Essential Care Versus Advanced Critical Care for COVID-19 Patients: A Cost-Effectiveness Analysis from a Resource-Scarce Area in Ethiopia

Hiruy Araya Tesfay[1], Adane Melka Wussobo[2], Messeret Molla[2], Abiye Assefa Berihun[1], Abdurahman Mohammedamin Asabel[1], Tesfahun Gulilat Debebe[1], Addis Dejen Minda[1], Bethlehem Tadesse Anteneh[1], Abebaw Bekele Seyoum[1], Tadios Niguss[1]*

1 Eka Kotebe General Hospital, Department of Research, Addis Ababa, Ethiopia

2 Addis Ababa University, School of Medicine, College of Public Health

***Corresponding author**: Abebaw Bekele Seyoum, abex4397@gmail.com*

Abstract

Background: The COVID-19 pandemic strained critical care capacity in low- and middle-income countries, requiring decision-makers in resource-scarce settings such as Addis Ababa, Ethiopia, to weigh investment in essential ward-based care (EC) against expanding advanced ICU-level critical care (ACC).

Objective: To estimate and compare the cost and cost-effectiveness of EC and ACC for COVID-19 patients in Addis Ababa, Ethiopia, to inform investment priorities in similarly resource-constrained health systems.

Methods: An institutional-based cross-sectional micro-costing study was conducted at Eka Kotebe General Hospital from February to August 2022 among 286 randomly sampled COVID-19 patients (150 severe, ward-admitted; 136 critical, ICU-admitted). Direct medical and non-medical costs were captured from the provider and health-system perspective. A decision-tree model (TreeAge Pro 2020) compared investing in EC alone versus EC+ACC, with effectiveness measured as disability-adjusted life years (DALYs) averted. The incremental cost-effectiveness ratio (ICER) was compared against a willingness-to-pay (WTP) threshold of USD 472 per DALY averted (50% of Ethiopia's 2021 GDP per capita), with one-way and probabilistic (Monte Carlo) sensitivity analyses assessing parameter uncertainty.

Results: Total inpatient cost was USD 557,746, with a mean cost per treated episode of USD 1,839 (USD 115/bed-day). Severe patients cost USD 1,003 per episode (USD 60/bed-day) versus USD 3,056 (USD 202/bed-day) for critical patients. Investing in EC alone averted 0.80 DALYs per patient, while EC+ACC averted 0.91 DALYs, an incremental gain of 0.1 DALY for an incremental cost of USD 142 — an ICER of USD 1,394 per DALY averted, exceeding the USD 472 WTP threshold. Monte Carlo simulation estimated only a 9.3% probability that EC+ACC was the cost-effective strategy at this threshold.

Conclusion: In this resource-constrained Ethiopian setting, strengthening essential care yields greater population-level health benefit per dollar invested than expanding advanced critical care, without displacing the continued need for ICU services. Policymakers facing constrained fiscal space should consider essential care a scalable, equitable first investment, while sustaining advanced critical care as a complementary component of the care continuum.

Keywords: *COVID-19; Essential care; Advanced critical care; Cost-effectiveness; Ethiopia*

Introduction

The COVID-19 pandemic exposed severe shortfalls in critical care capacity across low- and middle-income countries, where fewer than 5 ICU beds exist per 100,000 people across most of Africa (1). Ethiopia entered the pandemic with only 162 critical care beds nationwide; capacity was later expanded, but Addis Ababa's designated COVID-19 centre, Eka Kotebe General Hospital, remained the country's main referral site for essential and advanced critical care (2).

Given persistent resource constraints, decision-makers must choose how to allocate scarce funding between strengthening essential ward-based care (EC) and expanding advanced ICU-level critical care (ACC). This study estimated and compared the cost and cost-effectiveness of EC and ACC for COVID-19 patients in Addis Ababa, Ethiopia, to inform evidence-based investment priorities in similarly resource-constrained health systems.

Prior to the pandemic, Ethiopia's overall critical care capacity was less than 1% per 100,000 population, and public hospitals in Addis Ababa could not fully meet organ-support needs during the initial surge of severe and critical cases. These constraints underscore the urgency of identifying which investments — essential or advanced critical care — yield the greatest health return per dollar spent.

Methods

An institutional-based cross-sectional costing study was conducted at Eka Kotebe General Hospital, Addis Ababa, from February to August 2022, among 286 randomly sampled COVID-19 patients (150 severe, ward-admitted; 136 critical, ICU-admitted). Sample size was derived from a single population-mean formula using cost variance from a comparable low- and middle-income country setting, adjusted for a 15% non-response rate.

A micro-costing, bottom-up approach captured direct medical and non-medical costs — staffing, pharmaceuticals, non-pharmaceuticals, laboratory and radiology services, oxygen, equipment depreciation, accommodation, and meals — from the provider and health-system perspective. Staff costs were valued using clinical contact time multiplied by staff wage and duty-payment rates; pharmaceutical, oxygen, laboratory, and equipment costs were valued using hospital procurement records and market prices. Costs were collected in Ethiopian Birr (ETB), inflation-adjusted to August 2022 prices, and converted to USD (1 USD = 52.5 ETB).

A decision-tree model (TreeAge Pro 2020) compared two strategies: investing in EC alone versus investing in both EC and ACC, modeling patient pathways from admission through recovery or death under each strategy using transition probabilities, length of stay, and disability weights. Effectiveness was measured as disability-adjusted life years (DALYs) averted (8), calculated as the sum of years of life lost (based on standard life expectancy at age of death) and years lived with disability (incidence × duration of illness × disability weight). The incremental cost-effectiveness ratio (ICER) was compared against a willingness-to-pay (WTP) threshold of USD 472 per DALY averted (50% of Ethiopia's 2021 GDP per capita) (4). One-way and probabilistic (Monte Carlo, 1,000 iterations) sensitivity analyses assessed parameter uncertainty.

Results

Of the 286 patients (61.5% male; mean age 51 years), 52.4% had severe and 47.6% had critical COVID-19. The majority (57.3%) were married, and 45.5% had attained a degree-level education or higher. Mortality was markedly higher among critical patients (37.1% of all admissions) than severe patients (4.9%), and was concentrated among patients over 65 years, who accounted for 30.4% of admissions.

Total inpatient cost was USD 557,746. Staff costs dominated (55.9%), followed by pharmaceutical and non-pharmaceutical supplies (20.1%); remaining categories included meal services (7.6%), accommodation (3.5%), oxygen (2.6%), laboratory and diagnostics (1.9%), procedures and monitoring (1.6%), and equipment depreciation (1.0%). Mean cost per treated episode was USD 1,839 (SD 3,828) and mean cost per bed-day was USD 115. Severe (ward) patients cost USD 1,003 per episode (USD 60/bed-day), while critical (ICU) patients cost USD 3,056 per episode (USD 202/bed-day) — roughly three times higher.

Strategy	Cost (USD)	Effect (DALY)	Incr. Cost (USD)	Incr. Effect	C/E (USD)	ICER (USD)
Investing in EC	60	0.80	0	0	74.62	—
Investing in EC + ACC	202	0.91	142	0.1	222.97	1,393.96

Table 1. Cost-effectiveness ratio per DALY averted, EC vs. EC+ACC. DALY: disability-adjusted life year; C/E: cost-effectiveness ratio; ICER: incremental cost-effectiveness ratio.

Investing in EC alone averted 0.80 DALYs per patient at USD 60 per bed-day, while EC+ACC averted 0.91 DALYs at USD 202 per bed-day — an incremental cost of USD 142 for an incremental gain of 0.1 DALY (Table 1). The resulting ICER for EC+ACC versus EC was USD 1,394 per DALY averted, exceeding the USD 472 WTP threshold; EC+ACC was therefore not cost-effective at this threshold.

Sensitivity analysis identified the cost of critical care, the probability of ICU recovery, and the cost of essential care as the parameters most influencing the ICER. At the WTP threshold of USD 472, Monte Carlo simulation estimated only a 9.3% probability that EC+ACC was the cost-effective strategy (Figure 1), whereas investing in EC alone was cost-effective with near-certainty at low WTP values.

Discussion

These findings suggest that, under severe resource constraints, strengthening essential ward-based care yields greater operational efficiency and population-level health gain per dollar invested than expanding advanced critical care. This is consistent with cost-effectiveness studies from Kenya (5) and South Africa (6), which similarly found ICU expansion to be a high-cost, lower-yield strategy in resource-limited settings, and with an Ethiopian hospital-costing study reporting broadly comparable per-episode costs (7).

Our cost estimates were lower than those reported in Kenya, where total episode costs reached USD 1,494 for severe and USD 7,194 for critical COVID-19, but broadly comparable to another Ethiopian hospital-based study reporting USD 1,473 per treated episode (7). Differences in staffing patterns, treatment protocols, staff-to-patient ratios, and hospital pricing structures likely explain much of this cross-country and cross-facility variation.

The EC-only scenario is a modeling construct — reflecting settings where ICU access is unavailable or severely constrained — rather than a recommendation to withhold or restrict access to critical care. Essential and advanced critical care remain complementary components of the care continuum; the analysis instead highlights the opportunity cost of limited ICU capacity and the efficiency gained by preventing deterioration through stronger ward-level care. From an ethical standpoint, prioritizing essential care also aligns with utilitarian principles of maximizing population-level health benefit during public health emergencies characterized by extreme resource scarcity.

Limitations include the single-hospital setting, reliance on retrospective records, mortality parameters drawn from early-pandemic literature that may not reflect subsequent improvements in clinical management, and an EC-only comparator that represents an extreme rather than a realistic policy scenario.

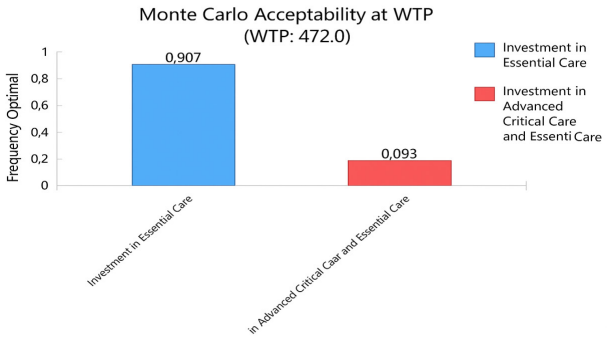


Figure 1. Probabilistic sensitivity analysis: probability that each strategy is cost-effective at the willingness-to-pay threshold of USD 472 per DALY averted (1,000 Monte Carlo simulations).

Conclusion

In resource-constrained urban Ethiopia, prioritizing investment in essential care capacity is likely to generate greater population-level health benefit per unit of expenditure than expanding advanced critical care alone, without displacing the continued need for ICU services for patients who deteriorate. Policymakers facing constrained fiscal space should consider strengthening essential care as a scalable, equitable first investment, while sustaining advanced critical care capacity as a complementary component of the care continuum. Multi-center studies are needed to confirm generalizability across other Ethiopian and sub-Saharan African hospital settings, and future research should evaluate combined incremental investment scenarios spanning both essential and advanced critical care capacity.

Abbreviations: ACC, advanced critical care; DALY, disability-adjusted life year; EC, essential care; ICER, incremental cost-effectiveness ratio; ICU, intensive care unit; WTP, willingness to pay.

References

1. Ma X, Vervoort D. Critical care capacity during the COVID-19 pandemic: Global availability of intensive care beds. J Crit Care. 2020;58:96.

2. Laytin AD, Sultan M, Debebe F, Walelign Y, Fisseha G, Gebreyesus A. Critical care capacity in Addis Ababa, Ethiopia: A citywide survey of public hospitals. J Crit Care. 2021;63:1-7.

3. Ministry of Health-Ethiopia. MOH COVID-19 Report for Parliament. September 2020.

4. Robinson LA, Hammitt JK, Chang AY, Resch S. Understanding and improving the one and three times GDP per capita cost-effectiveness thresholds. Health Policy Plan. 2017;32(1):141-5.

5. Kairu A, Were V, Isaaka L, Agweyu A, Aketch S, Barasa E. Modelling the cost-effectiveness of essential and advanced critical care for COVID-19 patients in Kenya. medRxiv. 2021.

6. Cleary SM, Wilkinson T, Tchuem CT, Docrat S, Solanki G. Cost-effectiveness of intensive care for hospitalized COVID-19 patients: experience from South Africa. BMC Health Serv Res. 2021;21(1):1-10.

7. Memirie ST, Yigezu A, Zewdie SA, Mirkuzie AH, Bolongaita S, Verguet S. Hospitalization costs for COVID-19 in Ethiopia: Empirical data and analysis from Addis Ababa's largest dedicated treatment center. PLoS One. 2022;17(1):e0260930.

8. Rushby JF, Hanson K. Calculating and presenting disability adjusted life years (DALYs) in cost-effectiveness analysis. Health Policy Plan. 2001;16(3):326-31.

9. Salomon JA, Haagsma JA, Davis A, et al. Disability weights for the Global Burden of Disease 2013 study. Lancet Glob Health. 2015;3(11):e712-23.

A Mid-Term Evaluation of the Cervical Cancer Screening Initiative: A Longitudinal Quasi-Experimental Study, 2019–2023

Zenawi Hagos Gufue [1, 3], Yimer Seid Yimer [1,3], Meaza Gezu Shentema [2,3], Awgichew Kifle [1,3], Zeytu Gashaw Asfaw [1,3], Sefonias Getachew [1,3], Kalkidan Solomon [2,3], Mulugeta Tamire [2,3], Girma Taye Aweke [1,3,*]

[1]Department of Epidemiology and Biostatistics, School of Public Health, Addis Ababa University, Addis Ababa, Ethiopia

[2] Department of Preventive Medicine, School of Public Health, Addis Ababa University, Addis Ababa, Ethiopia

[3] Addis Ababa Univesity, Capacity Building and Mentorship Program (CBMP), Addis Ababa, Ethiopia

* **Corresponding author:** Girma Taye, girmataye2009@gmail.com

Abstract

Background: Cervical cancer is a leading cause of mortality among Ethiopian women. Evidence on the real-world effectiveness of donor-supported interventions and facility-level determinants of screening performance remains limited. This study evaluated the mid-term outcomes of the NORAD–WHO Non-Communicable Disease (NCD) project on cervical cancer screening across the prevention cascade in Ethiopian primary care.

Methods: This longitudinal quasi-experimental study used a facility–month panel (5,022 observations; Jan 1, 2019, to Jun 30, 2023) from 93 public primary care facilities (31 intervention, 62 control) across seven Ethiopian regions. A difference-in-differences approach was applied using a two-part hurdle mixed-effects model (logistic for screening uptake, negative binomial for screening intensity) with facility-level random intercepts and a 24-month linear time spline. The primary outcome was the monthly count of screened women aged 30 to 49 years, offset by outpatient volume.

Findings: The analytical sample included 1,836 observations from 79 facilities. The intervention did not significantly increase the probability of facilities conducting screening (adjusted odds ratio [aOR] 1.05, 95% CI 1.00–1.11). Among actively screening facilities, the intervention had minimal effect on screening intensity after month 24 (adjusted incidence rate ratio [aIRR] 0.99, 95% CI 0.98–1.00). Overall screening volume increased system-wide over time, independent of the intervention (aIRR = 1.03 per month, 95% CI 1.02–1.04). Rural facilities were markedly less likely to conduct screening (aOR = 0.11, 95% CI 0.02–0.67). Only 2.8% (152 of 5,420) of screen-positive cases were referred for further care.

Conclusion and Recommendations: interventions that focus primarily on training and equipment are unlikely to be sufficient without embedding those services into routine health system operations. Program institutionalization, reliable supply chains, accountability mechanisms, and differentiated strategies for rural must be prioritized.

Keywords: Cervical cancer; difference-in-differences; hurdle mixed-effects model; health systems; prevention cascade; Ethiopia.

Introduction

Cervical cancer is a leading cause of cancer-related morbidity and mortality among women in low-income and middle-income countries.[1] In response, the World Health Organization (WHO) launched the global strategy for cervical cancer elimination, setting the "90–70–90" targets to be achieved by 2030.[2] Despite national commitment to this agenda through the integration of cervical cancer prevention into Ethiopia's non-communicable disease (NCD) strategy and primary care platform, screening coverage remains persistently below the WHO benchmark. [3,4]

Existing evidence in Ethiopia has primarily focused on demand-side barriers to screening uptake. [5–7] Additional challenges have been documented among high-risk populations.[8,9] While these studies offer important insights into individual-level and community-level determinants, substantially less attention has been given to facility-level, supply-side factors that shape service availability and delivery within routine primary care systems.

This study addresses these gaps through conducting a longitudinal evaluation applied to facility-level panel data from 2019 to 2023. The analysis estimates the mid-term effect of the NORAD–WHO NCD project on cervical cancer screening performance and identifies key structural determinants associated with variations in screening volume.

Methods

Study design, setting, and period.

This study was a longitudinal, multicenter, facility-based quasi-experimental evaluation nested within the NORAD–WHO noncommunicable disease (NCD) project 12, 13. The evaluation covered 54 consecutive calendar months, from January 1, 2019, to June 30, 2023, utilizing the facility-month as the unit of analysis. The study was conducted within the Ethiopian primary healthcare tier system, where primary hospitals, health centers, and satellite health posts serve as the first level of contact for cervical cancer screening services. [2,3] Data were drawn from Service Availability and Readiness Assessment (SARA) instrument, [2, 8] DHIS2, and outpatient department attendance records from HMIS.

Study size and sampling strategy.

We included 93 public primary care facilities from six regional states (Afar, Amhara, Benishangul-Gumuz, Central Ethiopia, Oromia, and Somali) and the Addis Ababa City Administration. We utilized a 2:1 control-to-intervention matching ratio targeted at the regional level, yielding 62 comparison facilities. With 54 months of follow-up and an expected intra-facility correlation of 0.15 to 0.20, this configuration provided greater than 80% power at = 0.05 (two-sided) to detect a screening rate ratio of 1.30.

Intervention and comparison groups

The NORAD–WHO NCD intervention is a standardized, multicomponent primary care strengthening package that operationalizes the WHO Package of Essential Noncommunicable Disease Interventions (WHO-PEN) for cervical cancer screening in low-resource settings. 12, 13

Variable definitions

The primary outcome was the monthly facility-level cervical cancer screening rate among women aged 30 to 49 years. Covariates were selected a priori based on the WHO Health Systems Building Blocks framework[27] and empirical evidence on service readiness and health system performance.10,11,28 Facility-level covariates included facility type, region, rural versus urban location, electricity backup, internet connectivity, presence of an established cervical cancer program, and availability of trained staff. Temporal covariates included continuous calendar time, monthly seasonal indicators, and a binary COVID-19 disruption term active from March 2020 through December 2021 to capture documented pandemic-related service disruptions. 35

Statistical analysis

All analyses were conducted using SAS version 9.4 (SAS Institute, Cary, NC, USA). To estimate the causal effects of the intervention, we employed a difference-in-differences (DiD) identification strategy. The fundamental parallel-trends assumption was assessed using locally weighted scatterplot smoothing (LOESS) pre-intervention trajectories and formal event-study specifications. A zero-inflated negative binomial (ZINB) model was fitted as a secondary analysis. Modified Poisson regression with robust variance was used to estimate risk ratios for binary secondary outcomes, such as referral completeness.

Results and discussions

Baseline facility characteristics and the primary care prevention cascade

Baseline facility type, geographic distribution, and infrastructure characteristics, including rural location (37.6%), electricity backup (81.7%), and internet access (50.5%), were comparable between the intervention and control groups (all p>0.05). The availability of established cervical cancer programs (61.3%), screening services (59.1%), trained staff (91.4%), and active screening delivery (59.1%) did not differ significantly at baseline. However, diagnostic services were slightly more common in intervention facilities (96.8% vs 82.3%; p = 0.049). The evaluation captured the primary care prevention cascade, encompassing program availability, screening, diagnosis, and referral.

Intervention effects on screening uptake and intensity

In the primary two-part hurdle model, the intervention was not associated with a meaningful change in screening uptake, the probability that facilities conducted any cervical cancer screening at all (adjusted OR [aOR] 1.05, 95% CI 1.00–1.11). Furthermore, among facilities already actively providing screening, the post-24-month difference-in-differences estimate indicated no programmatic improvement in screening intensity attributable to the intervention compared with active control facilities (adjusted incidence rate ratio [aIRR] 0.99, 95% CI 0.98–1.00). A secondary zero-inflated negative binomial (ZINB) model, utilized specifically to account for structural facility-level zeros, indicated a marginal relative increase in screening intensity after month 24 (aIRR = 1.02 per month, 95% CI 1.00–1.03). However, the absolute magnitude of this effect was programmatically limited, confirming that changes in active screening volume over time were identical between intervention and control facilities.

Prior studies in Ethiopia similarly indicate that standalone training is insufficient without sustained inputs such as reliable supply chains, supervision, and active demand generation[3–7], This aligns with global recommendations emphasizing the integration of cervical cancer services into broader health systems rather than relying on vertical interventions.2,25

Structural determinants of screening performance

Overall screening volume increased over time, particularly after month 24 (aIRR 1.03 per month, 95% CI 1.02–1.04). Facility-level characteristics served as the primary determinants of screening outcomes. Rural facilities were less likely to conduct any screening (aOR = 0.11, 95% CI 0.02–0.67). Compared to facilities led by physicians or health officers, midwife-led facilities were associated with lower adjusted screening intensity (aIRR = 0.61, 95% CI 0.42–0.89).

This suggests that geographic and infrastructural barriers are more influential than workforce capacity alone, consistent with evidence showing persistent rural-urban disparities in access to cervical cancer services in Ethiopia [3,4,10] and across other low-income and middle-income countries. [5]

Referral outcomes and the care continuum

Among 5,420 screen-positive cases identified during the study period, only 152 (2.8%) were officially referred for further evaluation or treatment. The intervention was not associated with improved referral rates (aOR = 1.02, 95% CI 0.34–3.07). Concerningly, referral odds significantly declined system-wide over time (aOR = 0.58 per year, 95% CI 0.37–0.91). Facilities equipped with on-site physicians demonstrated lower external referral odds; this is a clinically expected outcome, as these higher-tier facilities possess the internal capacity and equipment to provide immediate, on-site treatment for precancerous lesions (e.g., via thermal ablation or cryotherapy), effectively mitigating the need for external referral. Service disruptions during the COVID-19 pandemic did not statistically impact referral outcomes.

Without robust post-screening tracking data, it remains impossible to verify whether the remaining 97.2% of screen-positive women received definitive on-site care or were lost to follow-up. Screening without effective linkage to confirmed treatment cannot achieve meaningful reductions in cervical cancer mortality[2].

Conclusions and Recommendations

These findings have major implications for policy and practice. First, interventions that focus primarily on training and equipment are unlikely to be sufficient without embedding those services into routine health system operations. Program institutionalization,

through integration into daily workflows, reliable supply chains, and strict accountability mechanisms, must be prioritized. Second, differentiated strategies are urgently needed for rural areas where structural barriers severely limit service delivery. Third, national health information systems must be updated to explicitly capture on-site treatment and post-screening follow-up; without these tracking mechanisms, verifying the true health impact of the "screen-and-treat" model is impossible.

References

1. Bray F, Laversanne M, Sung H, Ferlay J, Siegel RL, Soerjomataram I, et al. Global cancer statistics 2022: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin 2024; 74: 229–63.
2. World Health Organization. Global strategy to accelerate the elimination of cervical cancer as a public health problem. Geneva: World Health Organization; 2020.
3. Ayenew AA, Zewdu BF, Nigussie AA. Uptake of cervical cancer screening service and associated factors among age-eligible women in Ethiopia: systematic review and meta-analysis. Infect Agent Cancer 2020; 15: 67.
4. Desta M, Getaneh T, Aynalem BY, Worku Y, Eshete T, Birhanu MY, et al. Cervical cancer screening utilization and predictors among eligible women in Ethiopia: a systematic review and meta-analysis. PLoS One 2021; 16: e0259339.
5. Rana T, Chan DNS, Law BMH, Choi KC, Shrestha S, So WKW. Determinants of cervical cancer screening utilisation among women in the least developed countries: a systematic review and meta-analysis. PLoS One 2025; 20: e0321627. https://doi.org/10.1371/journal.pone.0321627.
6. Mengesha A, Messele A, Beletew B. Knowledge and attitude towards cervical cancer among reproductive age group women in Gondar town, North West Ethiopia. BMC Public Health 2020; 20: 209
7. Shiferaw S, Addissie A, Gizaw M, Hirpa S, Ayele W, Getachew S, et al. Knowledge about cervical cancer and barriers toward cervical cancer screening among HIV-positive women attending public health centers in Addis Ababa city, Ethiopia. Cancer Med 2018; 7: 903–12.
8. Belete N, Tsige Y, Mellie H. Willingness and acceptability of cervical cancer screening among women living with HIV/AIDS in Addis Ababa, Ethiopia: a cross sectional study. Gynecol Oncol Res Pract 2015; 2: 6.
9. Mekonnen BD. Cervical cancer screening uptake and associated factors among HIV-positive women in Ethiopia: a systematic review and meta-analysis. Adv Prev Med 2020; 2020: 7071925.

Machine Learning Algorithms Application in WaSH Prediction using DHS Data in Sub-Saharan Africa

Jember Azanaw[1*], Molla Taye[2], Tsigie Baye Aragie[3], [1]Bikes Destaw Bitew

[1]Department of Environmental and Occupational Health and Safety, Institute of Public Health, College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia

[2]Department of Anatomy, School of Medicine, College of Medicine and Health Sciences, the University of Gondar, Gondar, Ethiopia

[3]Department of Field Epidemiology, Institute of Public Health, College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia

Corresponding author: Jember Azanaw, jemberazanaw21@gmail.com

Abstract

Background: Access to combined Water, Sanitation, and Hygiene (WaSH) services remains a critical challenge in Sub-Saharan Africa (SSA). To overcome the limits of traditional statistics, this study applied multiple machine-learning algorithms to identify key socioeconomic, demographic, and environmental determinants of household WaSH access.

Methods: We analyzed DHS data from 33 SSA countries to model WaSH access using seven machine-learning algorithms. Predictors included household demographics and socioeconomic factors. Data was preprocessed with SMOTE, optimized via grid search, and evaluated using repeated stratified cross-validation.

Results: Only 19% of households had access to combined WaSH services, with significant regional variation. Gradient Boosting achieved the highest predictive performance ($p < 0.01$). Household head education ($p < 0.001$), wealth index ($p < 0.001$), and age ($p < 0.05$) were the strongest predictors. Residence ($p < 0.01$) and media exposure ($p < 0.05$) also significantly influenced access, with rural and less-educated households facing substantially lower coverage.

Conclusions: Machine-learning algorithms effectively identified major determinants of WaSH access and demonstrated superior predictive capability. Persistent inequalities related to socioeconomic status, education, and demographics underscore the urgent need for targeted, evidence-based policies and context-specific interventions to promote equitable access and accelerate progress toward universal coverage in SSA.

Keywords: WaSH, machine learning, feature importance, Sub-Saharan Africa, DHS.

Introduction

Access to safe and reliable drinking water, sanitation, and handwashing with soap at critical times such as after potential fecal exposure and before eating or preparing food significantly enhances health, social, and economic well-being (WaSH)(1-4). Nearly 88% of diarrheal disease deaths worldwide could be prevented by adopting proper WASH practices (5). In particular, WaSH facilities are essential for lowering child mortality, avoiding waterborne infections including diarrhea, and improving general health (5).

Although some regions have made progress toward Sustainable Development Goal 6 (SDG 6), universal access to water and sanitation by 2030 remains overly ambitious, with progress in regions like Africa lagging significantly (6). The 2022 WHO/UNICEF Joint Program Monitoring Report on WaSH in Africa estimated that 839 million people need basic hygiene, 779 million lack access to basic sanitation, and 411 million lack basic water services (7). However, sub-Saharan Africa (SSA) bears significant risk, with a twofold rise in population and limited availability of hygiene and sanitation facilities (8, 9).

It might be argued that the approach of focusing on the supply of better water sources without concurrent advancements in the provision of safe water, proper sanitation, and hygiene has limited the ability to achieve anticipated gains in health outcomes (3). Hence, WaSH are interconnected and collectively essential for achieving improved public health, especially in the context of sustainable development goals and disease prevention in regions like SSA. Rather than existing alone, it is now essential to take into account how the water, sanitation, and hygiene concept and its operational framework must change to promote global public health (10).

To the best of the authors' knowledge, no research has been done representing SSA using WaSH as a single target and machine learning-based predictors. Therefore, this study aimed to understand predictors of WaSH as a single variable in SSA based on multi-DHS datasets.

Applying machine learning to WaSH prediction is important because it can reveal complex, non-linear correlations between socioeconomic, demographic, and community-level elements that conventional statistical methods could miss (11). WASH coverage is still lacking in many places, particularly for underserved populations, machine learning provides a strong, data-driven tool to promote equitable planning, maximize resource allocation, and eventually improve health outcomes by expanding access to safe WaSH services.

Methods

Study Variables: The outcome variable household access to combined WaSH services was categorized using the WHO/UNICEF Joint Monitoring Program (JMP) ladder (Levels 0–3), dichotomized into unimproved (Levels 0–2, lacking at least one component), and improved (Level 3, access all three components).

Individual-level predictors: Education of the household head (no education, primary, secondary, higher), Sex of the household head, Marital status, Family size (<4, 4-7, >7).

Community-level predictors: Exposure to media (exposed or unexposed), Place of residence (urban or rural), Wealth index (poor, middle, rich), Community-level poverty (low, lower middle, upper-middle), and Region (East, Central, West, and Southern Africa)

Data Preprocessing, Feature Selection and Engineering

The dataset was preprocessed by handling missing values, encoding categorical variables, and recoding variables into distinct classes. It was then randomly split into training (70%) and testing (30%) sets, with Synthetic Minority Over-sampling Technique (SMOTE) applied exclusively to the training set to address class imbalance. This study evaluated seven supervised machine-learning algorithms Logistic Regression, Decision Tree, Random Forest, K-Nearest Neighbors, Naive Bayes, Gradient Boosting, and Neural Networks using a streamlined pipeline for data preprocessing, training, and cross-validation.

To ensure robustness, each model was trained and evaluated across seven iterations using repeated stratified 7-fold cross-validation, allowing estimation of mean performance metrics while reducing variance due to data partitioning.

Model Evaluation and Selection

The best-performing model was selected based on a combined assessment of the untouched test set using Accuracy, Precision, Recall, Specificity, F1 Score, and AUC. Then feature importance was extracted from the top-performing model and visualized using Python (Jupyter Notebook) to highlight the key drivers of WASH access.

Results

Socio-Demographic Characteristics

The surveyed households were predominantly rural (60.56%) and led by adults aged 35–60 (48.65%), primarily concentrated in East (44.07%) and West Africa (38.68%). While nearly two-thirds had limited media exposure (62.75%) and only 9.67% reached higher education, community-level education was evenly split between high and low tiers (Table 1).

Table 1: Socio-Demographic Characteristics of the study Population (N = 233,391)

Variables		WaSH	
		Unimproved Weighted n (%)	Improved Weighted n (%)
Sex of HHH	Male	138,611(59.39)	30,220(12.95)
	Female	51,803 (22.20)	12,757 (5.47)
Marital status of HHH	Unmarried	49,566 (21.75)	12,773 (5.60)
	Married	136,708 (59.99)	28,842 (12.66)
Family size	< 4	65,442 (28.04)	17,637 (7.56)
	4-7	93,679 (40.14)	20,159 (8.64)
	>7	31,293 (13.41)	5,181 (2.22)
Wealth index	Poor	81,337 (34.85)	2,779 (1.19)
	Middle	40,703 (17.44)	4,751 (2.04)
	Rich	68,374 (29.30)	35,447 (15.19)
Residence	Rural	129,094 (55.31)	12,258 (5.25)
	Urban	61,320 (26.27)	30,719 (13.16)
Community level Income	Low income	107,384 (49.93)	17,950 (8.35)
	Lower middle income	52,386 (24.36)	13,651(6.35)
	Upper middle income	15,715 (7.31)	7,999 (3.72)
Community level education	Low	96,740 (41.45)	19,475 (8.34)
	High	93,674 (40.14)	23,502 (10.07)
Region	East Africa	86,002 (36.85)	16,854 (7.22)
	Central Africa	16,776 (7.19)	4,929 (2.11)
	West Africa	76,159 (32.63)	14,119 (6.05)
	Southern Africa	11,477 (4.92)	7,075 (3.03)

Proportion of WaSH Services

While 76.14% of households have improved water sources, overall WASH access is severely constrained: only 19.00% reach full access (Level 3), most fall into partial tiers (38.40% Level 2; 31.20% Level 1), and 11.99% have no access (Level 0).

Managing Class Imbalance

Applying SMOTE balanced the WaSH target variable from an initial 81% "Unimproved" and 19% "Improved" split to an even 50% distribution for fairer, more robust model training (Fig. 1).

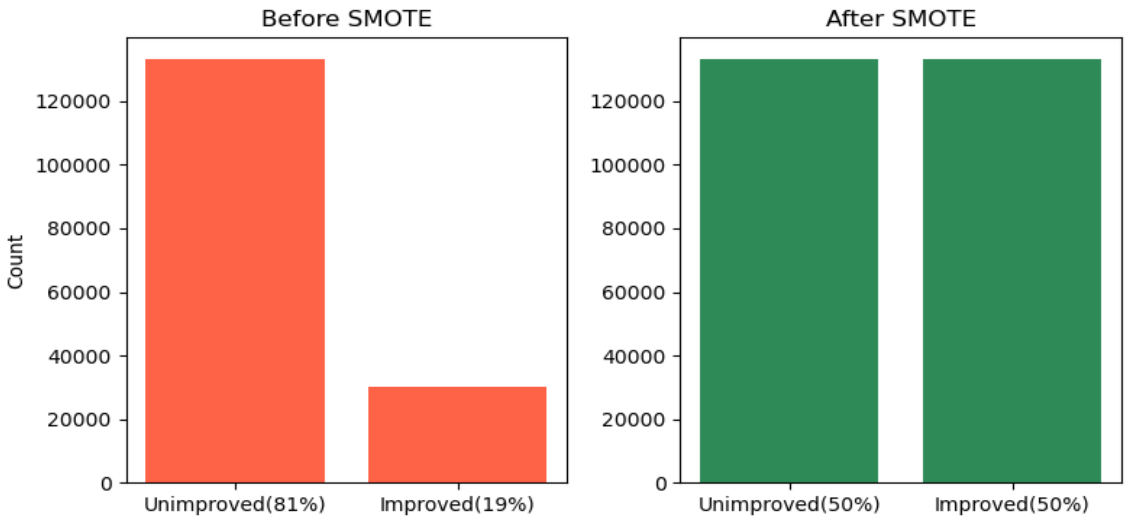


Fig. 1: Class Balance Comparison Before and After SMOTE Resampling

Model Selection and Performance Evaluation

According to the comparative analysis for WaSH classification, Gradient Boosting is the best overall performer with top accuracy (0.84) and AUC (0.83), whereas Naive Bayes is ideal for recall-sensitive tasks due to its superior recall (0.71) and F1-score (0.52).(Fig. 2).

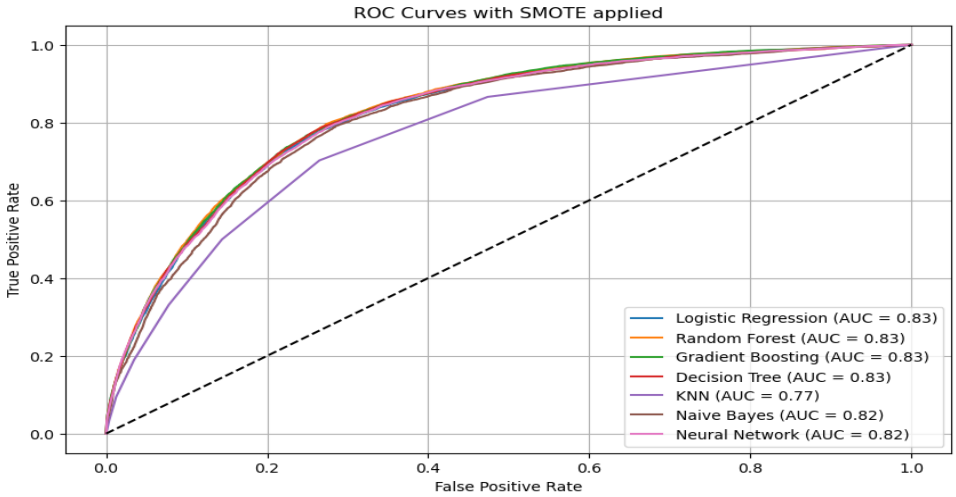


Fig. 2: Comparison of Machine Learning Models on WaSH Classification Performance Based on ROC Curves

Feature Importance

Feature importance is derived from the Gradient Boosting classifier used to predict WaSH improvement status. The most important predictors include the educational status of the household head, wealth index, and age of the household head, highlighting the role of educational attainment, household wealth, and child age in influencing WaSH outcomes (Fig.3).

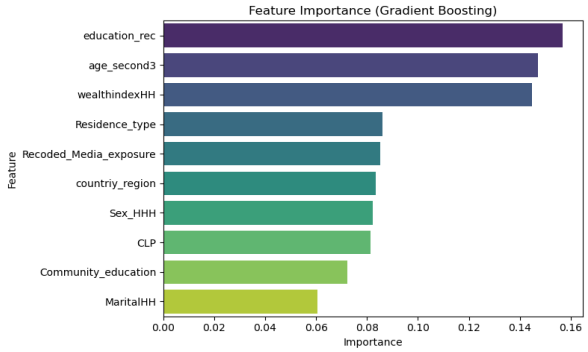


Fig. 3: Top Predictive Features in WaSH Services based on Gradient Boosting Model

Discussion

The disparity in WaSH coverage observed in this study (19.00% with 95%CI (18.26% 19.57%)) was very low compared to the studies conducted on WaSH coverage in Nepal (75.33%), Pakistan (59.47%), Afghanistan(33.54%)(20), and Bangladesh (40.2%) (12). To address class imbalance, SMOTE was applied to generate synthetic samples for the minority class (Improved WaSH). Because machine-learning algorithms tend to bias toward the majority class (Unimproved WASH), unbalancing often leads to poor minority-class detection and weak generalization. Among seven supervised machine-learning models evaluated for WASH prediction, Gradient Boosting performed best, with household head education, wealth index, and age emerging as the primary predictors.

As the second most significant factor, household head age reflects generational mindsets: younger heads adopt modern practices despite resource limits, while older heads rely on traditional routines. The household wealth index ranks third in importance because higher economic capacity directly enables families to afford clean water, sanitation, nutritious food, and healthcare (31). This finding was consistent with previous studies done in Ethiopia (30), Bangladesh(12), and South Asian Countries (20). Potential weaknesses of the wealth index include its reliance on asset ownership rather than actual income.

In SSA, rural residence significantly limits access to WASH services due to underdeveloped infrastructure and lower exposure to health education (34, 35). This finding is consistent with previous studies (12, 36), but it contradicts the other study done in Bangladesh (37).

Conclusion and Recommendation

Machine learning identifies socioeconomic status primarily age, household wealth, and education as the main driver of sub-Saharan Africa's WASH disparities. Policymakers should use these predictive models to target interventions toward high-risk populations, while resolving data, technical, and policy bottlenecks to ensure effective implementation.

References

1. Organization WH, Fund UNCs. Progress on household drinking water, sanitation and hygiene 2000-2020: five years into the SDGs: World Health Organization; 2021.
2. Organization WH. Water and sanitation. 2024.
3. Chakravarty I, Bhattacharya A, Das SK. Water, sanitation and hygiene: the unfinished agenda in the World Health Organization South-East Asia Region. WHO South-East Asia journal of public health. 2017;6(2):22-6.
4. Wolf J, Hubbard S, Brauer M, Ambelu A, Arnold BF, Bain R, et al. Effectiveness of interventions to improve drinking water, sanitation, and handwashing with soap on risk of diarrhoeal disease in children in low-income and middle-income settings: a systematic review and meta-analysis. The Lancet. 2022;400(10345):48-59.
5. Gordon B, Boisson S, Johnston R, Trouba DJ, Cumming O. Unsafe water, sanitation and hygiene: a persistent health burden. Bulletin of the World Health Organization. 2023;101(9):551.
6. Bobbins K, Diep L, Hofmann P, OkoWilliams A, Campos L, Steenmans I, et al. Accelerating progress towards the SDGs: Collaborative policymaking in sanitation for integrated benefits in Sub-Saharan Africa. World Development Sustainability. 2023;2:100037.

Essential Emergency and Critical Care (EECC) in Ethiopia

Tesfay Yohannes Ambese[1,3]; Peniel Kenna Dulla[1,2]; Aman Safewo[4]; Elubabur Buno[4]; Jonna Idh[5];

Tim Baker[6]; Fitsum K. Belachew[1,2]

[1]Debre Berhan University, Network for Perioperative and Critical Care (N4PCc), Debre Berhan, Ethiopia.

[2]Global Partners for Improving Surgical System (GPISS-N4PCc), Addis Ababa, Ethiopia.

[3]Global Partners for Improving Surgical System (GPISS-N4PCc), Department of Statistical and Data Governance, Addis Ababa, Ethiopia.

[4]Ethiopia Ministry of Health, Medical Services Lead Executive Office, Addis Ababa, Ethiopia.

[5] Västervik Hospital, Department of Anesthesiology and Intensive Care, Västervik, Sweden.

[6] Muhimbili University of Health & Allied Sciences | Tanzania, Global Public Health | Karolinska Institute | Sweden.

Corresponding author: Tesfay Yohannes Ambese, tesfay@n4pcc.com

Abstract

Background: Critical illness burden, location, and management outside intensive care units (ICUs) remain poorly characterized in Ethiopia. This study assessed the burden of critical illness, outcomes, the provision of Essential Emergency and Critical Care (EECC), and implementation barriers.

Methods: This prospective mixed-methods study was conducted across 12 public hospitals (June-September 2025). A point-prevalence survey assessed adult inpatients on a single census day per site using standardized vital-sign criteria, with 7-day mortality follow-up and assessment of hospital EECC-resource availability (67 items). Five key informant interviews and one focus group discussion were conducted to explore implementation barriers, and thematic analysis was used to analyze the data.

Results: Of 1,077 patients, 221 (20.5%) were critically ill; 62.0% were managed in general wards. Seven-day mortality was 14.0% among critically ill patients versus 2.8% among others. Only 1.8% received the full package of indicated EECC treatments. Median hospital EECC-resource availability was 70.9% (IQR 41.4-79.1%), with no hospital fully equipped. Seven interconnected barriers emerged: delayed identification, resource constraints, knowledge gaps, attitudes favoring advanced over basic care, organizational barriers, low motivation, and delivery delays. Male sex, hypertension, cancer, HIV/AIDS, other comorbidities, and critical illness independently predicted mortality.

Conclusion: One in five hospitalized adults is critically ill, mostly managed in general wards, with substantial mortality and EECC gaps. Decentralized EECC strengthening through training, resources, ward protocols, and organizational reform is urgently needed.

Keywords: Essential Emergency and Critical Care; critical illness; point prevalence; mortality; Ethiopia

Introduction

Critical illness affects an estimated 12% of the global inpatient population, and in low- and middle-income countries nearly half of this care is delivered outside intensive care units (ICUs), with African data suggesting up to 69% is managed in general wards. Ethiopia's ICU infrastructure remains limited despite a post-COVID-19 threefold expansion in bed capacity, and reliance on ICU-centric models risks delayed intervention when illness presents or deteriorates on general wards. The Essential Emergency and Critical Care (EECC) approach promotes basic, low-cost, high-impact interventions airway management, oxygen, intravenous fluids, and monitoring deliverable at the first point of contact. The true empirical burden of critical illness in Ethiopia, and the extent to which EECC is delivered, has not been well characterized. This study evaluated the burden, location, and management of critical illness, associated short-term outcomes, and barriers to EECC implementation using a mixed-methods approach

Methods

This convergent mixed-methods study was conducted across 12 public hospitals in Ethiopia (11 referral and regional hospital) within the N4PCc collaborating-site network, June-September 2025. A point-prevalence survey assessed all adult inpatients (≥18 years) on a single census day per site, using vital-sign criteria for critical illness (respiratory rate <8 or >30/min, oxygen saturation <90%, systolic blood pressure <90 mmHg, heart rate <40 or >130 bpm, or reduced consciousness on AVPU). Patients were followed for 7-day in-hospital mortality. Hospital-level availability of 67 EECC resources (equipment, consumables, drugs, human resources, training, guidelines, infrastructure) was assessed once per site. Qualitative data were collected through five semi-structured KIIs and one FGD (5 participants) with physicians, nurses, hospital leaders, and EECC focal persons, purposively sampled for EECC experience. Transcripts were double-coded using Braun and Clarke's thematic analysis, with disagreements resolved by consensus; given the exploratory scope, sample adequacy was guided by information power rather than a predetermined saturation target. Quantitative data were summarized descriptively; independent predictors of 7-day mortality were identified using multivariable logistic regression. Ethical approval was obtained from the Armauer Hansen Research Institute IRB (PQ49/23); individual consent was waived for the observational quantitative component, and verbal informed consent was obtained for all qualitative participants.

Results

Of 1,077 enrolled patients, 221 (20.5%) were critically ill. Critically ill patients were more often admitted as emergencies (95.5% vs. 79.8%) and had a higher burden of chronic conditions, including COPD/asthma (16.8%), heart disease (12.7%), and tuberculosis (11.8%). Although most patients overall were on general wards (82.6%), critically ill patients were still predominantly managed there (62.0%), with only 18.1% in high-dependency units and 19.9% in ICUs (Table 1). Seven-day in-hospital mortality was 14.0% among critically ill patients versus 2.8% among others (overall 5.1%). Only 4 of 220 critically ill patients (1.8%) received the full package of indicated EECC treatments; among those meeting respiratory criteria, 71.8% received oxygen, and among those with circulatory criteria, 62.8% received fluids or vasopressors (Table 1).

Table 1: Location of care, 7-day mortality, and EECC treatment receipt among critically ill patients (of N=1,077 total, 221 critically ill).

Characteristic	n (%)
Critically ill, managed in general ward	137/221 (62.0%)
Critically ill, managed in HDU	40/221 (18.1%)
Critically ill, managed in ICU	44/221 (19.9%)
7-day mortality, critically ill	31/221 (14.0%)
7-day mortality, not critically ill	24/856 (2.8%)
Received oxygen (respiratory criteria, n=149)	107 (71.8%)
Received fluids/vasopressors (circulatory criteria, n=86)	54 (62.8%)
Received all indicated EECC treatments (n=220)	4 (1.8%)

On multivariable analysis (Table 2), male sex (AOR 2.24, 95% CI 1.09-4.61), hypertension (AOR 2.93, 95% CI 1.25-6.89), cancer (AOR 5.92, 95% CI 2.23-15.71), HIV/AIDS (AOR 4.32, 95% CI 1.09-17.06), other comorbidities (AOR 3.65, 95% CI 1.93-6.89), and critical illness itself (AOR 5.18, 95% CI 2.75-9.73) independently predicted 7-day mortality

Table 2: Independent predictors of 7-day in-hospital mortality (multivariable logistic regression).

Predictor	AOR (95% CI)	p
Male sex	2.24 (1.09-4.61)	0.028
Hypertension	2.93 (1.25-6.89)	0.014
Cancer	5.92 (2.23-15.71)	<0.001
HIV/AIDS	4.32 (1.09-17.06)	0.037
Other comorbidities	3.65 (1.93-6.89)	<0.001
Critically ill (vs. not)	5.18 (2.75-9.73)	<0.001

Across the 12 hospitals, median EECC resource availability was 70.9% of 67 items (IQR 41.4-79.1%), ranging from 29.9% to 97.0% between sites (Table 3); no hospital was fully equipped across all domains, and consumables were never fully available at any site.

Table 3: Hospitals (of 12) with full availability of EECC resources, by domain. Overall median availability across all 67 items was 70.9% (IQR 41.4–79.1%; range 29.9–97.0%).

EECC resource domain	Hospitals fully equipped
Human resources	7/12 (58.3%)
Training	5/12 (41.7%)
Equipment	3/12 (25.0%)
Guidelines	3/12 (25.0%)
Infrastructure	3/12 (25.0%)
Drugs	2/12 (16.7%)
Consumables	0/12 (0.0%)
All domains fully equipped	0/12 (0.0%)

Thematic analysis identified seven interconnected barriers: (1) delayed identification amid high volumes and inconsistent vital-sign interpretation; (2) shortages of equipment, consumables, and medications, worse in general wards than ICUs; (3) knowledge/skills gaps from limited, largely didactic training; (4) attitudes favoring advanced over basic care; (5) organizational barriers (staffing, budget, procurement); (6) low staff motivation; and (7) delivery delays, worsened on nights, weekends, and by patients' financial constraints.

Discussion

This is among the first multicenter assessments of critical illness burden and EECC delivery in Ethiopia. The 20.5%-point prevalence exceeds global estimates of approximately 12% and is consistent with the African Critical Illness Outcomes Study (ACIOS), which similarly found most critical care delivered outside ICUs. The 14.0% seven-day mortality, while somewhat lower than the approximately 21% reported by ACIOS, remains high and rose with escalating level of care, likely reflecting severity-based triage. Despite reasonable resource availability in some domains, only 1.8% of critically ill patients received all indicated EECC interventions, indicating that gaps in care reflect not only resource shortages but also the organizational, behavioral, and knowledge-related barriers identified qualitatively. These findings mirror prior Ethiopian assessments showing persistent equipment, training, and protocol deficiencies despite expanding ICU capacity. Strengths include the prospective multicenter design, double-coded qualitative analysis, and integration of patient- and hospital-level data with staff perspectives. Limitations include the single-day census design, self-reported resource availability, restriction to public hospitals, and a qualitative component of one FGD and five KIIs; despite purposive sampling and double-coding, this precludes a claim of full saturation, so findings should be read as indicative, warranting confirmation through additional focus groups in future work.

Conclusion and Recommendations

One in five hospitalized adults in these Ethiopian hospitals was critically ill, most managed in general wards, with substantial short-term mortality and EECC gaps. Reliance on ICU-centric models alone is insufficient. National health authorities, hospital administrators, and partners should prioritize decentralized EECC through frontline training, reliable low-cost resources, ward-based early warning protocols, and attention to organizational and motivational barriers as a feasible, cost-effective route to reducing preventable mortality in similar resource-limited settings.

References

1. Schell CO, et al. Hospital burden of critical illness across global settings: Malawi, Sri Lanka and Sweden. BMJ Glob Health. 2025;10(3):e017119.
2. Baker T, et al. The African Critical Illness Outcomes Study (ACIOS): 22 nations in Africa. Lancet. 2025;405(10480):715–24.
3. Bartlett ES, et al. Critical care delivery across LMIC health systems: a systematic review. J Glob Health. 2023;13:04141.
4. Kifle F, et al. Intensive Care in Sub-Saharan Africa: national review in Ethiopia. Anesth Analg. 2022;134(5):930.
5. Belachew FK, Ambese TY, et al. Critical care capacity in Africa: postpandemic ICU capacity in Ethiopia. BMJ Glob Health. 2026;11(3):e021281.
6. Malterud K, Siersma VD, Guassora AD. Sample size in qualitative interview studies: guided by information power. Qual Health Res. 2016;26(13):1753–1760.
7. Laytin AD, et al. Critical care capacity in Addis Ababa: citywide survey. J Crit Care. 2021;63:1–7.

Intimate Partner Violence Among Infertile Women Attending Health Facilities in West Arsi and Bale Zones, Ethiopia

[1]Solomon Seyife Alemu, [2]Lema Fikadu Wedajo, [3]Firomsa Bekele, [4]Biruk Fikadu Kassaye, [1]Gemechu Gelan Bekele

[1]Department of Midwifery, College of Health Sciences, Madda Walabu University, Shashamene, Ethiopia

[2]Department of Midwifery, Institute of Health Sciences, Wollega University, Nekemte, Ethiopia

[3]Departments of Midwifery, and Pharmacy, Institute of Health sciences, Wollega University, Nekemte, Ethiopia

[4]Department of Medicine, College of Medicine and Health sciences, Hawassa University, Hawassa, Ethiopia

The Corresponding Author: Solomon Seyife Alemu; +251910766047, soleseifa@gmail.com

Abstract

Background: Intimate partner violence (IPV) is a pervasive human rights issue that disproportionately affects women, particularly in developing countries such as Ethiopia. Infertile women face an intensified risk due to social norms that blame them for childlessness. This intersection of infertility and IPV results in severe physical, psychological, and economic consequences. However, evidence on this issue in Ethiopia remains scarce. This study aims to assess the IPV among infertile women in the study area.

Objectives: The study aimed to assess the prevalence of IPV and associated factors among infertile women attending health facilities in the West Arsi and Bale Zones, Ethiopia, in 2025.

Methods: A health facility–based cross-sectional study was conducted among 423 women from May 1 to June 30, 2025. Intimate partner violence was assessed using WHO-validated domestic violence tools for low-income settings. Participants were selected through systematic random sampling, and data were collected via structured interviews and patient card review using Kobo Toolbox. The data were exported to SPSS version 26 for cleaning and analysis. Binary and multivariable logistic regression models were applied, with statistical significance determined at a p-value of < 0.05.

Results: Of the 423 women approached, 406 participated, yielding a response rate of 95.98%. The prevalence of intimate partner violence among infertile women attending gynecology referral clinics in West Arsi and Bale zone hospitals was 53% (95% CI: 48.1%–57.8%). Primary infertility was significantly associated with IPV (AOR = 2.67; 95% CI: 1.50–4.78), as was low marital satisfaction (AOR = 3.10; 95% CI: 1.40–6.79). Additionally, women with depressive symptoms had a higher likelihood of experiencing IPV (AOR = 1.77; 95% CI: 1.16–2.71).

Conclusion and Recommendations: This study revealed that intimate partner violence among infertile women is alarmingly high, affecting more than half of the participants. Types of infertility, low marital satisfaction, and depression were identified as significant associations. These findings highlight the need for routine IPV and mental health screening within infertility care services. Incorporating psychosocial support and marital counseling into reproductive health programs is strongly recommended. In hospitals, coordinated action across reproductive, mental health, and social services is essential.

Keywords: Intimate partner violence, Infertility, Women, Ethiopia

Introduction

Background and Rationale: Intimate partner violence (IPV) is a critical human rights violation that disproportionately impacts women in developing nations, with approximately 36% of infertile women in low- and middle-income countries reporting experiences of abuse(1, 2). Driven by stigma, marital instability, and entrenched gender norms, this intersection of infertility and IPV carries severe physical, psychological, and economic consequences including a roughly 16% higher likelihood of attempted suicide among affected women(3){Wang, 2022 #42}{Wang, 2022 #42}. Despite this high vulnerability, in Ethiopia there is no data, highlighting the critical need for this study to assess the prevalence of IPV among infertile women in the target study area.

Methods

Study Design & Setting: A facility-based cross-sectional study was conducted among infertile women receiving infertility-related gynecological care across health facilities in the West Arsi and Bale zones of Ethiopia. Located in the region's southeast, predominantly agrarian zones rely heavily on farming for their livelihoods. A specific time frame, from May 1 to June 30, 2025, was used to gather data on women seeking treatment during regular clinical service delivery.

Population, sample size & Sampling: The study was conducted among infertile women attending health facilities in the West Arsi and Bale zones during the study period. A total sample size of 423 was calculated using the single population proportion formula, incorporating a 10% non-response rate. Initially, health facilities actively providing specialized infertility care services were identified. To ensure representative sampling, 50% of these eligible facilities were selected via a simple lottery method in accordance with WHO sampling recommendations, yielding a total of seven hospitals. The calculated sample size was proportionally allocated to each selected facility based on average client flow, and study participants were systematically selected using a systematic random sampling technique.

Data Collection & Analysis: By using a structured questionnaire, both interviews and patient card reviews using KoboToolbox were used for data collection and were exported to SPSS version 26 for further analysis. Bivariate binary logistic regression was performed to screen candidate variables ($p < 0.25$), which were then entered into a multivariable model to identify associated factors of IPV ($p < 0.05$). Collinearity diagnostics (VIF and tolerance) and the Hosmer–Lemeshow test were applied to verify model goodness-of-fit, reporting strength of association through adjusted odds ratios with 95% confidence intervals.

Ethical Considerations: Ethical clearance and approval for the study were officially granted by the Shashemene Campus College Health Science Ethical Review Committee of Madda Walabu University.

Results

According to this study, the magnitude of IPV among infertile women who attended Gynecology Referral Clinics in West Arsi and Bale zone hospitals was 53% (95% CI: 48.1%, 57.8%). Primary infertility was significantly associated with IPV (AOR = 2.67; 95% CI: 1.50–4.78), as was low marital satisfaction (AOR = 3.10; 95% CI: 1.40–6.79). Additionally, women with depressive symptoms had a higher likelihood of experiencing IPV (AOR = 1.77; 95% CI: 1.16–2.71)

Table. Binary and multivariable logistic regression on IPV among Infertile Women Attending Gynecology Referral Clinics in West Arsi and Bale Zones Hospitals, 2025

Variables	Categories	Intimate Partner Violence		COR (95% CI)	AOR (95% CI)
		Faced IPV (215)	Have not faced IPV (191)		
Types of infertility	Primary	194(57.6%)	143(42.4%)	3.10(1.78,5.41)	2.67(1.50,4.78)*
	Secondary	21(30.4%)	48(69.6%)	1	1
Duration of infertility	<5	93(55.4%)	75(44.6%)	1	1
	5-9	103(54.2%)	87(45.8%)	0.95 (0.62,1.41)	0.83(0.53,1.30)
	≥10	19(39.6%)	29(60.4%)	0.52 (0.27,0.99)	0.53(0.27,1.06)
Willingness to adopt children	Yes	70(46.4%)	81(53.6%)	1	1
	No	145(56.9%)	110(43.1%)	1.53 (1.01,2.30)	1.44(0.93,2.23)
Family support	Poor	47(62.7%)	28(37.3%)	1.30 (0.85,2.01)	1.26(0.79,1.99)
	Moderate	101(53.7%)	87(46.3%)	1.90 (1.10,3.37)	1.46(0.78,2.74)
	Strong	67(46.9%)	76(53.1%)	1	1
Marital satisfaction	Low	34(73.9%)	12(26.1%)	3.70 (1.80,7.63)	3.10(1.40,6.79) *
	Average	111(55.8%)	88(44.2%)	1.64 (1.10,2.50)	1.37(0.87,2.14)
	High	70(43.5%)	91(56.5%)	1	1
Depression symptoms	Have not depression	91(47.6%)	100(52.4%)	1	1
	Have depression	124(57.7%)	91(42.3%)	1.50 (1.02,2,22)	1.77 (1.16,2,71)*

Foote note: *p-value ≤ 0.05 in multivariable analysis, 1-Reference group

Discussion

The findings of this study align closely with international research, revealing an IPV prevalence comparable to rates reported in Egypt (50.5%) (4) and Iran (55.35%) (5), while exceeding those from Northwest Nigeria (35.9%) (6), South-Western Nigeria (31.2%) (7) and Turkey (47.9%) (8) However, this prevalence is lower than the 61.8% reported in the study from Iran (61.8%) (9) due to potential temporal shifts and socio-demographic differences. Despite these regional and methodological variations, these converging statistics underscore a shared global reality: infertile women face a pervasive double burden of medical distress and interpersonal violence. Ultimately, these disparities highlight the influence of sociocultural norms and measurement tools, reinforcing the urgent need for culturally sensitive interventions, targeted advocacy, and integrated healthcare support systems tailored to protect vulnerable women.

This study highlights three critical factors significantly associated with intimate partner violence (IPV) among infertile women: low marital satisfaction, primary infertility, and depression. Women with low marital satisfaction were nearly three times more likely to experience IPV due to heightened conflict and a lack of emotional fulfillment, while those with primary infertility faced a 2.7-fold higher risk than women with secondary infertility—consistent with findings from China and Tanzania—likely because the absence of children deprives couples of the shared responsibilities and emotional bonds that help buffer against domestic disputes. Finally, a heavy burden of depressive symptoms was identified as a strongly associated factor with IPV, underscoring the urgent clinical imperative to integrate mental health support into routine reproductive healthcare and IPV intervention strategies.

Conclusion and Recommendations

This study reveals an alarmingly high burden of intimate partner violence, affecting over half of the participants, with primary infertility, low marital satisfaction, and depressive symptoms emerging as critical associated factors. These findings demand a clinical paradigm shift toward proactive, routine, and confidential screening for IPV and depression during standard gynecological consultations. Healthcare providers must direct tailored

psychological support and priority care toward high-risk patients experiencing primary infertility or marital distress. Furthermore, policymakers and institutional leaders must formalize trauma-informed mental health protocols directly within national reproductive health guidelines. Successful mitigation requires fortifying inter-agency referral networks and establishing strong pathways for safe, multi-sectoral support services.

References

1. Wang Y, Fu Y, Ghazi P, Gao Q, Tian T, Kong F, et al. Prevalence of intimate partner violence against infertile women in low-income and middle-income countries: a systematic review and meta-analysis. The Lancet Global Health. 2022;10(6):e820-e30.
2. Alemu SS, Tura MR, Wondie WT, Egu LM, Olkaba BF, Zerihun E, et al. Magnitude of intimate partner violence and its associated factors among HIV-positive women attending health facilities in Ethiopia: a systematic review and meta-analysis. BMC public health. 2025;25(1):3666.
3. Bondade S, Iyengar RS, Shivakumar BK, Karthik KN. Intimate Partner Violence and Psychiatric Comorbidity in Infertile Women - A Cross-Sectional Hospital Based Study. Indian journal of psychological medicine. 2018;40(6):540-6.
4. Ahmed DS, Elela AMA, Ismail SS, Almowafy AA, Abou-Elyazid H. Violence and its related factors among infertile women attending assisted reproductive technique unit at Al-Azhar University, Cairo. BMC Public Health. 2024;24(1):2063.
5. Silwal A, Thapa B. Prevalence of Domestic Violence among Infertile Women attending Subfertility Clinic of a Tertiary Hospital. JNMA; journal of the Nepal Medical Association. 2020;58(226):372-6.
6. Iliyasu Z, Galadanci HS, Abubakar S, Auwal MS, Odoh C, Salihu HM, et al. Phenotypes of intimate partner violence among women experiencing infertility in Kano, Northwest Nigeria. International Journal of Gynecology & Obstetrics. 2016;133(1):32-6.
7. Aduloju PO, Olagbuji NB, Olofinbiyi AB, Awoleke JO. Prevalence and predictors of intimate partner violence among women attending infertility clinic in south-western Nigeria. European journal of obstetrics, gynecology, and reproductive biology. 2015;188:66-9.
8. Akpinar F, Yilmaz S, Karahanoglu E, Ozelci R, Coskun B, Dilbaz B, et al. Intimate partner violence in Turkey among women with female infertility. Sexual and Relationship Therapy. 2019;34(1):3-9.
9. Gharacheh M, Ranjbar F, Kashefi F, Charkazi A, Azadi S, Shahbazi A, et al. Violence against infertile women in an Iranian setting. BMC Womens Health. 2024;24(1):645.

People's Voice and Health System Response: A Population-Based Assessment in Ethiopia

Ashenif Tadele[1], Aderajew Mekonnen[1], Teferra Tadele[1], Gebeyaw Molla[1], Adiam Nega[2], Anagaw Derseh[2], Damen Haile Mariam[2] Muluken Argaw[3], Mesay Hailu[1], Getachew Tollera[1]*

[1] *Ethiopian Public Health Institute, Health System Research Directorate, Addis Ababa, Ethiopia;*

[2] *Addis Ababa University, School of Public Health, Addis Ababa, Ethiopia;*

[3] *Ministry of Health, Strategic Affairs Executive office, Addis Ababa, Ethiopia;*

***Corresponding author**: Ashenif Tadele, asheniftadele@gmail.com, +251 911 555613*

Abstract

Background: High-quality, people-centered health systems require routine measurement of population perspectives on health system performance. Using the People's Voice Survey (PVS), We evaluated health system performance, user experience, care effectiveness, confidence, and financial protection in Ethiopia.

Methods: We analyzed national data from Peoples voice survey round-II (PVS-II), a population representative survey of 2,314 adults (aged 18+ years) conducted between October 2024–January 2025. Weighted data were analyzed in Stata v18 using the World Health Organization universal health coverage (WHO UHC) framework across standardized index scores (scaled 0-100).

Results: Among 2,314 respondents (51% female, 56% urban, 50% without formal education), 84.9% had usual source of care (of which 76.7% were public facilities). Only 38.0% rated care quality as excellent or very good. Overall unmet healthcare need was 12.6%, peaking among rural residents (19.0%) and older adults (17.3%). Across the WHO UHC performance domains indices (0-100), access scored highest (mean: 87), whereas user experience scored lowest (mean: 18). Care effectiveness was low (mean: 23); driven by a 36.0% annual preventive screening rate. The health improvement index (mean: 61) dropping sharply among adults aged 60+ (38 vs. 62 for age 18-29) and those respondents who had chronic conditions (34 vs. 69). Financial protection averaged 52, revealing a major affordability gap: 81% expected high-quality care if seriously sick tomorrow, but only 48% expected to get and afford it. Health insurance substantially increased financial security (mean: 77 vs. 20 for uninsured).

Conclusion: Despite high health service utilization, Ethiopians face severe deficits in care quality, user experience, and financial protection. Expanding health insurance and institutionalizing routine population-wide surveys like the People's Voice Survey into national monitoring frameworks such as the Ethiopia's Health Sector development and Investment Plan are essential to transform service expansion into high-quality, and affordable care.

Keywords: Health system performance; people-centered care; user experience; health system responsiveness; universal health coverage

Introduction

Poor-quality healthcare causes an estimated 8.5–8.6 million preventable deaths annually in low- and middle-income countries (LMICs), exceeding deaths caused by a lack of access alone(1,2) Achieving Universal Health Coverage (UHC) requires shifting toward people-centered care that systematically measures and acts on public feedback regarding user experience, trust, and service uptake(3,4). While the World Health Organization (WHO) framework prioritizes population-grounded evaluation, user experience metrics remain underutilized globally and nationally (5,6).

In Ethiopia, the Ministry of Health's Health Sector Medium-Term Development and Investment Plan (HSDIP-I) prioritized delivering safe, effective, affordable, and people-centered care(7). However, traditional health system evaluations such as Service Provision Assessments (SPA) or routine health information systems (HMIS/DHIS2)—focus almost exclusively on supply-side inputs like facility infrastructure, staffing, and equipment. These creates a critical blind spot regarding public confidence, user experience, and financial protection.

To bridge this evidence gap, the Quality Evidence for Health System Transformation (QuEST) Network developed the People's Voice Survey (PVS)—a rapid, population-representative instrument measuring system competence, care experience, and public confidence among both healthcare users and non-users(8). Grounded population assessments using this standardized framework remain scarce in Ethiopia. Using national data from PVS round II, this study evaluates Ethiopian health system performance across key WHO-aligned domains(6). We assess service utilization, perceived quality, user experience, and financial protection across demographic and geographic subgroups to support health sector transformation under the HSDIP-II.

Methods

Data source: We drew data from Peoples voice survey round II, a cross-sectional, population-representative survey, conducted between October 2024 and January 2025 among adults (18+) across all regions in Ethiopia. The study was implemented jointly by EPHI, the Federal Ministry of Health, Addis Ababa University's School of Public Health, and the Harvard T.H. Chan School of Public Health, following an established PVS protocol(9,10). We used a hybrid sampling approach: phone interview (random digit-dialing or known-list sampling) in high mobile ownership area and computer assisted personal interviewing (CAPI) in lower ownership, primarily rural settings. The instrument was developed to international survey standards under the Lancet HQSS Commission's conceptual framework (2,6), validated it through expert review and cognitive interviews (8), translated it into Amharic, Afaan Oromo, Somali, and Tigrigna, with piloting in all study settings before main-stage data collection.

Indicators: We aliened our analysis indicators with the WHO UHC framework, covering six key performance domains(6) : Care effectiveness, user experience, access, health improvement, people centeredness, and financial protection indexes (Details found in the report(10)). Care effectiveness referred to the ability of the overall health-care system to provide essential and clinically effective services to those who need them(11). User experience defined as the provision of care that is respectful and aligns with individual preferences, needs and values(12). Access referred to the availability and timely delivery of health-care services(13). People-centeredness encompassed the ability of the systems to capture the public's input, perceptions of quality, choice of provider, engagement in care and trust in the system (6). For financial protection we included the weighted proportion of respondents with health insurance as well as perceived health security, developed as a people reported measure of UHC(14). We also calculated domain score indexes.

The data quality assurance and Data analysis: Quality control included structured interviewer training, pre-scripted logic checks, live or recorded monitoring of 20-30% of phone interviews, and post-fieldwork screening for duplicates, implausible values, and speeders. Descriptive statistics (frequencies and weighed percentages) were calculated using STATA v18, and disaggregated by age group, sex, education, income tertile, and urban/rural residence, with five-point Likert items generally collapsed into "excellent/very good" categories.

Results and Discussion

Sample Characteristics

The majority of respondents were in the age, 18-29 (39%) followed by 30-39 (27%). The sample was near gender-balanced (51% female, 49% male). Half of respondents (50%) had no formal education, 37% fell into the lowest income tertile, and 56% lived in urban areas (Table 1).

Service Utilization, Access and Quality of care

Access and Perceived Quality: Most respondents (84.5%) had usual source of care, primarily public facilities (76.7%). Access peaked among women (87.5%), adults aged 50-59 (90.3%), urban residents (86.3%), and educated individuals (89.2%). Despite high access, satisfaction remained low: fewer than two-fifths rated care quality as very good or excellent. Perceived quality declined with advancing age and was markedly lower urban areas than rural ones (Table 1).

Unmet healthcare needs: Nationally, 12.6% of respondents reported unmet healthcare needs. Significant disparities emerged by residence and education: rural residents experienced double the unmet need of the urban residents (19.0% vs 7.7%), while individuals without formal education faced three times the unmet need of those with post-secondary education. The findings indicated that physical access alone cannot drive health improvements; health systems must deliver effective coverage to transform service contact into tangible health outcomes [15,16]

Table 1. Utilization of care and system competence, by background characteristics, PVS Wave II (%), PVS 2024–2025

	Background Characteristic	N	% Weighted	Has Usual Source of Care (%)	Usual Source Is Public (%)	Rates Quality (%) **	Unmet Need (%)
Age (Year)	**18–29**	570	39	85.8	73.2	48.1	13.9
	30–39	793	27	81.4	75.8	35.6	10.0
	40–49	507	15	85	82.2	31.5	11.5
	50–59	266	9	90.3	77.4	35.3	10.8
	60+	178	11	86.3	83.2	19.6	17.3
Gender	**Male**	1,233	49	82.3	79.7	32.5	13.7
	Female	1,081	51	87.5	73.9	43.2	11.6
Education Level	**No formal education**	284	50	83.2	79.4	39.5	14.4
	Primary	511	31	85.8	78.5	35.1	14.5
	Secondary	636	12	89.2	70.8	35.7	5.3
	Secondary+	883	8	85.8	62.2	44	5.1
Income *	**Lowest income**	611	37	84.2	80.9	36	12.5
	Middle income	652	36	85.2	72.2	45.7	12.2
	Higher income	889	28	84.7	74.4	34.9	12.1
Residence	**Rural**	516	44	83.1	81	43.9	19.0
	Urban	1,798	56	86.3	73.5	33.4	7.7
	Total	**2314**	**100**	**84.9**	**76.7**	**38**	**12.6**

Note *income n= 2152; **Rating Quality of care from usual sources as very good/excellent

Health System Performance across WHO UHC Domains

The health service access domain scored highest overall, with 85% to 88% respondents maintaining a regular connection to the health system. Care effectiveness suffered from low preventive service coverage; only 36.0% of adults aged 40 and older received annual blood pressure and blood sugar screenings. Primary care for chronic conditions received the lowest quality ratings. For user experience domain, respectful treatment rated the highest rating (48% excellent/very good), whereas the customer services like waiting time (32%) and consultation experience (34%) scored lowest Financial protection revealed a wider gab between expected quality and affordability: while 81% of respondents felt confident they would receive high-quality care if seriously ill by tomorrow, only 53% could afford it, and 48% were confident in receiving both high quality and affordable care. People centeredness domain scored lowest among all domains. Only 16% of respondents would recommend their usual source facility to others, with private facilities outperformed public facilities in overall quality ratings (Table 2).

Table 2. Overall health system performance by domain, PVS Wave II, Ethiopia, PVS 2024–2025

Domain	Indicator	Poor/Fair (%)	Good (%)	Excellent/Very good (%)	Percent (%)
Care effectiveness	**Public health system effectiveness**				**36**
	Quality of care for the last visit	**24**	**39**	**37**	
	Primary health care quality: chronic diseases	**48**	**28**	**24**	
	Primary health care quality: women's health	**21**	**37**	**42**	
	Primary health care quality: child health	**24**	**38**	**38**	
User experience	**Respect**	**14**	**39**	**48**	
	Courtesy	**22**	**39**	**39**	
	Voice: explanation	**18**	**40**	**42**	
	Voice: decision involvement	**22**	**42**	**36**	
	Customer service: waiting time	**29**	**39**	**32**	
	Customer service: visit time	**23**	**43**	**34**	
Access	**Connection to health system: usual source of care**				**85**
	Use of needed health care (people with chronic diseases)				**88**
	No unmet need				**87**
People-centeredness	**Quality of public health system**	**33**	**35**	**32**	
	Quality of private health system	**21**	**39**	**39**	
	Involvement in decision-making	**28**	**42**	**30**	
	Endorsement				**16**
Health improvement	**Self-rated health**	**16**	**31**	**53**	
	Self-rated mental health	**15**	**32**	**53**	
	Absence of disease				**76**
Financial protection	**Insurance**				**57**
	Health security (affordability)				**53**
	Can get good-quality care if very sick				**81**
	Can get AND afford good-quality care if very sick				**48**

Care Effectiveness & user experience: overall mean scores were low for both care (mean 23, SD:30) and user experience (mean 18, SD:29), though post-secondary educated adults rated both slightly higher user experience (27 vs. 15-19 in other groups) and care effectiveness (28 vs, 20-25 in other groups) (Table 3). This indicates critical gaps in routine screening for hypertension and diabetes; a growing concern as non-communicable diseases drive mortality and disability low and middle income countries [17]. Concurrently, user experience threatens performance by deterring care-seeking behavior, lowering treatment adherence,, and erode public trust [3].

Access: remined high overall, (82-92), favoring urban residents (89) and individuals with secondary education (92) over rural (83) and uneducated respondents (85). However, scores plummeted among respondents reporting unmet healthcare needs (51 vs. 92 for those without), revealing severe localized access bottlenecks.

Health improvement: the health improvement index averaged 61 nationally, rising with income and education. Scores declined steeply with age, falling from 71 adults aged 30-39 to 38 among those 60 and older, and substantially lower for individuals living with chronic conditions, indicating an unaddressed burden of illness in vulnerable groups.

Financial protection: at national level it was modest (52), showing the widest subgroup disparities. Insured respondent scored dramatically higher than (77 vs. 20), whereas post-secondary education holders reported lower protection (42) less educated groups (55-54) (Table 2). These findings confirm that while health insurance is vital metric of universal health coverage[14], coverage alone does not shield households from financial risks due to persistent high out-of-pocket costs and medical debt[18].

Table 3. Health systems performance assessment: intermediate and final goal domain index of UHC, PVS 2024–2025

Domain	Subgroup	Effectiveness index	User experience	Access index	Health improvement	People-centeredness	Financial protection
Age	**18-29**	23	21	87	62	43	57
	30-39	20	15	86	71	37	47
	40-49	24	17	86	59	39	58
	50-59	29	15	90	55	40	49
	60+	25	18	85	38	34	43
Gender	**Female**	24	16	88	61	39	52
	Male	22	20	85	61	40	52
Place of residence	**Urban**	25	17	89	62	39	53
	Rural	21	19	83	60	40	52
Insured	**No**	22	18	85	61	37	20
	Yes	23	18	88	61	42	77
Education	**No formal education**	21	16	85	57	39	53
	Primary	24	18	86	62	41	54
	Secondary	25	19	92	67	39	53
	Post secondary	28	27	90	73	36	42
Income	**Lowest income**	21	15	86	52	37	51
	Middle income	24	20	87	65	43	59
	Highest income	25	21	87	67	37	48
Unmet need	**No**	22	18	92	62	40	53
	Yes	29	16	51	55	34	49
Chronic disease	**No**	21	16	87	69	38	51
	Yes	28	22	84	34	43	57
Total		**23**	**18**	**87**	**61**	**39**	**52**

Study Limitations

The cross-sectional nature of the design prevents causal inference. Phone based sampling in high mobile areas risks underrepresenting highly vulnerable, non-mobile, or internally displaced populations, particularly in remote or conflict affected regions. All indicators rely on self-reported data, which are subject to recall and social desirability biases, capturing perceived experience rather than objective clinical quality. Despite these limitations, populations grounded surveys like the PVS provide vital signals to guide health sector planning and policy.

Conclusion and Policy Implication

While Ethiopia has achieved high primary access- with over 84% of population maintaining a usual source of care- major gaps persist in service quality, user experience, and financial protection. Quality ratings remain low. particularly for chronic disease management and routine preventive screening, while long wait times undermine user experience. Financial insecurity represents the system's primary vulnerability: fewer than half of respondents can afford essential care when they became sick tomorrow. Deep equity divides also persist, leaving older adults, rural residents, less educated populations, and individuals with chronic conditions to bear a disproportionate burden of unmet healthcare needs. To ensure healthcare expansion translates into high-quality, affordable care for all Ethiopians, national monitoring frameworks like the Health Sector Medium-Term Development and Investment Plan (HSDIP-II) must routinely integrate population reported feedback. To address identified health system gaps and align with Ethiopia's Health Sector Medium-Term Development and Investment Plan (HSDIP-II), policy-makers should prioritize the following actions:

- Integrate routine blood pressure and blood glucose screening into standard primary healthcare visits, targeting adults aged 40 and older to combat the growing burden of non-communicable diseases.
- Streamline customer services to shorten waiting times, improve patient flow, and enhance overall user experience.
- Expand health insurance coverage to and deepen benefit packages to lower out-of-pocket costs and protect households from healthcare-induced financial hardship.
- Direct resources to rural communities, older populations, and patients with chronic health conditions to close the equity gaps.
- Embed routine population surveys like the People's Voice Survey into national health monitoring frameworks to continuously track public trust, care quality, and health system performance.

References

1. Kruk ME, Gage AD, Joseph NT, Danaei G, García-Saisó S, Salomon JA. Mortality due to low-quality health systems in the universal health coverage era: a systematic analysis of amenable deaths in 137 countries. Lancet. 2018;392(10160):2203–12.
2. Kruk ME, Gage AD, Arsenault C, Jordan K, Leslie HH, Roder-DeWan S, et al. High-quality health systems in the Sustainable Development Goals era: time for a revolution. Lancet Glob Heal. 2018;6(11):e1196–252.
3. Doyle C, Lennox L, Bell D. A systematic review of evidence on the links between patient experience and clinical safety and effectiveness. BMJ Open. 2013;3(e001570).
4. Larson E, Sharma J, Bohren A, Tunçalp Ö. When the patient is the expert : measuring patient experience and satisfaction with care. 2019;(May):563–9.
5. WHO. WHO global strategy on people-centred and integrated health services Interim Report on people-centred and Interim report. 2015.
6. Papanicolas I, Rajan D, Karanikolos M, Soucat A, Figueras J E. Health system performance assessment: a framework for policy analysis. Geneva: World Health Organization, Copenhagen (Denmark): Geneva: World Health Organization; 2022.
7. MOH. Health Sector Medium Term Development and Investment Plan. 2023;(June):2016–8.
8. Todd P. Lewis, Neena R. Kapoor, Amit Aryal, Rodrigo Bazua-Lobato, Susanne Carai, Emma Clarke-Deelder, Kevin Croke, Rashmi Dayalu, Laura Espinoza-Pajuelo, Günther Fink, Patricia J. Garcia, Ezequiel Garcia-Elorrio, Theodros Getachew, Prashant Jarhyan, Munir MEK. Measuring people's views on health system performance: Design and development of the People's Voice Survey. PLoS Med. 2023;20(10)(e1004294):1–15.
9. Ethiopian Public Health Institute (EPHI), Ministry of Health HTHCS of PH and AAU. People's Voice Survey (PVS Wave-I)- Assessment of People's Perspective on Health System Performance in Ethiopia. 2023;(May).

10. Ethiopian Public Health Institute (EPHI), Ministry of Health HTHCS of PH and AAU. People's Voice Survey (Wave -II): Assessment of People's Perspective on Health System Performance in Ethiopia. 2025.
11. Arah OA, Klazinga NS, Delnoij DMJ, ten Asbroek AHA, Custers T. Conceptual frameworks for health systems performance: a quest for effectiveness, quality, and improvement. Int J Qual Heal Care. 2003 Oct;15(5):377–98.
12. Backman G, Hunt P, Khosla R, Jaramillo-Strouss C, Fikre BM, Rumble C, et al. Health systems and the right to health: an assessment of 194 countries. Lancet. 2008 Dec;372(9655):2047–85.
13. Kruk ME, Sabwa S, Lewis TP, Aniebo I, Arsenault C, Carai S, et al. Population assessment of health system performance in 16 countries. 2024;(2023):486–97.
14. Kruk ME, Kapoor NR, Lewis TP, Arsenault C, Boutsikari EC, Breda J, et al. Population confidence in the health system in 15 countries: results from the first round of the People's Voice Survey. Lancet Glob Heal. 2024;12(1):e100–11.
15. Ng M, Fullman N, Dieleman JL, Flaxman AD, Murray CJL, Lim SS. Effective coverage: a metric for monitoring Universal Health Coverage. PLoS Med. 2014;11(9):e1001730.
16. Leslie HH, Malata A, Ndiaye Y, Kruk ME. Effective coverage of primary care services in eight high- mortality countries. 2017;1–11.
17. GBD 2019 Diseases and Injuries Collaborators. Global burden of 369 diseases and injuries in 204 countries and territories, 1990-2019: a systematic analysis for the Global Burden of Disease Study 2019. Lancet. 2020;396(10258):1204–22.
18. Wagstaff A, Flores G, Hsu J, Smitz MF, Chepynoga K, Buisman LR, et al. Progress on catastrophic health spending in 133 countries: a retrospective observational study. Lancet Glob Heal. 2018;6(2):e169–79.

Spatial Distribution of Severe Acute Malnutrition and Associated Factors among Under-Five Children in Central Ethiopia Region

Lire Tirore[1], Samuel Darge Deleta[2], Mamush Hussen Shikur[1], Legese Petros[1], Ashenafi Petros[2], Temesgen Kelaye[1], Samuel Hailu Weldemariam[1], Terefe Markos[1]

[1]Central Ethiopia Region Public Health Institute, Worabe, Ethiopia.

[2]Central Ethiopia Regional Health Bureau, Worabe, Ethiopia.

Corresponding author: Lire Tirore, Email: lemmalire@gmail.com, +2519160897719

Abstract

Background: Ethiopia faces a high childhood severe acute malnutrition (SAM) burden. Increasing progress toward the national nutrition targets requires transforming from broad national estimates to subnational spatial mapping to guide targeted public health Interventions.

Objective: To assess the spatial distribution of SAM and identify its ecological predictors among under five year's children in the Central Ethiopia Region.

Methods: A retrospective ecological study was conducted by utilizing secondary data from July 8, 2022, to July 7, 2025. Spatial distribution patterns were analyzed using global and local spatial autocorrelation statistics. Ecological regression modeling was used to evaluate district-level Predictors of SAM prevalence.

Results: During the 2024/2025 fiscal period, the annual prevalence of SAM reached 20.5 per 1,000 children, significantly exceeding the national baseline of 1.0%. Spatial analysis confirmed non-random geographic clustering, with critical hotspots localized within the eastern, southern, and southwestern corridors of the region. Multivariate ecological regression demonstrated that the annual parasite incidence of malaria (aPRR = 1.77; 95% CI: 1.42 to 2.21) and the incidence of diarrhea (aPRR = 1.09; 95% CI: 1.03 to 1.16) were significantly associated with elevated SAM burdens. Conversely, higher terrain altitude (aPRR = 0.99; 95% CI: 0.98 to 0.99) and expanded basic water coverage (aPRR = 0.62; 95% CI: 0.48 to 0.81) exhibited significant protective associations. Particularly, districts with second-dose Vitamin A supplementation coverage exceeding national targets demonstrated a counterintuitive, 2.22-fold higher SAM prevalence (aPRR = 2.22; 95% CI: 1.65 to 2.98).

Conclusion: SAM shows spatial heterogeneity and geographic clustering across the Central Ethiopia Region. Mitigating this burden demands shifting toward localized public health interventions that strengthen diarrhea prevention, malaria control frameworks and scaling up water infrastructure within high-burden clusters

Keywords: Severe Acute Malnutrition; Spatial Distribution; Service Coverage; Disease Burden; Under-Five Children.

Introduction

Childhood undernutrition remains a critical structural determinant of global health, representing an insidious manifestation of prolonged, insufficient dietary nutrient consumption (1). In pediatric populations, the physiological impacts of undernutrition include elevated susceptibility to infections, increased morbidity and mortality (2). Early childhood nutritional deficit can impair long-term cognitive and mental development and suppress adult economic productivity, diminish academic attainment, and elevate lifetime risk for metabolic chronic diseases (2). Severe acute malnutrition (SAM) includes a very low weight-for-height index, a mid-upper arm circumference (MUAC) falling below 115 mm, or bilateral pitting edema (3). The etiology of SAM involves severe energy deficit, essential fatty acids, protein, and vital micronutrients required to sustain basic metabolic processes and physical growth (4).

The Global prevalence of SAM among under five children persists as a challenge. In 2022, an estimated 45 million children under five years of age were affected by severe wasting, with the vast majority were within South Asia and Sub-Saharan Africa (4). Despite established global mandates aiming to compress childhood wasting to less than 5% by 2025 and below 3% by 2030 (5), current epidemiological models indicate achieving Sustainable Development Goal (SDG) Target 2 the eradication of all forms of malnutrition is difficult (5, 6).

SAM is a leading public health priority in developing nations (7). By 2020, the estimated prevalence of SAM across Sub-Saharan Africa was 7.1% (8) from which Ethiopia consistently share significant number (9). Over the past three decades, the burden of child malnutrition in Ethiopia has remained elevated despite multispectral interventions (10). Surveys reveal that more than half of all Ethiopian under five children have been affected by at least by one form of malnutrition (10). In 2019, the overall prevalence of acute malnutrition estimated at 7% nationwide (11).

Furthermore, Ethiopia ranked among the top ten nations globally facing the highest number of wasting in 2022, estimated 187,396 concurrent cases (12). In response, The Ethiopia Government integrated nutritional mandates into its Second Health Sector Transformation Plan (HSTP-II), which aimed to reduce acute malnutrition from 7% in 2019 to 5% by the 2024/2025 (13). The 2025 National data indicated that overall prevalence of wasting was around 5%, the national baseline for severe wasting remained 1% (14).

Malnutrition acts as an underlying cause in 50% of all under-five mortalities globally, primarily clustered within low- and middle-income countries (15). In terms of disability-adjusted metrics, the global Years of Life Lost (YLL) rate attributable to childhood malnutrition was estimated at 57,615 per 100,000 populations in 2019 (10). For severe acute wasting specifically, the condition drives roughly 20% of all under-five deaths, claiming more than one million pediatric lives annually (4, 12).

In 2019, SAM was identified as an aggravating factor in approximately 367,000 deaths from pediatric pneumonia, accounting for 55% of the global pneumonia mortality (4, 12). This deadly scenario sharply reflected in Ethiopia; of the 190,173 total under-five deaths recorded nationwide in 2019, 108,864 cases (57.24%) were due to malnutrition, generating a national SAM-specific YLL rate of 18,566 per 100,000 population (10).

SAM has extreme geographic and demographic variation in Ethiopia, with prevalence rates shifting from 8% in urban to over 12% in rural administrative zones (16). Although national-level data shows a slow decline in SAM prevalence from 12% in 2005 to 7% in 2019 (17), these macro-level figures create doubtful subnational inequalities.

Broad regional averages effectively hide localized vulnerability, leaving public health authorities unable to pinpoint exactly where interventions are most critically needed. To bridge this data-to-policy gap, it is better to assess spatial patterns, trace how SAM varies across different levels of service coverage, and evaluate local disease burdens at the district level. To date, such spatial architectures have not been characterized within the newly organized Central Ethiopia Region.

Objective

This study aimed to assess the spatial distribution of the prevalence of severe acute malnutrition (SAM) and identify its independent variation by public health service coverage, climate metrics, and geographic disease burdens among under-five children.

Methods

Study Setting

This research was conducted in the Central Ethiopia Region that encompasses an area of 15,156 square kilometers, 55 rural districts and 27 town administrations with varying Topography According to forecasts for 2017 Ethiopian Calendar the total children under five years of age is 910,259.

Study Design and Period

Retrospective, population-level ecological study design was deployed, The temporal window of observation by using a three consecutive fiscal years data (July 8, 2022, to July 7, 2025)

Data Sources

Data extraction was systematically conducted across multiple databases using unique administrative district codes as the primary relational key:

Absolute annual counts of verified SAM cases per district were retrieved from the Public Health Emergency Management (PHEM) routine surveillance

District-level aggregates for childhood infectious disease vectors specifically the annual parasite incidence (API) of malaria, pneumonia incidence, and diarrheal disease incidence were obtained from the electronic District Health Information Software 2 (DHIS2) repository.

Climate indicators (surface temperature, precipitation patterns, and relative humidity) were acquired via the NASA Langley Research Center's Prediction of Worldwide Energy Resources (POWER) (19).

Centroid geographic coordinates for all 82 administrative nodes were extracted utilizing Google Earth Pro (20). Vector-based polygon administrative shapefiles were acquired from the Central Statistical Agency (CSA) of Ethiopia (21).

Spatial and statistical computing was done across using ArcGIS Pro (version 10.8) serving as the primary GIS engine. To assess global spatial pattern dependencies, the Global Moran's I statistic was applied to the annualized SAM prevalence rates to compute z-scores and p-values, testing the null hypothesis of complete spatial randomness. To evaluate structural associations between district-level covariates and SAM prevalence, adjusted Prevalence Rate Ratios (aPRR) along with their corresponding 95% confidence intervals were modeled using multivariable ecological regression techniques. All statistical tests were two-tailed, with significance established at alpha = 0.05.

Results and Discussion

During the 2024/2025 observation interval, the annual cumulative prevalence of SAM across the region reached 20.5 cases per 1,000 children aged 6–59 months, significantly exceeding the projected national severe wasting baseline of approximately 1.0% (14).

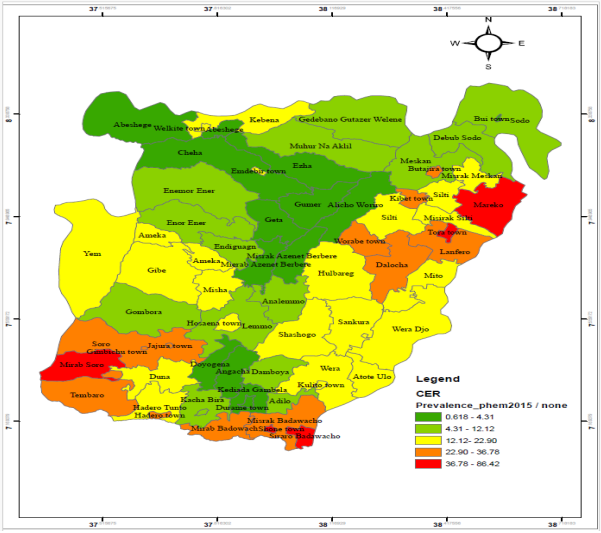


Figure 1: Spatial distribution of annual prevalence of SAM among districts of CER in 2022/23, January 2026.

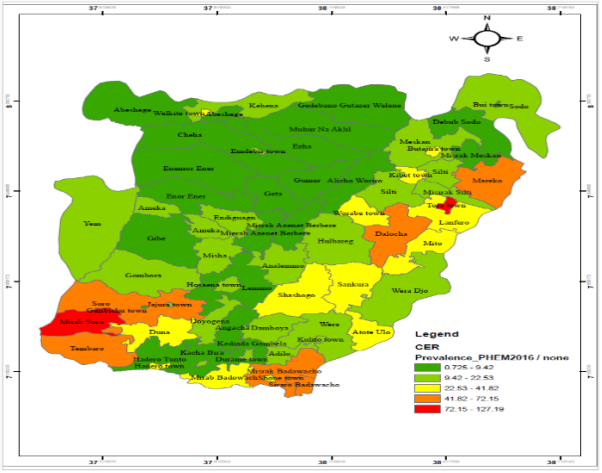


Figure 2: Spatial distribution of annual prevalence of SAM among districts of CER in 2023/24, January 2026.

The Global Moran's I coefficient demonstrated strong, positive spatial autocorrelation ($p < 0.01$), confirming significant clustering. Local indicators of spatial association isolated highly concentrated Hotspot (High-High) clusters across the eastern, southern, and southwestern border districts. This demonstrates deep geographic imbalances reflecting shifting localized conditions rather than uniform regional progress (16), proving that aggregated national statistics mask hyper-local pockets of vulnerability.

Multivariable ecological regression revealed strong positive associations between SAM distribution and localized pediatric infectious disease burdens. Specifically, a unit increase in the district-level API of malaria was associated with a 77% increase in SAM prevalence (aPRR = 1.77; 95% CI: 1.42 to 2.21; $p < 0.01$), while rising diarrheal disease incidence generated a 9% increase in acute malnutrition risk (aPRR = 1.09; 95% CI: 1.03 to 1.16; $p < 0.05$).

These findings illustrate a relationship where infection and acute malnutrition act in a bidirectional, mutually reinforcing biological cycle (1, 2). Malaria inflicts severe systemic stress on pediatric physiology by driving an acute-phase inflammatory response promoting catabolic tissue breakdown, causing anorexia, and inducing nutrient malabsorption (1, 4). Simultaneously, diarrheal diseases cause fluid loss, continuous electrolyte shifts, and severe intestinal enteropathy, compromising the mucosal barrier and preventing effective nutrient uptake (2, 7). When a child experiences acute malnutrition, cell-mediated immunity is suppressed, mucosal linings atrophy and secretory IgA production drops (1, 3). This decline leaves them vulnerable to frequent, severe reinfections, locking them into a destructive cycle of disease and wasting that contributes to high under-five mortality rates (10, 14).

Environmental and structural infrastructure parameters acted as significant protective factors. Higher district altitude showed a protective effect against SAM (aPRR = 0.99 per 100m elevation increase; 95% CI: 0.98 to 0.99; $p < 0.05$). On the structural side, expanded coverage of basic water infrastructure was strongly protective, with a high-saturation water supply reducing district-level SAM risk by 38% (aPRR = 0.62; 95% CI: 0.48 to 0.81; $p < 0.01$). The protective power of expanded water coverage highlights environmental sanitation as a cornerstone of nutritional health (2). Safe, reliable water access directly prevents exposure to waterborne pathogens, lowering the incidence of recurrent diarrhea and safeguarding children from nutrient depletion (4, 7).

Districts where the coverage of second-dose Vitamin A supplementation exceeded national targets exhibited an adjusted 2.22-fold higher prevalence of SAM (aPRR = 2.22; 95% CI: 1.65 to 2.98; $p < 0.01$). In an ecological model, this association represents a classic example of reverse causality and ecological confounding within public health reporting systems (16). Programmatically, this finding reflects an aggressive, targeted public health response: emergency nutritional interventions intensified monitoring, and mass micronutrient distribution campaigns are deliberately concentrated within known high-burden, food-insecure, and drought-prone districts (13, 18). Consequently, this pattern reflects the strategic allocation of resources to communities facing the greatest nutritional risk rather than an operational failure of the supplement itself.

References

1. Black RE, et al. *The Lancet*. 2008;371:243-260.
2. UNICEF, WHO, World Bank. Joint Child Malnutrition Estimates. Geneva: WHO; 2023.
3. WHO. Guideline: management of SAM in infants and children. Geneva: WHO; 2013.
4. UNICEF. Severe wasting child survival crisis. NY: UNICEF; 2022.
5. United Nations. 2030 Agenda for Sustainable Development. NY: UN; 2015.
6. Development Initiatives. Global Nutrition Report. Bristol: 2022.
7. Akombi BJ, et al. *Nutrients*. 2017;9:43.
8. UNICEF, WHO, World Bank. JME. NY: UNICEF; 2021.
9. FMOH. Strategy for Newborn and Child Survival. Addis Ababa: 2015.
10. GBD 2019 Child Malnutrition Collaborators. *The Lancet Child & Adolescent Health*. 2021; 5:775-789.
11. EPHI, ICF. Ethiopia Mini DHS 2019. Rockville: EPHI/ICF; 2019.
12. UNICEF. Child Malnutrition Progress Report. NY: 2023.
13. MOH. Health Sector Transformation Plan II. Addis Ababa: 2021.
14. EPHI, ICF. Ethiopia DHS 2025. Addis Ababa: EPHI/ICF; 2025.
15. Horton R. *The Lancet*. 2008;371:179-180.
16. Comprehensive Nutrient Analyst Group. *BMC Public Health*. 2023;23:1104.
17. CSA, ICF. Ethiopia DHS 2016. Addis Ababa: CSA/ICF; 2017.
18. FMOH. National Nutrition Program. Addis Ababa: 2016.
19. NASA. POWER Project. nasa.gov
20. Google LLC. Google Earth Pro v7.3. 2025.
21. CSA. Population Projections 2017 EC
22. Ethiopian Statistical Service (ESS) Addis Ababa: 2024

Spatial Distribution of Malaria in Central Ethiopia Region: A Bayesian conditional autoregressive model

Lire Tirore[1], Samuel Darge Deleta[2], Mamush Shikur[1], Legese Petros[1], Ashenafi Petros[2], Temesgen Kelaye[1], Samuel Weldemariam[1], Terefe Markos[1]

[1]Central Ethiopia Region Public Health Institute, Worabe, Ethiopia.

[2]Central Ethiopia Regional Health Bureau, Worabe, Ethiopia.

Corresponding author: Lire Tirore, Email: lemmalire@gmail.com, Phone: +2519160897719

Abstract

Introduction: To achieve national strategic objectives, it is essential to understand the distribution of malaria, map high-risk areas, and determine the coverage of vector control strategies. Despite these efforts, no study has been done in the study area. Therefore, this study aimed to assess the spatial distribution and associated factors of malaria across the districts of the central Ethiopian region.

Objective: To describe the spatial distribution and associated factors of malaria in the central Ethiopian region.

Methods: A retrospective ecological study was conducted in the central Ethiopian region based on the number of malaria cases from July 8, 2022 to July 7, 2025. Data sources such as weekly malaria surveillance data, the NASA Langley Research Center POWER Project website, and the Google Earth Pro website were considered. Spatial autocorrelation was measured using Global Moran's I. A Bayesian conditional autoregressive model was fitted.

Results: A total of 842968 confirmed cases were reported from July 8, 2022, to July 7, 2025. The trend of regional API was increasing, with a mean regional API of 43.07 cases/1000 population at risk. Districts with high incidence were clustered in the North West, South West, South East and Eastern parts of the region. Hotspot districts were identified in the eastern, northern and southern parts of the region. There was a spatial autocorrelation among the districts of the region (Global Moran's I=0.21). Altitude was significantly associated with the incidence of malaria (IRR=0.9993).

Conclusion: More than half of the districts had high malaria risk. There was spatial variation in malaria incidence across the districts. Spatial clustering was observed across the districts of the region. Increasing the coverage of integrated malaria prevention and control strategies is warranted. Further studies are warranted to identify the factors of malaria in high-risk areas considering additional environmental factors.

Keywords: Spatial Distribution, Malaria, Bayesian model, hotspot analysis, Central Ethiopia Region

Introduction

Childhood undernutrition remains a critical structural determinant of global health, representing an insidious manifestation of prolonged, insufficient dietary nutrient consumption (1). In pediatric populations, the physiological impacts of undernutrition include elevated susceptibility to infections, increased morbidity and mortality (2). Early childhood nutritional deficit can impair long-term cognitive and mental development and suppress adult economic productivity, diminish academic attainment, and elevate lifetime risk for metabolic chronic diseases (2). Severe acute malnutrition (SAM) includes a very low weight-for-height index, a mid-upper arm circumference (MUAC) falling below 115 mm, or bilateral pitting edema (3). The etiology of SAM involves severe energy deficit, essential fatty acids, protein, and vital micronutrients required to sustain basic metabolic processes and physical growth (4).

The Global prevalence of SAM among under five children persists as a challenge. In 2022, an estimated 45 million children under five years of age were affected by severe wasting, with the vast majority were within South Asia and Sub-Saharan Africa (4). Despite established global mandates aiming to compress childhood wasting to less than 5% by 2025 and below 3% by 2030 (5), current epidemiological models indicate achieving Sustainable Development Goal (SDG) Target 2 the eradication of all forms of malnutrition is difficult (5, 6).

SAM is a leading public health priority in developing nations (7). By 2020, the estimated prevalence of SAM across Sub-Saharan Africa was 7.1% (8) from which Ethiopia consistently share significant number (9). Over the past three decades, the burden of child malnutrition in Ethiopia has remained elevated despite multispectral interventions (10). Surveys reveal that more than half of all Ethiopian under five children have been affected by at least by one form of malnutrition (10). In 2019, the overall prevalence of acute malnutrition estimated at 7% nationwide (11).

Furthermore, Ethiopia ranked among the top ten nations globally facing the highest number of wasting in 2022, estimated 187,396 concurrent cases (12). In response, The Ethiopia Government integrated nutritional mandates into its Second Health Sector Transformation Plan (HSTP-II), which aimed to reduce acute malnutrition from 7% in 2019 to 5% by the 2024/2025 (13). The 2025 National data indicated that overall prevalence of wasting was around 5%, the national baseline for severe wasting remained 1% (14).

Malnutrition acts as an underlying cause in 50% of all under-five mortalities globally, primarily clustered within low- and middle-income countries (15). In terms of disability-adjusted metrics, the global Years of Life Lost (YLL) rate attributable to childhood malnutrition was estimated at 57,615 per 100,000 populations in 2019 (10). For severe acute wasting specifically, the condition drives roughly 20% of all under-five deaths, claiming more than one million pediatric lives annually (4, 12).

In 2019, SAM was identified as an aggravating factor in approximately 367,000 deaths from pediatric pneumonia, accounting for 55% of the global pneumonia mortality (4, 12). This deadly scenario sharply reflected in Ethiopia; of the 190,173 total under-five deaths recorded nationwide in 2019, 108,864 cases (57.24%) were due to malnutrition, generating a national SAM-specific YLL rate of 18,566 per 100,000 population (10).

SAM has extreme geographic and demographic variation in Ethiopia, with prevalence rates shifting from 8% in urban to over 12% in rural administrative zones (16). Although national-level data shows a slow decline in SAM prevalence from 12% in 2005 to 7% in 2019 (17), these macro-level figures create doubtful subnational inequalities.

Broad regional averages effectively hide localized vulnerability, leaving public health authorities unable to pinpoint exactly where interventions are most critically needed. To bridge this data-to-policy gap, it is better to assess spatial patterns, trace how SAM varies across different levels of service coverage, and evaluate local disease burdens at the district level. To date, such spatial architectures have not been characterized within the newly organized Central Ethiopia Region.

Objective: To describe the spatial distribution and associated factors of malaria in the Central Ethiopia region.

Methods

Study Area: This study was conducted in the Central Ethiopia region, Ethiopia. The Central Ethiopia region lies in southwest Ethiopia, between latitudes 7° 04' and 8° 03' north and longitudes 37° 20' and 38° 00'

east. There are three special districts, seven zones, and 55 districts and 27 urban administrations in the region(11).

Study design and period: A retrospective ecological study was conducted based on the number of confirmed malaria cases from July 8, 2022, to July 7, 2025(12).

Data source

The data on the incidence of malaria were obtained from the public health emergency management (PHEM) unit. Data on Indoor residual spraying (IRS) and long-lasting insecticidal nets (LLINs) were from the malaria program unit of the health bureau. Data on climatic variables were obtained from the NASA Langley Research Center POWER Project website (13). Latitude, longitude, and altitudes, and shapefiles were obtained from the Google Earth Pro website (14) and the Ethiopian Statistics Service (15), respectively.

Dependent variable: The total count of malaria. Annual parasite incidence (API) was used to stratify the districts' transmission and for spatial clusters and hotspot analysis.

Independent variables are: IRS coverage, LLIN access, altitude in m, mean annual temperature in Celsius, and total annual rainfall in mm.

Data management and analysis: API of malaria for each district was calculated by dividing the confirmed number of malaria cases per year by the total population of the same year, then multiplied by 1000.

ArcGIS version 10.8 and R version 4.6.0 were used for data analysis(17).

Global Moran's I was used to measure spatial autocorrelation(18). The Hot Spot Analysis was done using the Getis-Ord Gi* statistic(19). Spatial Cluster and Outlier Analysis was done using Anselin Local Moran's I(20). The three-year average API was considered for hotspot analysis and cluster identification. A Bayesian multivariate Leroux conditional autoregressive model (CAR) with Poisson family was used to identify factors associated with the incidence of malaria(21).

Adjusted incidence rate ratio (IRR) with 95% Credible Interval (CrI) was estimated.

Results and discussion

The distribution of malaria

A total of 842968 confirmed cases were reported from July 8, 2022, to July 7, 2025, with an annual average of 280989 cases per year (95% CI: 280423.56, 295653.26). The trend of regional API was increasing, with a mean regional API of 43.07 cases/1000 population at risk (95% CI: 40.23, 45.75) from 2022/2023 to 2024/2025. Based on the API, the region had moderate transmission intensity in 2022/2023 and 2023/2024 ($10 \leq API < 50$) and high transmission intensity in 2024/2025 ($API \geq 50$). More than half of the districts had a high malaria risk in 2022/2023 and 2024/2025.

Spatial distribution of malaria incidence across the districts of the region

Between 2022/2023 and 2024/2025, districts with high incidence were clustered in the northwest, southwest, southeast, and eastern parts of the region, as shown in red on the map. Districts with low incidence were located in the northern and central parts of the region and were represented by light green and yellow colors, including Geta, Gedebeno, Gutazer, and Wolene districts. The incidence was moderate in some central, western, and northeastern parts of the region, as shown in orange colors on the map (Figure 1).

Spatial clusters and Hotspot detection

Spatial clusters with high-high malaria incidence were identified in Misrak Silti, Dalocha, Misirak Badawacho, and Kulito town, as shown in red on the map below. Hotspot area with high-rate clusters was observed in Wolkite, Dalocha, Sankura, Lanfuro, Wera, Misrak Silti, Adilo, Tora, and Kulito town, as shown in red and yellow on the map. There was statistically significant positive spatial autocorrelation in API (global Moran's I= 0.35, p-value = 0.01) (Figure 2).

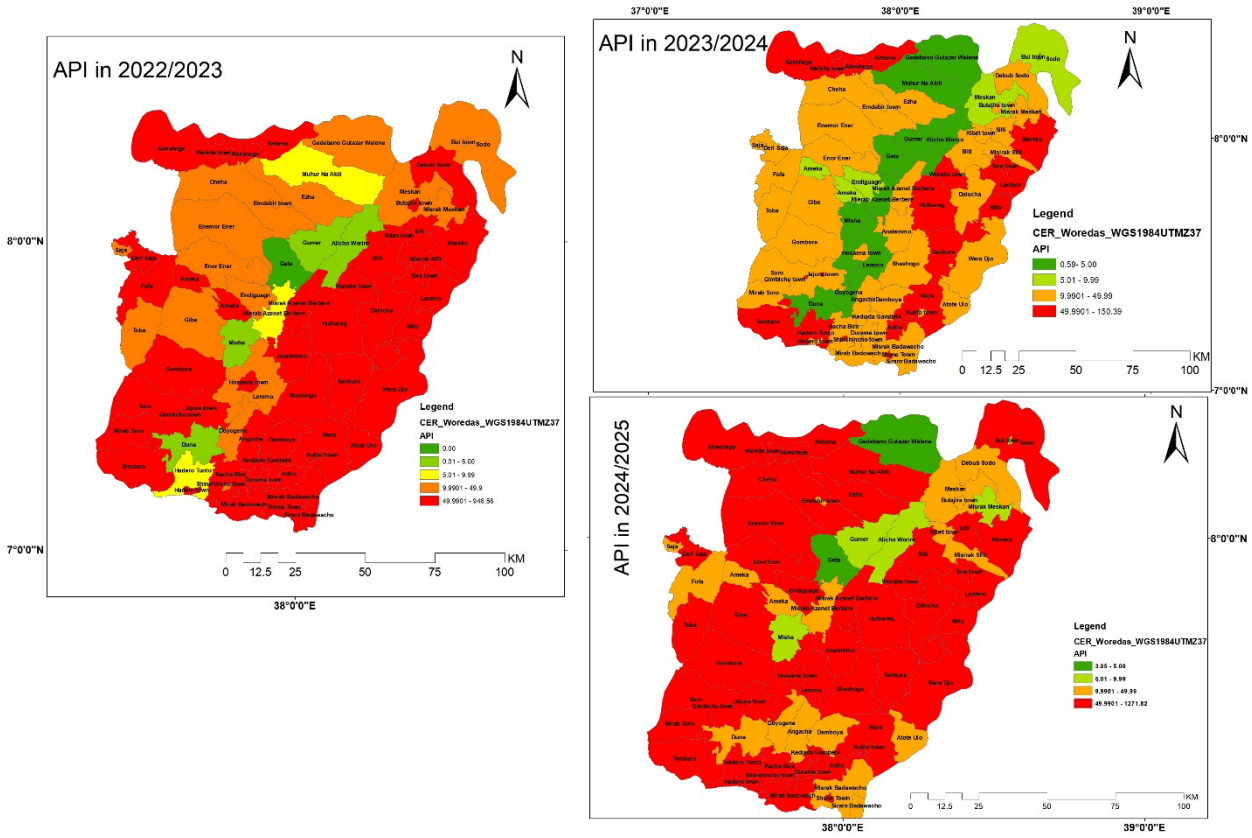


Figure 1: Spatial distribution of malaria API in CER from 202/2023 to 2024/2025.

Factors associated with the incidence of Malaria

The mean IRS coverage was 9.5% (SD=5.8), 8.61% (SD=4.3), and 12.81% (SD=2.57) in 2022/2023, 2023/2024, and 2024/2025, respectively, among the targeted districts weak negative correlation was observed between malaria incidence and IRS coverage in 2024/2025 (r = -0.0729, p-value = 0.69). The median access to LLIN was 57.43% (IQR=58) among the targeted districts in 2023. In a multivariable Leroux CAR model, the district altitude was significantly associated with the district incidence (cases) of malaria. The district-level incidence of malaria decreased by 7% for every 100 m increase in altitude across the districts (IRR=0.9993).

Malaria incidence in the region increased progressively between the 2022/2023 and 2024/2025 periods. This may be attributed to changes in climatic factors and enhancements in malaria surveillance(22).

Wolkite town, Dalocha, Sankura, Lanfura, Wera, Misrak Silti, Adilo, Tora, and Kulito towns were the hotspots for the high malaria incidence in the region. This could be due to the fact that the districts are in hot agro-climatic zones (23). As the altitude of the district increased, the district-level incidence of malaria decreased. This could be due to the decrease in mosquito abundance in highland areas(6).

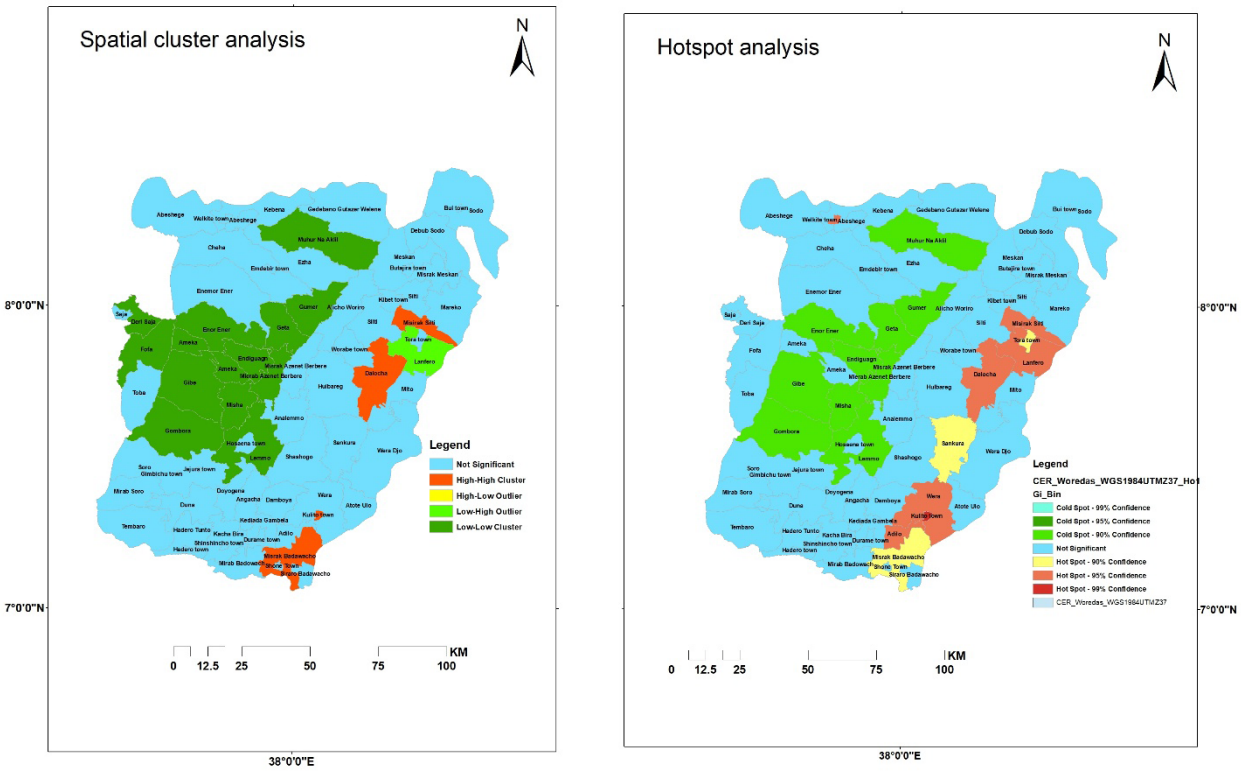


Figure 2: Spatial cluster and hotspot analysis of malaria API from 2022/2023 to 2024/2025.

Conclusion and recommendation

An increasing trend was observed in malaria incidence from July 8, 2022, to July 7, 2025. More than half of the districts had high malaria risk. Significant spatial clustering was observed across the districts of the region. Altitude was negatively associated with the incidence of malaria. Increasing the coverage of integrated malaria prevention and control strategies is warranted. Further studies are warranted to identify the factors of malaria in high-risk areas, considering additional environmental factors. There was a considerable residual spatial heterogeneity in malaria counts across the study area (τ^2=1.72). This suggests that neighboring districts share similar malaria risk patterns and that important spatially structured factors not captured by the observed covariates continue to influence malaria transmission.

References

1. World Health Organization (WHO). "Malaria." WHO Health Topics. https://www.who.int/health-topics/malaria (Accessed on June 13, 2025).). 2025.
2. Murray PR, Rosenthal KS PM. Medical Microbiology. 8th ed. Elsevier Saunders; 2016.
3. Centers for Disease Control and Prevention(CDC). Malaria's Impact Worldwide. 2025.
4. World Health Organization (WHO). World
5. Malaria Report 2022, Geneva; 2022.
6. World Health Organization (WHO). World malaria report 2024: addressing inequity in the global malaria response. Geneva: 2024.
7. Ministry of Health E. Ethiopia National Malaria Elimination Strategic Plan (NMSP) 2021-2025. Addis Ababa: MoH, Ethiopia; 2020.
8. World Health Organization (WHO). Disease Outbreak News; Malaria in Ethiopia.
9. WHO. WHO guidelines for malaria, 2023.
10. Venkatesan P. News: WHO World Malaria Report 2024. The Lancet Microbe 2025;6(4): 2025
11. Kamau A, Mogeni P, Okiro EA, Snow RW, Bejon P. A systematic review of changing malaria disease burden in sub-Saharan Africa since 2000: comparing model predictions and empirical observations. BMC Med [Internet]. 2020;18(1):94.
12. Federal Ministry of Health. Malaria elimination roadmap in Ethiopia: Phased approach for nationwide elimination by 2030. 2020.
13. Central Ethiopia Regional State Office of the President. Official website of the Central Ethiopia Regional State [Internet]. 2025. Available from: https://cerspo.gov.et/
14. Lash TL, VanderWeele TJ, Haneause S, Rothman K. Modern Epidemiology. Wolters Kluwer Health; 2020.
15. NASA Langley Research Center POWER Project. (n.d.). Prediction of Worldwide Energy Resources (POWER) Project. NASA Earth Science Division [Internet]. 2025.
16. Central Statistical Agency (CSA) [Ethiopia] and ICF. 2016. Population projection of Ethiopia for all regions at wereda level from 2014–2017.
17. Esri Inc. ArcMap 10.8 Desktop Help: Generate Spatial Weights Matrix (Spatial Statistics). Environmental Systems Research Institute. 2021.
18. Yitageasu G, Feleke H, Andualem Z, Demoze L, Asrat K GZ. Detection of spatial, temporal and spatiotemporal distribution of diarrhea incidence among under-five children in Central Gondar zone, Northwest Ethiopia: a time-series study (2019-2022). BMC Pediatr. 2024;
19. Aswi A, Rahardiantoro S, Kurnia A, Sartono B, Car S. MethodsX Bayesian spatio-temporal conditional autoregressive localized modeling techniques for socioeconomic factors and stunting in Indonesia. 2025;15(June).
20. Assefa GM, Muluneh MD, Alemu ZA. The Relationship of Climate Change and Malaria Incidence in the Gambella Region, Ethiopia. 2025.
21. Ministry of Health. Ethiopia malaria elimination strategic plan: 2021-2025. 2025.

Adherence to Medical Oxygen Therapy Clinical Standards in Ethiopian Public Hospitals: A Four-Cycle Cyclic Clinical Audit

Alebel Yaregal[1], Tesfaye Seifu[1], Dinkineh Bikila[1], Benti Firomsa[1], Amsalu Demisie[1], Tiliksew Bekele[1], Seid Mohammed[1], Salem Fisseha[1], Alemayehu Berhanu[1], Harriet Webster[2], Abraham Endeshaw[1], Rahel Belete[1]

[1]Clinton Health Access Initiative (CHAI), Addis Ababa, Ethiopia

[2]Clinton Health Access Initiative (CHAI), Kigali, Rwanda

Corresponding author: Alebel Yaregal, ayaregal@clintonhealthaccess.org, +251-911-042-485

Abstract

Introduction: Medical oxygen is a WHO-recognized essential medicine for managing hypoxemia. Despite established international and national guidelines, adherence to oxygen therapy standards across the care pathway, detection, prescription, administration, and monitoring, remains suboptimal in low- and middle-income countries. In Ethiopia, most published studies have focused on oxygen availability rather than bedside clinical practice.

Objective: To assess adherence to national and international medical oxygen therapy standards across Ethiopian public hospitals through four sequential clinical audit cycles.

Methods: Hospital-based cyclic clinical audits were conducted between March 2024 and December 2025 across 121 public hospitals (63 primary, 42 general, 16 comprehensive specialized). Patient charts were selected by systematic random sampling from four wards (NICU, adult ICU, pediatrics, and medical). Data were captured with SurveyCTO and analyzed in SPSS using chi-square tests and binary, ordinal, and multinomial logistic regression models, with hospital as a random intercept.

Results: Of 15,488 targeted evaluations, 12,639 (81.6%) charts were reviewed. Hypoxemia screening rose from 90.0% (Cycle 1) to 96.1% (Cycle 4; AOR 2.70, 95% CI 2.18–3.36). Among hypoxemic patients, oxygen administration increased from 85.3% to 94.2%, and no-monitoring fell from 5.5% to 0.9%. High adherence scores (5–7 of 8) rose from 16.5% to 57.8%, and composite end-to-end adherence improved from 66.6% to 88.1% (χ^2=135.63, p<0.001).

Conclusion: Audit-and-feedback cycles produced sustained, progressive improvements in adherence across the full oxygen care pathway. Institutionalizing these indicators within routine facility quality-improvement platforms and the national health information system is essential to sustain gains and extend them beyond program-supported facilities.

Keywords: Oxygen therapy; Clinical audit; Adherence; Ethiopia; Quality improvement

Introduction

Medical oxygen is a WHO-recognized essential medicine critical for managing hypoxemia. Safe use requires a clear indication, a prescription specifying the delivery device and flow rate, a defined target saturation, and continuous monitoring with deliberate weaning (1-3). Undertreatment sustains hypoxemia and drives preventable organ failure and death, whereas unmonitored high-flow delivery suppresses hypoxic drive and damages lung tissue (4,5).

International and national guidelines provide evidence-based recommendations for SpO_2 thresholds for initiation, target ranges (94-98% for acutely ill patients; 88-92% for hypercapnia risk), device selection, monitoring frequency, and safe discontinuation (6-8). Yet these standards are widely unmet: patients frequently receive oxygen without a valid prescription, oxygen service is e withheld from hypoxemic patients, or is delivered at unadjusted flow rates without documented targets (9-11). In LMICs, gaps extend to missing flow orders, inconsistent pulse oximetry use, and absent monitoring systems, a quality-of-care failure that runs deeper than equipment shortages (10,12).

Clinical audits offer a validated, low-resource strategy to improve care by measuring practice against explicit standards and driving targeted changes, particularly when embedded in a Plan-Do-Study-Act (PDSA) framework (13-15). Systematic oxygen therapy audits remain rare in LMIC hospitals, and most published Ethiopian studies have focused on oxygen availability rather than bedside adherence (12,16,17). From 2022 to 2025, the Clinton Health Access Initiative (CHAI), in partnership with Ethiopia's Ministry of Health (MOH), supported 121 public hospitals through clinician and biomedical engineer training, standardization of oxygen services, hub-and-spoke oxygen production, and quality improvement (18). This study assesses adherence to oxygen therapy standards across these facilities through four sequential audit cycles.

Objective

To assess healthcare providers' adherence to national and international medical oxygen therapy standards across Ethiopian public hospitals through four sequential clinical audit cycles, and to identify factors associated with adherence.

Methods

Study design and setting

Hospital-based cyclic clinical audits were conducted between March 2024 and December 2025 across 121 public hospitals in Ethiopia, 63 primary hospitals (PHs), 42 general hospitals (GHs), and 16 comprehensive specialized hospitals (CSHs) distributed across all administrative regions. Four audit cycles were completed (Cycle 1: March-August 2024; Cycle 2: October-December 2024; Cycle 3: March-May 2025; Cycle 4: October-December 2025), with structured supportive supervision and PDSA feedback between cycles.

Sampling

In each hospital, 32 patient charts were selected by systematic random sampling from four inpatient wards (NICU, adult ICU, pediatrics, and medical), eight per ward, yielding a target of 15,488 chart evaluations across the four cycles. Sampling intervals were calculated from admission registers covering the three months preceding each cycle. Sample size was aligned with NHS/University Hospitals Bristol clinical audit guidance (19).

Data collection

Data were captured using SurveyCTO with built-in validation, skip logic, and consistency checks, by trained health professionals (physicians, pharmacists, biomedical engineers, and nurses) drawn from MOH, regional health bureaus, and CHAI. The instrument was developed from WHO and national oxygen therapy guidelines (6-8), pretested in 14 hospitals (448 charts), and covered admission details, hypoxemia screening, SpO_2 at admission, prescription completeness, mode and flow rate of oxygen delivery, target SpO_2, administration, monitoring frequency, and discharge outcome.

Variables

Dependent variables were organized into five domains: (i) SpO_2 assessment at admission (yes/no); (ii) oxygen prescribed when clinically indicated (yes/no); (iii) frequency of SpO_2 monitoring (not monitored, <6/day, ≥6/day); (iv) oxygen actually administered (yes/no); and (v) an overall adherence score (0-7) grouped as low (0-2), medium (3-4), and high (5-7). Independent variables

included audit cycle, hospital type, ward, sex, and age category.

Analysis and ethics

Data were analyzed in SPSS v27. Chi-square tests examined proportional differences across cycles. Binary logistic regression assessed factors associated with screening and administration; multinomial logistic regression modeled monitoring frequency; and ordinal logistic regression assessed the overall adherence score, with hospital specified as a random intercept in all models. Ethical clearance was obtained from the institutional ethics review board, and confidentiality was maintained throughout.

Results

Hospitals and patients

Of 15,488 targeted evaluations, 12,639 (81.6%) patient charts were reviewed across the four cycles. Approximately 30% of admissions were from adult medical wards, 27% pediatric, 25% NICU, and 18% adult ICU. Half of the admissions were under 5 years and 40% were female.

Adherence across cycles

Adherence to every domain improved monotonically from Cycle 1 to Cycle 4 (Table 1). Hypoxemia screening coverage rose from 90.0% to 96.1%, while non-screening fell from 10.0% to 3.9%. Among the 3,394 (28.7%) screened patients diagnosed with hypoxemia, severe pneumonia accounted for 45% of admissions, followed by preterm birth complications (13%) and neonatal sepsis (11%). Oxygen administration among hypoxemic patients rose from 85.3% to 94.2%, and the proportion of oxygen-treated patients receiving no monitoring fell from 5.5% to 0.9%, with ≥6/day monitoring rising in parallel. The composite end-to-end adherence indicator correct screening, prescription, administration, and monitoring on the same chart, improved from 66.6% to 88.1% (χ^2=135.63, p<0.001; Cramér's V=0.200). High overall adherence scores (5-7 of 8) rose from 16.5% to 57.8%, while low scores (0-2) fell from 20.2% to 3.1%. All indicators showed statistically significant improvement (p<0.001).

Table 1 Adherence to medical oxygen therapy standards across four cyclic clinical audits (n = 12,639 patient charts).

Adherence indicator	Cycle 1	Cycle 2	Cycle 3	Cycle 4	p-value
Hypoxemia screening coverage (%)	90.0	92.4	94.7	96.1	<0.001
Oxygen administration among hypoxemic (%)	85.3	88.1	91.4	94.2	<0.001
Monitoring ≥6/day among oxygen-treated (%)	48.2	58.7	69.5	76.4	<0.001
No monitoring among oxygen-treated (%)	5.5	3.9	2.1	0.9	<0.001
High adherence score (5–7 of 8) (%)	16.5	28.7	43.6	57.8	<0.001
Composite end-to-end adherence (%)	66.6	74.2	81.5	88.1	<0.001

χ^2 p-values from tests of independence across the four audit cycles.

In adjusted models, the audit cycle was independently associated with every domain. Screening odds increased in a graded manner (Cycle 4 vs Cycle 1: AOR 2.70, 95% CI 2.18-3.36; p<0.001), as did oxygen administration among hypoxemic patients (Cycle 4: AOR 3.15, 95% CI 2.16-4.61) and ≥6/day monitoring (Cycle 4: AOR 3.42, 95% CI 2.71-4.32). Ordinal logistic regression of the overall adherence score confirmed sustained, monotonic improvement across cycles after adjustment for facility type, ward, age, and sex (Table 2). General hospitals had higher odds of adherence than primary hospitals; adult ICU and pediatric wards outperformed NICU; and age was inversely associated with several indicators, likely reflecting closer monitoring in the youngest patients.

Table 2 Multivariable ordinal logistic regression for the overall adherence score.

Variable	AOR	95% CI	p-value
Audit cycle (ref: Cycle 1)			
Cycle 2	2.14	1.83–2.51	<0.001
Cycle 3	3.87	3.28–4.56	<0.001
Cycle 4	6.42	5.24–7.86	<0.001
Facility type (ref: PH)			
General Hospital	1.29	1.13–1.48	<0.001
Comprehensive Specialized	1.08	0.89–1.31	0.437
Ward (ref: NICU)			
Adult ICU	1.62	1.34–1.96	<0.001
Pediatric	1.41	1.20–1.66	<0.001
Adult medical	0.95	0.81–1.12	0.548
Age category (ref: <1 month)			
1–59 months	0.42	0.32–0.55	<0.001
5–14 years	0.36	0.24–0.55	<0.001
15+ years	0.38	0.25–0.58	<0.001
Sex (ref: male)			
Female	0.91	0.82–1.02	0.098

AOR = adjusted odds ratio; CI = confidence interval. Hospital fitted as a random intercept.

Discussion

This four-cycle clinical audit demonstrates substantial and progressive improvement in adherence to medical oxygen therapy standards across 121 Ethiopian public hospitals. Hypoxemia screening, oxygen administration, monitoring frequency, and the composite adherence indicator all improved significantly and monotonically across cycles, and multivariable models confirmed that the cycle effect persisted after adjustment for hospital type, ward, sex, and age.

These findings align with the audit-and-feedback literature, which shows that structured cycles embedded in a Plan-Do-Study-Act framework produce measurable improvements in prescribing accuracy, device selection, SpO_2 targeting, and timely initiation of therapy (13,20). Comparable improvements have been documented in UK hospital audits (19–86% adherence to oxygen prescription following repeated cycles) (9,15) and in emerging LMIC audits in Rwanda, Uganda, Papua New Guinea, and Nigeria (12,17,21,22). The magnitude of change observed here, a 21.5 percentage-point rise in composite adherence and a fourfold increase in the share of charts scoring high, suggests that a coordinated national program combining audit cycles with training, supportive supervision, and equipment strengthening can achieve rapid gains that isolated interventions rarely deliver.

Several contextual factors likely contributed. First, the audits were integrated with CHAI–MOH capacity building, including clinician training, biomedical engineer training, standardized SOPs, and hub-and-spoke oxygen production (18), addressing supply-side barriers alongside practice change. Second, the digital tool provided action-plan reminders from prior cycles, reinforcing accountability at the bedside. Third, general hospitals consistently outperformed primary hospitals in screening and monitoring, likely reflecting better staffing and oximeter availability; these differential highlights where focused mentorship is most needed to close the equity gap.

Limitations

The audit relied on retrospective chart review, which is vulnerable to documentation bias; observed improvements may partly reflect improved recording rather than practice per se. Ethical constraints precluded direct bedside observation. The 121 hospitals were purposively selected for CHAI support, so generalizability to unsupported facilities requires further investigation. Finally, patient outcomes (mortality, length of stay) were not linked to adherence in this analysis and remain a priority for follow-on studies.

Conclusion and recommendations

Four cycles of structured clinical audit and feedback produced sustained, progressive improvements in healthcare provider adherence to medical oxygen therapy standards across Ethiopian public hospitals. Institutionalizing adherence indicators screening coverage, prescription completeness, monitoring frequency, and composite adherence within routine facility quality-improvement platforms and the national health information system is essential to consolidate these gains and equitably extend them beyond program-supported facilities. Priority actions include mainstreaming audit cycles into hospital quality management units, embedding oxygen adherence indicators in DHIS2, targeting mentorship at primary hospitals, and linking adherence data to clinical outcomes in future cycles.

References

1. WHO. WHO model list of essential medicines – 22nd list. Geneva: WHO; 2021.

2. WHO. Oxygen therapy for children: a manual for health workers. Geneva: WHO; 2016.

3. Duke T, Graham SM, Cherian MN, et al. Oxygen is an essential medicine: a call for international action. Int J Tuberc Lung Dis. 2010;14(11):1362–8.

4. O'Driscoll BR, Howard LS, Earis J, Mak V. BTS guideline for oxygen use in adults in healthcare and emergency settings. Thorax. 2017;72(Suppl 1):ii1–90.

5. Chu DK, Kim LH-Y, Young PJ, et al. Mortality and morbidity in acutely ill adults treated with liberal versus conservative oxygen therapy: a systematic review and meta-analysis. Lancet. 2018;391(10131):1693–705.

6. WHO. Oxygen sources and distribution for COVID-19 treatment centres: interim guidance. Geneva: WHO; 2020.

7. MOH-Ethiopia. National medical oxygen and pulse oximetry scale up road map II (2022–2027). Addis Ababa: MOH; 2022.

8. MOH-Ethiopia. Oxygen therapy facilitator guide. Addis Ababa: MOH; 2023.

9. Beasley R, Chien J, Douglas J, et al. Thoracic Society of Australia and New Zealand oxygen guidelines. Respirology. 2015;20:1182–91.

10. Graham HR, King C, Rahman AE, et al. Reducing global inequities in medical oxygen access: the Lancet Global Health Commission on medical oxygen security. Lancet Glob Health. 2025;e528–84.

11. Subhi R, Burhin M, Lam F, et al. Medical oxygen service readiness and service coverage in seven countries in Africa and Asia. Lancet Glob Health. 2025;13(10):e1701–14.

12. Bakare AA, Graham H, Ayede AI, et al. Providing oxygen to children and newborns: a multi-faceted assessment of oxygen access and use in secondary-level hospitals in southwest Nigeria. Int Health. 2019;12(1):60–8.

13. Ivers N, Yogasingam S, Lacroix M, et al. Audit and feedback: effects on professional practice. Cochrane Database Syst Rev. 2025.

14. Starmer B, Kaba R, Adeyoju AAB. Clinical audit: principles and practice. J Glob Med. 2023;3(S1):e129.

15. Hut-Mossel L, Ahaus K, Welker G, Gans R. Understanding how and why audits work in improving the quality of hospital care: a systematic realist review. PLoS ONE. 2021.

16. Belete AB, Kristinawati B. Medical oxygen service delivery and utilization in Ethiopian healthcare facilities. Jurnal Berita Ilmu Keperawatan. 2025;18(1):69–76.

17. Tolla HS, Woyessa DB, Balkew RB, et al. Decentralizing oxygen availability and use at primary care level for children under five with severe pneumonia. BMC Health Serv Res. 2022;22(1).

18. CHAI. Ethiopia's medical oxygen transformation: from shortage to reliable access. Boston: CHAI; 2025.

19. University Hospital Bristol and Weston. How to set an audit sample and plan your data collection (2005–2022). Version 5. 2022.

20. WHO. Statement on access to quality and safe medical oxygen. Geneva: WHO; 2023.

21. Duke T, Hwaihwanje I, Kaupa M, et al. Solar powered oxygen systems in remote health centers in Papua New Guinea. J Glob Health. 2017;7(1).

22. Graham HR, Kitutu FE, Kamuntu Y, et al. Improving effective coverage of medical oxygen services for neonates and children in health facilities in Uganda. Lancet Glob Health. 2024;12(9):e1506–16.

Implementation outcomes of immediate kangaroo mother care in a resource-limited settings: A 19 months study

Samson Tarekegn[1]

[1]Hawela Tula General Hospital, Hawassa, Ethiopia

Corresponding author: Samson Tarekegn**,** 0926065500, Email-samvodt@gmail.com.

ABSTRACT

BACKGROUND: Preterm infants have a gestational age below 37 weeks at birth and low-birth-weight (LBW) infants have a birth weight below 2.5 kg. Approximately 45% of all children under the age of five who die are newborns, and 60–80% of those newborns who die are premature and/or small for gestational age. Preterm and LBW infants have a 2- to 10-fold higher risk of mortality than infants born at term and with normal birth weight. Despite substantial progress over the last 10 years, the survival, health, growth and neurodevelopment of preterm and LBW infants remains concerning in many countries. Reasons include the complexities of caring for these vulnerable infants and preventing complications. Kangaroo mother care (KMC) is recommended as routine care for all preterm or low-birth-weight infants.

OBJECTIVE: To evaluate the implementation outcomes of immediate kangaroo mother care using WHO health system building blocks with an embedded quality improvement approach—specifically by assessing changes in preterm neonatal mortality, measuring the coverage of early and continuous skin-to-skin contact durations, and generating contextual evidence for scaling up IKMC.

METHODS: A facility-based pre-post intervention study embedded within a quality improvement initiative. Health workforce capacity building through category two CPD model was used as an intervention package. The learning involves experiential methods so that health care workers learn to solve the existing problem.

RESULT: The proportion of neonates receiving skin-to-skin contact at birth for one uninterrupted hour was zero. The most common reason for removing the baby before one hour was family interruption, and a different procedure that can be conducted later. Preterm care quality increased from pre-intervention 65% to 90 % of post-intervention period.

CONCLUSIONS: This study demonstrates that immediate kangaroo mother care can be successfully implemented at scale in resource-limited settings through a structured quality improvement approach.

RECOMMENDATION: Facility administrators should avoid rotating KMC-skilled staff to other areas. Implementing immediate KMC for small and/or sick newborns is the optimal approach to save newborn lives in the similar settings.

KEYWORDS: Immediate, prematurity, neonatal death and family involvement.

INTRODUCTION:

Prematurity remains a leading cause of neonatal morbidity and mortality worldwide, particularly in low- and middle-income countries. Immediate Kangaroo Mother Care (IKMC) is a proven intervention to improve survival among preterm and neonates. (1,2,4). There are few published studies on population-based coverage of KMC, but it is known that KMC coverage is low worldwide, despite long-standing WHO guidelines, continued advocacy and efforts by global organizations. (3,5).Before immediate KMC Implementation Hawela Tula general hospital faced several challenges, including high mortality among preterm and low birth weight neonates, no early initiation of skin-to-skin contact and recommended-durations of contact were not maintained and low family involvement, high rate of neonatal hypothermia, and low family satisfaction at NICU. (2,6).

METHODS AND MATERIALS

STUDY DESIGN: A facility-based pre-post intervention study embedded within a quality improvement initiative using routinely collected health data was used and the intervention was designed using the WHO health system building blocks framework. Reporting followed the Standards for Quality Improvement Reporting Excellence (SQUIRE 2.0) guidelines, while the implementation components were informed by the Standards for Reporting Implementation Studies (StaRI). The conceptual framework guided the intervention.

STUDY SETTING: Hawela Tula General Hospital is located in Hawassa, Sidama Region, Ethiopia, serving more than 750,000 people.

STUDY PERIOD: Pre-intervention, Jan 2024 – June 2024; post-intervention, July 2024 to February 2026. All preterm and low birth weight neonates were included, and census sampling was used.

DATA SOURCE: NICU register, delivery register, maternal records, HMIS and Health service quality improvement reports. Data were extracted using a structured data collection checklist. Descriptive statistics were used to analyze trends and outcomes, and findings were compared between pre and post intervention.

INTERVENTION PACKAGE: Health workforce capacity building through category two CPD model (mentorship, onsite orientation, peer-to-peer learning- experiential learning), establishment of M-NICU and dining room for mother by repurposing, strengthening intra- and inter facility's referral system, structured counseling, health education, and family engagement as family clinicians.

RESULTS

1 PHASE 1 BASELINE DATA: A total of 50 preterm deliveries were studied over 6 months from pre-implementation Jan-June 2024.The proportion of neonates receiving skin-to- skin contact at birth for one uninterrupted hour was zero. The most common reason for removing the baby before one hour was family interruption, and a different procedure that can be conducted later. Both immediate skins-to-skin contact and 8 hours duration /per day were zero. Maternal satisfaction and preterm care quality were found to be 76% and 65%, respectively. Neonatal mortality among preterm was 36%. KMC coverage at this period was about 70%.

2 POST INTERVENTION: In the early phase of intervention (July 2024- December 2024) 54 preterm neonates were assessed for their status within 24 hours. Of the 54 preterm neonates assessed, 42/54 (77.8%) received immediate skin-to-skin contact, while, 12/ (22.2%) did not receive early initiation, 49(90.7%) were on exclusive breastfeeding. Accordingly, 37/54 (68%) neonates were discharged home, 10 (18.5%) death and 7 (12.5%) left against medical advice (LAMA) and no transfer to another hospital. The major challenge reported was LAMA, commonly for the reason of food and other support; including clothes for both mother and neonates, (5/7) 71.43% mothers reported they would rather go home to take care of their husband and other children rather than take time for a hopeless life. About 26 % (14/54) of grandmothers reported they prefer to take care of the mother rather than the newborn. Both early initiation of skin-to-skin contact within 2 hours of birth and continuous skin-to-skin care for ≥8 hours per day improved from 0% to 100%. Preterm neonatal mortality decreased from 36% (18/50) to 6.25 % (9/144), absolute reduction 29.75 percentage points (95% CI: 15.9%-43.6%)-, relative risk reduction 82.6%, -Relative risk (RR)_0.17 the difference was statistically significant (X^2=27.4, df=1, $p < 0.0001$,

and hypothermia rates declined from 56 % (28/50) to 20% (29/144). Average length of stay for preterm infants reduced from 20 to 10 days. Family satisfaction improved significantly from 70% to 96 %, and, preterm admissions increased progressively across quarters. Preterm care quality increased from pre-intervention 65% to 90 % of post-intervention period. Senior physician involvement changed the perception of skin-to-skin contact as a lifesaving medical intervention rather than optional nursing activities. (5,6).

Table: Summary of key results

Indicator	Description	Pre(N=50)	Post(N=144)	Chi – square	df	P value
Place of SSC initiation	Delivery room	0	102(70%)	119.0	3	< 0.0001
	NICU	32(64%)	26(18.1%)			
	Postnatal	18 (36%)	0			
	Unknown	0	16(11.1%)			
Mode of delivery	Vaginal delivery	40(80%)	128(88.9%)	2.59	1	0.108
	Cesarean section	10(20%)	16(11.1%)			
Daily MCH assessment at M-NICU	Yes	0	70(48.6%)	38.98	1	< 0.0001
	No	50(100%)	74(51.4%)			
Joint MCH and NICU evaluation for high risk mother	Yes	0	50(34.7%)	53.0	2	< 0.0001
	No	50(100%)	24(16.7%)			
	Unknown	0	70(48.6)			
Surrogate selection	Immediately after delivery	0	15(10.4%)	82.9	3	< 0.0001
	At NICU admission	0	48(33.3%)			
	Not found	50	10(6.9%)			
	Not Known	0	71(49.3%)			

DISCUSSION: Implementing IKMC based on the WHO building blocks of health services is found to be essential. The findings from this study are highly comparable to the study conducted by Nils Bergman etal by analyzing 15 health system interventions. (7). The improvements in family engagement as family clinicians, and all WHO health system building blocks being interconnected with a quality improvement approach, contributed to better survival rates and enhanced quality of care. Overall, these findings are consistent with international studies, WHO guidelines, and NEST 360. (4,6).

CONCLUSION: This study demonstrates that immediate kangaroo mother care can be successfully implemented at scale in resource-limited settings through a structured quality improvement approach.

RECOMMENDATIONS: IKMC should be scaled up as an integrated intervention within the program, not as a stand-alone program. Regarding capacity building rather than a generic training approach, onsite mentorship, improvement driven supportive supervision, peer learning, and benchmarking are very effective. Facility administrators should avoid rotating KMC-skilled staff to other areas. Implementing immediate KMC for small and/or sick newborns is the optimal approach to save newborn lives in the similar settings.

REFERENCES

1. Federal Ministry of Health of Ethiopia. Neonatal Intensive Care Unit (NICU) Training Participants' Manual. January 2021.

2. World Health Organization, Department of Reproductive Health and Research. Kangaroo mother care: a practical guide. Geneva: World Health Organization; 2003.

3. World Health Organization. WHO recommendations for care of the preterm or low-birth-weight infant. Geneva: World Health Organization; 2022.

4. Mony PK, Tadele H, Gobezayehu AG, Chan GJ, Kumar V, Mazumder S, et al. Scaling up kangaroo mother care in Ethiopia and India: a multi-site implementation research study. BMJ Glob Health. 2021;6(9): e005905.

5. Ministry of Health Ethiopia. Kangaroo Mother Care technical and implementation guideline. Addis Ababa: Ministry of Health Ethiopia; January 2023.

6. Ethiopian Statistical Service (ESS) and ICF. Ethiopia Demographic and Health Survey 2024-25. Addis Ababa, Ethiopia, and Rockville, USA: ESS and ICF; 2026.

7. Nils Bergman, Megan Talej, et al. Health system intervention package on improving coverage of kangaroo mother for preterm or LBW infants: a mixed methods systemic review.2023; 05.16.23289958.



Section Two: Best Practice Articles

From Pilot to Policy: Institutionalizing Networks of Care to Strengthen Primary Health Care in Ethiopia

Nesredin Nursebo[1*], Hillina Tadesse[2], Nebreed Fesseha[2], Biruk Bogale[2], Mikiyas Teferi[3], Kasu Tola[1], Abas Hassen[1], Mesele Damte[3], Dessalew Emaway[2], Wubet Mihretu[4], Abiyou Kiflie[4]

[1] Ministry of Health, Health Service Innovation and Quality Lead Executive Office, Addis Ababa, Ethiopia

[2] JSI Research & Training Institute, Inc., Addis Ababa, Ethiopia

[3] Amref Health Africa, Addis Ababa, Ethiopia

[4] Institute of Healthcare for Improvement (IHI), Ethiopia

[*]**Corresponding author:** Nesredin Nursebo, nesredin.nursebo@moh.gov.et

Background

Ethiopia has made substantial progress in expanding access to primary health care (PHC) through its three-tier health system and the Health Extension Program, contributing to improved maternal and child health outcomes nationwide [1,2]. Yet fragmentation of services, weak referral and counter-referral linkages, limited continuity of care, and insufficient coordination across health posts, health centers, primary hospitals, and woreda health offices continue to constrain the efficiency, quality, and people-centeredness of care, particularly for maternal and newborn conditions that require timely coordination across levels of the system [3,4].

Networks of Care (NOC) have emerged globally as a systems-level response to this fragmentation: an approach to organizing existing facilities and providers around shared governance, referral coordination, communication, and collective accountability, rather than building new parallel delivery structures [5]. The approach aligns with Ethiopia's Health Sector Development and Investment Plan objectives to improve community ownership and PHC, accelerate universal health coverage, improve access to quality and equitable medical services, and harness innovation for quality, equity and safety [6].

While many health system innovations demonstrate promising results during pilot implementation, translating those experiences into sustainable national programs remains a common challenge. Successful institutionalization requires more than evidence of effectiveness; it depends on government leadership, adaptation through implementation learning, integration into existing systems, and alignment with national priorities [7].

Ethiopia's NOC experience is one of the illustrations of this pilot-to national implementation guidance. First tested in a limited number of agrarian and pastoralist woredas, then expanded for test-of-scale learning, NOC was ultimately consolidated through national dialogue and partner collaboration into Ethiopia's first National Network of Care Implementation Guidance [8]. This article documents how implementation evidence and multi-partner learning were synthesized into national implementation guidance, using published effectiveness and implementation findings as supporting evidence.

Approach

Beginning in 2022, the Ministry of Health (MOH), in collaboration with Regional Health Bureaus (RHBs) and implementing partners including JSI, Amref Health Africa and IHI, with Gates Foundation funding, introduced the NOC approach to strengthen coordination and continuity of PHC services across selected agrarian and pastoralist woredas in nine regions. Implementation followed a phased, adaptive approach guided by the RE-AIM (Reach, Effectiveness, Adoption, Implementation, and Maintenance) framework. The initiative was co-designed with regional and woreda stakeholders and then pressure-tested over two years in 21 pilot woredas. Routine monitoring data, process evaluation findings, and facility service statistics were used to assess feasibility, identify operational barriers, and inform adaptations. Lessons from this phase informed expansion to an additional 60 woredas as a test of scale [9].

NOC addressed both structural and relational dimensions of the health system. The woreda served as the operational unit, linking health posts, health centers, primary hospitals, woreda health offices, and community structures around coordinated service delivery and continuity of care. Key interventions included establishing coordinating committees, strengthening referral systems, joint planning and performance reviews, routine communication, resource sharing, continuous quality improvement, and shared accountability among managers, providers, and community representatives. Together, these interventions aimed to strengthen collaboration across the continuum of care and improve the responsiveness and efficiency of PHC services.

Building on lessons from the pilot and test-of-scale phases, the MOH initiated development of Ethiopia's first National Network of Care for Health Service Delivery Improvement Implementation Guidance through a structured, evidence-informed, and consultative process. A multidisciplinary Guideline Development Group, overseen by the Health Service Innovation and Quality Lead Executive Office, brought together MOH technical teams, RHBs, implementing partners, and experts to translate implementation experience into practical guidance. The process synthesized WHO guidance, national policies and strategies, NOC experience from implementation sites, and relevant literature, complemented by consultations with professional associations, RHBs, partners, and field implementers through national workshops and the Community of Practice. These consultations validated feasibility and adaptability across diverse contexts, incorporated implementation lessons, and built ownership beyond pilot sites. The guidance was refined through technical review and submitted for formal MOH endorsement, marking the transition from a tested model to nationally owned guidance for wider adoption and scale-up [8].

Results

NOC demonstrated improvements in both PHC service delivery and coordination among health system actors. The approach strengthened communication, trust, relational linkages, and continuity of care, accompanied by measurable gains in maternal and newborn health services. During the pressure-test period, the rate of ANC 8+ visits was 29.8% higher per month than expected without NOC (coefficient: 2.39; $p<0.01$), while the rate of obstetric complications managed increased by 18.4% per month (coefficient: 1.71; $p=0.050$), contributing to a 43% overall increase. In one woreda, perinatal mortality declined by 34%, from 31.3 to 20.1 per 1,000 births ($t=2.12$; $p=0.040$) [9].

Implementation also generated important learning on adapting NOC to diverse contexts. Key constraints included conflict, outbreaks, flooding, staff turnover, competing priorities, limited budgets, long travel distances, dispersed and mobile pastoralist communities, limited private-sector engagement, initially unclear objectives, and varying data-use capacity. In response, NOC objectives and activities were clarified; learning was integrated into routine PHCU meetings and catchment-based mentorship; private-facilities engagement was tailored; and hub-and-spoke arrangements were applied in pastoralist woredas. These adaptations reinforced the importance of a common framework with flexibility for local conditions.

The most significant achievement was the translation of implementation experience into national implementation guidance. Implementation experience was not left at the pilot level: the MOH brought together lessons from its own work and partner-supported experience to build a common national framework, repositioning NOC from a project-level intervention into a nationally owned health systems

innovation aligned with Ethiopia's broader PHC and quality agenda. Currently the implementation guidance is under its final stage of endorsement and will soon be launched and implemented.

Lessons Learned

The Ethiopia NOC experience offers lessons that extend beyond the intervention itself, to the broader process of translating health system innovation into national policy.

- Relationships are central to system performance. Communication, trust, teamwork, joint review, and shared accountability are critical to coordinated care.
- Innovations gain traction when they address recognized system challenges. NOC responded to fragmentation, weak inter-level linkages, and inconsistent continuity of care, creating a clear rationale for local ownership.
- Phased implementation and continuous learning support institutionalization. Moving from pilot to test-of-scale enabled stakeholders to generate evidence, identify and address implementation barriers, adapt the model to diverse contexts, and build confidence for national adoption.
- Government leadership is central. MOH stewardship was critical in convening stakeholders, synthesizing evidence, building consensus, and translating implementation experience into national guidance.

Overall, sustainable institutionalization requires more than a successful pilot. It depends on demand-driven and co-designed innovation, progressive testing, continuous adaptation, and government leadership to embed proven functions within routine systems.

Recommendations

National endorsement should be viewed as the beginning, not the end, of institutionalization. NOC functions should be integrated into routine governance, planning, supervision, budgeting, performance review, and accountability at national, regional, and woreda levels. National and regional authorities should provide policy direction, standards, technical support, and monitoring, while woredas and PHCUs lead contextual adaptation and implementation. Financing should be incorporated into existing planning and budgeting mechanisms for coordination, mentorship, referrals, data use, and performance review, with responsibilities assigned within existing workforce structures.

Scale-up should be accompanied by systematic documentation and learning to enable ongoing adaptation. Equity safeguards should explicitly address pastoralist and mobile populations, conflict- and displacement-affected communities, remote populations, and other underserved groups. Finally, because this experience does not establish NOC's efficiency or cost-effectiveness, future scale-up should assess resource requirements, costs, and value for money.

References

1. Ministry of Health, Ethiopia. Realizing universal health coverage through primary
2. health care: a roadmap for optimizing the Ethiopian Health Extension Program 2020–2035. Addis Ababa: Ministry of Health; 2020.
3. Assefa Y, Gelaw YA, Hill PS, Taye BW, Van Damme W. Community health extension program of Ethiopia, 2003–2018: successes and challenges toward universal coverage for primary healthcare services. Glob Health. 2019; 15:24.
4. Ethiopian Public Health Institute, MOH. National Health Equity Survey 2022/23: Key Findings. Addis Ababa, Ethiopia: EPHI; 2023.
5. Tiruneh GT, Demissie M, Worku A, Berhane Y. Community's experience and perceptions of maternal health services across the continuum of care in Ethiopia: A qualitative study. PLoS ONE. 2021; 16(8): e0255404.
6. World Health Organization. Networks of care for maternal and newborn health: implementation guidance. Geneva: World Health Organization; 2024.
7. Ministry of Health Ethiopia. Health Sector Medium-Term Development and Investment Plan II 2026/27-2029/30. Addis Ababa: Ministry of Health; 2023.
8. World Health Organization, Expand Net. Practical guidance for scaling up health service innovations. Geneva: World Health Organization; 2009.
9. Ministry of Health Ethiopia. National Networks of Care for Health Service Delivery Improvement: Implementation Guidance. Addis Ababa: Ministry of Health; internal document.
10. Tiruneh GT, Fesseha N, Ayehu T, Chitashvili T, Argaw MD, Shiferaw BB, et al. Networks of care for optimizing primary health care service delivery in Ethiopia: Enhancing relational linkages and care coordination. PLoS One. 2025;20(1):e0314807.

From Data to Transformation: Lessons from the Information Revolution in Tehuledrie Woreda, Ethiopia

Amare Minyihun[1,2], Berhanu Fikadie Endehabtu[2,3], Tajebew Zayede[1,2], Getasew Amare[1,2], Getachew Teshale[1,2*], Eshetu Ebrie[4], Melsachew Alebel[4], and Binyam Tilahun[2, 3]

[1] Department of Health Systems and Policy, Institute of Public Health, College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia

[2] Center for Digital Health and Implementation Sciences (CDHI), University of Gondar, Gondar, Ethiopia

[3] Department of Health Informatics, Institute of Public Health, College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia

[4]Tehulederie Woreda Health Office, South Wollo Ethiopia

***Corresponding Author:** Getachew Teshale, getateshale1221@gmail.com | Tel: +251 923536866

Introduction

Ethiopia's Health Sector Investment Plan I (HSDIP I), building upon the framework of the Second Health Sector Transformation Plan (HSTP-II), aims to accelerate Universal Health Coverage and fortify health system resilience through core strategic agendas: quality, equity, Woreda Transformation and the Information Revolution (IR) [1]. The Woreda Transformation provides the operational mechanism for translating high-level national strategies into frontline action. As a core engine of this transformation, the IR is defined as a national strategic initiative driving systemic digitization and a cultural shift from passive data collection toward routine data utilization for decision-making [2].

Despite strong national commitment, many Woredas struggle to institutionalize data-use practices and sustain Health Information System (HIS) performance in resource-constrained environments [3, 4]. This best-practice document examines how Tehuledere Woreda successfully operationalized the IR agenda to earn national recognition for Woreda Transformation. By analyzing its implementation pathways, operational adaptations, and governance strategies, this synthesis provides actionable lessons for policymakers, health managers, and development partners seeking to scale data-driven health reforms across similar contexts.

Objective:

To document Tehuledere Woreda's best practices and systemic adaptations in achieving IR excellence, providing scalable insights for health system reform in comparable settings.

Methods

Context & Setting: Tehuledere Woreda, located in South Wollo Zone, Amhara Region, Ethiopia, serves a catchment population of approximately 139,341 across 5 health centers and 26 health posts. The 2022 northern Ethiopian conflict severely damaged local health infrastructure, displaced health personnel, and disrupted routine HIS operations. During the post-conflict period, restoring health services and rebuilding HIS functionality became an urgent operational priority. The Woreda Health Office leveraged the IR agenda as a strategic entry point, transforming basic technical HIS activities into a comprehensive system reform. Technical support was provided through continuous partnership with the University of Gondar Capacity Building and Mentorship Program (UoG-CBMP).

Intervention Packages & Implementation Strategies

A multi-phased framework was deployed from 2021 to 2025:

- **Phase 1 (Problem Analysis):** Mapped systemic gaps in data quality, governance, and use via standard IR checklists and baseline audits.
- **Phase 2 (Co-Design):** Formulated context-specific action plans focused on leadership ownership and workflow integration.
- **Phase 3 (Leadership Engagement):** Embedded HIS indicators into administrative agendas and supervision.
- **Phase 4 (Targeted Mentorship):** Deployed peer-to-peer coaching and on-site technical assistance tailored to facility gaps.
- **Phase 5 (System Institutionalization):** Established role-based support models bridging health posts and PHCUs for predictable feedback loops.
- **Phase 6 (Monitoring & Motivation):** Revitalized Performance Monitoring Teams, quarterly review meetings, and public performance recognition.

Data Sources & Triangulation:

Using a concurrent mixed-methods design, we triangulated data across three streams: quantitative extraction of quarterly IR and Woreda Transformation composite scores (2021 Q1–2025 Q1); document reviews of IR/DQA audits, mentorship logs, and PMT minutes; and qualitative interviews with woreda executives, facility directors, HITs, and mentors.

Results

Data Quality & Completeness: Post-conflict reporting tools, streamlined formats, and routine audits re-established system integrity following 2021–2022 disruptions. By 2025, Composite IR scores stabilized at 91.0%–93.0%, surpassing the national benchmark.

Data Utilization & Evidence-Based Planning: Data practice evolved from passive compliance to active governance. By 2024/25, digital dashboards and team reviews directly guided quarterly budgeting and clinical supervision. Equity and service monitoring scores recovered from 0.0% during peak conflict (2022 Q2) to 100.0% (20.0/20.0 points) by 2025.

Leadership & Financial Decision-Making: Leadership accountability reached 93.0%–98.5% (37.2/40.0 to 39.4/40.0 points). Transparent tracking drove workforce motivation from 6.7 to 9.6 (out of 10), while data-guided financial decision-making rose to 6.9% by 2025 Q1.

Overall Woreda Transformation: The Composite Transformation Score jumped from 18.7%-25.0% in 2021 to 97.0% in 2025. Consequently, Tehuledere Woreda was officially recognized and awarded Model Woreda Status in IR performance by the Ministry of Health.

Table 1: Longitudinal Implementation Metrics and Transformation Trajectory (2021–2025)

Evaluation Metric / Domain	Baseline (Q1 2021)	Conflict Peak (Q2 2022)	Endline (Q1 2025)
Composite IR Score	18.7%- 25.0%	68.0%-88.0%	91.0% -93.0%
Woreda Transformation Score	Baseline Low	28.6%- 38.7%	97.0%
Equity & Service Monitoring	0.0% (0.0/20.0)	100.0% (20.0/20.0)	
Leadership & Accountability	Fragmented	93.0% (37.2/40.0)	98.5% (39.4/40.0)
Financial Decision-Making	Routine	5.5%	6.9%

Lessons Learned or Conclusion

What Worked Well & Key Enablers:

1. Strong Woreda Leadership & Political Will: Active executive involvement in mentorship and data review meetings established institutional accountability and sustained momentum.
2. Embedded Academic Partnership (UoG-CBMP): Long-term technical support, continuous coaching, and assessment frameworks proved far more effective than short-term training workshops.
3. Standardized Tools & Supportive Policy: Clear guidelines, DHIS2 infrastructure, and alignment with national HSTP-II targets provided a robust operational foundation.
4. Frontline Ownership & Non-Financial Motivation: Engaging Health Extension Workers in data analysis and celebrating model status boosted workforce morale and system resilience.

By embedding data practices into routine administrative reviews and performance monitoring teams, Tehuledere Woreda successfully transitioned its HIS from a passive reporting burden into an active governance mechanism.

Challenges & Mitigation Strategies:

- **High Staff Turnover:** Addressed via continuous peer mentorship and structured onboarding.
- **Post-Conflict Infrastructure Scarcity:** Mitigated by prioritizing core DHIS2 digital tools alongside hybrid paper-digital workflows.
- **Competing Priorities:** Managed by embedding HIS indicators into routine review meetings.

Innovation & Sustainability:

This approach transformed HIS from a reporting burden into an active governance mechanism, demonstrating that locally owned IR practices preserve institutional memory and operational continuity during crises.

Recommendations

Woreda Administrations: Embed routine performance review meetings into governance structures and integrate HIS metrics into staff appraisal frameworks.

Ministry of Health: Shift from episodic classroom trainings to continuous, gap-based technical mentorship and peer coaching models.

Partners & Donors: Invest in resilient digital infrastructure and long-term health system strengthening rather than parallel reporting systems.

References

1. Tarekegn, S.M., et al., *Progress towards Universal Health Coverage in Ethiopia: National achievement and regional disparities.* 2026.
2. Liu, L., et al., *District-level health management and health system performance: the Ethiopia primary healthcare transformation initiative.* International journal of health policy and management, 2020. 11(7): p. 973.
3. Abera, W.S., et al., *A strategy that improves the culture of information use at primary health care units in Ethiopia.* 2021.
4. Epizitone, A., S.P. Moyane, and I.E. Agbehadji, *A data-driven paradigm for a resilient and sustainable integrated health information systems for health care applications.* Journal of Multidisciplinary Healthcare, 2023: p. 4015-4025.

Sustaining Last-Mile Delivery of Health Products in Conflict-Affected Settings in Ethiopia via Third-Party Logistics

Tesfaw Sileshi[1], Tesfalem Adraro[1], Solomon Nigussie[2], Workneh Abebe[2], Amsalu Chanie[2], Hewan Semere[2], Yeheyis Sebehat[2], Muliey Abreha[2], Chanie Admasie[4], Edmealem Ejigu[1], Fikru Worku[1], **Andualem** Oumer[5], Mehari Teklehaymanot[3].

[1] US Government Supply Chain Strengthening (SCS) Project, Addis Ababa, Ethiopia

[2] Ethiopian Pharmaceutical Supply Service (EPSS), Addis Ababa, Ethiopia

[3] Fidelis Health Share Company, Addis Ababa, Ethiopia

[4] Amhara Regional Health Bureau, Bahir Dar, Ethiopia

[5] Management Sciences for Health (MSH) Head Quarter, Arlington, VA, USA

Corresponding author: Tesfaw Sileshi, ttefera@msh.org, +251983145400

Introduction

Since 2021, conflict in Ethiopia's Amhara, Oromia, and Benishangul-Gumuz regions has severely disrupted last-mile delivery (LMD) of life-saving health products through the Ethiopian Pharmaceutical Supply Service (EPSS). Blocked routes, attacks on delivery teams, and vehicle restrictions reduced refill rates to 7% in 2023, forcing fragmented self-collection by health facilities. At the same time, internal displacement increased demand for essential medicines. These shocks exposed weaknesses in conventional distribution systems and highlighted the need for multi-level governance and adaptive delivery approaches to sustain LMD in conflict settings.

This study aims to examine how multi-level governance mechanisms and adaptive last-mile delivery (LMD) strategies contributed to maintaining the distribution of life-saving health products in conflict-affected regions of Ethiopia. Specifically, it analyzes how coordinated decision-making, flexible delivery models and stakeholder collaboration helped address security, access and logistical challenges and sustain the continuity of essential health commodity supply during periods of conflict

Approach

The project was implemented in collaboration with the Ethiopian Pharmaceutical Supply Service (EPSS), Ministry of Health (MOH), Regional Health Bureaus (RHBs), and development partners. An adaptive LMD approach, based on a health systems strengthening framework, was applied through two models: center-to-hub and hub-to-facility distribution. The approach emphasized multi-level coordination, strategic partnerships, and security-informed planning to ensure continuous delivery of essential health commodities in challenging settings. Local third-party logistics (3PL) providers and the World Food Program (WFP)-led Logistics Cluster supported transportation in high-risk and inaccessible areas. Operations were guided by real-time route risk monitoring, incident reporting, and engagement with local authorities. Decentralized buffer stocks at EPSS hubs, zonal facilities, and woredas, along with flexible distribution schedules and contingency measures helped maintain supply continuity during access restrictions and insecurity.

Results

Hub to Facility Distribution Support

The hub-to-facility distribution model was initially launched in the conflict-affected areas of the Amhara Region to ensure uninterrupted access to essential health commodities. Building on this success, hub-to-facility distribution was subsequently expanded to Oromia and Benishangul-Gumuz Regions. Separately, the complementary center-to-hub distribution model was extended to the conflict-affected Tigray Region alongside Amhara — detailed under Center-to-Hub Distribution Support below. During the reporting period, the SCS Project implemented coordinated hub-to-facility operations through seven EPSS hubs across Amhara, Oromia, and Benishangul-Gumuz, facilitating the delivery of health commodities and strengthening supply chain continuity in conflict-affected and hard-to-reach areas. These operations contributed to improved access to essential health services by ensuring timely distribution of health products to health facilities across the supported regions.

The regional distribution shows a significant concentration of operations in Amhara, which accounts for 227 routes and 2,096 dropping points, making it the largest coverage area. Oromia has a smaller footprint with 31 routes and 298 dropping points, while Benishangul-Gumuz (B/Gumuz) records 5 routes and 41 dropping points (excluding Metekel Zone). This was because the extent of the conflict support started from Amhara and then geographic expansion to Oromia and Benishangul-Gumze regions.

Total Health Facilities Reached

Despite continued security and access challenges, the collaborative LMD intervention, maintained commodity flows to critical service delivery points and supports continuity of essential health services.

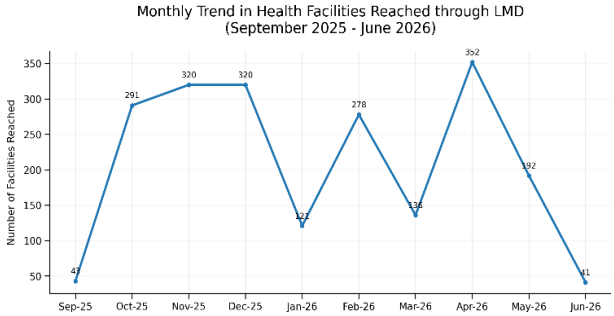


Figure 1. Number of health facilities covered through LMD per Month (September 2025 to June 2026).

As can be seen from Figure 2, there is a sharp increase in the number of health facilities from 45 in September 2025 to 281 in October 2025 on the number of health facilities reached with the LMD operations. Activity remains high through November and December 2025 (over 320 facilities each month), whereas a significant decline was observed in January 2026 (121). Performance rebounds in February 2026 (278), falls again in March 2026 (136) due to the global fuel cost escalation and difficulty accessing fuel in the regions for the 3PLs to provide the LMD service. LMD support was higher in April 2026, reaching a total of 352 Health facilities.

From September 16/2025 to June 30/2026, a total of 293 routes were covered delivering 4,933 m^3 of health commodities reached for 2,435 health facilities under seven EPSS hubs by travelling 127,145 Kms. The total value of health commodities distributed and reached health facilities was more than ETB 3.39 billion, while ETB 65.7 million was covered by USG/SCS Project to support the transportation cost for 3PLs demonstrating extensive nationwide logistics coverage and supply chain support.

Values of Commodities Transported

Under the USG-SCS Project, health commodity distributions from hubs to health facilities in conflict-affected areas reached a total value of ETB 3.39 billion (USD 22.26 million) benefiting 3.21 million people in four program services (HIV Treatment & Testing, Malaria Treatment & Testing, TB Treatment & Testing and MNCH treatments) during the reporting period.

Distribution performance improved significantly from ETB 1.09 billion in Quarter 1 to ETB 1.49 billion in Quarter 2, reflecting strengthened supply chain operations and increased service delivery support. However, distribution value declined to ETB 815.7 million in Quarter 3, mainly due to global fuel cost unexpected escalation as well as shortage access-related challenges commonly occurred in conflict-affected settings. Despite the Q3 decline, the project sustained continuous delivery of essential HIV/AIDS, TB, malaria, and MNCH commodities to health facilities serving vulnerable populations throughout the period.

Center to Hub Distribution Support

The US Government-funded Supply Chain Strengthening

(USG/SCS) Project provided critical transportation support to ensure the uninterrupted movement of vital and lifesaving health commodities across the conflict-affected regions of Amhara and Tigray through its Center-to-Hub Delivery Support intervention under the Last Mile Delivery (LMD) initiative. The support was initiated in November 2025 for the Bahir Dar and Gondar EPSS hubs, facilitating 17 truck movements with WFP escort. Subsequently, between April and June 2026, the project supported the transportation of health commodities from the central EPSS warehouse to the Mekele, Shire, Gondar, and Bahir Dar EPSS hubs through contracted third-party logistics (3PL) providers and coordinated transport arrangements. During this period, an additional 45 trucks were deployed to deliver vital health commodities to the targeted hubs.

Through these Center-to-Hub transportation interventions, a total of 62 truck deliveries were completed to the four EPSS hubs, transporting health commodities valued at ETB 3.124 billion (USD 20.27 million). The total transportation cost amounted to ETB 47.18 million (USD 303,130), financed by the USG/SCS Project through contracted 3PL service providers. These efforts strengthened the availability of essential health commodities and improved access to HIV, tuberculosis (TB), and malaria prevention, testing, and treatment services, as well as maternal and child health interventions, benefiting more than 4.454 million people across the two regions. The number of beneficiaries for center-to-hub and hub-to-facility deliveries should be considered separately. Center-to-hub beneficiaries represent the population that can potentially be served by the HIV, Malaria, TB, and MCH commodities delivered to the four hubs, whereas hub-to-facility beneficiaries represent the population covered by commodities distributed from the hubs to health facilities.

Tigray Region

Center-to-Hub support in Tigray was implemented through the Mekele and Shire hubs, utilizing 24 truck trips. A total of ETB 24.76 million (USD 158,696) was paid to 3PL providers to facilitate these deliveries through April 1/2026 to June 30/2026. Through this support, health commodities worth ETB 896.47 million (USD 5.71 million) were transported to the two hubs.

- Mekele Hub received 14 truck deliveries transporting health products valued at ETB 667.41 million (USD 4.25 million), at a transportation cost of ETB 13.17 million (USD 84,406).
- Shire Hub was supported through 10 truck deliveries, transporting commodities worth ETB 229.05 million (USD 1.46 million), with transportation expenditures totaling ETB 11.59 million (USD 74,290).
- Overall, the center-to-hub distribution support to the Tigray Region through EPSS Mekele and Shire has benefited over 1.627 million people, enhancing access to testing and treatment services for HIV, TB, and malaria, as well as maternal and child health interventions.

Amhara Region

In Amhara Region, Center-to-Hub support was provided through the Bahir Dar and Gondar hubs, utilizing 38 truck deliveries through November 2025 and April 1/2026 to June 30/2026. The project paid more than ETB 22.42 million (USD 144,434) to 3PL providers, enabling the transportation of health commodities valued at ETB 2.227 billion (USD 14.497 million).

- Gondar Hub received 20 truck deliveries; transporting commodities valued more than ETB 1.169 billion (USD 7.52 million) at a transportation cost of ETB 13.46 million (USD 86,620).
- Bahir Dar Hub received 18 truck deliveries, transporting commodities valued more than ETB 1.086 billion (USD 6.99 million) at a transportation cost of ETB 8.958 million (USD 57,813.86).
- Overall, the center to hub distribution support provided to Amhara region through EPSS Bahir Dar and Gondar has benefited over 2.827 million people by improving access to treatment and diagnostic services for HIV, Tuberculosis (TB) and Malaria as well as maternal and child health care services.

Generally, through its Last Mile Delivery (LMD) support, the USG/SCS Project enabled the distribution of health commodities worth more than ETB 3.124 billion (USD 20.207 Million) across the Amhara and Tigray

regions via Bahir Dar, Gondar, Mekele and Shire EPSS hubs. A total of 62 Long-Haul trucks were deployed with transportation costs amounting to ETB 47.18 million (USD 303,130) covered by the project through contracted 3PL service providers. This support has benefited over 4.454 million people, enhancing access to testing and treatment services for HIV, TB, and malaria, as well as maternal and child health interventions.

Please note that The Center-to-Hub model positioned commodities sufficient to serve an estimated 4.454 million beneficiaries at hub level, whereas the Hub-to-Facility model delivered commodities sufficient to serve 3.21 million beneficiaries directly to health facilities. Because hub-level stock functions as a replenishment source for facility-level inventories, these beneficiary estimates represent different stages of the supply chain and should not be aggregated.

Lessons Learned

The experience of implementing adaptive last-mile delivery (LMD) in conflict-affected areas generated several important lessons for sustaining health commodity availability during insecurity, access restrictions, and other disruptions.

a) Adaptive distribution models are critical for maintaining supply continuity during disruption. The experience demonstrated that combining center-to-hub and hub-to-facility distribution models provided the flexibility needed to maintain the movement of essential health commodities when conventional distribution routes were disrupted. The ability to adapt delivery routes, schedules, and distribution modalities was particularly important in conflict-affected and hard-to-reach areas.

b) Multi-level coordination and local partnerships are key to effective delivery in fragile settings. Close coordination among the MOH, EPSS, RHBs, development partners, local authorities, and logistics service providers enabled timely operational decisions and facilitated access to difficult areas. Local third-party logistics (3PL) providers were particularly valuable because of their knowledge of local conditions and ability to operate where conventional logistics arrangements faced limitations.

c) Security-informed planning and decentralized preparedness improve supply chain resilience. Real-time route risk monitoring, incident reporting, flexible scheduling, and decentralized buffer stocks helped mitigate the effects of insecurity and access restrictions. The experience showed that supply chain planning in fragile settings must consider security and accessibility risks alongside conventional logistics factors.

d) Resilience requires preparedness for multiple and interconnected disruptions. While conflict and insecurity were major challenges, fuel availability and rising transportation costs also affected delivery performance. This demonstrates that resilient LMD systems require contingency measures covering security, transportation, fuel, financing and other operational risks. It also highlights the importance of routinely measuring commodity availability and stock-out indicators to demonstrate the effect of LMD on continuity of health services.

e) Sustainability

Ultimately, the intervention should be viewed as a hybrid model rather than solely a temporary humanitarian measure or a permanent replacement for public-sector logistics. The experience suggests that emergency outsourcing can complement EPSS operations by enhancing resilience during crises while allowing the government to maintain core supply chain functions. The key lesson is that effectiveness during emergencies does not automatically translate into long-term sustainability, which depends on balancing flexibility, cost-efficiency, institutional capacity and government ownership. Given the current challenges in government fleet management and transportation efficiency, the potential of 3PLs as a permanent replacement requires comprehensive cost-effectiveness analyses and comparative studies. Nevertheless, the integration of 3PL transport services within the EPSS system has demonstrated significant operational benefits and can be considered a promising best practice for improving last-mile distribution performance.

f) Practical Description of Analysis of Conventional and Adaptive Last-Mile Distribution (LMD)

Adaptive LMD approaches are more resilient than conventional supply chain models during disruptions. Unlike routine transport, fixed routes, centralized stock and standard coordination, adaptive systems use flexible transport capacity, real-time risk-informed planning, decentralized buffer stocks and emergency coordination mechanisms. These strategies improve continuity of supply and enable effective delivery of critical commodities in humanitarian and public health emergencies.

Conclusion

The experience demonstrates that adaptive last-mile delivery can sustain the flow of essential health commodities to conflict-affected and hard-to-reach areas when supported by multi-level coordination, flexible distribution models, local logistics partnerships, security-informed planning and decentralized preparedness. Through the combined center-to-hub and hub-to-facility approaches, substantial quantities of essential commodities were transported to EPSS hubs and health facilities despite significant security and access challenges. Overall, the approach provides a practical model that can inform Ethiopia's broader efforts to build a more resilient pharmaceutical supply chain capable of maintaining life-saving and essential services during conflict and other disruptions.

Recommendations

The Ministry of Health and EPSS should institutionalize adaptive LMD approaches within national supply chain contingency and emergency preparedness plans, including predefined mechanisms for switching between distribution modalities and rapidly mobilizing qualified local 3PL providers when conventional routes are disrupted. Security and access risk monitoring should be integrated into routine distribution planning, while strategically decentralized buffer stocks should be maintained in locations where they can mitigate temporary access interruptions. Contingency arrangements should also address fuel shortages, transportation cost increases, and other operational shocks that can affect preparedness and resource allocation. Although drone technology was not employed in this article because of various country-specific constraints, it could offer an effective solution for delivering life-saving medicines to underserved and remote populations when enabling conditions are in place.

Elevating Adolescent and Youth Engagement in Health Through Youth-Led Community Scorecards: Experience from four AYFHS facilities, Addis Ababa, Ethiopia

Worknesh Kereta , Abebe Kassa[1], Firehiyaw Birhanu[1] and Teshager Mersha[1]

[1] Pathfinder International Ethiopia, Addis Ababa, Ethiopia

Corresponding author: Worknesh Kereta, WKereta@pathfinder.org

Background

The role of adolescents and youth in Ethiopia's health system is critical in improving the quality of health services and increasing the utilization of essential care by adolescents and youth. Adolescents and youth play a critical role in improving the quality and use of health services in Ethiopia. Despite the expansion of Adolescent and Youth-Friendly Health Services (AYFHS), their meaningful engagement in monitoring service quality and influencing health-system decisions remains limited. The Youth-led Community Scorecard (CSC) is a participatory social accountability approach that enables young people to assess service quality, share their experiences, and engage constructively with health care providers and health managers. Through scoring, dialogue, and joint action planning, the approach creates a structured mechanism for identifying service gaps, strengthening accountability, and supporting continuous quality improvement.

The Youth-led CSC was introduced and integrated into four AYFHS facilities in Addis Ababa selected for having dedicated AYFHS spaces, high adolescent and youth client volume, and active peer educator engagement. The initiative aimed to strengthen meaningful adolescent and youth engagement and improve the responsiveness and quality of AYFHS. This paper documents the implementation experience and lessons learned, focusing on the feasibility of engaging adolescents and youth in social accountability, their contribution to facility quality-improvement processes, and the potential of the approach to promote more responsive and client-centered AYFHS.

Intervention Process

The Youth-led CSC is an AYFHS-specific social accountability tool aligned with Ethiopia's Adolescent and Youth Health Strategy and AYFHS Service Standards. It enables adolescents and youth to assess the services they receive and work with health facilities to identify and address service gaps. The assessment covers key standards, including provider attitudes, availability of comprehensive services, privacy and confidentiality, youth engagement, facility organization, essential commodities and SBC materials, and provider competence.

Implementation began with an orientation for more than 20 participants at each facility, including facility leaders, quality improvement teams, AYFHS providers, peer educators. This created a shared understanding of the approach and secured commitment to participate in the quality improvement process. Youth Councils were then established to coordinate the initiative. Members were selected based on criteria such as gender balance, willingness to volunteer, vulnerability, and ability to communicate with peers. They received training on AYFHS standards, the CSC process, and their roles in facilitating ratings, collecting feedback, and supporting dialogue and conducting town hall meetings.

More than 25 adolescents and youth clients who had used AYFHS were then invited to rate the services. After providing informed consent and receiving orientation on the AYFHS standards, they assessed service quality using a simple color-coded scoring system: green indicated that the standard was met, yellow indicated partial satisfaction, and red indicated a need for improvement. This simple approach enabled young clients to share their experiences in a structured and understandable way. The youth led CSC rating findings are presented in the table below

Table 1: shows the results on the major AYH standards of the AYFHS implemented in within the AYFHS room.

AYFHS service standards/indicators	AYFHS facility; Rate %														
	Arabsa HC			Goro HC			Amoraw HC			Woreda 02 HC			Aggregate		
	3	2	1	3	2	1	3	2	1	3	2	1	3	2	1
When I was in the YFS room, I received a warm welcome from the healthcare provider	60	24	16	100	0	0	93	67	0	100	0	0	88	8	4
I had a comprehensive health service that I needed within the YFS room from one provider	36	48	16	27	47	0	13	60	27	92	4	4	42	35	23
I was provided with a service that respected my privacy and confidentiality	20	28	52	100	0		93	0	7	96	4	0	77	8	15
Peer educators/young people gave me the necessary information and guidance when I came to the YFS room	42	28	28	87	0	13	0	8	93	88	8	4	55	11	35
I was given health information by trained peer educators and young people, and directed to the YFS program from the Community School	60	28	12	93	8	0	87	8	8	76	12	12	79	13	8
when we go to the health facility, there is a clean and comfortable environment	40	48	12	100	0	0	53	47	0	72	20	8	66	29	5
I saw different adolescent and youth health-related posters and messages in the YFS room	56	44	0	100	0	0	60	27	13	72	16	12	72	22	6

Note: The Adolescent and youth clients rated the facilities using green, yellow, and red cards. 3=Green represented agreement with the indicators, 2=Yellow indicated modest agreement, and 1=Red signified disagreement, and the results were compiled for feedback.

The rating findings indicate that AYFHS facilities are generally performing well in welcoming young people and maintaining privacy and confidentiality. However, comprehensive service provision from a single provider remains a key gap. Peer educator support and referral are encouraging, while improvements are still needed in the facility environment and availability of adolescent- and youth-friendly information materials. These findings highlight priority areas for strengthening the quality and accessibility of AYFHS.

Youth Councils compiled the feedback and shared the findings with AYFHS providers, facility leaders, and quality improvement teams. Together, they identified priority gaps and developed practical action plans, which were discussed during Town Hall meetings with adolescents and youth, community representatives, facility leaders, and other stakeholders. This created a transparent space for dialogue, shared accountability, and follow-up.

Providers also conducted a self-assessment using the national AYFHS standards. Comparing provider assessments with adolescent and youth feedback helped facilities identify service gaps, prioritize improvements, and track progress. The process followed the Federal Ministry of Health's CSC Implementation Guideline and Manual and captured experiences from youth, providers, and facility teams to support learning, quality improvement, and future scale-up.

Major Achievement

Integrating the Youth-Led CSC into AYFHS established a practical and participatory quality improvement mechanism that placed adolescents and youth at the center of rating and improving the services intended for them. Rather than serving only as beneficiaries, young people became active partners in monitoring service quality, identifying challenges, and proposing solutions alongside health care providers and facility managers.

The Youth-led CSC created opportunities for adolescents and youth, health care providers, facility leaders, and quality improvement teams to communicate and jointly address identified service gaps. The process was observed to strengthen dialogue and shared accountability and provided a structured mechanism for youth participation in service quality improvement.

The Youth-Led CSC also generated valuable evidence on the implementation of AYFHS standards. By rating the welcoming services, availability of comprehensive care, and protection of privacy and confidentiality, the process helped facilities recognize both good practices and areas requiring improvement. This evidence informed facility action plans and supported more adolescents and youth responsive and client-centred AYFHS service delivery.

Overall, the integration demonstrated that the Youth-led CSC is a feasible and promising approach for strengthening adolescent and youth engagement in AYFHS governance. By linking youth and stakeholder feedback with facility quality improvement processes, the approach supported dialogue, shared accountability, and identification of priority areas for service improvement. However, measurable changes in service quality, satisfaction, or service utilization were not formally assessed; therefore, the findings should be interpreted as implementation experiences.

Lessons Learned

Several factors facilitated implementation of the Youth-led CSC. Early orientation and sensitization of facility leaders, quality improvement teams, AYFHS providers, peer educators, and adolescents and youth created a shared understanding of the CSC process and secured commitment from key actors.

Meaningful adolescents and youth participation was also important; involving adolescents and youth in service rating, feedback sessions, and town hall meetings enabled them to directly communicate their experiences and priorities to providers and facility leaders. Linking the CSC with AYFHS standards and existing quality improvement processes helped translate youth feedback into specific service-improvement priorities and action plans. Empowering adolescents and youth to assess services and participate in identifying solutions transformed them from service beneficiaries into active partners in quality improvement. Their feedback provided valuable insights that complemented routine facility monitoring and informed targeted AYFHS service improvements.

Implementation also highlighted important challenges. Differences in provider responsiveness and service availability across facilities required facility-specific discussions and actions rather than a standardized response. The process therefore needed flexibility to adapt feedback and action plans to each facility's identified gaps. Regular dialogue between youth, providers, facility leadership, and quality improvement teams was necessary to maintain engagement and support follow-up.

The experience also showed that adolescents and youth participation alone is not sufficient. Successful implementation requires supportive facility leadership, committed providers and quality improvement teams, trained youth representatives, opportunities for open dialogue, and regular follow-up of agreed actions.

Implementation of the Youth-led CSC required relatively modest resources, mainly staff and youth orientation, preparation of the scoring tools, time for facility rating and feedback sessions, and facilitation of dialogue and town hall meetings. The process relied largely on existing facility staff, quality improvement teams, youth representatives, and routine facility structures, making it feasible within existing health-system arrangements. No formal cost data were collected during the implementation.

Based on the positive implementation experience and lessons generated through the pilot, the Ministry of Health incorporated the Youth-led CSC into the National Meaningful Adolescent and Youth Engagement Guide and the AYH Strategy 2026–2030, supporting its integration into routine AYFHS. Pathfinder subsequently expanded the approach to 10 additional AYFHS facilities across five regions through the Gates-funded Youth Friendly and Community Approaches to Reach Adolescents and Youth project. Guided by the new AYH Strategy and Meaningful Youth Engagement Guide, the approach will be integrated into routine facility quality-improvement processes, with facility leadership and quality-improvement teams coordinating implementation and following up on youth-identified priorities. Youth councils and peer educators will continue to support service rating, feedback, dialogue, and follow-up, while regular experience-sharing and use of existing facility resources will help sustain the approach.

Expansion of Emergency Surgery and Obstetric Ultrasound Services at Primary Health Care Units

Umer Mudesir[1], Jemal Bedru[1]

[1]Worabe Comprehensive Specialized Hospital, Clinical Governance and Quality Improvement Directorate, Worabe, Silte Zone, Ethiopia

Corresponding author: Dr Kalid Sherefa — ksherefa3465@gmail.com, +251913360809

Introduction

Frequent and avoidable patient referrals from nearby Primary Health Care Units (PHCUs) to Worabe Comprehensive Specialized Hospital (WCSH) resulted from a lack of basic surgical and ultrasound services at the primary care level. This led to increased patient waiting times, delays in receiving critical care, and overwhelmed capacity at the specialized hospital, straining both patient outcomes and hospital resources.

To address this gap, WCSH, in collaboration with the Silte Zone Health Department (SZHD) and PHCU leadership, led a cluster-based initiative to expand emergency surgery and obstetric ultrasound services at four primary hospitals and selected health centers within its catchment area, aiming to strengthen these facilities' capacity to manage surgical and obstetric emergencies locally, reduce unnecessary referrals, and improve access to timely, quality care for the surrounding population.

Methods/Approach

The intervention targeted the following PHCUs — Kibet PH, ALEM GEBEYA PH, Tora PH, Kilto PH, Kawakoto HC, and Lerra HC, Werabe HC, Dalocha HC, and Kerate HC. Operating room theatres (ORTs) were established at Kawakoto and Lerra Health Centers, equipped with anesthesia machines, OR tables, patient monitors, caesarean section sets, and essential drugs. Ultrasound machines were provided to Werabe and Kawakoto Health Centers, and mechanical ventilators were delivered to Kibet and Torra Primary Hospitals to strengthen their intensive care unit (ICU) services. The total value of essential drugs and equipment distributed exceeded 7.2 million ETB.

Three scrub nurses and one anesthesia provider per PHCU were trained at WCSH to staff the new services, supported by continuous mentorship from WCSH general surgeons, obstetricians, and anesthetists. Biomedical engineering teams provided installation and ongoing technical support, and mobile ultrasound teams were deployed to Kerate and Dalocha Health Centers, which experienced high patient flow but lacked on-site ultrasound machines, to extend obstetric ultrasound access further.

Implementation drew on human resources (surgical, obstetric, and anesthesia mentors), medical equipment and supplies, structured training and mentorship support, and financial support exceeding 10 million ETB.

Results/Relevant Change

Following implementation, elective surgical procedures were successfully initiated at supported health centers, and obstetric ultrasound services commenced at multiple sites (Table 1). High-risk obstetric cases were identified and referred early through the expanded ultrasound access, supporting timely maternal care. Maternal care improved, the burden of unnecessary referrals to WCSH was reduced, and the autonomy of PHCUs in managing surgical and obstetric cases increased.

Table 1. Key initiatives and outcomes of the PHCU service expansion

Initiative	Outcome
ORT establishment (Kawakoto, Lerra & dalocha HCs, Kilto PH)	Service initiated at supported HCs
Ultrasound provision (all HCs)	Obstetric ultrasound services commenced
Mobile ultrasound outreach (Kerate, Dalocha)	High-risk obstetric cases identified and referred early
Mechanical ventilators (Kibet, Torra)	Strengthened ICU services
Staff training & mentorship	3 scrub nurses + 1 anesthesia provider trained per PHCU
Investment	>7.2M ETB equipment/drugs; >10M ETB total support

Lessons Learned/Conclusion

Strengthening catchment PHCUs proved to be an effective strategy for reducing unnecessary referrals to the specialized hospital and providing local access to essential surgical and ultrasound services directly improved patient satisfaction and clinical outcomes. Early management of maternal and surgical emergencies at the primary care level reduced complications and lowered overall healthcare costs for both patients and the health system.

Providing basic surgical and ultrasound services at PHCUs improves care, access, and quality. This model reduces referrals, costs, and delays while improving patient outcomes, and represents a replicable approach for strengthening referral networks between specialized hospitals and their catchment primary care facilities.

Recommendations

Hospitals and health systems seeking to reduce avoidable referral burden are encouraged to systematically assess catchment PHCU capacity gaps in surgery, obstetric ultrasound, and critical care equipment before designing an expansion package. Pairing equipment provision with structured staff training and continuous specialist mentorship, as demonstrated through general surgeon, obstetrician, and anesthetist support in this model, is recommended to ensure safe and sustained local service delivery. Institutions should also consider mobile outreach teams (e.g., for ultrasound) to extend access to high need sites and should track referral volume and PHCU service utilization over time to monitor and communicate impact.

From Summit to Action for Evidence Informed Decision Making in Ethiopia

Yibeltal Mekonnen Feyissa[1], Mohammed Aliye[2], Teklemariam Ergat[2], Gobena Godana[2], Abebaw Gebeyehu[2], Gebeyehu Tsega[2], Kassu Ketema Gurmu[3], Bejoy Nambiar[3], Aster Tsegaye[4]

[1]World Health Organization Ethiopia and Policy, Strategy and Research Lead Executive Office, Ministry of Health, Addis Ababa, Ethiopia

[2]Policy, Strategy and Research Lead Executive Office, Ministry of Health, Addis Ababa, Ethiopia

[3]World Health Organization, Addis Ababa, Ethiopia

[4]Policy, Strategy and Research Lead Executive Office, Ministry of Health, and Addis Ababa University, Addis Ababa, Ethiopia

Corresponding author: *Yibeltal Mekonnen Feyissa; yibeltal.feyissa@who.int; +251 985 247 164*

Introduction

Ethiopia has substantial research institutions, routine information systems, universities and program experience, yet evidence has not consistently informed policy, program management, financing and implementation. Fragmented funding, limited rapid synthesis, weak researcher–policymaker linkages, passive repositories and insufficient accountability for evidence uptake remain constraints. Platforms connecting researchers, policymakers and other stakeholders remain limited [1,2].

The Ministry of Health's Policy, Strategy and Research Lead Executive Office (PSR LEO), with its co-host the Ethiopian Academy of Sciences and national institutions and partners, convened the inaugural Evidence-Informed Decision-Making (EIDM) Summit from 23–25 June 2026 at Adwa Museum Hall, Addis Ababa [1]. Its theme, From Evidence to Action: building learning health systems, focused on institutionalizing evidence use. The initiative supports the second Health Sector Development and Investment Plan (HSDIP-II) priorities on governance, health intelligence, research, innovation, knowledge management, resilience, equity and accountability [3].

The Summit aimed to connect evidence generators, decision-makers, implementers, communities and funders; examine evidence-to-action bottlenecks; demonstrate practical methods; and develop a time-bound action portfolio aligned with the 2019 Ethiopian Fiscal Year (EFY) planning cycle and HSDIP-II.

Methods and approach

The program combined pre-conference capability building, political and technical keynotes, four parallel tracks, implementation casebooks, policy dialogues, a funders' roundtable and action synthesis. A pre-conference course used implementation science and Evidence-to-Decision (EtD) methods to help teams convert implementation problems into policy-facing products [1,2]. This deliberate sequence connected priority problems, relevant evidence and decision authority to focused dialogue and planning follow-through.

Technical synthesis drew on the program, speeches, presentations, rapid evidence reviews, rapporteur notes, track reports, dialogue records and action tables. A structured template required each proposed action to identify the decision or commitment, lead owner, co-owners, timeline and evidence of progress [1]. This descriptive account documents processes, immediate outputs and author-reported post-Summit progress at revision; it does not evaluate implementation effectiveness or health outcomes.

Results and relevant change

The Summit framed EIDM as a stewardship and governance function. Opening messages linked evidence use with the revised National Health Policy, HSDIP-II, digital transformation, health security, regulatory maturity, health sovereignty and accountability. Participants emphasized routine evidence requirements, rapid synthesis, implementation research embedded in programs and regional health bureaus, and measurable dialogue follow-up [1].

The four tracks identified the following priorities:

- Track 1 — Preparedness and resilience: link surveillance, genomics, laboratories and universities to rapid decision channels.
- Track 2 — EIDM governance and policy implementation: establish evidence review and sign-off, knowledge-translation and rapid-response functions, regional links and dialogue follow-up, consistent with policy-document standardization [1,4].
- Track 3 — Knowledge management and digital infrastructure: govern repositories and artificial intelligence through metadata standards, interoperability, data quality, ethics, cybersecurity, source traceability and human verification.
- Track 4 — Multisectoral coordination and equity: define institutional roles, shared indicators, community and frontline participation, joint monitoring and feedback [1].

Of two planned high-level policy dialogues, the financing session proceeded as designed. The Emergency and Climate Resilience session was adapted when an unforeseen government meeting prevented most invited presenters and panelists from attending. An expert presentation on population mobility, undocumented migrants, emergency preparedness and climate resilience was followed by discussion, questions and answers, and synthesis. Priorities included incorporating climate and mobility risks into emergency planning; integrating environmental, meteorological, epidemiological and mobility information for early warning; and coordinating health, environment, disaster management, migration, security, research and community actors. These were learning and discussion outputs, not formal policy-dialogue decisions; a technical completion dialogue remained a follow-up action [5].

The financing dialogue proposed defining and costing core EIDM functions, a domestic budget line or sub-budget, resource mapping, partner alignment and a health policy and systems research (HPSR) study before selecting any matched, aligned or pooled financing mechanism. No new fund was agreed [1,6].

The principal operational product was a 12-month Action Pack with proposed owners, timelines and evidence of progress [1]. The Action Pack was subsequently synthesized and endorsed at the Bishoftu workshop, and many of its interventions have been integrated into 2019 EFY planning, supporting HSDIP-II implementation. Priorities include core EIDM functions; investment mapping; decision-ready research priorities; rapid synthesis; a costed implementation research strategy and mentored cycles; repository and data governance; multisectoral demonstration platforms; and evidence-uptake monitoring. Implementation and monitoring remain. Some recommendations await executive leadership decisions; others extend beyond PSR LEO or the Ministry and require follow-up dialogue. The separate high-level interministerial panel did not take place at the Summit and was recorded as a 90-day follow-up action [1]. Table 1 summarizes the practice; Figure 1 distinguishes reported progress from remaining actions

.

Table 1. Summit design and practical routines [1]

Design element	Practical routine
Pre-conference implementation-science course	Convert an implementation problem into an EtD-informed option, brief or action and dialogue plan
Four technical tracks	Connect governance, resilience, digital and equity priorities
Policy dialogue and funders' roundtable	Examine financing options and an HPSR study before any fund decision
Action-synthesis template	Record proposed owners, dates, dependencies and evidence of progress
Controlled proceedings	Separate completed outputs from proposed follow-up

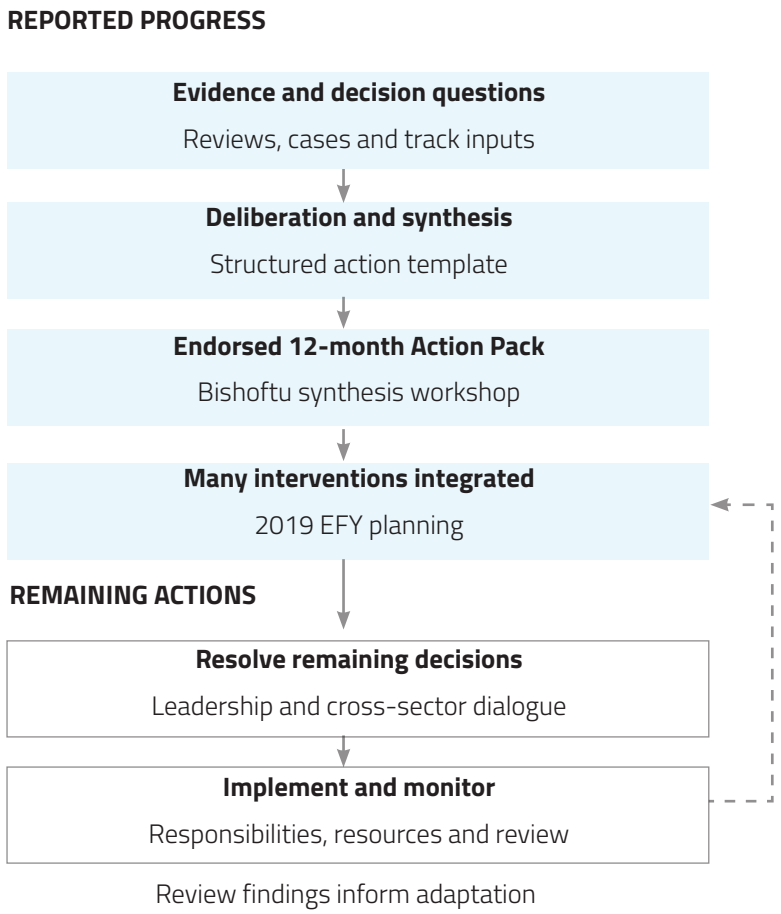


Figure 1. Evidence-to-policy pathway from Summit outputs to post-Summit follow-through. Solid boxes show reported progress; dashed boxes show remaining actions. Arrows indicate sequence and learning.

Lessons learned and conclusion

The central lesson is the deliberate design of convening as an evidence-to-decision process: frame priority problems, bring together actors with evidence, implementation experience and decision authority, structure deliberation, and translate agreed actions into plans. Political sponsorship, co-hosting and technical synthesis enabled this sequence. Bishoftu endorsement and 2019 EFY integration demonstrate early planning follow-through. Flexible facilitation preserved learning when invited speakers were unavailable, while transparent reporting distinguished discussion from decisions. This structured, focused approach is replicable across Ministry programs. Sustained institutionalization, resource efficiency and benefits to communities remain to be demonstrated.

Recommendations for implementation and replication

Implement and monitor interventions integrated into 2019 EFY plans; clarify responsibilities and resources for remaining actions; pursue executive decisions and cross-institutional dialogue where mandates require them; complete the deferred technical dialogue and interministerial panel with decision records; establish regular portfolio review; and publish verified proceedings. Institutions adopting the approach should frame decision questions, assemble relevant evidence and actors, structure deliberation, budget follow-up, secure community and frontline input, and track decisions, financed functions, timely evidence products, implementation-learning cycles, repository governance milestones and policy or practice changes. Future Summits should review delivery against the previous Action Pack before generating new commitments.

References

1. Ministry of Health, Ethiopia. Evidence-Informed Decision-Making Summit Ethiopia 2026: proceedings report and 12-month Action Pack. 15 July 2026. Final draft. Addis Ababa: Ministry of Health; 2026.

2. World Health Organization. Evidence, policy, impact: WHO guide for evidence-informed decision-making. Geneva: WHO; 2022.

3. Ministry of Health, Ethiopia. Second Health Sector Development and Investment Plan, 2019-2021 EFY (2026/27-2028/29). Addis Ababa: Ministry of Health; 2026.

4. Ministry of Health, Ethiopia. Standard Protocol for the Development of Health-Related Policy Documents, Addis Ababa: Ministry of Health; August 2025.

5. Policy Dialogue 2: Emergency and Climate Resilience report. EIDM Summit Ethiopia 2026; 25 June 2026; Addis Ababa. Unpublished session report; 2026.

6. Ministry of Health, Ethiopia. National health research priority agenda and roadmap. Working documents. Addis Ababa: Ministry of Health; 2025–2026.

In-Hospital Production of Infection Prevention and Control Supplies to Ensure Reliable Access

Umer, Mudesir[1], Jemal, Bedru[1]

[1]Worabe Comprehensive Specialized Hospital, IPC Directorate, Clinical Governance and Quality Improvement Directorate, Worabe, Silte Zone, Ethiopia

Corresponding author: Dr Kalid Sherefa, ksherefa3465@gmail.com, +251913360809

Introduction/Background

Infection prevention and control (IPC) is vital to patient safety and quality of care but depends on reliable access to essential detergents and disinfectants. At Worabe Comprehensive Specialized Hospital (WCSH), maintaining this supply proved challenging due to price fluctuations, frequent stock-outs, and logistics constraints. IPC material procurement consumed over ETB 3 million per year, with inflated and fluctuating market prices straining the hospital's operational budget. These budget constraints directly threatened continuity of essential IPC activities, posing a significant risk to patient and staff safety. This practice specifically covers a defined set of locally producible environmental cleaning and hand-hygiene products — alcohol-based hand sanitizer, liquid detergents (formulated separately for toilet/sanitary use and for laundry use), chlorine-based bleach, and an antiseptic surface solution — and does not extend to other IPC commodities such as personal protective equipment (PPE) or sterilization consumables, which continue to be procured through standard hospital and central procurement channels.

To address this vulnerability, WCSH established an in-house production unit for detergents and disinfectants, aiming to ensure uninterrupted IPC supply and reduce stock-outs, reduce annual procurement expenditure, enhance patient safety, improve infection prevention standards, and develop local expertise and infrastructure for sustainable, long-term production that reduces external dependency.

Methods/Approach

The intervention began with a feasibility assessment and planning phase, followed by preparation of a dedicated, well-ventilated production room with adequate water supply and drainage. Equipment and materials required for essential production were procured, and trained staff were assigned to manage day-to-day production.

A Standard Operating Procedure (SOP) was developed to govern production, and small-scale pilot production with quality assurance testing was conducted before scale-up. Full-scale production and ongoing monitoring and evaluation followed, with regular review of output, cost savings, and compliance with IPC standards. Key inputs included raw materials such as surfactants, sodium hypochlorite concentrate, glycerin, fragrances, and distilled water, together with mixing tanks, measuring jugs, stirrers, and PPE labeling materials used by production staff. These inputs support five defined product lines: alcohol-based hand sanitizer, toilet/sanitary detergent, laundry detergent, chlorine-based bleach, and an antiseptic surface solution.

Implementation required an initial setup cost of 572,152 ETB for renovation, equipment, and the first raw material batch, alongside a recurring monthly operating cost of approximately 67,000 ETB for raw materials, labor, and utilities.

Results/Relevant Change

The intervention reduced annual IPC procurement cost from approximately 3,000,000 ETB to 804,000 ETB, yielding net annual savings of 2,096,000 ETB, a reduction of over 70% (Table 1). Stock-outs of key IPC materials were eliminated, guaranteeing uninterrupted supply, while dependency on the external market was significantly reduced. Product quality became more consistent and reliable, IPC compliance improved, and the risk of hospital-acquired infections (HAIs) associated with inconsistent supply availability was reduced.

Table 1. Financial and supply outcomes before and after in-house IPC production

Indicator	Before	After
Annual IPC procurement cost	~3,000,000 ETB	804,000 ETB
Net annual savings	—	2,096,000 ETB (>70%)
Stock-outs of IPC materials	Frequent	Eliminated
Dependency on external market	High	Significantly reduced

Table 2 summarizes annual production output by item. Combined output across the four highest-volume lines reached approximately 49,216 liters per year, alongside ongoing production of alcohol-based hand sanitizer. This scale of output demonstrates that the production model reliably meets hospital-wide demand and has capacity to scale further by increasing batch frequency or mixing-tank capacity without major additional infrastructure

Table 2. Annual production output by item

Item Produced	Category	Annual Volume
Bleach	Chlorine-based disinfectant	21,600 L
Antiseptic solution (locally referred to as "Dettol")	Surface antiseptic	6,016 L
Hand-wash soap	Hand hygiene	7,200 L
Laundry soap	Detergent	14,400 L
Alcohol-based hand sanitizer	Hand hygiene	Produced (volume tracked separately)
Total (four measured lines)	—	49,216 L

Lessons Learned/Conclusion

Strong commitment from hospital management proved essential for securing resources and overcoming implementation barriers, while strict adherence to SOPs and continuous quality checks were paramount to ensuring product efficacy and staff safety. Continuous training and engagement of production staff were vital for maintaining standards and fostering a culture of safety, and identifying backup suppliers for raw materials helped prevent production halts due to shortages.

The establishment of an in-hospital production unit for IPC supplies has proven to be a sustainable, reliable, and cost-efficient approach. This initiative not only secures essential hygiene and disinfectant supplies but also strengthens the hospital's overall infection prevention capacity, qualifying it as a replicable best practice for other facilities facing similar supply constraints.

Recommendations

Hospitals facing similar IPC supply challenges are encouraged to begin with a structured feasibility assessment before investing in production infrastructure. Developing and strictly enforcing SOPs, with built-in pilot testing and quality assurance before scale-up, is recommended to safeguard product efficacy and staff safety. Institutions should secure dedicated production space, trained staff, and identified backup raw-material suppliers, and should embed regular monitoring of output, cost savings, and compliance to sustain gains and inform continuous improvement. This model applies specifically to the locally producible environmental cleaning and hand-hygiene products described above (hand sanitizer, detergents, bleach, and antiseptic solution); it does not extend to other IPC commodities such as PPE or sterilization consumables, which require distinct manufacturing standards and regulatory pathways. Hospitals considering replication should first confirm which specific commodities are safe and feasible for in-house production before scaling.

Making HDSS Online: Real-Time Dashboard for Data Visualization and Field Worker Monitoring at Wonago-HDSS

Natnael Abebe Asrat[1], Habtamu Endashaw Hareru[2]

[1]Dilla University, Wonago Health and Demographic Surveillance System, Dilla, Ethiopia

[2]Dilla University, Wonago Health and Demographic Surveillance System, Dilla, Ethiopia

Corresponding author: Natnael Abebe; nataniumcs9@gmail.com

Introduction and Background

The Wonago Health and Demographic Surveillance System (WHDSS) is situated in the Gedeo Zone, South Ethiopia Regional State, encompassing eight kebeles and 29 sub-villages. Wonago was purposefully selected as a long-term surveillance site due to its unique characteristics: it is one of the most densely populated rural districts in Ethiopia and Sub-Saharan Africa, with densities frequently exceeding 1,000 inhabitants per square kilometer.

According to the 2024/25 baseline survey, the surveillance population includes 38,119 residents across 7,668 households, with 72.3% of households and 71.7% of residents in rural settings. The population is predominantly young, with 37.82% of children under 15 years, and women of reproductive age constitute 52.25% of the female population, underscoring the critical need for targeted maternal, reproductive, and child health programs.

The WHDSS encountered major challenges due to fragmented and manual processes, which restricted data visibility, delayed the identification of discrepancies, and obstructed the delivery of crucial feedback necessary for maintaining data quality.

To tackle these operational issues, a transition to an online platform was initiated with key goals: enabling real-time, centralized tracking of field workers; providing quick and easy access to feedback; and enhancing overall data integrity. This initiative aims to implement a monitoring dashboard that illustrates how evidence-based innovation can improve data quality and increase data vitality, ultimately strengthening decision-making and enhancing HDSS data visibility for greater policy and community impact.

Methods or Approach

The technical team at Wonago HDSS, Dilla University, set out to build a solution from scratch but faced a major hurdle: their MySQL 5.6 database did not support the complex subqueries required for a comprehensive dashboard. Rather than waiting for a costly upgrade, the team adopted a modular view strategy.

All data is stored in a centralized MySQL database on a dedicated server at Dilla University. Since MySQL 5.6 does not allow subqueries in view clauses, we created seven interconnected views to support monitoring and data quality assessment. The team broke the problem into seven distinct views, each serving a specific purpose.

These seven views were joined into a final performance matrix and displayed via a web-based dashboard built with open-source tools, as shown in Figure 1.

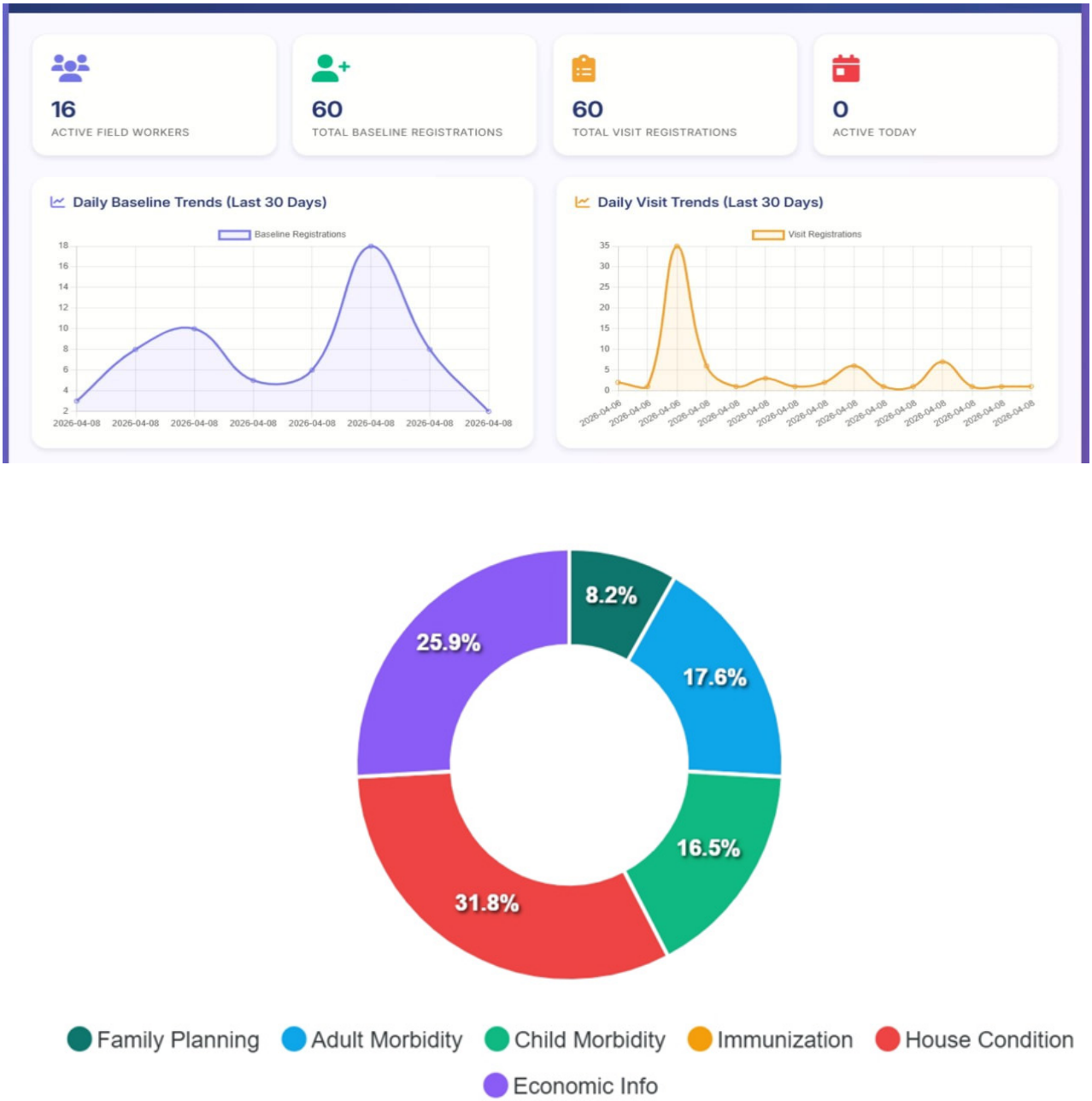


Figure 1 - Wonago HDSS Field Workers Monitoring Dashboard

The dashboard enables real-time data visibility, allowing supervisors to identify discrepancies within minutes, deliver feedback, and strengthen data quality. Key implementers included the technical team at Wonago HDSS, Dilla University, in collaboration with WHDSS field staff and supervisors. The intervention was conducted in the Wonago HDSS catchment area, Gedeo Zone, South Ethiopia, with implementation beginning after installing a dedicated server, deploying OpenHDS, ODK, and MySQL, and relabeling over 7,600 households with barcode IDs.

Results or Relevant Change

The implementation of the dashboard produced immediate, measurable improvements in both data quality and team culture, drastically altering the "before and after" state of the surveillance site.

Quantifiable Impact on Data Quality: The time taken to detect and flag errors dropped from a maximum of 14 days to less than 4 hours, representing a 98.8% reduction in delay. Baseline records missing relationship data dropped from 47 to just 8. Missing parent/family relationships decreased from 12 to 2, an 83% improvement in data quality.

The data manager who had previously struggled with unusable datasets reflected on the change: *"When I opened the dashboard for the first time and saw that number drop... I called my supervisor immediately. I said, 'This is working. This is really working.' We finally had our eyes open."*

Transformation of Supervision Culture: The dashboard moved supervision from a formal, often punitive monthly event to a daily, supportive conversation. One supervisor explained: *"Yesterday, I saw that a field worker had submitted ten forms without completing the parent/family relationship module. I called him within the hour. He had forgotten to scroll down on his tablet. A simple mistake, but without the dashboard, I would have found out two weeks later, after he had already made the same mistake on fifty more households."*

Another supervisor reflected on the broader cultural impact: *"The dashboard has changed the culture of our team. Before, feedback was a monthly event—slow, formal, and often demoralizing. Now, feedback is a daily conversation. It is quick, specific, and constructive. My team trusts me more because I am helping them in real time, not judging them two weeks later."*

Employee Motivation and Incentivized Performance: Unexpectedly, field workers began using the dashboard to track their own progress, turning performance into a source of pride. One worker admitted, "At *first, I was nervous. I thought the dashboard was a tool to punish us. But then I saw that my supervisor was using it to help me... I check my own numbers every evening now. It has become a game. I want to see my name at the top of the list."*

Another data collector offered a closing thought: *"The dashboard showed me that my work matters. My supervisor sees my effort. And when I make a mistake, I know about it the same day. I do not have to wait two weeks to find out I did something wrong. That has made me a better data collector."*

Lessons Learned and Conclusion

Major Lessons from the Intervention: The most important takeaway was the success of the modular view strategy. By working within their existing technical limitations rather than fighting against them, the team built a sophisticated tool for zero licensing cost. The team turned a limitation into an innovation: a modular view approach in MySQL proved effective, enabling full functionality despite system constraints. Automated relationship validation was critical for identifying missing links efficiently. The move from monthly "judging" to daily "helping" built trust between supervisors and field staff, which is essential for long-term site sustainability.

What Did Not Work: Attempts to create a single complex view failed due to database constraints, and the initial dashboard design was overly complex, requiring simplification based on user feedback.

Benefits to the Target Population: The real-time visibility and improved data quality enabled by the dashboard directly benefit the 38,119 residents of the Wonago HDSS catchment area. Accurate, complete, and timely data ensures that maternal, reproductive, and child health programs which are critical given that 37.82% of the population is under 15 years and women of reproductive age constitute 52.25% of the female population are informed by reliable evidence. This allows health planners and policymakers to allocate resources more effectively, identify emerging health trends faster, and target interventions to the communities and households that need them most. Ultimately, better data quality translates into more responsive health programs, improved health outcomes, and more equitable service delivery for the surveillance population.

Why This Is Considered a "Best Practice": The Wonago dashboard is considered a best practice because it achieves digital self-reliance using non-proprietary tools. It addresses a core operational challenge of HDSS sites—timely supervision—without requiring the high costs often associated with technical modernization. As the project team noted, this is exactly what the ImpactHDSS Ethiopia project aspires to build: digital solutions, self-reliance, and standardization. Overall, this approach represents a best practice, as it is proven, scalable, cost-effective, and easily replicable.

Sustainability of the Best Experience: The system is sustainable, using open-source tools with no additional cost, and can be maintained locally.

Recommendations

For HDSS sites and other health programs seeking to replicate this best practice, the following recommendations are offered:

Start with What You Have: Do not wait for a perfect database or expensive software upgrade to improve your quality control.

Modularize Complexity: If a report or dashboard seems too complex, break it into smaller, specific "views" that are easier for your current system to process.

Ensure Mobile Compatibility: Make the dashboard accessible on mobile devices for supervisors and field workers who may not have regular access to desktop computers.

Incentivize Transparency: Allow field staff to see their own performance data. Transparency creates a culture of self-correction and healthy competition rather than fear.

As one of the developers concluded, "We *turned a limitation into an innovation. That is the story of this dashboard. What started as a response to a frustrating constraint became a model for cost-effective, real-time supervision that other sites can adopt today.*"

Predicting eLearning CPD Adoption among Healthcare Professionals in Ethiopia Using a Modified UTAUT-2 Model

Jenberu Mekurianew Kelkay[1]*, Sisay Maru Wubante[2], Deje Sendek Anteneh[2], Kassahun Dessie Gashu[2]

[1]Department of Public Health, Debark University, Debark, Ethiopia.

[2]Department of Health Informatics, University of Gondar, Gondar, Ethiopia

***Corresponding author:** Jenberu Mekurianew, jenberu.uog11@gmail.com, 0919592835

Introduction / Background

Continuing professional development enables healthcare professionals to maintain current knowledge and skills throughout their careers (1). However, traditional CPD programs may be limited by financial costs, geographic inaccessibility, staff shortages, and time constraints (2). eLearning can provide a flexible and scalable alternative that allows professionals to learn without leaving their workplaces (3).

Ethiopia's health-sector and digital-health strategies recognize workforce capacity building as a priority and identify digital platforms as potential mechanisms for expanding CPD (4). Nevertheless, implementation may be affected by healthcare professionals' perceptions of usefulness, ease of use, available infrastructure, enjoyment, established technology habits, and computer literacy.

The UTAUT-2 model explains technology acceptance through performance expectancy, effort expectancy, social influence, facilitating conditions, hedonic motivation, price value, habit, and behavioral intention (5). This study extended the model by including computer literacy and assessed healthcare professionals' intention to use eLearning-based CPD in referral hospitals in the Amhara Region.

Methods

Study design and setting

A hospital-based cross-sectional study was conducted in eight referral hospitals in the Amhara Region, Ethiopia, from 28 March to 28 April 2023. Approximately 6,015 healthcare professionals worked in the participating hospitals.

Participants and sampling

Healthcare professionals who had worked in the hospitals for at least six months and were available during data collection were eligible. The required sample size was calculated using the structural equation modeling rule of ten observations per free parameter. For 96 free parameters, 960 participants were required; after adding 10% for possible non-response, the final target sample was 1,056. Participants were selected using proportional allocation across hospitals and simple random sampling from staff lists.

Operationalization of intention to use eLearning-based CPD

Intention to use eLearning-based CPD was measured using three five-point Likert-scale items (1 = strongly disagree to 5 = strongly agree), yielding a total score of 3–15. The score was dichotomized at the median (10): scores ≥10 indicated intention, while scores <10 indicated no intention.

Data collection and analysis

Data were collected using a structured, self-administered questionnaire adapted from validated UTAUT-2 instruments. Items were measured using five-point Likert scales. The questionnaire was pretested among 5% of the intended sample at Debark General Hospital. Five health informatics professionals collected the data under supervision. The instrument demonstrated acceptable internal consistency, with Cronbach's alpha values above 0.70.

Data were entered using EpiData version 4.6 and analyzed using SPSS version 26 and AMOS version 23. Structural equation modeling was conducted using maximum likelihood estimation, with bootstrapping applied to address potential non-normality. Model fit was assessed using the chi-square-to-degrees-of-freedom ratio, comparative fit index, Tucker–Lewis index, root mean square error of approximation, and standardized root mean square residual. Multi-group analysis was used to assess moderation by gender and age. Ethical approval was obtained from the University of Gondar College of Medicine and Health Sciences (Ref. IPH/2495/2023). Written informed consent was obtained from all participants.

Results

Participant characteristics and intention

Among the 1,056 invited professionals, 976 completed the questionnaire. Most participants were male (57.6%), aged 30–39 years (49.0%), married (45.1%), nurses (28.8%), bachelor's degree holders (81.1%), and earned 10,000 Ethiopian birr or less per month (83.9%). Overall, 506 participants (51.8%; 95% CI: 48.7–55.0) intended to use eLearning-based CPD. The median intention score was 10 (IQR: 7–12) out of 15.

The measurement model demonstrated good reliability and validity. Cronbach's alpha values ranged from 0.827 to 0.976, composite reliability values exceeded 0.70, and average variance extracted values exceeded 0.50. The structural model showed excellent fit: $\chi^2/df = 2.61$, CFI = 0.975, TLI = 0.968, RMSEA = 0.031, and SRMR = 0.026.

Structural model findings

The model explained 68% of the variance in intention to use eLearning-based CPD. Habit was the strongest predictor, followed by performance expectancy, hedonic motivation, computer literacy, facilitating conditions, and effort expectancy (Table 1). Social influence and price value were not statistically significant.

Table 1. Structural model predictors of intention to use eLearning-based CPD

Predictor	Standardized	p-value	Result
Performance expectancy	0.233	0.031	Significant
Effort expectancy	0.082	0.041	Significant
Social influence	0.049	0.207	Not significant
Facilitating conditions	0.102	0.032	Significant
Hedonic motivation	0.199	0.001	Significant
Price value	–0.029	0.369	Not significant
Habit	0.473	<0.001	Significant
Computer literacy	0.116	<0.001	Significant

Gender significantly moderated the habit–intention relationship ($\Delta\chi^2 = 7.606$, $p = 0.033$), with a stronger association among males than females. Age also moderated this relationship ($\Delta\chi^2 = 5.029$, $p = 0.045$), with a stronger association among professionals aged 30 years or older.

Discussion

Only slightly more than half of the healthcare professionals intended to use eLearning-based CPD (51.8%), suggesting that intention to use eLearning-based CPD was not widespread and highlighting a potential implementation gap. The model's explanatory power was strong, accounting for 68% of the variance in intention. Adding computer literacy to UTAUT-2 therefore provided an important contribution to understanding eLearning acceptance in this setting.

Habit was the strongest predictor of intention. This suggests that professionals who regularly use digital technologies may be more willing to adopt eLearning-based CPD (6). The stronger habit effect among male and older professionals may reflect differences in previous technology exposure, workplace roles, or access to digital resources. These differences should be investigated further and considered when designing implementation strategies (7).

Performance expectancy was also an important predictor, indicating that professionals are more likely to intend to use eLearning when they believe it will improve their knowledge, skills, and work performance (8). Effort expectancy and facilitating conditions further demonstrate the importance of simple platforms, adequate internet access, suitable devices, technical support, and protected learning time.

Hedonic motivation was significantly associated with intention, suggesting that engaging and enjoyable learning experiences may improve uptake. Computer literacy was also significant, highlighting the need to strengthen users' confidence and practical digital skills. In contrast, social influence and price value were not significant, possibly because CPD decisions are mainly institutionally determined or because training costs are expected to be covered by employers (9).

Conclusion and recommendations

Intention to use eLearning-based CPD among healthcare professionals in Amhara Region was moderate, with 51.8% reporting an intention to use it. Habit, performance expectancy, hedonic motivation, computer literacy, facilitating conditions, and effort expectancy were significant predictors, while gender and age moderated the habit–intention relationship. Expanding ICT infrastructure, improving platform usability, strengthening computer literacy, and integrating engaging content could support the equitable scale-up of eLearning-based CPD in Ethiopia.

Health institutions and policymakers should:

- Use the findings to inform the design and further evaluation of eLearning-based CPD strategies in Ethiopia.
- Promote regular use of eLearning platforms through routine, continuous CPD activities to strengthen habitual engagement.
- Develop simple, mobile-responsive, and locally relevant learning platforms.
- Improve internet connectivity, access to computers or mobile devices, and technical support in referral hospitals.
- Provide computer literacy and digital-learning orientation before platform deployment.
- Use age- and gender-sensitive implementation strategies, while avoiding assumptions that may reinforce inequalities.

References

1. Liu N, Pu Q. Factors influencing learners' continuance intention toward one-to-one online learning. Interactive Learning Environments. 2023;31(3):1742-63.
2. El-Masri M, Tarhini A. Factors affecting the adoption of e-learning systems in Qatar and USA: Extending the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2). Educational Technology Research and Development. 2017;65(3):743-63.
3. Kanwal F, Rehman M, Asif MM. E-learning adoption and acceptance in Pakistan: moderating effect of gender and experience. Mehran University Research Journal of Engineering & Technology. 2020;39(2):324-41.
4. (FMOH EFMoH. Continuing Professional Development (CPD) Guideline for Health Professionals in Ethiopia. 2019.
5. Venkatesh V, Thong JY, Xu X. Unified theory of acceptance and use of technology: A synthesis and the road ahead. Journal of the association for Information Systems. 2016;17(5):328-76.
6. Mzava K, Kalinga EA. Determinants of nurses' intention to use eLearning in Tanzania. 2017.
7. Venkatesh V, Thong JY, Xu X. Consumer acceptance and use of information technology: extending the unified theory of acceptance and use of technology. MIS quarterly. 2012:157-78.
8. Azizi SM, Roozbahani N, Khatony A. Factors affecting the acceptance of blended learning in medical education: application of UTAUT2 model. BMC medical education. 2020;20:1-9.
9. Ahmed MH, Bogale AD, Tilahun B, Kalayou MH, Klein J, Mengiste SA, et al. Intention to use electronic medical record and its predictors among health care providers at referral hospitals, north-West Ethiopia, 2019: using unified theory of acceptance and use technology 2 (UTAUT2) model. BMC Medical Informatics and Decision Making. 2020;20(1):1-11.

Strengthening Community Cause of Death Data Through Verbal Autopsy: Lessons and Best Practices

Wubetsh Ayenew [1,2*], Yeshitila Worabu[2], Hailu Mio[1], Selam Dergaba[1], Azeb Ataraga[1], Tangut Azeze[1], Beruck Agedew[1,2], Robert Mswia[2], Martin Bratschi [2] Isaac Lyatuu [2]

[1]Ministry of Health, Addis Ababa, Ethiopia

[2]Vital Strategies, Addis Ababa, Ethiopia

Corresponding author: Wubetsh Asnake: wasnake@dataforhealth.org +251910503364

Introduction

Reliable, cause-specific mortality data are the backbone of evidence-based health planning. In Ethiopia, more than 80% of deaths are believed to occur outside health facilities [1] [2], yet until recently the country had no representative system for capturing Community Causes of Death (CCOD). This left health managers and decision makers at woreda, regional, and national level without evidence on the leading causes of death, and on the geographic, age, and sex distribution of deaths occurring in the community, limiting data-driven planning and resource allocation.

Verbal Autopsy (VA), a structured interview with a deceased person's caregiver or relative using a standardized instrument, followed by cause of death assignment and quality review, offers a pragmatic and scalable way to close this gap. Building on this approach, the Ministry of Health introduced a Health Extension Worker (HEW)-led VA data collection system, now implemented in 132 woredas. This article documents the journey of establishing the VA system, with the objective of generating timely, and quality-assured Community Causes of Death data from all regions of Ethiopia, which is accessible for decision-making at woreda, regional, and national level.

Methods / Approach

Phase 1: Feasibility pilot (October 2022 – December 2023)

VA was initiated in 47 Woredas and, a few months later, expanded to include 17 additional districts, for a total of 64 districts. All regions were included except Tigray, which was excluded due to the conflict at the time. Districts were selected to capture both urban and rural areas.

Phase 2: National scale-up (from February 2026)

Building on the evidence from the feasibility pilot, the system was expanded to 132 districts, 12% of all districts nationally, proportionally selected across urban, agrarian, and pastoralist settings. This scale-up decision was informed by community acceptability of VA, and causes-of-death analytics findings from the VA, which gave promising results that could be used for different decision-making if implemented with wider, representative geographical coverage.

Table 1 Regional distribution of VA implementing woredas

S. N	Region	VA districts
1	Tigray	9
2	Afar	3
3	Amhara	20
4	Benishangul Gumuz	3
5	Oromia	36
6	South-West	6
7	Gambela	3
8	Central Ethiopia (SNNPR)	10
9	South Ethiopia	11
10	Sidama	5
11	Somali	5
12	Harari	9
13	Dire Dawa	3
14	Addis Ababa	9
	Total	**132**

The following describes the characteristics of the ongoing implementation of VA:

- Data is collected using the WHO-2016 electronic VA questionnaire, with age-specific modules for neonatal, child, and adult deaths, capturing chronic conditions, signs and symptoms, care-seeking behavior, and the sequence of events leading to death as narrated by the family [3].
- The WHO-2016 VA questionnaire has been translated into six regional languages.
- National guidelines are aligned with WHO recommendations, and standard operating procedures (SOPs) for HEWs' day-to-day VA implementation have been developed and translated into six local languages.
- National guidelines allow VA interviews up to one year after death, although 45 days is recommended to minimize recall bias.
- A Master Training of Trainers was conducted for 84 participants from the national and regional levels, followed by ToT training for 368 participants who came from zonal and woreda administrative levels. Finally, more than 4,000 HEWs have been trained to conduct VA interviews.
- Standardized VA data collection is carried out by HEWs, leveraging their existing trust and reach within the community.
- VA interview data is captured using ODK at the households of the deceased and stored locally on mobile devices. Once HEWs access network coverage, the forms are synchronized to a central database, enabling near real-time monitoring on the live, web-based dashboard.
- A live, web-based dashboard has been developed that ingests VA data as it is collected, enabling near real-time monitoring of implementation progress, probable cause of death, geographic distribution of deaths, age and sex distribution of the deaths, and the quality of collected VA data (see Figure 1).
- The probable causes of death are determined using the computer algorithm called interval 5.
- Dashboard access is tiered across woreda, regional, and national level, so managers at each level can monitor their own catchment area while national stakeholders view the overall picture. The pilot-to-scale-up transition followed a structured process: national guidelines and SOPs, translated into six languages, ensured districts implemented VA using the same protocols documented during the pilot; the cascade Master ToT-to-zonal/woreda-to-HEW training model described above was used to transfer skills from district to district; and the live dashboard was used to monitor whether the implementation quality and data flow observed during the pilot were being replicated as new districts came online.

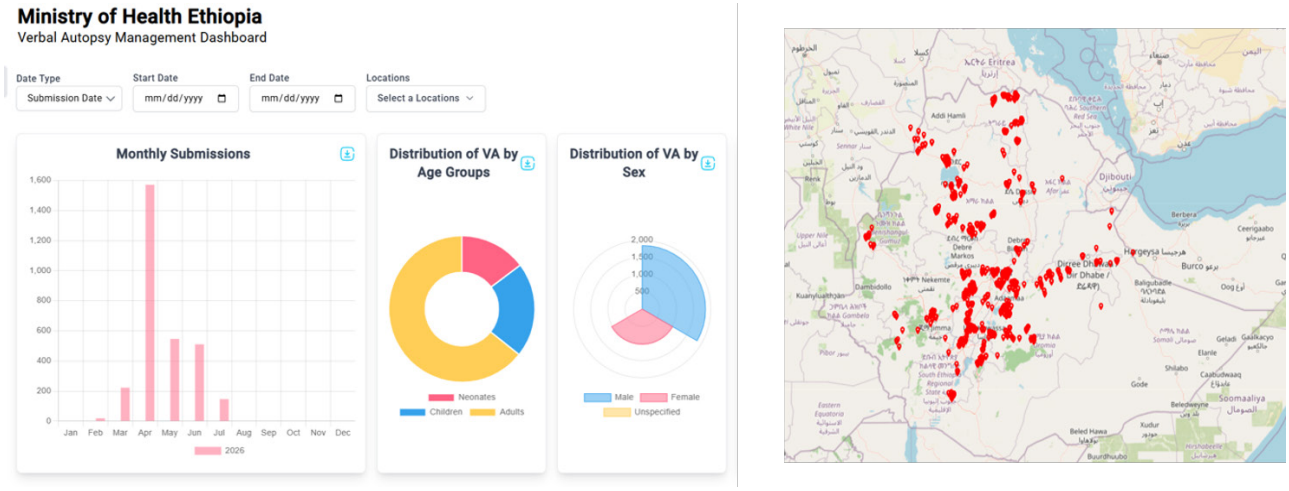


Figure 1. Live dashboard views of the VA-based CCOD system: age and sex distribution of deaths (left) and geographic distribution of deaths (right), as of July 2026.

Results / Relevant Change

As of July 2026, five months since the launch of the VA scale up in February 2026, more than 3,000 deaths have been captured through VA and analyzed and visualized on the live dashboard (Fig 1). This represents one of the first nationally representative, near real-time datasets on community deaths in the country. Because the initiative is still at an early stage, the results below describe implementation output and system establishment; a longer follow-up assessment will be needed to evaluate sustained data quality and downstream use of the evidence for decision-making.

The dashboard enables users at each level to assess overall implementation progress, probable causes of death, the geographic distribution of deaths, age and sex distribution, and the quality of collected VA data turning what was previously invisible community mortality into a routinely monitored, actionable data source for woreda, regional, and national decision-makers alike (Figure 2). Data completeness and quality are also monitored through the dashboard, which tracks indicators such as the proportion of expected household deaths captured relative to kebele-level mortality estimates.

The result of VA from the data collected so far shows that Neonatal deaths are concentrated in just three causes, neonatal pneumonia, neonatal sepsis, and birth asphyxia, which together account for roughly 70% of all neonatal mortality. In contrast, adult mortality is spread more evenly across a mix of non-communicable diseases (cardiac conditions, diabetes, stroke), communicable diseases (TB, HIV/AIDS, malaria, pneumonia), and injuries (road accidents, assault), with cardiac disease as the single largest contributor at just under 9% of all deaths (see Figure 2).

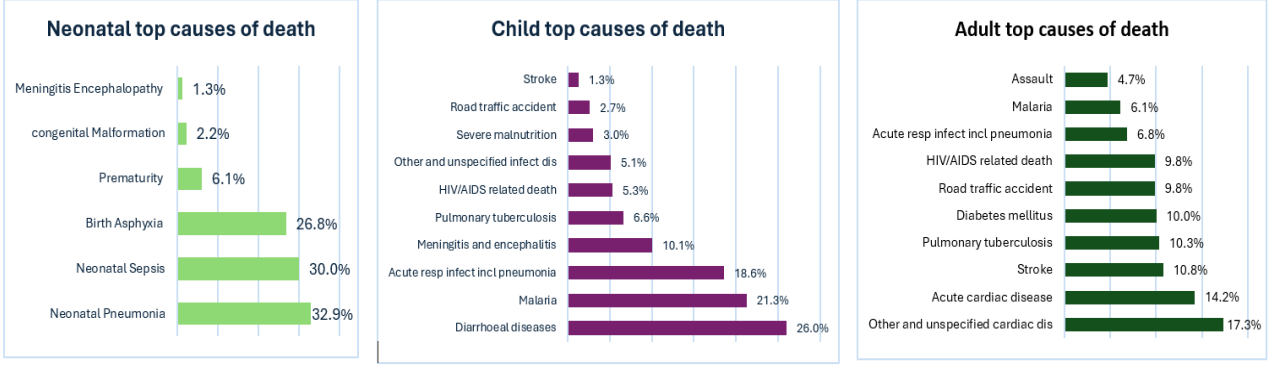


Figure 2. Leading causes of death identified through the VA-based CCOD system, by age group as of July 2026.

Lessons Learned / Conclusion

Emerging lessons (five months into rollout): using the existing HEW cadre for VA data collection, rather than a new dedicated workforce, allowed rapid scale-up to 132 districts within months of launch. Building the analytic dashboard alongside data collection, rather than as an afterthought, meant that implementation quality and probable causes of death could be monitored almost as soon as data started flowing in, rather than waiting for periodic manual reports. Connectivity problems have been among the challenges encountered during rollout.

Even at this early stage, the initiative is benefiting the target population by making community deaths, which account for more than 80% of all deaths nationally, visible in national data for the first time through a sample covering urban, agrarian, and pastoralist settings. It is emerging as a best practice because it closes a long-standing data gap using an existing, affordable government platform, the HEW program, and a live dashboard that managers at woreda, regional, and national levels can use, without creating a parallel data system.

Sustainability and local ownership: VA implementation is being integrated as part of the routine Health Management Information System (HMIS) within the Ministry of Health, across all health administrative units. To help manage HEW workload, annual expected mortality has been estimated for each kebele, averaging about 30 deaths per kebele per year. With two HEWs typically assigned per kebele, each HEW conducts around 15 VA interviews annually. Key barriers encountered to date include unreliable network connectivity in some pastoralist and remote areas, which delays data synchronization, and competing demands on HEW time given their broader primary health care responsibilities; ongoing mitigations include periodic supportive supervision and troubleshooting of synchronization issues at the woreda level. Community structures, including kebele administrations and religious and community leaders, were engaged during VA orientation and sensitization activities in each new district, building on HEWs' existing trust within their communities to support the acceptability of VA interviews among bereaved families.

Recommendations

The following are recommendations for the further scale-up of VA in Ethiopia and for other countries aiming to use similar approaches to gain an increased understanding of the causes of death for community deaths:

- Digitize VA tools from the outset to reduce transcription burden and speed up data availability.
- Invest in initial training and regular refresher supervision for interviewers, with direct feedback on data quality.
- Use a hybrid computer-coded and physician-reviewed approach to cause of death assignment to balance speed and accuracy.
- Strengthen linkages between community death notification and VA through trusted local leaders.
- Build simple data-quality dashboards to support real-time monitoring and course correction.
- Secure early ownership and budget commitment from local health authorities to support sustainability beyond project funding. This scale-up has depended on an evolving partnership across levels of the health system: the Ministry of Health sets national guidelines and quality standards, regional health bureaus coordinate training and supervision, and woreda and kebele administrations, together with HEWs, execute VA data collection and community engagement. Sustaining and clarifying these roles, particularly as VA moves fully into routine HMIS, will be important to the feasibility of further scale-up.

References

[1] C. AbouZahr, D. de Savigny and L. Mikkelsen, "Civil registration and vital statistics: progress in the data revolution," 2015.

[2] W. H. Organization., Global Civil Registration and Vital Statistics: Scaling up Investment..

[3] W. H. Organization, "Verbal Autopsy Standards: The 2016 WHO Verbal Autopsy Instrument," 2016.

Innovation Journey from Field testing to National Guidelines: Institutionalizing the Combined Community–Facility Quality Improvement in Ethiopia's Primary Health Care

Kiflemariam Tsegaye[1*], Mikiyas Teferi[2], Agumasie Semahegn[2], Hillina Tadesse[3], Shegaw Mulu[1,2], Nebreed Fesseha[3], Addis Girma[2], Kassahun Semie[3], Yenegeta Walelign[2], Biruk Bogale[3], Israel Ataro[1], Helina Worku[2], Dessalew Emaway[3&], Mesele Damte[2&], Aklog Getinet[1], Wondossen Nigatu[1]

[1] Ministry of Health, Community Engagement and Primary Health care Lead Executive Office, Addis Ababa, Ethiopia

[2] Amref Health Africa in Ethiopia, Addis Ababa, Ethiopia

[3] JSI Research & Training Institute, Inc., Addis Ababa, Ethiopia

[&]Lead the implementation CCFQ project in partnership

* **Corresponding author**: Kiflemariam Tsegaye, kiflemariam.tsegaye@moh.gov.et

Background

Ethiopia has expanded access to Primary Health Care (PHC) through its three-tier health system. The Health Sector Development and Investment Plan 2023/24-2025/26 places strong emphasis on quality and equity, highlighting them as central pillars for improving health service delivery and ensuring fair access to care [1,2]. However, poor-quality care, in addition to inadequate access, continues to be a major contributor to preventable mortality and erosion of public trust in the health system [3]. Documented disrespectful treatment during childbirth can also suppress demand for facility-based maternity care [4]. Although conventional facility-driven quality improvement (QI) initiatives can enhance clinical processes, they have generally provided communities with limited structured opportunities to participate in identifying and resolving quality gaps, even though service utilization is strongly shaped by distance, mobility, transport availability, cultural beliefs, and family decision-making dynamics [5,6].

Translating promising innovations into sustainable national programs requires government leadership, adaptation through implementation learning, and integration into routine systems [7]. This best practice document presents Ethiopia's experience in piloting and scaling up the Combined Community-Facility Quality Improvement (CCFQI) Initiative through an iterative learning process. With technical support from the Improve Primary Health Care Service Delivery (IPHCSD) Project, implemented by Amref Health Africa and JSI, the initiative evolved from local testing and adaptation to national institutionalization, demonstrating a practical pathway for scaling quality improvement interventions within the health system.

Methodology

This best practice is documented as a case study of iterative, adaptive, and practice-based implementation, supported by embedded quantitative program evaluation evidence. It synthesizes findings from co-design workshop reports, seven documented PHCU quality improvement projects, implementation records, and an independent Difference-in-Differences (DiD) evaluation comparing 21 project-supported woredas with 21 comparison woredas [8-12]. Building on the evidence, lessons learned, and implementation experience generated through this process, the Combined Community-Facility Quality Improvement (CCFQI) Implementation Guideline was developed, endorsed, and subsequently implemented across multiple regions of Ethiopia.

Approach

CCFQI is implemented through facility- and kebele-level Community Quality Improvement (CQI) teams operating as an integrated, collaborative learning and quality improvement system. Within each woreda's Network of Care (NOC), health center QI teams work closely with kebele CQI teams comprising approximately 12 members, including Health Extension Workers (HEWs), kebele leaders, teachers, representatives of women and youth groups, religious leaders, Village Health Leaders, and members of the Women Development Union who possess strong knowledge of local health issues [8].

The teams follow a structured five-step improvement cycle that is typically completed within 12 to 15 months. The cycle includes: (1) establishing governance structures; (2) jointly assessing and prioritizing quality gaps; (3) co-designing an improvement project around a shared SMART aim; (4) testing change ideas through Plan-Do-Study-Act (PDSA) cycles; and (5) jointly evaluating results, standardizing successful practices, and repeating the cycle. Standardized quality improvement tools used throughout the process include prioritization matrices, fishbone diagrams, 5-Whys analysis, driver diagrams, outcome, process, and balancing measures, as well as a common documentation template [8].

Results

Implementation and Contextual Adaptation

Implementation was phased and adaptive: orientation, co-design workshops, QI project launch, coached PDSA testing, and collaborative review. In one woreda, a three-day co-design workshop convened HEWs, nurses, midwives, health officers, religious leaders, and managers from kebele to zonal level; each PHCU left with a launched QI project and dated action plan [9].

Across seven documented QI projects, structured prioritization placed the eighth antenatal contact (ANC8) first. Teams set aims from documented baselines of 12–72% toward targets of 50–95%. Root causes included late ANC initiation, beliefs that care is needed only when ill, distance and mobility, flooding, and weak referral linkage. Change ideas were locally adapted, including pregnant women's conferences, religious-leader engagement in pastoralist settings, and boat transportation across floodwaters in riverine kebeles. Balancing measures considered the time and cost of community gatherings [9,11].

Quality Improvement and Service Outcomes

Community participation progressed from attendance toward shared decision-making: kebele teams reviewed performance monthly, owned change ideas, and engaged woreda administrations through community platforms [9,11].

At population level, the independent DiD evaluation of 21 project-supported versus 21 comparison woredas (October 2022–March 2026) reported favorable point estimates for five indicators, with the largest reported gain in early postnatal care within seven days [10]. These estimates reflect the broader project-supported implementation environment; the available source does not support attribution of the population-level changes exclusively to CCFQI.

Table 1. Difference-in-differences results, 21 project-supported versus 21 comparison woredas, October 2022–March 2026

Indicator	Baseline	Endline	Estimated DiD effect
Outpatient attendance per capita	0.86	1.46	+0.18 visits
Immediate postpartum contraceptive acceptance	10%	24%	+4.6 pp
ANC 4th-visit coverage	56%	85%	+5.8 pp
Skilled birth attendance	37%	63%	+4.3 pp
Early postnatal care within 7 days	71%	93%	+11.6 pp

Note. pp = percentage points.

Institutionalization of CCFQI into National health system

A major achievement of the program was the translation of field-based learning into the CCFQI Implementation Guideline, which was developed and endorsed in October 2024 [8]. Building on this experience, the Ministry of Health led the development of the national Primary Health Care Unit (PHCU) Quality Improvement Implementation Guideline, issued in April 2026, which formally recognized the contribution of the IPHCSD project to the design, testing, and institutionalization of quality improvement approaches within Ethiopia's primary health care system [12].

Limitations

- The source brief reports point estimates but does not provide information on confidence intervals, statistical significance, model specification, baseline comparability, or parallel-trends diagnostics; therefore, the findings should be interpreted as project-associated effects rather than causal effects attributable solely to the CCFQI approach. Furthermore, because CCFQI was implemented as part of the broader IPHCSD intervention package, observed population-level changes may also reflect the influence of concurrent project activities and contextual factors.
- Implementation fidelity may have varied across PHCUs and between pastoralist and agrarian contexts, limiting assumptions of uniform exposure.

Lessons Learned

CCFQI demonstrates that communities can effectively co-produce quality improvements when empowered with clear roles, structured improvement methods, practical QI tools, and opportunities to co-design locally relevant solutions. Its long-term sustainability and institutionalization depend on government stewardship and the integration of CCFQI functions into routine health system planning, budgeting, supervision, workforce development, performance management, and accountability mechanisms.

Call for Action

Priority actions are needed to integrate CCFQI functions into routine planning, capacity building, supervision, budgeting, and performance review processes at all levels of the health system. In addition, scale-up efforts should be accompanied by systematic documentation of CCFQI implementation processes, outputs, outcomes, and impacts to support continuous learning, accountability, and evidence-based decision-making [7,10].

References

1. Federal Ministry of Health, Ethiopia. National Healthcare Quality and Safety Strategy 2021–2025. Addis Ababa: Ministry of Health; 2021.

2. Federal Ministry of Health, Ethiopia. Health Sector Development and Investment Plan (HSDIP) 2023/24–2025/26. Addis Ababa: Ministry of Health; 2023.

3. Kruk ME, Gage AD, Arsenault C, et al. High-quality health systems in the Sustainable Development Goals era: time for a revolution. Lancet Glob Health. 2018;6(11):e1196–e1252.

4. Kassa ZY, Husen S. Disrespectful and abusive behavior during childbirth and maternity care in Ethiopia: a systematic review and meta-analysis. BMC Res Notes. 2019;12(1):83.

5. World Health Organization. WHO Community Engagement Framework for Quality, People-Centered and Resilient Health Services (WHO/HIS/SDS/2017.15). Geneva: WHO; 2017.

6. World Health Organization, OECD, World Bank. Delivering Quality Health Services: A Global Imperative for Universal Health Coverage. Geneva: WHO; 2018.

7. World Health Organization, ExpandNet. Practical Guidance for Scaling Up Health Service Innovations. Geneva: WHO; 2009.

8. Amref Health Africa, JSI. Combined Community–Facility Quality Improvement (CCFQI) Implementation Guide. Addis Ababa: IPHCSD Project; 2024.

9. Amref Health Africa, IPHCSD Project. CCFQI Co-designing Workshop Report (pastoralist implementation woreda). Internal program report; March 2024.

10. IPHCSD Project (Amref Health Africa, JSI). MNCNH Investment Performance Update: Difference-in-Differences Analysis of 21 Project-Supported versus 21 Comparison Woredas, October 2022–March 2026. Programme evaluation brief; 2026.

11. IPHCSD Project. Facility CCFQI Project Documentation (seven PHCU project presentations) and Standardized CFCQI Project Documentation Template. Programme records; 2024.

12. Federal Ministry of Health, Ethiopia. Primary Health Care Unit Quality Improvement Implementation Guideline. Addis Ababa: Ministry of Health; April 2026.

Blended Learning as a Solution for Scaling Health Workforce Capacity in Primary Healthcare Settings of Ethiopia

Robel Tezera[1], Bezawit Mesfin[1], Dessalew Emaway[1]

[1] JSI Research & Training Institute, Inc, Addis Ababa, Ethiopia

Corresponding author: Robel Tezera, robel.tezera@jsi.org

Background

Ethiopia faces persistent challenges in delivering quality in-service training to healthcare providers, particularly in remote, underserved, and geographically diverse regions. Traditional face-to-face training approaches are costly, disruptive to service delivery, and often inaccessible to providers working in pastoralist and hard-to-reach areas (1, 2, 3, 4,5). These challenges contribute to uneven competency levels and service quality in reproductive, maternal, newborn, and child health (RMNCH) services.

To address these barriers, the Ministry of Health and implementing partners introduced a blended learning model that combines self-paced digital learning with competency-based face-to-face practical sessions. The initiative aimed to strengthen provider competence while expanding access to training across agrarian and pastoralist settings. This article describes the design and implementation of the blended learning model and reflects on its feasibility and scalability for strengthening healthcare provider competencies across diverse geographic settings in Ethiopia.

Methods/Approach

To strengthen the competencies of healthcare providers, JSI, in collaboration with the Ministry of Health (MOH), developed and implemented a blended learning program that integrates self-paced online learning with facilitated face-to-face practical training. The initiative began with a comprehensive landscape assessment to examine Ethiopia's digital learning ecosystem, identify priority in-service RMNCH training needs, and review existing MOH digital and hybrid learning initiatives.

A structured co-design approach guided curriculum development, including storyboard design, eLearning script preparation, multimedia production, and the development of complementary face-to-face training materials. The resulting competency-based blended curriculum was aligned with the MOH Continuing Professional Development (CPD) framework and designed for national scale-up through 15 public CPD centers. The program has been implemented across 50 woredas in eight agrarian and pastoral regions of Ethiopia.

To promote sustainability, modules are co-developed with the Ministry of Health and relevant stakeholders and approved as CPD programs. eLearning is implemented through the national CPD eLearning platform, while face-to-face sessions are delivered through accredited public CPD centers, with certification integrated into iHRIS. More than 270 professionals have been trained on the blended-learning implementation model and technical support systems, while 27 professionals from the MoH, public CPD centers, and professional associations have been trained in blended-learning design and development, strengthening local instructional design capacity for quality and scalable implementation.

Preliminary Results

More than 10,080 healthcare providers enrolled in blended learning courses across the 50 participating woredas, with over 81% completing the eLearning component. Because the self-paced eLearning could be completed alongside routine duties, providers in remote and pastoralist settings were able to take part in continuing professional development without the extended absence from service delivery required by traditional face-to-face training.

Lesson Learned and Conclusion

Successful scale-up was enabled by embedding the blended learning model within existing Ministry of Health systems, including the national Learning Management System, iHRIS, and established CPD centers, rather than creating parallel structures. Because the model runs through these existing platforms, the Ministry of Health is positioned to continue leading, maintaining, and expanding implementation with limited need for ongoing external support, which is a key condition for scale-up beyond the life of the project. The flexibility of combining self-paced digital learning with practical face-to-face sessions also reduced service disruption while supporting competency-based learning, and extended access to continuing professional development for healthcare providers in remote, underserved, and pastoralist communities who face the greatest geographic and logistical barriers to traditional training.

Blended learning is a feasible and scalable digital health solution for strengthening health workforce competency across Ethiopia's primary healthcare settings. Because the model is embedded within national systems rather than run in parallel, it offers a practical pathway for the Ministry of Health to sustain and expand access to quality in-service training and to support RMNCH service delivery at scale. Rigorous evaluation of provider performance, unit training costs, and downstream health outcomes will be important next steps to confirm the effectiveness and cost-efficiency of the blended approach relative to traditional face-to-face training.

References

1. Annan RA, Aduku LNE, Kyei-Boateng S, Yuen HM, Pickup T, Pulman A, et al. Implementing effective eLearning for scaling up global capacity building: findings from the malnutrition elearning course evaluation in Ghana. Global Health Action. 2020;13(1):1831794. doi: 10.1080/16549716.2020.1831794.

2. Bluestone J, Johnson P, Fullerton J, Carr C, Alderman J, BonTempo J. Effective in-service training design and delivery: evidence from an integrative literature review. Hum Resour Health. 2013;11:51. doi: 10.1186/1478-4491-11-51.

3. Rowe AK, Rowe SY, Peters DH, Holloway KA, Chalker J, Ross-Degnan D. Effectiveness of strategies to improve health-care provider practices in low-income and middle-income countries: a systematic review. Lancet Glob Health. 2018;6(11):e1163-e75. doi: 10.1016/s2214-109x(18)30398-x.

4. Kibret AG, Belete WM, Hanlon C, Ataro I, Tsegaye K, Tadesse Z, et al. Ethiopian primary healthcare clinical guidelines 5 years on-processes and lessons learnt from scaling up a primary healthcare initiative. BMJ Glob Health. 2024;9(Suppl 3). doi: 10.1136/bmjgh-2023-013817.

5. Frehywot S, Vovides Y, Talib Z, Mikhail N, Ross H, Wohltjen H, et al. E-learning in medical education in resource constrained low- and middle-income countries. Hum Resour Health. 2013;11:4. doi: 10.1186/1478-4491-11-4.

Making EMR and eCHIS Adoption Work: Practical Lessons from Ethiopia

Tezera Berheto[1], Birhan Abtew[2], Henock Taddese[2], Alice Witt[3], Kidest Getu[1], Selamawit Hirpa[1], Kathryn Forbes[2], Birhanu Taye[4], Mesoud Mohammed[4], Maria-Gloria Basáñez[2], Jane Hirst[3], Roy Anderson[2]

[1] Ethiopia Data Analytics and Modelling Project, Addis Ababa, Ethiopia

[2] Imperial College London, London, United Kingdom

[3] The George Institute for Global Health, Imperial College London, London, United Kingdom

[4] Strategic Affairs Executive Office, Ministry of Health, Addis Ababa, Ethiopia

Corresponding author: Tezera Berheto; moshagot1@gmail.com; +251 901 214 643

Background

Ethiopia has expanded electronic medical records (EMRs) in health facilities and the electronic Community Health Information System (eCHIS) at the health-post level. These platforms can strengthen record retrieval, coordination, household follow-up, surveillance, and planning, but their value depends on whether clinicians, health extension workers (HEWs), managers, and support teams can use them safely and efficiently in routine work.

The 2026 Ethiopia Data Analytics and Modelling (EDAM) mapping found comparatively strong EMR and eCHIS assets but uneven adoption. Mature EMR departments connected registration, triage, laboratory, pharmacy, and payment; HEWs reported that eCHIS improved visibility of missed appointments, vaccination defaulters, expected deliveries, and follow-up. Parallel paper, infrastructure interruptions, shared devices, variable training, fragmented platforms, and weak referral exchange still constrained use. These are transition-maturity problems, not evidence that frontline workers reject digital health.

This lessons-learned article presents a practical adoption package for preventing faltering implementation. It focuses on pre-deployment preparation and a time-bound paper-to-digital transition intended to reduce provider burden and improve continuity of care, directly supporting HSDIP priorities in digital health, primary health care, service quality, and health information use (Ministry of Health, 2021). The package is an operational synthesis of observed practice rather than an evaluated intervention, and the transition thresholds proposed here are indicative starting points for local calibration.

Methods or Approach

The practice was reconstructed from the 2026 EDAM mixed-methods assessment, which mapped 50 health-data assets and included 15 formal key-informant interviews with national analysts, clinicians, EMR and health-informatics personnel, HEWs, supervisors, and public-health staff. Evidence was synthesized thematically, comparing stronger and faltering facility and community workflows.

The analysis examined implementation mechanisms rather than vendor performance. Community experience was represented through HEW accounts; households were not interviewed directly. The six-element package combines observed practices, lessons from faltering implementation, and relevant guidance; it was not implemented or evaluated as one intervention. The findings are therefore operational lessons, not causal or before-and-after effect estimates.

The package covers workflow and documentation-burden assessment; minimum data sets, roles, and authoritative records; phased rollout; role-specific onboarding and mentorship; resilient infrastructure and downtime procedures; and feedback, identifiers, and exchange aligned with national architecture. Resources include devices, backup power, connectivity, local support, protected mentorship time, supervision transport, maintenance financing, and funded handover.

The EDAM assessment operated under the applicable administrative approvals of the Ministry of Health and the Ethiopian Public Health Institute. Participants gave informed consent, and interview material was anonymized.

Result or Relevant Change

1. **Useful systems replaced identifiable manual tasks.**

   In stronger EMR departments, patients became visible to receiving services without a paper intermediary, while clinical, laboratory, pharmacy, and payment functions were more connected. In eCHIS, HEWs retrieved due and overdue follow-up without searching multiple family folders. The practical change was faster access to information needed for the next care action.

2. **More consistent use followed defined workflows rather than platform-wide installation.**

   More consistent use was observed where teams mapped current and desired workflows, removed duplicate steps, assigned field ownership, agreed the minimum data set, tested interfaces with users, and prepared local support before scale-up. WHO guidance similarly places requirements gathering, workflow mapping, data dictionaries, decision logic, and health-worker participation before point-of-service implementation (World Health Organization, 2024). Digitizing an unexamined paper process can preserve or multiply unnecessary work.

3. **A controlled hybrid protected care; an unmanaged hybrid institutionalized duplication.**

   Premature paper withdrawal can interrupt care during outages or before users are competent. Indefinite paper-electronic duplication increases documentation time, creates conflicting records, and normalizes delayed entry. The findings support a time-bound hybrid with one authoritative record, paper limited to specified safety, legal, or downtime functions, monitored concordance and workload, and explicit retirement gates.

Table 1. Replicable preparation, adoption, and paper-transition gates for EMR and eCHIS

Pillar	Required action	Lead responsibility
Workflow optimization	Map the actual workflow and documentation time; remove redundant forms; define the minimum data set, field ownership, identifiers, indicators, legal requirements, and the authoritative record.	Facility leadership, end users, and health-information team
Configure and test	Co-design with users; test usability, validation, offline operation, privacy, referral data, downtime recovery, devices, power, network, and support.	Facility implementation team, end users, vendor, and RHB
Embedded coaching	Pair role-specific onboarding with routine on-site mentorship, rapid troubleshooting, refresher support, and feedback on errors and completeness.	Facility leadership and RHB, with vendor support
Resilient operations	Provide adequate devices, offline functionality, auto-save, backup power, connectivity, local maintenance, and transport for community supervision and verification.	Facility and RHB; Ministry and partners for standards and financing
Retire and scale	Stop routine duplicate forms only after uptime, competence, concordance, support, downtime recovery, and continuity criteria are met; retain a minimal downtime pack. Indicative gates, to be locally calibrated and sustained across three consecutive months: system uptime ≥95% of scheduled service hours; ≥90% concordance between the electronic record and the retained paper source on a monthly reconciliation sample; ≥90% of role-holders certified against role-specific onboarding; local troubleshooting response within one working day; a downtime procedure tested at least once, with all downtime records back-entered within 48 hours; and no unresolved continuity or safety incident attributable to the transition.	Facility leadership, with RHB or Ministry approval where required
Architecture alignment	Use FHIR-conformant exchange specifications and align with the national facility registry, patient-identity strategy, terminology standards, minimum referral data set, and DHIS2 exchange requirements.	Ministry of Health, with RHBs, vendors, and architecture stewards

4. Embedded support converted training into routine competence.

One-off training did not resolve unfamiliar interfaces, slow typing, indicator changes, or device and network failures. Adoption was more stable when role-specific onboarding was followed by on-site coaching, rapid troubleshooting, refresher support, and feedback. For eCHIS, supervision, transport, connectivity, realistic catchments, and adequate devices were integral because data quality depends on household visits and event verification.

5. Interoperability and feedback increased the perceived value of data entry.

Standards such as Fast Healthcare Interoperability Resources (FHIR), ICD classifications, and shared identifiers supported exchange only when procurement, configuration, governance, and workflows were aligned. African evidence similarly identifies fragmented infrastructure, limited technical capacity, and weak regulatory implementation as persistent barriers (Kamuhanda et al., 2026). Participants described greater willingness to use systems consistently when data supported histories, referrals, reduced repetition, and service feedback.

Lessons Learned

A recurrent cause of faltering implementation was transition without adequate workflow, infrastructure, support, and paper-retirement preparation. Paper may be needed temporarily for safety, legal continuity, or downtime, but it should not become a permanent second production system. Programs should simplify work before digitization and measure whether documentation time and repeated tasks decline.

The package is relevant and designed for replication because it is vendor-neutral and uses staged readiness rather than installation counts. It is best presented as a lessons-learned practice: EDAM identified plausible operational benefits and recurring mechanisms but did not prospectively measure effectiveness, efficiency, patient outcomes, or cost. Reviews confirm that organizational, governance, infrastructure, ownership, and sustainability barriers are as consequential as software design (Bostan et al., 2024).

A further limitation concerns whose experience the package reflects. Community perspectives were obtained from HEWs rather than from households. Provider accounts are informative about workload and workflow, but they cannot establish how digitization affects household experience, consent, privacy expectations, or trust — particularly where devices are shared between workers or where catchments are mobile or pastoralist. Future evaluations should interview patients, caregivers, and household representatives directly, and should report community-level acceptability and privacy findings alongside provider-reported measures.

Successful adoption should be judged by safer and easier work, continuity of care, referral closure, reduced duplication, data quality, and user benefit—not by installations. Prospective implementation should test whether the package reduces provider burden and improves service and data-quality outcomes.

Recommendations for Replication

- Require a pre-deployment dossier covering redesigned workflow, baseline documentation burden, minimum data set, staffing, infrastructure, privacy, maintenance, financing, handover, downtime, and paper-retirement responsibilities.
- Use a time-bound hybrid with one authoritative record, limited safety paper, a fixed review date, sample reconciliation, and explicit retirement gates. Avoid both premature paper withdrawal and indefinite duplicate entry.
- Implement by high-value pathway or department, correct defects, and expand only after reliable service continuity and acceptable provider burden.
- Fund mentorship, local technical support, power and network resilience, offline functionality, supervision transport, and two-way referral feedback as recurrent operating costs.
- Embed digital health operating costs in subnational recurrent budgets. Regional health bureau and woreda health offices should cost the annual operating envelope per facility — maintenance and repair, mentorship and supervision time, connectivity and airtime, backup power, device replacement on a defined depreciation cycle, and supervision transport — and enter it as a standing line in the woreda-based annual health plan rather than as a project or capital item. Where deployment is donor-financed, agree a dated handover with declining co-financing and a government commitment to absorb the recurrent line before the grant closes, and link disbursement to readiness and data-quality indicators so the allocation is protected from in-year reallocation.
- Include clinicians, HEWs, patients, caregivers, and household representatives in usability, privacy, referral, and communication design, particularly for eCHIS.
- Monitor correct use, documentation time, duplicate steps, downtime, record concordance, unresolved referrals, repeated investigations, user experience, and selected care-quality indicators; pause or redesign deployment when digital work does not ease care delivery.
- Align EMR and eCHIS with national facility and patient identifiers, referral and terminology standards, DHIS2 exchange, and governed access. Scale through iterative exploration, adaptation, and learning rather than one-time installation targets (World Health Organization, 2026).

Bridging Gaps in Industrial Parks: Best Practices for Enhancing Sexual and Reproductive Health among Young Workers in Ethiopia

Teshager Mersha, Abebe Kassa, Worknesh Kereta and Firehiyaw Birhanu

Corresponding authors: Teshager.mersha@pathfinder.org

Background

Ethiopia's Ten-Year Development Plan places industrialization at the center of national economic transformation. As manufacturing industries expand rapidly, more young people are entering industrial employment. While this growth presents vital economic opportunities, it also introduces critical public health challenges. Many young workers migrate from rural communities, leaving behind family support systems, and face demanding production schedules. Compounding these pressures, many possess limited knowledge of sexual and reproductive health (SRH), encounter social stigma when seeking services, and struggle to visit conventional health facilities during standard operating hours. Traditional, facility-based service delivery models consistently fail to meet these unique needs.

Despite the increasing concentration of adolescents and youth in Ethiopia's industrial workforce, access to quality, youth-friendly SRH services remains inadequate. Limited workplace health services, insufficient SRH knowledge, stigma, and weak linkages between workplaces and nearby public health facilities create significant barriers to service utilization. As a result, many young workers remain at increased risk of unintended pregnancy, sexually transmitted infections, and other adverse reproductive health outcomes, highlighting the need for innovative, workplace-based service delivery models that are both accessible and responsive to their needs. Recognizing these gaps, the Ministry of Health (MOH) prioritized strengthening workplace health services by developing a Minimum Service Package (MSP) alongside standards for Adolescent and Youth Health in Workplaces. This initiative—targeting industrial parks and large commercial enterprises—aims to deliver essential on-site health, nutrition, and psychosocial support. It stands as one of three flagship programs under the Family Planning (RH/FP) and Adolescent & Youth Health (AYH) agenda, alongside the IUCD expansion and the Smart Start initiative. Despite its strategic importance, implementing the workplace MSP has proven challenging. Operational complexities and a limited evidence base have constrained its effectiveness, making it difficult to generate actionable insights for future scale-up.

To address these realities, Pathfinder International partnered with the MOH, the Oromia and Amhara regional health bureaus, industrial park management, and local public health facilities to launch an innovative initiative in the Adama and Bahir Dar Special Economic Zones. Supported by the Gates Foundation under the *Youth Friendly Services and Community Approaches to Reach Adolescents and Youth Project*, this implementation research aimed to determine whether adapting both health services and workplace systems could improve access to youth-friendly SRH services without compromising industrial productivity. Specifically, the initiative evaluated the feasibility, acceptability, and effectiveness of integrated demand- and supply-side interventions while documenting operational lessons to guide future scale-up.

Intervention Approach

The intervention recognized that improving health service utilization requires more than increasing awareness—it requires redesigning services around the realities of young workers' lives.

Building Strong Partnerships

Implementation began with extensive stakeholder engagement. Partnerships were established with industrial park management, regional health bureaus, investment bureaus, labor offices, city administrations, and nearby public health facilities. Early engagement created institutional ownership, secured workplace access, and ensured that health promotion activities aligned with work schedules rather than competing with them. SRH education was also incorporated into employee induction programs, enabling new workers to receive health information immediately upon joining the workforce.

Strengthening Capacity

Health providers from workplace clinics and nearby public health facilities received specialized training in adolescent and youth-friendly health services. In total, ten providers were trained in Bahir Dar and eight in Adama.

At the same time, thirty-three peer educators (13 in Bahir Dar and 20 in Adama) were recruited and trained to become trusted sources of information within the workplace.

Recognizing the operational realities of industrial work, the standard five-day peer educator curriculum was redesigned into a practical three-day program without compromising essential competencies.

Bringing Information Closer to Young Workers

Rather than relying solely on one, the intervention adopted multiple communication channels. Peer educators facilitated weekly discussions with workers, supported by moderated Telegram groups that enabled continuous learning beyond working hours. Factory announcement systems, workplace buses, and targeted edutainment campaigns were used to disseminate culturally appropriate messages. Outreach teams also mapped residential areas where workers lived and organized evening home visits, community discussions, and periodic open-house events that linked workers with nearby health facilities.

Making Services More Accessible

On the supply side, health facilities adjusted service delivery to fit workers' schedules by providing early morning, evening, and weekend services. Mobile outreach teams delivered services directly within industrial parks and nearby residential communities.

The intervention also strengthened confidential counselling and referral systems by promoting Ethiopia's toll-free 952 SRH hotline while improving providers' capacity to deliver youth-friendly counselling, family planning, STI management, and gender-sensitive care.

Early Results

Early implementation findings demonstrate encouraging progress in both the Amhara and Oromia regions, highlighting how flexible, workplace-based approaches successfully expand the reach of sexual and reproductive health (SRH) information and services to young industrial workers.

In the Amhara region's Bahir Dar Special Economy Zone, outreach activities engaged a total of 472 participants—comprising 186 through facility health-worker channels and 286 through peer educators. This group was predominantly young adults aged 20 to 24 (462 participants) alongside 10 adolescents aged 15 to 19, and included 266 young women, 206 young men, and one person with a disability. The initiative successfully onboarded 429 new participants and welcomed 43 repeat participants, with 454 workers receiving individual counselling and crucial information on the national toll-free 952 hotline. Clinical services in Bahir Dar reached 28 participants, including 16 who received contraceptives, 7 who received condoms, and 21 who completed HIV counselling, testing, and referral, alongside 11 psychosocial support referrals and 20 social and behavior change communication materials through the outreach services.

Meanwhile, in the Oromia region's Adama Special Economy Zone, comprehensive health education activities generated approximately 1,500 participant contacts distributed evenly across 10 vital topics—such as puberty, menstrual hygiene, family planning, HIV/STI prevention, gender-based violence, healthy relationships, HPV immunisation, mental health, and hotline promotion, each logging 150 participant contacts. Furthermore, individual information and counselling in Adama reached 150 workers, HIV counselling, testing, and referral services reached 95 clients, and family planning uptake was supported through the provision of various contraceptive types.

Although implementation was still in its early stages, these regional findings confirm that integrating on-site education, peer-led networks, and flexible clinical pathways significantly enhances young workers' access to vital SRH services.

Lessons Learned

The implementation generated several important lessons that are relevant for programs working with adolescents and young workers.

1. Leadership and institutional ownership are critical.

Early engagement with industrial park leadership, regional health bureaus, and factory managers-built trust, facilitated access, and ensured program activities aligned with production schedules. Institutional commitment proved essential for successful implementation.

2. Health programs must adapt to workplace realities.

Traditional health programs designed around standard clinic hours do not adequately serve industrial workers. Flexible service hours, mobile outreach, and workplace-based education substantially reduced access barriers.

3. Peer educators are trusted agents of change.

Young workers were more willing to seek information and discuss sensitive SRH issues with trained peers who understood their daily experiences. Peer-led approaches also allowed health messages to be delivered without interrupting factory operations.

4. Multiple communication channels incérasse engagement.

Combining face-to-face discussions with Telegram groups, workplace announcements, and community outreach created repeated opportunities for workers to receive accurate information through channels they trusted.

5. Coordination between workplaces and health facilities improves service utilization.

Close collaboration between factory management, workplace clinics, and nearby public health facilities strengthened referral pathways and improved continuity of care.

6. Education alone is not sufficient.

One of the strongest lessons from the initiative is that increasing knowledge does not automatically lead to service utilization. Workers were much more likely to use services when education was combined with confidential, convenient, and accessible service delivery. Flexible clinic hours, workplace outreach, and on-site counselling were far more effective than awareness campaigns delivered in isolation.

7. Continuous adaptation improves implementation.

Regular communication with human resource departments and production managers allowed program activities to respond to changing factory schedules and operational realities, maintaining implementation without disrupting production.

Recommendations for Scale-Up

The experience from Adama and Bahir Dar offers practical recommendations for expanding youth-friendly SRH services across Ethiopia's industrial parks.

- Institutionalize partnerships between industrial park management and public health facilities.
- Integrate SRH orientation into employee induction programs.
- Expand peer educator networks across industrial parks.
- Scale up flexible clinic hours, mobile outreach, and workplace service delivery.
- Strengthen digital engagement platforms and expand promotion of the national 952 hotline.
- Establish workplace health committees and coordinators to sustain health promotion activities.
- Invest in continuous monitoring, learning, and adaptation to ensure interventions remain responsive to workers' evolving needs.

Ultimately, this experience demonstrates that improving the sexual and reproductive health of young industrial workers requires more than providing information—it requires bringing services closer to where young people live and work, designing interventions around their realities, and fostering strong partnerships between workplaces and the health system. These lessons provide a practical roadmap for building healthier workplaces while supporting Ethiopia's broader industrial and economic development goals.

Health Extension Program Optimization: Implementation Lessons, Challenges, and Future Direction

Kasahun Sime[1], Yehualaw Getahun[2], Wondesen Nigatu[2], Chala Tesfaye[3], Israel Ataro Otoro[2]

1JSI and Ministry of Health, Addis Ababa, Ethiopia

[2]Community Engagement and Primary Health Care Lead, Executive Office, Ministry of Health, Addis Ababa, Ethiopia

[3]JSI Ethiopia, Addis Ababa

Corresponding author: Kasahun Sime; kassahun.sime@moh.gov.et; +251 911724854

Background

Since its inception, the Ethiopian Health Extension Program (HEP) has been a core component of the Primary Health Care Unit (PHCU). Since 2003, the program has made preventive, promotive, and curative services more accessible to residents of agrarian Ethiopia; since 2006, to pastoralist communities; and since 2009, to the urban population. Over the years, the program has grown to encompass 18 essential health service packages, with a workforce of more than 45,000 health extension workers (HEWs) working from more than 15,000 health posts (HPs).

Ethiopia introduced a HEP optimization roadmap in 2020 to guide all HEP programming in the country for the next 15 years. The roadmap has outlined key strategic objectives to address systemic challenges based on a systematic assessment. These areas include stratifying HPs into three categories, redefining health service packages, changing the professional mix, rethinking community engagement strategies, using innovative methods to ensure sustained financing, and ensuring HEP resilience to maintain essential service delivery during public health emergencies.

Statement of the problem and the rationale

Despite historical gains, access to basic primary care across Ethiopia remained uneven, marked by severe regional disparities, poor infrastructure, and gaps in rural, urban, and pastoralist service delivery. Frontline HEWs faced burnout, low retention, supply chain failures, and unbudgeted workloads. Additionally, the health system remained over-reliant on external donor financing and vulnerable to natural disasters, conflict, and administrative disruptions. The HEP Optimization roadmap was designed to address these operational constraints, improve service quality and equity, and build a resilient, domestically funded primary healthcare architecture.

Methods/Approach:

To sustain strong political commitment at all government levels, structured advocacy on the HEP optimization strategy was conducted at federal, regional, and woreda levels. Key normative and operational documents were developed, including implementation guidelines, improved HEP service packages, and health post reform directives, and structured orientation and training programs were delivered to health staff across all system levels.

The implementation of the HEP optimization interventions was organized as key strategic initiatives. First, service delivery was restructured by categorizing health posts into (1) health posts providing integrated HEP services in health centers and primary hospitals by establishing HEP units, (2) Basic Health Posts (BHPs), (3) Comprehensive Health Posts (CHPs) based on the distance from the supervising health center or primary hospital. Workforce capacity and service quality were enhanced by deploying clinical nurses to BHPs to improve the skill mix, staffing CHPs with multi-cadre teams, updating service packages, and expanding digitization through the electronic Community Health Information System (eCHIS). Sustainability was promoted through financing and advocacy measures that prioritized budgets for PHC, expanded Community-Based Health Insurance (CBHI), and introduced user fees at CHPs. Furthermore, community engagement models were tailored to the needs of agrarian, pastoralist, urban, and mobile populations by deploying Village Health Leaders (VHLs) as local links between communities and health services. HEP resilience and governance were strengthened by formulating the Community Public Health Emergency Management (c-PHEM) framework and introducing the Health Posts Reform Implementation Guideline (HPRIG).

To gather and organize this evidence, we conducted desk and scoping reviews, held learning visits and team consultations, and analyzed supervision data alongside partner and government reports.

Result/Relevant Change:

HEPO Phase I produced measurable gains in service utilization, service package delivery, community engagement, and health system integration. National outpatient department visits per capita increased from 0.9 in 2020 to 2.08 in 2025, exceeding the target of 2.0. Similarly, the proportion of Essential Health Service Package interventions delivered through HEP increased from 29.5% to 44%, surpassing the 35% target. These changes indicate that the optimization effort contributed to expanded frontline access to essential maternal, child, preventive, and selected curative health services.

The program also strengthened structural integration within the primary health care system. By 2025, 82% of health centers and Primary Hospitals had established functional HEP units, and clinical nurses had been deployed to more than 1,700 basic health posts. This improved the linkage between health posts and health centers, expanded the scope of services available closer to communities, and contributed to improved service quality and staff satisfaction.

Community engagement was another major achievement. The redesigned community engagement model reached more than 400 woredas and mobilized over 65,000 Village Health Leaders to support demand creation, referral linkage, local accountability, and community trust. Domestic resource mobilization also showed strong momentum, with more than 13 billion ETB mobilized over five years from diversified sources, including 2.2 billion ETB from non-government sources and 800 million ETB from community contributions. However, implementation progress was uneven. Infrastructure expansion fell substantially below target: only 366 comprehensive health posts became functional, representing 20.8% of the planned target, while only 131 optimized basic health posts were achieved, about 3% of the target. Slow construction, limited water and power supply, and inadequate utility readiness constrained the translation of the optimized model into fully functional service delivery platforms.

Operational readiness also remained a limiting factor. Health post-level OPD share reached 31.9%, below the 40% target, while about 52% of essential tracer equipment remained unavailable. eCHIS adoption reached 50%, but inconsistent electricity, weak connectivity, and limited routine use of data for decision-making constrained its effectiveness. Service gains were also stronger in urban and more accessible areas, while pastoralist and underserved regions such as Somali and Afar continued to lag.

Lessons Learned

The evidence from Phase I shows that HEPO can improve primary health care performance when political ownership, local accountability, and community structures are aligned. However, the results also show that service expansion cannot be sustained without infrastructure, supplies, utilities, predictable financing, and context-specific implementation models.

What Worked

- Political commitment and accountability: integration of HEPO into regional performance frameworks and the Oromia experience, including the motto "One Comprehensive Health Post in a Woreda," helped mobilize lower administrative structures and maintain implementation focus.
- Community leadership: reaching 400+ woredas and deploying 65,000+ VHLs strengthened demand creation, referrals, social accountability, and public trust in the PHC platform.
- Domestic resource mobilization: mobilization of more than 13 billion ETB showed that local resources can complement government and partner financing when advocacy and leadership engagement are strong.
- Service integration: establishment of HEP units in 82% of health centers and deployment of clinical nurses to 1,700+ BHPs improved linkage between health posts and health centers, supporting expanded service availability and quality.

What Did Not Work

- Infrastructure expansion did not progress as planned: with only 20.8% of planned CHPs and 3% of optimized BHPs achieved, construction delays and lack of water and power constrained implementation.
- Equity gaps persisted: gains were concentrated in urban and accessible areas, while pastoralist and underserved regions remained behind, indicating that uniform implementation is inadequate for diverse geographic and livelihood contexts.
- Operational readiness remained weak: health post OPD share fell below target, tracer equipment gaps remained large, and eCHIS expansion was limited by electricity, connectivity, and low routine data use.
- Sustainability mechanisms were insufficient: earmarked HEP budgets were not fully established, donor dependence continued, and VHL turnover and burnout reflected weak incentive, recognition, and tenure arrangements.

Conclusion

HEPO Phase I established a foundation for stronger PHC by improving service utilization, expanding the HEP service package contribution, strengthening community engagement, and integrating HPs. Nevertheless, the program did not fully achieve its infrastructure, readiness, equity, and sustainability ambitions. Phase II should therefore focus on revisiting areas that remain insufficient and on the rapid scale-up of successful interventions through sustained financing and leadership support.

Recommendations

- Document and rapidly scale successful practices in political accountability, community engagement, domestic resource mobilization, and HEP units.
- Accelerate HPs infrastructure expansion with dedicated financing, construction follow-up, and minimum utility readiness standards for water, power, and connectivity.
- Adopt differentiated implementation packages for agrarian, pastoralist, urban, remote, and conflict-affected settings, with explicit equity indicators for underserved areas.
- Strengthen health post readiness by ensuring tracer equipment, essential supplies, nursing support, referral linkages, and routine use of eCHIS data.
- Institutionalize sustainable financing through earmarked HEP budget lines and strengthen VHL retention through clear roles, realistic expectations, recognition, incentives, and defined tenure.

References

1. Ministry of Health: A roadmap for optimizing the health extension program 2020-2035, Addis Ababa, Ethiopia

2. Ministry of Health: The Health Extension Program Optimization Roadmap (2020-2025): First phase implementation review report, Addis Ababa

3. Ministry of Health: Joint learning visit report in regions with better performance of the HEP Optimization initiatives, Addis Ababa

4. Tesfaye C, Bogale B, Semahegn A, Tiruneh GT, Girma A, Daniel R, Geleta KS, Belete M, Zemichael NF, Altaye DE, Ayehu T. (2026) Health extension program unit for optimizing access to quality health care service in Ethiopia: a case study. Primary HealthCare Research & Development 27(e30): 1–7.

Glycemic Control among Children and Young Adults with Type 1 Diabetes: Following Enrollment into PEN-Plus Clinics

Besufekad Mulugeta[3*], Natnael Abebe[2], Hiwot Solomon[1], Selamwit Ayele[1], Addisu Worku[1], Fassil Shiferaw[1] Wondu Bekele[3], Zelalem Mengistu[3], Betelehem Dires[3], Temesgen Seleshi[3], Elias Hussien[3], Bezanesh Melese[3], Abebe Sharew[3], Tolosa Tolcha[3].

[1]Ministry of Health, Addis Ababa, Ethiopia

[2]*NCDI Poverty Network, Center for Integration Science Division of Global Health Equity, Brigham and Women's Hospital, USA*

[3]*Mathiwos Wondu Foundation, Addis Ababa, Ethiopia*

Corresponding author: Besufekad Mulugeta*, besufekadm@mathiwos.org , +251 913 62 53 19

Introduction

Type 1 diabetes mellitus (T1DM) continues to be a major global health burden, with increasing prevalence and associated healthcare costs. Globally, an estimated 9.5 million people are living with T1DM in 2025, an increase of 1.1 million people (13 %) since the previous estimate of 8.4 million in 2021. Globally, if the mortality of people with T1DM matched that of the general population in their country, the number of people living with T1DM in 2025 would be 13.9 million (46 % higher) [1]. T1D is the most common form of diabetes in children and adolescents, accounting for >90% of childhood diabetes in most westernized countries. Worldwide, T1D is also one of the commonest chronic diseases of childhood. In 2021, there were an estimated 108,300 children and adolescents aged less than 15 years newly diagnosed with T1DM, and 651,700 children and adolescents living with the condition worldwide [2]. In lower-income countries (lower-middle and low-income countries), prevalent cases increased by 20 % from 1.8 million in 2021 to 2.1 million in 2025 [3]. The national NCDs STEPS survey 2024 indicated that the prevalence of diabetes in Ethiopia is 4.2%. An estimated 2.3 million adults living are with diabetes, with projections indicating an increase to 6 million by 2050. In Ethiopia, the estimated prevalence of T1DM among children and adolescents of 0–19 years old is 2.4 per 100,000 per year according to International Diabetes Federation (IDF) 2021 report [4]. Glycated hemoglobin (HbA1c) is widely recognized as the gold standard for assessing long-term glycemic control in individuals with diabetes, reflecting average blood glucose levels over the preceding 2 to 3 months. Achieving and maintaining target HbA1c levels is a cornerstone of diabetes management, as robust evidence demonstrates a strong correlation between HbA1c and the risk of diabetes-related complications. According to the recommendations of the American Diabetes Association (ADA) and the International Society for Pediatric and Adolescent Diabetes (ISPAD), children and adolescents who have access to comprehensive diabetes care should aim to achieve a target of HbA1c <7.0%. However, a higher HbA1c target (<7.5%) is appropriate in settings where there is lack of access to analog insulin and continuous glucose monitoring [5, 6, 7]. PEN-Plus is an integrated strategy based on the World Health Organization's (WHO) Package of Essential Non-communicable Disease Interventions (WHO PEN). It aims to improve the quality of services, including early diagnosis, protocol-based treatment, monitoring and management of complications, follow-up, and referral for severe chronic Non-Communicable Diseases (NCDs) at primary referral facilities, such as district hospitals in resource-poor settings by empowering mid-level providers. Ethiopia endorsed PEN-Plus in 2022 during the WHO AFRO conference in Lome, Togo. It contributes to reducing premature mortality from severe NCDs by providing integrated care and services among Africa's poorest children and young adults [8].

Statement of the Problem and Rationale

In many low and middle-income countries, chronic care services for less common & more severe NCDs are only available at referral hospitals; making treatment both inaccessible and unaffordable for those resides in the rural and underserved community that is far from the specialized care. As a result, many poor children and young adults left untreated for severe conditions like T1DM that almost always lead to premature death. In resource-limited settings, Type 1 Diabetes care often fails not just because of missing supplies, but because health providers lack specialized skills, and families lack the structured support needed to manage a complex, daily condition. Evidence from Southwest Ethiopia highlights a profound gap in pediatric diabetes management, where 76.6% of young patients exhibit poor glycemic control, with a mean HbA1c of 9.67 ± 2.28%, which is higher than the recommended target < 7.5%. More than half of the caregivers (56.3%) had poor level of diabetes knowledge, and this shows that many caregivers may have difficulty in managing their children's diabetes. Studies in Sudan similarly reported a 76% rate of poor control, and other studies revealed the mean HbA1c levels reached 9.6 ± 2.4% across Ethiopia, 9.2 ± 2.5% in Cameroon, 10.5% in Southeast Niger, and 11.1 ± 2.1% in Tanzania. This is alarming because children and adolescents with poor glycemic control are at risk of multiple complications of diabetes [7, 9, 10, 11, and 12].

The core aim of the PEN-Plus strategy for T1DM is to decentralize specialized, life-saving care from tertiary hospitals to primary hospitals. The PEN-Plus initiative addresses critical health system and human resource gaps by implementing an integrated educational and task-sharing framework. PEN-Plus bridges this provider gap by up skilling mid-level health workers (nurses and health officers) through structured curricula and continuous specialist mentorship, enabling decentralized, high-quality care. Furthermore, it addresses caregiver knowledge deficits by embedding structured Diabetes Self-Management Education and peer support networks into routine care, empowering families and caregivers with the essential skill required for effective, home-based glycemic control. This assessment aims to determine the glycemic control status of individuals with T1DM enrolled in PEN-Plus clinics and receiving ongoing care at PEN-Plus implementing primary hospitals in rural Ethiopia at Addis Zemen Primary Hospital (AZPH) and Muketuri Primary Hospital (MTPH).

Methods or Approach

The implementation started in 2022 at Addis Zemen and Muketuri primary hospitals found in Amhara and Oromia regions respectively by Mathiwos Wondu Foundation/MWF, in collaboration with Ministry of Health, Regional Health Bureau, and other key stakeholders through the support from NCDI Poverty Network. For Type 1 Diabetes, the package delivers: (i) training for mid-level clinicians to provide comprehensive T1D care; (ii) guaranteed access to essential medicines and diagnostics (insulin, home glucometers with strips, and HbA1c testing); (iii) structured Diabetes Self-Management Education for patients and caregivers during routine follow-ups; and (iv) clinical mentorship Additionally, the PEN-Plus in implementation was guided by a protocol-based management and integrates the packages of peer and psychosocial support into the PEN-Plus clinic addressing the young and financially constrained people affected by the disease.

Statistical Analysis

A descriptive analysis was conducted using retrospectively collected data from the PEN-Plus implementation sites. Data were collected by REDCap for 175 children and young adults (age <30 years) with Type 1 diabetes enrolled in the PEN-Plus program from January 1, 2023, to December 31, 2024. Participants were included if they had an initial HbA1c measurement obtained within 3 months of enrollment, at least one follow-up visit, had been on treatment for at least 3 months, and had a most recent HbA1c measurement obtained within the final 3 months of the data collection period.

Data were entered, cleaned, and analyzed using R statistical software (version 4.4.3).

Result and Relevant Change

From the age data of 175 Children and Young Adults with T1DM at PEN-Plus, the mean age of the participants were 18.8 years with minimum and maximum age of 2 and 30 years old respectively. More than half 110 (62.9%) of the study participants were males (**Table 1**).

Table 1 Sex and Age Distribution of T1DM Patients Enrolled in PEN-Plus Clinic (n, %).

Age Group	Sex		
	Female	Male	Total
Children (≤ 5)	7 (4%)	3 (1.7%)	10 (5.7%)
Children (6-12)	10 (5.7%)	13 (7.5%)	23 (13.1%)
Adolescents (13-17)	14 (8%)	23 (13.1%)	37 (21.2%)
Adults (18-30)	34 (19.4%)	71 (40.6)	105 (60%)
Total	65 (37.1%)	110 (62.9%)	175 (100%)

Age			
Mean	Min.	Max.	Stdev.
18.8	2	30	7.28

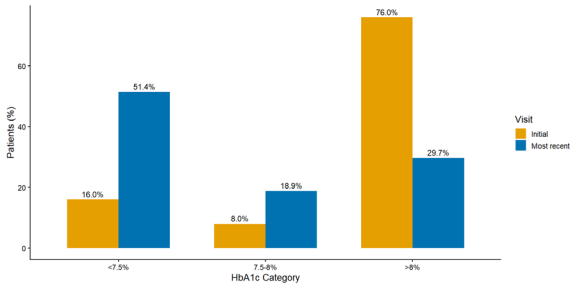


Figure 1 Change in HbA1c value at initial and most recent.

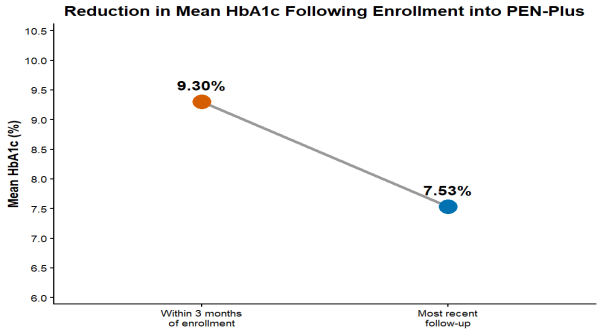


Figure 2 Change in the Mean value of HbA1c at initial and most recent visit.

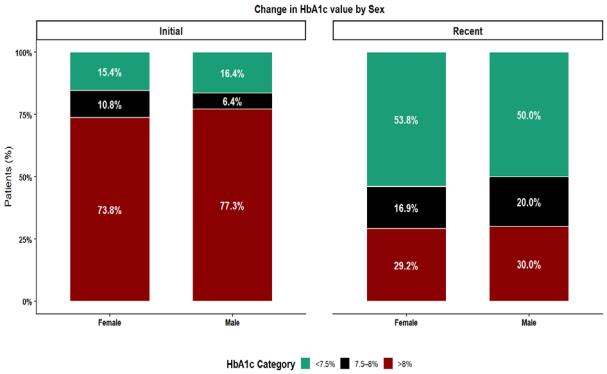


Figure 3 Change in HbA1c by Sex of patients.

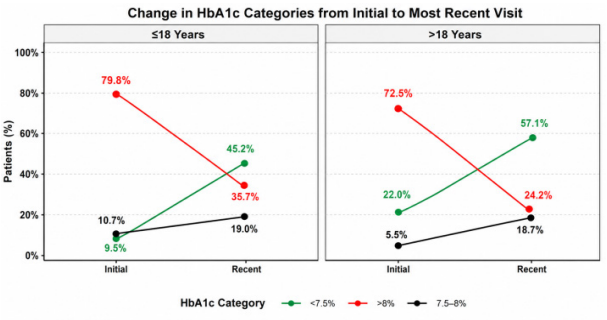


Figure 4 Change in HbA1c value by age group.

Regarding the level of HbA1c; the mean of HbA1c was 9.3% measured at initial and 7.53% measured at most recent follow up visit. Within 3 months of initial visit about 76% of the patients were having poor glycemic control (>8%) and this decreased to 29.7% at most recent visit (Figure 1 & 2).

Patients with high HbA1c levels (>8%) fell from 73.8% to 29.2% in females and 77.3% to 30% in males, while a good HbA1c levels (< 7.5%) rose to over 50% for both sexes (Figure 3).

By age group: patients aged > 18 years achieved higher control rates (57.1% vs. 45.2%) and lower poor control rates (24.2% vs. 35.7%) at their recent visit compared to those aged ≤18 years, indicating that while both demographics improved, adult patients achieved slightly better overall glycemic outcomes (Figure 4).

Lessons Learned

The PEN-Plus model demonstrated that decentralizing integrated T1DM care to primary hospitals can improve access, reduce barriers to care, and contribute to improved glycemic control, as reflected by better HbA1c outcomes. By bringing diagnosis, treatment, and access to essential medicines closer to communities, the model reduced the need for patients to travel long distances to tertiary-level hospitals for life-saving diabetes care. In conclusion, PEN-Plus is sustained through the leadership of Ministry of Health and Regional Health Bureaus with close partnership created and active involvement of Mentors by integrating with existing health structure and improve access to quality care. It is a best practice due to its decentralized and integrated model with proven outcomes.

Recommendations

We recommend strengthening and expanding the implementation of the PEN-Plus program to improve access to comprehensive diabetes care at rural primary hospitals. Efforts should focus on ensuring the sustainability of the program through continuous capacity building of healthcare providers, strengthening patient education and adherence counseling, and promoting the active involvement of caregivers in diabetes management. Self-monitoring of blood glucose (SMBG) should be integrated into routine care.

Reference

1. G.A. Gregory, T.I.G. Robinson, S.E. Linklater, F. Wang, S. Colagiuri, C. de Beaufort, et al. Global incidence, prevalence, and mortality of type 1 diabetes in 2021 with projection to 2040: a modelling study Lancet Diabetes Endocrinol, 10 (10) (2022), pp. 741-760
2. I. Libman, A. Haynes, S. Lyons, P. Pradeep, E. Rwagasor, J.Y. Tung, et al. ISPAD Clinical Practice Consensus Guidelines 2022: Definition, epidemiology, and classification of diabetes in children and adolescents Pediatr Diabetes, 23 (8) (2022), pp. 1160-1174
3. Ogle, G. D., Wang, F., Haynes, A., Gregory, G. A., King, T. W., Deng, K., ... & Maniam, J. (2025). Global type 1 diabetes prevalence, incidence, and mortality estimates 2025: Results from the International diabetes Federation Atlas, and the T1D Index Version 3.0. Diabetes Research and Clinical Practice, 225, 112277.
4. International Diabetes Federation. IDF Diabetes Atlas, 10th edn. Brussels, Belgium; [cited January 10, 2022]. Available from: https://www.diabetesatlas.org(open in a new window). Accessed June 14, 2022.
5. Care D, Suppl SS. 6. Glycemic targets: standards of medical care in diabetes. American Diabetes Association. Diabetes Care. 2022;42(January):S61–S70.
6. DiMeglio LA, Acerini CL, Codner E, et al. ISPAD clinical practice consensus guidelines 2018: glycemic control targets and glucose monitoring for children, adolescents, and young adults with diabetes. Pediatr Diabetes. 2018;19:105–114. doi:10.1111/pedi.12737
7. Abrahim, A. M., Tilahun, T., & Gelana, B. (2023). Glycemic control and associated factors among children and adolescents with type 1 diabetes mellitus, Southwest Ethiopia. Diabetes, Metabolic Syndrome and Obesity, 2025-2037.
8. Non-communicable diseases." World Health Organization ,https://www.who.int/news-room/fact-sheets/detail/ noncommunicable-diseases
9. Noorani, M., Ramaiya, K., & Manji, K. (2016). Glycaemic control in type 1 diabetes mellitus among children and adolescents in a resource limited setting in Dar es Salaam-Tanzania. BMC endocrine disorders, 16(1), 29.
10. Taha, Z., Eltoum, Z., & Washi, S. (2018). Predictors of glucose control in children and adolescents with type 1 diabetes: results of a cross-sectional study in Khartoum, Sudan. Open Access Macedonian Journal of Medical Sciences, 6(11), 2035.
11. Shibeshi, M. S., Daba, A. K., Meiso, K. M., & Tadesse, B. T. (2022). Glycemic control among children and adolescents with diabetes in Southern Ethiopia: a cross-sectional study. BMC endocrine disorders, 22(1), 161.
12. Djonou, C., Tankeu, A. T., Dehayem, M. Y., Tcheutchoua, D. N., Mbanya, J. C., & Sobngwi, E. (2019). Glycemic control and correlates in a group of sub Saharan type 1 diabetes adolescents. BMC research notes, 12(1), 50.

Unlocking Access to Life-saving Health Products: Lessons from the National Supply Base Analysis

Abdulkadir, Gelgelo[1], Gedamnesh, Asferaw[2], Biniam, Hailu[3], Abyu, Faris[4]

[1]Ethiopian Pharmaceutical Supply Service (EPSS), Addis Ababa, Ethiopia

[2]Ethiopian Pharmaceutical Supply Service (EPSS), Marketing and Customer Experience Management Directorate (EPSS), Addis Ababa, Ethiopia

[3]Ethiopian Pharmaceutical Supply Service (EPSS), Marketing and Customer Experience Management Directorate (EPSS), Addis Ababa, Ethiopia

[4]Results for Development (R4D), Addis Ababa, Ethiopia

Corresponding author: Biniam Hailu: binihaylu55@gmail.com, +251-9-40-40-10-00

Introduction

Market shaping is a systematic approach to identifying market shortcomings and their underlying causes and designing catalytic interventions to ensure the sustainable availability of affordable and quality-assured essential health commodities where they are needed. Its primary objective is to maximize public health impact by improving market performance. Effective market-shaping interventions can address chronic constraints, such as limited production capacity or substandard quality, as well as acute market disruptions, including fluctuations in prices and supply volumes. [1,2]

In Ethiopia, the Ethiopian Pharmaceutical Supply Service (EPSS) has conducted a national supply base analysis annually since 2021 to assess the adequacy of the supplier base for pharmaceuticals and medical commodities. The analysis draws on data from the Electronic Regulatory Information System (eRIS) of the Ethiopian Food and Drug Authority (EFDA) and the EPSS Procurement Archive. The most recent analysis, conducted from 21–23 July 2026, covered 822 commodities within the Committed Demand Supply System, including medicines, medical supplies, laboratory commodities, and medical devices, as well as health program pharmaceuticals covering HIV, tuberculosis (TB) and leprosy, malaria, maternal health, child health, nutrition, family planning, and vaccines. It aimed to identify gaps in supplier availability and concentration that may affect supply security and market performance. This article presents the findings of the analysis and discusses their implications for market-shaping interventions in Ethiopia.

Statement of the Problem and Rationale

EPSS plays a pivotal role in ensuring the availability of essential health products across Ethiopia's public health system. As a supply chain leader in the public health system, EPSS has improved its supply chain performance over the last ten years. However, critical gaps remain that impede full access to health commodities in the public health system. Supply chain issues such as long procurement lead time, poor demand planning, and inadequate supply base have hindered the consistent availability of critical products at service delivery points.

Since 2021, EPSS, in partnership with R4D, has been undertaking a comprehensive supply base analysis; the initiative that is aimed at optimizing EPSS's supply base and improving health products availability, affordability and quality. This systematic approach enables EPSS to expand and diversify its supplier portfolios and develop appropriate sourcing strategies. The analysis also supports EPSS to identify supply chain risks and vulnerabilities like single-source dependencies. Through regular analysis of the supply base, EPSS seeks to foster a more competitive, efficient, and resilient pharmaceutical market environment.

Methods or Approach

Pharmaceutical product registration data were extracted from the Ethiopian Food and Drug Authority's (EFDA) Electronic Regulatory Information System (eRIS), which serves as the national platform for managing product registration and regulatory information. The analysis covered a total of 822 pharmaceuticals, medical supplies, laboratory reagents, and medical devices. The eRIS platform provides standardized regulatory information, including product registration status, market authorization details, and supplier information, thereby supporting data quality, transparency, and consistency in regulatory decision-making.

For each product, detailed information was collected on registered suppliers, market authorization holders (license holders), and the validity period of registration certificates. The dataset was reviewed to determine the number of active suppliers per product, identify products with limited or no registered suppliers, and assess the overall strength and sustainability of the supply base across different product categories.

The findings were subsequently used to generate evidence for strategic procurement and market shaping interventions aimed at strengthening supplier competition, improving market sustainability, and enhancing the availability of essential health commodities in Ethiopia. Attention was given to identifying products requiring targeted regulatory and market development support, including those with no registered suppliers or a limited supply base.

Results

The analysis showed that 40.51% (n=333) of the pharmaceuticals have adequate number of suppliers (i.e. products that have 5 or more registered suppliers), which is higher than the previous five years' supply base analyses. However, the EPSS supply base is still narrow since 59.49% (n=489) products have zero or inadequate number of registered suppliers. Anti-cancer and all health program commodities have relatively low supply base in 2026 as compared to products included in the Committed Demand Supply System (CDSS). The latest analysis also showed steady improvement in the supply base of all product categories; the improvement ranges from 2.26% for medical devices to more than 5% supply base expansion for routine supplies, RDF medicines and regular laboratory commodities.

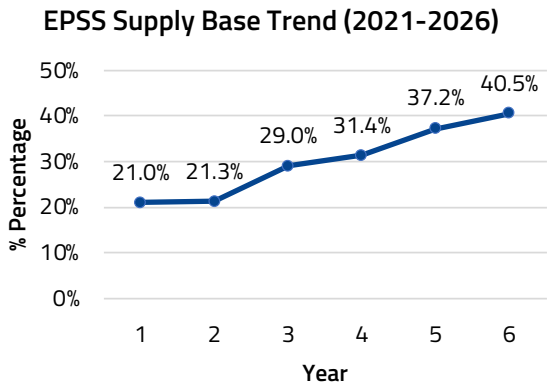


Figure 1. EPSS Supply Base Trend (2021-2026)

There has also been a positive trend in the reduction of products without a registered supplier. This percentage declined from 28% (n=292) in 2022 to 20.69% (n=155) and 16.05% (n-135) in 2024 and 2025 respectively and further declined to 13.87% (n=114) in 2026.

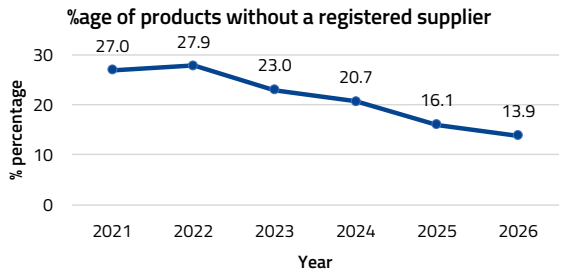


Figure 2. Percentage of products without a registered supplier (2021-2026)

Conclusion and lessons learnt

The annual Pharmaceutical Supply Base Analysis demonstrates continued progress in strengthening Ethiopia's pharmaceutical supplier landscape. Over the past five years, market-shaping efforts by the Ethiopian Pharmaceutical Supply Service (EPSS), in collaboration with the Ethiopian Food and Drug Authority (EFDA) and Results for Development (R4D), have contributed to measurable improvements in supplier availability. These gains reflect the value of coordinated advocacy, supplier engagement, regulatory strengthening, and evidence-informed market interventions.

A key lesson is that **alignment with national pharmaceutical sector reforms strengthens institutional ownership and sustainability**. Integrating supply base analysis within the Pharmaceutical Supply Transformation Plan II (PSTP II) and the Pharmaceutical Supply Development and Investment Plan (PSDIP) positioned it as a component of broader sector reform and supported the translation of findings into strategic and operational priorities.

Leadership commitment and inter-institutional collaboration are essential for sustained market change. Engagement from the Ministry of Health (MOH), EPSS, and EFDA helped strengthen market-shaping efforts, facilitate stakeholder dialogue, and support regulatory improvements. EPSS and R4D also contributed to generating and disseminating market intelligence and engaging manufacturers and suppliers through platforms such as the International Suppliers Conference. Technical support to EFDA to address registration backlogs further contributed to improving product registration and market access.

Regular, data-driven market monitoring is critical for proactive market shaping. Analysis of supplier availability, market concentration, and product registration status provided evidence to identify supply vulnerabilities and inform targeted interventions. Routine assessment also enables stakeholders to monitor market changes, identify emerging risks, and assess the effects of interventions over time.

Despite these improvements, important gaps remain. Essential medicines, anti-cancer medicines, vaccines, TB and leprosy medicines, and several health-program commodities continue to have limited supplier bases. Supplier registration efforts also appear to be concentrated on products with relatively adequate supplier availability, while products with no or limited suppliers receive less attention. Future market-shaping efforts should therefore prioritize these undeserved products and strengthen targeted supplier engagement and regulatory interventions.

Overall, the experience demonstrates that **sustained leadership, institutionalized market intelligence, targeted supplier engagement, and regulatory strengthening are critical to building a more competitive and resilient pharmaceutical market**. Continued application of these approaches, with greater focus on products with persistent supply-base gaps, will be important for improving sustainable access to affordable, quality-assured pharmaceutical products in Ethiopia.

Recommendation

The findings highlight the following priority actions to strengthen Ethiopia's pharmaceutical supply base and address persistent market gaps:

- **Establish a Product Registration and Supplier Engagement Function within EPSS:** EPSS should establish a dedicated function within the Marketing and Customer Experience Directorate (MCXD) to identify products with no or limited suppliers, maintain a priority watch list, disseminate market intelligence, and coordinate targeted supplier engagement and registration support.

- **Institutionalize Supply Base Monitoring and Early Warning:** EPSS should institutionalize annual supply base assessments and develop a dynamic monitoring dashboard linked, where feasible, with procurement and regulatory data to identify supplier attrition, market concentration, and emerging supply risks.

- **Strengthen EPSS–MOH–EFDA Coordination:** The three institutions should establish mechanisms for joint prioritization of products requiring supplier expansion, routine sharing of market intelligence, monitoring of registration bottlenecks, and improved communication of procurement forecasts and market opportunities.

- **Prioritize Supplier Mobilization for Underserved Products:** EPSS and EFDA should develop and regularly update a priority list of products with no or limited suppliers and actively engage local and international manufacturers using information on demand, procurement volumes, and market opportunities.

- **Strengthen Local Manufacturing and Product Diversification:** Government and development partners should support local pharmaceutical manufacturers to diversify production toward products with limited competition and strategic health priorities, while addressing financing, technology, quality, and regulatory barriers.

- **Improve Supplier Retention and Procurement Experience:** EFDA and EPSS should address factors contributing to supplier exit and strengthen regulatory predictability, procurement transparency, timely communication, contract management, and payment processes. Regular supplier feedback should inform process improvements.

- **Expand Strategic Market-Shaping Partnerships:** EPSS, MOH, EFDA, and partners should leverage pooled procurement, demand consolidation, framework agreements, and regional and global partnerships to improve market attractiveness, particularly for products with persistent supply constraints.

- **Conduct Targeted Diagnostic Studies and Market-Shaping Interventions:** Further studies should examine the root causes of limited supplier participation, including market size, pricing, procurement practices, regulatory requirements, foreign exchange constraints, and manufacturing capacity. Findings should inform targeted interventions for high-risk categories such as oncology, vaccines, RMNCH, TB and leprosy, and selected health-program commodities.

Reference

1. Kudymowa, J., Hu, J., & Basnak, M. (2023). An overview of market shaping for global health: Landscape, new developments, and gaps. Rethink Priorities.

2. United States Agency for International Development (USAID). (2018). *Healthy markets for global health: A market shaping primer. Center for Accelerating Innovation and Impact (CII), Bureau for Global Health, USAID*

Electronic Medical Record Implementation in a Teaching Hospital: Experience from the University of Gondar Comprehensive and Specialized Hospital, Ethiopia

Tesfahun Melese Yilma[1], Eliyas Addisu Taye[1], Selamsew Tesfaye[1], Shegaw Marie[1], Rahel Deribew[1], Tibebu Tadesse[2], Mequanint Melesse[3], Tajebew Zeyede[1], Berhanu Fikadie Endehabtu[1], and Binyam Tilahun[1]

[1]Center for Digital Health and Implementation Science, University of Gondar, Ethiopia

[2]University of Gondar Comprehensive Specialized Hospital, Gondar, Ethiopia

Corresponding author: Tesfahun Melese Yilma, **tesfahun.yilma@cdhi-uog.edu.et**

Introduction

Electronic Medical Records (EMRs) have transformed healthcare delivery by improving information availability, supporting clinical decision-making, enhancing continuity of care, and strengthening health system management. Despite their benefits, implementation remains difficult in low- and middle-income countries due to limited infrastructure, financial constraints, insufficient technical capacity, and user-related challenges [1-3]. Successful EMR adoption requires more than software installation; it depends on organizational readiness, workflow alignment, leadership commitment, user acceptance, and continuous system improvement [4-8].

In Ethiopia, digital health transformation has been prioritized through national strategies; however, healthcare facilities continue to face challenges related to infrastructure, workforce preparedness, and sustainable system maintenance [6, 9]. Teaching hospitals present additional complexity due to multiple departments, diverse users, frequent trainee rotation, and specialized clinical workflows. The University of Gondar Comprehensive and Specialized Hospital initiated EMR implementation to improve healthcare documentation, information management, and service efficiency. The implementation adopted a context-sensitive approach that combined phased deployment, multidisciplinary coordination through an EMR Excellence Taskforce, workflow mapping, customization to local clinical requirements, department-specific training, and continuous end-user feedback. The integration of the EMR with the national pharmaceutical system (eAPTS) and the transition to a Docker-based deployment environment further reflected efforts to address local interoperability, scalability, and system maintenance needs. These contextually adapted strategies provide practical lessons for other teaching hospitals in resource-constrained settings, particularly in managing complex clinical workflows, strengthening local technical capacity, and supporting sustainable EMR adoption. This paper presents the implementation experience, highlighting key strategies, challenges, lessons learned, and recommendations for healthcare institutions planning EMR adoption in similar settings.

Objectives

This paper aims to (1) describe the structured three-phase EMR implementation process at the University of Gondar Comprehensive and Specialized Hospital from 2022 to 2026; (2) identify key facilitators and barriers encountered during implementation; (3) synthesize practical lessons learned and context-relevant recommendations; and (4) provide actionable guidance for other low-resource healthcare settings seeking to adopt or scale EMR systems.

Methods

The EMR implementation was conducted at the University of Gondar Comprehensive Specialized Hospital, a teaching hospital providing diverse clinical services with multiple departments, healthcare professionals, and trainee groups. The implementation followed a structured three-phase approach: preparation and customization, pilot testing and rollout, and system integration and upgrading. Data and insights were gathered through multiple qualitative sources, including direct observation of clinical workflows and real-world system usage across departments, expert perspectives from members of the multidisciplinary EMR Excellence Taskforce and technical leads, and reflections documented during stakeholder workshops, coordination meetings, and end-user feedback sessions. These sources provided practical insights into implementation processes, workflow adaptation, user experiences, system performance, and challenges encountered throughout the EMR deployment journey.

Phase 1: Preparation and Customization (2022-2023)

Following the readiness assessment, the preparation phase established the foundation for EMR implementation through an EMR Excellence Taskforce comprising hospital leadership, clinical and administrative staff, health information and informatics professionals, ICT personnel, and representatives from pharmacy, laboratory, and other key departments. Key activities included workflow mapping, customization to local requirements, development of training materials and user manuals, and system validation. Teaching-hospital-specific requirements included multiple and specialized clinical workflows, diverse user roles, frequent trainee rotation, and integration across clinical and support departments.

Phase 2: Pilot Testing and Rollout (2024-2025)

The pilot and rollout phase involved introducing the system in selected service areas, including triage, the medical records unit, and five outpatient departments (Medical, Pediatric, ANC, Chronic, and Dermatology OPDs). Activities included pilot testing, migration of patient information from the legacy SMARTCare system, department-specific and group-based user training, one-on-one coaching, system refinement based on feedback, and continuous coordination with stakeholders.

Phase 3: Integration and Upgrading (2026-Now)

The integration phase focused on improving sustainability, interoperability, and system performance. The EMR was integrated with the national pharmaceutical system (eAPTS) through secure mediators, and the system architecture was upgraded from CentOS-based deployment to a Docker-based environment to improve scalability, maintainability, and reliability. Key implementers and collaborators included the EMR Excellence Taskforce, clinical departments, hospital management, the Center for Digital Health and Implementation Science, the Ministry of Health, and Digital Health Activity partners. Continuous engagement with end-users through meetings, feedback sessions, Telegram groups, and email communication supported problem-solving and user acceptance.

Result

The phased implementation approach enabled gradual system adaptation, improved user engagement, and continuous optimization of the EMR system. A multidisciplinary EMR Excellence Taskforce strengthened coordination among clinical, technical, and administrative teams and supported evidence-informed decision-making throughout implementation. Comprehensive capacity building was conducted alongside technical customization, including Training of Trainers (TOT) for 25 HMIS staff and EMR-related training for more than 1,000 healthcare professionals, including doctors, nurses, laboratory professionals, medical record unit staff, health financing staff, and liaison officers. Training was delivered through both onsite and off-site sessions, supported by developer and end-user manuals, quick-reference leaflets, and structured eLearning materials. These approaches strengthened local technical and user capacity and supported continuous learning and EMR sustainability.

Workflow customization ensured that the EMR reflected the operational realities of a teaching hospital rather than applying a generic digital solution. User training using multiple approaches improved familiarity with the system, while continuous feedback mechanisms supported identification and resolution of usability challenges. The integration with eAPTS improved interoperability between clinical documentation and pharmaceutical management systems, while the migration to Docker-based architecture enhanced system scalability and technical sustainability.

Several factors facilitated successful implementation, including strong institutional leadership, collaboration with national digital health programs, local technical capacity development through the Center for Digital Health and Implementation Science, continuous stakeholder engagement, and systematic requirement gathering.

However, implementation challenges remained. Frequent power interruptions were managed through backup power arrangements, while network interruptions were addressed through 24/7 ICT support to promptly troubleshoot and restore connectivity. Outdated hardware was upgraded or replaced where feasible, and varying digital literacy and user resistance were addressed through repeated training, onsite support, and continuous user engagement. The complexity of teaching-hospital workflows was managed through workflow customization, department-specific training, and EMR Excellence Taskforce coordination. However, chart archival and management of legacy paper records remained an ongoing challenge.

Conclusion

The University of Gondar experience demonstrates that sustainable EMR adoption in low-resource settings requires a phased, context-sensitive approach that considers technology, people, processes, and partnerships. A major lesson learned is that successful implementation depends not only on selecting an appropriate EMR platform but also on understanding local workflows, engaging users, strengthening institutional capacity, and maintaining continuous improvement. What worked well was the establishment of a multidisciplinary implementation team, early workflow assessment, strong stakeholder engagement, continuous training, and collaboration with national digital health initiatives. These approaches improved ownership, reduced implementation barriers, and supported system acceptance.

Challenges such as infrastructure limitations, digital literacy gaps, and user resistance highlight the importance of adequate preparation, continuous technical support, and change management strategies. Addressing these barriers requires institutional commitment, investment in infrastructure, and sustained capacity-building efforts. The intervention benefited healthcare providers and patients by improving access to digital health information, strengthening documentation practices, supporting clinical workflows, and creating a foundation for interoperable digital health services.

Sustainability was supported through local capacity strengthening, integration with national digital health systems, technical upgrading, and establishment of institutional structures responsible for ongoing system management. Support from hospital leadership, the Ministry of Health, and digital health partners played an important role in maintaining implementation momentum. Moreover, the University allocates a yearly budget of 700,000 to 1,000,000 ETB to support the EMR implementation, maintenance, and support. Furthermore, the hospital has recruited 16 health informatics professionals to support the EMR implementation and maintenance.

Recommendations

Healthcare institutions planning EMR implementation should conduct comprehensive readiness assessments before deployment to identify infrastructure, workforce, and organizational gaps. A phased rollout strategy with pilot testing and continuous improvement is recommended rather than immediate full-scale implementation. Establishing multidisciplinary implementation teams with clearly defined responsibilities is essential for effective coordination and sustainability. Institutions should invest in local technical capacity through continuous training, mentorship, and knowledge transfer to reduce dependency on external support. User engagement should be maintained throughout all implementation stages, and training should be tailored to department-specific workflows to improve practical usability. Investments in reliable infrastructure, including backup power systems, network redundancy, hardware maintenance, and technical support, are critical for minimizing system disruptions. Finally, alignment with national digital health strategies and interoperability frameworks should be prioritized to ensure scalable, sustainable, and effective EMR implementation. We recommend EMR training be integrated into the medical and health science curriculum so that new students who engage in patient management are familiar with the EMR system.

Reference

1. Gatiti, P., et al., *Enhancing Healthcare Quality in Hospitals through Electronic Health Records: A Systematic Review.* Journal of Health Informatics in Developing Countries, 2021. 15(2).
2. Hamilton, C., *The WHO-ITU national eHealth strategy toolkit as an effective approach to national strategy development and implementation*, in *MEDINFO 2013*. 2013, IOS Press. p. 913-916.
3. Abdekhoda, M., A. Dehnad, and J. Zarei, *Determinant factors in applying electronic medical records in healthcare.* Eastern Mediterranean Health Journal, 2019. 25(1): p. 24-33.
4. Akwaowo, C.D., et al., *Adoption of electronic medical records in developing countries-A multi-state study of the Nigerian healthcare system.* Front Digit Health, 2022. 4: p. 1017231.
5. Biruk, S., et al., *Health Professionals' readiness to implement electronic medical record system at three hospitals in Ethiopia: a cross sectional study.* BMC Medical Informatics and Decision Making, 2014. 14(1): p. 115.
6. Yehualashet, D.E., et al., *Barriers to the adoption of electronic medical record system in Ethiopia: a systematic review.* Journal of multidisciplinary healthcare, 2021: p. 2597-2603.
7. Jawhari, B., et al., *Benefits and challenges of EMR implementations in low resource settings: a state-of-the-art review.* BMC medical informatics and decision making, 2016. 16: p. 1-12.
8. Jawhari, B., et al., *Barriers and facilitators to Electronic Medical Record (EMR) use in an urban slum.* International journal of medical informatics, 2016. 94: p. 246-254.
9. Asemahagn, M.A., *Health professionals' challenge in using ICTs to manage their patients: the case of hospitals in Addis Ababa, Ethiopia.* Online Journal of Nursing Informatics (OJNI), 2016. 20(2).

Health Information Revolution in Practice: Lessons from Hulbareg Woreda Using the Health Information Revolution Army Approach—Hawassa University CBMP

Keneni Gutema [1, 3], Desalegn Tsegaw[1,3], Betelhem Eshetu[1, 3], Alemu Tamiso [1, 3], Tsion Tekle [3], Berhanu Bifato[3], Rekiku Fikre [1,2]

[1]Hawassa University, College of Medicine and Health Sciences, School of Public Health

[2]Hawassa University, College of Medicine and Health Sciences, School of Nursing and Midwifery

[3] Hawassa University, Capacity Building and Mentorship Program

Corresponding author: Berhanu Bifato, Email: berhanubif12@gmail.com

INTRODUCTION

Ethiopia's Ministry of Health (MoH) envisions Health Information System (HIS) transformation through three pillars: cultural change, digitalization, and HIS governance (1-3). To advance this agenda, the Capacity Building and Mentorship Program (CBMP) was established as collaboration between the MoH and six public universities, including Hawassa University (4,5). Through mentorship, supervision, implementation research, and innovative approaches such as the Practice-Based Learning Approach (PBLA) (6,7), the augmented FADE (FGD–ECR) model (8), diffusion of innovations, and sustainability-focused interventions (9,10), Hawassa University has contributed significantly to the strengthening and sustainability of HIS transformation.

In the implementation experience of the Hawassa University CBMP team, earlier HIS improvement activities often depended heavily on designated HMIS/HIS focal persons and a relatively small number of mentors or facility leaders. This experience suggested that concentrating HIS responsibilities among a limited number of individuals could constrain continuous attention to HIS processes, limit broader staff ownership, and undermine the sustainability of change. In response, and under the motto "Health Information Revolution in Practice," Hawassa University CBMP introduced the Health Information Revolution "Army" (HIRA) approach as a participatory and sustainable strategy to institutionalize HIS transformation by distributing implementation responsibilities across facility teams while maintaining technical support and structured follow-up (11).

Significance: Why a New Approach Was Needed

- Dependency on external mentors limited local capacity and ownership.
- Limited-service staff engagement excluded most facility workers.
- Weak sustainability mechanisms risked early gains after mentor withdrawal.
- Limited stakeholder communication reduced HIS effectiveness.
- Broad expectations burdened focal persons, causing irregular attention, inconsistent progress, and superficial changes.

METHODS OR APPROACH

What is new about the HIRA APPROACH?

HIRA was implemented as a bottom-up, participatory HIS improvement approach designed to shift HIS improvement from reliance on designated focal persons toward facility-wide ownership and routine institutionalization. Its innovation lay in integrating five complementary features: experience sharing with a model facility; a dedicated Woreda HIS Week for enhancing staff engagement; development of local HIS leaders; Leaders' Morning Rounds using simple daily and monthly checklists; and Progress Monitoring Charts for visualizing performance and identifying gaps. These features were reinforced through practice-based learning, on-site technical support, and structured follow-up by local HIS leaders and the Hawassa University CBMP team, creating an integrated mechanism for shared learning, distributed leadership and continuous performance improvement (daily, monthly and quarterly). HIRA approach therefore complemented, rather than replaced, the Ethiopian MOH's IR implementation roadmap. (2, 6, 7)

Setting, Implementers, and Timeline

Hulbareg Woreda Health Office (WoHO) in Silte Zone serves about 100,800 people through 4 health centers (Kerate, Angamo Yede, Ambericho Gimba, and Bilawanja) and 10 health posts, staffed by 246 workers delivering primary healthcare. HIRA was piloted at Hulbareg WoHO and their four-health center in October 2024 a dedicated local data week was declared by the WoHO in communication with RHB and ZHD. Key implementers included a seven-member Hawassa University–CBMP central team (one leader, one coordinator, five experts), each assigned by domain expertise. They worked with the Regional. (Fig 1)



Fig. 1, Key features of HIRA approach, Hulbareg,2024

Preparation, Orientation, and Experience-Sharing

The central team formed from HU CBMP and experts from WoHO in October 2024, held a half-day awareness session, and visited Tulla Health Center (17–18 October) to observe model facility as a preparation principle. The HU CBMP team prepared implementation materials—training PPTs, report formats, KPI charts, posters, logbooks, registries, Monthly monitoring chart, Morning round checklist and Kobo forms—while securing budget and logistics. The team also briefed the RHB, ZHD, WoHo, and health centers. On 21 October, a one-day orientation on HIS basics was conducted for all WoHo and health center staff and the week was announced as dedicated week for IR in practice. Fourteen participants, including heads and focal persons from the woreda, joined the experience-sharing session at Tulla Sub city Health Center.

Facility-Level Implementation

- Following a baseline HIS assessment, implementation ran from 21–30 October 2024 under mentorship of central team experts, organized into three areas:
- Structure and resources: Sorting patient cards, establishing HMIS offices, organizing records, supportive supervision, and facility action plans.
- Data quality: LQAS checks, completeness and consistency reviews, and monitoring report timeliness.
- Data use: Annual planning, KPI review, performance charts, root-cause analysis, and ensuring feedback reached lower-level units.
- Close follow up by WoHO and Central HU CBMP team was carried out for the next consecutive 3 months
- HIS performance was assessed using the Ethiopian Ministry of Health Information Revolution assessment tool. The assessment combines three major domains: HIS structure and resources (30%), data quality (30%), and information use (40%). The tools intended to assess whether health institutions have the structural and operational capacity to implement HIS, whether routinely generated information meets quality requirements, and whether information is used for management, clinical care, performance monitoring, and decision-making. (2,8, 12)

RESULTS

At baseline, every facility scored in the "Emerging" category (52%–68%). Within 15 days, all four health centers and the Woreda Health Office achieved marginal "Model" HIS status (scoring ~91%). The remaining score gap was due to structural requirements that could not be completed within the short implementation window, such as quarterly supervision evaluations. (Figure1). This rapid shift reflects HIRA's approach, not a one-off effort: mobilizing entire facility staff rather than one focal person let tasks across all three domains run in parallel; embedded domain experts gave real-time, on-site correction instead of periodic outside supervision; and the Leaders' Morning Round introduced daily and monthly checks that closed gaps while implementation was still under way, compressing a normally longer, sequential process into one intensive week.

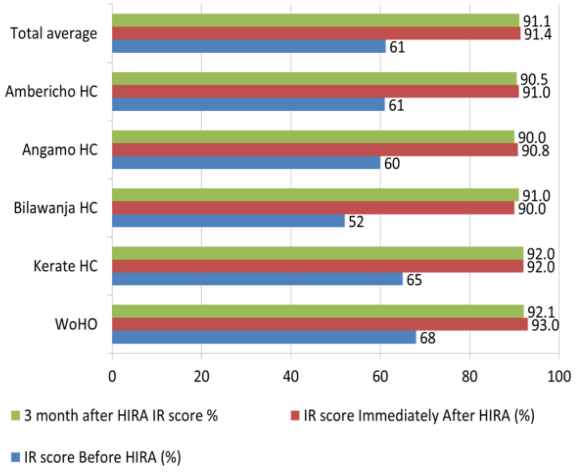


Figure 2. Fig1. Observed changes between the baseline and end-line assessments following the implementation of the HIRA Approach

At Kerate Health Center, for example, a previously disorganized record room (Figure 2) was reorganized into a labeled, functional space simply by identifying and separating active and inactive patient cards showing how structural gains translated into day-to-day usability, not only score improvements.



Figure 3. Kerate Health Center's medical record, 2024

Because the Monitoring Chart and Morning Round were built into the rollout itself, facilities began tracking performance from day one. Three months later, the average score stood at 91.1%, virtually unchanged from 91.4% immediately after HIRA, with all facilities above the 90% "Model" threshold. Bilawanja Health Center's score even rose from 90.0% to 91.0%. Kerate and Ambericho Gimba Health Centers self-financed record-room and office construction to sustain gains, while the WoHo and RHB continue monthly score tracking. Hulbareg Woreda was nationally recognized as a model IR woreda and received a Ministry of Health award in 2026.

LESSONS LEARNED

Major Lessons Learned

- Engaging all staff, not just HIS focal persons, was essential for moving from "Emerging" to "Model.".
- Experiential Learning: Practice-based, hands-on internalizes new routines far more effectively than conventional training
- Embedding daily in turn monthly operational monitoring (e.g., Morning Rounds, Monitoring Charts) prevents performance backsliding without relying on constant external oversight.

What Worked Well

- Inclusive Staff Engagement: Collective responsibility across departments.
- The PBLA approach: Hands-on learning embedded routines effectively and efficiently.
- Built-in Accountability: Early adoption of monitoring tools ensured visibility.
- Multilevel Administrative Support: Communication across WoHo, health centers, RHB, and ZHD enabled rapid problem-solving.

Challenges and Actions Taken

- Resource and Infrastructure Constraints: Motivation alone could not resolve facility space and resource limitations (e.g., Kerate Health Center's small medical record Room (MRU) and Ambericho Gimba's under-resourced HMIS office). Lacking dedicated budget lines, facilities self-financed local adaptations—a burden not all facilities can sustain. Both facilities; especially Kerat HC mobilized local resource in communication with woreda administrators and renovate the MRU.
- Tight Implementation Timelines: Rapid rollout left limited time to institutionalize routines during initial implementation. Post-rollout tools (Morning Rounds, Monitoring Charts) were introduced to sustain momentum.
- High Operational Intensity: The Health Information System Assessment and Improvement (HIRA) model depends on multi-skilled central teams and dedicated logistics (vehicles, per diems). Replicating it beyond Capacity Building and Mentorship Program (CBMP) woredas requires direct Ministry of Health (MOH) budget allocations.

Impact on Target Population

- The woreda verified as a model IR woreda, sustaining change and improving service delivery through quality data for resource management and planning.
- Leadership Diffusion: Woreda leaders mentored adjacent areas (Mito, Tora TA), now progressing toward model IR status.
- Accelerated Change: Demonstrated rapid attainment of "Model" HIS status compared to conventional approaches.

Sustainability & Local Authority Support

- Embedded Routines & Communication: Morning Rounds, Monitoring Charts, regular facility meetings, and digital networks (Telegram/phone) maintain peer engagement and operational standards.
- Institutional Ownership: The WoHO, RHB, and Silte Zone Health Department have committed to ongoing oversight, reducing long-term dependence on external mentors.

CONCLUSION

The HIRA approach proves that Hulbareg Woreda's health facilities can rapidly advance to "Model" HIS performance through inclusive staff ownership

Hands-on learning and daily accountability tools like Morning Rounds. Supported by local health leaders, this low-cost model enhances data quality and use in turn improve patient care, though national scale-up will require dedicated Ministry of Health funding for logistics and infrastructure gaps.

RECOMMENDATIONS

- Expand Practice-Based Learning: roll out PBLA as a routine part of HIS training nationally.
- Standardize continuous monitoring: adopt the Monitoring Chart and Morning Round across all facilities as a routine was a challenge that required more engagement of ZHD and RHD.
- Budget for HMIS infrastructure (shelving, DHIS2/eCHIS) so facilities aren't forced to self-finance.
- Integrate HIRA into routine practice, and document successes and challenges to inform scale-up.

REFERENCES

1. Ministry of Health Ethiopia. Health Sector Transformation Plan II (HSTP II), 2020/21–2024/25 (2013 EFY–2017 EFY). Addis Ababa: Ministry of Health; 2021.

2. Ministry of Health Ethiopia. Information Revolution Implementation Guideline 2021–2025. Addis Ababa: Ministry of Health; 2021.

3. Ministry of Health Ethiopia. Information Revolution Booklet. Addis Ababa: Ministry of Health; 2021.

4. Tilahun B, Gashu KD, Mekonnen ZA, Endehabtu BF, Asressie M, Minyihun A, et al. Strengthening the national health information system through a capacity building and mentorship partnership (CBMP) programme: a health system and university partnership initiative in Ethiopia. Health Res Policy Syst. 2021; 19(1):141. Doi: 10.1186/s12961-021-00787-x.

5. Binyam T, et al. Lessons learned from the capacity building and mentorship program to improve health information systems in 11 districts of Ethiopia. Glob Health Sci Pract. 2022; 10(4):e2100690. Doi: 10.9745/GHSP-D-21-00690.

6. Alemu T, Gutema K, et al. Practice Based Learning Approach: an alternative responsive method for Health Information System change intervention. Ethiop J Med Health Sci. 2024; 4(Suppl 1).

7. Gutema K, Zerihun B, Tsegaw D, Bifato B, Eshetu B, Fikre R, Tamiso A. Accelerated mentors training for Health Information System transformation using a Practice Based Learning Approach: The Hawassa University CBMP experience, Ethiopia. Ethiop J Med Health Sci. 2024; 4(Suppl 1).

8. Tamiso A, Negeri KG. An innovative change approach towards IR model woreda formation: Experience from demonstration woredas of Sidama region in Southern Ethiopia. MOH Special Bulletin: 22nd Annual Review Meeting. 2020 Nov: 53.

9. Negeri KG. Sustainability of Health Information System Changes in Capacity-Building and Mentorship Programs: A qualitative analysis of barriers and facilitators in the targeted Woredas of Southern Ethiopia. Ethiopian Journal of Medical and Health Sciences. 2024; 4(Suppl 1):16–25. Doi: 10.82127/b07qaa94.

10. Negeri KG, Zerihun B, Bifato B, Eshetu B, Likka MH, Debiso AT. Ensuring sustainability of HIS changes. Ethiopian Journal of Medical and Health Sciences. 2024; 4(Suppl 1):47–51. Doi: 10.82127/5ba33375.

11. Hawassa University–CBMP Coordinating Office. Health Information Revolution in Practice through the Health Information Revolution Army (HIRA) at Hulbareg Woreda Health. Report. Hawassa: Hawassa University–CBMP Coordinating Office; October 2024.

12. Ministry of Health - Ethiopia. (n.d.). Health Information Systems Performance Management Dashboard (HISPMD): Data sources.https://hispmd.moh.gov.et/app/start.php#datasources.

From Paper to Real-Time Action: Digitizing Routine Data Quality Assessment in Amhara Region

Yibeltal Amsalu[1]*, Getachew Abe[1], Amare Shumet[2],

[1] JSI Research & Training Institute, Inc., Data Use Partnership (DUP), Bahir Dar, Ethiopia

[2] Amhara Regional Health Bureau, Bahir Dar, Ethiopia

* **Corresponding Author:** Yibeltal Amsalu

Email: yibeltal.amsalu@jsi.org | Telephone: +251 91 870 7523

Introduction

Previously, Routine data quality assessment (RDQA) relied on manual, paper-based processes for data collection, aggregation, and analysis processes. These methods were inefficient and prone to errors, resulted in fragmented reports, and limited insights. As a result, critical data quality issues were identified too late for effective interventions, causing significant delays in providing feedback to health facilities and hindering timely, data driven managerial decisions.

Intervention

The Digital Ethiopia 2030, HSDIP-II, and the health-sector reform agenda operationalize the national priorities of digital transformation, information revolution, quality data, evidence-based decision-making, accountability, and improved health-system performance. By integrating digital tools with routine health information systems and performance monitoring, the initiative moves beyond data reporting toward data use for action and continuous health-system improvement. This makes it a strategic health-system transformation intervention rather than simply an ICT investment.

To address these challenges, the Amhara Regional Health Bureau (RHB), in collaboration with JSI, transitioned from a manual, paper-based RDQA process to an automated digital system. JSI provided technical support for coordination, system development, and resource mobilization across regional program directorates. The RDQA questionnaires were digitized using the Open Data Kit (ODK) platform and deployed on the regional server. Before implementation, the digital RDQA tool underwent comprehensive validation and functionality testing to ensure its accuracy, usability, and operational readiness. Following successful validation, the tool was integrated with Power BI to enable real-time data visualization and automated reporting. To support implementation and ensure sustainability, a total of 248 HMIS, M&E, HIS, and HIT professionals from hospitals, woredas, zones, and the regional level were trained on the Health Information System (HIS) mentorship program, which was integrated into the continuous professional development (CPD) center to institutionalize mentorship and strengthen long-term capacity for digital RDQA implementation.

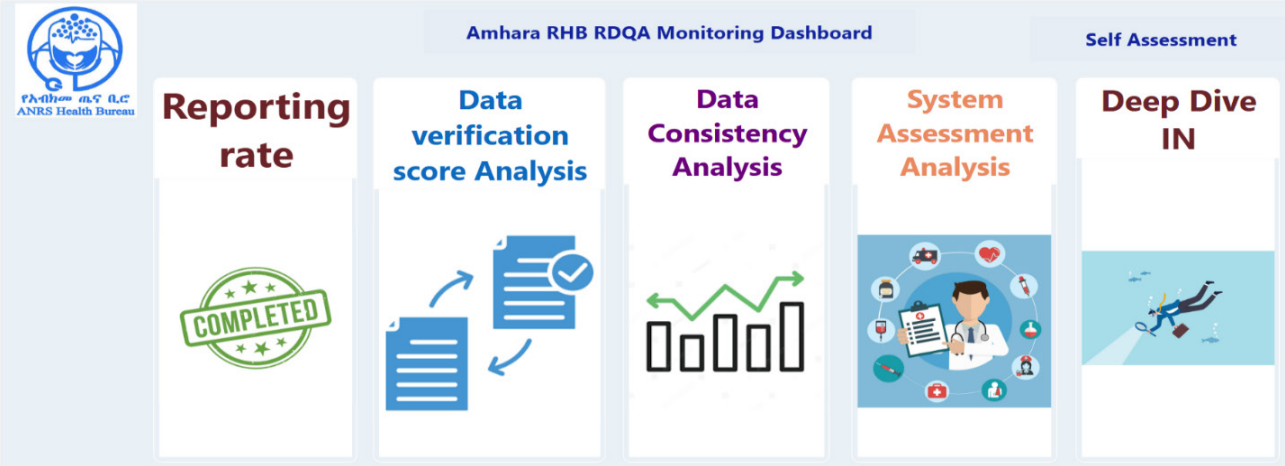


Figure 1: Amhara RHB Routine Data Quality Assessment (RDQA) monitoring dashboard

Results

Intervention transformed the region's RDQA into an agile, digital, real-time decision-making system. Key achievements observed during 2018 EFY:

- **Scale:** Utilized by over 573 facilities for self-assessment and created a strong culture of data quality and use.
- **Indicators Tracking:** Expanded assessment from seven to 14 program indicators.
- **Efficiency**: The average number of days for aggregation, analysis, and reporting of RDQA results has reduced from more than 7 days (paper-based) to less than 1 day (digital system).
- **Feedback:** Real-time Power BI dashboards leverage immediate, actionable feedback by regional teams.
- **Resource allocation:** Based on the findings, 16-million-birr worth of budget was allocated for the distribution of 20 types of registers
- **Data verification**: The proportion of health facilities meeting the minimum data verification (90% - 110%) reached 79.7% during the 2nd quarter of 2018 EFY assessment, showing an improvement from the previous quarter baseline of 59.1%.
- **Data Quality:** 12 out of the 14 indicators (85.7%) selected for verification were found to be verifiable in both rounds of assessment, indicating good overall data quality.
- **Sustainability:** Digitized RDQA has been sustained beyond the initial technical support through capacity building, routine use of digital tools, and integration of RDQA activities into regular data quality assurance processes.
- **Institutionalization:** Digitized RDQA has been institutionalized within existing health-system structures and routine monitoring mechanisms, strengthening ownership by health facilities and above-site leadership for implementation, feedback, and corrective actions for self-assessment and external assessment.

Lessons Learned

- **Institutional ownership:** Initiative leadership by RHB head and decentralized program-based funding model foster deep ownership and sustainability, and they used it for self-assessment at the health institution level.
- **Peer-Driven capacity:** Cross-zonal expert exchanges build robust, local digital health capacity, reducing reliance on external support.
- **Capacity building:** Coaching, mentoring, and use of CPD centers to enhance knowledge and skills played a role in improving health information system expertise and ability to identify, prevent, and remedy data-quality problems.
- **Real-time feedback:** The feedback provided during the rapid assessments enabled facilities to respond to data quality issues on time rather than waiting for the final report of the rapid assessment.
- **Data use for action:** The use of RDQA findings and feedback to guide corrective action improved facility and managerial response to data-quality issues and strengthened the overall reporting process.

Recommendation

The Amhara region's experience indicates that digitizing routine data quality assessment significantly improves the health sector's ability to routinely and consistently assess data quality, identify gaps, and take corrective measures. The use of standardized digital tools enhances the accuracy and utilization of the findings for subsequent actions at both the facility and above-site levels. Therefore, we recommend scaling up these digitized tools across all regions to sustain improvement in data quality and evidence-informed decision-making.

Strengthening Routine Immunization Data Quality and Coverage Estimation Through the Ethiopia AHEAD Initiative: Advancing Equity and Reaching Zero-Dose Children

Mesoud Ahmed[1], Melkamu Kokebie[1], Muluken Argaw[1], Mariamawit Asfaw[1], Yakob Wonderad[1], Yohannes Lakew[1], Amsalu Moges[2], George Mwinnyaa[2], Lauren Francis[2], Yoshito Kawakatsu[2], Maria Muñiz[2], Wondimu Ayana[3], Sileshi Solomon[1]

[1]Ministry of Health, Ethiopia, Strategic Affairs, Maternal, Child and Adolescent Health Services Lead Executive Office

[2]UNICEF

[3] World Health Organization, Addis Ababa, Ethiopia

Correspondent Authors: Sileshi Solomon Mekonnen, sileshi.solomon@moh.gov.et +251911059640

ABSTRACT

Background: High-quality routine immunization data are fundamental for monitoring program performance, identifying immunization gaps, guiding resource allocation, and supporting evidence-based policy and programmatic decision-making. In Ethiopia, routine administrative immunization data have historically been affected by poor data quality, outdated population denominators, reporting inconsistencies, and incomplete reporting, resulting in substantial discrepancies between administrative coverage estimates and external estimates. These challenges have limited the ability of the national immunization program to accurately monitor progress, identify underserved populations, and prioritize interventions for zero-dose and under-immunized children. Strengthening routine immunization information systems has therefore become a strategic priority under Ethiopia's National Immunization Strategy (2026–2030) and contributes directly to achieving the goals of the Immunization Agenda 2030 (IA2030).

Objective: This study aimed to strengthen routine immunization data quality and improve vaccination coverage estimation through the Ethiopia Analysis for Health, Equity and Data (AHEAD) Initiative, generating reliable evidence to identify zero-dose and under-immunized children and support evidence-based planning, prioritization, and program decision-making.

Methods: A comprehensive, country-led data quality improvement approach was implemented using routine immunization data collected between 2018 and 2025. More than 21,000 health facility records for DTP1, DTP3, and MCV1 were systematically reviewed using standardized data quality assessment methods to identify missing reports, outliers, internal inconsistencies, repeated reporting patterns, and other anomalies. The assessment was complemented by a multi-level verification and validation process involving the Ministry of Health, Regional Health Bureaus, zonal and woreda health offices, health facilities, UNICEF, and technical partners. Alternative target population estimates were generated by triangulating cleaned administrative data with National Immunization Program Evaluation findings, World Population Prospects 2024, Central Statistics Agency population estimates, and other available survey evidence to produce more reliable coverage estimates.

Results: The Ethiopia AHEAD Initiative substantially improved the quality and reliability of routine immunization data and generated more plausible estimates of vaccination coverage and zero-dose burden. National vaccination coverage in 2025 was estimated at 84% for DTP1, 81% for DTP3, and 77% for MCV1, reflecting continued improvements since 2019. Vaccination service delivery volumes increased across all major antigens, while the estimated number of zero-dose children declined compared with previous years. Nevertheless, approximately 762,235 zero-dose

children remain nationally, with the highest burden concentrated in Oromia, Somali, and Amhara regions. Significant geographical inequities persist, particularly in pastoralist, remote, densely populated, and conflict-affected areas, where low coverage, high dropout rates, and large numbers of unvaccinated children continue to limit equitable access to immunization services. The analysis also demonstrated that moderate coverage gaps in highly populated regions contribute substantially to the national zero-dose burden, highlighting the importance of considering both vaccination coverage and the absolute number of unvaccinated children when prioritizing interventions.

Conclusion and Recommendations: The Ethiopia AHEAD Initiative demonstrates that strengthening routine administrative data through systematic data quality improvement, denominator refinement, and country-led validation can substantially enhance the accuracy and usefulness of immunization information for program management. Institutionalizing these approaches within routine monitoring systems will strengthen evidence-based decision-making, improve the identification and prioritization of zero-dose and under-immunized populations, support equitable allocation of resources, and accelerate progress toward achieving national immunization targets and the Immunization Agenda 2030. Continued investment in routine data quality, digital health information systems, denominator refinement, and data use capacity at all levels of the health system is recommended to sustain program improvements and ensure that every child is reached with life-saving vaccines.Background

High-quality routine immunization data are essential for monitoring program performance, guiding resource allocation, identifying inequities, and enabling timely course correction. In low- and middle-income countries, administrative data remains the timeliest and geographically granular source for monitoring immunization coverage. However, data quality challenges, inaccurate population denominators, incomplete reporting, and inconsistent reporting practices can substantially affect coverage estimates.

The WHO/UNICEF Estimates of National Immunization Coverage (WUENIC) provide an important national reference by triangulating administrative data, household surveys, and other evidence. However, WUENIC is not designed to provide the subnational granularity required for routine planning and program action. Ethiopia continues to face substantial challenges in routine immunization data quality, including incomplete and inconsistent reporting, discrepancies between source documents and reported data, limited data-use capacity, and outdated population denominators. In 2024, DHIS2 administrative data suggested national DTP1 coverage of 110%, compared with 81% estimated by WUENIC, highlighting the need for systematic data quality improvement and locally relevant coverage estimation. As Ethiopia implements its 2026–2030 National Immunization Strategy, the Ethiopia AHEAD initiative aims to establish a continuously improving, quality-assured data system that generates more credible national and subnational coverage estimates, identifies children and communities being missed, and enables targeted action to reach zero-dose and under-immunized children.

Objective

This study aimed to strengthen routine immunization data quality and improve vaccination coverage estimation through the Ethiopia Analysis for Health, Equity and Data (AHEAD) Initiative, generating reliable evidence to identify zero-dose and under-immunized children and support evidence-based planning, prioritization, and program decision-making.

Methods

A comprehensive review of more than 21,000 health facility immunization records for DTP1, DTP3, and MCV1 from 2018–2025 (EFY 2010–2018 [6M]) was conducted using Ministry of Health DHIS2 data. Records were assessed for missing reports, outliers, internal inconsistencies, and repeated identical monthly values indicating potential reporting errors. Regional Excel-based data quality trackers supported anomaly identification and iterative verification by health facilities, woredas, zones, regional health bureaus, and the Ministry of Health. Multiple rounds of data cleaning and validation were conducted, with rolling-median imputation used for sensitivity analysis. The Technical Working Group adopted the sensitivity-analysis dataset for 2025 estimates due to potential age-group misclassification during the Big Catch-Up campaign.

To address denominator uncertainty, population estimates were triangulated using NIPE, the Tigray region community survey, cleaned DHIS2 data, UN

World Population Prospects (2024), and Central Statistics Agency distributions. The NIPE-derived denominator, calibrated against UN population trends, was selected for national and subnational estimation. Where population movement and administrative boundaries resulted in coverage exceeding 100%, excess doses were redistributed to neighboring woredas using geographic proximity and service-capacity weighting. Ethiopian calendar dates were converted to Gregorian dates, and R was used for data cleaning, denominator estimation, analysis, and visualization, producing reproducible datasets and dashboards at national, regional, zonal, and woreda levels.

Result

National Coverage

At the national level, immunization indicators show stable coverage in recent years, increasing service delivery volumes, and a persistently high absolute burden of unvaccinated children, reflecting population growth alongside incremental program gains (Figures 1 and 2).

In 2018, the DHIS2 system was newly introduced into the Ethiopian health system, and immunization data were not yet fully captured in all health facilities, resulting in lower coverage of all antigens.

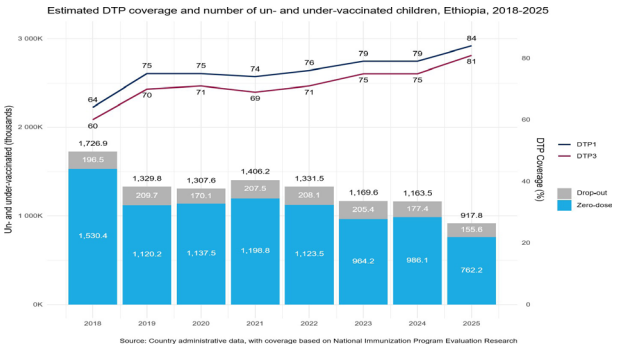


Figure 1: National DTP coverage, zero-dose, and under-vaccinated trends, 2018-2025

Table 1 summarizes 2025 routine immunization coverage by region and antigen. When compared with WHO/UNICEF global immunization objectives, which define adequate subnational performance as at least 80 per cent coverage for essential routine antigens, including DTP1, DTP3, and MCV14, and a 90 per cent national benchmark under Immunization Agenda 2030 (IA2030)5, Table 3 shows that half of the 14 regions (Addis Ababa City Administration, Amhara, Central Ethiopia, Dire Dawa City Administration, Sidama, South West Ethiopia and Tigray) met the minimum global threshold (≥80 per cent) across all three antigens, reflecting adequate access to immunization services, completion of the primary DTP series, and population-level measles protection. In contrast, two regions did not meet targets for any of the three antigens, and eight regions fell below MCV1 targets, which is insufficient to sustain measles control.

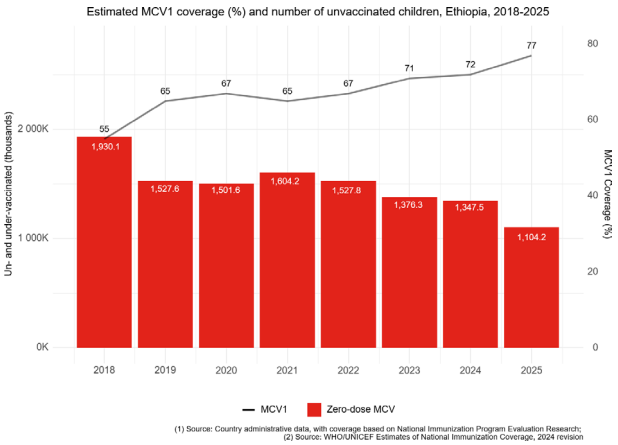


Figure 2: National MCV1 coverage and measles zero-dose trends, 2018-2025

Across regions, DTP1 coverage ranged from 73 per cent to 96 per cent, while DTP3 coverage ranged from 66 per cent to 95 per cent and MCV1 coverage ranged from 60 per cent to 94 per cent (Table 3, Figure 3). The wider range observed for MCV1 indicates larger differences in measles vaccination coverage between regions compared with DTP antigens.

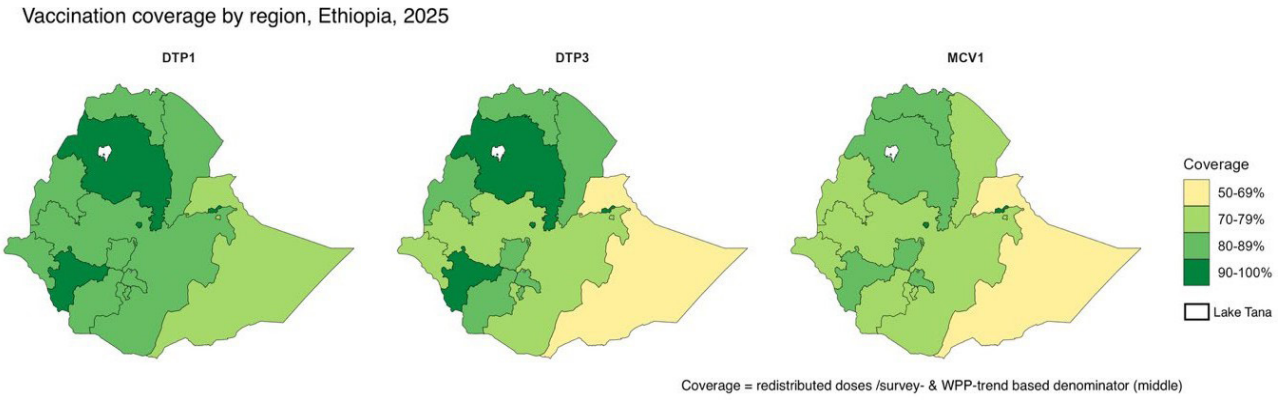


Figure 3: Vaccination coverage by region, 2025

Table 1: 2025 vaccination coverage by region and antigen (coverage)

NATIONAL / REGION	DTP1 (%)	DTP3 (%)	MCV1 (%)
National	84	81	77
Addis Ababa City Administration	94	93	90
Afar Region	85	80	75
Amhara Region	91	90	87
Benishangul-Gumuz Region	86	81	74
Central Ethiopian Region	85	82	80
Dire Dawa City Administration	96	95	94
Gambella Region	83	77	72
Harari Region	79	73	70
Oromia Region	81	78	74
Sidama Region	89	86	84
Somali Region	73	66	60
South Ethiopia Region	85	82	78
Southwest Ethiopia Region	92	90	86
Tigray Region	86	84	80

As it shown in table 1, Dire Dawa City Administration and Addis Ababa City Administration fell into the highest coverage category (90–100 per cent) for all three antigens. In contrast, Somali Region showed comparatively low coverage across antigens. Several large-population regions fell in the mid-coverage range. Oromia recorded 81 per cent DTP1, 78 per cent DTP3, and 74 per cent MCV1, while Amhara recorded 91 per cent DTP1, 90 per cent DTP3, and 87 per cent MCV1. Although these coverage levels were higher than those observed in Somali and Gambella regions, coverage for some antigens remained below optimal levels and translated into large absolute numbers of unvaccinated children because of population size

National zero-dose trends

At the national level, the absolute number of zero-dose children remained high despite improvements in DTP1 coverage. In 2025, Ethiopia recorded 762,235 zero-dose children, down from 986,105 in 2024, while DTP1 coverage increased from 79% to 84% (Figure 3). As shown in Table 2, zero-dose children were concentrated in a few regions, reflecting both population size and coverage levels. Oromia (401,695), Somali (96,161), and Amhara (76,169) together accounted for 75% of the national zero-dose burden. High coverage does not necessarily translate into a low zero-dose burden: Oromia and Amhara had DTP1 coverage of 81% and 91%, respectively, but large zero-dose populations, while Somali combined the lowest DTP1 coverage (73%) with a high zero-dose burden. Most regions improved DTP1 coverage between 2019 and 2025 (Table 2).

Table 2: Zero dose, DTP1 coverage (2025) and percentage point change since 2019 by region (coverage <80% and negative change highlighted)

NATIONAL / REGION	Zero-dose	DTP1 coverage (%)	DTP1 Δ pp since 2019
National	762,235	84	+9
Oromia Region	401,695	81	+9
Somali Region	96,161	73	+15
Amhara Region	76,169	91	+9
South Ethiopia Region	52,473	85	+10
Central Ethiopian Region	42,997	85	+10
Tigray Region	28,554	86	0
Sidama Region	22,196	89	+9
Afar Region	11,323	85	+19
South West Ethiopia Region	9,080	92	+10
Addis Ababa City Administration	8,990	94	+4
Benishangul-Gumuz Region	6,035	86	+6
Gambella Region	3,114	83	+11
Harari Region	2,851	79	+11
Dire Dawa City Administration	596	96	+12

Woreda/sub-city coverage trends

Coverage at the woreda and sub-city level reveals substantial subnational variation that is masked by national and regional averages. Figure 6 shows the distribution of DTP1, DTP3, and MCV1 coverage in 2025.DTP1 coverage was generally higher than DTP3 and MCV1, indicating stronger initial access but greater challenges with continuity and measles vaccination; a larger share of woredas and sub-cities had DTP3 and MCV1 coverage below 80%. Geographic disparities were also evident, with eastern and south-eastern Ethiopia generally showing lower coverage, while higher coverage was more common in urban and highland areas.

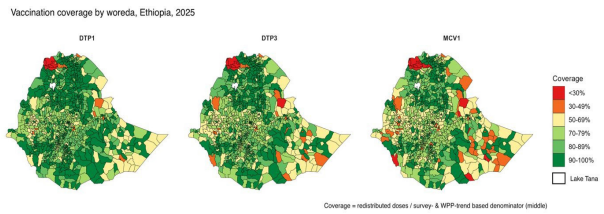


Figure 4: Vaccination coverage by woreda, Ethiopia, 2025

National overview of zone-level coverage and zero-dose burden

Figure 5 shows the 20 zones with the lowest DTP1 coverage in 2025, from Western (24%) to West Arsi (highest in this group). Hatched bars identify zones also among the 20 highest in absolute zero-dose burden. Coverage was below 60% in several zones, including Western (24%), Abadir (42%), Amir Nur (52%), Aboker (57%), and Sitti (58%), while East Hararge (79%) and Arsi (82%) had relatively higher coverage but large zero-dose populations due to their population size, underscoring the need to prioritize both coverage gaps and absolute zero-dose burden.

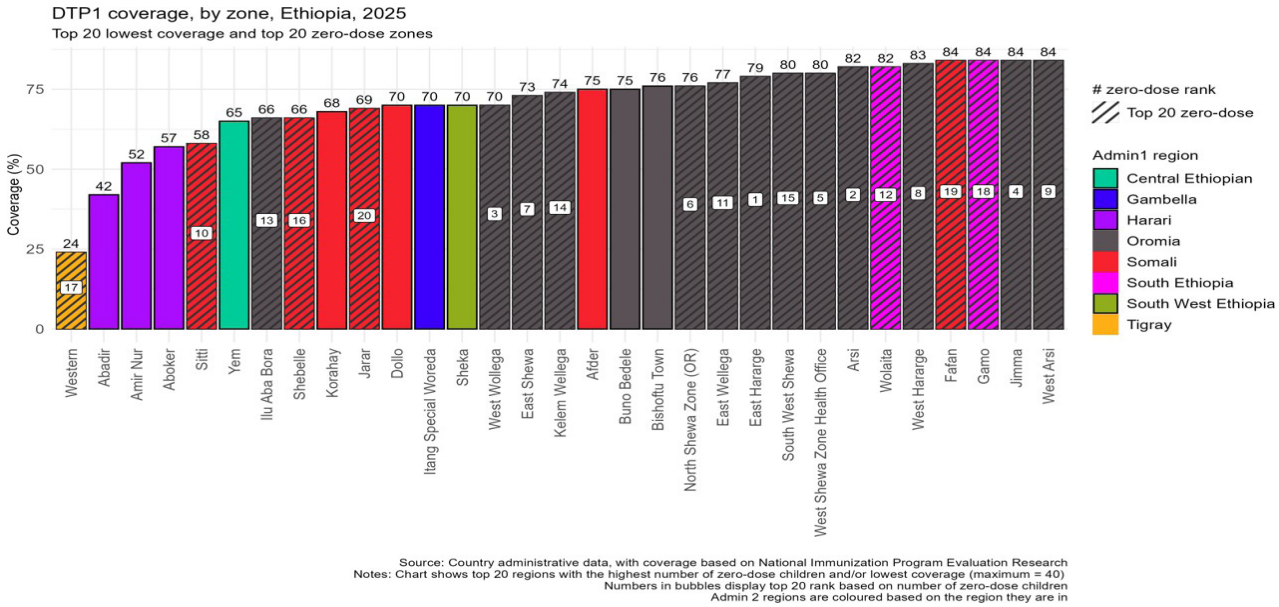


Figure 5: DTP 1 Coverage versus number of Zero Dose

Coverage and absolute zero-dose burden provide complementary perspectives, identifying both high-proportion coverage gaps in smaller areas and large numbers of unvaccinated children in highly populated zones. Together, they support more equitable and efficient prioritization of immunization interventions and resources.

National overview of woreda-level coverage and zero-dose burden

Figure 6 shows the 20 woredas with the lowest DTP1 coverage in 2025, ordered from left to right in ascending order of coverage. Hatched bars indicate woredas that also ranked among the top 20 for the highest absolute number of zero-dose children, with numeric labels inside the bars showing their zero-dose burden ranking.

Several woredas exhibited critically low levels of DTP1 coverage, signaling severe barriers to initial contact with immunization services. Gunchire Town, Setit Humra, and May Kadra Town recorded coverage below 20 per cent, while Dansha Town, Kafta Humera, Daymeed Woho, Awra, and Tsegede remained below 25 per cent. These patterns point to concentrated pockets of very low coverage, particularly in Tigray Region, where access, security, or service delivery challenges are likely to be most acute.

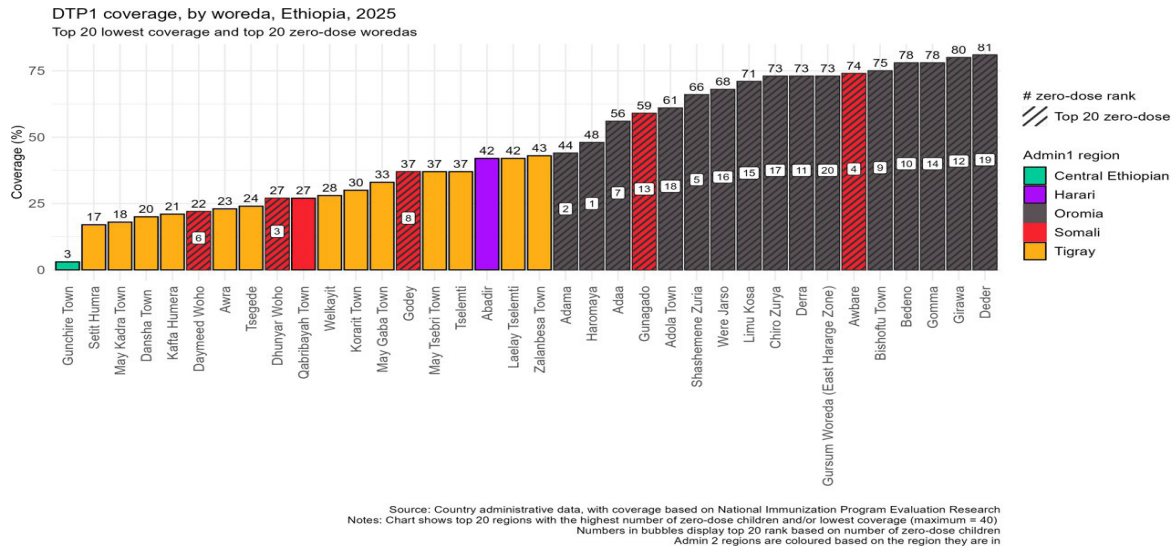


Figure 6: DTP 1 Coverage versus number of zero dose

Figure 6 further emphasizes the pattern that high zero-dose burdens are not limited to the lowest-coverage settings. Several relatively higher-coverage but densely populated woredas, including Awbare, Gursum Woreda (East Hararge Zone), Chiro Zurya, Bishoftu Town, Bedeno, and Deder, appeared among the top-ranked woredas for absolute numbers of zero-dose children, despite having DTP1 coverage ranging from roughly 73 to 81 per cent.

Overall, the woreda-level analysis supports a dual prioritization approach that considers both proportional coverage gaps and absolute zero-dose burden to identify areas with the greatest access challenges and the highest potential impact for reducing the national number of unvaccinated children, thereby promoting more equitable and effective immunization planning.

Limitations

AHEAD estimates remain subject to denominator uncertainty, population mobility, residual data quality issues, age-group misclassification, outdated administrative boundaries, and limited subnational detail in recent EDHS data, which may affect the precision of subnational estimates.

Conclusion

The AHEAD initiative strengthened Ethiopia's routine immunization data system by improving data quality, refining denominator estimates, and producing more reliable national and subnational coverage estimates. Collaborative data validation addressed reporting inconsistencies, missing data, outdated census denominators, conflict-related disruptions, and population movement. The 2025 analysis estimated DTP1 coverage at 84%, DTP3 at 81%, and MCV1 at 77%, all below IA2030 targets. Only four regions achieved at least 80% coverage across major antigens, while Oromia, Amhara, and Somali accounted for approximately 76% of all zero-dose children. Persistent inequities remained in pastoralist, remote, and conflict-affected areas, whereas urban regions such as Addis Ababa consistently performed better.

Overall, AHEAD demonstrates the value of integrating routine data quality improvement, denominator strengthening, and equity-focused analysis into national health information systems. Institutionalizing these approaches will support evidence-based planning, better targeting of zero-dose children, and accelerated progress toward equitable immunization coverage.

Recommendations

- Institutionalize AHEAD analytics within routine planning, monitoring, and performance review to guide implementation of the National Immunization Strategy (2026–2030).
- Prioritize equitable service delivery by focusing on low-coverage, high zero-dose, pastoralist, conflict-affected, and underserved populations through outreach and tailored interventions.
- Strengthen routine data quality through regular verification, supportive supervision, improved feedback, and accountability mechanisms.
- Improve denominator estimation by continuously triangulating survey, administrative, and population projection data while accounting for population movement.
- Enhance collaboration with WHO, UNICEF, WUENIC, Countdown2030, DHIS2, and national partners to improve methodological consistency and data use.
- Scale the AHEAD approach to other health program, including maternal and child health, nutrition, and disease prevention, to strengthen Ethiopia's health information system.

Reference

1. WHO/UNICEF Estimates of National Immunization Coverage (WUENIC), 2024 revision, published 15 July 2025.

2. United Nations, Department of Economic and Social Affairs, Population Division (2024). World Population Prospects 2024, Online Edition.

3. Consortium of CBMP Universities in Collaboration with Ministry of Health and Amref Health Africa, National Immunization Program Evaluation Research in Ethiopia, Service Delivery Summary Report, Addis Ababa, May 2024.

4. World Health Organization (2017). Data quality review: a toolkit for facility data quality assessment. Module 1. Framework and metrics. Geneva: World Health Organization:

5. Countdown to 2030 / GFF / UNICEF / WHO, National and subnational coverage and other service statistics for reproductive, maternal, newborn and child health using health facility data and surveys, Ethiopia, Brief synthesis of the analyses, July 2022: https://www.countdown2030.org/wp-content/uploads/2023/02/Ethiopia-Overall-Country-Report-July-2022-v2-Draft.pdf

6. World Health Organization. (2013). Global Vaccine Action Plan 2011-2020. World Health Organization.

7. Implementing the Immunization Agenda 2030, A Framework for Action through Coordinated Planning,

Availability of health insurance, medicine list, benefit package and its associated factors among public health facilities in Ethiopia, 2026: Multi-center cross-sectional study

Dachasa Dabalo (Bsc, MPH)[1], Debela Ejeta (MD, MPH, Internist)[2], Muluneh Fromsa (PhD) [3]

[1]*Ethiopian Health Insurance Services, Strategic health Service Purchase and Quality Assurance, Addis Ababa, Ethiopia*

[2]*Ambo University, Collage of Health Science and Referral Hospital), Ambo, Ethiopia*

[3]*Ambo University, Collage of Health Science and Referral Hospital), Ambo, Ethiopia*

Corresponding author: Dachasa Dabalo, ddachasa586@gmail.com

Abstract

Background: Despite the introduction of health insurance and policy intentions that aimed to enhance financial protection and equitable access to essential medicines and health services in Ethiopia, shortages and unavailability of insured medicines remain a major bottleneck in the Ethiopian health system.

Objective: To assess the availability of the health insurance medicine list benefit package and its associated factors among public health facilities in Ethiopia in 2026.

Methods: An institution-based cross-sectional study was conducted from April 10 to July 15, 2026, on 222 public healthcare facilities. Data was collected using a structured checklist developed in the Kobol tool platform through face-to-face interviews, then exported to SPSS version 27 for analysis. The logistic regression analysis was applied to establish association and statistical significance, declared at a p-value of 0.05 with their respective 95% adjusted odds ratios.

Results: Overall, the availability of essential medicines in the health facilities was 68.9% at the time of the survey, with a higher proportion of primary health care facilities having high medicine availability compared with secondary and tertiary levels of health care facilities. In this study, medicine store capacity and infrastructure status, EPSS lead time to delivery in days > 7 days, total budget allocated for the health facilities in million dollars < 0.505, and lack of manpower and budget were factors associated with availability of health insurance medicine list benefit package among public health facilities in Ethiopia.

Conclusion: Even though overall medicine availability in Ethiopian public health care facilities is fairly-high, a substantial variation across health facilities levels of care implies that strengthening medicine storage and infrastructure, reducing EPSS delivery lead times, improving facility-level budget allocation, and addressing manpower and budget constraints are critical to improving availability of medicines in the health insurance benefit package across all levels of health care facilities.

Keywords: medicine availability, health insurance, public health facilities, Ethiopia

Introduction

Despite these policy intentions, shortages and unavailability of insured medicines remain a critical bottleneck in the Ethiopian health system. Various assessments and reports indicate that insured patients often fail to obtain prescribed medicines from public facilities, forcing them to purchase medicines from private pharmacies at out-of-pocket cost. This not only undermines the core objective of the health insurance program to protect households from catastrophic health expenditures but also erodes public trust in the insurance system [1,2]World Health Organization (WHO. The health insurance medicines list was developed based on priority interventions, national standard treatment guidelines, and the national essential medicines list. However, public health facilities often encounter shortages and stockouts. Furthermore, stock-outs may be exacerbated by the mismatch between the national essential medicine list and the insurance medicine benefit list, leading to procurement and budgeting inconsistencies at the facility level [3,4]. The literature identifies storage capacity, logistics management information systems, rational medicine use, inventory control, pharmacy personnel, budget, and facility management as important factors influencing medicine and evidence shows substantial variation and generally low availability of essential medicines in public health facilities, with stockouts, and additional out-of-pocket expenditures for unavailable medicines remaining a persistent [5–10]health facilities continue to report stockouts in Uganda. Objectives: This study aimed to assess the status and performance of the supply chain system across all levels of care in health facilities in Uganda. Methods: This was a cross-sectional study conducted in 128 public and private-not-for-profit health facilities across 48 districts in Uganda. These facilities included all levels of care from Health Centres II, III, IV, general and referral hospitals, and national referral hospitals. Data were collected using desk reviews, health facility surveys, and key informant interviews with key personnel. Stock registers were reviewed to assess the availability of a basket of essential medicines based on the essential medicines list of the Ministry of Health. Results: Less than half (42%. While those scattered studies and reports have assessed general pharmaceutical supply issues in Ethiopia, there is limited evidence specifically focusing on the availability of medicines listed in the health insurance benefit package and the factors influencing their availability across public health facilities. Despite the development of the health insurance medicine list the shortages and inconsistent availability of insured medicines continue to undermine public trust and the core objective of providing financial risk protection against health-related expenses. Therefore, evidence on the availability of insured medicines and factors associated with their supply across public health facilities is limited, justifying the need for this study. Hence, this study aimed to systematically assess the availability of insured medicines and identify factors associated with their supply across public health facilities, which is crucial to understanding the current situation, identifying gaps, and informing strategic interventions to improve the effectiveness and sustainability of Ethiopia's health insurance benefit package. Furthermore, the study will contribute to the national effort to strengthen the pharmaceutical supply chain, address shortages and stock-outs of insured medicines, and promote equity in access to quality healthcare services. The findings will inform policymakers, the EHIS, the Ministry of Health, regional health bureaus, and pharmaceutical supply services in designing targeted interventions to improve medicine availability and reduce out-of-pocket expenditure among insured members. Ultimately, the results will support the effectiveness and sustainability of Ethiopia's health insurance programs and guide strategic decisions aimed at achieving universal access to essential medicines.

Methods

Study Design, Area, and Period

A facility-based cross-sectional study was conducted in selected public health facilities across Ethiopia from April 10 to July 15, 2026. Ethiopia nowadays comprises 4,033 governmental health facilities, distributed across the 13 regions, including Addis Ababa and Dire Dawa cities, as follows: Benishangul-Gumuz (61), Oromia (1,447), Amhara (947), Addis Ababa (108), Afar (103), SNNP (532), Dire Dawa (16), Somali (204), South West Ethiopia (140), Sidama (160), Gambela (24), Tigray (276), and Harari (15) [11].

Population and Eligibility

The source population comprised all hospitals and health centers in Ethiopia, while the study population included selected functional hospitals and health

centers during the study period. Hospitals and health centers that were not fully functional, closed, or had incomplete data were excluded.

Sample Size and Sampling

The sample size was determined using a single population proportion formula, assuming a 95% confidence level, 5% margin of error, and 80.62% medicine availability report from health sector medium-term development and investment plan (HSDIP), with a 1.5 design effect and 5% non-response rate. The initial sample size was 239, and, after finite population correction for the 4,033 governmental health facilities, the final sample size was 238. Proportional allocation was applied across Ethiopia's 13 regions using the number of governmental health facilities in each region, followed by simple random sampling using regional facility lists as sampling frames.

Variables and Operational Definitions

The dependent variable was medicine availability (high/low). Major independent variables included facility characteristics, Logistics Management Information System (LMIS), rational use of medicines, inventory control systems, LMIS and Ethiopian Pharmaceuticals Supply Service (EPSS) supply performance, Drug and Therapeutics Committees, and training and capacity building. Medicine availability was defined as the physical presence of any quantity of the required medicine in the specified dosage form and strength on the day of data collection. HIML availability was the percentage of surveyed public health facilities where a medicine included in the HIML was physically present in the required dosage form and strength on the survey day. Following WHO/HAI methodology, medicine availability was calculated as the percentage of facilities where each medicine was present and categorized as high (≥80%) and low (<80%). Overall availability was further classified as very low (<30%), low (30–49%), fairly high (50–80%), and high (≥80%).

Data Collection and Quality Assurance

A structured and pre-tested questionnaire and observation checklist, adapted from national standards and related literature, assessed facility characteristics, tracer medicine availability, six-month stock-out history, reasons for stock-outs, storage conditions, LMIS, inventory control, pharmacy workforce, supply chain performance, budget, and governance structures. Availability was assessed through physical verification of 50 essential medicines selected from the 2025 Ethiopian Health Insurance Service medicines list, aligned with the national essential medicines list, supplemented by stock records and facility documents. Data were collected using Kobo Toolbox through interviews with pharmacy personnel, direct observation, and document review. Data collectors were multidisciplinary health professionals from the EHIS Quality Assurance Directorate and 24 branches across the country and received orientation on the study procedures. Data quality was ensured through pre-testing, continuous supervision, daily review and validation, Kobo-based skip patterns and required fields, and prompt correction of identified inconsistencies or missing data.

Data Processing and Analysis

Data were exported to SPSS Windows version 27 for analysis. Descriptive statistics used to describe the data. Bivariable logistic regression was used to identify candidate variables for multivariable logistic regression, with variables having $p < 0.25$ included in the final model. Multicollinearity was assessed using the variance inflation factor (VIF) with a cutoff of 5; type of health facility (VIF=7.733) was excluded because of high multicollinearity. Model goodness of fit was assessed using the Hosmer–Lemeshow test ($\chi^2 = 5.396$, $p = 0.715$). Multivariable logistic regression was used to adjust for potential confounding and identify predictors of medicine availability. Statistical significance was declared at $p \leq 0.05$ with corresponding 95% confidence intervals.

Ethical Consideration

Ethical clearance was obtained from the Ethical Review Board of the College of Health Science and Referral Hospital of Ambo University. A supportive letter was obtained from the university, and permission was secured from respective health facilities. Confidentiality of the collected information was maintained throughout the study.

Results

A total of 222 public health facilities were included in the study with a response rate of 93.3%, comprising 148 (66.7%) health centers, 41 (18.5%) primary hospitals,

19 (8.6%) general hospitals, and 14 (6.3%) specialized hospitals. Most health facilities, 183 (82.4%), had a total annual budget of less than US$0.505 million, whereas 19 (8.6%) had budgets ranging from US$0.505 to US$0.832 million, and only 20 (9.0%) had budgets of US$0.971 million or more. Overall, 125 (56.3%) facilities had adequate medicine storage and infrastructure, while 97 (43.7%) had inadequate capacity. Although 99.5% submitted report and requisition forms to EPSS on time, only 36.9% received medicines within seven days, while 63.1% experienced lead times exceeding seven days. The overall availability of the 50 key medicines included in the 2025 Ethiopian Health Insurance Service medicine list was 68.9%, corresponding to a fairly high level according to WHO/HAI categories. However, a 31.1% stock-out was observed on the day of assessment. Facility-level analysis showed that 45.5% of health centers had fairly high medicine availability, while 21.6% of primary healthcare facilities, including primary hospitals, achieved high availability (≥80%), compared with only 3.6% of secondary and tertiary-level facilities. Multivariable logistic regression identified four independent factors significantly associated with medicine availability. Facilities with inadequate medicine storage capacity and infrastructure were 73% less likely to achieve high medicine availability (AOR=0.27; 95% CI: 0.11–0.69; p=0.006). Facilities with EPSS delivery lead times exceeding seven days were less likely to have high availability (AOR=0.38; 95% CI: 0.16–0.93; p=0.034). Facilities with an annual budget below US$0.505 million were less likely to achieve high availability compared with facilities allocated ≥US$0.971 million (AOR=0.18; 95% CI: 0.03–0.96; p=0.045). Facilities reporting lack of manpower and budget were also substantially less likely to achieve high medicine availability (AOR=0.18; 95% CI: 0.05–0.74; p=0.018).

Discussion

The overall medicine availability of 68.9% indicates a fairly high level according to WHO/HAI categories; however, the 31.1% stock-out demonstrates that approximately one-third of expected medicine availability points were affected by non-availability on the day of assessment. The observed availability was higher than previous studies reporting availability ranging from 29.4% to 54.4% across WHO regions, 44.4% in Nepal, 40% in Malaysia, 16% in Uganda, and 43% in Nairobi [5,12–14]. Differences may reflect variations in study periods, medicine baskets, health-system capacity, procurement and financing mechanisms, inventory management, facility types, sampling strategies, and study designs; therefore, direct comparisons should be interpreted with caution. The higher medicine availability observed in primary healthcare facilities compared with secondary and tertiary hospitals may reflect differences in service scope and medicine inventory requirements. Primary healthcare facilities generally maintain a relatively limited list of essential medicines with more predictable demand, whereas higher-level hospitals require a broader range of specialized medicines for complex clinical services, increasing challenges in procurement, inventory management, and supply-chain coordination [15–17]. Inadequate medicine storage capacity and infrastructure were significantly associated with lower availability. This finding is consistent with evidence from Southeast Asia and Ethiopia showing that inadequate storage infrastructure constrains inventory management and medicine availability[18–22]. Proper storage infrastructure is therefore essential for maintaining medicine stocks, appropriate organization, inventory control, and uninterrupted availability. Longer EPSS delivery lead time was another significant determinant. Facilities experiencing delivery times exceeding seven days were less likely to achieve ≥80% medicine availability. This is consistent with studies reporting that transportation, distribution inefficiencies, and lengthy procurement lead times contribute to stock-outs and reduced medicine availability in Ethiopian public health [23,24] and a sustainable supply of quality-assured medicines is central to the EPSS mandate and is critical for maintaining medicine availability [25,26]. Budget availability was also significantly associated with medicine availability. Facilities with annual budgets below US$0.505 million were 82% less likely to achieve ≥80% availability than facilities with budgets of ≥US$0.971 million. Similar findings have been reported in West Gojjam and southwestern [6,7] Inadequate budgeting for medicines is a major contributor to limited access and increased out-of-pocket expenditure[27],while pharmaceutical expenditure coverage is an important measure of medicine availability within universal health coverage [28]. Finally, facilities reporting lack of manpower and budget were 82% less likely to achieve the recommended ≥80% medicine availability. This finding is consistent with studies from West Gojjam and southwestern Ethiopia and with evidence identifying inadequate human resources and budget limitations as major barriers to

essential medicine availability in African countries [6,7,29] The findings indicate that achieving adequate medicine availability requires coordinated strengthening of storage infrastructure, supply-chain performance, financing, and human resources rather than addressing a single factor.

Conclusion and Recommendation

Medicine availability in Ethiopian public health facilities was 68.9%, below the WHO-recommended target of ≥80%, with substantial variation across medicine classes and levels of care. Strengthening medicine storage and infrastructure, reducing EPSS delivery lead times, improving facility-level budget allocation, and addressing manpower and budget constraints are critical to improving availability of medicines in the health insurance benefit package. Regional health bureaus and the Ministry of Health should strengthen facility capacity, while EPSS should reduce delivery lead times. The government should also review and strengthen annual budget allocation to ensure continuous availability of essential medicines. The study's strength was the use of nationwide data from public health facilities and a standard tool adapted from national guidelines, standards, and related literature. However, because of the cross-sectional design, causal relationships between the identified factors and medicine availability cannot be established.

References

1. Sisay, M., Amare, F., Hagos, B. & Edessa, D. Availability, pricing and affordability of essential medicines in Eastern Ethiopia: a comprehensive analysis using WHO/HAI methodology. *J. Pharm. Policy Pract.* 14, 1–20 (2021).
2. Berassa, M. S. & Worku, S. G. Availability of Essential Medicines at a University Hospital in Addis Ababa, a cross-sectional study. *Ethiop. J. Heal. Dev.* 37, (2023).
3. Alemayehu, Y. K. *et al.* The impact of community-based health insurance on health service utilization and financial risk protection in Ethiopia. *BMC Health Serv. Res.* 23, (2023).
4. Hussien, M., Azage, M. & Bayou, N. B. Financial viability of a community-based health insurance scheme in two districts of northeast Ethiopia: a mixed methods study. *BMC Health Serv. Res.* 22, 1–13 (2022).
5. Lugada, E. *et al.* Health supply chain system in Uganda: assessment of status and of performance of health facilities. *J. Pharm. Policy Pract.* 15, (2022).
6. Bahiru Tefera, B. & Tilahun Anbessa, G. Pharmaceutical Supply Chain Practices and Its Associated Factors in Public Health Facilities, West Gojjam Zone, Ethiopia: Cross-Sectional Study. *Hosp. Pharm.* 57, 622–632 (2022).
7. Negera, G., Merga, H. & Gudeta, T. Health professionals' perception of pharmaceuticals procurement performance in public health facilities in Southwestern Ethiopia. *J. Pharm. Policy Pract.* 14, 58 (2021).
8. Hussien, M. A., Haile, E. B. & Demisse, B. N. The burden of unavailable drugs cost to patients admitted to internal medicine ward of tikur anbessa specialized hospital. *Patient Prefer. Adherence* 15, 1775–1784 (2021).
9. Demessie, M. B., Workneh, B. D., Mohammed, S. A. & Hailu, A. D. Availability of Tracer Drugs and Implementation of Their Logistic Management Information System in Public Health Facilities of Dessie, North-East Ethiopia . *Integr. Pharm. Res. Pra*ct. Volume 9, 83–92 (2020).
10. Tiye, K. & Gudeta, T. Logistics management information system performance for program drugs in public health facilities of East Wollega Zone, Oromia regional state, Ethiopia. *BMC Med. Inform. Decis. Mak*. 18, (2018).
11. Policy, C. & Note, I. *Country Policy and Information Note Ethiopia : Internal Relocation Executive Summary*. (London).
12. Cameron, A., Ewen, M., Ross-Degnan, D., Ball, D. & Laing, R. Medicine prices, availability, and affordability in 36 developing and middle-income countries: a secondary analysis. *Lancet* 373, 240–249 (2009).
13. Thapa, A. K., Ghimire, N. & Adhikari, S. R. Access to Drugs and Out of Pocket Expenditure in Primary Health Facilities. *J. Nepal Health Res. Counc.* 14, 139–142 (2016).
14. Ongarora, D. *et al.* Medicine Prices, Availability, and Affordability in Private Health Facilities in Low-Income Settlements in Nairobi County, Kenya. *Pharmacy* 7, 40 (2019).
15. World Health Organization. *Monitoring the Building Blocks of Health Systems : A Handbook of Indicators and Their Measurement Strategies*. (2010).
16. Cameron, A., Ewen, M., Ross-Degnan, D., Ball, D. & Laing, R. Medicine prices, availability, and affordability in 36 developing and middle-income countries: a secondary analysis. *Lancet* 373, 240–249 (2009).

17. WHO. Measuring medicine prices, availability, affordability and price components. *WHO Tech. Rep. Ser.* 20, 763–765 (2007).

18. Hlaing, T. & Lat, T. W. Drug supply management at first-level public health facilities: Case of Pyay District, Myanmar. *PLOS Glob. Public Heal.* 4, (2024).

19. EMOH. Health sector transformation plan II (2015/16–2019/20). *Ethiopian Minstry of Health* vol. 25 96 https://extranet.who.int/cpcd/sites/default/files/public_file_repository/ETH_Ethiopia_Health-Sector-Transformation-Plan-II_2021-2026.pdf (2019).

20. Gutesa, A., Jebena, T. & Kebede, O. Inventory Management Performance for Tracer Medicines in Public Health Facilities of Southwest Shewa Zone Oromia Region, Ethiopia: A mixed study. *SAGE Open Med.* 12, 20503121241274040 (2024).

21. Bekele, A. *et al.* Inventory management performance of essential medicines in public health facilities of Jimma Zone, Southwest Ethiopia. *PLOS Glob. Public Heal.* 5, e0004379 (2025).

22. Degebo, A. S. & Tilahun, G. Inventory Management Performance for Lifesaving Maternal and Child Health Medicines in Amhara Regional State, Ethiopia: A Facility-Based Cross-Sectional Mixed Method Study. *Heal. Sci. Reports* 9, e72222 (2026).

23. Getahun, K. T., Bilal, A. I. & Cho, D. J. Public sector pharmaceutical distribution system and its challenges: a case of a central Ethiopian Pharmaceuticals Supply Service and selected branches. *BMC Heal. Serv. Res. 2025 251* 25, 278- (2025).

24. Bilal, A. I., Bititci, U. S. & Fenta, T. G. Effective Supply Chain Strategies in Addressing Demand and Supply Uncertainty: A Case Study of Ethiopian Pharmaceutical Supply Services. *Pharmacy* 12, 132 (2024).

25. Negera, B. Assessment of Procurement Lead Time Reducing Practices and Challenges: The Case of Ethiopian pharmaceutical Supply Service Central, Addis Ababa. at https://etd.aau.edu.et/handle/123456789/2809 (2023).

26. Lesego, A. *et al.* Assessment of the Global Fund-supported procurement and supply chain reforms at the Ethiopian Pharmaceuticals Supply Agency: a mixed-methods study. *BMJ Open* 13, e073390 (2023).

27. Assembly, W. H. *Addressing the Global Shortage of Medicines and Vaccines. World Health Organization* vol. 2016 (2016).

28. Singh, P. K. & Travis, P. Universal health coverage in the World Health Organization South-East Asia Region: how can we make it 'business unusual'? *WHO South-East Asia journal of public health* vol. 7 1–4 https://iris.who.int/home (2018).

29. Yenet, A., Nibret, G. & Tegegne, B. A. Challenges to the Availability and Affordability of Essential Medicines in African Countries: A Scoping Review. *Clin. Outcomes Res.* 15, 443–458 (2023).

Integrating Family Planning into RMNCH Services at the Primary Health Care Level: Addressing Missed Opportunities in Ethiopia

Netsanet Belete[1], Bezawit Mesfin[1], Takele Yeshiwas[1], Ismale Ali[1], Chala Tesfaye[1], Menberu Getachew[1], Dessalew Emaway[1]

[1]JSI, Addis Ababa, Ethiopia

Corresponding author: Netsanet Belete - netsanet.belete@jso.org

Introduction

Family planning and other RMNCH services are typically delivered through stand-alone programs. This vertical approach fragments the healthcare experience and leads to significant missed opportunities to provide comprehensive, holistic care during a single facility visit. To bridge access gaps and reduce unmet needs, in line with FP2030 goals and other global and national commitments, this service fragmentation needs to be addressed. This is especially vital in geographies where community-level barriers and transport limitations restrict healthcare access, making it critical to maximize every client interaction through integrated service delivery. Ultimately, this integration needs to be centered within primary healthcare, designing services that by design meet the holistic needs of the community at their first point of contact with the health system. This intervention targets selected woredas in eight regions of Ethiopia: Afar, Amhara, Oromia, Somali, Sidama, Central Ethiopia, South west Ethiopia and South Ethiopia. The primary barriers that were identified during the baseline assessment were the providers' skill gap in service integration; a lack of supportive tools, including job aids and referral tools to link mothers receiving the intervention to family planning services and inadequate data recording and reporting systems within and beyond health facilities. Accordingly, this intervention aimed to strengthen PHC level service integration, through supporting the government led interventions.

Method

Pre-intervention assessment: a baseline assessment was conducted to evaluate the status of integrated health services provision at primary health care facilities, including facility readiness to provide integrated services, provider training/orientation, the availability of supportive tools, service workflows, supply chain and stock management, and the recording and reporting of integrated health services. This baseline information has informed the planned interventions.

Implementation setting, package and collaborators:

Intervention: Aligning with national family planning integration guidance, the comprehensive intervention package, includes onsite orientation training for healthcare providers, distribution of implementation support tools, documentation, recording and reporting and onsite technical assistance and cross-learning platforms to review implementation progress and share best practices. Seven integration units were identified, including ANC, labor and delivery, PNC, immunization, under-five OPD, youth-friendly services, and comprehensive abortion care. Staff across all integration units are trained to assess women for eligibility, counsel them, and refer eligible clients to the family planning unit for detailed counseling and service provision.

Setting: This was implemented in eight regions, 50 woredas and 296 health facilities composed of primary hospitals, health centers and comprehensive health post, 18 months (January 2025 – June 2026). This was implemented by the technical and financial support of JSI in collaboration with the ministry of health, regional health bureaus, zonal health departments, woreda health offices and local implementing partners.

Community engagement: Besides the routine community-level awareness creation sessions, health extension workers, village health leaders, and women development unions had an orientation session to create awareness of the integrated services that were delivered at health facilities.

Results:

These results were derived from the monthly monitoring that was conducted in implementing health facilities.

Table: Women Counseled for FP, linked and got service at family planning unit, August 2026

Counselled at different Integration units	Linked to Family Planning Unit	Got FP service
112133	50129 (44.7%)	43229 (86.2%)

As it is clearly indicated in the table, out of 112,133 individuals counselled across the identified integration units, 50,129 were successfully linked to the Family Planning Unit, and 43,229 received family planning services through this integration platform.

- The data demonstrates that while many clients receive counselling, not all are linked to family planning services. To address this gap, facilities need to optimize workflows and minimize waiting times to prevent mothers from facing duplicate waiting times at referring and receiving units. Additionally, community-level awareness of these integrated facility services needs to be strengthened. Finally, it is important to note that not all counselled women are eligible for immediate service uptake, particularly those counselled within antenatal care units.
- Service Delivery Rate (86.2%): Of those who successfully made it to the Family Planning Unit, the majority (43,229 out of 50,129) received FP services. Only 6,900 individuals (13.8%) were linked but did not receive services.
- Overall Service Completion (38.6%): Overall, slightly under two out of every five mothers counselled at integration units completed by receiving family planning services.

The data indicates that once individuals are successfully linked to the Family Planning Unit, service delivery is highly effective (86.2%). However, this also clearly shows that two out of every five eligible mothers who show up at health facilities could represent missed opportunities to provide more than one service during a single facility visit. This, in turn, means that, if this intervention was not in place, more than 43,000 mothers could be missed for family planning services after they visit health facilities for other RMNCH services.

The contraceptive acceptance rate has been also monitored in the implementation sites, together with other efforts. Accordingly, CAR Performance increased by 18 percentage points from a baseline of 85% to an end line of 103%, maintaining strong, stable momentum across months.

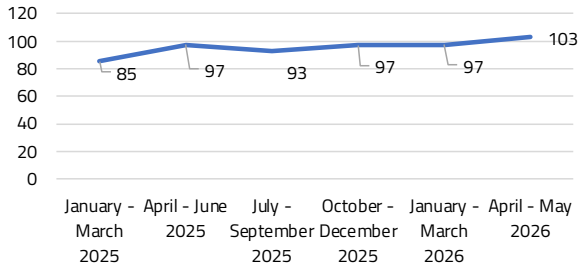


Figure 1- CAR performance of implementation sites, Source: National DHIS2, SSD 50 Woredas

Lessons Learned:

1. Joint Capacity Building

- Integrate service integration directly into program-level technical training to avoid fragmented, and duplicated training for providers and managers
- Sustain program momentum and long-term viability using onsite technical support, peer learning sessions, and routine cross-learning platforms.

2. Supply Chain and Integration Protocols

- Prioritize supply chain planning to meet the increased commodity demand driven by service integration.
- Establish clear facility-level integration classifications (Levels A–D) and explicit internal stock management protocols especially for integration units.

3. HMIS and Method-Mix Tracking

- Upgrade HMIS tools to track client journeys from initial counselling to referral and final family planning service delivery
- Standardize reporting tools to explicitly capture specific family planning method mixes for complete data accuracy, and separately track the contribution of family planning service integration for the overall service uptake and method mix.

4. Local Ownership and Community Links

- Align integrated service delivery with a special focus at the Primary Health Care level with national strategies to holistically address women's needs
- Engage local health managers, providers, health extension workers, and community structures across all phases, from design to best-practice documentation and dissemination to build true ownership and context-tailored solutions
- Plan community-level awareness initiatives backed by close supervision and monitoring to continuously drive demand and eliminate care barriers

Recommendation

Ministry of Health, Regional Health Bureaus

- Policy and National Scaling: Establish national frameworks to prioritize and scale service integration across primary health care settings to optimize overall health system performance
- Tool Harmonization: Standardize and harmonize internal facility referral, recording and reporting tools to systematically capture and monitor integrated services across all platforms

Zonal Health Departments and Woreda Health Office

- Supply Chain Management: Streamline district-level logistics and stock distribution to ensure reliable commodity availability at facilities which initiate service integration
- Institutional Ownership: Lead operational oversight and build local system ownership to secure the long-term sustainability of integrated care delivery

Program Implementers

- Integrated Capacity Building: Design and deliver unified training modules that fully embed service integration into technical skill-building programs.
- Implementation Support: Provide contentious technical assistance to health facilities to operationalize integration workflows and support the rollout of harmonized tracking tools.

Institutional Transformation of Ethiopia's Public Health Logistics: A Legal, Operational, and Policy Synthesis under Proclamation No. 1354/2024 and Directive No. 1066/2025

Boru, Abdulkedir[1], Melefia, Akanw[1], Ebrahim, Awol[1], Banti, Degefa[2]

[1]Ethiopian Pharmaceutical Supply Service, Addis Ababa, Ethiopia

[2]USG- Supply Chain Strengthening (SCS) Project, Addis Ababa, Ethiopia

Corresponding Author: Dr. Abdulkedir Gelgelo Boru, abdulkedir.gelgelo@epss.gov.et, +251 944305056

Introduction

The consistent availability of quality-assured, affordable essential pharmaceuticals is a prerequisite for achieving Universal Health Coverage (UHC). Across low- and middle-income countries, public health supply chains face structural challenges, including currency volatility, supply chain disruptions, and administrative delays.

In Ethiopia, the public pharmaceutical sector serves over 420 hospitals, 4,100 health centers, and 18,500 health posts through the Ethiopian Pharmaceuticals Supply Service. Despite significant expansions in distribution coverage, the operational model historically encountered severe structural bottlenecks.

Health facilities frequently defaulted or delayed payments to the central supplier, tying up working capital and causing delays in settling international procurement contracts.

Standard public procurement regulations failed to account for specialized medical requirements, such as proprietary closed diagnostic equipment consumables, emergency reagents, and short-shelf-life medicines.

Facility-level purchasing lacked contractually binding commitments, producing inaccurate quantification, frequent emergency stockouts, and high product expiration rates.

To address these vulnerabilities, the Federal Government enacted Proclamation No. 1354/2024 (Ethiopian Pharmaceuticals Supply Service and Pharmaceutical Fund Establishment Proclamation) and the Ministry of Finance issued Directive No. 1066/2025 (Procurement Directive on Centrally Procured Pharmaceuticals and Medical Equipment). Together, these legal frameworks redefine the governance, procurement, and financial operations of public health logistics in Ethiopia.

Objective

General Objective

The primary objective of this presentation is to provide a comprehensive structural synthesis of the reforms instituted under Proclamation No. 1354/2024 and Directive No. 1066/2025.

Specific Objectives

- Examines the statutory mandates, governance shifts, and financial mechanisms created by Proclamation No. 1354/2024.
- Evaluates the specialized procurement pathways, domestic market preferences, and life-cycle management rules established under Directive No. 1066/2025.
- Maps the integrated financial cash-flow and operational supply chain architecture governing central logistics and health facilities.
- Provides actionable policy and strategic directives to maximize implementation efficiency across federal and regional health administration tiers.

Methods

This study employs an integrated qualitative legal synthesis and public health policy analysis framework to evaluate the structural transition of Ethiopia's health supply chain. By combining statutory interpretation, policy process mapping, and comparative institutional evaluation, the methodology assesses how legislative shifts under Proclamation No. 1354/2024 and Ministry of Finance Directive No. 1066/2025 resolve historical operational vulnerabilities.

Study Design & Analytic Framework

A multi-tier legal-policy analytical framework was constructed to evaluate reforms across three primary operational axes for Governance & Legal Autonomy, Financial Sustainability & Debt Mechanisms, and Procurement Operations & Market Incentives.

Statutory Legal Document Analysis

A systematic review of Ethiopian public pharmaceutical procurement legislative instruments was conducted to map the evolution of the public pharmaceutical supply management legal framework.

Proclamation No. 1354/2024 (Ethiopian Pharmaceuticals Supply Service and Pharmaceutical Fund Establishment Proclamation) and Directive No. 1066/2025 (Ministry of Finance Directive on Centrally Procured Pharmaceuticals and Medical Equipment by the Ethiopian Pharmaceutical Supply Service).

Proclamation No. 1263/2021 (Definition of Powers and Duties of the Executive Organs of the FDRE), Proclamation No. 553/2007 (Drug Fund and Pharmaceuticals Supply Agency Establishment Proclamation—Legacy baseline), and standard Federal Public Procurement frameworks under Proclamation No. 1333/2024 and Directive No. 1073/2025.

Analytic Procedure

The legal text was subjected to qualitative content analysis focusing on the dimension examines structural changes to institutional governance, focusing on modifications to corporate personality, board authority, profit margin setting, and statutory permissions for outsourcing third-party logistics (3PL). This analysis evaluates Article 23 of Proclamation No. 1354/2024, focusing specifically on direct banking execution powers and the backstop liability protections provided by the Ministry of Finance. The focus area assesses Directive No. 1066/2025 to categorize exemptions from general public procurement laws, including specific mechanisms like closed-equipment reagent lock-ins, single-source emergency items, and multi-year framework agreements.

Policy Framework & Process Mapping

To observe how legislative provisions translate into logistics operations, policy process mapping was performed across four critical supply chain workflows.

Traceability analysis of capital movement from public health facility budget allocations through product delivery, invoice maturation (>6 months), automated Article 23 bank deductions, and replenishment of the Revolving Drug Fund (RDF).

End-to-end process mapping contrasting standard public tender workflows with the streamlined options in Directive No. 1066/2025 (e.g., pooled procurement, consignment inventory, and direct closed-system contracting).

Flowchart analysis of facility-level requisition processes under legacy ad-hoc ordering versus the structured Committed Demand System backed by enforceable annual supply contracts (Articles 2 & 24).

Mapping the auditing and scoring algorithms used under Directive No. 1066/2025 to calculate domestic value addition, grant up to 25% price preferences, and process foreign-currency bids from domestic manufacturers.

Operational Comparative Evaluation Metrics

A matrix was constructed to compare legacy baseline structures against the reformed legal environment across standardized operational and policy parameters as presented in table 1 below.

Table 1: Comparative Analysis of Legacy vs. Reform Operational Framework

Operational Matrix Dimension	Legacy Framework Metrics (Proc. 1263/2021 & Proc. 553/2007)	Reform Framework Metrics (Proc. 1354/2024 & Dir. 1066/2025)	Analytic Focus
Institutional Governance	Direct civil service control; fixed profit margins; administrative reporting.	Autonomous public entity; 11-member Board supervision; flexible pricing & 3PL mandate.	Operational agility and strategic decision-making autonomy.
Financial Security	Accounts receivable write-offs; facility non-payment arrears; high credit risk.	Statutory debt recovery via direct bank deductions (Art. 23); ring-fenced RDF.	Liquidity preservation and foreign supplier contract stability.
Procurement Mechanics	Rigid 12-step public tender process; high failure rates for closed reagent systems.	4 tailored pathways (pooled, direct, consignment, framework agreements).	Lead-time reduction and elimination of reagent stockouts.
Demand Precision	Unbound facility projections; severe forecasting variance; high expiration waste.	Mandatory Committed Demand Contracts (Art. 24).	Quantification accuracy and bulk pricing negotiation strength.
Local Industry Support	Preference margin applied without domestic value-addition auditing.	Up to 25% price preference based on audited net local value addition; FX quoting rights.	Import substitution and domestic industrial expansion.

Limitations

This methodology relies on legislative analysis, legal process mapping, and early implementation frameworks. Long-term quantitative empirical data assessing post-reform lead-time reductions and financial yield performance were not incorporated, as system-wide implementation across all regional health hubs remains ongoing.

Results

Regulatory & Legal Architecture

The new legislative framework decouples public health commodity supply from standard civil service and public procurement rules, establishing a dedicated statutory domain as presented in figure 1 below.

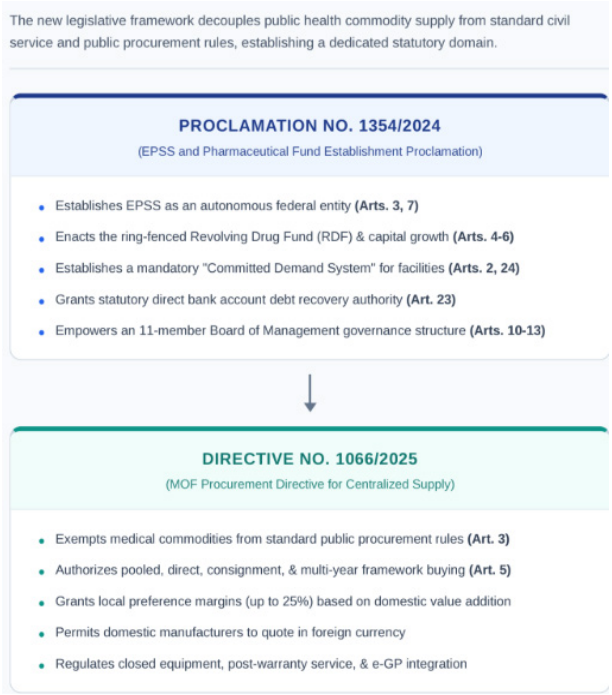


Figure 1: Regulatory & Legal Architecture Framework

Proclamation No. 1354/2024: Statutory Governance and Capital Security

Proclamation No. 1354/2024 establishes the institutional foundation for central logistics management:

Legal Autonomy and Board Supervision (Articles 3, 7, 10–13): EPSS is established as an autonomous federal entity accountable to the Ministry of Health. It is governed by an 11-member Board of Management appointed by the Prime Minister, comprising cross-ministerial, parliamentary, and regional health representatives.

Revolving Drug Fund (RDF) Protection (Articles 4–6): The legislation ring-fences the RDF. Composed of initial government seed capital, operational revenues, service fees, donations, and investment yields, the fund is legally protected from general treasury re-appropriation.

Statutory Debt Recovery (Article 23): To address facility-level payment defaults, Article 23 empowers EPSS to issue direct payment orders to financial institutions, deducting outstanding debts (>6 months) directly from the bank accounts of defaulting public health institutions. Where public facility funds are insufficient or depleted by emergency response, mandatory debt settlement falls to the Ministry of Finance or Regional Finance Bureaus.

Committed Demand and Supply System (Articles 2, 24): Public health facilities are required to source their essential pharmaceutical needs through EPSS under legally binding, pre-enforceable annual supply contracts, reducing forecasting variance.

Directive No. 1066/2025: Customized Health Procurement Pathways: Issued by the Ministry of Finance, Directive No. 1066/2025 establishes specialized procurement mechanisms:

Exemption from Generic Public Procurement Constraints: Decouples health commodity tenders from standard procurement laws, establishing direct pathways for closed diagnostic systems, emergency reagents, and short-shelf-life items.

Domestic Preference and Currency Flexibility: Local manufacturers receive price preference margins of up to 25% based on audited net domestic value addition. Crucially, domestic producers are permitted to bid in foreign currency, mitigating foreign exchange risks and encouraging local industry growth.

Advanced Contracting Models: Formally standardizes multi-year framework contracts, pooled procurement, consignment inventory models, and pre-negotiated volume pricing agreements.

Comprehensive Operational & Financial Analysis

Comparative Analysis Across Legal Frameworks

This comparative presentation evaluates the transformation from the legacy legal framework to the reform framework across key operational dimensions, highlighting the resulting system-wide impacts on governance, procurement, financial stability, demand precision, and domestic industry support. The tables 2 below present the comparative analysis in detail.

Table 2: Comparative Analysis of Legacy and Reform Legal Frameworks Across Operational Dimensions

Operational Dimension	Legacy Legal Framework (Proc. 1263/2021)	Reform Framework (Proc. 1354/2024 & Dir. 1066/2025)	System-Wide Impact
Institutional Mandate	Standard public agency subject to standard civil service regulations.	Autonomous public body overseen by an empowered Board of Management.	Enhanced operational agility, commercial flexibility, and administrative efficiency.
Procurement Regulations	Bound by generic Federal Public Procurement Authority procedures.	Specialized procurement pathways are managed by an internal Procurement Board.	Shorter procurement lead times; eliminates stockouts for proprietary closed systems.
Working Capital Integrity	Vulnerable to chronic facility non-payment and cash-flow deficits.	Ring-fenced Revolving Drug Fund backed by direct bank account debt deduction.	Prevents illiquidity; ensures reliable settlement of international supplier contracts.
Demand Aggregation	Non-binding, fragmented facility orders leading to inaccurate forecasting.	Mandatory Committed Demand and Supply System backed by enforceable supply contracts.	High forecasting accuracy; stronger leverage in bulk price negotiations.
Domestic Manufacturing Policy	Standard local preferences with limited foreign exchange protection.	Up to 25% price preference based on net value addition; domestic bids allowed in foreign currency.	Stimulates local pharmaceutical manufacturing and reduces import dependency.

Financial Cash-Flow Circuit and Reserve Capital Management

The financial model under Proclamation No. 1354/2024 secures systemic liquidity through an enclosed financial loop:



This direct collection mechanism preserves the RDF's working capital. Additionally, the Board of Management is authorized to invest excess RDF capital into short-term financial instruments and infrastructure developments (such as cold-chain capacity and regional hub automation), hedging against inflation and currency depreciation

Discussion & Strategic Policy Directions

Restructuring Credit Risk and Capital Protection

The statutory recovery powers established in Article 23 resolve a major vulnerability in public health logistic for unpaid facility arrears. Shifted from an administrative request to an automated financial instruction, credit risk is neutralized at the central level, securing capital for international procurement commitments.

Industrial Policy and Local Supply Resilience

The provisions in Directive No. 1066/2025 allowing local producers to quote in foreign currency and applying up to a 25% price preference based on domestic value addition align public procurement with national industrial goals. With domestically produced items currently accounting for approximately 42% of total public supply, these measures support the target of expanding domestic production's share of central procurement.

Digital Integration with E-Procurement Frameworks

Directive No. 1066/2025 mandates full integration with the federal electronic Government Procurement (e-GP) platform. Interfacing the e-GP platform with EPSS's internal inventory software SAP S/4HANA/ERP

improves supply chain visibility, tracking consumption patterns from primary health facilities through to central tender executions.

Conclusion

The enactment of Proclamation No. 1354/2024 and Ministry of Finance Directive No. 1066/2025 establishes a modernized legal and operational framework for public sector health logistics in Ethiopia. By combining statutory financial protections as the Revolving Drug Fund and automated debt collection with flexible procurement regulations, the legal architecture provides a structured foundation for building a resilient national health supply chain.

Policy Recommendations

EPSS, the Ministry of Finance, and the National Bank of Ethiopia should finalize standardized operational guidelines for Article 23 bank account deductions, establishing clear timelines for recovering invoices older than six months.

In line with Directive No. 1066/2025, clear verification standards should be implemented to audit local value addition, ensuring price preferences are applied accurately.

EPSS should utilize its statutory authority under Article 10 to outsource specialized transport routes to verified private logistics providers, improving last-mile delivery efficiency.

References

1. Federal Democratic Republic of Ethiopia. (2025). *Ethiopian Pharmaceuticals Supply Service and Pharmaceutical Fund Establishment Proclamation No. 1354/2024*. Federal Negarit Gazette, 31st Year No. 29, Addis Ababa.

2. Ministry of Finance - Ethiopia. (2025). *Procurement Directive on Centrally Procured Pharmaceuticals and Medical Equipment by the Ethiopian Pharmaceutical Supply Service (Directive No. 1066/2025)*. Addis Ababa, Ethiopia.

3. Federal Democratic Republic of Ethiopia. (2021). *Executive Organs Re-establishment Proclamation No. 1263/2021*. Federal Negarit Gazette, Addis Ababa.

4. Ministry of Health - Ethiopia. (2024). *Health Sector Transformation Plan & Essential Medicines Supply Strategy*. Addis Ababa, Ethiopia.

5. Federal Public Procurement and Property Authority (FPPA). (2025). *Federal Government Public Procurement Directive No. 1073/2025*. Addis Ababa, Ethiopia.

Embedding Government-Owned Quality Standards to Strengthen Family Planning Services in Humanitarian Settings: Transitioning to Ethiopia's National Family Planning Quality Standards

Hezkiel, Mamo[1], Netsanet, Nigatu[1], Eyasu, Dasa[1]

[1]Family Guidance Association of Ethiopia (FGAE), Program Department, Addis Ababa, Ethiopia

Corresponding author: nyibeltal@fgaeet.org.et

ABSTRACT

Ensuring consistent, high-quality, respectful, and client-centered family planning services remains challenging in conflict-affected and humanitarian settings. In Afar, Amhara, and Tigray, insecurity, workforce shortages, staff turnover, commodity disruptions, and weak supportive supervision affected service quality and continuity. To strengthen government-owned quality improvement systems by institutionalizing the Ministry of Health (MoH) National Family Planning Quality Standards Assessment Tool and embedding quality improvement within routine health-system processes. WISH 2 implemented a government-led approach across supported facilities in Afar, Amhara, and Tigray, integrating quality assessment with Regional Health Bureau, Woreda Health Office, and facility quality improvement structures. Baseline and follow-up assessments were conducted in 36 facilities between January and June 2026. The approach included capacity building, Quality of Care committees, facility action plans, mentorship, supportive supervision, performance reviews, and categorization of gaps into Quick Fixes, Quality Improvement Projects, and Advocacy Issues. Quality assessments were completed in 77% (77/100) of supported facilities, 86% established functional Quality of Care Committees, and the baseline overall quality score was 70%. Follow-up scores increased from 75% to 81% in Afar, 74% to 89% in Amhara, and 73% to 81% in Tigray. In conclusion, embedding the national FP quality standards within existing government systems strengthened ownership and was associated with measurable improvements in service quality. Sustained mentorship, supportive supervision, action planning, digitalization, and government investment are important for continued quality improvement and scale-up.

Keywords: Family planning; Quality improvement; Quality of care; National quality standards; Government ownership; Humanitarian settings.

BACKGROUND

Ethiopia has made significant progress in expanding access to family planning services. However, ensuring consistent, high-quality, respectful, and client-centered care remains challenging, particularly in conflict-affected and humanitarian settings. [1,2] In Afar, Amhara, and Tigray, insecurity, workforce shortages, staff turnover, disrupted commodity supplies, and weak supportive supervision affected the quality and continuity of FP services.

The Ministry of Health (MoH) developed the National Family Planning Quality Standards Assessment Tool to support standardized quality improvement. However, limited mentorship and institutional capacity constrained routine implementation.[3] Quality improvement activities therefore often depend on project- or donor-specific systems, creating risks to government ownership and long-term sustainability.

The WISH 2 Eastern and Southern Africa (ESA) Program, funded by the UK Foreign, Commonwealth and Development Office (FCDO) and implemented by FGAE in partnership with IPPF, JHU-CCP, and Ipas, supported FP services in 101 health facilities across Afar, Amhara, and Tigray. Rather than creating a parallel mechanism, WISH 2 transitioned from the Donor Quality of Care Assessment Tool to the government-owned National Family Planning Quality Standards Assessment Tool. [4]

Objective: To strengthen government-owned quality improvement systems for FP services by institutionalizing the MoH National Family Planning Quality Standards Assessment Tool, improving service quality, strengthening government leadership, and promoting sustainable quality improvement through routine health-system processes.

METHODS / APPROACH

WISH 2 implemented a government-led quality improvement approach that replaced the project-specific quality assessment tool, starting from the project period November 2025 to date, with the MoH National Family Planning Quality Standards Assessment Tool. The tool includes nine standards covering essential resources and infrastructure, voluntary informed choice, contraceptives, supplies, equipment and instruments, respectful care, competent and motivated providers, client safety, accessibility, service integration, and quality data for decision-making. [4]

The intervention was implemented across supported facilities in Afar, Amhara, and Tigray and integrated into existing Regional Health Bureau, Woreda Health Office, and facility quality improvement structures.

The assessment, including both baseline and followup evaluations, was conducted across 36 facilities: 6 in Tigray, 16 in Amhara, and 8 in Afar. The facilities included 3 hospitals, 2 medium clinics, and 31 health centers, and data were collected from January to June 2026.

This distribution allowed for a comprehensive analysis of service quality across different facility types and regions, ensuring that the findings reflect diverse contexts and operational capacities.

The data collection was carried out by the facility Quality of Care committee together with Project Quality Improvement (QI) Officers.

- Converted the FP quality-of-care assessment tool from the national PDF standard into a user-friendly Excel version.
- Conducted baseline quality assessments using the national standards tool.
- Strengthened Regional Health Bureau, Woreda, and Facility Quality of Care (QoC) Committees.
- Trained facility managers and healthcare providers on national quality standards.
- Developed facility-level Quality Improvement Action Plans.
- Categorized gaps into Quick Fixes, Quality Improvement Projects, and Advocacy Issues.
- Integrated into regular mentorship, supportive supervision, bi-weekly performance reviews, provider job aids, and performance dashboards.
- Embedded quality assessments within existing government supervision mechanisms to promote sustainability.

Key implementers and collaborators included FGAE and WISH 2 partners, working with the MoH, Regional Health Bureaus, Woreda Health Offices, facility managers, providers, and QoC committees.

RESULTS

The intervention strengthened government ownership and produced measurable improvements in FP service quality.

- Quality assessments were completed in 77% (77/100) of supported facilities despite humanitarian and operational challenges.
- 86% of supported facilities established functional Quality of Care Committees.
- Baseline assessment showed an overall quality score of 70% and identified gaps in provider competence, client safety, accessibility, and commodity availability.

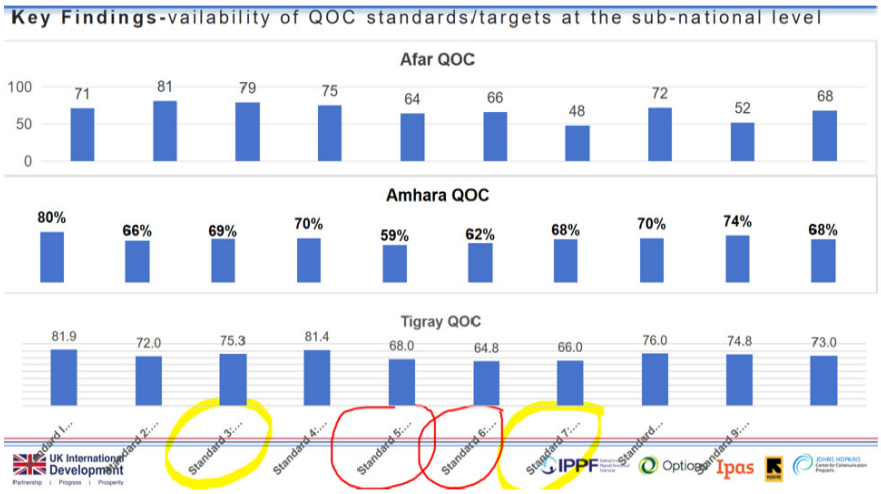


Figure 1: Baseline assessment identified key quality gaps

- Follow-up assessments in 36 facilities during Year 3 Quarter 1 demonstrated improvement across all three regions.

Region	Year 2 Q4	Year 3 Q1	Change
Afar	75%	81%	+6 pp
Amhara	74%	89%	+15 pp
Tigray	73%	81%	+8 pp

Tigray's average quality score increased from 73% to 81%, associated with strengthened supportive supervision, provider support tools, improved commodity availability, and regular virtual performance reviews. Amhara recorded the largest improvement, from 74% to 89%, associated with strengthened commodity supplies, support tools, targeted mentorship, and

Zonal and district-level quality review workshops. Afar increased from 75% to 81% following strengthened supportive supervision, provider support tools, improved commodity availability, and routine performance reviews.

LESSONS LEARNED / CONCLUSION

- Government ownership is critical for sustainability. Strengthening existing government systems was more sustainable than creating parallel project mechanisms.
- Structured action planning converts evidence into improvement. Categorizing findings into Quick Fixes, Quality Improvement Projects, and Advocacy Issues supported prioritization and follow-up.
- Continuous mentorship accelerates quality improvement. Mentorship, supportive supervision, provider job aids, and performance reviews contributed to measurable gains.
- Risk-based prioritization improves efficiency by directing technical support and limited resources toward lower-performing facilities.
- Some quality challenges require broader health-system investment. Workforce shortages, infrastructure limitations, disability accessibility, and supply-chain disruptions require sustained government leadership and investment.

The practice benefited the target population by strengthening the systems used to identify and address FP service-quality gaps. This Practice demonstrates a practical transition from a donor-specific quality mechanism to a government-owned national standard while achieving measurable quality improvements. Sustainability was addressed by embedding assessment, mentorship, supervision, action planning, and performance review within government structures.

"The National Family Planning Quality Standards Assessment Tool is practical and easy to use. It helps our facility identify service gaps, improve client satisfaction and strengthen the quality of family planning services. Our main challenge is ensuring that more staff are trained so responsibility for implementing the tool is shared across the whole facility." Quality Improvement Focal Person, Health Centre.

"The WISH 2 Quality of Care approach is practical because it assesses both service readiness and service delivery while providing clear feedback and action plans for improvement. Transitioning to the national assessment tool has strengthened routine quality improvement within our health system. Going forward, adding clearer verification methods and identifying critical 'must-pass' indicators would make the tool even more effective.", Regional Health Bureau

RECOMMENDATIONS FOR REPLICATION

- Scale up the National Family Planning Quality Standards Assessment Tool across other public and private facilities.
- Digitalize the tool and integrate quality assessment into routine government supervision rather than maintaining parallel project mechanisms.
- Strengthen Regional Health Bureau, Woreda, and facility leadership to institutionalize continuous quality improvement.
- Digitize the assessment tool and establish real-time dashboards to strengthen data use and decision-making.
- Institutionalize mentorship and peer learning through MoH and regional platforms.
- Use risk-based prioritization to focus technical support and resources on lower-performing facilities.
- Advocate for sustained investment in workforce retention, infrastructure, disability accessibility, and reliable commodity and water supplies.

KEY BEST PRACTICE PATHWAY

Government Standard
↓
Capacity Building + QoC Committees
↓
Quality Assessment
↓
Action Plans (Quick Fixes / QI Projects / Advocacy)
↓
Mentorship + Supervision + Performance Review
↓
Improved Quality + Government Ownership + Sustainability

REFERENCE

1. World Health Organization. Quality of care in contraceptive information and services, based on human rights standards: a checklist for health care providers. Geneva: WHO; 2017.
2. World Health Organization. Ensuring human rights in the provision of contraceptive information and services: guidance and recommendations. Geneva: WHO; 2014.
3. Federal Democratic Republic of Ethiopia, Ministry of Health. National Guideline for Family Planning Services in Ethiopia, third edition, July 2020.
4. National Family Planning Quality Standards Implementation Guideline, Addis Ababa, Ethiopia, 2023.

Impact of Catchment Based Clinical Mentorship (CBCM) on Immediate Postpartum Family Planning Uptake in Ethiopia, Lessons from Smart Pathways Program by PSI

Zenebe Akale[1], Biruk Hailu[1], Eba Abera[2]

[1]Population Services International (PSI) Ethiopia

[2]Ethiopian Midwives Association (EMwA)

Corresponding author: Zenebe Akale, zakale@psiet.org

Background

Immediate postpartum family planning (IPPFP) is a key intervention for improving maternal and newborn health by preventing unintended and closely spaced pregnancies. Despite expanded family planning services in Ethiopia, unmet need for postpartum contraception remains a challenge.

Antenatal care (ANC) provides an opportunity for women to make informed postpartum contraceptive decisions; however, counseling quality remains inconsistent due to provider and system-level barriers .

To address these gaps, Population Services International (PSI) through its partner Ethiopian Midwives Association (EMwA), implemented a Catchment-Based Clinical Mentorship (CBCM) program across 132 health centers in Ethiopia between July 2024 – December 2025 to strengthen provider capacity, improve ANC family planning counseling quality, and increase IPPFP uptake. Rather than relying on one-time classroom training, CBCM delivered continuous, facility-based support over approximately six months, combining guided clinical practice, demonstration and return-demonstration of key procedures (including PPIUD insertion, implant, and Jadelle provision), case-based problem solving, and structured follow-up assessments at baseline, midterm, and endline. Mentors provided on-site coaching and supervised practice to midwives and other maternity care providers working in ANC, delivery, and immediate postpartum units, with a particular focus on integrating FP counseling into every maternal health contact rather than treating it as an occasional task.

A core content element of the mentorship was the Counseling for Choice (C4C) framework, a structured, client-centered counseling approach through which providers were coached to present contraceptive options in a balanced and unbiased manner, explore women's preferences and reproductive intentions, actively invite questions, address misconceptions, document a postpartum family planning plan during pregnancy, and affirm each client's autonomy to choose, delay, or decline a method. The program also reinforced the linkage between ANC counseling and postpartum service delivery, ensuring that women who developed a family planning intention during pregnancy were re-engaged after delivery and offered their preferred method promptly. While no formal feasibility or acceptability tool was administered, providers who completed at least one mentorship cycle consistently described the approach as feasible within routine service conditions and reported sustained changes in their counseling practice and confidence, suggesting the model was practically deliverable across the urban, peri-urban, and rural facility contexts included in this study. This study assessed counseling quality and its association with IPPFP uptake among women delivering in supported health facilities in Ethiopia.

Methods

A convergent parallel mixed-methods design was used, integrating quantitative and qualitative approaches to assess ANC family planning counseling quality and IPPFP uptake. The study was conducted in 20 purposively selected health centers across five regions of Ethiopia: Amhara, Central Ethiopia, Oromia, Sidama, and South Ethiopia.

Data sources: Data were collected through multiple sources, including exit interviews with 134 postpartum women, observation of 51 ANC family planning counseling sessions, in-depth interviews with twenty-eight women and providers, and HMIS data review to assess IPPFP trends before and after CBCM mentorship.

Analysis: Quantitative data were analyzed using descriptive statistics and regression analysis to identify factors associated with IPPFP uptake. Qualitative data were analyzed thematically, and findings from all data sources were triangulated to strengthen interpretation.

Results

Quality and Coverage of ANC Family Planning Counseling

ANC family planning counseling coverage was high among women receiving maternity services:

- **97.0%** of women received family planning counseling during pregnancy.
- **94.8%** participated in joint contraceptive method selection through the Counseling for Choice (C4C) model.

The strongest counseling domains were:

- Counseling process: **91.7%**
- Linkage to IPPFP services: **92.1%**

Beyond attendance, the frequency of FP-specific discussion during ANC showed a clear dose-response relationship with IPPFP uptake, rising from 48.1% among women counseled at 1–2 visits to 91.4% among those counseled at every visit ($p<0.001$), indicating that repeated FP discussion, rather than ANC contact alone, drove postpartum contraceptive adoption.

Timing of IPPFP Method Receipt

IPPFP services were provided promptly, with 96.3% of users receiving their chosen method within 24 hours after delivery, reducing missed opportunities for postpartum family planning.

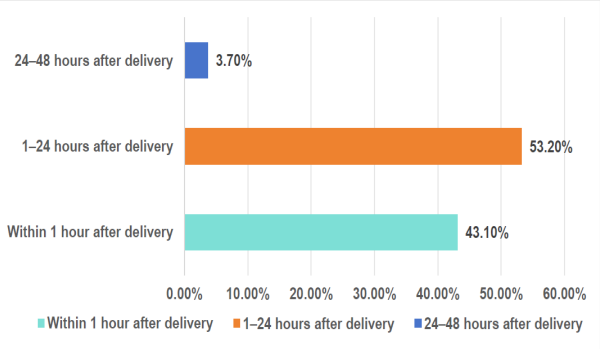


Figure 1: Timing of IPPFP Uptake After Delivery Among Study Participants

Immediate Postpartum Family Planning Uptake

Among postpartum women interviewed within 48 hours after delivery:

- **81.3%** adopted a contraceptive method.
- Most selected methods were:
  - Implants: **57.8%**
  - IUCD: **31.2%**

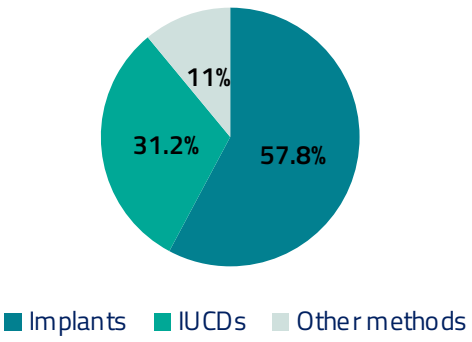


Figure 2: Distribution of Contraceptive Methods Among Study Participants

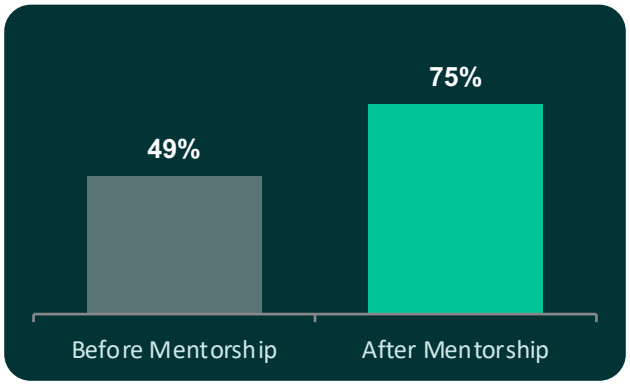


Figure 3: Immediate Postpartum Family Planning (IPPFP) Uptake Before and After CBCM Mentorship Implementation

Client satisfaction was high, with **96.3%** of IPPFP users reporting satisfaction with services received.

Reasons for dissatisfaction among the remaining 3.7% (n=4) were not captured. As satisfaction was assessed at the facility around the time-of-service receipt, social desirability bias may have inflated this estimate.

Routine HMIS data showed improvement following CBCM mentorship:

- IPPFP uptake increased from **49.1% before mentorship** to **74.7% after mentorship** across five regions.

Factors Associated with IPPFP Uptake

Key factors associated with higher IPPFP uptake included joint contraceptive method selection through the C4C model, intention to use family planning before delivery, positive perception of IPPFP, and planned pregnancy. counseling. Provider-assisted method selection showed the strongest association with uptake, though this may partly reflect that assistance necessarily co-occurs with a decision to adopt a method; it more plausibly signals counseling quality shaping continuation and satisfaction.

Qualitative findings corroborated these results. Women described ANC counseling as respectful, comprehensive, and enabling voluntary, informed method choice, while providers attributed improved, systematic counseling practice to CBCM mentorship and the C4C framework. Reported barriers to uptake included community misconceptions about contraception, spousal opposition, and commodity stock-outs, underscoring the need for complementary health-system and community-level support.

Conclusion

The CBCM program improved ANC family planning counseling quality and increased IPPFP uptake across five regions of Ethiopia. Integrating client-centered counseling with continuous mentorship strengthened informed contraceptive decision-making. These findings underscore the value of institutionalizing quality-focused, client-centered ANC counseling within routine maternal health services.

Recommendations

1) Institutionalize standardized ANC family planning counseling, including C4C, in routine services.

2) Strengthen clinical mentorship and supportive supervision for providers.

3) Provide early and repeated IPPFP counseling throughout pregnancy.

4) Enhance counseling on method choice, side effects, and reproductive intentions.

5) Strengthen community engagement, partner involvement, and contraceptive commodity supply chains to address the misconceptions, spousal opposition, and stock-outs identified as barriers to uptake.

6) Scale up ANC–IPPFP integration through MOH and partner collaboration.

Building Digital Workforce Intelligence: Institutionalizing Competency Management for Health Supply Chain Workforce Development in Ethiopia

Zeine Abosse[2], Dr Abdulkadir Gelgelo[1], Kim Hoppenworth[3], Andualem Oumer[3], Edmealem Ejigu[2], Yoseph Belay[2], Daniel Tesfaye[1], Zinash Demissie1, Adnew Weldetensy[1], Fikreselassie Woldaregay[1], Bereket Samuel[2]

[1]Ethiopian Pharmaceuticals Supply Service (EPSS), Addis Ababa, Ethiopia

[2]USG SCS Project, Management Sciences for Health (MSH), Addis Ababa, Ethiopia

[3]Management Sciences for Health (MSH), Addis Ababa, Ethiopia

Corresponding author: Zeine Abosse, zabosse@msh.com, +251911745672

Introduction

A competent health supply chain workforce is fundamental to ensuring reliable access to essential medicines and achieving resilient health systems. While substantial global investment has strengthened supply chain infrastructure and technology, comparatively less attention has been given to institutionalizing workforce competency management through digital solutions. In many low- and middle-income countries, competency assessments remain paper-based, spreadsheet-driven, or otherwise manual, resulting in fragmented data, inconsistent processes, delayed reporting, and limited use of competency information for strategic workforce planning. Institutionally owned, digital competency management platforms within public health supply chains remain particularly rare.

The Ethiopian Pharmaceuticals Supply Service (EPSS), which manages Ethiopia's national public health supply chain, recognized similar limitations in its own competency assessment approach. The process functioned primarily as a subjective training needs assessment, relying on self-reported competency ratings rather than objective measurement against standardized, role-based competency standards. While useful for informing training plans, it generated limited organizational intelligence for competency gap analysis, evidence-based workforce planning, succession planning, supportive supervision, and strategic investment in workforce development, leaving competency assessment an isolated human resources function rather than an institutionalized management tool.

To address these gaps, EPSS, with technical support from the U.S. Government-funded Supply Chain Strengthening (SCS) Project implemented by Management Sciences for Health (MSH), designed and developed a centralized digital Competency Assessment System (CAS). The platform digitizes competency assessment, objectively measures competencies against standardized role-based frameworks, automates analytics and reporting, and generates a stronger evidence base for competency-based workforce management and strategic decision-making, with a design oriented toward long-term institutional ownership and sustainability. This abstract describes the design, validation, and organizational readiness of the CAS prior to large-scale implementation.

Objective

The general objective was to establish a sustainable, scalable, and user-friendly digital platform capable of supporting periodic competency assessment, automated scoring, competency analytics, dashboard reporting, and continuous monitoring of workforce development.

The specific objectives were to:

- Digitalize competency assessment across EPSS's six priority directorates with organization-wide rollout planned in subsequent phases
- Standardize competency measurement using a nationally adapted competency framework.
- Prepare EPSS for routine competency assessment supported by automated workforce analytics.

Method

USG SCS applied a participatory, user-centered, and iterative digital system development approach between November 2025 and July 2026 to design, develop, validate, and prepare the CAS for organizational deployment within EPSS.

System requirements were established through collaborative consultations involving Human Resources and Information Communication Technology Directorates of EPSS, Enterprise Resource Planning (ERP) Project Office, senior management, and technical advisors. Competency content was developed using the EPSS Competency Framework, aligned with the globally recognized People that Deliver (PtD) Health Supply Chain Competency Framework, and customized for six directorates. These six directorates were selected for the initial implementation because they represent the core functions of the public health supply chain and were prioritized by EPSS for the first phase of organizational implementation: Procurement Management, Contract Management, Demand Management, Warehouse Operations and Shipping, Transport Management, and Marketing and Customer Experience. The tool will be applied for these Directorates and expand to other directorates at central EPSS and to all the hubs by refining the tool as implementation progresses. These six directorates comprise 431 staff members, representing approximately 59% of the 725 headquarters' workforce and about 14% of EPSS's total workforce of approximately 3,100 employees.

The software was developed using an Agile methodology consisting of requirements analysis, business process mapping, software architecture design, questionnaire development, iterative programming, functionality testing, and continuous refinement. The platform incorporates role-based competency assessments, automated scoring, competency dashboards, executive reporting, user administration, and organizational analytics.

Validation included system functionality testing, ERP compatibility verification, User Acceptance Testing (UAT), issue identification and resolution, end-user orientation, administrator training, workflow verification, and go-live readiness assessment. Technical and operational issues identified during UAT including role-based permissions, dashboard functionality, reporting workflows, user authentication, and system performance were resolved through iterative improvements before organizational approval for deployment.

Results/Outputs

Development

The Competency Assessment System was successfully developed, validated, and deployed within the EPSS institutional server environment, establishing the organization's first centralized digital platform for competency management. Competency questionnaires were standardized and mapped to six priority operational directorates using nationally adapted competency standards aligned with the People that Deliver framework. All planned software development milestones were completed successfully. The CAS was successfully developed, validated, and deployed as a standalone digital platform, with the analytics component that will be configured for integration with the EPSS ERP environment.

Functionality

Functional verification confirmed that the platform operated according to predefined functional requirements. The platform supports role-based competency assessment through integrated modules for user registration, authentication, automated scoring, competency level calculation, individualized competency profiles, competency dashboards, executive reporting, organizational analytics, administrative management, and secure data storage.

Validation and User Acceptance Testing

User Acceptance Testing (UAT) was completed jointly by Human Resources, Information Technology directorate, ERP project office, and technical advisors. UAT identified several opportunities for system optimization, including

refinement of role-based questionnaire assignments, enhancement of dashboard visualization, improvement of user navigation, strengthening of authentication processes, optimization of reporting functions, and improvement of overall system usability. All identified issues were documented, prioritized, corrected, and successfully retested prior to deployment.

Organizational Readiness

Comprehensive end-user orientation and administrator training were conducted to familiarize staff with system workflows, competency assessment procedures, reporting functionality, and administrative responsibilities. These activities prepared end users and system administrators for implementation and supported organizational readiness for routine system use.

Go-live readiness assessment confirmed successful completion of all planned implementation milestones, including software development, functionality verification, UAT completion, issue resolution, administrator configuration, user orientation, and deployment preparation. Following completion of these activities, the platform was formally transferred to EPSS and approved for routine organizational implementation.

Although organization-wide competency assessment has not yet commenced, the completed digital platform provides the infrastructure required to conduct standardized competency assessments, generate real-time workforce analytics, monitor competency trends over time, and support workforce planning. It also enables leadership to identify competency gaps, prioritize capacity development activities, and support succession planning using competency assessment data.

Conclusion and the Way Forward

This initiative demonstrates that digitalizing competency management extends beyond replacing paper-based assessments with electronic forms. By institutionalizing competency assessment within an integrated digital platform, EPSS has established a foundation for transforming workforce information into actionable organizational intelligence that supports evidence-based workforce planning and development.

The successful development and deployment of the Competency Assessment System (CAS) demonstrate that digital transformation requires organizational readiness in addition to software development. Close collaboration with EPSS, competency harmonization, scoping of future ERP integration, rigorous user acceptance testing (UAT), issue resolution, administrator training, end-user orientation, and go-live preparation collectively produced a technically robust, country owned and operationally ready platform. These experiences highlight the importance of combining technical development with organizational preparation before routine implementation.

Equally important, the CAS was designed with governance and change-management measures to support sustainable adoption. Role-based access controls, protection of individual competency results, and clear communication that assessment outcomes are intended to guide professional development for enhanced performance were incorporated to foster user trust, encourage acceptance, and support long-term use of the system.

Unlike many competency assessment initiatives that conclude with individual assessment reports, the CAS was intentionally designed to support executive decision-making through automated dashboards, competency analytics, and organizational reporting. Once implemented, these capabilities are expected to enable more strategic allocation of training resources, evidence-based supportive supervision, succession planning, and continuous monitoring of workforce capability across technical directorates.

The CAS also provides a practical and adaptable model for ministries of health, central medical stores, and other public sector organizations seeking to strengthen competency-based workforce management through locally owned digital solutions. The phased development and deployment approach described here may reduce implementation risks while supporting sustainable digital transformation in resource-constrained settings.

Future work will evaluate workforce competency profiles following routine implementation and examine how digital workforce intelligence contributes to workforce development, organizational performance, and health supply chain resilience.



Section Three: New Initiatives, programs or services

Committed Demand and Supply System: National Model for Accountable Pharmaceutical Supply Chains, One-Year Implementation Results

Boru Abdulkedir[1], Abebe Solomon[1], Workineh Mengistie[1], and Banti Degefa[2].

[1]Ethiopian Pharmaceutical Supply Service/Ministry of Health, Addis Ababa Ethiopia,

[2]USG – Supply Chain Strengthening (SCS) Project, Addis Ababa Ethiopia

Corresponding Author: Dr. Abdulkedir Gelgelo Boru, abdulkedir.gelgelo@epss.gov.et,+251944305056

Introduction

For decades, Ethiopia's public pharmaceutical supply chain operated on a fragile, push-based, facility-level requisition model. Under this legacy system, demand quantification was fragmented and poorly synchronized with approved health facility budgets. These structural weaknesses generated recurring supply chain volatility, frequent emergency orders, simultaneous overstocking and stockouts of vital medicines, high commodity wastage, and eroding trust between the Ethiopian Pharmaceutical Supply Service and over 5,000 public health facilities across nineteen regional logistics hubs.

Ministry of Health along with EPSS reviewed the CDSS implementation during the 2023 piloting phase among 143 priority pharmaceuticals, medical supplies, and laboratory reagents were conducted across thirty-one tertiary and teaching hospitals. While it demonstrated strong strategic potential, it failed to scale-up nationally due to the lack of a legal mandate, standardized governance, and integration with national budgeting systems.

In response, EPSS transitioned from a push-based system to the Committed Demand and Supply System (CDSS), a contract-based, mutually accountable pull system designed for national scale. Endorsed under Article 24 of Proclamation No. 1354/2024, CDSS converted budget-supported annual quantification and advance service-contract signing into enforceable legal obligations. Supported by financial flexibility through Directive No. 1120/2025, CDSS aligns national procurement directly with actual facility budgets and consumption. This manuscript presents the design, first-year (2018 E.C.) implementation outcomes, and lessons learned from scaling CDSS across Ethiopia's public health system.

Objectives

General Objective

To evaluate the intervention over the first-year implementation period for, operational feasibility and systemic impact of scaling up of the Committed Demand and Supply System as a national model for predictable and accountable pharmaceutical supply chains in Ethiopia for public health facilities.

Specific Objectives

- To assess the extent of national coverage, facility contract sign offs, and total committed demand value achieved during the first year of CDSS implementation.
- To evaluate the operational performance of CDSS across key health indicators, including essential medicine availability, commodity wastage rates, line-fill rates, and hub-visit frequencies.
- To map and examine the digital enablement architecture, governance tiers, and legal frameworks supporting CDSS.
- To analyze equity gaps, financial collection rates, and facility-level forecast variances between implementation cycles.
- To identify implementation challenges, facilitators, and strategic recommendations to inform CDSS optimization and HSDIP II health sector priorities.

Methods

Study Setting and Scope

This national implementation evaluation covers 5,023 public health facilities serviced across EPSS's network of nineteen hubs and sixty-three warehouses nationwide using the cross-**sectional mixed study design.**

Program Design & Operational Framework

CDSS functions through three interconnected operational pillars indicated below:

1. Demand-Based Planning: Facilities conduct budget-supported quantification through a phased national process involving preparation, Revolving Drug Fund (RDF) facility quantification, and regional-to-national consolidation. Facilities commit their annual pharmaceutical requirements against approved budgets.

2. Committed Supply: EPSS enters into legally binding executory contracts with each facility to deliver quality-assured medicines on a fixed schedule in exchange for committed demand.

3. Entitled Supply & Replenishment: A data-driven, pull-based replenishment model operates based on actual facility consumption, backed by regular inventory analysis, automated financial tracking, and institutionalized quarterly Sales & Operations Planning (S&OP).

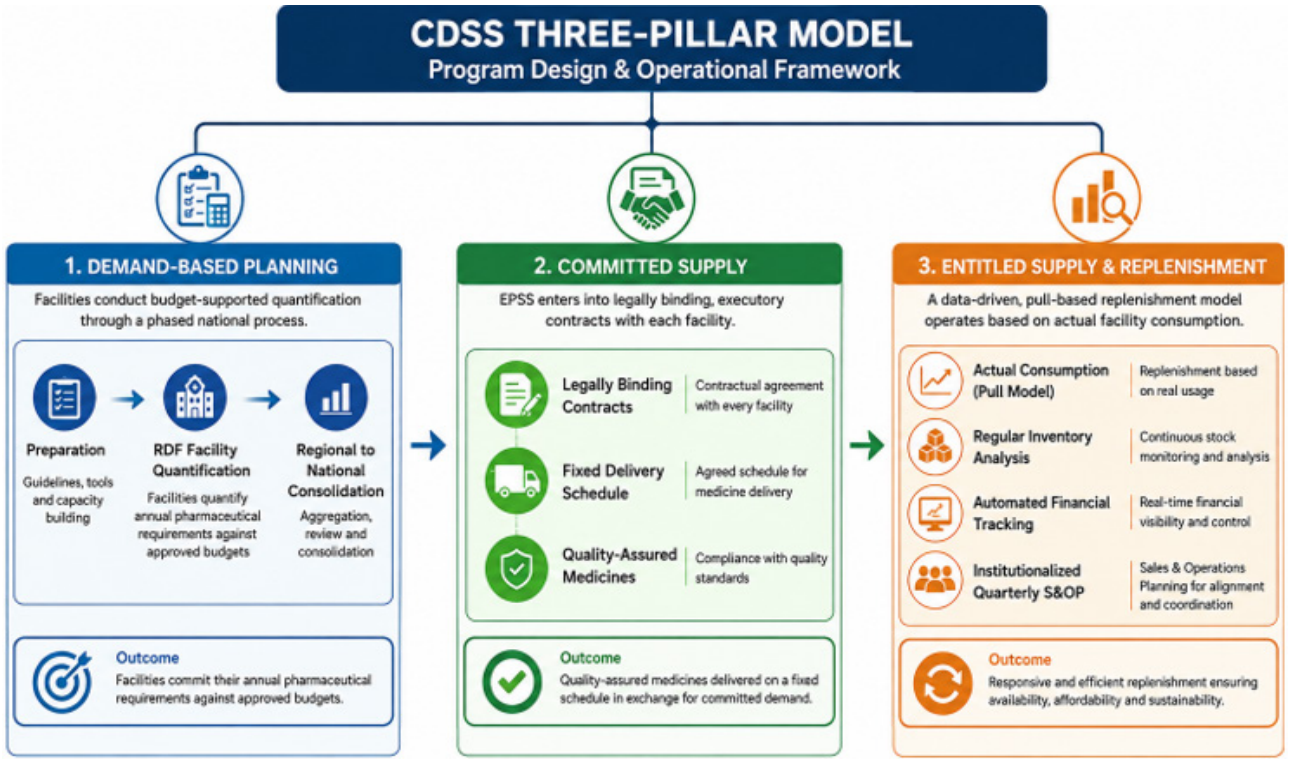


Figure 1. CDSS Three-Pillar Program Design and Operational Framework

Digital Ecosystem

Digital integration was built in partnership with Opian Health, linking facility-level consumption data directly into EPSS's SAP ERP system and the ForLab+ AI forecasting tool. Smart forecasts and real-time fill-rate dashboards monitor branch collections, delivery schedules, stock levels, and budget thresholds.

Data Sources and Analysis

Primary data were synthesized from EPSS's internal CDSS command-center monitoring dashboards, SAP ERP transactional records, quarterly hub customer-visit logs, fill-rate reports, and national quantification submissions during the 2018 E.C. implementation year and subsequent 2019 E.C. cycle. Quantitative performance metrics for availability, wastage, collection rates, and variance were analyzed using descriptive statistics.

Results

National Scale and Coverage

During the 2018 E.C. baseline year, the Committed Demand and Supply System (CDSS) achieved nationwide scale, with 98.7% of public health facilities (4,961 of 5,023) executing active supply contracts that generated ETB 24.2 billion in total consolidated committed demand. This structural shift tripled EPSS-managed inventory from ETB 8 billion to ETB 24 billion, driving essential medicine availability up from 63% to 85% and cutting commodity wastage from 1.4% to 0.42%. Facility engagement strengthened as quarterly hub visits peaked at 83.3% in Quarter 4, though financial execution highlighted ongoing liquidity challenges, yielding a 63% average national collection rate against committed contract values.

Sourcing Stream Categorization

To structure the procurement strategy, commodities were categorized into three distinct sourcing streams to balance commodity risk, clinical necessity, and procurement efficiency.

- **Core CDSS Line Items:** 567 core items procured via pre-planned annual contracts.
- **Consolidated Frameworks:** 555 items under multi-vendor sourcing frameworks.
- **Special Agreements:** seventy-seven items managed under specialized clinical supply arrangements.

Infrastructure & Logistics Capacity Expansion

The surge in committed demand tripled EPSS's managed inventory value from ETB 8 billion to ETB 24 billion. EPSS expanded operational infrastructure to:

- **Logistics Hubs & Warehouses:** nineteen hubs operating sixty-three warehouses providing 114,658 m² of ambient storage and 5,265 m² of cold-chain capacity.
- **Transportation Fleet:** 410 delivery vehicles (including thirty-five refrigerated trucks), supplemented by third-party logistics (3PL) outsourcing in high-volume hubs.

Key Supply Chain Performance Outcomes

- **Essential Medicine Availability:** Improved national availability of core essential medicines from baseline levels of 63% up to 85%.
- **Wastage Reduction:** Commodity expiry and damage rates dropped significantly from 1.4% to 0.42%.
- **Hub Engagement:** Facility quarterly hub-visit rates increased steadily, peaking at 83.3% in the fourth quarter. Analysis confirmed a positive relationship between hub visit frequency and higher line-fill rates.

Collection Rates & Equity Gaps

Despite operational gains, financial collection averaged 63% nationally against committed contract values:

- **Equity Distribution:** Only 20.8% of facilities collected between 80% and 120% of their committed value.
- **Under-collection:** 78.6% of facilities collected below 80% of their contractual forecast.
- **Concentration of Demand:** High financial concentration was observed; just 0.5% of facilities accounted for 20% of the total national forecast value.

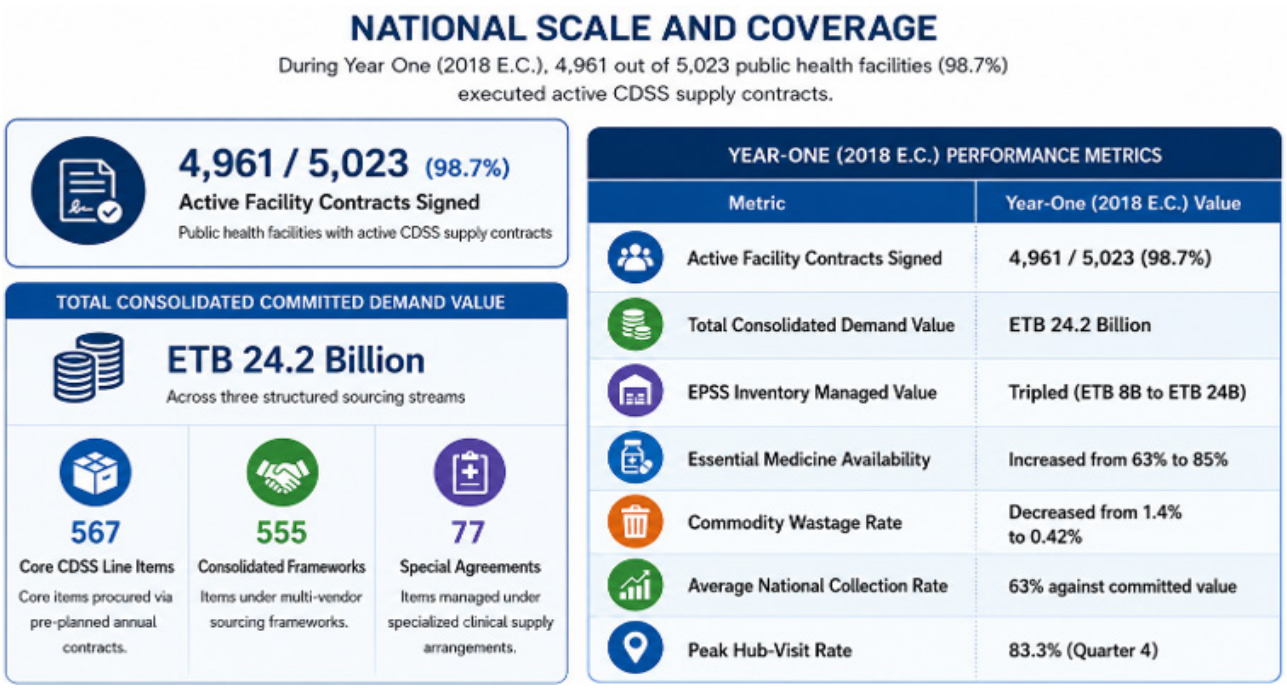


Figure 2. National Scale and Coverage for CDSS Performance in Year One (2018 E.C.)

Challenges and Facilitators

Facilitators

- **Legal Backing:** Enactment of Proclamation No. 1354/2024 (Article 24) provided the mandate required to enforce budget-supported quantification and contract execution.
- **Financial Policy Support:** Directive No. 1120/2025 introduced flexible payment mechanisms (credit, cash, and pre-financing modalities) to support facility participation.
- **Political Alignment:** High-level commitment, anchored by a multi-stakeholder Memorandum of Understanding signed at Adwa Memorial and a national launch webinar reaching over 12,000 health professionals.
- **Multi-Tiered Governance:** Structured oversight across a National Coordination Team, an operational EPSS Command Center, a Technical Task Force, a National Supply Chain Advisory Committee, and Regional Health Bureaus.
- **Digital Ecosystem:** Direct platform synchronization linking facility inputs to SAP ERP and AI-assisted ForLab+ forecasting tools.

Challenges

- **Forecast Volatility:** Significant item-level variances were observed between 2018 E.C. and 2019 E.C. facility forecasts. Key line items experienced demand swings exceeding 100%, with extreme cases exceeding 800%.
- **Participation Drops:** Facility participation in the subsequent 2019 E.C. quantification round dropped to 3,663 out of 5,400+ facilities, demonstrating that legal mandates alone do not guarantee sustained engagement without active management.
- **Procurement & Price Volatility:** Price fluctuations affected capital medical equipment, and non-placement laboratory reagents remained outside initial quantification scopes.
- **Feedback Systems:** Absence of a structured escalation mechanism for handling facility-level supply complaints.

Lessons Learnt

- **Mandates and Digital Systems Require Active Engagement:** Legal mandates and digital platforms are essential baselines, but sustained facility participation requires active relationship management, performance monitoring, and ongoing field support.
- **Forecast Validation is Critical:** High forecast variance (up to 800%) and severe demand concentration (0.5% of facilities holding 20% of value) show that raw facility forecasts cannot be accepted passively; they require root-cause analysis and data validation.
- **Relationship Management Drives Supply Performance:** The direct link between quarterly facility hub visits (reaching 83.3%) and improved line-fill rates indicates that close operational communication directly improves delivery efficiency.
- **Command-Center Dashboards Must Drive Field Action:** Real-time visibility through command-center dashboards is effective for identifying supply gaps, but turning data into action requires stronger regional accountability.

Conclusion

The first-year implementation of Ethiopia's Committed Demand and Supply System demonstrates that a legally backed, contract-based demand-and-supply model supported by AI forecasting, flexible financing, and multi-tiered governance can successfully transform a fragile, push-based supply chain into a predictable, accountable pull system across 5,000+ health facilities. While baseline medicine availability reached 85% and wastage fell to 0.42%, implementation highlighted the need to manage equity gaps, forecast variance, and ongoing facility participation. Ethiopia's experience offers a practical, scalable model for low-resource settings seeking to build demand-driven and financially sustainable pharmaceutical supply chains.

Recommendations

- Institutionalize rigid Sales & Operations Planning (S&OP) processes and automated validation protocols within SAP/ForLab+ to smooth multi-year forecast volatility before contract execution.
- Implement targeted support for low-volume, remote health facilities to narrow the gap where 78.6% of facilities fall below an 80% collection rate.
- Incorporate non-placement laboratory reagents into the CDSS quantification scope and establish a formal grievance and escalation mechanism for facilities.
- Formally link CDSS contract structures with Ethiopia's Universal Health Insurance scheme (covering 62+ million lives) to ensure sustainable liquidity and revenue collection for facilities.
- Empower Regional Health Bureaus (RHBs) to oversee facility participation during annual quantification cycles to prevent drops in contract renewal.

Digitizing Performance Monitoring Tool: The ePMT+ Innovation for Strengthening Health System Performance in Ethiopia

Asaye Birhanu Senay*[2,4], Nahil Kebede[2,3], Dawud Yimer[2,3], Ketema Lemma Abdi[2], Animut Addis[2,4] and Muluemebet Abera Wordofa[1,2]

[1] Jimma University, Department of Population and Family Health, Jimma, Ethiopia,

[2] Jimma University, Capacity Building and Mentorship Program, Jimma, Ethiopia,

[3] Jimma University, Department of Computer Science, Jimma, Ethiopia,

[4] Jimma University, Department of Health Policy and Management, Jimma, Ethiopia.

***Corresponding author**: asayebr@gmail.com

Introduction

Health Information Systems (HIS) play a critical role in improving healthcare delivery, decision-making, and system performance (WHO, 2008; Lippeveld et al., 2000). In Ethiopia, the Performance Monitoring Team (PMT) approach is widely used to track health service performance across administrative levels. However, the traditional paper-based PMT system has been characterized by inefficiencies, including delays in reporting, data inconsistencies, poor documentation, and limited analytical capacity.

To address these inefficiencies, Jimma University, through the JU-CBMP initiative, developed the Electronic Performance Monitoring Tool (ePMT+) within the last year as a modern digital health solution. By digitizing paper-based PMT logbook workflows and integrating directly with DHIS-2, the system establishes role-based access control, automated data validation, and real-time tracking of agreed action plans. This initiative directly aligns with the Health Sector Development and Investment Plan (HSDIP-I) priority area on Health System Capacity and Regulation specifically Digital Health and HIS strengthening by establishing evidence-based decision-making and accountability across all operational levels (Jimma University CBMP, 2026).

Objective

General Objective: To digitize the Performance Monitoring Team (PMT) process across the Ethiopian health system to enhance data quality, accountability, and timely evidence-based decision-making.

Specific Objectives:

1. To digitize PMT meeting records and action logs by transitioning from paper-based systems to a secure web-based platform.
2. To improve data quality through automated validation and consistency checks that reduce data entry errors.
3. To increase timeliness by enabling real-time access to performance indicators for managers and Performance Monitoring Teams (PMTs).
4. To enhance accountability by implementing role-based access controls, audit trails, and exportable reports for performance review and decision-making.

Methods

1.1. Target Population and Geographic Scope: The ePMT+ system was designed for multi-tier deployment across administrative levels of the Ethiopian health system (Region, Zone, Woreda, and Health Facility/Health Post).

1.2. Problem Analysis & System Design: The project began with a need assessment of the existing paper-based PMT logbook system used across Ethiopian health administrative levels (Region, Zone, Woreda, and Health Facility). Key challenges identified included incomplete records, delayed reporting, poor action tracking, and lack of data sharing across levels. Stakeholders were involved in gap analysis and following that we have developed a requirement analysis. Based on these findings, a digital solution the ePMT System was designed to align with Ethiopia's health system hierarchy and existing reporting workflows.

1.3. System Architecture & Development: A responsive web-based application was engineered using TypeScript, Tailwind CSS, and Laravel. The architecture enforces strict hierarchical, role-based access control corresponding to administrative boundaries (Region → Zone → Woreda → Health Facility). The system retrieves health indicators directly from DHIS-2 (e.g., service statistics, LQAS data) to eliminate redundant data entry.

1.4. Testing: The system was initially tested by the developers to ensure that the requirements identified during the requirement analysis were addressed. Subsequently, it was tested at the facility level with stakeholders, and their feedback was incorporated and addressed. Stakeholder involvement in the testing phase.

1.5. Expert Review: The system was reviewed by experts from different organizations, including the Ministry of Health, as well as regional, zonal, and woreda-level administrators, and representatives from various health facilities. Piloting has now begun at JU-CBMP sites.

Results/Outputs

The implementation of ePMT+ generated key operational outputs and measurable system improvements. During the field test, the system was implemented across 1 woreda, 1 hospital, and 3 Health Centers, with 20 users/participants receiving a one-day orientation (12 from the health system side and 8 from JU-CBMP). The system was then used continuously for three months, providing an opportunity to assess routine usability and incorporate user feedback before scale-up.

The implementation of ePMT+ generated key operational outputs and measurable system improvements:

- **Core Functionality Rollout:** Core modules including Report Timeliness & Completeness Monitoring, Lot Quality Assurance Sampling (LQAS), Intra Data Element Inconsistency Checks (IDECS), and Digital PMT Minute Tracking were successfully deployed and validated.
- **Improved Data Quality and Completeness:** The automated IDECS module flags internal data discrepancies directly from DHIS-2 prior to submission, significantly reducing human error. Automated validation rules prevent incomplete submissions.
- **Enhanced Accountability and Tracking:** Structured minute templates record identified problems, 5-Why root-cause analyses, assigned responsible individuals, and explicit timelines. Supervisors receive real-time visibility into pending, completed, or overdue tasks via full audit trails without modifying primary records.
- **Streamlined Timeliness & Reporting:** Real-time dashboards allow managers to monitor submission status from Health Posts to Health Centers and upward, cutting down manual compilation and physical report transport times.
- **Cost Efficiency:** Transitioning from physical logbooks to web-based digital records reduced printing, paper compilation, and storage overheads while offering offline export/print capabilities for connectivity downtime.

Qualitative Findings

Feedback from woreda and health center experts indicated that ePMT+ was useful for routine performance monitoring and follow-up. Key feedback included:

- **Improved monitoring and follow-up:** *"It is easier to identify performance gaps and follow up on the actions assigned during the PMT."*
- **Improved access to information:** *"The dashboard helps us access performance information quickly and use it during performance review and decision-making."*
- **Strengthened documentation and accountability:** *"Recording the minutes, responsible person, timeline, and action status digitally helps us remember and follow up on agreed actions."*

Overall, users perceived ePMT+ as useful, practical, and more efficient than paper-based approaches

Table 1: Core Modules, functionalities and impact

S.No	Core Module	Key Functionality	Primary Impact
1	Data Quality (IDECS & LQAS)	Automated consistency checks & outlier detection from DHIS-2	Early detection and correction of reporting errors
2	Timeliness & Completeness	Tracks report submission status across organizational tiers	Reduced delays in health facility performance tracking
3	PMT Minutes & Action Plan	Digitizes meeting minutes, RCA (5 Whys), and task assignments	Eliminates lost minutes and enforces action item follow-up

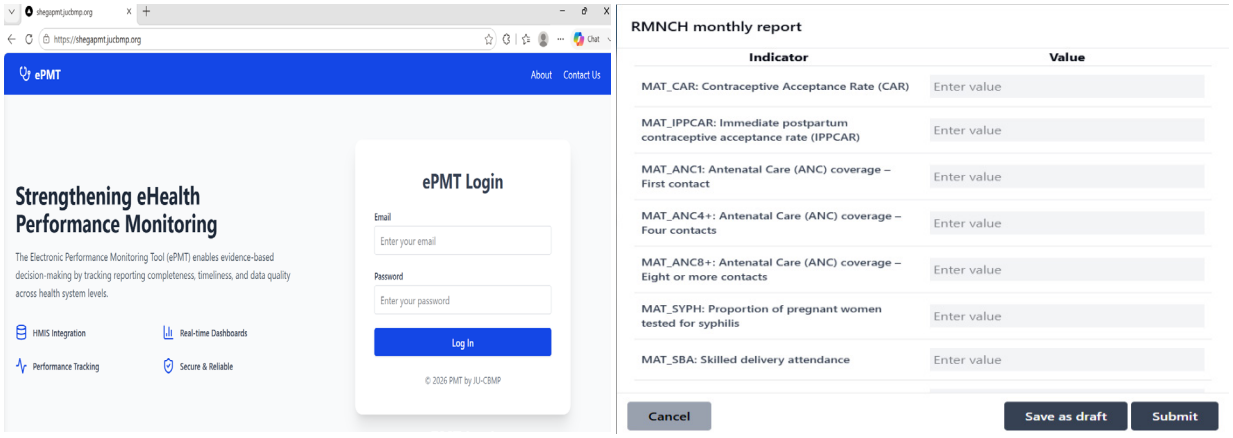


Figure 1: ePMT+ homepage and HC Department level report Timeliness and Completeness monitoring

Conclusion and the Way Forward

ePMT+ system represents a scalable digital health innovation that addresses long-standing structural inefficiencies in Ethiopia's paper-based performance monitoring system. By automating data validation, integrating with DHIS-2, and institutionalizing real-time action tracking, ePMT+ strengthens routine health information systems and fosters data-driven decision-making.

To maximize national impact, health managers, policy-makers, and development partners must prioritize institutionalizing ePMT+ within routine health management workflows. Continued investment in local technical capacity, server infrastructure, and user training will be crucial for national scale-up. Expanding institutional ownership across all administrative tiers will further ensure long-term health system accountability and service delivery improvements.

Transforming a Paper-Based PMT Logbook into a Digital System: Development of the PMT eBook

Mengistu Yilma[1,2]*, Zeytu Gashaw[1,2], Awgichew Kifle[1,2], Meskerem Mengistu[1,2], Girma Taye[1,2]

[1]Department of Epidemiology and Biostatistics, School of Public Health, Addis Ababa University, Addis Ababa, Ethiopia

[2]Capacity building and Mentorship Partnership (CBMP), Addis Ababa University, Addis Ababa, Ethiopia

***Corresponding author**: email: mengistu.yilma@aau.edu.et

Introduction

The Performance Monitoring Team (PMT) is a multidisciplinary group of health leaders that play a critical role in strengthening health information systems by promoting the regular use of data for evidence-based decision-making, planning, resource allocation, and quality improvement initiatives. In many low- and middle-income countries, including Ethiopia, PMTs have become an essential governance mechanism for improving accountability and enhancing the performance of healthcare services (1-3). Reliable data enable health managers and policymakers to identify service gaps, monitor trends, evaluate interventions, and improve health outcomes through evidence-based actions (4-6).

Traditionally, PMTs have relied on paper-based logbooks and manual reporting systems to document performance reviews, data quality findings, action plans, and follow-up activities. Although these conventional systems have supported routine monitoring activities, they are often associated with several limitations, including data incompleteness, reporting delays, difficulty in retrieving historical records, poor data security, limited accessibility, duplication of work.

To address these challenges, digital health innovations and electronic health information systems are increasingly being adopted globally to improve data management and health system performance (7, 10). Web-based electronic systems offer advantages such as real-time data entry, automated reporting, improved data accuracy, centralized data storage, enhanced accessibility, easier tracking of action plans, and improved data visualization through dashboards and analytics tools. Therefore, this project aimed to design and digitize the conventional paper-based PMT logbook into a web-based electronic Performance Monitoring System.

Description of the system

An innovative digital solution called the Health Data Quality Monitoring System (PMT eBook) has been developed to replace the conventional paper-based PMT logbook with a fully functional web-based platform. Completeness, timeliness, Lot Quality Assurance Sampling (LQAs), Routine Data Quality Assessment (RDQA), Intra-Data Inconsistency Checks (IDIC), and PMT meeting documentation are included into this system. The platform ensures a more effective, structured, and easily available method of tracking the quality of health data across programs and facilities by centralizing the components. The system architecture integrates five core modules that operate together to support end to end data quality management. These core modules are Health Data Quality module that contains the three data quality dimensions (completeness, timeliness and accuracy); the RDQA module that verifies the monthly and cumulative data quality of facilities; the IDICs module that identifies data elements with inconsistencies to resolve the gap; the PMT minutes module includes performance and data quality discussions, performance indicators, prioritization matrix, and action plan; and the final module is the User Management module that provides secured and role based assess for the users.

This digitalized system increases accuracy by automating crucial computations and logic, such as assessing completeness and timeliness (Yes/No) and calculating data verification factors, cumulative and prioritization matrix total score. Additionally, the PMT meeting discussions are AI-powered to capture meeting audio, transcribe it automatically, and convert it into well-structured formal minutes. The transcription can be in English or Amharic based on the languages we used during discussions. The system also allows downloading of the recorded audio for manual transcription and export to Excel.

The system is designed with strong security controls so that only the administrator can provide access for the users. The users are not allowed to change or update their passwords by themselves

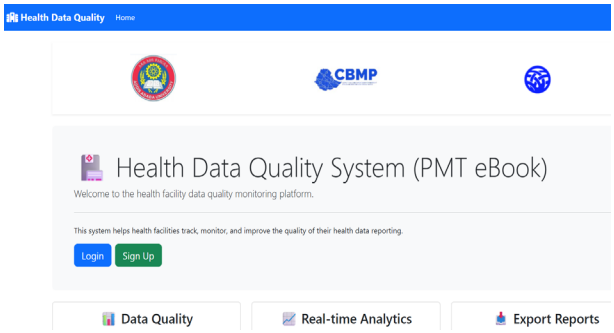


Figure 1: The interfaces before login

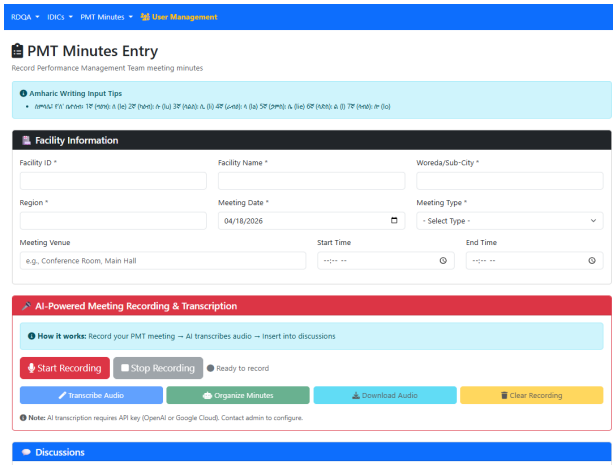


Figure 2: PMT minutes entry interface with AI- Powered audio recording and transcription.

Methods

This innovative data quality monitoring system has been designed using the three-tier design patters for the technical architecture. These tiers include the frontend layer, the backend layer, and the data layer. For frontend layer design, we have used HTML5 with Bootstrap 5 for responsive design, vanilla JavaScript for client-side calculations and interactivity, KeymanWeb integration for Amharic virtual keyboard, and Media Recorder API for browser-based audio recording. The backend layer has been built on python with Flask framework which provides Representational State Transfer API (RESTful API) endpoints, session-based authentication, JavaScript Object Notation (JSON) storage for complex data structures, and OpenAI API integration for audio transcription and organizing the texts services. The data layer has been designed using SQLite database for portability and ease of deployment, with normalized schema design including foreign key relationships and JSON columns for flexible data storage. Currently, the system is deployed on PythonAnywhere cloud platform, which will be migrated to the server after testing and piloting completed.

Results

This automated system completely can replace the paper-based PMT logbook with web-based, easily accessible, attractive and user-friendly interfaces. The system performs all calculations and logic in the PMT document that reduces errors. The data can be accessed online anywhere and anytime for the privileged users. All entries can be exported to Excel table for easily sharing and further investigation. The system allows the user to select, edit, delete, and export specific entries. The interactive dashboard shows the total number of reports, completed, timely and no discrepancy reports. The system can conduct AI-Powered audio recording, transcription, text organization to formal minutes.

Table 1: Summary of result

Evaluation Activity	Participants/ Reviewers	Key Result
Expert Review	6 experts	All five modules were tested and confirmed to be functioning well.
User Testing	3 HIT professionals (from 3 sub-cities)	Users tested all modules and confirmed that they functioned properly.
MOH Health Data Week 2026 Competition	Expert reviewers	The system was reviewed and selected to proceed to oral demonstration and presentation during the data week.
Presentation and demonstration in 2026 data week	Participants from various stakeholder organizations	The system received positive feedback from the audience.
Overall Usability/ Functionality Result	Experts and end users	The system demonstrated good functionality, usability, and acceptability across all five modules.

System performance evaluation

Expert reviews and users test have been conducted to ensure the system functionality, ease of use and user-friendliness. The feedback from sub-city experts and the users was very constructive and encourage the advancement of the system.

Sustainability

As the system is maintaining simplicity and user-friendliness that addresses the actual users need, it will be sustainable and scalable to facilities of all regions in Ethiopia and beyond. After completion of testing and piloting in some facilities, CBMP will develop clear policies, standard operation procedures, and align with the national strategies to ensure continuity of the system functionality.

Collaboration

CBMP will strongly collaborate with other consortium universities, FMOH, and other implementing partners to upgrade and expand the system functionality and use. The end users engagement from the beginning is started to ensure the users need and to make the system user-centered.

Future Enhancement

This system will be enhanced to advance and comprehensive features in short and long term plan. In short term, the system will be refined to mobile-responsive mode to better use of the system by phone and tablet, enable the forms to work offline and sync when connectivity is restored, integrating with DHIS2 to allow automatic data exchange, and enable the system to send automated email alert when the reports are late, incomplete, and data verification factors are out of the standard. In long term, advanced AI features will be added to conduct predictive analysis that can flag facilities at high risk of poor data quality based on the historical patterns and to suggest corrective actions. Native offline-first mobile applications will be developed for low connectivity areas, where internet access is limited.

Conclusions and recommendations

The system was reviewed by domain experts and tested by end users, and all modules were confirmed to function effectively according to the intended requirements. The web-based electronic PMT system demonstrated its potential to improve performance monitoring, data quality management, reporting efficiency, and accessibility of information compared with the conventional paper-based logbook system. The digitization of the PMT logbook can strengthen evidence-based decision-making, enhance data use practices, and support continuous quality improvement within the health system.

The system will be registered in the MOH National Digital Health Projects Inventory (DHPI) portal and will be validated to align with the National Digital Health Architecture and integration with the DHIS2.

The Federal Ministry of Health Ethiopia and development partners should provide technical, financial, and organizational support for the integration with the DHIS2, institutionalization, and application of the system.

References

1. Federal Ministry of Health Ethiopia. National Health Management Information System (HMIS) Monitoring and Evaluation Guidelines. Addis Ababa, Ethiopia.
2. MEASURE Evaluation. Routine Data Quality Assessment Tool (RDQA). Chapel Hill, NC: MEASURE Evaluation; 2019.
3. Federal Ministry of Health Ethiopia. Information Revolution Roadmap. Addis Ababa, Ethiopia; 2016.
4. World Health Organization. Monitoring the Building Blocks of Health Systems: A Handbook of Indicators and Their Measurement Strategies. Geneva: WHO; 2010.
5. World Health Organization. Data Quality Review: A Toolkit for Facility Data Quality Assessment. Geneva: WHO; 2017.
6. AbouZahr C, Boerma T. Health information systems: the foundations of public health. Bulletin of the World Health Organization. 2005;83(8):578–583.
7. Lippeveld T, Sauerborn R, Bodart C. Design and Implementation of Health Information Systems. Geneva: WHO; 2000.
8. Tamiso A, Alemu H, Belaye H, Gebayehu A, Wendrad N, Tsegaw D, et al. Improving PMT Functionality in Public Health Facilities for Better Utilization of Data: A Qualitative Study in the Sidama Region, Ethiopia. Ethiop J Health Dev. 2022;36.
9. Girma Taye, Wondimu Ayele, Awgichew Kifle, Ephrem Biruk, Meskerem Mengistu, Tigist Habtamu, Meskerem Abebaw, Melkamu Tiruneh, Tsegaye Shewangzaw, Berhan Tassew, Daniel Getachew, & Yosef Tsehaye. (2024). Evaluation of Performance Monitoring Team (PMT) Functionality and the Level of Health Information System (HIS) Implementation in selected public health facilities in Addis Ababa: A Baseline Study. The Ethiopian Journal of Health Development, 38(4). https://doi.org/10.20372/ejhd.v38i4.6399.
10. Aqil A, Lippeveld T, Hozumi D. PRISM framework: a paradigm shift for designing, strengthening and evaluating routine health information systems. Health Policy and Planning. 2009;24(3):217–228.

Expanding Access and Equity: Integrating HPV Vaccination into Community-Based Health Platforms in Ethiopia

Rahel Demissew Gebreyohannes[1], Helen Negassi Tesfom[1], Claire W. Rothschild[2], Biruk Hailu Tesfaye[1], Lidiya Berihun Abegaz[1]

[1]Population Services International (PSI), Sexual and Reproductive Health, Addis Ababa, Ethiopia
[2]Population Services International (PSI), Sexual and Reproductive Health, Seattle, USA

Corresponding author: Helen Negassi, hnegassi@psiet.org

Introduction

Cervical cancer is the second most common cancer among women in Ethiopia [1]. HPV vaccination is the most effective prevention strategy when administered before HPV exposure [2]. Ethiopia introduced HPV vaccination in 2018 through school-based campaigns targeting 14-year-old girls, expanded eligibility to girls aged 9–14 years in 2021, and adopted a single-dose schedule in 2024 following WHO recommendations [3]. Despite these advances, equitable coverage remains challenging, particularly among out-of-school girls, rural communities, and populations with limited access to health services [4,5]. This highlighted the need for complementary approaches that strengthen routine immunization, community demand generation, and referral pathways [6].

To address these gaps, PSI, in partnership with the Federal Ministry of Health, Addis Ababa University Centre for Implementation Sciences, and Regional Health Bureaus, implemented the HPV Vaccine Integrated Service Implementation (HPV-VISION) project by leveraging Smart Start, a national community-based program that engages young married couples through financial planning discussions and links them to family planning and other health services. Initially developed by PSI Ethiopia and subsequently adopted and scaled nationally by the Ministry of Health through the Health Extension Program, Smart Start provides an established platform for community engagement, demand generation, and referral for HPV vaccination.

The HPV-VISION project builds on these established community platforms to strengthen HPV vaccine demand generation, identify underserved girls, and link communities with health facilities. The initiative directly contributes to the Health Sector Development and Investment Plan (HSDIP) priorities by strengthening primary healthcare systems, improving equitable access to essential health services, advancing adolescent health, reinforcing community participation, and generating evidence to inform sustainable scale-up of HPV vaccination.

Objectives

General Objective

To assess the effectiveness, and implementation outcomes of integrating HPV vaccination into routine immunization and adolescent health service platforms to improve equitable access among girls aged 9–14 years.

Specific Objectives

- Compare HPV vaccination uptake through routine immunization and adolescent health integration models.
- Strengthen community identification, demand generation, and referral pathways through Smart Start.
- Improve access to HPV vaccination among out-of-school and underserved girls.
- Generate evidence to inform national HPV vaccination scale-up strategies.

Methods

Between March 2025 and February 2026, HPV-VISION was implemented in eight rural woredas across Oromia, Sidama, and Somali regions, including four intervention woredas (Gomma, Sokoru, Hawella, and Awbare) and four comparison woredas, covering 288 public health facilities (157 intervention and 131 comparison). Intervention woredas were selected based on a large population of girls aged 9–14 years, active Smart Start implementation, a high proportion of out-of-school girls, and low HPV vaccination coverage using DHIS2 data, programme records, and woreda information.

Two integration models were evaluated: the routine immunization (EPI) integration model in Gomma and Awbare woredas and the adolescent health (AH) integration model in Sokoru and Hawella woredas. Community mobilization was conducted through existing structures, including Village Health Leaders, Women's Development Army members, and Traditional Birth Attendants, who conducted household visits to identify eligible girls, provide HPV vaccination counselling, and facilitate referrals to health facilities. A total of 80 healthcare providers, 243 HEWs, and 865 community mobilizers were trained. The AH model additionally provided puberty education, menstrual health counselling, nutritional screening, reusable menstrual pads for post-menarche girls, and HPV vaccination referral. HPV indicators were integrated into the Smart Start DHIS2-based monitoring system, with program data triangulated against national DHIS2 reports.

Results

Community mobilizers conducted 55,948 household visits, identifying 77,229 unvaccinated girls aged 9–14 years. Of these, 69,325 (90%) completed referrals, resulting in 68,787 verified HPV vaccinations. Community-generated referrals accounted for 81% of vaccinations delivered through participating facilities, highlighting the importance of household identification and community-to-facility referral pathways. Nearly half (48%) of vaccinated girls were out of school, demonstrating successful reach among populations often missed by school-based campaigns. The EPI model vaccinated 45,347 girls, while the AH model vaccinated 23,440 girls. The EPI model reached a higher proportion of younger girls (48% aged 9–10 years vs. 41% in AH), while the AH model reached more older adolescents (32% aged 13–14 years vs. 21% in EPI). This suggests that routine immunization supports timely vaccination of younger girls, whereas adolescent health services provide an opportunity to reach older girls who may have missed earlier vaccination opportunities, potentially through additional services such as puberty education and menstrual health support. Vaccination coverage in intervention woredas was more than 15 times higher than in comparison woredas relying primarily on school-based campaigns. Program and national DHIS2 data showed >95% concordance, demonstrating strong data quality and reporting consistency.

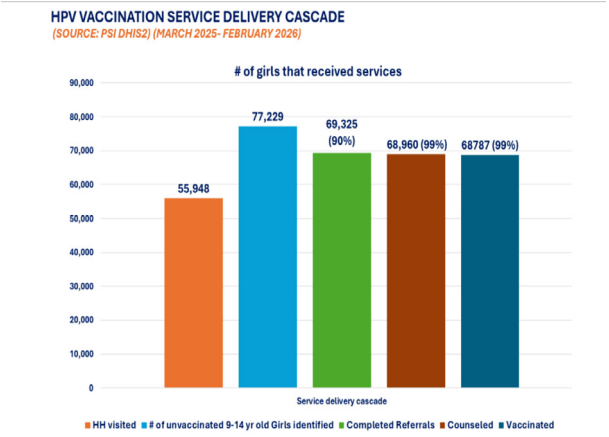


Figure 1: HIV Vaccination service delivery cascades

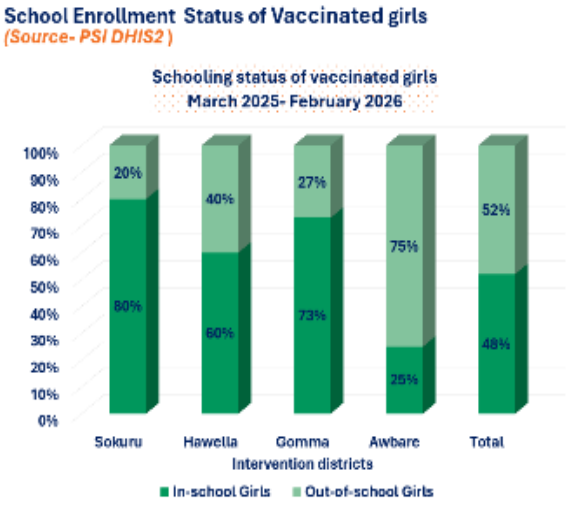


Figure 2: HIV Vaccination service delivery cascades

Conclusion and Way Forward

The HPV-VISION experience demonstrates that achieving equitable HPV vaccination coverage requires multiple complementary delivery approaches. While school-based campaigns remain an important and cost-efficient strategy, integration with routine immunization, adolescent health services, and community referral platforms is essential to reach girls who are missed through school-based approaches.

Routine immunization was more effective in reaching younger girls, while adolescent health services successfully engaged older adolescents through a broader package of health services. Leveraging government-led platforms such as Smart Start strengthens community engagement, referral pathways, and sustainability.

Ministry of Health should consider a differentiated HPV vaccination strategy that combines school-based delivery with routine immunization and adolescent-friendly health services based on regional context, target population characteristics, and implementation costs. Continued investment in community platforms, monitoring systems, and health system integration will be critical for sustainable expansion of equitable HPV vaccination coverage in Ethiopia.

Reference

1. Bruni L, Albero G, Serrano B, *et al.* Human Papillomavirus and Related Diseases in Ethiopia. 2023.
2. Brisson M, Kim JJ, Canfell K, *et al.* Impact of HPV vaccination and cervical screening on cervical cancer elimination: a comparative modelling analysis in 78 low-income and lower-middle-income countries. *The Lancet*. 2020;395:575–90. doi: 10.1016/S0140-6736(20)30068-4
3. Federal Ministry of Health. Ethiopia National Expanded Program on Immunization: Comprehensive Multi-Year Plan (2021-2025). Addis Ababa, Ethiopia 2021.
4. Amponsah-Dacosta E, Blose N, Nkwinika VV, *et al.* Human Papillomavirus Vaccination in South Africa: Programmatic Challenges and Opportunities for Integration With Other Adolescent Health Services? *Front Public Health*. 2022;10:799984. doi: 10.3389/fpubh.2022.799984
5. Rosser EN, Wysong MD, Rosen JG, *et al.* HPV Vaccine Delivery Strategies to Reach Out-of-School Girls in Low- and Middle-Income Countries: A Narrative Review. *Vaccines*. 2025;13:433. doi: 10.3390/vaccines13050433
6. Rujumba J, Akugizibwe M, Basta NE, *et al.* Why don't adolescent girls in a rural Uganda district initiate or complete routine 2-dose HPV vaccine series: Perspectives of adolescent girls, their caregivers, healthcare workers, community health workers and teachers. *PLoS ONE*. 2021;16:e0253735. doi: 10.1371/journal.pone.0253735

Strengthening Pharmaceutical Supply Chains and Pharmacy Services: Findings from Ethiopia's First Community Commodity Monitoring Model

Yalemsew Derib[1], Dr. Mulugeta Endale[2], Netsanet Diro[2], Gizaw Thomas[2], Alemtsehay Adam[2], Nancy Chebet[3], Yonas Mamo[3], Tefera Biteye[3], Elias Geremew[1], Dr. Fikru Worku[1], Edmealem Ejigu[1], Andualem Oumer [1], Kristin Johnson[1], Habtamu Tesfaye[1]

[1] Management Sciences for Health (MSH), USG Supply Chain Strengthening Project, Addis Ababa, Ethiopia
[2] Addis Ababa City Administration Health Bureau, Addis Ababa, Ethiopia
[3]AlignAfrica, Addis Ababa, Ethiopia

Corresponding Author: Yalemsew Derib, yderib@msh.org, +251 911 380 137

Introduction

Communities are often the first to experience medicine stock-outs, service delays, and gaps in pharmacy service quality, yet their role in monitoring pharmaceutical supply chain performance and informing corrective actions remains limited in Ethiopia. Existing supply chain and service information systems primarily generate operational data and fail to capture community perspectives or to provide structured mechanisms for feedback and continuous quality improvement. Consequently, communities have remained passive recipients of pharmaceutical services rather than active participants in identifying and addressing commodity- and service-related challenges. Concerns about stock-outs and service interruptions have often remained informal or poorly communicated to health facilities, leading to limited timely corrective actions and weakened accountability across the supply chain system.

To address this gap, the Addis Ababa City Administration Health Bureau (AACAHB), with technical support from the United States Government (USG)-funded Supply Chain Strengthening (USG SCS) Project implemented by Management Sciences for Health (MSH) and its sub-partner align Africa, designed and piloted Ethiopia's first structured Community Commodity Monitoring (CCM) Model in 20 public health centers (HCs) across five sub-cities. The model aligns with Ethiopia's National Community-Led Monitoring (CLM) Framework (2024) and broader health sector priorities of community participation, accountability, and resilient health system strengthening.

General objective:

To assess how community-led monitoring influences pharmaceutical supply chain and pharmacy service performance; and informs corrective actions and accountability.

Specific objectives:

- To assess the influence of community-led monitoring on commodity availability at HCs.
- To examine how community-led monitoring improves pharmacy service quality.
- To examine how community-led monitoring promotes accountability and community participation.
- To assess how community-generated evidence informs corrective actions and decision-making.

Method

This article presents findings from implementation of the CCM Model, piloted from Feb to Jun 2026 in 20 purposively selected public HCs in Addis Ababa. Data was collected through routine CCM visits, distinct from other supply chain strengthening initiatives implemented alongside it.

A CCM Operational Model, comprising selection criteria, standard operating procedures, roles, reporting structures, advocacy strategies, and monitoring tools, guided implementation. Community Commodity Monitors (CCMs) were selected from nearby communities with health-facility facilitation and trained on basic pharmaceutical supply chain and pharmacy service concepts, and the CCM model before deployment across the 20 facilities to conduct biweekly monitoring visits.

During each visit, CCMs reviewed facility records and conducted direct observation, following a predefined schedule: the first monthly visit assessed pharmacy service quality and client experience, the second assessed tracer commodity availability across the HIV, TB, malaria, and MCH programs.

Pharmacy service quality was measured via five structured exit-interview questions on medicine-use instructions, waiting space, cleanliness, staff language use, and respectful treatment (percentage answering "Yes"). Client satisfaction was assessed separately, as the percentage rating overall services "Poor", "Fair", "Good", or "Very Good".

Findings were shared during immediate facility feedback and monthly review meetings with facility management, which also tracked progress on previously agreed action points. Quantitative data were validated by supervising

Advocacy and Community Mobilization Officers (ACMOs), entered into the DREAM@MSH platform (built on DHIS2), and analyzed descriptively.

Qualitative data on implementation experience were collected separately by the national-level team via key informant interviews with CCMs and facility staff, analyzed thematically.

Participation was voluntary. Clients gave verbal informed consent before exit interviews; no identifying patient information was retained, and all respondents were adults. CCMs gave signed, voluntary consent for qualitative data collection.

Results/Outputs

Eighty-four trained CCMs (44 women and 40 men) were deployed in teams of 3 to 5 to the participating HCs. Each team conducted 10 biweekly monitoring rounds, linking communities, health facilities, and health administrative units in a structured accountability mechanism.

Overall tracer commodity availability increased from 87.2% (71.0% - 100.0%) at the first visit to over 95.0% (83.0% - 100.0%) during the subsequent three months, with up to 40% of the health facilities achieving 100% availability, despite a slight decline to 93.4% in June 2026 due to national shortages of Plasma Preparation Tubes (PPTs) and HIV test kits. These improvements were observed alongside several CCM-related activities: early identification of shortages, direct communication of gaps to facility management, and facilitation of stock redistribution. TB commodities consistently demonstrated the highest availability, followed by HIV and MCH commodities, with availability remaining above 90% across all three categories. Malaria commodity availability fluctuated, falling slightly below 90% in two months before reaching 100% in May 2026, likely to reflect Addis Ababa's relatively low malaria burden.

Client exit interviews showed consistent improvement in pharmacy service quality, increasing from 94.3% in Feb to 97.5% in Jun 2026. Figure 1 presents the monthly trend in pharmacy service quality and tracer commodity availability.

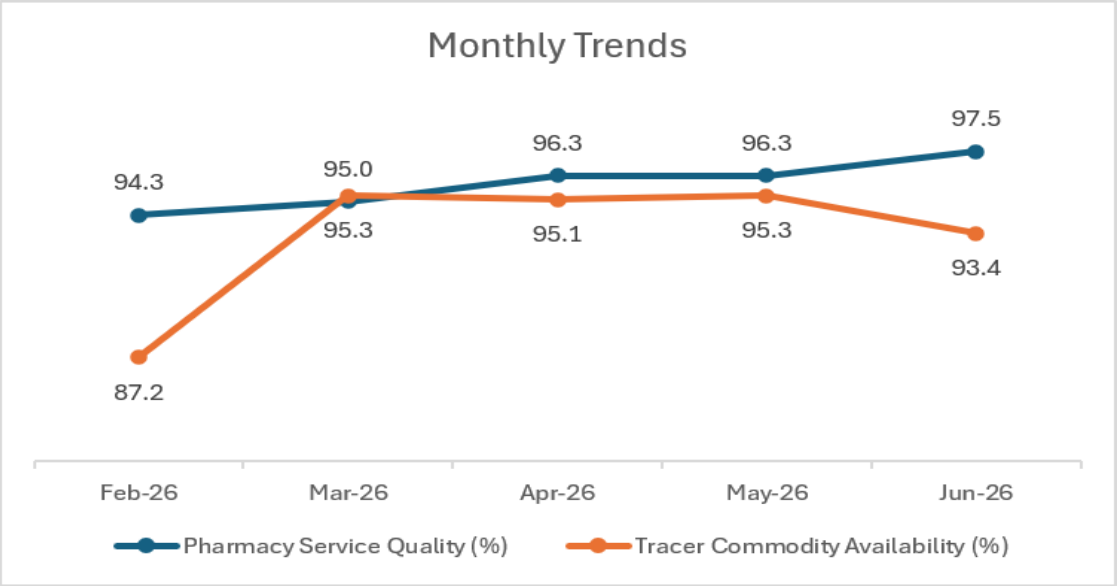


Figure 1. Monthly trend in pharmacy service quality and tracer commodity availability across five monitoring month, Feb–Jun 2026.

Overall client satisfaction with pharmacy services was high throughout, with the percentage of interviewed clients rating the service good or very good increasing from 93.4% in Feb to 96.2% in Jun 2026. These figures are based on exit interviews with a cumulative total of 851 clients across all monitoring rounds combined, averaging approximately 170 clients per month, with each round's percentage calculated independently rather than cumulatively.

Community engagement was strengthened through awareness sessions, community consultations, and the distribution of 7,350 advocacy materials. The CCMs also promoted rational medicine use by educating communities on medicine adherence, safe storage, and avoiding sharing medicine, while ensuring community concerns informed health facility decisions. Awareness activities were delivered largely through existing community platforms; in Kolfe Woreda 01 alone, CCMs reached 5,810 people through coffee ceremonies, idir meetings, and other community events.

Five monthly review meetings demonstrated that community-generated evidence was routinely integrated into health facility performance reviews, strengthening transparency, accountability, and evidence-based decision-making. For example, at Feres Meda HC, persistent stock-outs and limited staff engagement with CCM recommendations during Feb–Apr 2026 were linked to limited staff understanding of the CCM Model's purpose. Following a CCM orientation integrated into an existing staff learning platform on April 20, jointly facilitated by facility leadership, CCM findings became a standing agenda item at monthly management meetings, and departments began jointly implementing corrective actions on identified gaps. Tracer commodity stock-outs at the facility fell from five to one within the following two months; while other factors may also have contributed, this observed change suggests that translating community-generated evidence into facility-level action depends on staff understanding and ownership, not on monitoring alone.

Key informant interviews with CCMs and facility staff described how community feedback was used to identify and address gaps in health commodity availability and pharmacy service quality. Respondents consistently described the model as strengthening accountability and service responsiveness. One CCM explained, *"We serve as the voice of the community..., create awareness among community.... leading to improved service delivery."* A facility manager noted that CCMs *" Previously, there was no structured mechanism for obtaining community feedback. CCMs have bridged this gap ..."*, and a pharmacy head observed that *"communities are now part of the solution."*. CCMs and facility staff expressed interest in the model's continuation as a permanent, institutionalized part of the health system.

The CCM Model was formally transitioned to AACAHB, including through a high-level handover of the complete CCM Implementation Package to government ownership. AACAHB has expressed intent to institutionalize the Model within existing health system structures.

Conclusion and Way Forward

The CCM model established a structured channel through which communities could identify and communicate pharmaceutical supply chain and service-quality issues, and through which facilities could respond. Improvements in medicine availability, pharmacy service quality, and accountability were observed during CCM implementation. The Feres Meda HC experience illustrates a broader lesson: this value depends on staff understanding, which shifts staff perception of CCMs from external inspectors to improvement partners. The structured transition to government ownership offers a practical, replicable model for institutionalizing community participation in pharmaceutical supply chain management, both within Addis Ababa and for scale-up elsewhere in Ethiopia.

Because CCMs are volunteers, and the model relies on existing facility and community structures rather than new infrastructure or salaried positions, the approach may offer a low-cost pathway for government and communities to sustain and scale; however, cost and long-term sustainability were not directly measured in this evaluation and warrant dedicated assessment. One approach worth exploring is embedding CCM recruitment, orientation, and monitoring functions within existing, already-trusted community platforms, such as idirs, alongside woreda structures and women's and youth associations, anchoring the model within community-owned institutions rather than a stand-alone, project-mobilized volunteer cadre.

Cultivating Care Beyond the Health Service: Integrating Vegetable Gardening into Adolescents and Youth-Friendly Health Facilities for Climate Resilience

Worknesh Kereta[1], Abebe Kassa[1], Firehiyaw Birhanu[1] and Teshager Mersha[1]

Pathfinder International Ethiopia, Addis Ababa, Ethiopia

Corresponding author: Worknesh Kereta, WKereta@pathfinder.org

Introduction:

Climate change, food insecurity, and poor dietary diversity continue to threaten the health and well-being of women, children, adolescents, and youth. Evidence shows that facility-based gardening can improve nutrition, promote climate resilience, and transform unused spaces into productive green environments. In Ethiopia, many public health facilities have spacious compounds that remain underutilised, missing an opportunity to support health promotion, nutrition, and environmental sustainability.

To address this gap, Pathfinder International introduced an innovative initiative that integrates vegetable gardening and fruit tree planting into the safe spaces of health facilities that integrate Adolescent and Youth-Friendly Health Services (AYFHS). The initiative equips peer educators and young volunteers who promote healthy behaviours and link peers to health services with practical gardening skills, enabling them to become champions of nutrition, environmental stewardship, and climate action.

The health facility gardens served as demonstration sites where mothers, caregivers, adolescents, and community members learn practical skills for establishing home gardens, improving dietary diversity, sustaining the health facility CASH (clean, safe and attractive health facilities) and adopting climate-smart practices. Fresh vegetables and fruits produced within the facilities has been supplementing meals for pregnant women staying in maternity waiting homes while reinforcing nutrition education during routine health services.

By transforming underutilised health facility compounds into productive learning spaces, the initiative strengthens adolescents and youth engagement, teaches new skills, improves community nutrition, promotes environmental conservation, and supports Ethiopia's vision for climate-resilient and environmentally sustainable health facilities. It demonstrates a practical, low-cost, and scalable approach that integrates health promotion, sustainable facility CASH, nutrition, skill transfer, and climate action while empowering young people as agents of sustainable community change.

Program implementation: Pathfinder International launched the gardening and fruit tree plantation initiative in 2018 as part of its efforts to strengthen Adolescent and Youth-Friendly Health Services (AYFHS). Since then, the initiative has been integrated into more than 60 AYFHS facilities across Ethiopia, transforming underutilised safe spaces within health facility compounds into productive gardens that promote nutrition, environmental sustainability, and youth engagement.

AYFHS providers and peer educators attached to AYFHS facilities lead the initiative; they primarily create demand for adolescent and youth health services, provide health education, and facilitate referrals. Recognising the potential of unused spaces within health facility compounds, peer educators proposed establishing vegetable gardens and fruit tree plantations to complement their health promotion activities. In response, Pathfinder linked them with nearby agriculture offices for training and technical assistance and provided gardening tools, fruit tree seedlings, and vegetable seeds.

Following practical training and continuous technical support from horticulture experts, peer educators prepared the land, planted fruit tree seedlings and vegetable seeds, and maintained the gardens using safe spaces free from biohazardous waste. They cultivated a variety of fruit trees, including papaya, mango, and avocado, alongside vegetables such as cabbage, carrots, and green pepper.

The vegetable gardens have become valuable learning and nutrition hubs within the health facilities. Fresh vegetables supplement meals for pregnant women staying in maternity waiting homes, while peer educators conduct practical nutrition demonstrations and teach mothers, caregivers, and families how to establish backyard gardens, improve dietary diversity, and prepare nutritious meals using locally available foods. Mothers attending immunisation and other maternal and child health services are encouraged to replicate these gardens at home, strengthening community-based nutrition practices.

Beyond improving nutrition, the gardens have created attractive, welcoming health facility environments that encourage community participation and leadership among adolescents and youth. Surplus produce is sold locally, with the proceeds supporting the maintenance of the vegetable gardens and sustaining peer educator activities, demonstrating a practical and self-sustaining model that integrates health promotion, nutrition, and climate-resilient environmental practices.

Lessons Learned: The initiative demonstrated that peer educators can successfully expand their role beyond health education by promoting nutrition, environmental stewardship, and climate action through practical gardening activities.

Establishing vegetable gardens and fruit tree plantations within AYFHS facilities transformed underutilised spaces into productive learning environments that benefited peer educators, health workers, pregnant mothers, adolescents, and the surrounding community.

The gardens served as practical demonstration sites where families learned how to establish home gardens, improve dietary diversity, and make better use of locally available resources. Fresh produce harvested from the gardens also supported nutrition demonstrations and contributed to healthier diets for pregnant women staying in maternity waiting homes.

The initiative demonstrated that collaboration among the health, agriculture, and education sectors is essential for sustainability. The health sector integrated gardening into AYFHS facilities and linked it with nutrition promotion, while the agriculture sector provided technical support on gardening practices. Schools recruited and assigned students as peer educators and created additional opportunities to promote gardening skills and nutrition education among young people. This multisectoral partnership strengthened ownership, knowledge sharing, and the sustainability of the initiative.

In addition to improving nutrition awareness, the initiative enhanced the attractiveness of health facilities, strengthened youth leadership, and showed that integrating gardening into routine health promotion is a simple, low-cost, and sustainable approach that supports climate-resilient and environmentally sustainable health facilities.

Way Forward: Building on these encouraging results, Pathfinder International will continue to strengthen this initiative through experience-sharing visits, peer learning, and ongoing technical support to AYFHS facilities. Pathfinder is currently expanding the model to 43 additional AYFHS facilities, supported by the Gates Foundation under the *Youth Friendly Services and Community Approaches to Reach Adolescents and Youth Project*, enabling more peer educators to establish demonstration gardens, promote healthy diets, and support climate-resilient health care. This experience provides a practical, scalable model that other health facilities can adopt to strengthen nutrition, youth engagement, environmental sustainability, and community ownership within Ethiopia's primary health care system.

Operationalizing Effective Coverage Measurement (ECM) in Tehuledrie Woreda, Amhara Region

Yeshanew Asnake[1], Second Author: Dr. Yonatan Desalew[2]

[1]Amhara Regional Health Bureau, Bahir Dar, Ethiopia

[2]Amhara Regional Health Bureau, Bahir Dar, Ethiopia

Corresponding Author: Yeshanew Asnake, yeshanew2013@gmail.com, 0918487357

Introduction

In Ethiopia's journey toward Universal Health Coverage (UHC), the focus has shifted from merely tracking service contact to measuring the quality and impact of care. The Ministry of Health has championed Effective Coverage Measurement (ECM) as a strategic approach to identify critical service delivery bottlenecks and drive evidence-based quality improvement (QI). This initiative responds to the need to move beyond crude coverage metrics to understand *how well* people are served and what health benefits they gain. The Tehuledrie Woreda Health Office, in collaboration with ARHB & MOH, started an ECM assessment for maternal health services to pinpoint where coverage is lost and design targeted interventions. This aligns directly with the HSDIP-II goal of accelerating progress toward UHC through strengthened primary health care.

Objective

General objective - to measure the effective coverage and make improvements of selected maternal health services like Family Planning (FP), Antenatal Care (ANC), Skilled Birth Attendance (SBA), and Postnatal Care (PNC) in Tehuledrie Woreda.

Specific objectives

1. Determine target population, contact, and input-adjusted coverage;
2. Assess intervention and quality-adjusted coverage; and
3. Identify key gaps to provide evidence-based recommendations for improvement.

Method: A multi-step process was employed to operationalize ECM. A cascade training approach was used, starting with a 3-day Federal Ministry of Health training for 38 key personnel, followed by facility-level training for 129 staff across all seven health facilities. An ECM implementation taskforce was established at the woreda and each facility to ensure sustained ownership. A cross-sectional, facility-based baseline assessment was then conducted during Quarter 4 across one primary hospital and six health centers. The assessment employed standardized tools to capture data across the seven stages of the ECM cascade, including facility readiness checklists, systematic client chart reviews (19 per service per facility), and client exit interviews to measure process quality.

Data Analysis and Weighting: Woreda-level aggregate scores were calculated as volume-weighted averages using facility-level service contact numbers to accurately reflect performance across the woreda's health system. This approach ensures that facilities with higher patient volumes have a proportional influence on the overall results.

Cascade Calculation Method: The final effective coverage (EC) was computed using a multiplicative sequence, reflecting that a health benefit is only realized if a client passes through each stage of the cascade without «loss.» The formula used for this analysis is: **Effective Coverage = Contact Coverage × Readiness × Intervention Score × Process Quality Score × Adherence Score.** This sequential method clarifies that a drop at any stage (e.g., poor quality of care) directly reduces the final effective coverage, even if contact coverage is high.

Results: The assessment revealed a stark disparity between service contact and effective coverage. While woreda-level contact coverage appeared strong (FP: 128%, ANC: 99.6%, SBA: 84%, PNC: 84%), effective coverage dropped dramatically to **15.8% for FP, 60.8% for ANC, 41.0% for SBA, and 29.8% for PNC**. The ECM cascade analysis identified several critical bottlenecks, including target population underestimation (e.g., Sulula HC at 117% for FP), severe facility readiness gaps (Sulula and Kosero HCs scoring only 28% for PNC), and significant process quality deficits in both the provision of care (e.g., incomplete history taking) and the experience of care (e.g., lack of effective communication). Wide performance variation was noted, with Seglen HC demonstrating exceptional effective coverage (82% for SBA) while Sulula HC showed critically low performance (1.2% for PNC).

Table 1. Effective Coverage Assessment by Cascading in in four service area at woreda level

Indicator	FP	ANC	SBA	PNC
Target Population	8,031	1,338	1,338	1,338
Contact Number	10,296	1,332	1,118	1,118
Contact Coverage %	**128%**	**99.6%**	**84%**	**84%**
Readiness Score	75.1%	87.8%	83.4%	69.1%
Input Adjusted Coverage	68.6%	87.2%	70.5%	51.4%
Intervention Score	46.2%	94.4%	76.2%	65.3%
Intervention Adjusted Coverage	44.2%	82.1%	51.7%	40.4%
Process Quality Score	41.1%	75.9%	71.0%	63.2%
Quality Adjusted Coverage	20.4%	62.8%	42.0%	30.8%
Adherence Score	78.1%	NA	NA	NA
Effective Coverage (EC)	**15.8%**	**60.8%**	**41.0%**	**29.8%**

Note on Target Population: The target population for ANC, SBA and PNC services (1,338) is based on the estimated number of expected pregnancies in the woreda based planning. The identical numbers for these services reflect the fact that they are intended for the same cohort of women (pregnant women and postpartum women).

Table 2 Contact coverage (CC) and Effective Coverage (EC) by Service and Facility

Facility	FP		ANC		SBA		PNC	
	CC	EC	CC	EC	CC	EC	CC	EC
Haik HC	100%	23.3%	94%	83.4%	64%	48.4%	64%	31.9%
Sulula HC	100%	4.2%	100%	60.4%	94%	20.2%	94%	1.2%
Hara HC	84%	26.0%	99%	41.0%	99%	12.0%	99%	5.0%
Seglen HC	100%	31.4%	100%	82.0%	96%	82.0%	96%	80.0%
Kosero HC	100%	4.7%	100%	64.0%	100%	59.0%	100%	6.6%
Wahilo HC	100%	6.8%	99%	41.0%	81%	10.4%	81%	41.0%
Haik Hospital	40.7%	13.9%	103.4%	53.7%	93%	54.8%	93%	42.9%
Woreda Aggregate	**100%**	**15.8%**	**99.6%**	**60.8%**	**84%**	**41.0%**	**84%**	**29.8%**
Coverage loss	84.2%		38.8%		43.0%		**54.2%**	



Figure 1. Woreda-level cascade analysis showing the cumulative loss of effective coverage across the four service areas.



Figure 2. Comparison of Effective Coverage for Maternal Health Services across the Seven Health Facilities in Tehuledrie Woreda

Conclusion and Way Forward:

The assessment confirms that while most women access services, the quality of care is often insufficient to achieve the desired health benefits, with the most severe coverage losses occurring in FP (84.2% loss) and PNC (54.2% loss). The high contact coverage for FP, combined with extremely low effective coverage, suggests a significant quality-of-care crisis in family planning services. Conversely, the high ANC contact coverage shows the platform is effective for reaching pregnant women, but the 38.8% loss in effective coverage reveals missed opportunities for high-impact interventions, such as counseling on birth preparedness and danger signs.

To address these challenges, an actionable improvement plan has been developed focusing on:

1. **Strengthening Target Population Estimation:** Using eCHIS and community-level data to refine population estimates and address denominator anomalies.
2. **Improving Facility Readiness:** Procuring essential inputs, with a focus on facilities with critical gaps (e.g., Sulula and Kosero HCs for PNC).
3. **Enhancing Intervention Coverage and Process Quality:** Implementing systematic clinical mentorship, coaching, and respectful maternity care training to improve the «quality of care provided.»
4. **Establishing Routine ECM Monitoring:** Institutionalizing quarterly ECM reviews with the taskforces to monitor progress and adapt interventions.
5. **Designing a high-level intervention plan** (a performance improvement plan and quality improvement projects) to target the most critical bottlenecks identified.

To ensure sustainability, the ECM process is being integrated into the woreda's routine supervision and review processes, with clear roles for the established taskforces. This initiative represents a fundamental shift toward a quality-oriented, data-informed health system in Tehuledrie Woreda, setting a precedent for similar efforts across the Amhara Region.

CHOICE: Scaling Health AI Innovation Through Ethics-by-Design

Hanna Minaye[1], Liya Wassie[1], Hailemichael Getachew[1], Mekdelawit Alemayehu Belayneh[1], Raffaele Joseph[1], Birtukan Harun[1], Rosa Tsegaye[1], Abraham Aseffa[1], Alemseged Abdissa[1]

[1] Armauer Hansen Research Institute, Addis Abeba, Ethiopia

Corresponding author: Hanna Minaye, hanna.minaye@ahri.gov.et

Introduction:

Health AI innovation has broadened the diversity of actors who must be aware of the bioethics standards in people-centered care - including developers, funders, entrepreneurs, and regulators - who collaborate to deliver novel AI innovations in healthcare and medicine. Despite a plethora of health AI ethics guidelines and principles, they remain high-level and offer limited actionability in contexts where innovators are racing to develop and deploy [1]. This weakness is exacerbated by a lack of literature tailored for contexts where innovators have even fewer resources, systemic support, and regulatory imperative to reduce the harms related to the AI innovation landscape.

The Ethiopian Federal Ministry of Health introduced the Health Sector Medium-Term Development and Investment Plan (HSDIP) 2023-2026 [2], outlining its core strategic goals, including the need for innovation and the role of digital health and data science. It equally provides a sober analysis of its gaps in health information systems, digital health infrastructure, and financing. Innovation is framed as a conduit for improved quality, equity, and safe health services. However, while a commitment to quality in healthcare has a bearing on bioethics, ethics-driven healthcare elevates the end-goal to include principles regarding autonomy and justice [3], and it should play a bigger role where innovation is concerned.

The HSDIP outlines important technical and operational needs for improving the digital health infrastructure, yet while *innovation* is mentioned 32 times, *ethics* is mentioned only five times. Regarding artificial intelligence (AI), HSDIP makes robust considerations for data quality practices, as well as building local capacity for data science, machine learning and AI. However, data ethics practices required to reduce the algorithmic bias issues related to unrepresentative data for AI systems are absent - a demonstrated ethical, technical, and quality challenge across the globe in health AI interventions. The need to ensure innovation is values-driven and accompanied by an ethics-by-design ethos is critical considering the additional risks that AI can introduce alongside its promise in healthcare.

In 2025, a consortium of institutions including the Armauer Hansen Research Institute (AHRI) and the Pan-African Bioethics Initiative (PABIN), Grand Challenges Ethiopia, Grand Challenges India and other partners in the Grand Challenges Network, supported by WHO/TDR and the Gates Foundation, partnered to address the ethical concerns emerging across their health AI portfolios. Through a survey of 50 innovators from 13 countries, the group identified that ¾th of health AI innovators felt they neither had the competency to identify ethics risks related to their work, nor received any formal training on the same [4]. These findings and the growing interest across multiple stakeholders led to the establishment of CHOICE - the Coalition for Health AI Innovation and Ethics - an initiative whose aim is to develop a practical guide for AI ethics for health innovators from a Global Majority lens.

As actors in the healthcare sector translate policies and strategic plans into actions, this paper introduces the CHOICE initiative and how its goal complements national health sector innovation through strengthening the case for operationalized AI ethics. Given its strategic placement, its stakeholders and collaborators, the CHOICE initiative primarily targets innovators representing the Global Majority. Health AI ethics guidelines tend to stem from Global North countries and institutions [5] and often fail to contextualize to Global South realities. For example, the HSDIP describes its digital health status as underfunded, with inadequate competencies and digital literacy among health actors, poor ICT infrastructure at different levels, weak governance structures, inadequate data governance techniques and limited network coverage and hardware availability [2]. This scenario is prevalent in CHOICE's target audience, and underlines the urgency for capacity strengthening and implementation of ethics in AI innovation. As an increasingly dominant and essential technology in digital health innovation, how AI is applied in the Global South is a matter of critical ethical concern. How AI evolves depends on how, where and by whom it is developed and whom it is designed to serve. The CHOICE approach contributes a perspective that joins ethics with innovators' realities in a practical manner.

Methods:

Since its inception, CHOICE has applied a crowdsourcing and co-creation approach. Leveraging institutional support and engages a broad range of expertise across several disciplines in healthcare, technology, policy, research and bioethics, it is designed to ensure diverse inputs and voices building toward the end goal of delivering a modular and dynamic practical guide. Firstly, a multidisciplinary working group of over 50 members (44% of whom are women), whose work spans 10 regions across the globe and covers over 8 disciplines, was established and meets regularly to advance the work of the initiative.

As a means to engage the broader community, CHOICE then launched a 2025 call for case studies from health AI innovators. It also launched a webinar series, inviting expert speakers and participants to engage with and design the practical guide. Using qualitative methods, including of existing literature on health AI ethics guidelines, relevant perspectives from across the world continue to be synthesized to contribute to the final product, which will be launched in 2027. The CHOICE working group met in person for its inaugural meeting in Burayu, Ethiopia in February 2026 [6], and plans to hold a validation meeting in Delhi, India in 2027. In both in-person engagements, expert presentations and workshop-style discussions will contribute to the development of the guide.

Outputs: The call for case studies from health AI innovators garnered 19 case studies from innovators in 13 countries, 73.7% of whom were women. Each of them has been analyzed thematically for ethical considerations. Two webinars in the series, with around 300 participants, have thus far been convened and have tackled why such a practical guide is necessary and how to operationalize and contextualize health AI ethics in practice. The webinar speakers reflect perspectives from diverse health and medical scenarios, global health policy and decolonization research. The subsequent discussions have garnered multiple hours of qualitative content on pressing ethical considerations. The webinar series will continue through 2027 as the practical guide develops.

Following the expert guidance of the working group and its sub-committees, the draft practical guide has identified the values grounding its approach: ethics-by-design throughout the health AI innovation lifecycle. The guide is being developed to promote a collaborative ethics ecosystem, transparent learning, and ethics as a team-wide and individual responsibility, all of which are core to achieving reduced harm and improved outcomes in health AI innovation. While the final guide may need to remain rather generic in much of its health and AI details, it will be designed to help innovators navigate the real-world challenges - questions, resources and gaps that emerge when applying ethics in a local context.

This initiative will produce a validated, widely disseminated and easily adaptable practical guide, which will be available through multiple media. It is hoped that the document will be further enriched from practical feedback and an accompanying training material will eventually follow. We envision that it will be embedded within standards, protocols, manuals and align with guidelines targeted at other audiences in the regulatory ecosystem. Current and future policies such as the HSDIP will be able to engage with the ethics-by-design ethos suggested by CHOICE's guide.

Conclusion: CHOICE goes beyond principles to reintroduce actionable considerations in spite of infrastructural, regulatory, or other health system challenges. Its work so far has contributed to shaping the imminent guide, to become a practical tool for health AI innovators across diverse contexts. The HSDIP's vision of scaling alternative and contextualized health services delivery through mobile and digital means reiterates CHOICE's approach to continuously contextualize not only interventions, but the ethical considerations related to their design and delivery as well.

Recommendations: We recommend a) increased multi-stakeholder collaboration in designing responsible and ethical AI, and investing in platforms that facilitate this collaboration; b) advancing ethics-by-design as a grounding principle across health AI development and deployment; and c) embedding ethics in digital transformation strategies in health systems to ensure policy-level awareness.

References

1. Correa NK, Galvão C, Santos JW, Del Pino C, Pinto EP, Karen C, et al. Worldwide AI ethics: A review of 200 guidelines and recommendations for AI governance. arXiv (Cornell University). 2023 Oct 13;4(10):100857–7. Available from: https://www.sciencedirect.com/science/article/pii/S2666389923002416

2. Federal Ministry of Health of Ethiopia. Health Sector Medium-Term Development and Investment Plan (HSDIP). 2023 Nov. Available from: https://ethiopiadup.jsi.com/wp-content/uploads/2023/11/Health-Sector-Medium-Term-Development-Investment-Plan-HSDIP.pdf

3. Marckmann G, Schildmann J. Quality and ethics in healthcare. Bundesgesundheitsblatt - Gesundheitsforschung - Gesundheitsschutz. 2022 Feb 7;65(3).

4. Joseph R, Wassie L, Getachew H, Wangari D, Gitau E, Pirmez C, et al. Fostering an enabling environment for health AI innovation and scale: The need for tailored ethics training for innovators in low- and middle-income countries. AI Ethics. 2025 Dec 17;6(71). Available from: https://doi.org/10.1007/s43681-025-00921-3

5. Hagendorff T. The ethics of AI ethics: An evaluation of guidelines. Minds and Machines [Internet]. 2020 Feb 1;30(1):99–120. Available from: https://link.springer.com/article/10.1007/s11023-020-09517-8

6. AHRI. CHOICE Kickoff Meeting. Armauer Hansen Research Institute. 2026. Available from: https://ahri.gov.et/2026/02/21/choice-kickoff-meeting/

Effective Coverage Measurement and Improvement System (ECMS) in Ethiopia: A National Quality Improvement Approach

Nesredin Nesrebo[1], Kasu Tola[1], Abas Hassen[1], Amsayew Tefra[1], Ftalew Dagnaw[1]

[1]Health System Innovation and Quality Lead Executive Office, Ministry of Health, Addis Ababa, Ethiopia,

Corresponding author: Nesredin Nesrebo, nesredin.nursebo@moh.gov.et

Introduction

Health systems must measure not only whether individuals access services, but also whether care is ready, appropriate, high quality, and capable of producing health gains. ECMIS has therefore emerged as a quality-adjusted measure that links population need and service use to the potential health benefit delivered by the health system (Karim and de Savigny, 2023; Kruk et al., 2018).

Evidence from Ethiopia illustrates why this approach is important. A recent assessment of maternal and newborn services found substantial losses between initial contact, facility readiness, delivery of essential interventions, and quality-adjusted coverage, with important regional differences (Tiruneh et al., 2026). An analysis of ECMIS practice in Ethiopia further highlights the importance of combining demand-side and supply-side data and addressing methodological and implementation challenges when constructing cascades (Lemma et al., 2026).

In response to this need, the Ministry of Health developed the National ECMIS Guideline in March 2025. The guideline defines effective coverage as the proportion of the target population that receives care from a ready facility, obtains necessary interventions according to recommended standards, and achieves positive health outcomes. The initiative supports the Health Sector Development and Investment Plan I (HSDIP-I), the National Healthcare Quality and Safety Strategy II (NQSS-II), and Universal Health Coverage (UHC) goals (Ministry of Health, Ethiopia, HSDIP-I; Ministry of Health, Ethiopia, NQSS-II).

Prior health system performance monitoring emphasized basic service coverage and provided limited insight into facility readiness, completeness of interventions, quality of care, user adherence and outcomes. The absence of a standardized ECMIS also contributed to inconsistent measurement approaches, fragmented use of data, and weak linkage between performance results and quality improvement action.

The program was formally established to create a common national measurement framework and connect measurement to gap identification, quality improvement, accountability, learning, and scale-up. This is consistent with the call for health systems to make quality central to progress toward universal health coverage and the Sustainable Development Goals (Kruk et al., 2018).

Objectives

General objective: To institutionalize a standardized, data-driven system for measuring and improving effective coverage of priority health services in Ethiopia.

Specific objectives: establish national governance; develop guidelines, indicator reference manual, training packages, and digital tools; assess effective coverage and identify bottlenecks; strengthen capacity at all levels; design quality improvement interventions; and document learning for phased scale-up.

Methods or approach

Governance and coordination: A national technical working group was established to provide technical guidance, coordination, governance, and oversight. It collaborates with relevant Ministry of Health offices, the Ethiopia Public Health Institute, regional health bureaus, universities, professional associations, development partners, and implementing organizations.

Standardized measurement framework: The program utilizes a seven-stage of effective coverage cascade model: target population, service contact coverage(A), input-adjusted coverage based on facility readiness(B), intervention coverage(C), quality-adjusted coverage(D), user-adherence-adjusted coverage(E), and outcome-adjusted coverage(F). The final Effective Coverage (EC) estimate is calculated as the product of all cascade components:

Digital and data systems: Comprehensive guidelines, indicator reference manual, gap-analysis tool (BNA), root-cause-analysis tools (RCA), high impact intervention, action trackers, and reporting formats were developed. DHIS2 was customized to support effective coverage data entry, analysis of gaps and bottlenecks (BNA), root-cause analysis (RCA), high impact intervention, action tracking, continuous monitoring, and reporting.

Training Package: A standardized Effective Coverage Measurement and Improvement training package was developed and formally endorsed. It covers measurement concepts, indicator definitions, data management and analysis, Bottleneck analysis (BNA), Root Cause Analysis (RCA), High impact intervention, QIP design, innovative solution, PDSA cycles, M&E system.

Facility implementation: Pilot woredas were selected across five woreda's in five regions collectively include 32 participating health facilities (27 health centers and 5 hospitals). Capacity-building training provided for 200 health leaders and technical experts from those RHBs, woreda's and HFs. Multidisciplinary task forces were established with clear terms of reference, and focal persons were assigned to ensure accountability, coordination, and continuous mentorship. Deep dive baseline assessment was conducted at all health facilities.

Quality improvement: Pilot woredas conducted baseline self-assessments using the ECMIS applicable cascades. Gaps were analyzed and prioritized according to magnitude, severity, feasibility, availability of solutions, equity implications, and potential impact on health outcomes. Measurable targets, actionable plans, and structured QIPs were then developed.

The pilot implementation strengthened capacity across regional health bureaus, zonal health departments, woreda health offices, hospitals, and health centers. Training, onsite orientation, baseline assessment, gap analysis, target setting, QIP design, implementation, supportive supervision, mentorship, coaching, and documentation were conducted as an integrated improvement cycle

Achievements and relevant changes

A National ECMIS TWG was established, and the national ECMIS guidelines, framework, and indicator reference manual were developed. DHIS2 was customized to support data entry, bottleneck analysis, root-cause analysis, the design of high-impact interventions, action tracking, monitoring, and reporting. In addition, a standardized training package was developed and formally endorsed.

Pilot sites were selected across five regions: Oromia, Sidama, Somali, Amhara, and Central Ethiopia. Approximately 200 leaders and frontline workers, from the regional level to health facilities, were trained. Facility governance was strengthened through onsite orientation, the establishment of multidisciplinary task forces, the development of terms of reference, and the assignment of focal persons.

Baseline self-assessments were conducted, enabling the gap identification, analysis, and prioritization of quality gaps in pilot woredas and health facilities. Measurable targets were designed, actionable improvement plans were developed, and structured quality improvement projects were established. These interventions were implemented with ongoing monitoring, supervision, mentorship, and coaching. Lessons learned and good practices were also documented and shared.

These achievements demonstrate that effective coverage measurement has progressed beyond policy and guideline development to operational

implementation. The program is now preparing for a planned, phased scale-up. Lessons from the pilot phase used to validate the tools, assess feasibility, strengthen data quality, refine coaching and reporting mechanisms, and guide future expansion.

Lessons learned

What worked well. High-level policy alignment and collaboration among technical and implementing partners supported implementation. Linking effective coverage to quality improvement made the system practical and action oriented. The cascade helps managers identify whether performance losses arise from contact, readiness, intervention delivery, quality, adherence, or outcomes.

What remains challenging. Effective coverage requires data from different sources, and data linkage may be technically difficult and target setting, and catchment population. Data quality and incomplete documentation. Phased scale-up will allow the program to address these challenges progressively before wider expansion.

Why this is best practice. The program has moved from policy commitment to operational implementation. It addresses a national measurement gap, uses a standardized framework, links measurement to improvement, involves all health system levels, integrates digital and routine information systems, and uses pilot learning to guide phased national scale-up. The ECMIS has entered in its first phased scale-up stage, by incorporating the lessons from the pilot which includes validating DHIS2 digital tools and refining training and technical-support packages, to expand to additional woredas and facilities. Moreover, to ensure sustainability the ECMIS findings will inform planning and resources allocation and as well as learning agenda in learning platforms and review meetings as well as supportive supervision activities

Recommendations

Pilot evidence should be used to refine the training package, indicator reference manual, DHIS2, and implementation protocol before each scale-up phase. National technical leadership should be maintained while assigning clear responsibilities and focal persons at the regional, zonal, woreda, and facility levels. DHIS2 integration and data quality assurance should be strengthened, with the eventual goal of integrating these systems into the electronic medical record.

Regular coaching, mentorship, and supportive supervision should be provided throughout each scale-up phase. Findings on effective coverage should be incorporated into annual plans, budgets, review meetings, and accountability mechanisms. Finally, follow-up assessments should be conducted to demonstrate changes in readiness, intervention, quality, effective coverage, equity, and health outcomes.

Conclusion

Ethiopia's National Effective Coverage Measurement and Improvement Program provides a practical approach for transforming health system performance measurement from crude utilization toward meaningful effective coverage that incorporates readiness, intervention, quality, adherence, and outcomes. With the major foundational milestones achieved, the planned phased scale-up offers an opportunity to institutionalize a sustainable, data-driven quality improvement and accountability system across the health sector.

References

1. Karim A, de Savigny D. Effective Coverage in Health Systems: Evolution of a Concept. Diseases. 2023;11(1):35. doi:10.3390/diseases11010035.
2. Kruk ME, Gage AD, Arsenault C, et al. High-quality health systems in the Sustainable Development Goals era: time for a revolution. Lancet Glob Health. 2018;6:e1196–e1252. doi:10.1016/S2214-109X(18)30386-3.
3. Lemma S, Berhanu AT, Tadele A, et al. Effective coverage practice in Ethiopia. BMJ Glob Health. 2026;11:e019105. doi:10.1136/bmjgh-2025-019105.
4. Ministry of Health, Ethiopia. Effective Coverage Measurement and Improvement Guideline. Addis Ababa: Ministry of Health; March 2025.
5. Tiruneh GT, Chitashvili T, Hunegnaw BM, et al. Effective coverage of maternal and newborn health services across the antepartum and peripartum continuum in primary health care in Ethiopia. Reprod Health. 2026;23:14. doi:10.1186/s12978-025-02241-5.
6. World Health Organization. Guide for Documenting and Sharing Best Practices in Health Programmes. Geneva: WHO; 2008.

Five Birr for My Health: A Community-Led Approach to Improve CBHI Enrollment and Renewal

Mentesenot Seid[1, 2], Addisu Birhanu[1, 2], Mohamed Ebrahim[3], Reha Fuad[3], Yibeyin Belay[3], Daniel Birhane[1,2], Zewudu Alemu[1], Kelemu Dires[1,4], Tilahun Shiferaw[1, 4]

[1]Capacity Building and Mentorship Program (CBMP) Haramaya University, Ethiopia

[2]Department of Epidemiology and Biostatistics, School of Public Health, College of Health and Medical Sciences, Haramaya University, Haramaya, Ethiopia

[3]Jinela Woreda Health Office, Harar, Ethiopia

[4]Department of Information Sciences, College of Computing and Informatics, Haramaya University, Haramaya, Ethiopia

Corresponding author: Mentesenot Seid, mntesnotseidb@gmail.com

Introduction

Community-Based Health Insurance (CBHI) is an important mechanism for advancing universal health coverage (UHC), financial protection, and equity in Ethiopia. National priorities under the Health Sector Development and Investment Plan (HSDIP 2024–2026) emphasize stronger domestic health financing and financial protection. However, evidence from Ethiopia shows persistent challenges with membership renewal and dropout, particularly where households have irregular income and face lump-sum premium payments (Geta et al., 2024; Toleha & Bayked, 2023).

In Jinela Woreda, Harari Region, routine CBHI performance monitoring and community feedback identified a similar pattern: households valued CBHI but often struggled to mobilize the full premium when due. The problem was therefore understood less as unwillingness to pay than as a timing and liquidity constraint. Existing mobilization and reminder approaches did not adequately address this underlying barrier. The Woreda Health Office Performance Monitoring Team, with support from HU-CBMP, used data triangulation and quality-improvement tools to identify and prioritize a locally feasible solution. "Five Birr for My Health" was developed in 2026 to convert a large, periodic premium obligation into small, flexible savings that households can build before enrollment or renewal. The initiative supports HSDIP priorities by promoting financial protection, community participation, and more sustainable CBHI membership.

Objective

General objective: To strengthen CBHI enrollment and continuity of membership through a community-led, flexible micro-saving approach.

Specific objectives: (1) reduce CBHI dropout by addressing household financial barriers; (2) improve enrollment and renewal, particularly among low-income and previously defaulted households; (3) improve financial transparency and strengthen community trust and ownership of CBHI.

Method

Target population and setting: Households in Jinela Woreda, Harari Region, including current CBHI members, previously dropped-out households, and vulnerable households. The initiative was implemented at community level through kebele structures and existing CBHI and primary healthcare platforms.

Implementation modality: A locally initiated quality-improvement intervention to address financial barriers of households to join or renew for CBHI. The team conducted root-cause analysis using a fishbone diagram and prioritized the change idea through a driver diagram. The selected model enables households to save small, flexible amounts, starting from five birr, daily or periodically, toward CBHI enrollment or renewal. Saving can be daily, weekly, monthly, or otherwise aligned with household income, with dedicated saving arrangements linked to the CBHI cycle.

Partnership and roles: The Jinela Woreda Health Office led design, coordination, monitoring, and integration with CBHI processes. Health Extension Workers (HEWs) led household sensitization, follow-up, and reminders; kebele leaders supported mobilization and accountability; health facilities and CBHI focal persons aligned saving with enrollment and renewal; and the Cooperative Bank of Oromia (Coop) provided the dedicated savings infrastructure through a formal memorandum of understanding. HU-CBMP supported evidence generation, data triangulation, implementation, and documentation.

Community involvement and sustainability: Community consultations and discussion forums were used to validate the problem and refine the approach. Households participate voluntarily and choose a saving frequency and amount that fits their income. The model uses existing CBHI and primary healthcare structures and household contributions rather than relying on external financing, supporting sustainability and adaptation.

Digital support: HU-CBMP also supported an Integrated Registration and Renewal Dashboard System (IRRDS) to strengthen membership tracking, renewal monitoring, and use of CBHI data for decision-making.

Results/outputs

Implementation status: The initiative was introduced and operationalized in Jinela Woreda in 2026. Key implementation outputs included a tailored action plan; stakeholder and community discussion forums; a formal partnership with Coop; community mobilization through house-to-house and community engagements; opening of dedicated savings accounts; initiation of flexible savings; and routine monitoring and supportive supervision.

Component	What was implemented	Immediate output
Partnership	MoU with Coop and coordination with CBHI structures	Dedicated saving pathway established
Mobilization	HEW-led household visits, meetings and sensitization	Community awareness and voluntary participation
Saving	Small, flexible contributions from five birr, matched to income patterns	Households able to build premiums over time
Monitoring	Woreda/CBHI focal and kebele review and follow-up	Progress and bottlenecks routinely tracked

The documented implementation reported full coverage among the targeted households and reactivation of previously defaulted households as active CBHI members. The initiative also generated strong community engagement and positive feedback about the reduced financial pressure of lump-sum payment. These early results are implementation outputs rather than a formal impact evaluation; continued measurement is needed to quantify changes in dropout, renewal, and retention over time.

Lesson learned

- Affordability is often a cash-flow and timing problem, not simply unwillingness to pay; payment-support mechanisms should reflect how households earn and manage income.
- Small, consistent contributions can make a large annual premium more manageable and can be integrated into existing CBHI processes without creating a parallel program.
- Community ownership and trust are central. Consultations, transparent communication, and trusted HEWs and kebele leaders helped address concerns and encourage participation.
- Cross-sector partnership with financial institutions can strengthen the security, transparency, and practicality of health-related saving mechanisms.
- Flexible designs improve equity because households can choose saving amounts and frequencies that fit different income patterns.

Conclusion and the way forward

Five Birr for My Health demonstrates how health information, quality improvement, community participation, and financial-sector partnership can be translated into a practical response to a persistent CBHI retention challenge. By changing the timing and flexibility of saving rather than changing the core principle of CBHI, the initiative makes premium preparation more manageable for households with irregular income and offers a locally grounded approach to strengthening enrollment and renewal.

The model should be followed through routine CBHI indicators and progressively assessed for its effect on renewal, dropout, retention, and equity. Regional and national health managers should document and share implementation experience, support appropriate linkages with regulated financial institutions, and assess how flexible saving mechanisms can be accommodated within CBHI policy and operational guidance. Other woredas should consider local adaptation rather than direct replication, with strong community engagement, transparent fund management, and alignment with existing CBHI structures.

1. References

2. Alemayehu YK, Dessie E, Medhin G, et al. The impact of community-based health insurance on health service utilization and financial risk protection in Ethiopia. BMC Health Services Research. 2023;23:67.
3. Geta ET, Lushe KA, Desisa AE, et al. Determinants of community-based health insurance membership renewal decision among rural households in Kellem Wollega Zone, Oromia Regional State, Ethiopia. 2024.
4. Toleha HN, Bayked EM. Dropout rate and associated factors of community-based health insurance beneficiaries in Ethiopia: a systematic review and meta-analysis. BMC Public Health. 2023;23:2425.
5. Terefe B, Alemu TG, Techane MA, et al. Spatial distribution and associated factors of community-based health insurance coverage in Ethiopia: further analysis of Ethiopian Demographic and Health Survey, 2019. BMC Public Health. 2022;22:1523.

UNICEF. Health Investments within a Constrained Economy. 2025.

Operationalizing AHRI's Bioequivalence Center as a National and Regional Contract Research Organization (CRO)

Mekonen, Teferi[1], Amha, Kebede [1], Markos, Abebe[1], Alemseged, Abdissa[1], Messay, W/Mariam[1], Afework, Kassu[1]

[1] Armauer Hansen Research Institute, AA, Ethiopia;

Corresponding Author: Amha Kebede, amha.kebede@ahri.gov.et

Background

Bioequivalence (BE) is evidence used to demonstrate that a generic medicine performs comparably to an established reference product. It is important for assuring the quality, safety and efficacy of generic medicines, supporting confidence in their use, and improving access to affordable pharmaceutical products. Ethiopia has historically had limited national capacity to conduct BE studies. Although the Regional Bioequivalence Center (RBEC), established in 2013 and hosted at AAU School of Pharmacy through a public-private partnership, conducted two pilot and one pivotal study, it subsequently became non-operational. This capacity gap has constrained implementation of BE requirements for locally manufactured generic medicines and increased reliance on external services.

The Ethiopian BE Capacity Roadmap was developed to address this gap and position Ethiopia as a regional leader in BE studies by 2030 (MoH, AHRI, & EFDA, 2023). Its immediate ambition is to establish fully functional and sustainable BE services through improved infrastructure, skilled human resources, strengthened regulatory systems, partnerships, increased demand from local manufacturers and sustainable business models. The roadmap also proposes phased development of BE centers and risk-based enforcement linked to the availability of competent local services.

Against this strategic background, AHRI has been operationalizing a BE Center as an integrated CRO. A CRO is an organization that provides specialized research services to sponsors, including clinical, laboratory, analytical and related research functions. The Center is therefore being developed not simply as a laboratory, but as an integrated platform for BE studies, pharmaceutical research, training and collaboration. The initiative contributes directly to HSIDP II priorities on health-system capacity and regulation, pharmaceutical production, health research, innovation and private-sector engagement.

Objective

The overall objective is to document the transition of the AHRI BE Center from establishment toward a fully operational BE-focused CRO and highlight the implementation approach, achievements, remaining challenges and priorities for sustainable national and regional service delivery.

Specifically, the initiative aims to:

1. Establish integrated clinical trial infrastructure, medical, bioanalytical, and pharmaceutical quality control capacity for BE studies.
2. Strengthen the Center's quality management, regulatory compliance, licensing, and accreditation systems.
3. Develop and retain competent technical and clinical personnel.
4. Provide accessible national BE services to support implementation of Ethiopia's regulatory requirements.
5. Build partnerships with pharmaceutical manufacturers, universities, regulators, technical agencies, and regional institutions.
6. Establish a sustainable operating and financing model for long-term national and regional service delivery.

Implementation Approach

The initiative has been implemented through an institution-led, multi-stakeholder approach involving the MoH, AHRI, EFDA, pharmaceutical manufacturers, universities, and technical and development partners. The implementation process has been guided by the Ethiopian BE Capacity Roadmap and the EFDA Action Plan for phased enforcement of BE studies. Progress has been assessed through review of institutional readiness, infrastructure and equipment status, regulatory and accreditation milestones, workforce development, emerging service opportunities, operational constraints and partnership arrangements.

- The operational model integrates:
- Dedicated clinical trial infrastructure, screening facilities, pharmacy, emergency support, and patient accommodation.
- LC-MS/MS, HPLC, UV-Visible spectroscopy, dissolution, friability, hardness, FTIR, and stability-related capabilities.
- EFDA licensing, quality management system development, method validation and verification, and progression toward ISO 17025:2017 and ISO 15189:2022 accreditation.
- Technical training, competency development, regulatory training, mentorship, and professional attachment.
- Early engagement with local manufacturers to identify priority BE studies and develop a predictable service pipeline.

Technical collaboration and external support for bioanalytical operations, method development, accreditation preparedness, quality assurance, and institutional sustainability.

This integrated model is intended to ensure that regulatory enforcement and national service capacity develop in parallel rather than independently.

Longer-term sustainability is being considered through public, private, research-industry and partnership-based CRO models, consistent with the roadmap's recommendations.

Progress and Emerging Results

The operationalization process has moved the Center substantially beyond the establishment stage. A state-of-the-art facility has been established **(Fig 1)**, critical equipment installed and qualified, the licensing dossier is close to completion, and an EFDA pre-licensing inspection conducted. An initial quality management system is under development, while staff competency development and regulatory training have commenced. The Center's intended service portfolio includes BE studies, medical laboratory services; bioanalytical and physicochemical testing; clinical services; consultancy; and training, mentorship and professional attachment.



Fig 1. The Newly Inaugurated AHRI's Bioequivalence Center Facility in the presence of H.E. Prime Minister Dr Abiy Ahmed.

The next stage is focused on converting infrastructure and systems into compliant and reproducible services. Analytical methods and study protocols are being validated or prepared for validation; medical laboratory methods are being verified toward ISO 15189 accreditation; and pilot and pivotal studies are being prepared/conducted. The Center is pursuing EFDA licensing, ISO 17025:2017 accreditation for analytical laboratories and ISO 15189:2022 accreditation for medical laboratories. The clinical trial ward has undergone EFDA pre-licensing inspection. Very minor issues remain as a specific infrastructure requirement before full clinical operations can commence, while corrective and preventive actions (CAPA) arising from regulatory observations are close for timely closure.

Technical and operational support has become an important component of the transition. Essential laboratory consumables remain to be secured, while suppliers are providing follow-up support for recently installed bioanalytical equipment. International technical support is being mobilized for bioanalytical operations, method development, staff competency and accreditation preparedness. A proposed consulting firm is also expected to accelerate operationalization and accreditation. In parallel, technical support from the United States Pharmacopeia (USP), through a four-year Phase I package secured through UNITAID, is expected to strengthen institutional systems, technical competency, quality assurance, accreditation readiness and long-term sustainability.

Early market engagement indicates that the Center is beginning to generate practical demand. San Sheng Pharmaceutical has requested BE studies for Nifedipine and Folic Acid. The Center considers itself technically positioned to undertake the Nifedipine study in the short term, while regional collaboration is being considered for Folic Acid because of additional analytical method-development requirements. This early engagement demonstrates both emerging domestic demand and the importance of regional technical partnerships during the initial operating phase.

The remaining challenges are significant but clearly defined. They include timely procurement of consumables, continued technical mentorship, accelerated regulatory follow-up and CAPA closure, and adequate operational financing. A pooled study support mechanism has been identified as a practical option for financing early studies and building confidence among manufacturers. Sustainable institutional core support is also considered essential for staff retention, quality assurance and continuity of services.

Conclusion and Way Forward

The AHRI BE Center translates Ethiopia's BE strategy into practical regulatory and pharmaceutical capacity. With major infrastructure and regulatory milestones achieved and early industry demand emerging, the immediate priorities are to complete EFDA licensing and CAPA closure, address clinical infrastructure gaps, accelerate ISO accreditation, secure essential inputs, strengthen governance and technical support, and ensure sustainable financing. Going forward, Ethiopia should consolidate the Center as a sustainable national CRO while expanding capacity and regional partnerships. With sustained alignment among regulation, quality, industry demand, service capacity, and financing, the Center can strengthen access to quality generics, support local pharmaceutical manufacturing, and advance Ethiopia's goal of becoming a regional BE center of excellence by 2030.

References

1. MoH, AHRI, & EFDA. (2023). Roadmap for the development of bioequivalence (BE) services in Ethiopia (pp. 1–25).

2. EFDA. (2023). Action Plan for Enforcement of BE Study for Locally Manufactured Generic Drug Products (pp.1-16).

From Vision to Action: Establishing Human Vaccine Manufacturing in Ethiopia

Dereje, Nigussie[1], Amha, Kebede [12], Markos, Abebe[3], Alemseged, Abdissa[1], Messay, W/Mariam[1], Afework, Kassu[1]

[1] Armauer Hansen Research Institute, AA, Ethiopia; [2]Corresponding Author, [3]ShieldVax, AA, Ethiopia

Corresponding Author: Amha Kebede, amha.kebede@ahri.gov.et

Introduction

Reliable access to vaccines is a cornerstone of health security. While Ethiopia has a history of vaccine production dating back to the 1950s, its domestic human vaccine manufacturing capacity has remained limited, leaving the country heavily reliant on external sources for childhood and epidemic vaccines. The COVID-19 pandemic underscored the risks of global supply chain dependencies and strengthened the case for sustainable local manufacturing **(Doua et al, 2025)**.

In response, MoH and AHRI initiated a coordinated effort to establish a modern, current Good Manufacturing Practice (cGMP)-compliant human vaccine manufacturing facility, namely ShieldVax. This initiative aligns with national priorities regarding local production, import substitution, outbreak preparedness, and domestic health-system ownership, while contributing to the continental ambition of expanding African vaccine manufacturing.

As the initiative evolved, its institutional and financing architecture matured significantly. Transitioning ShieldVax from Public Enterprises Holding and Administration Agency (PEHAA) to Ethiopian Investment Holdings (EIH) under Ethio-BioPharma Enterprise unlocks substantial sovereign capital, reducing reliance on donor funding. Supported by ongoing technical contributions from the MoH, AHRI, and other key stakeholders, this change anchors ShieldVax as a sustainable, nationally owned manufacturing investment

Initiative Goal: To establish a state-of-the-art, cGMP-compliant vaccine manufacturing enterprise that builds national capacity in technology transfer, R&D, workforce development, and supply security through an integrated platform linking research, manufacturing, regulation, and market access.

Approach and Implementation

The establishment process followed a staged, evidence-informed approach. AHRI and its partners commissioned feasibility studies evaluating disease burden, immunization requirements, financial viability, and technical capacity. The findings confirmed the viability of local production and highlighted its potential to enhance health security, economic value, industrial capability, and technology transfer.

A Technical Working Group (TWG), supported by MoH and AHRI leadership, translated these findings into an implementation pathway. Technical specifications were developed for consultancy services covering facility design, equipment selection, human-resource planning, technology transfer, reliable access to bulk antigen, and the future local production of Drug substance (DS). The goal is to produce vaccines by 2029, ensuring compliance with international standards.

The manufacturing strategy follows a phased development pathway to manage technical, financial, regulatory, and technology-transfer risks while progressively building operational competence. This pathway moves from initial manufacturing capability toward deeper integration of drug-substance production and R&D across three distinct phases:

Phase I: Fill-finish

Phase II: Drug substance production

Phase III: Research & Development

Product Portfolio and Priority Antigens

Product selection is a dynamic, strategic process rather than a fixed list. While initial planning evaluated a range of vaccines based on public health needs, market conditions, and technical feasibility, the current priority antigens remain confidential and subject to change; but they are among childhood EPI antigens or outbreak-prone disease vaccines. Final selection will depend on the terms of technology-transfer partnerships, manufacturing readiness, regulatory conditions, market opportunities, and evolving national and regional priorities.

Institutional and Partnership Framework

The establishment of ShieldVax in 2023 is driven by a complementary partnership among the MoH, AHRI, Ethio-BioPharma, and EIH:

Ministry of Health (MoH): Provides strategic policy direction, health-sector alignment, and integration with national immunization agenda and public health priorities.

Armauer Hansen Research Institute (AHRI): Delivers scientific, technical, and capacity-development support, playing a central role in feasibility studies, technical planning, workforce training, and R&D.

Ethio-BioPharma Enterprise: Owns and operates ShieldVax as an enterprise unit, serving as the commercial and operational platform to drive the manufacturing project.

Ethiopian Investment Holdings (EIH): Serves as the parent holding company and primary source of sovereign financing, providing institutional backing, anchoring national ownership, and enabling capital-intensive construction and scale-up **(UNIDO, 2025)**.

Ethiopian Food and Drug Authority (EFDA): Provides regulatory oversight, facility licensing, GMP compliance inspections, and product marketing authorizations to ensure local and international quality standards.

AHRI–ShieldVax Partnership

The AHRI–ShieldVax partnership enables a transition from technical preparation to industrial-scale vaccine production (Fig. 1). ShieldVax serves as the commercial manufacturing arm of Ethio-BioPharma Enterprise, while AHRI provides strategic R&D support. ShieldVax leverages AHRI's R&D expertise and infrastructure. AHRI, in turn, gains a pathway to commercialize research and access manufacturing platforms for clinical testing.

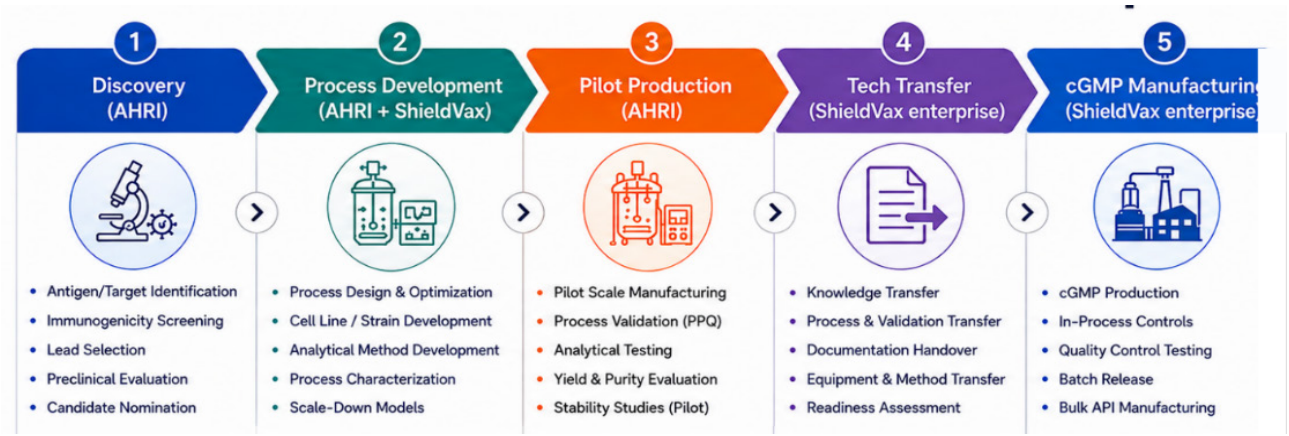


Figure 1: AHRI–ShieldVax R&D-to-API Pipeline

Key Milestones

- Completed financial, market, and technical feasibility studies.
- Developed evaluation frameworks and selection criteria for technology-transfer partners.
- Established ShieldVax under the Ethio-BioPharma enterprise.
- Transitioned from initial ownership of PEHAA to major government financing through EIH, strengthening national ownership.
- Established a dedicated project office and initiated consultancy services.
- Trained over 80 personnel, in major vaccine manufacturing facilities, from AHRI, ShieldVax, and partner institutions in vaccine manufacturing, bioprocessing, biosafety, quality, and regulatory systems
- Completed facility design and technical planning for the manufacturing plant.
- Developed and updated the Human Resource Capacity Building Roadmap (2025–2035).
- Finalized the high-level technology-transfer roadmap and implementation plans.

Commenced construction of the new 23,000 m² ShieldVax facility within the Kilinto Special Economic Zone.

Current Status

The initiative has successfully moved from concept and feasibility assessment to institutionalization, investment, and physical implementation. ShieldVax is entering a major construction phase on its new 23,000 m² site, marking a significant shift from preparatory planning to infrastructure development.

- To guide implementation, the following indicative milestones have been established:
- 2026–2028: Completion of facility construction and cGMP certification;
- 2029: First fill-finish product (Phase I) launched;
- 2030: API production (Phase II) operational;
- 2031 onward: Full R&D integration (Phase III) with AHRI co-developed antigens entering clinical trials.

The financing landscape has also matured. Moving beyond its initial reliance on external development partners, the initiative has secured major government financing through EIH, representing a substantial increase in public-sector commitment. The broader institutional framework now effectively integrates the MoH, AHRI, Ethio-BioPharma, and EIH, alongside technical and technology-transfer partners.

Challenges and Lessons Learned

- Establishing domestic vaccine manufacturing requires simultaneous attention to regulation, technology, financing, human resources, and market demand. Key lessons from the ShieldVax experience include:
- Early feasibility work and coordinated technical leadership are vital to translate political commitment into an actionable manufacturing program.
- Product selection must remain flexible to accommodate Technology Transfer partner capabilities, technology-transfer arrangements, and evolving strategic priorities as well as the timeframe of graduating from Gavi.
- Facility construction, workforce training, quality systems strengthening, regulatory capacity, and technology transfer must advance concurrently.
- Clear institutional roles and secure financing are absolute prerequisites for transitioning from project development to an operational enterprise.
- A multi-partner model strengthens resilience by blending government backing with research capabilities and enterprise expertise.
- A clear pathway between research institutions and the manufacturing enterprise ensures that technical support is maintained while operational independence is progressively built.

Market/Bid-Back Guarantee: The most critical mechanism for local vaccine manufacturers' financial and operational viability is market guarantee. Without guaranteed public-sector procurement, domestic facilities face significant financial risk.

Conclusion and Way Forward

ShieldVax marks a major step toward Ethiopia's self-reliant vaccine manufacturing. With construction, workforce preparation, technology-transfer planning, and increased government financing underway, the next phase requires sustained coordination among MoH, AHRI, Ethio-BioPharma, EIH, regulators, and technology partners. Priorities are to maintain construction momentum, ensure cGMP compliance, strengthen quality systems, secure technology transfer, and build independent manufacturing and R&D capacity (WHO, 2026). AHRI will remain a key R&D partner, helping bridge research and industrial production. With sustained commitment and effective implementation, ShieldVax can become a cornerstone of Ethiopia's vaccine security and Africa's local manufacturing agenda.

References

1. Doua et al. (2025). Advancing local manufacturing capacities for vaccines within Africa – Opportunities, priorities and challenges. Vaccine, 50, 126829. https://doi.org/10.1016/j.vaccine.2025.126829.

2. UNIDO. (2025). Increasing African production of vaccines and essential medicines through business linkages & technology transfer: Investment portfolio—Ethiopia, Kenya and Nigeria. https://hub.unido.org/sites/default/files/publications/Increasing%20African%20Production%20of%20Vaccines%20and%20Essential%20Medicines%20through%20Business%20Linkages%20and%20Technology%20Transfer.pdf

3. World Health Organization. (2026, July 20). *WHO and partners strengthen global commitment to sustainable local manufacturing for health*. https://www.who.int/news/item/20-07-2026-who-and-partners-strengthen-global-commitment-to-sustainable-local-manufacturing-for-health?utm_source=chatgpt.com

H-STIL initiative: A new Collaborative Model for Woreda Health System Transformation in Sidama Region

Keneni Gutema[1,2], Desalegn Tsegaw[1],[2], Betlhem Eshetu [1,2], Birhanu Bifato[2], Tsion Tekle[2], Alemu Tamiso[1,2], Emela Lamacha[3], Karesa k[3], Kaleb Meyiso[1], Samrawit Fantaw[1] Ruth Abriham[1], Melese Siyoum[1], Mulugeta Mengistu[1], Ephrem Awulachew[1], Rekiku Fikre[1,2], Yakob Wondirad[4], Mesoud Mohammed[4], Belayneh Bekele[3]

[1]Hawassa University, College of Medicine and Health Sciences, Hawassa, Ethiopia

[2]Hawassa University, CBMP

[3]Sidama Regional Health Bureau, Hawassa, Ethiopia

[4]Federal Ministry of Health, Addis Ababa, Ethiopia

***Corresponding author:** Rekiku Fikre, frekiku719@gmail.com, +251942521125

Introduction

The Ethiopian Ministry of Health (MOH) prioritizes Woreda Health System Transformation under the Health Sector Transformation Plan II (HSTP-II) to ensure equitable, high-quality primary care (1). Building on lessons from earlier efforts, in 2025/2026, Hawassa University and the Sidama Regional Health Bureau launched the Health Sector Transformation, Innovation, and Learning (H-STIL) initiative. H-STIL is a joint academic–government platform that bridges national policy with local healthcare delivery (Fig 1). H-STIL bridges national policy with local delivery by translating HSTP-II and Health System Development and Innovation Program (HSDIP) priorities into district-level interventions (2). Its design is consistent with the MOH's Woreda Health sector Transformation Coordination, which provides the national framework for woreda-level implementation (3). This approach drives systemic alignment across the five existing transformation agendas—Quality and Equity, Information Revolution, Workforce, Financing, and Leadership &governance—while remaining flexible to accommodate forthcoming priorities under HSTP and HSDIP (2,4).

Objectives:

- Establish Wondo Genet as a national model for district health system excellence by 2026.
- Mobilize households and kebeles as certified "model" communities by 2026.
- Certify 80% of PHCUs as highperforming facilities by 2026.
- Expand CBHI enrollment by 30% and reduce service barriers by 2026.
- Implement model IR practices in 100% of Wondo Genet health facilities by September 2026 (achieved earlier the date).

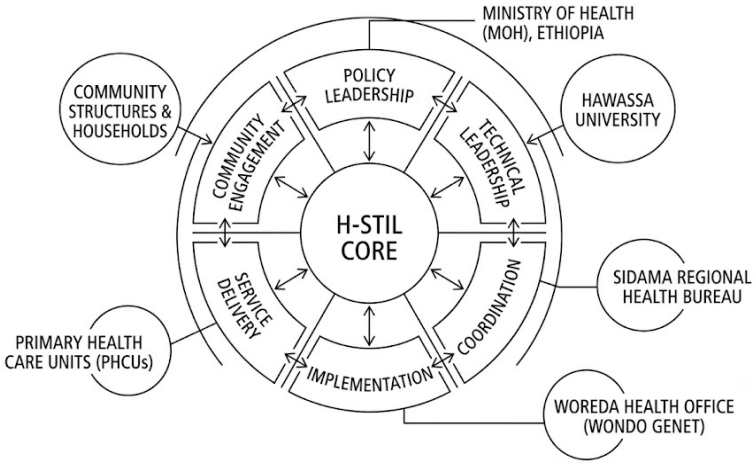


Fig 1. Schematic diagram of H-STILL initiative

Method

Study Design and Sampling The study was conducted in Wondo Genet Woreda, with a total population of 160,919 and 32,841 households, served by three Primary Health Care Units (PHCUs): Aruma, Wosha, and Babo. A multistage stratified sampling approach was applied at the household level. The sample size was calculated using a 95% confidence level, 5% margin of error, and an assumed proportion of 0.5, yielding 384 households. After adjusting for a design effect of 2.0 and a 10% nonresponse rate, the final sample size was 854 households. Allocation followed a proportionaltopopulation size (PPS) method: Aruma 42.5% (363 households), Wosha 38.5% (328 households), and Babo 19% (163 households). A threestage procedure was used: stratification by PHCU, proportional allocation to health posts, and systematic random household selection, ensuring geographic and demographic representativeness across all 13 health posts.

Target Population and Area: The intervention focused on the estimated population of the 160,919 residents of Wondo Genet Woreda in the Sidama Region of Ethiopia. These communities are served by 16 public health institutions (three HC and 13 HPs), and the Woreda Health Office.

Modality of Implementation: Implementation followed a twolayer change approach using the augmented FGDECR model—Focus, Gap analysis against standards, develop action plans, Execute and Evaluate, Cascade the change, and Reward and recognition. The process began with a pilot at one primary health center and was subsequently scaled across all 16 public health facilities and the Woreda Health Office.

Partnership and Strategic Alignment The initiative was anchored in strategic collaboration between Hawassa University and the Sidama Regional Health Bureau/Woreda Health Office. Hawassa University provided technical leadership, research, and innovation, while the regional and woreda offices coordinated, integrated, and executed operations. This partnership advanced HSDIP goals through joint governance under the HSTIL platform.

Community Involvement Community participation was based on the findings of the standardized household baseline surveys capturing sociodemographic data, health insurance utilization, water, sanitation, and hygiene (WASH) practices, maternal and child health (MCH) indicators, and disease burden .

Capacity Building and Supervision Capacity strengthening was achieved through bimonthly practicebased learning sessions. Joint mentorship and supportive supervision were conducted across all 20 health facilities to reinforce skills and sustain improvements.

Political Commitment and Sustainability The initiative was formally recognized by the Ministry of Health under the Health Sector Woreda Transformation agenda. Local woreda administration bodies were actively engaged, and the program was integrated into regional health system planning, ensuring sustainability and supporting national scaleup.

Results and Outputs

Baseline Household Survey Findings

A standardized baseline survey of 850 households across three target PHCUs—Aruma, Babo/Cho, and Wosha—established operational benchmarks in sociodemographics, health insurance utilization, maternal and child health, and sanitation.

SocioDemographics: Most households (60.8%) had 4–6 members, and 80.8% of household heads worked in agriculture. Income distribution showed that 24.2% earned ≤ ETB 5,000 monthly, while 16.8% earned > ETB 15,000.

CBHI Utilization: Enrollment stood at 41.5% overall, with Wosha lagging at 25.9%. Nearly half (47.8%) of active CBHI users paid extra outofpocket, mainly for prescription drugs (97.7%) due to stockouts. Nonenrollment was largely attributed to poor service quality (54.7%) and limited awareness (23.1%).

Maternal and Child Health: Institutional delivery averaged 64.0%, with Wosha lowest at 42.7%. Early ANC initiation was only 34.7%, and full immunization coverage reached 51.0%.

WASH Conditions: 63.0% of latrines were unsanitary, and only 2.0% of households had dedicated handwashing stations—indicating major hygiene gaps.

Programmatic Capacity Building

Integrated Training of Trainers (TOT) was delivered to 50 local health leaders using the PBLA methodology. Bimonthly clinical and administrative mentorship is now operational across all 16 public health facilities, strengthening leadership and service quality.

Table 1. Household Socio-demographic & Economic Characteristics across Target PHCUs (n=850)

Variable	Categories	Aruma PHCU (n=362)	Babo/Cho PHCU (n=163)	Wosha PHCU (n=325)	Total (N=850)
Household Size	1–3 members	108 (29.8%)	53 (32.5%)	126 (38.8%)	287 (33.8%)
	4–6 members	228 (63.0%)	100 (61.3%)	189 (58.2%)	517 0.8%)
	>than members	26 (7.2%)	10 (6.1%)	10 (3.1%)	46 (5.4%)
Monthly Income (ETB)	≤5,000	94 (26.0%)	49 (30.1%)	63 (19.4%)	206 (24.2%)
	5,001–10,000	129 (35.6%)	52 (31.9%)	94 (28.9%)	275 (32.4%)
	10,001–15,000	88 (24.3%)	42 (25.8%)	96 (29.5%)	226 (26.6%)
	>15,000	51 (14.1%)	20 (12.3%)	72 (22.2%)	143 (16.8%)
Occupation of Head	Agriculture	321 (88.7%)	158 (96.9%)	208 (64.0%)	687 (80.8%)
	Business	27 (7.5%)	4 (2.5%)	75 (23.1%)	106 (12.5%)
	Gov/Private Employee	13 (3.6%)	0 (0.0%)	38 (11.7%)	51 (6.0%)

Table 2. Community-Based Health Insurance (CBHI) Utilization and Bottlenecks

Variable	Categories	Aruma PHCU	Babo/Cho PHCU	Wosha PHCU	Total
CBHI Enrolled	Yes	183 (50.6%)	86 (52.8%)	84 (25.9%)	353 (41.5%)
	No	179 (49.4%)	77 (47.2%)	241 (74.1%)	497 (58.5%)
Paid Extra Out-of-Pocket *(n=180 users)*	No	32 (36.4%)	51 (91.1%)	11 (30.6%)	94 (52.2%)
	Yes	56 (63.6%)	5 (8.9%)	25 (69.4%)	86 (47.8%)
What Paid For *(n=86 paid)*	Prescription Drugs	55 (98.2%)	4 (80.0%)	25 (100.0%)	84 (97.7%)
Reason for non-enrollment *(n=497 non-enrolled)*	Poor service quality	95 (53.1%)	40 (52.0%)	137 (56.8%)	272 (54.7%)
	Cannot afford premium	36 (20.1%)	18 (23.4%)	43 (17.8%)	97 (19.5%)
	Lack of awareness	43 (24.0%)	19 (24.7%)	53 (22.0%)	115 (23.1%)

Table 3. Maternal Care, Child Immunization, and Environmental Sanitation Indicators

Variable	Categories	Aruma PHCU	Babo/Cho PHCU	Wosha PHCU	Total
Place of Delivery *(n=239 recent births)*	Health Facility	97 (87.4%)	15 (46.9%)	41 (42.7%)	153 (64.0%)
	Home	14 (12.6%)	17 (53.1%)	54 (56.3%)	85 (35.6%)
ANC Initiation Time *(n=239)*	Early ANC	35 (31.5%)	23 (71.9%)	25 (26.0%)	83 (34.7%)
	Late ANC	76 (68.5%)	9 (28.1%)	71 (74.0%)	156 (65.3%)
Child Immunization Status *(n=308 children)*	Fully Immunized for age	81 (60.9%)	21 (41.2%)	55 (44.4%)	157 (51.0%)
Toilet Cleanliness & Quality *(n=610 toilet owners)*	Clean with lid	106 (37.5%)	3 (3.1%)	93 (40.6%)	202 (33.1%)
	Smelly, no lid	165 (58.3%)	92 (93.9%)	127 (55.5%)	384 (63.0%)
Handwashing Station Facility *(n=610)*	Present	5 (1.8%)	0 (0.0%)	7 (3.1%)	12 (2.0%)

Outcome and Next Steps

Wondo Genet Woreda has been officially designated as a Model Information Revolution (IR) Woreda by the Ministry of Health. Baseline assessments revealed gaps in the remaining four transformation agendas, which will be addressed through forthcoming HSDIP interventions using the HSTIL approach. Hawassa University has committed to extending the project's first phase, while Sidama Regional Health Bureau will lead implementation and resource mobilization.

The HSTIL model demonstrates that districtlevel transformation is achievable when academic partnerships reinforce local government leadership through structured frameworks aligned with HSDIP goals. Sustaining progress requires strong leadership ownership of the change, stable and predictable funding, and capacitating the woreda to monitor implementation through a standardized checklist to ensure continuity (6,7).

References

1. Federal Democratic Republic of Ethiopia Ministry of Health. *Health Sector Transformation Plan II (HSTPII) 2020/21–2024/25*. Addis Ababa: FMoH; 2021.
2. Federal Ministry of Health. *Health Sector Medium-Term Development and Investment Plan (HSDIP), 2016-2018 EYF (2023/24-25/26).*
3. Federal Ministry of Health. *Health Sector Woreda Transformation Coordination Manual*. Addis Ababa: FMoH; 2023.
4. Federal Ministry of Health. *Information Revolution Strategic Plan 2018–2025*. Addis Ababa: FMoH; 2018.
5. Alemu T & Keneni G. MOH Special bulletin 22nd Annual review meeting 2020 November. 2020
6. Negeri KG, Zerihun B, Bifato B, Eshetu B, Likka MH, Debiso AT. Ensuring the sustainability of health information system changes in Ethiopia. Ethiop J Med Health Sci. 2024;4(Suppl 1). Available from: https://journals.hu.edu.et/hu-journals/index.php/ejmhs.
7. PMNCH, Clinton Health Access Initiative. *Mapping and Assessment of Commitments towards Women's, Children's and Adolescents' Health in Ethiopia*. Addis Ababa: PMNCH; 2025.

Point-of-Use Water Flow Optimization for Groundwater and Wastewater Resilience

Sitra Hussien[1], Alem Gulelat [1], Mewal Hagos[1], Abel Amare[1], Fuad Temam [1]

[1]Kadisco General Hospital, Quality & Innovation Office and Engineering Department, Addis Ababa, Ethiopia

Corresponding author*:* Sitra Hussien: Sitrahuss@gmail.com, +251927056224

Introduction

Kadisco General Hospital depends substantially on groundwater drawn from private boreholes to run its clinical and non-clinical services. Recent internal reviews flagged rising risks tied to this dependence: high-volume abstraction is placing measurable stress on the aquifer, wear is accumulating faster on pumps and distribution infrastructure, and peak wastewater flows from handwashing stations were found capable of destabilizing the biological treatment process at the hospital's wastewater plant. These pressures sit alongside a tightening regulatory outlook for groundwater abstraction and effluent discharge, which is expected to raise compliance costs over time.

Prior facility experience showed that ad hoc fixture replacement, done without measurement or a structured improvement cycle, produced inconsistent water savings and left pressure and infection-prevention concerns unresolved. This new initiative responds directly to that gap by piloting point-of-use flow-control technology (Eco 365 aerators) under a formal Plan-Do-Study-Act (PDSA) cycle, with measured baselines, defined targets, and staff feedback built in from the start. The approach is aligned with IFC Performance Standard 3 (Resource Efficiency and Pollution Prevention) and Performance Standard 4 (Community Health, Safety and Security), the hospital's Environmental and Social Management System (ESMS), and the resource-efficiency and environmental-resilience priorities embedded in the Health Sector Development and Investment Plan (HSDIP). It was adopted and piloted within the last year, positioning it as a candidate strategic direction for facility-wide water stewardship.

Objective

General objective: To determine whether point-of-use flow optimization can meaningfully reduce hospital water consumption while protecting groundwater resources, infrastructure, and wastewater treatment performance.

Specific objectives:

- Reduce flow rates at designated pilot fixtures by at least 70% relative to baseline.
- Confirm that reduced flow does not compromise clinical hand hygiene or IPC compliance.
- Assess the intervention's effect on wastewater hydraulic loading and treatment stability.
- Generate evidence to support a facility-wide scale-up decision.

Method

The pilot targeted high-consumption, high-traffic fixtures at Kadisco General Hospital: the staff cafeteria, outpatient department (OPD) toilets, OPD triage handwashing stations, and the Gate 1 handwashing point. A multidisciplinary team — the Quality & Innovation Office, Engineering Department, and ESMS/OHS unit — implemented a PDSA cycle: baseline flow rates were established, Eco 365 aerators were installed at pilot fixtures, and a two-day controlled volumetric assessment compared baseline and aerator-equipped flow using calibrated containers and timed collection (Flow Rate = [(Volume in mL ÷ 1000) ÷ Time in seconds] × 60).

A structured staff feedback survey captured perceived water pressure, IPC compliance, and splash/aerosol behavior at each pilot site. The intervention was implemented as a small, closely monitored pilot not yet a national or system-wide rollout with findings intended to inform a phased, hospital-wide expansion beginning with the ICU, ER, and Maternity units. Sustainability is supported by integrating monitoring indicators into the hospital's ESMS and assigning ongoing responsibility to the Quality & ESMS team.

Results / Outputs

Flow reductions were recorded at every pilot site, with several exceeding the 70% target (Table 1). The strongest results were at OPD Triage (83.3% reduction, from a projected 8.00 to 1.33 L/min) and the Cafeteria (75.0% reduction, from 8.00 to 2.00 L/min); OPD Toilet and Gate 1 showed more modest reductions of 37.7% and 50.7% respectively.

Pilot Site	Baseline (L/min)	Eco 365 (L/min)	Reduction
Café	8.00	2.00	75.0%
OPD Toilet	5.67	3.53	37.7%
OPD Triage*	8.00	1.33	83.3%
Gate 1	5.33	2.63	50.7%

**Projected baseline based on equivalent manual fixtures. Day 1 screening measurements at additional points (café, OPD toilet, OPD triage, Gate 1) corroborated the direction and scale of these reductions.*

Staff feedback (n = frontline users at pilot sites) rated water pressure adequate for routine handwashing (average 3–4 out of 5) and IPC compliance favorable overall (average 2.5–5 out of 5). The main improvement opportunity identified was splash and aerosol affecting clothing at higher-pressure sites, flagged for engineering mitigation before wider rollout. A root-cause review also linked pre-existing hydraulic instability pressure fluctuations

and water-hammer effects from the absence of centralized pressure regulation to inconsistent flow delivery across sites.

Based on these outputs, hospital leadership approved the intervention as successfully completed and recommended it for facility-wide scale-up (Table 2), with actions assigned across Engineering, IPC, Facilities, and ESMS teams through Q3–Q4 2026.

Action	Responsible	Timeline
Scale up aerator installation (ICU, ER, Maternity)	Engineering Dept.	Q3 2026
Splash/aerosol mitigation assessment	Engineering & IPC	Q3 2026
Hydraulic system audit; evaluate PRVs	Engineering/ Facilities	Q3 2026
Wastewater loading & equalization review	Engineering & ESMS	Q3 2026
Monitor water/ wastewater trends	Quality & ESMS	Ongoing

Conclusion and the Way Forward

This pilot shows that point-of-use flow optimization is a low-cost, rapidly deployable way to cut hospital water consumption by up to 83.3% at the best-performing site without undermining hand-hygiene practice. Beyond direct savings, it reduces borehole abstraction pressure, eases mechanical stress on pumps and distribution infrastructure, and lowers hydraulic shock loading on the wastewater treatment plant, helping stabilize biological treatment and support environmental compliance.

Facility leadership, engineering teams, IPC focal persons, and ESMS staff are encouraged to support the phased scale-up already approved for the ICU, ER, and Maternity units, and to resolve the splash/aerosol and hydraulic-stability issues identified before broader deployment. Continued monthly monitoring of water and wastewater trends, and integration of results into the ESMS sustainability report, will be essential to confirm sustained impact and to build the evidence base needed for a full facility-wide rollout.

Elevating Adolescent and Youth Engagement in Health Through Youth-Led Community Scorecards: Experience from four AYFHS facilities, Addis Ababa, Ethiopia

Background

The role of adolescents and youth in Ethiopia's health system is critical in improving the quality of health services and increasing the utilization of essential care by adolescents and youth. Adolescents and youth play a critical role in improving the quality and use of health services in Ethiopia. Despite the expansion of Adolescent and Youth-Friendly Health Services (AYFHS), their meaningful engagement in monitoring service quality and influencing health-system decisions remains limited. The Youth-led Community Scorecard (CSC) is a participatory social accountability approach that enables young people to assess service quality, share their experiences, and engage constructively with health care providers and health managers. Through scoring, dialogue, and joint action planning, the approach creates a structured mechanism for identifying service gaps, strengthening accountability, and supporting continuous quality improvement.

The Youth-led CSC was introduced and integrated into four AYFHS facilities in Addis Ababa selected for having dedicated AYFHS spaces, high adolescent and youth client volume, and active peer educator engagement. The initiative aimed to strengthen meaningful adolescent and youth engagement and improve the responsiveness and quality of AYFHS. This paper documents the implementation experience and lessons learned, focusing on the feasibility of engaging adolescents and youth in social accountability, their contribution to facility quality-improvement processes, and the potential of the approach to promote more responsive and client-centered AYFHS.

Intervention Process

The Youth-led CSC is an AYFHS-specific social accountability tool aligned with Ethiopia's Adolescent and Youth Health Strategy and AYFHS Service Standards. It enables adolescents and youth to assess the services they receive and work with health facilities to identify and address service gaps. The assessment covers key standards, including provider attitudes, availability of comprehensive services, privacy and confidentiality, youth engagement, facility organization, essential commodities and SBC materials, and provider competence.

Implementation began with an orientation for more than 20 participants at each facility, including facility leaders, quality improvement teams, AYFHS providers, peer educators. This created a shared understanding of the approach and secured commitment to participate in the quality improvement process. Youth Councils were then established to coordinate the initiative. Members were selected based on criteria such as gender balance, willingness to volunteer, vulnerability, and ability to communicate with peers. They received training on AYFHS standards, the CSC process, and their roles in facilitating ratings, collecting feedback, and supporting dialogue and conducting town hall meetings.

More than 25 adolescents and youth clients who had used AYFHS were then invited to rate the services. After providing informed consent and receiving orientation on the AYFHS standards, they assessed service quality using a simple color-coded scoring system: green indicated that the standard was met, yellow indicated partial satisfaction, and red indicated a need for improvement. This simple approach enabled young clients to share their experiences in a structured and understandable way. The youth led CSC rating findings are presented in the table below

The below table shows the results on the major AYH standards of the AYFHS implemented in within the AYFHS room.

AYFHS service standards/indicators	AYFHS facility; Rate %														
	Arabsa HC			Goro HC			Amoraw HC			Woreda 02 HC			Aggregate		
	3	2	1	3	2	1	3	2	1	3	2	1	3	2	1
When I was in the YFS room, I received a warm welcome from the healthcare provider	60	24	16	100	0	0	93	67	0	100	0	0	88	8	4
I had a comprehensive health service that I needed within the YFS room from one provider	36	48	16	27	47	0	13	60	27	92	4	4	42	35	23
I was provided with a service that respected my privacy and confidentiality	20	28	52	100	0		93	0	7	96	4	0	77	8	15
Peer educators/young people gave me the necessary information and guidance when I came to the YFS room	42	28	28	87	0	13	0	8	93	88	8	4	55	11	35
I was given health information by trained peer educators and young people, and directed to the YFS program from the Community School	60	28	12	93	8	0	87	8	8	76	12	12	79	13	8
When we go to the health facility, there is a clean and comfortable environment	40	48	12	100	0	0	53	47	0	72	20	8	66	29	5
I saw different adolescent and youth health-related posters and messages in the YFS room	56	44	0	100	0	0	60	27	13	72	16	12	72	22	6

Note: The Adolescent and youth clients rated the facilities using green, yellow, and red cards. 3=Green represented agreement with the indicators, 2=Yellow indicated modest agreement, and 1=Red signified disagreement, and the results were compiled for feedback.

The rating findings indicate that AYFHS facilities are generally performing well in welcoming young people and maintaining privacy and confidentiality. However, comprehensive service provision from a single provider remains a key gap. Peer educator support and referral are encouraging, while improvements are still needed in the facility environment and availability of adolescent- and youth-friendly information materials. These findings highlight priority areas for strengthening the quality and accessibility of AYFHS.

Youth Councils compiled the feedback and shared the findings with AYFHS providers, facility leaders, and quality improvement teams. Together, they identified priority gaps and developed practical action plans, which were discussed during Town Hall meetings with adolescents and youth, community representatives, facility leaders, and other stakeholders. This created a transparent space for dialogue, shared accountability, and follow-up.

Providers also conducted a self-assessment using the national AYFHS standards. Comparing provider assessments with adolescent and youth feedback helped facilities identify service gaps, prioritize improvements, and track progress. The process followed the Federal Ministry of Health's CSC Implementation Guideline and Manual and captured experiences from youth, providers, and facility teams to support learning, quality improvement, and future scale-up.

Major Achievement

Integrating the Youth-Led CSC into AYFHS established a practical and participatory quality improvement mechanism that placed adolescents and youth at the center of rating and improving the services intended for them. Rather than serving only as beneficiaries, young people became active partners in monitoring service quality, identifying challenges, and proposing solutions alongside health care providers and facility managers.

The Youth-led CSC created opportunities for adolescents and youth, health care providers, facility leaders, and quality improvement teams to communicate and jointly address identified service gaps. The process was observed to strengthen dialogue and shared accountability and provided a structured mechanism for youth participation in service quality improvement.

The Youth-Led CSC also generated valuable evidence on the implementation of AYFHS standards. By rating the welcoming services, availability of comprehensive care, and protection of privacy and confidentiality, the process helped facilities recognize both good practices and areas requiring improvement. This evidence informed facility action plans and supported more adolescents and youth responsive and client-centred AYFHS service delivery.

Overall, the integration demonstrated that the Youth-led CSC is a feasible and promising approach for strengthening adolescent and youth engagement in AYFHS governance. By linking youth and stakeholder feedback with facility quality improvement processes, the approach supported dialogue, shared accountability, and identification of priority areas for service improvement. However, measurable changes in service quality, satisfaction, or service utilization were not formally assessed; therefore, the findings should be interpreted as implementation experiences.

Lessons Learned

Several factors facilitated implementation of the Youth-led CSC. Early orientation and sensitization of facility leaders, quality improvement teams, AYFHS providers, peer educators, and adolescents and youth created a shared understanding of the CSC process and secured commitment from key actors.

Meaningful adolescents and youth participation was also important; involving adolescents and youth in service rating, feedback sessions, and town hall meetings enabled them to directly communicate their experiences and priorities to providers and facility leaders. Linking the CSC with AYFHS standards and existing quality improvement processes helped translate youth feedback into specific service-improvement priorities and action plans. Empowering adolescents and youth to assess services and participate in identifying solutions transformed them from service beneficiaries into active partners in quality improvement. Their feedback provided valuable insights that complemented routine facility monitoring and informed targeted AYFHS service improvements.

Implementation also highlighted important challenges. Differences in provider responsiveness and service availability across facilities required facility-specific discussions and actions rather than a standardized response. The process therefore needed flexibility to adapt feedback and action plans to each facility's identified gaps. Regular dialogue between youth, providers, facility leadership, and quality improvement teams was necessary to maintain engagement and support follow-up.

The experience also showed that adolescents and youth participation alone is not sufficient. Successful implementation requires supportive facility leadership, committed providers and quality improvement teams, trained youth representatives, opportunities for open dialogue, and regular follow-up of agreed actions.

Implementation of the Youth-led CSC required relatively modest resources, mainly staff and youth orientation, preparation of the scoring tools, time for facility rating and feedback sessions, and facilitation of dialogue and town hall meetings. The process relied largely on existing facility staff, quality improvement teams, youth representatives, and routine facility structures, making it feasible within existing health-system arrangements. No formal cost data were collected during the implementation.

Based on the positive implementation experience and lessons generated through the pilot, the Ministry of Health incorporated the Youth-led CSC into the National Meaningful Adolescent and Youth Engagement Guide and the AYH Strategy 2026–2030, supporting its integration into routine AYFHS. Pathfinder subsequently expanded the approach to 10 additional AYFHS facilities across five regions through the Gates-funded Youth Friendly and Community Approaches to Reach Adolescents and Youth project. Guided by the new AYH Strategy and Meaningful Youth Engagement Guide, the approach will be integrated into routine facility quality-improvement processes, with facility leadership and quality-improvement teams coordinating implementation and following up on youth-identified priorities. Youth councils and peer educators will continue to support service rating, feedback, dialogue, and follow-up, while regular experience-sharing and use of existing facility resources will help sustain the approach.

Ethiopia's Private Sector Engagement Strategy for Health (2026–2030): From Fragmented Projects to a National System: A Framework for Engagement

Abdissa Kabeto[1], Mazengia Ayalew[1], Animut Ayalew[2], Melka Geleta[2], Sisai Tessema[2], Yibeltal Mekonnen[2], Muluken Argaw[2]

[1] Clinton Health Access Initiative, Addis Ababa, Ethiopia

[2] Ministry of Health, Ethiopia

***Corresponding author:** Abdissa Kabeto, Akabeto@clintonhealthaccess.org

Introduction

Ethiopia's health system is undergoing a policy-driven transition anchored in the FDRE Health Policy (2024), which reaffirms health as a constitutional right and calls for a self-reliant system less dependent on external financing (1). With a population of 135.5 million growing at 2.6% annually, demand continues to outpace what public financing and capacity alone can deliver (2,3,4), making universal health coverage (UHC) contingent on structured engagement of private providers, manufacturers, financiers and innovators who already deliver a substantial share of health services.

Ethiopia has engaged private actors for over two decades through public–private mix (PPM) programs in TB, HIV and family planning, non-clinical support service outsourcing (about 45% of public hospitals by 2017), and the USAID-funded Private Health Sector Project (2004–2020) (5,6,7,8). More recently, government has pursued formal PPPs for clinical services, including the Integrated Diagnostic Center at St. Peter's Comprehensive Specialized Hospital and a cancer care center under feasibility study at St. Paul Hospital Millennium Medical College. These experiences proved the private sector's potential but also exposed a persistent pattern: project-based, donor-dependent engagement, poorly captured in national data and never governed by one coherent framework (5,8,9,10), producing fragmentation rather than system-level impact.

Building on the Health Sector Development and Investment Plan II (HSDIP II), the Ministry of Health finalized Ethiopia's first National PSE Strategy (2026–2030), endorsed under MoH's standard protocol following a Ministerial-directed revalidation (11), translating two years of consultation into a single governance framework that positions PSE as a core health-system reform instrument supporting HSDIP II's pillars on financing, strategic purchasing, and private sector engagement toward UHC (12).

Objective

General objective: Establish a coherent, coordinated national framework that aligns private sector contributions with Ethiopia's health system goals, institutionalizing continuous engagement between government and private actors.

Specific objectives:

- Provide a unifying framework for private sector engagement across the health system.
- Strengthen governance, stewardship and regulatory functions for a mixed health system.
- Institutionalize platforms for sustained public–private dialogue and joint problem-solving.
- Identify priority areas and strategic initiatives aligned with national health priorities.
- Integrate private providers into service delivery, financing, supply chains and information systems.
- Build sustainable engagement mechanisms, including strategic purchasing and performance monitoring.

Method

Target population and geography: The Strategy applies nationwide to all private actors in health financing, production, supply and service delivery, formal and informal.

Modality: Rather than a pilot, this is a national policy framework cascading into four strategic objectives and sixteen initiatives across six priority areas, from tertiary services and supply chains to primary care and strategic purchasing, sequenced through operational plans developed by MoH and RHBs.

Goal and strategic objectives: Guided by a vision of a resilient, equitable, innovative and inclusive health system, the Strategy strengthens structured, transparent and accountable public-private partnerships through four objectives: quality service delivery within the private health sector; equitable health service coverage and system resilience; public-private partnership capacity, governance and dialogue mechanisms; and private sector participation in health planning, financing and investment.

Implementation: A Ministry-led governance framework, supported by a dedicated Private Sector Engagement Secretariat, Steering Committee, technical working groups, and a Public-Private Dialogue Forum, will provide oversight and accountability, while monitoring and evaluation systems track progress through defined indicators. Through these mechanisms, the Strategy aims to mobilize private sector expertise, innovation and investment to improve access, quality, sustainability and resilience of health services, supporting Ethiopia's health sovereignty and domestic resource mobilization goals.

Sustainability and political commitment: Commissioned by Ministerial directive, the Strategy frames PSE as an instrument of health sovereignty amid declining donor assistance, emphasizing domestic resource mobilization, local production and strategic purchasing over donor-dependent financing (13).

Stakeholder and community involvement: The Strategy was developed through an inclusive, multi-stakeholder process involving private healthcare providers, professional associations, industry bodies, development partners and government institutions — including the Ethiopian Healthcare Federation (EHF) and the Ethiopian Pharmaceutical and Medical Supply Importers and Manufacturers Association (EPMIMSA) — through technical working groups, national consultation workshops, and the 2026 revalidation process. These stakeholders, together with civil society and communities, are expected to contribute to implementation, monitoring and evaluation, keeping the Strategy responsive and accountable to Ethiopia's mixed health system.

Results/Outputs

As a newly finalized strategy, the PSE Strategy is at the rollout rather than outcome-evaluation stage. Outputs to date are institutional: the Strategy document (endorsed under MoH's Standard Protocol for Policy Document Development, 2025); an established governance architecture; and an illustrative M&E framework built on HSDIP II and the national HIS, tracking six domains from governance and data integration to financing and innovation/digital health.

The Strategy builds on existing PSE experience — PPM programs in TB, HIV, family planning and RMNCAH (14), MSI Ethiopia's social franchising model, the EPSS reagent-rental model, and diagnostic PPPs such as the Integrated Diagnostic Service Center — though incomplete, uneven private-facility reporting into HMIS platforms reinforces the priority on data governance and interoperability (15).

Cascading strategic initiatives into costed operational plans, and establishing indicator baselines, is the immediate next step as governance structures become operational at federal and subnational levels.

Conclusion and the Way Forward

Ethiopia's PSE Strategy 2026–2030 marks a shift from two decades of fragmented, donor-driven engagement to a coordinated, policy-owned framework embedded within HSDIP II. Its success depends less on the document than on whether its governance architecture is resourced, used and sustained.

Health managers and regulators should promptly operationalize the Dialogue Forum, Steering Committee and Technical Working Groups, and prioritize integrating private-facility data into the national HIS. Private providers and professional associations should engage constructively through these platforms and strengthen compliance with reporting and quality standards.

Development partners should align support behind the Strategy's priorities rather than parallel project streams, supporting the transition toward domestic resource mobilization. Communities and civil society have a role in the participatory monitoring and evaluation process the Strategy foresees.

Sustained political commitment, disciplined execution, and shared accountability across public and private actors will determine whether this Strategy translates into a stronger, more resilient and more equitable mixed health system for Ethiopia.

References

1. Federal Democratic Republic of Ethiopia Ministry of Health. National Health Policy (revised). Addis Ababa: MoH; 2024.

2. United Nations Population Fund. Ethiopia population 2025. New York: UNFPA; 2025.

3. Ethiopian Statistical Service, ICF. Ethiopia Demographic and Health Survey 2024–25: Key Indicators Report. Addis Ababa; Rockville: ESS and ICF; 2025.

4. Debie A, Khatri RB, Assefa Y. Contributions and challenges of healthcare financing towards universal health coverage in Ethiopia: a narrative evidence synthesis. BMC Health Serv Res. 2022;22:866.

5. Federal Democratic Republic of Ethiopia Ministry of Health. Private Health Sector Assessment in Ethiopia. Addis Ababa: MoH; 2019.

6. Health Finance and Governance Project. Outsourcing Non-Clinical Services in Public Hospitals: Achievements and Lessons from Ethiopia. Rockville: Abt Associates; 2018.

7. United States Agency for International Development. Private Health Sector Project (PHSP) Final Report (2004–2020). Addis Ababa: USAID; 2020.

8. United States Agency for International Development, Ali D, HANZ Consulting. Private sector integration and engagement assessments for Ethiopia, 2020–2023 [consolidated citation; individual report titles not separately available].

9. World Health Organization. Global Strategy on Engaging the Private Sector for UHC and Health Systems Strengthening. Geneva: WHO; 2020.

10. Amri M, Sam O, Anye M, Zibwowa Z, Karamagi H, Nabyonga-Orem J. Assessing the governance environment for private sector engagement in health in Africa: results from a multi-country survey. J Glob Health. 2023;13:04113.

11. Federal Democratic Republic of Ethiopia Ministry of Health. Health Sector Medium Term Development and Investment Plan II (HSDIP-II), draft. Addis Ababa: MoH; 2026.

12. Ministry of Health Ethiopia, Ethiopian Health Insurance Service. Strategic Health Purchasing in Ethiopia: An Assessment and Strategic Actions to Improve Purchasing. Addis Ababa: MoH/EHIS; 2022.

13. Koricho M, Zerayacob T, Abebe F, Argaw M, Mengistu D, Birhane F, Negash S, Haileselassie A, Gatome-Munyua A. An assessment of provider payment mechanisms (PPMs) in Ethiopia: implications for redesign of PPMs and progress toward universal health coverage. Health Syst Reform. 2024;10(1):2377620.

14. Mandal M, Ali D, Woldegiorgis AG, Tilaye M, Yilma Y, Berhane HY, Tewahido D, Abelti G, Neill R, Silla N, Gilliss L. Integrating private health facilities in government-led health systems: a case study of the public–private mix approach in Ethiopia. BMC Health Serv Res. 2022;22:1477.

15. Clarke D, Feyissa YM, Gurmu KK, Nambiar B, Thabet A, Appleford G. Using Data for the Effective Governance of the Private Health Sector in Ethiopia [unpublished WHO case study]. Geneva/Addis Ababa: WHO; 2025.

Introducing Ethiopia's Amniotic Membrane Graft Service for Ocular Surface Reconstruction

Habtamu Guyaho[1]*, Liya Tigabo[2], Abiy Ambaye[1,3]

[1]Ethiopian Blood and Tissue Bank Service, Tissue Banking Department, Addis Ababa, Ethiopia

[2]Ethiopian Blood and Tissue Bank Service, Quality Assurance Department, Addis Ababa, Ethiopia

[3]World Health Organization, Health Systems Strengthening, Addis Ababa, Ethiopia

***Corresponding author:** Habtamu Taye Guyaho: hab.taye@yahoo.com, +251913361822

Introduction

The amniotic membrane, the innermost fetal membrane, has anti-inflammatory, antimicrobial, antiangiogenic, and low-immunogenicity properties that support its use in ocular surface reconstruction [1–3]. Clinical evidence indicates that amniotic membrane transplantation (AMT) can promote epithelial healing in selected cases of persistent corneal epithelial defects, corneal ulcers, and acute chemical or thermal burns. However, randomized evidence is mixed: although AMT may accelerate epithelial healing in moderate burns, it has not consistently improved final visual acuity, corneal clarity, vascularization, or symblepharon formation compared with standard medical therapy in severe injuries [4–6]. Thus, its use should be guided by specific clinical indications rather than assumed effectiveness across all ocular surface conditions.

The Eye Bank of Ethiopia was formally inaugurated on 28 June 2003 through a tripartite agreement between the Ministry of Health, Addis Ababa Health Bureau, and ORBIS International. Over two decades, it facilitated corneal tissue distribution supporting transplantation for more than 3,500 recipients, although this figure reflects graft distribution rather than independently verified visual outcomes. The frequently cited estimate of 300,000 Ethiopians blind from corneal scarring derives from a 2006 study and represents historical population-level need rather than current waiting-list data. On 8 February 2023, Council of Ministers Regulation No. 528/2023 established the Ethiopian Blood and Tissue Bank Service (EBTBS) through the merger of the Eye Bank and National Blood Bank Service and designated EBTBS as the authorized provider of tissue banking services in Ethiopia [8–10].

Before this service was established, amniotic membrane grafts were not routinely available in Ethiopia's public health system as domestically processed products, to the authors' knowledge. The service has expanded local access to AMT and represents a milestone in tissue banking and ophthalmic care. It also supports national health-system objectives for quality, equitable care, and capacity strengthening. Lessons from the corneal program—including donor screening, cold-chain processing, and international technical collaboration—helped inform the design of the AMG service, launched to address a longstanding gap in ocular surface reconstruction.

Objective

General objective: To establish and scale up an Amniotic Membrane Graft (AMG) service within EBTBS to expand access to ocular surface reconstruction in Ethiopia.

Specific objectives:

- Build staff capacity in AMG procurement, processing, and quality assurance.
- Establish donor screening, processing, and preservation protocols consistent with international standards, including WHO Guiding Principles on Human Cell, Tissue and Organ Transplantation
- Expand equitable access to AMG-based treatment for patients with corneal and conjunctival disease nationally.

Method

Target population and setting: Patients with persistent corneal epithelial defects, corneal ulcers or perforations, chemical or thermal burns, and those undergoing pterygium or conjunctival reconstruction, referred from health facilities across Ethiopia.

Service modality: The AMG service was piloted at the EBTBS Addis Ababa facility as an extension of the existing corneal tissue bank. In July 2024, nine personnel (7 eye bank technicians and 2 quality officers) received training in procurement, processing, quality control, clinical application, storage, and distribution. Graft distribution began in August 2024, with planned national scale-up through regional branches. The service currently partners with three maternity facilities for placenta procurement and 14 ophthalmic facilities across four regions for graft distribution.

Partnership and collaboration: ORBIS International supported the original Eye Bank of Ethiopia, while SightLife and the Himalayan Cataract Project, through the Cure Blindness Project, strengthened technical capacity, quality systems, and staff training, including the July 2024 AMG training.

Donor procurement and community involvement: Amniotic membranes are procured following cesarean delivery after screening for HIV, hepatitis B, hepatitis C, and syphilis and obtaining written informed consent. Trained obstetric staff obtain consent antenatally or on admission for delivery, emphasizing voluntary donation without impact on maternity care. Donor information is protected through coded identifiers and separate storage of consent and serology records, consistent with WHO ethical frameworks; consent covers both tissue procurement and infectious-disease screening.

Regulatory and institutional commitment: The service operates under Council of Ministers Regulation No. 528/2023, which establishes EBTBS as the authorized tissue banking service provider in Ethiopia and assigns its tissue-service responsibilities [8–10]. The Ministry of Health has assigned EBTBS responsibility for coordinating tissue donors and supporting tissue transplantation services.

Quality standards and SOPs: EBTBS uses a comprehensive AMG processing manual based on established international protocols. Placentae are obtained from cesarean deliveries, excluding those with positive HIV, HBsAg, HCV, or syphilis results, maternal fever or infection, or gestational age <37 weeks. Amniotic membrane is separated from chorion under a Class II biosafety laminar-flow hood, mounted on 7.5 × 7.5 cm nitrocellulose paper, and preserved in DMEM containing amphotericin B (2.5 µg/mL), penicillin (50 µg/mL), streptomycin (50 µg/mL), and glycerol. All batches undergo thioglycollate broth sterility testing, with no growth at 48 hours at 37°C as the acceptance criterion. Grafts are stored at −70°C with continuous temperature monitoring and a one-year expiry period. Release requires a written request and verification of sterility and serology records. Donor-to-recipient traceability is maintained using unique identifiers in the EBTBS database, with adverse-event reporting and recall procedures following WHO Principle 10. Automated temperature monitoring and electronic donor-recipient linkage are planned enhancements.

Results / Outputs

Following the July 2024 training, the AMG service became operational in August 2024, making EBTBS a two-service tissue bank offering both corneal grafts and amniotic membrane grafts. Between August 2024 and August 2026, 217 amniotic membrane graft units were distributed to 14 health facilities across Addis Ababa, Oromia, Amhara, and Sidama Region for use in the management of persistent corneal epithelial defects, corneal ulcers and perforations, chemical and thermal burns, and pterygium or conjunctival reconstruction. No adverse events have been reported to date, though systematic recipient follow-up remains limited, and absence of surveillance does not confirm absence of complications.

EBTBS has achieved Quality Partner Certification (certification number QP_2024_004) from the Cure Blindness Project following assessment in August 2024, valid through 30 September 2027. This certification recognizes EBTBS's quality system in tissue banking, covering donor screening, processing, storage, and traceability for tissue services. The corneal program has distributed tissue supporting transplantation for over 3,500 individuals to date.

Conclusion and the Way Forward

The AMG service addresses a longstanding treatment gap in Ethiopian ophthalmic care and demonstrates the potential of integrated, partnership-driven tissue banking. Sustaining and scaling the service will require expanded regional branches, continued investment in cold-chain infrastructure, workforce development, and public awareness to strengthen donor supply.

The Ministry of Health, through EBTBS, will lead expansion, with regional health bureaus coordinating facility-level distribution [8–10]. Current financing covers Addis Ababa operations, while expansion to other regions will depend on partner support and national health-sector budget allocation. Key challenges include maintaining donor supply beyond major maternity facilities and preserving cold-chain integrity during transport to remote facilities. Community engagement has so far focused on consent at participating maternity facilities; broader awareness campaigns remain planned.

Distribution of 217 grafts demonstrates early operational capacity for domestic AMG production and distribution, while national demand, utilization, safety, outcomes, and equity remain to be systematically assessed. EBTBS, with the Ministry of Health and partners, plans a national AMG demand assessment in 2027 to guide expansion and resource allocation.

References

1. Meller D, Tseng SC. Amniotic membrane transplantation for ocular surface reconstruction. Curr Opin Ophthalmol. 1999;10(4):274–81. doi:10.1097/00055735-199908000-00006.
2. Titiyal GS, Sharma N, Sen S, Vajpayee RB. Risk factors for graft failure after amniotic membrane transplantation in ocular surface disorders. Indian J Ophthalmol. 2006;54(4):247–51. doi:10.4103/0301-4738.29479.
3. Sangwan VS, Vemuganti GK, Gupta S, Ifthekar G, Murthy SI. Amniotic membrane transplantation in ocular surface disorders. Ophthalmology. 2007;114(5):843–50. doi:10.1016/j.ophtha.2006.08.045.
4. Tandon R, Venkatesh N, Tewari HK, Khosla PK, Vajpayee RB. Amniotic membrane transplantation as an adjunct to medical therapy in acute ocular burns. Br J Ophthalmol. 2011;95(2):199–204. doi:10.1136/bjo.2009.173716.
5. Meller D, Pires RT, Tsai RJ, Figueiredo F, Heiligenhaus A, Kruse FE, et al. Amniotic membrane transplantation for acute chemical and thermal injuries. Cornea. 2002;21(2):123–8. doi:10.1097/00003226-200203000-00005.
6. Clare G, Suleman H, Bunce C, Tullo A, Shortt A. Amniotic membrane transplantation for acute ocular burns. Cochrane Database Syst Rev. 2021;9(9):CD009379. doi:10.1002/14651858.CD009379.pub3.
7. Cure Blindness Project. Eye Bank of Ethiopia celebrates 15 years of service [Internet]. 2018 Jun 27 [cited 2026 Sep 22]. Available from: https://cureblindness.org/news/eye-bank-of-ethiopia-celebrates-15-years-of-service
8. Council of Ministers. Ethiopian Blood and Tissue Bank Service Establishment Council of Ministers Regulation No. 528/2023. Federal Negarit Gazetta. 2023 Feb 8.
9. Ethiopian Blood and Tissue Bank Service. EBTBS Development and Investment Plan [Internet]. 2023 [cited 2026 Sep 22]. Available from: http://repository.iphce.org/handle/123456789/5408
10. Ministry of Justice, Ethiopia. Health & Humanitarian Affairs: Council of Ministers Regulation No. 528/2023 [Internet]. 2024 [cited 2026 Sep 22]. Available from: https://justice.gov.et/en/sector/health-humanitarian-affairs/

SPECIAL BULLETIN

28ኛው የጤና ዘርፍ ዓመታዊ የግምገማ ጉባዔ

The 28th Annual Review Meeting of the Health Sector