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MINISTRY OF HEALTH - ETHIOPIA

SPECIAL BULLETIN

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The 27th Annual Review Meeting of the Health Sector

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Driving Health Gains Through Sustainable Investments and Innovations

October, 2025

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Editorial Board members and Reviewers

Reviewers

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Foreword

It is with immense pleasure that I extend a warm welcome to all participants of the 27th Annual Review Meeting (ARM), the premier event in the Ethiopian health sector's calendar. This gathering represents a pivotal moment for reflection, collaboration, and renewed commitment to our nation's health.

In conjunction with this landmark event, I am delighted to present the 14th edition of our Special Bulletin. For over a decade, this publication has stood as a cornerstone of our efforts to strengthen Ethiopia's health information ecosystem. It was established with a clear and critical mission: to enhance the generation, availability, and accessibility of high-quality evidence from a wide array of sources.

This year's bulletin continues its vital role as a dynamic repository of knowledge. Within these pages, you will find a curated collection of salient best practices, promising new initiatives, and cutting-edge research. The evidence presented is meticulously organized into three key categories, designed to provide actionable insights for a diverse audience—from researchers and policymakers to frontline healthcare workers and program implementers. It is our firm belief that the findings showcased here are directly aligned with the core goals, objectives, and priority areas of Ethiopia's health sector transformation.

As we steadfastly advance on our path toward Universal Health Coverage (UHC), the need for reliable data and shared learning has never been greater. This bulletin is more than a mere publication; it is an invaluable instrument for tracking progress, diagnosing challenges, illuminating gaps, and fostering a culture of evidence-based decision-making and continuous improvement. It serves to document our collective journey, celebrating innovations that work and critically examining areas requiring renewed focus.

Over time, with an active engagement of experienced public health professionals and experts from academia as editorial board members and reviewers, I want to wholeheartedly express my conviction that the quality of the special bulleting is ever improving.

I extend my deepest gratitude to the editors, reviewers, and the dedicated staff of the Strategic Affairs Executive Office, whose expertise and meticulous efforts ensure the integrity and relevance of this work. My sincere appreciation also goes to the researchers, health leaders, and professionals across MOH executive offices, regional health bureaus, and agencies. Your contributions are the lifeblood of this publication.

Finally, I invite every reader to engage deeply with the insights contained in this edition. Let us use this knowledge to inform our strategies, refine our interventions, and reinforce our shared resolve to build a more resilient, equitable, and high-quality health system for all Ethiopians.

Dr. Muluken Argaw

Executive Officer, Strategic Affairs Executive Office

Federal Ministry of Health

Editorial

Driving Health Gains Through Sustainable Investments and Innovations

In an era defined by rapid technological advancement, environmental pressures, unprecedented emergencies, and widening health inequities, the path to better health outcomes requires more than short-term solutions. **Driving health gains through sustainable investments and innovations** is not just a strategic imperative — it is a moral one. By aligning financial flows with long-term health priorities and embracing transformative innovations, we can build resilient health systems that deliver equitable, cost-effective, and climate-conscious care. This integrated approach ensures that health systems are not only reactive to crises but also proactively equipped to improve population health, reduce disparities, and deliver value over time. The convergence of sustainable financing and innovation offers an unprecedented opportunity to close the health gap and create healthier, more equitable societies—today and for future generations.

One of the cornerstones for achieving Universal Health Coverage (UHC) and the health-related Sustainable Development Goals (SDGs) is ensuring affordable access to quality essential medicines, health products, and services. Globally, the current drive to achieve UHC has been characterized by the proliferation of innovative interventions aimed at enhancing life expectancy, quality of life, by availing effective and efficient diagnostic and treatment options.

Nowadays, health gain, advancements achieved in the healthcare sector, is a way to express improved health outcomes of populations using different health services. This can also be used to reflect the resilience of the health systems and quality of health services, and to reflect the advantages of one form of health intervention over another in producing the greatest health gain for the given populations. Though the health gains vary from population to population, from place to place, from time to time, and from one health care service to another. The health gains can be denoted by proxy indicators such as increasing life expectancy, reduction of disease incidence, prevalence, mortality, and morbidity rates, patient satisfaction, shortened recovery times, and quality-adjusted life years (QALYs), which provide a useful framework for comparing the effectiveness of interventions, particularly in mitigating the growing economic pressure due to complex interplaying factors. The relationship between health and the economy is a dynamic, two-way street—each profoundly influences the other in ways that are often subtle, complex, and deeply interwoven. These require meticulous, sustainable investment and innovations to overcome their unwanted influences on the health gains of the population.

Ethiopia has provided robust and intensive attention for health investment and innovation, whether from governments, the private sector, or global health funds, which direct and improve access, strengthen primary care, and support preventive health measures spending of government expenditure in health and infrastructure. The national health account of Ethiopia indicates that the majority (70%) of the health investment is expended to prevent and control communicable and non-communicable health burdens. Furthermore, health investment and innovations encapsulate the core philosophy of the Ethiopian health sector's strategic direction. It emphasizes that lasting health improvements are not merely a result of increased spending but are fundamentally tied to smart, sustainable investments and the courage to embrace innovation. In cognizant of this, MOH has revised its health financing strategies to maximize innovations in financing and expand the financial sources and sustainability, including through public-private partnerships (PPPs), the shift from passive to strategic purchasing, exempted health Services, and Performance financing.

Similarly, innovations have been leveraged not only through new technologies but also through novel delivery models, data-driven decision-making, and community-led solutions that prioritize local context and long-term impact. The MOH of Ethiopia has prioritized the required health innovation by strengthening structures, strategies, and ecosystems to maximize the positive impacts of the innovations in access, healthcare delivery, and quality. Furthermore, MOH has taken breakthrough initiatives using evidence-based and priority-setting to enhance the health care services through innovations. As part of the initiative, the national health innovation framework has been prepared, and the national innovation laboratory has already been set up. Numerous innovations and technologies, including Telemedicine to bridge the health service gap, Mobile Health Applications, Electronic Health Records, and Advanced Diagnostic Tools have been adopted and utilized to advance the healthcare system of the country.

Section One: Research Articles

Ethiopia's progress towards Sustainable Development Goal 3: Is Ethiopia on track towards the targets?

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Abstract

Introduction: Ethiopia aligns the Sustainable Development Goals (SDGs) with its strategic plans. With only five years remaining until the 2030 SDG deadline, a comprehensive assessment of Ethiopia's current performance, emerging gaps, and policy priorities is critical to inform national efforts toward sustainable development goals.

Objectives: The study aims to assess past trends, project their trajectory toward 2030, identify the main enablers and barriers to achieving SDG3; and predict the likelihood of achieving the 2030 SDG 3 targets

Methods: A mixed methods design integrating quantitative, qualitative and scoping reviews was employed. Quantitative methods were used to evaluate trends of SDG3 indicators, and project the future trajectory. A log-linear and linear regression models were used to estimate progress over the past two decades and project trajectories toward 2030 targets. For the qualitative method, key informant interviews with 156 stakeholders were done and thematic analysis was done using NVivo software.

Results and discussion: The trend analysis showed that between 2000 and 2023, maternal mortality ratio (MMR) has decreased from 950 to 195 per 100,000 live births with a 6.7% annual rate of decline, neonatal mortality rate (NNMR) was reduced from 48 to 27 per 1,000 live births with a 2.6 annual rate of decline and under five mortality rate (U5MR) was reduced from 140 to 46 with a 5.0% annual rate of decline. Projection with the current rate of decline showed that Ethiopia can achieve SDG targets of MMR and U5MR in 2034, while NNMR SDG target will take more than 20 years after 2030. The review results also informed health systems challenges – leadership and accountability, health workforce density and motivation, community engagement and emergencies– affecting the progress

Conclusion and recommendation: Ethiopia has achieved remarkable progress over the past two decades; however, the country is not on track to meet most SDG3 targets by 2030 with the current annual rate of change. The study emphasizes that Ethiopia needs an urgent renewed commitment and acceleration of the progress over the next five years, focusing on high impact and cost-effective interventions, contextualized to fit into specific geographies and population.

Keywords: Sustainable Development Goal 3, Progress, Ethiopia

Introduction

Ethiopia adopted the Sustainable Development Goals (SDGs) in 2015, which led to the preparation of a ten-year development plan (2020–2030) and consecutive Health Sector Transformation Plans (HSTPs) to align national strategies with global agenda. The first plan, HSTP-I (2015/16–2019/20), and the second HSTP-II (2020–2023), were developed in alignment with the global SDG agenda, and emphasized on improving quality and equity, strengthening emergency preparedness, and health system responsiveness. While notable progress was achieved, reviews of HSTP-I and HSTP-II revealed ongoing challenges in access, equity, and quality of care, highlighting the need for accelerated efforts to achieve the SDG 3 targets [1,2].

The health sector of Ethiopia updated its strategic direction by developing the Health Sector Development and Investment Plan (HSDIP, 2023/24–2025/26) that is aligned with national development priorities and global agendas. The HSDIP focuses on accelerating progress toward Universal Health Coverage (UHC), strengthening health system resilience, and promoting quality and equity [3]. However, the nation has faced major shocks – COVID-19 pandemic, economic inflation, armed conflicts, and drought - that challenged the health systems and its progress toward the 2030 SDG-3 agenda. According to the 2025 SDG report, only 21% of Ethiopia's SDG indicators were achieved or on track, with SDG 3 showing moderate progress but still facing challenges [4]. The country's progress towards the attainment of the SDG targets has not been comprehensively evaluated though there is some isolated evidence. With only five years remaining until the 2030 SDG deadline, a comprehensive assessment of Ethiopia's current performance, emerging gaps, and policy priorities is critical to inform national efforts toward UHC and sustainable health outcomes. The study's findings will inform the development of a five-year SDG 3 acceleration plan.

Objectives

This study aims to assess the performance of Ethiopia's health sector and outline a clear path toward achieving SDG 3 targets by identifying key challenges and priority areas for targeted action. Specifically, it seeks to: (1) Analyse past trends and project their trajectory toward 2030; (2) predict the likelihood of achieving the 2030 SDG 3 targets (2) identify the main enablers and barriers to achieving SDG 3

Methods

General approach: This assessment employed mixed methods design integrating quantitative, qualitative and scoping reviews. Quantitative methods were used to evaluate trends of SDG3 indicators, project the future trajectory and to model scaling up of high impact interventions. Qualitative methods and scoping reviews were used to complement quantitative findings and gain a nuanced understanding of the health system factors influencing Ethiopia's progress.

Quantitative method

Indicators: The quantitative evaluation used 28 prioritized SDG3 and other health-related SDG indicators. The indicators were selected based on criteria such as alignment with national strategies, data availability, and coverage across health system functions.

Data sources: The study used secondary data from various sources including national household and facility surveys such as the Ethiopian Demographic and Health Surveys (2000–2019), Performance Monitoring for Action (2013–2023), the 2023 National Health Equity Survey, Service Provision Assessment (SPA), routine health information systems (DHIS2), disease surveillance systems, global databases (such as WHO Global Health Observatory, World Bank database), modelled estimates (GBD, WUENIC…) and peer-reviewed literatures.

Data analysis: A combination of statistical and mathematical modelling techniques were applied to track progress, and project future trends. Trend analysis employed log-linear and linear regression models to estimate progress over the past two decades and project trajectories toward 2030 goals under three scenarios: long-term (2000–2022/3), recent (2010–2022/3), and a best-case scenario derived from the highest-performing sub-Saharan African countries. The time gap from achieving 2030 targets was calculated by identifying the earliest year each target would be met under these scenarios. Rate of change using a linear regression model was applied to the log-transformed variable (ln(y) ~ Year) for mortality and disease specific indicators. For coverage indicators, we used a linear (rather than log-linear) model to maintain simplicity in interpretation.

These models projected indicator trajectories to 2030 and beyond, calculating how far Ethiopia is from achieving SDG targets under each scenario.

Qualitative method: Key informant interviews were conducted with 156 stakeholders at national and regional levels, including representatives from government institutions, civil society organizations, academia, and development partners. Key informants were purposively selected based on their experience. Data was collected by trained professionals and thematic analysis was done using NVivo software. For the scoping review, 231 publications were screened, extracted and analyzed using PRISMA-ScR methodology.

Ethical consideration: The study adhered to national ethical standards; a verbal informed consent was obtained from key informants. A support letter from the Ministry of Health and permissions from regional authorities were secured. Participants were briefed on the study's purpose, scope, and voluntary nature. Confidentiality and anonymity were ensured.

Limitations of the study: There was limited data availability and inadequacy of data points that made the trend analyses and projections based on extrapolations between sparse data points. There was lack of subnational data for several indicators. Unavailability of data during COVID-19 pandemic. Data from war prone regions in Ethiopia such as Tigray, Amhara, Afar and Oromia may not be consistently collected (such as the PMA (2013–2023), the 2023 NHES, SPA, DHIS2, and disease surveillance systems.

Results and Discussion

Maternal, neonatal and Child Health (Targets 3.1 and 3.2)

Maternal mortality: Maternal mortality ratio (MMR) declined from 950 to 195 deaths per 100,000 live births between 2000 and 2023 [5], with an average annual rate of decline of 6.7%. With this rate of decline, Ethiopia will achieve the 140 target of MOH, while the 70 MMR SDG could be a bit far to reach by 2030. To achieve an MMR below 70 by 2030, Ethiopia would need to exceed its recent rate of reduction by up to 14.8% (Figure 1). Key drivers of progress include the Health Extension Program, expanded midwifery training, EmONC services, and improved access to antenatal and delivery care, though effective coverage of maternal health services is a critical area of improvement.

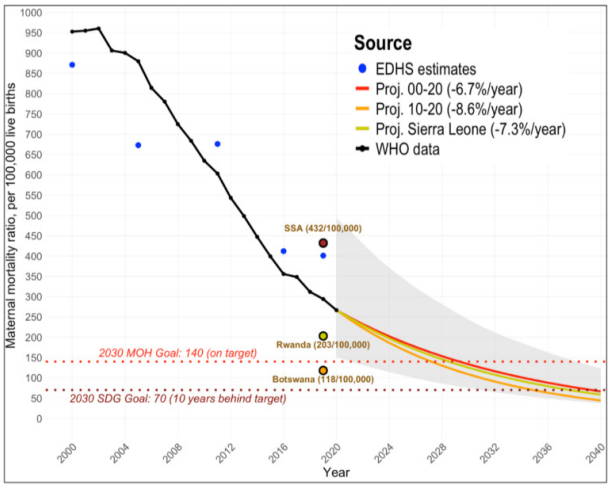
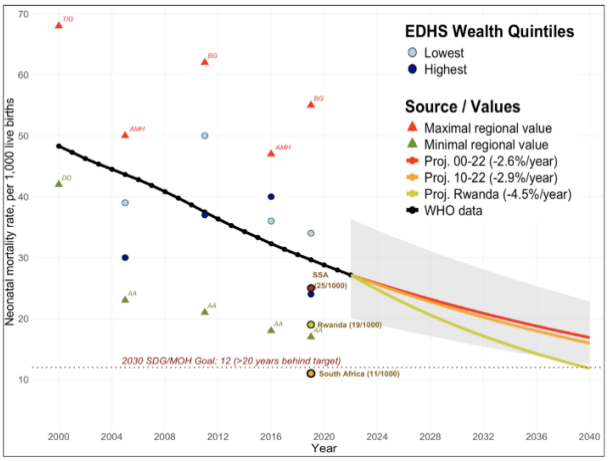


Figure 1. Trends and projections of maternal mortality ratio (per 100,000 live births) in Ethiopia from 2000 onward.



Neonatal mortality: Neonatal mortality rate (NNMR) was reduced from 48 to 27 deaths per 1,000 live births between 2000 and 2023 [6], with an average annual rate of reduction of 2.6%. With this trajectory (2000–2022), projections indicate that Ethiopia will not achieve the SDG target of reducing NNMR to 12 per 1,000 live births by 2030. There is a high disparity in NNMR between regions, and high across the regions including Addis Ababa that found out to be on track on many of the SDG-3 indicators.

Figure 2. Trends and projections of neonatal mortality rate (per 1,000 live births) in Ethiopia from 2000 to 2030.

Under-five mortality: Under-five mortality rate (U5MR) was significantly reduced from 140 to 46 deaths per 1,000 live births between 2000 and 2023 [6], with an average annual rate of reduction of 5.0%. With this rate, the country is on track to meet its national target of 37 by 2027 but will likely miss the global SDG target of 25 by 2030. There was a high regional disparity, developing regional states, including Somali (101), Benishangul-Gumuz (90) and Gambella (86) and continue to experience high U5MR levels, and the poorest households experience significantly higher mortality rates. Associated with, the malnutrition rate – both for wasting and stunting – is way behind the SDG target that requires consorted efforts to accelerate the performance.

Communicable Diseases (Target 3.3):

The analysis showed that HIV incidence has been reduced from 0.9 in 2000 to <0.1 per 1,000 uninfected people in 2023, with an annual rate of reduction of 11%. With this the pace, Ethiopia is on track to meet the SDG target of reducing new HIV infections to 0.03 per 1,000 by 2030. Tuberculosis (TB) incidence was reduced from 421 cases per 100,000 population in 2000 to 146 in 2023, with an average annual rate of reduction by 5.6%. However, recent trends show a reversal, with incidence rising from 119 in 2021 back to 146 in 2023. With the current or best-case decline rates, Ethiopia is unlikely to meet the SDG target of a 90% reduction from 2015 levels by 2030, with projections indicating this may only be achieved after 2050. The incidence of malaria declined from 329 cases per 1,000 population at risk in 2000 to 46 in 2021, with an average annual reduction by 8%. Despite this progress, malaria resurgence occurred in 2012–2014 and again after 2019. Ethiopia's malaria burden remains well below the Sub-Saharan Africa average, but still above countries like South Africa (1 case per 1,000). Even if current or best-case trends continue, Ethiopia is not on track to meet the SDG target of ending malaria by 2030, with projections extending the timeline beyond 2050.

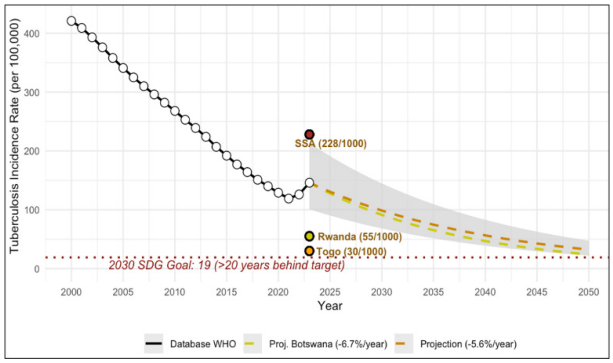


Figure 3. Trends and projections of tuberculosis incidence rate (per 100,000 population) in Ethiopia from 2000 to 2030.

Non-Communicable Diseases (Target 3.4)

Premature mortality from major communicable diseases (NCDs) declined from 25% in 2000 to 17% in 2021, with an average annual rate of reduction of 2.0%. Despite the declining trend,

no noticeable reduction was observed since 2013. Compared to SSA, Ethiopia had a lower probability of premature death from NCDs than the SSA regional average of 24% in 2021. At the current decline rate, this target may only be achieved by 2040. NCDs now account for over 40% of all deaths in Ethiopia.

Universal Health Coverage (Target 3.8)

The UHC-service coverage index increased from 13% in 2000 to 35% in 2021, with an average annual rate of increase of 1.2%. At this current rate of increment, Ethiopia is off-track to achieve the UHC targets by 2030. The projections show that the country will only achieve the national target of 79% coverage or the SDG target of 100% UHC service coverage after 2050, which requires more than two decades beyond the SDG calendar. Coverage varies by program areas, with infectious diseases at 53%, compared to 38% for RMNCH and 35% for NCDs. Service capacity and access remain low at 20%, highlighting significant gaps [7].

Summary of indicators: When will the SDG targets be achieved with the current rate of change?

The results indicated that, if current trends continue, HIV incidence and the contraceptive prevalence rate are on track to be achieved by 2030. For U5MR and MMR, the MOH targets—37 per 1,000 live births for U5MR and 140 per 100,000 live births for MMR—are expected to be reached before 2030. However, achieving the SDG targets will take longer, with projections showing they will likely be met by 2034 at the current pace. Seven indicators will be achieved between 2040 and 2050 and the remaining indicators require more than 2050 to be achieved if the current rate of change continues (Figure 4).

Indicator	Current Performance	SDG-3 Target MOH (SDG)	Data Source	Year of most recent data
HIV incidence (per 1,000 population)	0.1	0.03	UNAIDS	2023
Under 5 Mortality (per 1000 live births)	48	37 (25)	UN-IGME, ED..	2022
Contraceptive prevalence rate (%)	45.9	54	NHES, EDHS	2023
Maternal Mortality Rate (per 100,000 live births)	267	140 (70)	MMEIG, EDHS	2020
Penta3 coverage (%)	71	95	EDHS, CBMP..	2023
Mortality from NCDs (%)	17	11	WHO	2021
Skilled Birth Attendance Rate (%)	59	95(100)	NHES, EDHS	2023
Unmet need for contraception (%)	14.7	0	EDHS, PMA	2023
MCV1 coverage (%)	58.5	95	EDHS, WUE..	2019
Births by Caesarean Section (%)	5.4	12	EDHS	2019
ANC 4+ Coverage (%)	54	95(100)	NHES, EDHS	2023
Full Vaccination Coverage (%)	44	95 (100)	NHES, EDHS,..	2023
Adolescent Birth Rate (per 1000 women aged 15..	103	30	EDHS	2019
Malaria Incidence (per 1000 population)	46	0	WHO	2021
Neonatal Mortality (per 1000 live births)	28	12	UN-IGME, ED..	2022
Prevelance of Stunting (%)	39	13	EDHS, Nutrit..	2021
Prevelance of Wasting (%)	11	3 (5)	EDHS, Nutrit..	2021
TB Incidence (per 100,000 population)	146	19	WHO	2023
UHC Service Index (%)	35	79 (100)	WHO	2021
Core health workforce density (per 10,000 popul..	17.2	33 (44.5)	HMIS	2024
Mortality from road traffic (per 100,000 populat..	28.2	13	WHO	2019
Catastrophic health expenditure (%)	2.1	1.5 (0)	WHO	2021
General Government Health Expenditure (%)	5.7	12	WHO, NHA	2022
Anemia among reproductve age women	13	_	EDHS, Nutrit..	2021

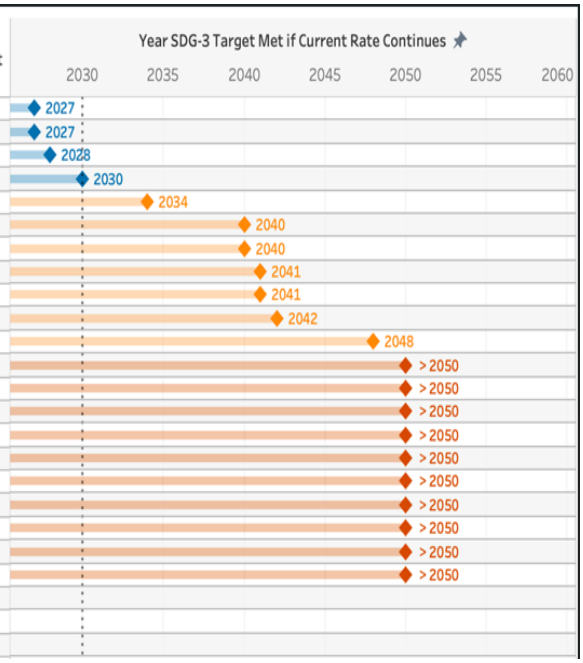


Figure 4: Progress of SDG3 indicators in Ethiopia: Timeline of achievement if current trend continues

Health System Inputs (Targets 3.b and 3.c)

Ethiopia's health systems governance demonstrated strong political and institutional commitment over the past two decades. Through decentralized governance structures, flagship initiatives like the HEP, and strategic plans such as HSDPs, HSTPs and HSDIP, the country has expanded access to essential health service. However, some programs such as NCDs, mental health, and adolescent health continue to be underprioritized. Community engagement has slowed, which could affect the service access and uptake at PHC that in turn affect the SDG performance.

Health workforce density of core health professionals (physicians, health officers, nurses, and midwives) increased from 1.5 to 17.2 per 10,000 population between 2000 and 2024. However, this is far below the global target of 45 per 10,000 and is with wide regional disparities. Despite increasing trend, there was a persistent mismatch between supply and demand due to poor workforce planning, inequitable distribution, weak governance, low motivation, high turnover and limited absorption capacity. Attrition is driven by low salaries, poor working conditions, and limited incentives.

Ensuring access to essential medicines was constrained by challenges in availability, affordability, local production, and equitable distribution. Local production of pharmaceuticals meets only 36% of demand, heavily dependent on imports, making the system vulnerable to global disruptions. Availability of essential medicines varies widely, with frequent shortages of drugs. Although reforms such as the Revolving Drug Fund, health financing initiatives, and partnerships with foreign pharmaceutical firms show promise, affordability remains a major barrier, and regulatory gaps undermine quality assurance.

Government health expenditure has been inconsistent, with 9% of total government spending in 2001 but dropping to 5.7% in 2022, which is lower than the 12% SDG target and the 15% Abuja Declaration goal. Total health expenditure (THE) increased by 156% from 2013/14 to 2019/20, yet per capita spending remained low at US$34, well below WHO's recommended US$86 for low-income countries. Government contributions cover only 32.3% of the Total Health Expenditure, while donor funding (33.9%) and out-of-pocket payments (30.6%) had a large share.

Conclusion and recommendations

The study comprehensively assessed Ethiopia's progress toward achieving SDG3 targets and shows that Ethiopia has achieved remarkable progress mainly in reducing maternal and child mortality and combating communicable diseases over the past two decades. However, the country is not on track to meet most SDG3 targets by 2030, with only four indicators on track if the current rate of change continues. There is a significant disparity in health system inputs, access, utilization and health outcomes among regions. The underperforming regions face the weakest governance and institutional capacity. The study emphasizes that Ethiopia needs an urgent response to accelerate progress over the next five years. The acceleration should focus on high impact and cost-effective interventions, contextualized to fit into specific geographies and population and address health system enablers—governance and financing, infrastructure, health workforce development and supply chain management – to create a sustainable foundation for progress.

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References

1. Ethiopian Public health Institute, ministry of Health and Countdown to 2030. 2022. Health sector transformation plan-I: end line Review study. Addis Ababa, Ethiopia, 2022
2. Ministry of health. Comprehensive report of Midterm review of Health sector transformation plan-II. Addis Ababa, Ethiopia, 2023.
3. Ministry of health. Helath Sector development and investment plan (2023/24-2025/26). Addis Ababa, Ethiopia, 2023.
4. Sachs, J.D, Lafortune, G., Lablonovski, G. (2025). Financing sustainable Development to 2030 and Mid-Century Sustainable Development Report 2025. Paris: SDSN, Dublin: Dublin University Press. DOI: https://doi.org/10.25546/111909
5. WHO: Trends in maternal mortality estimates 2000 to 2023: estimates by WHO, UNICEF, UNFPA, World Bank Group and UNDESA/Population Division. Geneva: World Health Organization; 2025. Licence: CC BY-NC-SA 3.0 IGO. 2025.
6. United Nations Inter-agency Group for Child Mortality Estimation (UN IGME), Levels & Trends in Child Mortality: Report 2024 – Estimates developed by the United Nations Inter-agency Group for Child Mortality Estimation, United Nations Children's Fund, New York, 2025
7. Eregata, G. T., Hailu, A., Memirie, S. T., & Norheim, O. F. (2019). Measuring progress towards universal health coverage: National and subnational analysis in Ethiopia. *BMJ Global Health*, *4*(6), e001843. https://doi.org/10.1136/bmjgh-2019-001843

Countdown to 2030 Insights: Enhancing Maternal and Child Health Estimates through Routine Health Information System

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Abstract

Background: Although interest in DHIS2 data in Ethiopia is increasing, approaches to generate reliable health coverage estimates are limited. This study aimed to estimate and evaluate the consistency of maternal and child health services coverage from 2019 to 2024 using both population-based and facility-based-denominators.

Methods: We used DHIS2 data from 2019-2024 to estimate coverage for ANC4+, institutional deliveries, and Penta3 immunization. The national and regional estimates derived from population (DHIS2 and UN) and facility-based-denominators compared with the survey data (NHES 2022). Agreement deemed adequate if estimates fell within the survey›s 95% confidence interval.

Results: The alternative approach with denominators derived from facility data gave results that were more plausible and consistent with survey results than based on population. The facility-based estimates of ANC4+ and institutional delivery increased overtime while Immunization coverage showed limited progress. The coverage of the indicators also showed increment in all regions although inconsistent results remained for some of the regions.

Conclusion: This systematic assessment shows that routine data can produce reliable health statistics at national and regional levels; however, improving data quality is essential for progress monitoring and informed maternal and child health policymaking, and further support information revolution goals to enable data-driven health governance of the Health Sector Transformation Plan.

1. Introduction

Routine health information systems (RHIS) like DHIS2 have become indispensable tools for monitoring health service delivery. It provides frequent, sub-national data that is critical for managing service quality, tracking progress towards health goals like Universal Health Coverage, and assessing equity gaps in ways that less frequent national household surveys cannot match (1, 2). However, a significant challenge persists in using this data: while RHIS easily provides the numerator (the number of individuals receiving a service), calculating a reliable denominator (the total population in need of that service) is notoriously difficult (2). While traditional methods rely on population projections, using facility data itself to derive denominators is an innovative but complex approach due to concerns over data quality and calculations (2, 3, 4).

Countdown to 2030 for Women's, Children's, and Adolescents' Health is a global partnership that monitors progress toward health-related sustainable development goals (SDG) by analyzing existing data on service coverage, equity gaps, and policies. The Ethiopia Countdown to 2030 collaboration study conducted by with Ethiopian Public Health Institute (EPHI) and the Ministry of Health in collaboration with African Population and health Research center (APHRC), University of Manitoba, and London School of Hygiene and Tropical Medicine (LSHTM). The main objectives of the collaboration are to strengthen the local capacity in data analysis by producing estimates on key Reproductive Maternal, Newoborn, Child, and Adolescent Health (RMNCAH) by integrating the DHIS2 with other multiple data sources (such as the demographics and health survey, UN population etc) to evaluate regional progress and disparities. The initiative also promotes innovative data analysis techniques to facilitate evidence-based decision-making by developing DHIS2 based denominator adjustment for RMNCAH estimates. Accurate denominators are crucial in DHIS2 to ensure reliable estimations of health service coverage by providing the correct reference population for health interventions. The main objective of this paper was to produce more accurate and reliable estimates of coverage, equity, and trends for key maternal and child health indicators at national and regional levels USING DHIS2 data from 2019 to 2024.

2. Methods:

2.1 Data Sources: The analysis combines data from multiple sources for a comprehensive assessment, including routine health system data, and national representative data such as National Health equity survey (2022 NHES) (5). For validation, global data such as population estimates from UNDESA, immunization coverage from WUENIC, and mortality estimates from WHO's MMEIG and UN IGME used in this analysis.

2.2 Analysis Tools and Process: The workflow managed using the Countdown to 2030 R Shiny Application, based on the cd2030.Rmnch R package. It guides analysts through data quality assessment (checking for completeness, consistency, and outliers), data cleaning, and processing. It then computes coverage statistics and trends at national and subnational levels, performs equity analyses with visualizations like equiplots, and generates outputs including datasets, graphs, tables, R data files, and reports for diverse audiences.

2.3 Data Quality Assessment: We first assessed the quality of the service data (the numerator) using WHO-recommended metrics 6) for reporting completeness (consistency over time, and internal consistency between related services (ANC1, DPT1, and DPT3). Extreme outliers were defined as any value falling outside five median absolute deviations (MAD) from the median of the multi-year period, identified, and corrected if no satisfactory explanation is found for the outlier value (7,8).

2.4 Adjustment for Incomplete Reporting: To correct for incomplete data, we adjusted the reported numbers using the formula: N(adjusted) = Nreported + Nreported * (1/(c) - 1) * k. In this formula: Nreported is the number of services reported in the DHIS2 system, c is the facility reporting completeness rate, k is an adjustment factor for the level of service at non-reporting facilities. Given that reporting completeness in Ethiopia was over 80%, experts recommended a k-value of 0.25. This assumes that non-reporting facilities provided services at 25% of the level of reporting facilities (8).

2.5 Denominator and Coverage Estimation: We evaluated four potential denominators: two population-based projections (DHIS2 and UN) and two service-based estimates derived from first antenatal care (ANC1) and first pentavalent vaccine (Penta1) visits. We calculated coverage estimates ANC4+, institutional delivery, Penta3 from 2019 to 2024. These estimates were then compared against recent survey data (2022 NHES) (5). This comparison showed that denominators derived from ANC1 and Penta1 data were the most suitable for estimating coverage (Figure 1).

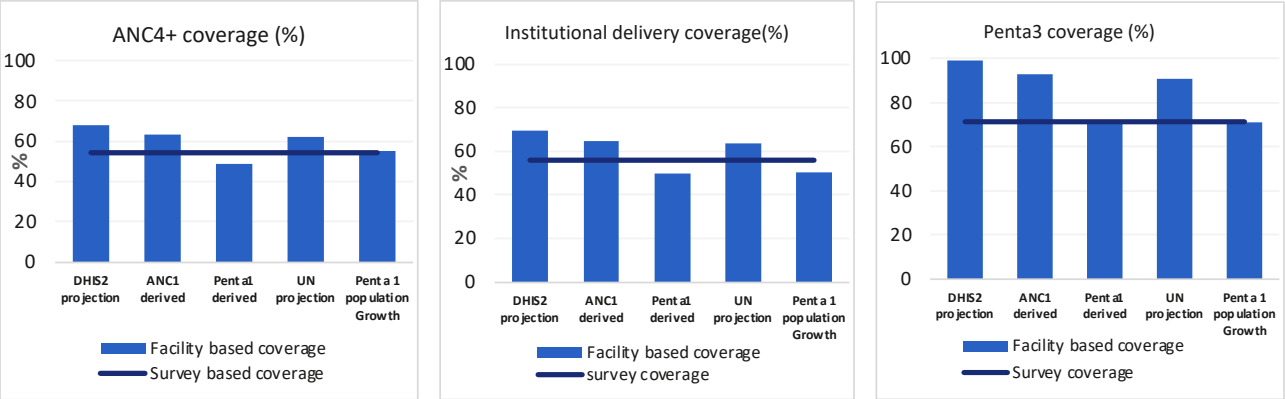

Figure 1: National coverage of ANC4+, Institutional delivery, and Penta3 vaccination using the with different denominators and survey coverage

3. Result and Discussion

National Coverage

As shown in Figure 2, the national survey indicated that ANC4+ increased from 18% in 2011 to 43% in 2018 and then to 54% in 2022. The health facility-based estimates (ANC1 as a denominator) also showed that ANC4+ coverage increased from 59% in 2019 to 68% in 2024. Coverage of institutional deliveries significantly increased from 10% in 2011 to 56% in 2022. The health facility-based estimates (ANC1 as a denominator) of institutional deliveries also showed a similar upward trend, rose from 57% in 2019 to 69% in 2024. Penta3 vaccination coverage shows conflicting trends. While survey data indicated a consistent increase from 2011 to 2022, health facility-based estimates (penta1-as a denominator) showed the coverage has stagnated at approximately 70% from 2019 to 2024. The analysis suggested that the ANC1- and Penta1-derived denominators are useful tool for tracking progress, while the existing data discrepancies highlight the need to improve data quality for accurate monitoring and policy decisions.

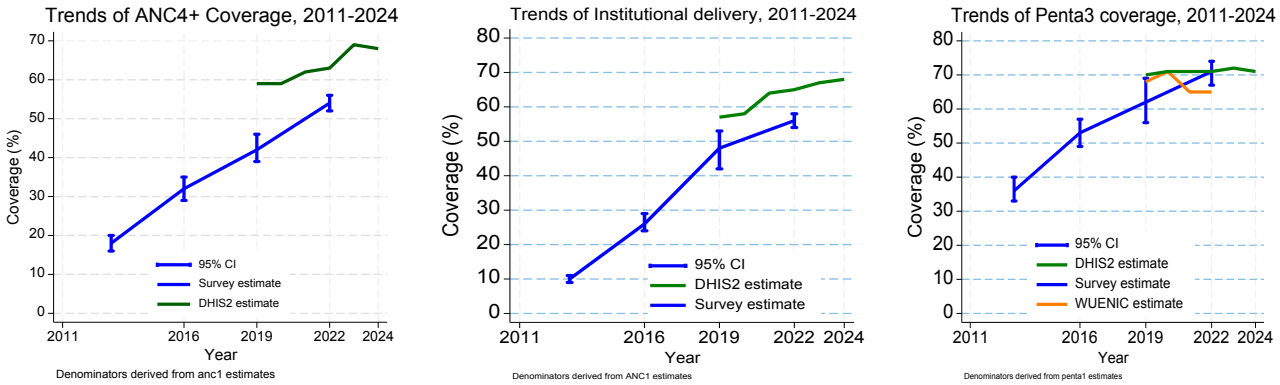

Figure 2: Trends of ANC4+, Institutional delivery, and Penta3 vaccination coverage 2011-2024.

Regional coverage and trends

Table 1 provides the trends of ANC4+, Institutional delivery, and Penta3 vaccination by regions. The facility-based estimates showed that ANC4+ coverage in all regions, the lowest noted in Gambella and the highest found in Addis Ababa. In 2022, five out of thirteen regions—Addis Ababa, Benishangul Gumuz, Gambela, Harari, and Oromia, were within the survey's 95% CI. These findings suggest that ANC1-denominator based estimates gives a reliable estimate for measuring ANC4+ coverage for regions, even though, remarkable discrepancies (absolute differences) between the survey and facility-based estimate was high in Sidama, Somali, and Afar region, 28, 26, and 22 percentage points, indicating possible over-reporting.

The triangulation of institutional deliveries data revealed that four out of thirteen regions (Afar, Amhara, South Ethiopia, and Southwest Ethiopia) fall on the 95% CI of the national equity survey estimates. The highest absolute difference observed in Harari, Sidama, and Oromia, 34, 26, 20 percentage points, respectively, indicating over reporting while Benishangul-gumuz and Addis Ababa showed 22 and 20 percentage points, respectively indicating that under reporting in the DHISs.

For Penta3 coverage, the penta1 based estimates showed that five regions (Gambella, Harari, Oromia, Sidama, and South Ethiopia) fell within the 95% confidence interval of the 2022 survey. In the context of improving coverage estimates for maternal and child health interventions in Ethiopia, it is vital to leverage both health facility data and population-based surveys like EDHS.

Table 1: Trends of ANC4+, Institutional delivery, Penta3 vaccination coverage by region.

	ANC4+ (%)		Institutional delivery (%)		Penta3 (%)		NHES 2022		
Region	2022	2024	2022	2024	2022	2024	ANC4+	Institutional delivery	Penta3
Addis Ababa	78	85	79	80	74	75	82[77,87]	99[97,101]	96[92,99]
Afar	42	53	30	31	64	67	20[9,31]	39[27,52]	21[13,28]
Amhara	62	70	54	65	71	71	51[44,57]	59[49,68]	83[78,88]
Benishangul Gumuz	48	51	61	58	69	67	50[39,60]	83[73,92]	86[79,94]
Central Ethiopia***	78	82	80	80	73	73	ND	ND	ND
Dire Dawa	48	50	65	53	67	64	61[50,71]	78[67,90]	85[79,91]
Gambella	31	42	53	49	67	68	42[31,53]	70[61,79]	75[65,85]
Harari	49	68	120	88	68	72	50[36,65]	86[78,94]	70[60,79]
Oromia	60	68	69	72	71	71	54[47,62]	49[39,58]	63[56,70]
Sidama	73	78	68	68	74	73	45[30,60]	42[33,52]	79[71,87]
Somali	57	57	61	49	67	67	31[20,42]	44[31,56]	46[35,57]
South Ethiopia*	69	71	68	70	71	72	58[51,65]	64[53,77]	71[64,79]
Southwest Ethiopia	60	68	55	54	70	72	42[32,54]	58[45,71]	42[34,50]
Tigray**	ND	43	ND	64	ND	73	58[51,63]	58[50,67]	52[46,59]
National	63	68	65	68	71	71	54[50,58]	56[51,61]	71[67,74]

*The value of the south Ethiopia in EDHS 2019 includes both Sidama, Central Ethiopia, and Southwest Ethiopia and in NHES2022 it includes Central Ethiopia; **No DHIS2 Based data for Tigray region since 2022; ***No survey data for Central Ethiopia in 2022

Previous studies indicate varying degrees of agreement between these two data sources (9–12). The analysis also revealed inequalities in reporting rates among regions, which require targeted interventions in conflict-affected areas. These observed discrepancies could be attributed by many factors; Women's limited access to health facilities, particularly in rural areas, prompting them to seek care from alternative sources or informal providers not captured in DHIS2 data. In addition, healthcare providers may underreport the number of services delivered due to inadequate record-keeping practices or a lack of resources, leading to lower reported coverage in DHIS2. Furthermore, data quality issues characterized by inconsistent reporting and a lack of comprehensiveness, especially when resources are dwindling and staff are inadequate (8–12).

4. Conclusion and recommendations

- The analysis demonstrated that facility-based denominators derived from ANC1 and Penta1 closely align with survey-based estimates for maternal and immunization indicators, respectively.
- Although coverage of Maternal and immunization indicators improved gradually, discrepancies between survey data and facility-based estimates point to possible under-reporting by health facilities.

Recommendations:

- Ministry of Health should adopt and encourage ANC1 and Penta1 denominators as the national standard for consistently estimating population coverage and monitoring the progress of maternal and immunization programs.

- Institutionalize Data Quality: Establish regular data quality audits and validation reviews to create robust feedback loops.
- Strengthen the support and follow-up for Underperforming Regions: Provide tailored support to and underperforming and conflict-affected regions to improve reporting completeness of RMNCH indicators.

5. References

1. AbouZahr C, Boerma T. Health information systems: the foundations of public health. Bulletin of the World Health Organization. 2005; 83(8):578–83.PMID: 16184276
2. Maina I, Wanjala P, Soti D, Kipruto H, Droti B, Boerma T. Using health-facility data to assess subnational coverage of maternal and child health indicators, Kenya. Bulletin of the World Health Organization. 2017; 95(10):683–94. https://doi.org/10.2471/BLT.17.194399 PMID: 29147041
3. Bhattacharya AA, Umar N, Audu A, Felix H, Allen E, Schellenberg JRM, et al. Quality of routine facility data for monitoring priority maternal and newborn indicators in DHIS2: A case study from Gombe State, Nigeria. PloS one. 2019;14(1):e0211265.
4. Maïga A, Jiwani SS, Mutua MK, Porth TA, Taylor CM, Asiki G, et al. Generating statistics from health facility data: the state of routine health information systems in eastern and southern Africa. BMJ Glob Health. 2019;4(5):1–9.
5. EPHI/MoH. National Health Equity Survey 2022/23. Addis Ababa; 2024.
6. WHO. Data quality review: a toolkit for facility data quality assessment. Module2. Desk review of data quality. Geneva: World Health Organization; 2017.
7. Health facility and community data toolkit. Geneva: World Health Organization; 2014. Available from: http://www.who.int/healthinfo/facility_information_systems/Facility_Community_Data_Toolkit_final.pdf?ua=1http://[cited 2025 February 12].
8. EPHI/MoH/APHRC. Enhancing Decision-making: APHRC leveraging routine health information systems in Ethiopia to generate actionable insights/ recommendations Report 2024, Addis Ababa, Ethiopia.
9. Wagenaar BH, Gimbel S, Hoek R, Pfeiffer J, Michel C, Manuel JL, et al. Effects of a health information system data quality intervention on concordance in Mozambique: time-series analyses from 2009-2012. Popul Health Metrics.2015;13(1):9. https://doi.org/10.1186/s12963-015-0043-3.
10. Braa J, Heywood A, Sahay S. Improving quality and use of data through data-use workshops: Zanzibar, United Republic of Tanzania. Bull World Health Organ. 2012;90(5):379–84. https://doi.org/10.2471/BLT.11.099580.
11. Bhattacharya AA, Allen E, Umar N, Usman AU, Felix H, Audu A, et al. Monitoring childbirth care in primary health facilities: a validity study in Gombe state, northeastern Nigeria. J Glob Health.2019;9(2):020411. https://doi.org/10.7189/jogh.09.020411.
12. Agiraembabazi, G., Ogwal, J., Tashobya, C. et al. Can routine health facility data be used to monitor subnational coverage of maternal, newborn and child health services in Uganda? BMC Health Serv Res 21 (Suppl 1), 512 (2021). https://doi.org/10.1186/s12913-021-06554-6

Assessment of Local Pharmaceutical Manufacturing Market Share in Ethiopia

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Abstract

Background: Ethiopia, with a population exceeding 130 million and a growing triple burden of disease, is experiencing rapidly increasing pharmaceutical demand. The government launched the National Strategy and Plan of Action for Pharmaceutical Manufacturing (2015–2025) to meet 60% of national essential medicines needs through local production. However, significant gaps remain due to low capacity utilization, operational inefficiencies, and fragmented data systems.

Objective: To assess the current market share of locally manufactured pharmaceuticals in Ethiopia.

Methods: A cross-sectional mixed-methods study was conducted in March 2025 across 13 large-scale pharmaceutical manufacturers. Data were collected through site visits, facility assessments, interviews with key stakeholders, and secondary sources from EPSS, EFDA, Customs, and production records. Quantitative data were analyzed using descriptive statistics; qualitative findings were analyzed thematically.

Results: Local production met only 14.4% of national medicine demand and contributed 36% to the public sector supply. A total of 178 formulations were produced locally, of which 53 (29.8%) fully met local demand, and 138 were aligned with the 2024 Essential Medicines List (EEML). In terms of therapeutic categories, local production covered 53.5% of Alimentary Tract and Metabolism drugs, 38.5% of Anti-infectives, and 15.2% of Cardiovascular medicines listed in the EEML. Critical gaps persist in anti-TB, vaccine, and reproductive health medicines. Top produced products included Sodium Chloride 0.9%, Acyclovir 200mg, and Amoxicillin 500mg. Common dosage forms included tablets, capsules, syrups, and IV infusions. Key challenges included limited foreign currency access, high input costs, low technical capacity, and regulatory hurdles.

Conclusion: Significant potential exists to substitute imports with local production. Strengthening local API production, building regulatory and technical capacity, and improving supply chain efficiency are key to reducing import dependence and enhancing medicine access.

Keywords: Local Pharmaceutical Manufacturing, Essential Medicines, Market Share, Ethiopia

Introduction

Ethiopia, with a population exceeding 130 million and rapid demographic growth, faces a triple burden of disease comprising communicable diseases, noncommunicable diseases, and public health emergencies.[1] The expansion of healthcare services and improved access have led to a substantial increase in pharmaceutical demand, which is projected to grow from USD 1.6 billion in 2022 to over USD 3.6 billion by 2030.[2] In response, the Ethiopian government has prioritized the development of local pharmaceutical manufacturing to meet the rising demand for medicines and reduce dependence on imports. The National Strategy and Plan of Action for Pharmaceutical Manufacturing Development (2015–2025) targets meeting 60% of the national demand for essential medicines by 2025.[2] Additionally, the Ethiopian Pharmaceuticals Suppliers & Manufacturers Sectoral Association (EPSMSA) outlined plans in 2024 to establish 20 new pharmaceutical manufacturers including a dedicated facility for Active Pharmaceutical Ingredients (APIs) to develop a sustainable domestic supply chain capable of meeting 70% of demand for medicines and medical devices.[3] Furthermore, the Ethiopia Investment Commission recognizes the country as a potential pharmaceutical production hub for the region and continent.[4] Thus, scaling up local production of quality medicines is crucial to advancing self-sufficiency and strengthening health system resilience.[2]

Despite these efforts, a significant gap remains between supply and demand, with most essential medicines still imported. Domestic pharmaceutical industries face multiple challenges, including unplanned operational downtimes, a substantial skills shortage, outdated industrial production technologies, and underutilization operating at only about 20% of their capacity.[5] Furthermore, there is no reliable, centralized database capturing local pharmaceutical production and market share. Reporting on production and distribution remains fragmented and inconsistent across key stakeholders, including the Armauer Hansen Research Institute (AHRI), Ethiopian Pharmaceutical Supply Service (EPSS), the Ethiopian Food and Drug Authority (EFDA), the Ministry of Health, customs authorities, and manufacturers.

Objective

To determine the market share of locally produced medicines in Ethiopia, identify the range of products and dosage forms manufactured, and explore key challenges within the local pharmaceutical manufacturing sector.

Methodology

Study Design and Period

A descriptive cross-sectional mixed-methods study was conducted from March 4 to March 21, 2025.

Sampling Approach

All large-scale pharmaceutical manufacturers operating in the country were included in the study to ensure comprehensive coverage. In addition, key stakeholders from AHRI, EFDA, and EPSS were purposively selected for interviews.

Data Collection and Management

Primary data were collected through site visits, facility assessments, and structured interviews with production managers and regulatory stakeholders. Secondary data were sourced from EPSS forecasted demand reports, manufacturer production records, and Customs import data. Quantitative data, including production volumes and market share metrics, were analyzed using descriptive statistics in Microsoft Excel. Qualitative data from interviews were thematically analyzed to identify systemic challenges and emerging opportunities in local pharmaceutical manufacturing.

Ethical Considerations

A support letter was secured from the Ministry of Health, and written permissions were obtained from all participating manufacturers prior to data collection. Confidentiality and anonymity of participants and facilities were strictly maintained throughout the study.

Results and Discussion

Industry Profile

The study assessed 13 large-scale pharmaceutical manufacturers in Ethiopia, nearly half of which have operated for over 15 years. Ethiopian Pharmaceuticals Manufacturing (EPHARM), established in 1964, is the oldest company. At the time of assessment, only six manufacturers complied with Good Manufacturing Practice (GMP) standards. Most firms were situated in or near Addis Ababa. Reported capital investments varied widely, ranging from ETB 49.5 million to ETB 1.13 billion. This finding aligns with Madebo (2020), showing that fewer than half of Ethiopian pharmaceutical firms comply with EFDA GMP standards. Additionally, the lack of local research and development for active pharmaceutical ingredients (APIs) and the absence of domestic production of pharmaceutical starting materials reveal persistent structural limitations that restrict industry growth and self-sufficiency. Manufacturers have also faced difficulties exporting due to their inability to meet the certification and regulatory requirements of the World Health Organization's GMP guidelines.[6]

Market Share and Public Sector Contribution

Local pharmaceutical production accounted for an estimated 14.4% of Ethiopia's total medicine demand. In the public sector, domestic manufacturers supplied 36% of medicines procured through EPSS. Among public procurement by country of origin, India led with 40.1%, followed by Ethiopia at 14.6%, and the United States at 6.6%. This finding is consistent with broader assessments by the United Nations Conference on Trade and Development which estimate that **local manufacturers account for no more than 20% of Ethiopia's pharmaceutical market,** with the vast majority of medicines imported.[7]

Table 1: Top 10 Countries Supplying Medicines to the Ethiopian Market, Ranked by Total Supply Value in Ethiopian Birr (ETB), 2016 EFY

No.	Country	Total Supply Value (Birr)	% Share
1	India	15,852,046,521	40.10%
2	Ethiopia (Local)	5,762,279,940	14.60%
3	United States	2,600,396,790	6.60%
4	China	2,141,313,943	5.40%
5	Belgium	1,933,074,055	4.90%
6	Puerto Rico	1,788,162,101	4.50%
7	Italy	1,550,505,148	3.90%
8	Netherlands	1,217,317,634	3.10%
9	United Kingdom	882,290,380	2.20%
10	South Korea[1]	856,634,651	2.20%
	Others	4,946,754,360	12.50%
	Total	39,530,775,523	100.00%

Product Portfolio and Alignment with Essential Medicines

A total of 178 finished pharmaceutical formulations were produced locally, with 138 (77.5%) listed on the 2024 Ethiopian Essential Medicines List (EEML). The remaining 40 products were categorized as non-essential or supplementary. Regarding molecules, 103 of the 548 molecules on the EEML (18.8%) were manufactured domestically, across 127 locally produced API presentations. Comparatively, a study in Kenya reported that only 22% of the 664 molecules listed in the 2023 Kenya Essential Medicines List were locally manufactured.[8] This highlights the challenge of scaling up local pharmaceutical production to meet essential medicine needs in the country.

Dosage Forms and Production Lines

Manufacturers operated between one and eight production lines. Core dosage forms included tablets, capsules, syrups, and suspensions.

Select firms also produced intravenous infusions, injectables, and topical preparations.

Therapeutic Category Coverage

Local production coverage varied significantly by therapeutic category. Of the EEML-listed medicines, 53.5% of Alimentary Tract & Metabolism drugs, 38.5% of systemic Anti-infectives, and 15.2% of Cardiovascular medicines were produced locally. Notably, critical gaps persist in the production of anti-tuberculosis medicines, vaccines, and reproductive and perinatal health products.

High-Volume and High-Value Products; Self-Sufficiency

Commonly produced medicines included Normal Saline 0.9%, Amoxicillin 500 mg capsules, and Acyclovir 200 mg capsules. Among the top ten locally produced medicines by value, four achieved 100% coverage within the public sector. Overall, 53 of the 178 formulations (29.8%) fully met local demand, reflecting a self-sufficiency rate of approximately 30% for assessed products.

Table 2 Top 10 locally produced medicines by value in 2016 EFY.

S. No	Medicine	Value in ETB	Market Share (%)
1	Sodium Chloride (Normal saline 0.9%)	835,090,050	100
2	Acyclovir 200 mg Capsule	446,249,480	100
3	Amoxicillin 500 mg Capsule	314,424,732	42.1
4	Ciprofloxacin 500 mg Tablet	301,728,937	54.6
5	Ringer's Solution	216,951,652	94.4
6	Haem up (iron folic acid), syrup	194,076,207	100
7	Paracetamol 500 mg Tablet	188,354,406	85.5
8	Cloxacillin Sodium - 500 mg Capsule	178,686,330	64.8
9	Ceftriaxone - 1g in vial - Powder for Injection	124,703,809	11
10	Propylthiouracil 100 mg Tablet	111,503,250	100

Capacity Utilization and Export Performance

Installed production capacity remains largely underutilized, with an average utilization rate of 24%, and tablet production lines operating at just 4.14% capacity. Export activities were minimal and have declined over the past three years, primarily limited to the export of empty hard gelatin capsules and crude heparin sodium. This mirrors broader regional challenges, as Africa's pharmaceutical manufacturing sector continues to lack the capacity needed to meet the continent's substantial demand for medicines and health products.[9]

Challenges

The local pharmaceutical manufacturing sector faces multiple, interconnected challenges. Limited access to foreign currency, high raw material costs, and transaction fees significantly constrain operations. Underutilization of installed capacity is exacerbated by technical skill gaps in research and development, quality assurance, and equipment maintenance. Fragmented data systems and inconsistent reporting hinder effective planning and decision-making. Additionally, regulatory complexities, prolonged import procedures, and policy inconsistencies delay production cycles. The sector also contends with unfair competition from international suppliers and high logistics costs, further impacting competitiveness and capacity to meet national medicine demand. These finding is consistent with another study conducted by Marew et al. (2024), that reported frequent operational downtimes, limited use of installed capacity (around 20%), inadequate compliance with quality standards, and poor infrastructure. [5]

Conclusion and Recommendations

Ethiopia's local pharmaceutical manufacturing sector holds considerable untapped potential to reduce import dependency and enhance access to essential medicines. However,

current challenges related to capacity utilization, technical expertise, and supply chain inefficiencies must be addressed to realize this potential.

Key recommendations include:

- Promoting local production of active pharmaceutical ingredients and raw materials.
- Strengthening regulatory frameworks and technical capacity, particularly in quality assurance.
- Improving supply chain efficiency and incentivizing investment for capacity expansion and product diversification.
- Establishing coordinated policy measures alongside robust monitoring systems to accelerate sector growth and competitiveness.

References

1. Ministry of Health (MOH). (2023). *Health Sector Medium-Term Investment and Development Plan (HSMIDP)*. Addis Ababa, Ethiopia.
2. Ministry of Health (FDRE-MoH). (2015). *National strategy and plan of action for pharmaceutical manufacturing development in Ethiopia (2015–2025)*.
3. Fortune, A. (2024). Pharma's export ambitions meet regulatory, capacity hiccups. *Fortune*, 25.
4. Ethiopia Investment Commission (EIC). (2018). *Investing in Ethiopia: The future pharmaceutical hub of Africa*. Ethiopian Investment Commission.
5. Marew, T., Belete, A., Richmond, F. J., & Gebre-Mariam, T. (2024). Assessment of local pharmaceutical manufacturing sector in a low-income country: A descriptive study.
6. Madebo, R. (2020). *Impact of the Ethiopian National Quality Infrastructure Institutions on the economic development of the country* [Master's thesis, St. Mary's University].
7. United Nations Conference on Trade and Development (UNCTAD). (2023). *Improving the investment landscape for local production of essential antibiotics in Ethiopia: An advisory report*.
8. Ministry of Health. (2023). *Report on the assessment of local manufacturing capacity for medicines in Kenya*. Nairobi, Kenya: Ministry of Health. Retrieved from https://www.health.go.ke
9. Adebisi, Y. A., Nwogu, I. B., Alaran, A. J., Badmos, A. O., Bamgboye, A. O., Rufai, B. O., Okonji, O. C., Malik, M. O., Teibo, J. O., & Abdalla, S. F. (2022). Revisiting the issue of access to medicines in Africa: Challenges and recommendations. *Public Health Challenges*, 1(2).

Enhancing TB Detection Using CADOOL Chest X-Rays and Stool Xpert in Oromia Region, Ethiopia: A Cross-Sectional Study

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Abstract

Background: Tuberculosis (TB) remains the leading cause of death by a single infectious agent globally. Ethiopia is among the highest TB and HIV/TB burden countries. Diagnostic gaps particularly, among household contacts (HHCs) unable to expectorate hinder early case detection. Computer-aided detection (CAD) software for chest X-ray (CXR) and non-respiratory molecular assays such as stool-based Xpert MTB/RIF testing represent promising strategies for scalable screening.

Objective: To evaluate the diagnostic accuracy of computer-aided chest X-rays (CAD4TB) and stool-based Xpert MTB/RIF testing, individually and in combination, for improving TB detection among household contacts of TB patients unable to expectorate in Oromia Region, Ethiopia.

Methods: A cross-sectional study was conducted at St. Luke Catholic Hospital, Oromia, Ethiopia, enrolling 478 study participants (152 TB index cases and 326 HHCs). All HHCs ≥4 years of age underwent digital CXRs screening, with or without CAD4TB software assistance, and brought stool and sputum samples for Xpert MTB/RIF testing. The accuracy of CAD4TB and stool Xpert was evaluated against sputum Xpert as a reference Test using sensitivity, specificity, predictive values with 95% confidence intervals, and concordance assessed by Cohen's kappa.

Results: CAD4TB showed strong diagnostic performance, with a sensitivity of 0.77 (95% CI: 0.70–0.83) and specificity of 0.93 (95% CI: 0.90–0.96), with positive and negative predictive values of 88% and 86%, respectively. Performance was higher among adults (Se 0.79, Sp 0.94) than children (Se 0.64, Sp 0.92). Stool Xpert demonstrated high concordance with sputum Xpert (Cohen's kappa 0.76), with sensitivity of 0.77 (95% CI: 0.70–0.84) and specificity of 0.97 (95% CI: 0.93–0.99). During the study, 10.6% (34/321) of HHCs were newly microbiologically diagnosed with TB.

Conclusion: The combined use of CAD4TB and stool Xpert testing significantly improves TB detection, particularly among household contacts in high-burden, and low-resource settings. This strategy is especially valuable in children and adults unable to produce sputum and where radiologists are limited.

Keywords: Tuberculosis, CAD4TB, Stool Xpert MTB/RIF, Household Contacts, Diagnostic Accuracy

Introduction: Tuberculosis (TB) remains a leading global cause of death from infectious disease, with incidence rising post-COVID-19 [1]. Key risk factors include undernutrition, HIV, smoking, and diabetes [1,2]. While high-income countries often use chest CT for diagnosis, low-income, high-burden regions rely on chest X-rays (CXR), which vary in accuracy and require skilled expertise. AI tools like CAD4TB offer standardized, sensitive detection of TB on CXRs and have WHO endorsement [3,4].

The WHO also promotes stool-based Xpert MTB/RIF testing to detect TB in patients unable to produce sputum, such as children and asymptomatic household contacts. Ethiopia, with high TB and TB/HIV burdens, widespread poverty, and undernutrition, faces challenges in funding and community screening coverage [5]. Improving TB screening among household contacts is vital to control transmission and identify subclinical cases [6].

Objective: This study aimed to assess the triage performance of CAD4TB and the diagnostic accuracy of stool Xpert MTB/RIF testing among pediatric and adult household contacts of TB patients in Oromia, Ethiopia. The findings will support scalable diagnostic strategies in low-resource settings by combining AI-based radiographic tools and non-respiratory molecular testing.

Methods: We conducted a prospective, cross-sectional diagnostic accuracy study during active tuberculosis (TB) contact investigation at St. Luke Catholic Hospital, Wolisso, Oromia, Ethiopia. The hospital is a referral facility serving approximately 1.4 million people. Routine TB screening at the site is symptom-driven, occasionally complemented by chest X-ray (CXR).

Index cases were adults or children with microbiologically confirmed pulmonary TB, defined as at least one sputum sample positive on Ziehl–Neelsen smear or Xpert MTB/RIF (sputum or stool). Patients already receiving anti-TB therapy for more than 72 hours were excluded. Household contacts (HHCs) aged ≥5 years who lived or worked in the same dwelling as the index case during the preceding two months were eligible. Pregnant women were enrolled but were not offered CXR. Contacts on treatment for active or latent TB were excluded.

The Oromia Health Bureau Research Ethics Committee approved the study (REF N° BFO/MBTFH/1-16/856). Written informed consent was obtained from all adult participants; parental consent and child assent were collected for those aged 5–17 years. The study complied with the Declaration of Helsinki and was registered at ClinicalTrials.gov (NCT05818059).

Close contacts were identified through a standardized questionnaire administered to index cases. Research staff actively recruited contacts, providing transport and meal reimbursement. Participants were randomized to one of two assessment sequences: (i) clinician assessment without CAD followed by CAD-assisted assessment, or (ii) the reverse.

All participants were screened for TB-related symptoms (cough, fever, hemoptysis, night sweats, chest pain, shortness of breath, poor weight gain/weight loss). Posterior–anterior CXR was performed using a digital radiography system linked to CAD4TB cloud software. CAD4TB generated an abnormality score (0–100) and a heatmap of suspected lesions. Clinicians independently classified participants as “possible TB,” “unclear,” or “unlikely TB” and graded their diagnostic confidence (0–100), both with and without CAD4TB support.

All participants were asked to provide sputum and stool specimens. Sputum was processed for Xpert MTB/RIF according to national guidelines, while stool was processed using the Simple One-Step (SOS) method. Participants unable to provide either specimen were not excluded; inability was recorded.

The primary outcome was the diagnostic accuracy of CAD4TB against sputum Xpert, expressed as sensitivity, specificity, and predictive values. Secondary outcomes included: (i) concordance between stool and sputum Xpert, (ii) diagnostic accuracy of stool Xpert versus sputum Xpert, and (iii) accuracy of CAD4TB versus Xpert stratified by age and clinical subgroups. Exploratory outcomes assessed added diagnostic value and discordance when CAD4TB was available to clinicians, as well as the association between CAD4TB scores and clinician confidence.

The initial calculation assumed 90% confirmation among "possible TB" cases, requiring 231 HHCs. Interim analyses showed lower-than-expected confirmation rates; thus, index cases were included. A revised target of 350 participants, based on a 3:1 HHC:index ratio and 60% confirmation among presumptive cases, was approved. Final enrollment comprised 478 participants (152 index cases, 326 HHCs).

Categorical variables were reported as counts and percentages; continuous variables as medians with interquartile ranges. Diagnostic accuracy metrics were calculated with 95% confidence intervals. Concordance between stool and sputum Xpert was evaluated using Cohen's kappa and Gwet's AC1. CAD4TB scores were compared across clinician categories using Kruskal–Wallis tests. Analyses were performed in R version 4.4 (R Foundation for Statistical Computing, Vienna, Austria). Statistical significance was set at $p<0.05$.

Results: At interim checkpoints (3, 6, and 12 months), enrollment progressively increased from 61 to 337 participants, with rising proportions of possible and confirmed TB cases. The final analysis included 478 participants (152 index cases and 326 household contacts) enrolled between April 2023 and December 2024.

CAD4TB data were available for 460 participants, with valid CAD4TB and Xpert results for 455. Compared to Xpert as the reference, CAD4TB demonstrated a sensitivity of 77% and specificity of 93%, with positive and negative predictive values of 88% and 86%, respectively.

Among adults, stool and sputum samples were successfully collected and tested with high completeness (>95%). Stool Xpert showed good concordance with sputum Xpert (Cohen's kappa = 0.76), and sensitivity and specificity of 77% and 97%, respectively, using sputum as the reference.

Accuracy metrics of CAD4TB compared to Xpert across subgroups were summarized, though small sample sizes in some groups (smokers, HIV-positive, malnourished) limited detailed analysis.

During the study, 10.6% (34/321) of household contacts were newly diagnosed with TB based on stool or sputum Xpert results.

When clinicians had access to CAD4TB results, 7.4% of cases initially judged negative or unclear were reclassified as positive.

Among cases judged positive with CAD4TB, 12.1% were false positives by Xpert standards.

There was a 16% discordance rate between CAD4TB and clinician chest X-rays assessments.

Clinician confidence correlated positively with CAD4TB scores when CAD data was unavailable (Spearman 0.61, $p<0.0001$).

When CAD4TB results were available, median CAD scores were significantly higher in cases classified as "possible TB" compared to "unclear" or "unlikely TB" ($p<0.0001$).

Discussion: In this high TB-burden setting, CAD4TB showed good sensitivity and excellent specificity for detecting active TB among household contacts compared to sputum Xpert MTB/RIF, confirming its reliability in

distinguishing TB cases. Sensitivity was lower in children under 15 (64%) due to pediatric TB's radiological features being harder to detect, and subgroup analyses for HIV-positive patients were limited by small sample size, though existing studies show mixed results on CAD performance in HIV [7]. Prior TB history, increased CAD4TB sensitivity but reduced specificity, likely due to residual lung lesions causing false positives; this suggests a need for AI systems that can differentiate past disease from active infection [8]. Malnourished individuals also showed higher sensitivity but lower specificity, highlighting the importance of nutritional status in TB disease severity [9].

Stool Xpert testing showed strong agreement with sputum Xpert and was easy to perform, supporting its use as a complementary diagnostic tool, especially as many patients no longer produce sputum. However, stool Xpert should augment, not replace, sputum testing due to some false negatives.

CAD4TB also increased clinicians' confidence in interpreting chest X-rays, reducing misclassification in settings without expert radiologists. Given the cost advantages of CAD over human radiologists in resource-limited settings, high TB-burden areas, its use is a pragmatic step toward improving TB diagnostics where radiology expertise is scarce.

The study demonstrated the feasibility of combining CAD4TB and stool Xpert in community active case-finding, detecting over 10% TB positivity among household contacts, consistent with expectations in high-risk groups.

Several limitations must be acknowledged. First, this was a single-center study and may not generalize to areas with different TB or HIV prevalence. Second, we were unable to implement the latest Xpert MTB/RIF Ultra assay, which constrained our diagnostic capacity. Furthermore, follow-up rescreening of contacts was poor due to political instability and low perceived risk.

There is a need to recalibrate CAD4TB thresholds for children and HIV-positive populations to optimize accuracy. Comparing CAD4TB with AI applied to lung ultrasound could be valuable, especially for remote areas where portable chest X-rays are not feasible.

Conclusion: Combining AI-based CAD4TB chest X-rays analysis with stool Xpert testing provides an effective, resource-appropriate approach for TB detection in high-burden, low-resource settings, enhancing case-finding and timely treatment.

References:

1.WHO. Global tuberculosis report 2024. WHO. [accessed on 2nd June 2025].

2.Pizzol, D. et al. (2016). Tuberculosis and diabetes: current state and future perspectives. Tropical medicine & international health: TM & IH, 21(6), 694–702.

3.Hua, D. et al. (2023). Benchmarking the diagnostic test accuracy of certified AI products for screening pulmonary tuberculosis in digital chest radiographs: Preliminary evidence from a rapid review and meta-analysis. International journal of medical informatics, 177, 105159.

4.World Health Organization. (2025, June 11). WHO approves six software products for computer-aided detection of TB on chest X-ray. [Accessed on 16th June 2025]

5.Agizew, T. B. et al. (2022). Prospects for tuberculosis elimination in Ethiopia: feasibility, challenges, and opportunities. The Pan African medical journal, 43, 146.

6.Wolde, H. M. et al. (2024). Comparison of the yield of two tuberculosis screening approaches among household contacts in a community setting of Silti Zone, Central Ethiopia: a prospective cohort study. BMC pulmonary medicine, 24(1), 135.

7.Gelaw, S. M et al. (2023). Diagnostic accuracy of three computer-aided detection systems for detecting pulmonary tuberculosis on chest radiography when used for screening: Analysis of an international, multicenter migrants screening study. PLOS global public health, 3(7), e0000402.

8.Kagujje, M. et al. (2023). The Performance of Computer-Aided Detection Digital Chest X-ray Reading Technologies for Triage of Active Tuberculosis Among Persons with a History of Previous Tuberculosis. Clinical infectious diseases: an official publication of the Infectious Diseases Society of America, 76(3), e894–e901.

9.Hoyt, K. J. et al. (2019). Effect of malnutrition on radiographic findings and mycobacterial burden in pulmonary tuberculosis. PloS one, 14(3), e0214011.

Implementation of Health Extension Program Units to Strengthen Primary Healthcare in Ethiopia: A Qualitative Process Evaluation

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Abstract

Background: Ethiopia has been working to achieve universal health coverage through optimizing the Health Extension Program (HEP), a national flagship community-based health program. The health extension program optimization aspires to increase health service access, quality, and equity through different strategies, including establishing HEP units in health centers and primary hospitals. There is limited evidence regarding the implementation of the HEP unit. Therefore, exploring the processes of the HEP unit and its implementation experience is crucial for scale-up and sustainability.

Method: This research collected qualitative data from the project implementation districts/woredas, both from agrarian and pastoralist regions in 2023. The woredas and study participants were selected purposively. Forty-three in-depth interviews (IDIs) and four focus group discussions (FGDs) were conducted for qualitative data. The sample size was decided based on the point of information saturation. Audio-recorded data were transcribed verbatim and translated to English. A thematic analysis approach was used to analyze the data, and direct quotations were used to present the findings.

Result: In the 'Improve Primary Health Care Service Delivery (IPHCSD)' project implementation, 14 woredas, all 64 health centers, and primary hospitals established HEP units. Setting up the unit at health center improved healthcare provision by promoting collaboration and teamwork among health workers, enhancing their skills, coordination, and technical support to the catchment health post, and overall performance. It also increased access to healthcare services through outreach delivery. However, challenges such as a shortage of human resources, a lack of dedicated offices for the unit coordinators and team members, inadequate community and other stakeholders' engagement in the establishment processes, and insufficient tools and supplies were identified.

Conclusion: The HEP unit has improved community-level health services, enhanced health professionals' skills and teamwork, and improved technical support to catchment health posts. Strengthening community engagement, advocacy, mentorship, capacity building, and ensuring sufficient staffing, infrastructure, and supplies are essential for the program's scale-up and sustainability.

Keywords: Community Health Program, Ethiopia, Health Extension Program, Primary Healthcare

Background

The Ethiopian government is investing in universal health coverage through the Health Extension Program (HEP), a community-based initiative launched in 2003 to improve access to basic health services. Over 40,000 female Health Extension Workers (HEWs) operate in more than 18,000 health posts, serving a population of 5,000 each. The HEP focuses on reproductive, maternal, newborn, and child health (RMNCH), disease control, hygiene, and health education to enhance equitable access to essential health services (1). The program effectively shifts health facility tasks to communities, leading to significant improvements in maternal and child health, infectious disease prevention, hygiene practices, and health-seeking behavior in rural and hard-to-reach areas of Ethiopia (2–4).

However, the program has encountered challenges, including low performance of HEWs, poor infrastructure, and a rapid transition in demographics and disease, necessitating a systemic approach with community and stakeholder involvement. Additionally, care coordination among multidisciplinary teams, like nurses and health officers, has been inadequate (5–7). The HEP roadmap aims to restructure HEP service delivery, which includes merging nearby health posts and establishing HEP units within health centers and primary hospitals to enhance coordination of health promotion and disease prevention and provision of technical and administrative oversight for the health posts in their catchments. Each HEP unit comprises 3-5 multi-disciplinary staff and can be formed with or without the health extension workers (HEWs). If health posts are merged, HEWs become part of the unit; if not, the health facility will create the unit using existing staff without the HEWs (8).

JSI and Amref Health Africa have been providing support to the MOH, regional health bureaus, and woreda (i.e., district) health offices by piloting the HEP unit approach through the "Improving Primary Health Care Service Delivery (IPHCSD)" project. The project tested the HEP unit in 64 health centers and primary hospitals in 14 woredas in pastoralist and agrarian communities since March 2022. Therefore, this paper aims to document and share the lessons learned from the HEP unit implementation, including its success, challenges, and recommendations for future scaling up.

Methods

Study Design: A qualitative process evaluation to assess the HEP unit's implementation in agrarian and pastoral contexts in Ethiopia.

Sampling data collection and analysis: A purposive sampling strategy was applied to select woredas that have implemented the HEP unit for a minimum of one year. Participants were selected from four woredas: Seka Chekorsa and South Bench (Oromia) for agrarian, and Awash Fentale and Dasench (Afar) for pastoral settings. Data collection conducted in September 2023, included 43 in-depth interviews and four FGDs. The sample size was decided based on the point of information saturation. In addition, facility observations were conducted using a checklist. Collected data were transcribed into local languages (Amharic, Afan Oromo, and Afari) were used to conduct the discussions. and translated into English. The translated versions of the data were then coded and organized based on the assessment objectives and questions. The assessment objectives were considered as a thematic area to organize the report.

Ethical consideration

This study protocol was ethically approved by the Ethiopian Public Health Association (EPHA) Institutional Ethical Review Board with Ref #: EPHA/OG/728/23, dated 17 July 2023. Informed verbal consent was obtained from all participants. Confidentiality and privacy were upheld throughout the process.

Results

Characteristics of study participants

A total of 43 study participants participated (Table 1).

Table 1: Characteristics of the study participants, September 2024

Institutions	Number of participants		
	Male	Female	Total
Woreda Health Office head/HEP focal	6	2	8
Health center director	8	0	8
HEP unit coordinators	3	6	9
Primary hospital CEO	2	0	2
HEWs at a basic health post	0	6	6
Kebele administrator	3	0	3
Community members	2	5	7
Total	24	19	43

Themes and sub-themes

The major themes that emerged from the data analysis Summarized in table 2.

Table 2: Themes and sub-themes, September 2024

1) HEP establishment processes,	• Assessment • Advocacy meetings & training
2) Performance of the HEP unit	• Improved access to and quality • Improved technical oversight and linkage
3) Health workers' and communities' perceptions and acceptance	• Improved technical support to the HEWs • Community acceptance and satisfaction
4) Implementation challenges.	• Infrastructure • Community engagement

2) Implementation processes

Assessment: Health facilities were assessed and categorized into merged, basic, and comprehensive types based on factors such as infrastructure and local health plans, enabling the HEP unit to provide tailored support and prevent service overlap. Staff training ensured a shared understanding of their roles in establishing HEP units.

Advocacy meetings and training: advocacy meetings with local stakeholders, including administrators and community leaders, emphasized the significance of HEP units in improving community health services and clarified the collaborative roles in their establishment.

"… we trained on the [HEP] roadmap from JSI. After the training, we set an action plan for the next steps of operationalizing the roadmap." (HEP coordinator, *Male, agrarian site)*

3) Performance of the HEP units

Improved access to and quality of community health services: Team-based outreach involving midwives, nurses, and HEWs has improved community-based services like pregnant women conferences, immunization, nutritional screening, and family planning. Supported by the HEP unit team, the HEWs have improved their community outreach and home visits with better skills and support. while a team-based service delivery approach has improved healthcare quality through integrated provision of essential services.

Improved technical oversight and linkage among facilities: The HEP unit has enhanced accountability by assigning a coordinator to each healthcare facility to oversee implementation. it has also strengthened communication and collaboration among primary-level healthcare workers and support systems, improving referral networks.

"Previously, the linkage of the health post and health center was weak, but currently, there is a big improvement in technical support, both in terms of frequency and content of the supervision, that improved our skills." (HEW, Female, Agrarin Site)

3) Health workers' and communities' perceptions and acceptance

Improved technical support to the HEWs: The program significantly enhanced HEWs' skills and fostered better collaboration with other health workers working at the health center. The unit members provide technical support in undertaking community mobilization, such as training of VHLs and WDUs.

"… since they joined the health center, the HEWs' skills have improved. They are advancing their skills by working together in different areas such as family planning, EPI, and ANC." -Health Center Director, Male, agrarin site)

Community acceptance and satisfaction: The community accepted the establishment of the HEP unit and the provision of community health services through the team-based approach. The health centers' proximity to the health posts made it the preferred choice for community members, resulting in underutilized health posts.

"… the health posts are adjacent to the health center. From the beginning, the community chose the health center because it is close to the health center." **(Health Center Director, Male, agrarian site)**

The establishment of the HEP unit has improved collaboration between health workers and local leaders, enhancing community trust and ensuring consistent follow-up on health issues.

"… Now we see the health workers and leaders coming together, discussing our issues, and solving them. We feel heard and respected." — community member

4) Implementation challenges

Health system's challenges: poor infrastructure, which limited their functionality due to a lack of dedicated offices and essential supplies. Additionally, a high turnover of health professionals resulted in HEWs often working alone during outreach, while inadequate training contributed to confusion about guidelines and teamwork.

Community Engagement: Low community engagement in some areas shows a preference for health posts despite their merger with health centers. Initial service drops, such as in vaccination rates, raised concerns among community members.

"…engagement of kebele administration and communities is limited …" (Health Center HEP Unit Coordinator, male, Pastoralist site)

Discussion

The study found that establishing the HEP unit in a participatory manner improved the skills and motivation of HEWs and enhanced health service delivery.

Engagement of stakeholders was crucial for community acceptance and successful implementation, as evidenced by other studies (9,10). Community resistance during the initial implementation of HEP units in pastoralist areas often stems from fears of increased distance to health services. Addressing these concerns through discussion and stakeholder engagement is essential for the program's success and sustainability (11–13).

The establishment of the HEP unit enhanced the HEWs' skills, service access, and quality of community health services through a multidisciplinary team with active community engagements and provided better technical support to catchment health posts. This is in line with the previous evidence that an effective multidisciplinary team enhanced the demand creation, engagement, and community ownership to take responsibility for their health (14,15).

Further, the program created a platform for cross-learning and experience sharing within the team that enhances their skills, motivation, and capacity, especially the HEWs, which is

in line with the previous studies that have shown the effectiveness of integrating CHWs into multidisciplinary teams to reduce health disparities among vulnerable and underserved populations (16–18).

This study also confirms the goals of the HEP unit, which is to improve the performance and efficiency of the primary healthcare system (19). Similarly, the HEP unit demonstrated improved service delivery, where the integration of the HEWs with allied healthcare providers enhanced the efficiency of the outreach programs and community-level service delivery (15,20,21).

Lack of adequate infrastructure, including dedicated rooms, supplies, and equipment, was the most frequently raised challenge. Evidence in Ethiopia shows a significant number of HCs and HPs lack the basic infrastructure to provide quality curative and preventive health care services (2).

Conclusion and recommendations: The HEP unit exemplified the benefits of a participatory approach to enhancing primary healthcare by fostering collaboration among stakeholders, improving community health care workers' acceptance and service accessibility. However, challenges such as limited human resources, infrastructure gaps such as a dedicated office, and insufficient community engagement hindered its full impact. To ensure sustainability and scalability, it is vital to strengthen advocacy, build health worker capacity, and prioritize resource allocation for infrastructure.

Reference

1. MOH. Health Sector Transformation Plan II (2020/21-2024/25). Addis Ababa, Ethiopia; 2021.

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. Global Health [Internet]. 2019;15(1):24. Available from: https://doi.org/10.1186/s12992-019-0470-1

3. Gebrehiwot TG, San Sebastian M, Edin K, Goicolea I. The Health Extension Program and Its Association with Change in Utilization of Selected Maternal Health Services in Tigray Region, Ethiopia: A Segmented Linear Regression Analysis. PLoS One [Internet]. 2015 Jul 28;10(7):e0131195-. Available from: https://doi.org/10.1371/journal.pone.0131195

4. Rieger M, Wagner N, Mebratie A, Alemu G, Bedi A. The impact of the Ethiopian health extension program and health development army on maternal mortality: A synthetic control approach. Soc Sci Med [Internet]. 2019;232:374–81. Available from: https://www.sciencedirect.com/science/article/pii/S0277953619303016

5. Sebastian MS, Lemma H. Efficiency of the health extension programme in Tigray, Ethiopia: a data envelopment analysis. BMC Int Health Hum Rights [Internet]. 2010;10(1):16. Available from: https://doi.org/10.1186/1472-698X-10-16

6. Yitbarek K, Serawit A, Medhin G, Alemayehu YK, Teklu AM, Assefa Y, et al. Capacity of the Ethiopian primary health care system to achieve universal health coverage: a primary health care progression approach. Health Policy Plan [Internet]. 2023 May 1;38(4):474–85. Available from: https://doi.org/10.1093/heapol/czad013

7. Zerfu TA, Tareke AA, Biadgilign S. Challenges and experience of the Ethiopian rural health extension program: implications for reform and revitalization. BMC Health Serv Res [Internet]. 2023;23(1):1309. Available from: https://doi.org/10.1186/s12913-023-10253-9

8. 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; 2020.

9. Erku D, Khatri R, Endalamaw A, Wolka E, Nigatu F, Zewdie A, et al. Community engagement initiatives in primary health care to achieve universal health coverage: A realist synthesis of scoping review. PLoS One [Internet]. 2023 May 3;18(5):e0285222-. Available from: https://doi.org/10.1371/journal.pone.0285222

10. Neuwelt P. Community participation in primary care: what does it mean'in practice'? J Prim Health Care. 2012;4(1):30–8.

11. Arthur M, Saha R, Kapilashrami A. Community participation and stakeholder engagement in determining health service coverage: A systematic review and framework synthesis to assess effectiveness. Vol. 13, Journal of Global Health. University of Edinburgh; 2023.

12. Masefield SC, Msosa A, Chinguwo FK, Grugel J. Stakeholder engagement in the health policy process in a low-income country: a qualitative study of stakeholder perceptions of the challenges to effective inclusion in Malawi. BMC Health Serv Res [Internet]. 2021;21(1):984. Available from: https://doi.org/10.1186/s12913-021-07016-9

13. Petkovic J, Magwood O, Lytvyn L, Khabsa J, Concannon TW, Welch V, et al. Key issues for stakeholder engagement in the development of health and healthcare guidelines. Res Involv Engagem [Internet]. 2023;9(1):27. Available from: https://doi.org/10.1186/s40900-023-00433-6

14. Dussault G, Barkley S, Bourgeault I, Buchan J, Catton H, Chater B, et al. Building the primary health care workforce of the 21st century - Background paper to the Global Conference on Primary Health Care: From Alma-Ata Towards Universal Health Coverage and the Sustainable Development Goals. Geneva; 2018.

15.Saint-Pierre C, Herskovic V, Sepúlveda M. Multidisciplinary collaboration in primary care: a systematic review. Fam Pract [Internet]. 2018 Mar 27;35(2):132–41. Available from: https://doi.org/10.1093/fampra/cmx085

16. Knowles M, Crowley AP, Vasan A, Kangovi S. Community Health Worker Integration with and Effectiveness in Health Care and Public Health in the United States. Annual Review of Public Health Public Health [Internet]. 2023;44:8. Available from: https://doi.org/10.1146/annurev-publhealth-

17. Islam N, Nadkarni SK, Zahn D, Skillman M, Kwon SC, Trinh-Shevrin C. Integrating Community Health Workers Within Patient Protection and Affordable Care Act Implementation. Journal of Public Health Management and Practice [Internet]. 2015;21(1). Available from: https://journals.lww.com/jphmp/fulltext/2015/01000/integrating_community_health_workers_within.9.aspx

18. Van Iseghem T, Jacobs I, Vanden Bossche D, Delobelle P, Willems S, Masquillier C, et al. The role of community health workers in primary healthcare in the WHO-EU region: a scoping review. Int J Equity Health [Internet]. 2023;22(1):134. Available from: https://doi.org/10.1186/s12939-023-01944-0

19.Hierink F, Oladeji O, Robins A, Muñiz MF, Ayalew Y, Ray N. A geospatial analysis of accessibility and availability to implement the primary healthcare roadmap in Ethiopia. Communications Medicine [Internet]. 2023;3(1):140. Available from: https://doi.org/10.1038/s43856-023-00372-z

20. Leach B, Morgan P, Strand de Oliveira J, Hull S, Østbye T, Everett C. Primary care multidisciplinary teams in practice: a qualitative study. BMC Fam Pract [Internet]. 2017;18(1):115. Available from: https://doi.org/10.1186/s12875-017-0701-6

21. Quinlan E, Robertson S. Mutual understanding in multi-disciplinary primary health care teams. J Interprof Care [Internet]. 2010 Sep 1;24(5):565–78. Available from: https://doi.org/10.3109/13561820903520385

One Health Perspective and Antimicrobial Resistance (AMR) Profiles of Major Bacterial Fish Pathogens in Ethiopia

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Abstract

Introduction: Fish is among the healthiest foods available, but it can also carry various zoonotic pathogens, raising important public health concerns.

Objective: This cross-sectional study was conducted to investigate the one health perspective and AMR profiles of major Gram-negative bacterial fish pathogens in Ethiopia.

Methods: Fresh fish, processed fish, and water samples were collected from three Lakes, Hawassa, Langano, and Ziway, Ethiopia.

Result and discussion: from the total of 254 samples, bacteria were isolated from 83.86% with significant difference in their distribution with respect to sample type. The prevalence of bacteria was 50%, 45% and 91.4% in water, processed fish, and fresh fish samples, respectively. 16 genera were identified of which 13 were identified into 21 species using molecular characterization. Eight prevalent bacteria were evaluated for antibiotic susceptibility against eight antibiotics using the Kirby-Bauer disk agar diffusion method, and 59.4% of them showed resistance against the antibiotics.

Conclusion and recommendation: This study highlights the ongoing spread of AMR in bacterial fish pathogens, which might end up infecting humans via eating infected and uncooked fishery products. This calls for deliberate “One Health” epidemiological studies to document information on the transmission between humans, fish, and water which result in the formulation of a consolidated bacterial zoonosis control policy by the environmental, human, and veterinary health sectors.

Keywords: One Health, Antimicrobial Resistance (AMR), fish pathogens, Ethiopia

1. Introduction

Fish plays a vital role in the human diet serving as essential sources of protein [1]. However, fish have been documented as carriers of foodborne bacterial pathogens. The majority of fish diseases are caused by Gram-negative bacterial pathogens, which are zoonotic with the potential to infect humans [2]. Assessment of the bacterial community in fresh and processed fish, and the source natural habitat, is essential to monitor fish health, product quality, and related public health risk of fish-borne bacterial illnesses. Reports on the one health perspective and AMR profiles of bacterial fish pathogens are scant in Ethiopia. There is a high prevalence of AMR, which is one of the major public health challenges in Ethiopia [3]. Treatment of bacterial infections needs to be guided by up-to-date national guidelines considering local antimicrobial susceptibility patterns [4]. A better understanding of the existing One Health Perspective and antimicrobial susceptibility profiles of bacterial pathogens is required to inform the development and implementation of effective preventative methods. This study was aimed at investigating the prevalence and AMR profiles of bacterial pathogens from a one health perspective, encompassing water, fresh fish, and processed fish samples, in Ethiopia.

2. Objectives

2.1. General objective: To investigate the one health perspective and AMR profiles of major Gram-negative bacterial fish pathogens in Ethiopia

2.2. Specific objectives: 1) To isolate and identify gram-negative bacteria from fresh fish, processed fish, and water samples. 2) To assess the prevalence of gram-negative bacteria on these samples. 3) To determine the antimicrobial susceptibility profiles of selected bacteria

3. Materials and Methods

3.1. The Study design: A cross-sectional study was conducted from February 2024 to October 2024, by the investigation of one health perspective and AMR profiles test on bacteria [5].

3.2. Sample size: The sample size used to assess the prevalence of gram-negative bacteria from the three samples was determined using the formula: $n = Z^2P(1 - P))/d^2$; Where 'n' is the sample size, 'Z' the confidence interval (1.96), 'P' the average prevalence estimate of 16.5% calculated from a review report in Ethiopia and'd' the expected error (0.05) [15].

3.3. Sampling strategy: Different sampling points of three lakes (Ziway, Langano, and Hawassa) were used for sample collections by using a random sampling technique.

3.4. Water samples collection: Surface water samples from each sampling point were collected with sterile glass bottles (100ml) as per the standard sampling procedure [6].

3.5. Fish samples: The fresh fish were drawn from the sampling points using fishing boats of local fishermen and were dissected under aseptic conditions using sterile dissecting scissors following established protocol [7]. Tissue samples were aseptically transferred to sterile bottles (100ml) and homogenized with physiological saline solution [7]. About ten (10) grams of muscle was cut from processed fish and kept in sterile universal bottles (100ml), and homogenized with 10ml physiological saline solution. Finally, all samples were stored at 4°C in the health biotechnology laboratory at Addis Ababa University for bacteriological analysis.

3.6. Bacteria colony morphology: All experiments were performed following Bergey's manual of determinative bacteriology [8]. All incubations were for 24 hours at 37°C. Sample suspensions were spread across nutrient agar medium (Oxoid, England) and incubated under

aerobic conditions. Specific colonies were picked up and inoculated on selective media, EMB and XLD agar (HIMEDIA, India), and incubated further. Colony morphology and pigmentation were examined. The morphologically identified isolates were stored at -20°C in 25% glycerol (Fine Chemical, Ethiopia) using 1.8ml cryovials (IMEC, China) for biochemical identification.

3.7. Biochemical characterization: Indole production, Methyl red (MR), Voges-Proskauer (VP), Catalase enzyme, citrate utilization, hydrogen sulfide, urea production, and sugars fermentation test were used as biochemical characterization techniques. The tests began with inoculating the respective media with 24-hour-old pure culture colonies. All incubations were at 37°C for 24 hours, and expected color changes were confirmed by test positivity.

3.8. Bacterial DNA extraction: Qiagen DNeasy DNA extraction protocol for bacterial cultures, adapted from the Qiagen DNeasy handbook, was used for DNA extraction.

3.9. PCR amplification: PCR reactions were performed in Eppendorf with a final volume of 25µl containing 20ng of DNA, 0.1–0.3µl of each primer (rD1 and fD1), and 1µl of Hot Star Taq Master Mix containing MgCl2, Hot Star Taq DNA polymerase, and dNTPs. The PCR products were analyzed by electrophoresis on 1.5% agarose gels stained with ethidium bromide using 1µM Tris-Acetate-EDTA buffer at 100V for 1 hour and were visualized by UV transillumination [9].

3.10. 16S rRNA sequencing: Sequencing of the 16S rRNA was performed using the universal bacteria primers rD1 and fD1 by Sanger sequencing. Chain elongation was terminated with sample loading buffer, and sequencing was performed on buffer-gradient gels [10].

3.11. Antibiotic sensitivity test: The testing was carried out following the Disc diffusion method on Mueller-Hinton agar (Oxoid England), as described by Hudzicki [11], using eight commercially available antibiotic disks (Oxoid UK). Inhibition zones for various isolates were measured and interpreted according to the Clinical Laboratory Standards Institute [12].

3.12. Data analysis: The prevalence of bacteria on different sample types was determined, and the proportion of isolates was compared between various samples using the Chi-squared test. Statistical analysis was performed using IBM SPSS software version 26 (IBM, Chicago, USA).

4. Results

4.1. Morphology of the isolates: The morphology of bacterial isolates was determined using Gram staining, bacterial colony formations, and cell morphology. Based on cell morphology, all strains were short rods and non-spore formers. Sixteen bacterial genera (*Acinetobacter, Aeromonas, Citrobacter, Edwardsiella, Enterobacter, Escherichia, Klebsiella, Morganella, Pectobacterium, Proteus, Providencia, Pseudomonas, Salmonella, Serratia, Shigella,* and *Stenotrophomonas.*) were identified. *Aeromonas* was the dominant genus with 31 isolates.

4.2. Pooling and Heterogeneity of Overall Prevalence of bacterial pathogens: The prevalence of gram-negative bacteria among water, processed fish, and fresh fish samples was 50%, 45%, and 91.4%, respectively. The difference was statistically significant ($p<0.0001$) (Table 4.1).

Table 4.1 The number and proportion of samples positive for Gram-negative bacteria species among water (N = 24) and fresh fish (N = 210) samples collected from Lakes Hawassa, Langano, and Ziway, and processed fish samples (N = 20) from Batu town

Isolated bacteria	Sample type (n =254)			
	Water, n (%)	Fresh fish, n (%)	Processed fish, n (%)	Total
Acinetobacter	0(0)	15(7.14)	0(0)	15 (5.91)
Aeromonas	2(8.3)	29(13.8)	0(0)	31 (12.2)
Citrobacter	2(8.3)	6(2.86)	0(0)	8 (3.15)
Edwardsiella	2(8.3)	10(4.76)	0(0)	12 (4.7)
Enterobacter	0(0.0)	17(8.1)	1(5)	18 (7.1)
Escherichia	1(4.2)	15(7.14)	2(10)	18 (7.1)
Klebsiella	1(4.2)	4(1.9)	2(10)	7 (2.76)
Morganella	0(0)	12(5.7)	0(0)	12 (4.7)
Pectobacterium	0(0)	4(1.9)	0(0)	4 (1.6)
Proteus	0(0)	10(4.76)	0(0)	10 (3.94)
Providencia	0(0)	17(8.1)	0(0)	17 (6.7)
Pseudomonas	1(4.2)	24(11.43)	0(0)	25 (9.84)
Salmonella	1(4.2)	7 (3.33)	4(20)	12 (4.7)
Serratia	0(0)	5(2.38)	0(0)	5 (1.97)
Shigella	2(8.3)	5(2.38)	0(0)	7 (2.76)
Stenotrophomonas	0(0)	12(5.7)	0(0)	12 (4.7)
Total	12(50)	192(91.43)	9(45)	P<0.0001

4.3. Molecular identification: Thirteen prevalent bacterial genera were identified into 21 species by the 16S rRNA gene sequencing. Compared with the GenBank database, nucleotide sequences of 16S rRNA gene identified the bacteria at the species level.

4.4. Antibiotic sensitivity testing: The result showed that, 59.4% of the pathogens tested were resistant to the antibiotics evaluated, suggesting maximum levels of acquired antibiotic resistance in fish bacteria from the study area (Table 4.2).

Table 4.2 Antibiotic susceptibility patterns of the bacterial pathogens, based on CLSI's inhibition zones interpretive criterion (NOTE: Amp: Ampicillin, Chl: Chloramphenicol, Ery: Erythromycin, Gen: Gentamicin, Oxa: Oxacillin, Pen: Penicillin, Tet: Tetracycline, Van: Vancomycin, R: Resistance, S: Sensitive, I: intermediate.

Antibiotics and their susceptibility patterns								
Bacterial strains	Amp	Chl	Ery	Gen	Oxa	Pen	Tet	Van
A. hydrophila	R	S	S	S	I	R	R	R
A. veronii	R	R	S	S	R	R	R	R
E. tarda	S	S	I	S	R	R	S	R
E.coli	R	R	R	S	R	R	R	R
P. fluorescens	R	S	R	S	R	R	S	S
P. mirabilis	S	S	R	S	S	S	R	R
S. flexneri	R	R	R	S	S	R	R	R
S. maltophilia	R	I	S	R	R	R	S	R

5. Discussion

The result obtained from 254 total samples showed an overall prevalence of 83.86% gram-negative bacterial pathogens in Ethiopia. The prevalence of Gram-negative bacteria was high in fresh fish with 90.14%, water with 50% and processed fish with 45%. This is higher compared to a similar investigation conducted in Ethiopia, with 43% in fish, 36.3% in water in the freshwater fish [13]. In this study, twenty-one (21) species of thirteen genera were identified by molecular characterization. Several gram-negative bacterial species, including *Aeromonas* spp., *Citrobacter* spp., *Enterobacter* spp., *Pseudomonas* spp., and *S. marcescens,* have been reported from freshwater fish [14]. This study showed that the prevalence of zoonotic human pathogens was higher in fish samples. By contrast with the findings in Spain [15], this reported a high prevalence of zoonotic human pathogens from the environmental samples. Food safety, zoonotic disease control, environmental health, and antimicrobial resistance are among the areas of work where a "One Health" approach is particularly relevant [15]. The presence of zoonotic bacteria, particularly *Enterobacter*, *Klebsiella*, *Escherichia,* and *Salmonella* in fresh fish, processed fish, and the water indicates that there is a possibility of ongoing circulation of the pathogens, and should be taken into consideration in Ethiopia. Zoonotic bacteria such as *Edwardsiella*, *Salmonella, Vibrio* and *Aeromonas* were recovered from fish in various parts of Ethiopia [14]. Detection of the zoonotic bacterial human pathogens in fish in this study, serves as a warning sign for the passage of these pathogens to human through infected and contaminated fish products. Antimicrobial resistance is a worldwide public health concern that has drawn attention in recent times. The majority of the pathogens tested were resistant to most of the antibiotics evaluated. The passage of antimicrobial resistance genes and resistant bacteria from aquatic to terrestrial animal and human environment can have detrimental effects on both human and animal health and aquatic ecosystems [16]. This work will serve as an initial step to establish a baseline dataset of one health and antimicrobial resistance profiles of bacterial communities associated with fish and their habitat in Ethiopia. But, it has certain notable limitations. It didn't quantify the detected bacteria, and did not assess seasonal patterns of bacterial prevalence in each sample. The results would have been more robust if large samples from different lakes have been included.

6. Conclusion

The study revealed the prevalence of zoonotic bacterial pathogens in water, fresh fish, and processed fish in Ethiopia, highlighting a significant knowledge gap regarding fish-related bacterial zoonoses in this country. The results demonstrated a high prevalence of bacterial pathogens in fresh fish than in processed fish and water emphasizing the main public health hazard associated with the presence of bacterial pathogens in the fish production chain, which may eventually affect humans. To minimize the risk of transferring antibiotic-resistant bacteria to the human population through fish products, the use of antibiotics in fish farming in Ethiopia should be discouraged. The detection of bacterial pathogens in all samples suggested a need for a consolidated "One Health" approach from the ecological, human, and animal health sectors in terms of epidemiological, therapeutic, and policy formulation research.

7. Recommendation

From the study result, I recommend strengthening surveillance and diagnostics for fish-borne bacteria, implementing strict food safety and hygienic practices in the fish value chain, and promoting responsible antibiotic use to curb antimicrobial resistance (AMR).

8. References

1. Pękala-Safińska (2018). Contemporary threats of bacterial infections in freshwater fish. *J Vet Res* 62:261-267.
2. Haenen, O. L. M., Evans, J. J. and Berthe, F. (2021). Bacterial infections from aquatic species: potential for and prevention of contact zoonoses. *Rev Sci tech off Int Epiz.* 32 (2): 497-507.
3. Laxminarayan, R., Duse, A. and Wattal, C. (2013). Antibiotic resistance the need for global solutions. *The Lancet Infectious Diseases* 13(12): 1057-1098.
4. Daniel, W. W and Cross, C. L. (2013). Biostatistics: A Foundation for Analysis in the Health Sciences. 10th Ed. New York: John Wiley and Sons.
5. Eshetu Yimer (2000). Preliminary survey of parasites and bacterial pathogens of fish at Lake Ziway. SINET: Ethiop J Sci 23(1): 25-33.
6. WHO (2017). Guidelines to drinking-water quality, 4th Ed. World Health Organization, Geneva, Switzerland.
7. Holt, J. G., Krieg, P. H., Sneath, J. T. and Williams, S. T. (1994). Bergey's manual of determinative bacteriology. 9th Ed. William and Wilkins, London.
8. Sedlacek, I., Stankova, E. and Svec, P. (2016). Composition of cultivable enteric bacteria from the intestine of Antarctic fish (family Nototheniidae). *Czech J Anim Sci* 61:127-132.
9. Weisburg, G, W., Barns, M, S., Pelletier, A, D. and Lane, J, D. (1991). 16S rDNA Amplification for Phylogenetic Study. *J Bacteriol* 173: 697-703.
10. Biggin, M. D., Gibson, T. J. and Hong, G. F. (1983). Buffer gradient gels and 35S label as an aid to rapid DNA sequence determination. *Proc Natl Acad Sci USA* 80:3963- 3965.
11. Hudzicki, J. (2009). Kirby-Bauer Disk Diffusion Susceptibility Test Protocol. American Society for Microbiology. Pp. 1-23.
12. CLSI (2020). *Performance Standards for Antimicrobial Susceptibility Testing.* 30th Ed. CLSI supplements M100. Wayne, PA: Clinical and Laboratory Standards Institute.
13. Matter, F, A., El Asely, M, A., Shaheen, A, A., El-Gawad, A, A., El-Abd, A, H., Abdel Gawad, A, E. and Abbass, A. (2018). Phenotypic and molecular characterization of bacterial pathogens isolated from diseased freshwater fishes. *Int J fish Aquat Sci* 6(2): 34-41
14. World Health Organization (WHO). A health perspective on the role of the environment in One Health. Copenhagen: WHO Regional Office for Europe; 2022.
15. Sorsa, M., Mamo, G., and Abera, L. (2019). Major fish-borne bacteria and parasitic zoonoses in Ethiopia: A review. Int J Fauna Biol Stud 6 (4):50-58.

    Santos, L. and Ramos, F. (2018). Antimicrobial resistance in aquaculture: Current knowledge and alternatives to tackle the problem. *Int J Antimicrob Agent* 52(2):135-143.

Establishing and Strengthening Public Health Emergency Preparedness in Ethiopia: An Issue Brief

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Abstract

Introduction: Preparedness in public health emergency management determines the outcome of any emergency response. For effective preparedness, coordinated efforts of the entire health system and intersectoral collaboration are very important. In Ethiopia, the government has undertaken significant steps to strengthen emergency preparedness and national health security. However, various policies and program-level constraints continue to hinder the country's overall preparedness for public health emergencies.

Objective: The aim of the issue brief was to identify bottlenecks, inflicted challenges, and actionable policy recommendations to strengthen preparedness for public health shocks.

Methods: A desk review was conducted using findings from recent after-action and intra-action reviews, as well as 7-1-7 reports, covering 12 public health emergencies, including yellow fever, Cholera, Measles, IDP response, COVID-19, Polio, Dengue Fever, and Anthrax in Ethiopia. The review was conducted by experienced public health emergency officers, purposefully selected from public health institutes, academic institutions, and non-governmental organizations. The data was analyzed, and the findings were organized into themes and presented accordingly.

Results: The findings of the review showed critical gaps in the preparedness of selected organizations and institutions in Ethiopia for public health emergencies. Key gaps identified include the absence of essential system capabilities, no guidelines or standards for managing and communicating public health emergencies, no formally assigned sector to lead coordination, absence of emergency funding, and no compensation mechanisms for healthcare providers during imminent public health emergencies with humanitarian crisis.

Conclusion and recommendations: The findings highlight important gaps in Ethiopia's public health emergency preparedness related to systems building blocks, policies, and resources. These gaps create serious risks for the timely detection, coordination, and management of emergencies. Thus, improving preparedness for emergencies requires immediate policy and system reforms through developing standardized guidelines, standard operating procedures (SOPs), and designating a responsibility for sector coordination. Designing emergency funding strategies and establishing support systems for healthcare providers are also crucial. This will enhance resilience and health security while reducing the harmful effects of future public health crises.

Key Words: Public Health Emergency, Preparedness, Public Health Crises, Health Security

Introduction

The outcome of a public health emergency is determined by the activities carried out during preparation. Preparedness is therefore a critical stage in the emergency management cycle. These activities aim to strengthen the capacity of health systems to prevent and reduce the impact of impending public health emergencies.

Because of the multidimensional nature of the public health sector, preparedness planning requires the involvement of the entire health system and the broadest possible inter-sectoral and inter-agency collaboration in developing policies and plans and implementing activities to reduce their impacts. This can significantly improve preparedness by providing the necessary logistics and funding, establishing the necessary protection, prevention, and effective response systems, providing public health personnel and responders with the necessary knowledge and tools, and informing the public that appropriate measures will be taken.

Context Description

The Ethiopian government has taken substantial initiatives to increase the nation's health security capabilities and health workforce competencies to improve the national health system's preparedness for managing PHEs. Furthermore, the government's commitment towards this is reflected in the Health Sector Transformation Plan (HSTP) and Health Sector Medium-Term Development and Investment Plan (HDSIP) Political commitment in Joint External Evaluation, preparation, and implementation of the National Action Plan for Health Security (NAPHS).

Public health emergency system establishment and human resource development to improve their competencies through providing short and long-term building at all administrative levels, establishment of PHEOCs at the national and sub-national levels, and the preparation of legislations, guiding documents, and Standard Operating Procedures (SOPs) to guide emergency coordination at all health system levels was also among the efforts made by the government in this regard.

Despite significant efforts to strengthen the PHEM system preparedness capabilities, multiple policy and program-level constraints hampered the overall emergency PHE preparedness efforts in the country. Findings of the recent After-action Reviews/Intra-action Reviews (AAR/IARs) and 7-1-7-time metrics retrospective findings of 12 PHEs in Ethiopia show that identified challenges in the health system are widespread in all pillars of the health system preparedness, as well as inadequate supportive environments for mandated institutions to manage PHEs.

Methods:

A desk review was conducted using findings from recent after-action (review of actions taken to respond to a public health event after it declared over) and intra-action (review of actions taken to respond to a public health event before it declared over) reviews, as well as 7-1-7 reports (a global target and framework for improving outbreak detection, notification, and early response by setting benchmarks of 7 days for detection, 1 day for notification, and 7 days to complete early response actions), covering 12 public health emergencies, including yellow fever, Cholera, Measles, IDP response, COVID-19, Polio, Dengue Fever, and Anthrax in Ethiopia.

System Bottlenecks and Inflicted Challenges

Bottleneck 1: Absence of system capabilities and competencies required to accomplish the emergency preparedness

Inflicted Challenges

- Absence / limited functionality of platforms and systems for facilitating early detection, reporting, and providing effective PHE response and control
- Stakeholder engagement and the availability and functionality of multi-sector coordination and communication platforms are suboptimal under normal circumstances, resulting in the absence of an agreed emergency preparedness and response plan
- Scarcity of required competencies to plan and avail optimal resources to detect, characterize, forecast related mortality and morbidity burden, and communicate timely to relevant stakeholders and the general community about the risk for necessary preparedness
- Being reactive when new development emerges rather than being proactively in taking necessary preparatory activities and providing an effective response
- Failure to provide required basic information to be used as an input for forecasting, planning, and resource mobilization, which results in under- or over-estimation of posed PH risk

Bottleneck 2: Lack of policy and legal protocols, SOPs, and guidance for public health emergency preparedness and communication for imminent public health emergencies.

Inflicted Challenges

- Absence of accepted national guidance/ protocol to be used during emergency/ humanitarian settings to mobilize and deploy required logistics and human resources from in-country and outside the country working partners automatically based on the degree of the emergency and pre-established agreement
- Mandate overlap or absence of an agreed plan of action between MoH and EPHI to establish well-equipped treatment and isolation centers
- Absence of standards and procedures for communicating risks to relevant stakeholders and the general community using different platforms, considering the context
- Absence of guidance/protocol to assess required capabilities and competencies for identified imminent PHEs

Bottleneck 3: Absence of an officially assigned sector for leading the coordination and multi-sectoral collaboration to ensure inter-organizational accountability in PHEs

Inflicted Challenges

- Having multiple coordination platforms that are not synergistic resulted in duplication of efforts and resource wastage.
- Different levels of perception and expectation about the scale of the pandemic because of differences in inputs used, which in turn mislead the required level of preparedness and response.
- No or sub-optimal engagement of relevant sectors during preparedness and no accountability.
- The health sector shoulders the overall preparatory activities for imminent PHEs, which resulted in ineffective emergency preparedness and response
- Ineffective communication, information sharing, and collaboration among relevant stakeholders.

Bottleneck 4: Shortage or absence of emergency funding and a functional financial system that considers the nature of PHEs

Inflicted Challenges

- Failure/late implementation of preparatory activities, including system development, capacity building, monitoring and rehearsal, and resource allocation for detecting, reporting, and managing PHEs
- Difficulty in procuring and making available the required logistics, lifesaving drugs and supplies, PPEs, and spare parts timely manner.

Bottleneck 5: Absence of a standard for compensation mechanisms, insurance, and relevant health services for emergency health response providers

Inflicted Challenges

- Existence of different compensation mechanisms and strategies which doesn't consider the level of effort and time spent to execute the duties and responsibilities which resulting in grievance among public health emergency workers.
- Loss of motivation and engagement of relevant experts during preventive and response measures.
- Risk of morbidity and mortality among service providers, which resulted in frustration and less engagement among service providers

Recommendations and their Implications

1. Recommendations for PHEM Preparedness System Building at all levels

1.1 Delegate a Lead Office and Avail Enabling Policy and Legal Protocols

Priority activities to be undertaken:

- Delegate/assign and empower organizations/groups that focus on emergency/risk grading, coordination, readiness, and response for various contexts.
- Create legal and policy documents that specify the responsibilities of all pertinent stakeholders in various contexts and PH grades, as well as the responsible sectors that must be involved in the preparation activities.
- Define the lead's roles, responsibilities, and mandates.
- Assure stakeholder participation in the preventative and planning stages.
- Create/establish a system to ensure accountability among all identified pertinent stakeholders and involve law enforcement agencies in the enforcement of new or existing laws.

1.2 Strengthen Human Resource Capacity at Health Facilities and Protect Frontline Responders

Priority activities to be undertaken:

- Map current PHEM employees against the necessary skills and competencies by conducting a thorough Human Resource (HR) gap analysis.
- Identify critical shortages in critical roles, such as emergency logisticians and epidemiologists.
- Create and implement a standardized PHEM training guide and materials for the health facility (HF).
- Establish a human resources roster (surge capacity database).
- Evaluate the current methods and mechanisms that are available.
- Create alternate guidelines for various methods and mechanisms of compensation.

1.3 Ensure Budget Allocation and Sustainable Financing

Priority activities to be undertaken:

- Organize multiple advocacy meetings with relevant stakeholders
- Estimate the required financial support to implement PHEM preparedness measures
- Establish a local resource mobilization approach to finance the emergency preparedness for imminent PHE.

2. Recommendations for the Operation of PHEM Preparedness

2.1 Develop a Strategic Logic Model to Guide and Evaluate Preparedness

Priority activities to be undertaken:

- Develop and advance required system capabilities and competencies to prevent, mitigate, and provide response for prioritized imminent PHEs identified using Vulnerability, Risk Assessment and Mapping (VRAM).
- Conduct routine assessment to monitor and evaluate the status of the PHEM system capacity to detect, report, and provide an effective response.
- Prepare and implement improvement plans based on the routine assessment findings.

2.2 Avail Operational Protocols for Response and Coordination

Priority activities to be undertaken:

- Create and provide officially recognized protocol or guidance to establish medical and personnel countermeasures according to the level of PH risk.
- Establish a standard for communication and collaboration

Pharmaceutical Budget Allocation and Utilization in Public Health Facilities: Current Challenges and Way Forward

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Abstract

Background: Pharmaceutical budget allocation and utilization in public health facilities face significant challenges, hindering access to essential medicines. While national health spending has increased over the years, health sector allocation remains below the 15% target set by the Abuja Declaration, with real budget value eroded by inflation and currency depreciation.

Objective: To assess pharmaceutical budget allocation and utilization practices in public health facilities in Ethiopia.

Methods: A cross-sectional mixed-methods study was conducted from March 4–22, 2024, involving 145 public health facilities and administrative bodies. Quantitative data were collected through structured questionnaires and records review, while qualitative data were obtained from interviews with 188 key informants from various organizations to identify factors and challenges in pharmaceutical budget allocation and utilization. Quantitative data were cleaned and analyzed using SPSS version 26 and Microsoft Excel, and results were presented using descriptive statistics. Qualitative data were transcribed, coded, and thematically analyzed using MAXQDA.

Results: The average share of the pharmaceuticals budget from the health facility budget in the surveyed health facilities for the fiscal years 2011-2015 was 15.8%. Structural and procedural challenges, such as delays in budget disbursement and weak reimbursement mechanisms; capacity-related issues, including shortages of skilled finance and pharmacy staff, weak demand-based planning, and inefficient budget utilization; and systemic and external factors, such as inflation, and exchange rate depreciation, and regional disparities contributed to frequent stockouts lasting up to two months in some regions.

Conclusion: The assessment identified major challenges in pharmaceutical budgeting in Ethiopia, including inconsistent practices, delayed disbursements, and weak reimbursements. Low budgets and regional disparities contribute to medicine shortages. Strengthening demand-based budgeting, timely funding, and financial management is crucial to improve access to essential medicines and health services.

Keywords: Pharmaceuticals, Budget Allocation, Budget Utilization, Ethiopia

Introduction

Ethiopia has made significant progress in strengthening its health system, viewing health as key to human capital development. The Health Sector Medium-Term Development and Investment Plan (HSDIP) focuses on achieving Universal Health Coverage through better primary care, leadership, equity, and financing reforms.[1] The National Health Care Financing Strategy (2022–2031) supports this by boosting domestic funding, lowering out-of-pocket costs, and expanding health insurance coverage.[2]

Healthcare budgeting is vital for effective service delivery, with 40–60% of health facility budgets typically spent on medicines and medical devices.[3] Ethiopia's healthcare spending has grown steadily over two decades but still struggles to fund pharmaceuticals adequately. In 2019/20, the government covered 32.2% of health costs, donors 33.9%, households 30% (out-of-pocket), and the private sector 2.5%. Despite increased spending, the 2023/24 government health budget allocation is 8.3%, below the 15% Abuja Declaration target, and its real value is reduced by inflation and currency depreciation.[4]

Factors influencing budget allocation include national priorities, population health needs, and economic conditions. Healthcare budgeting is especially challenging due to unpredictable costs, varying patient needs, and revenue fluctuations. Decentralized governance gives regional states control over health budgets, with an increasing share allocated to them.[5] There is limited objective evidence on how pharmaceutical budgets are allocated, and inconsistencies exist in using internal revenue for medicine procurement.

Objective

To assess pharmaceutical budget allocation and utilization practices and identify challenges in public health facilities in Ethiopia.

Methodology

Study Design and Period

A cross-sectional study design with concurrent mixed methods approach employing both qualitative and quantitative methods was utilized to collect the data from March 4, 2024, to March 22, 2024.

Sampling Approach

A maximum variation sampling approach was employed to ensure diverse representation. The assessment included 145 public health organizations across 12 regions and 2 city administrations, comprising 107 health facilities (50 health centers, 21 primary hospitals, 23 general hospitals, and 13 tertiary hospitals) and 38 administrative bodies (12 regional health bureaus, 2 city administrations, and 24 woreda health offices). For the qualitative component, 188 key informants were purposively selected from different levels of the health and finance systems, including health facilities (pharmacy heads, finance heads, and facility directors), Regional Health Bureaus, Woreda Health and Finance Offices, the Ethiopian Pharmaceutical Supply Service, the Ethiopian Health Insurance Service, and parliamentary standing committees. Key informant interviews were conducted concurrently across all regions.

Data Collection and Management

Data were collected using structured tools and document reviews (EFY 2011–2015), including Dagu, Model 19, APTS, and sales records. Key informant interviews were conducted with stakeholders from institutions such as MoF, EHIS, EPSS, RHBs, WoHOs, hospitals, universities, and parliament. Data quality was ensured through pre-tested tools, three-day training for data collectors, and electronic tools with skip logic. Accuracy checks and stakeholder feedback on preliminary results further improved reliability. Quantitative data were analyzed using SPSS v26 and Excel

with descriptive statistics disaggregated by region and facility type. Qualitative data were thematically analyzed using MAXQDA, guided by predefined and emerging themes.

Ethical Considerations

Ethical clearance was secured from the Ethics Review Committee of the School of Pharmacy, Addis Ababa University with reference number SOP/PHAR/69/2023. Authorization letters were obtained from the Ministry of Health and respective regional health bureaus. All participants were informed about the study's purpose and procedures, and informed consent was obtained. Confidentiality and anonymity were strictly maintained, with no individual or facility-specific data disclosed.

Results and Discussion

Characteristics of Study Settings and Key Informants

The survey included 145 public institutions across 12 regions and 2 city administrations, comprising 107 health facilities (health centers, primary, general, and tertiary hospitals) and 38 administrative bodies (12 regional health bureaus, 2 city administrations, and 24 woreda health offices). A total of 188 key informants were interviewed, representing different levels of the health and financial systems. Of these, 94 were from public health facilities, 73 from regional health bureaus, bureaus of finance, and woreda offices, 10 from regional parliamentary standing committees, 1 from the Ministry of Finance, and 10 from the Ethiopian Pharmaceutical Supply Service.

Challenges in Pharmaceutical Budgeting

Although the national budget allocation for health has grown in absolute terms in recent years, its share of the overall budget has displayed a fluctuating pattern. The health sector accounted for 9.7% of the budget in the 2021/22 fiscal year, dropped to 8.1% in 2022/23, and then saw a modest increase to 8.3% in 2023/24.[4] These figures are considerably lower than the 15% target established by the 2021 Abuja Declaration of the African Union.[7] Moreover, the high level of inflation in the economy resulted in a decline in the real value of the budget. The real value of the budget is expected to further decline with the changes in the exchange regime in the 2024/25 fiscal year. The limited budget allocated to health results in only a meagre portion being directed toward pharmaceutical funding. Challenges in pharmaceutical budgeting in Ethiopia are further compounded by problems in budget planning, insufficient budget allocation, delays in disbursement, inefficient utilization of funds, and weak reimbursement mechanisms. Previous month, but buying medicines follows different rules.

Inadequacy of allocated budget for essential pharmaceuticals

The assessment found that, the pharmaceutical budget represents an average of 15.8% of the total health facility budget, based on data from 2011 to 2015 EFY. This figure falls below the practice of allocating 40-60% observed in other countries. Moreover, pharmaceutical budget increases from 2011 to 2015 EFY did not keep pace with Ethiopia's overall inflation rates, as reported by the World Bank, consistently lagging inflation during this period.[8] There are notable disparities across facility levels, with tertiary hospitals allocated 23% of their budgets to pharmaceuticals, followed by general hospitals at 16%, health centers at 15%, and primary hospitals at 14%. Among regions, Sidama region allocated an average of just 8.4% of their budget to pharmaceuticals, followed by Gambella at 9.4%. In contrast, the Amhara region allocated an average of 21.1% of the budget for pharmaceuticals.

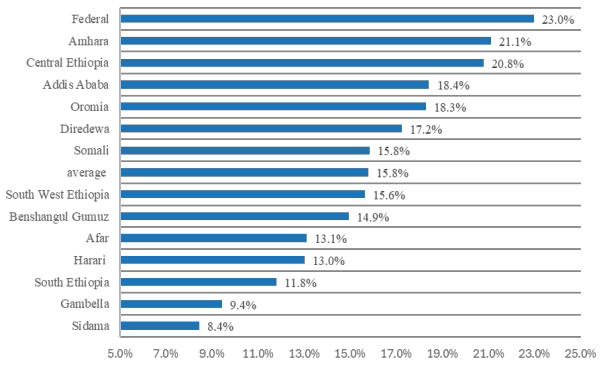

Figure 1: Proportion of Pharmaceuticals Budget Share from the Health Facility Budget by

Region (Fiscal Years 2011-2015)

While comprehensive studies are limited, evidence shows that about one in four patients in Ethiopia lacks reliable access to essential medicines. Availability varies widely, with Dire Dawa and Addis Ababa reaching 90%, while Southwest Ethiopia lags at 69%. Tertiary hospitals show better availability (83%) than health centers (70%). Nationally, average stockout duration is 33 days, reaching up to two months in some regions, leading to service gaps and patient dissatisfaction. These shortages push patients toward private pharmacies or unsafe sources, where medicine prices are over 350% higher. For example, cancer patients at one tertiary hospital spent over 35,000 Birr annually on medicines that would have cost only 6,200 Birr in the public sector.

Demand based pharmaceutical budget planning

Health facilities are required to forecast their pharmaceutical needs to determine budget requirements, with 78.5% of facilities reporting that they conduct quantification exercises. However, only 33% of these facilities could provide documentation to support their claims, and the average forecasting accuracy was just 58%. The national data revealed that many facilities did not conduct quantification due to the perception that actual needs are ignored in favor of predetermined budget limits.

Budget proposals preparation based on spending ceilings set by the Ministry of Finance and justifies allocations through defense sessions rather demand based planning. The process involves setting ceilings, submitting proposals, and engaging stakeholders to align health priorities with available resources. Health facility involvement in pharmaceutical budget preparation varies by region and facility type. Higher-level facilities, such as tertiary hospitals, often have more structured, participatory budget processes, while many lower-level facilities have minimal involvement, leading to weak budget justification. A national assessment found that about 38% of facilities lack representation in the budget process, relying on the Woreda health office and regional health bureaus to defend their budgets.

Budget Disbursement

Budgets are often released late due to delays in approvals and complicated rules. The government gives out budgets based on reports from the previous month, but buying medicines follows different rules. This monthly budget release does not fit well with how medicines are procured. As a result, it can be hard to buy pharmaceuticals on time, which creates uncertainty in planning and affects how much stock is available for health services. This can lead to shortages of essential medicines, which hurts patient care and health outcomes. Untimely release of budget also makes it difficult to manage inventory properly, causing medicines to be wasted. Furthermore, inconsistencies exist in the utilization of internal revenue for pharmaceutical procurement among public health facilities.

Weak Reimbursement Mechanism

The government is implementing exempt services for selected population groups to provide equitable access to essential health services and Community-Based Health Insurance Schemes as one of health financing initiatives. Health facilities analysis

of expenditures for 2011 - 2025 EYF for exempted pharmaceutical services within health facilities revealed an average of 15% of the pharmaceutical budget allocated. The data also showed disparity among regions where Central Ethiopia and Sidama regions exhibited the highest proportions of exempted service expenditures at 38% and 29%, respectively. Conversely, Somali regions reported the lowest, with 2%.

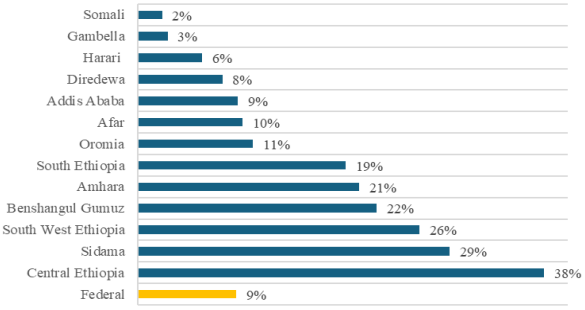

Figure 2: Percentage of exempted service expenditure relative to total pharmaceutical expenditure, in public health facilities in Ethiopia (2011-2015EFY), March 2024.

The reimbursement rates for exempted services were drastically underfunded, covering only 3.54% of expenditures between 2011 and 2015 (ETB 17,476,057.75 refunded from ETB 494,269,126.28 expended for exempted services). Furthermore, lack of clear directives for reimbursement, declined external budget source and weak system of recording and reporting mechanism adds to the financial strain of the public health facilities.

Despite CBHI implementation towards achieving universal healthcare, poor health insurance data management, documentation, delayed refund request and reimbursement has created a burden on health facilities budgets leading to a declined availability of essential medicines compromising quality of care.

Budget Utilization

The data collected and analyzed from a review of financial reports, sales records, and Model 19 from health facilities in 2011 – 2015 showed a concerning trend of allocated budget overspending, reaching as high as 140%, except for the Harari region, which stood at 87.2%. Regional disparities in internal revenue utilizations ranging from 27.6% to 89.6% were observed. Could be leading factor in 76.9% availability and 33 days out of stock of tracer medicine. The contributing factors include weak monitoring systems, poor data management, and shortages in human resources all hinder effective resource utilization, which paradoxically contributes to pharmaceutical wastage. Additionally, governance and policy gaps, such as delays in budget releases, ineffective procurement policies, and the absence of reimbursement guidelines were reported. Auditing practices are lacking, with only 56.7% of facilities undergoing annual audits and reports of inadequate auditing skills.

Conclusion & Recommendation

The assessment found major challenges in Ethiopia's public health pharmaceutical budgeting, including inconsistencies, delayed disbursements, and weak reimbursements. Low budget levels and regional disparities contribute to frequent medicine shortages and stockouts.

Recommendations

- The health sector budget should be increased, and pharmaceutical funding must be allocated based on evidence from demand forecasting to ensure efficient use and prevent stockouts.
- Strengthen forecasting through better training, data systems, and alignment with needs and budget cycles.
- Establish a committed demand implementation approach by linking forecasted needs to actual budgets and ensuring consistent follow-through in resource allocation.

- Align health facilities budget disbursement with health facilities procurement plan, which will help with planning and managing inventory better.
- Strengthen the system for recording, reporting, and reimbursement of pharmaceuticals used in exempted services and CBHI by issuing clear directives and leveraging digital technologies.
- Improve internal revenue use for pharmaceuticals in tertiary hospitals by adopting strategies that promote accountability and efficiency.
- Enhance regular annual auditing in all health facilities to ensure proper governance

References

1. Ministry of Health (2023). Health Sector Medium-Term Investment and Development Plan (HSMIDP). Addis Ababa, Ethiopia.
2. Ministry of Health (2022). Health Care Financing Strategy 2022–2031. Addis Ababa, Ethiopia.
3. MSH (2012). Managing Drug Supply: The Selection, Procurement, Distribution, and Use of Pharmaceuticals (3rd ed.). West Hartford, CT: Kumarian Press.
4. Ministry of Health (2022). Ethiopia National Health Accounts Report 2019/20. Addis Ababa, Ethiopia.
5. Debie, A., Khatri, R. B., & Assefa, Y. (2022). Contributions and challenges of healthcare financing towards universal health coverage in Ethiopia
6. World Health Organization (2016). Public Financing for Health in Africa: From Abuja to the SDGs. Geneva: WHO.
7. World Bank (2024). Inflation, Consumer Prices (Annual %): Ethiopia.

Low-Cost, High-Fidelity Placenta Simulator for Nursing and Midwifery Education: An Italy-Ethiopia Collaboration.

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Abstract

Introduction: Simulation training provides safe environment for skill acquisition and retention. This study addresses a critical challenge in Africa – umbilical cord and placenta management after childbirth –aiming to bridge theoretical learning with practical experiences through simulation. We realized a new low-cost high-fidelity simulator of placenta and umbilical cord.

Objective: We conducted a needs-based training course for nursing and midwifery students at St. Luke Hospital of Wolisso, Ethiopia, to validate our new simulator and compare its acceptability and teaching effectiveness with other two simulators (conventional low-fidelity model and human placenta).

Methods: We surveyed St. Luke Hospital medical experts to obtain their feedback on the new simulator's face, content, and usability. We carried out a simulation training course for 67 students who received theoretical lectures and simulation courses being divided into three groups according to the simulator used. We assessed the simulators' user acceptability using the Technology Acceptance Model (TAM) and compared the final objective evaluations by tutors between groups.

Results: Experts confirmed the new simulator's fidelity, material quality, and usability. Students training on the new simulator demonstrated higher objective scores and perceived it as more useful and user-friendly compared to human placenta, while there was no difference between conventional simulator and human placenta in the TAM items.

Conclusion: We validated a new high-fidelity simulator developed by the Sant'Anna School of Advanced Studies in Pisa, Italy, using the TAM scale and robust statistical methods, thanks to a successful collaboration with St. Luke's Hospital in a simulation training course where students achieved higher objective scores and perceived the simulator.

Keywords: Placenta, Umbilical cord, Simulation, Midwifery, Ethiopia

Introduction: Maternal and neonatal mortality remain critical global health issues, particularly in low-resource settings. Many deaths are preventable with proper management of childbirth complications, especially during the third stage of labor and immediate newborn care [1,2]. However, a significant gap often exists between theoretical knowledge and practical skills among healthcare providers. Simulation-based training offers a proven solution to bridge this gap, providing a safe environment for skill development and decision-making [3,4].

Objective: This study addresses the urgent need for improved training in umbilical cord and placenta management by presenting a collaborative effort between Italy and Ethiopia to develop and evaluate a low-cost, high-fidelity placenta simulator, aiming to enhance the practical competence of nursing and midwifery students in resource-constrained environments and ultimately reduce preventable deaths.

Methods: The new low-cost, high-fidelity placenta and umbilical cord simulator (Fig. 1) was developed collaboratively between Sant'Anna School and St. Luke's Hospital, building on a previously validated low-fidelity model. Validation involved expert surveys assessing face, content validity, and usability using Likert scales.

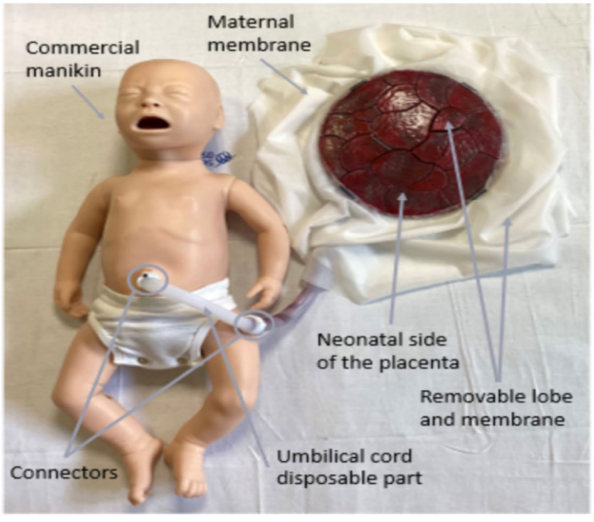

Figure 1 High fidelity umbilical cord and placenta simulator realized by the BioRobotics Institute of the Sant'Anna School

The study was conducted at St. Luke Catholic Hospital and College of Nursing and Midwifery in Ethiopia. Sixty-seven second-year nursing and midwifery students participated voluntarily. The training spanned four days, including lectures on placenta and cord care, followed by hands-on practice with three simulators: a standard low-fidelity simulator, the new high-fidelity simulator, and a real placenta.

Students were randomly assigned to groups for simulation practice and evaluated on skill performance by teachers using quantitative checklists. Pre- and post-training questionnaires assessed knowledge gain and technology acceptance based on the TAM model, analyzing perceived usefulness, ease of use, behavioral intention, and simulator fidelity.

Statistical analyses included Mann-Whitney U tests, paired t-tests, and partial least squares structural equation modeling (PLS-SEM) to evaluate outcomes and relationships between TAM dimensions, with significance set at $p < 0.05$.

Result and discussion: Thirty-seven health professionals, including midwives, nurses, and specialists, evaluated the new high-fidelity simulator. It received high scores for anatomical accuracy (4.38), material quality (4.24), visual appearance (4.43), ease of use (4.59), and teaching usefulness (4.59) on a 1–5 Likert scale.

Sixty-seven nursing and midwifery students (median age 21, 73% female) participated in the training. Pre/post-test scores significantly improved from 4.7 to 8.4 out of 10 after training (Tab 1). Students using the new simulator scored higher on usability and usefulness (TAM scores) than those using the standard simulator or real placenta.

Table 1 Pre-post difference in the Pre/post evaluation test scores

Score true/false	Mean	95% CI
Pre (Day 1)	4,7	4,4 to 4,9
Post (Days 3–4)	8,4	8,2 to 8,6
Difference pre-post	-3,7	-4 to -3,5
Student's t test *p*-value	<0.001	

Objective teacher evaluations showed the new simulator group achieved higher skill scores (mean 11) compared to the standard (8.5) and real placenta (7) groups (Tab 2).

Statistical analyses confirmed the reliability and validity of the assessment tools, with no significant differences between groups in factor loadings or structural model paths.

Table 2 Between- group differences in the objective final scores given by tutors

	C) Human placenta	A) Standard simulator	*p*-value
	n=22	*n*=22	
Final score by tutors, median (IQR)	7.0 (6.0, 9.0)	8.5 (3.0, 10.0)	0.94
	C) Human placenta	**B) New simulator**	***p*-value**
	n=22	*n*=23	
Final score by tutors, median (IQR)	7.0 (6.0, 9.0)	11.0 (8.0, 11.5)	<0.001
	A) Standard simulator	**B) New simulator**	***p*-value**
	n=22	*n*=23	
Final score by tutors, median (IQR)	8.5 (3.0, 10.0)	11.0 (8.0, 11.5)	<0.001

Overall, the new simulator demonstrated strong validity, acceptability, and improved teaching effectiveness, highlighting the value of a low-cost, high-fidelity simulator in resource-limited settings, as previously shown in the literature [5,6].

We developed and validated a new low-cost, high-fidelity placenta and umbilical cord simulator with Ethiopian experts and implemented a simulation course for midwifery and nursing students. Experts confirmed the simulator's realism and usability. Students showed significant improvement in knowledge and skills after training, with the new simulator outperforming standard models and real placenta in objective assessments. The course used familiar teaching methods, hands-on practice, and local facilitators to create an engaging learning environment.

Acceptability: The new simulator was rated easier to use and more useful than a real placenta, while no significant differences were found compared to the standard simulator in some usability aspects. Behavioral intention to use was similar between the new simulator and real placenta.

Limitations: This study has some limitations. First, our results are not generalizable because the study was conducted in a single center. Second, the evaluation session was conducted by all three groups with the new high-fidelity simulator; therefore, students who had done the training with that simulator may have been advantaged.

Furthermore, the simulator's silicone components are sustainable but not locally sourced, raising cost and supply challenges. Environmental factors like heat and water access in Africa also complicate equipment maintenance.

Implications: This is the first high-fidelity umbilical cord and placenta simulator allowing comprehensive training in a safe, reusable, and biohazard-free environment. It offers better anatomical realism than existing low-fidelity models and avoids risks linked to using real organs. While the disposable parts are costly, the reusable components enable long-term use and integration with local materials. The simulator supports improved preparedness for real clinical scenarios and fosters safer, more efficient training in resource-limited settings. Collaboration between manufacturers and low-income institutions could expand access to such tools.

Conclusion and recommendations: We successfully validated the new high-fidelity umbilical cord and placenta simulator developed by Sant'Anna School using established tools and the TAM scale. Collaboration with St. Luke's College enabled a rigorous simulation training course that met high educational standards. Students trained with the new simulator scored higher in evaluations and found it more useful and easier to use than the real placenta, demonstrating its value as an effective teaching tool.

These results support the integration of high-fidelity simulators into medical education to enhance learning outcomes and prepare healthcare professionals better. Future research should explore broader applications of such simulators, especially within Basic Emergency Obstetric and Newborn Care (BEmONC) programs in Ethiopia, to assess their impact on training for critical maternal and neonatal emergencies.

Reference:

1. Sobhy S, Arroyo-Manzano D, Murugesu N et al. Maternal and perinatal mortality and complications associated with caesarean section in low-income and middle-income countries: a systematic review and meta-analysis. The Lancet. 2019;393(10184):1973–82.https://link inghub. elsevier.com/retrieve/pii/S0140673618323869

2. World Health Organization. WHO recommendations on Postnatal care of the mother and newborn. 2014; https:// www.who.int/publications/i/

item/9789241506649

3.Swart R, Duys R, Hauser ND, Sass. South African simulation survey – a review of simulation-based education. South Afr J Anaesth Analgesia. 2019;25(4):12–20.

4. Olalere AA, Samuel Babafemi O,Odufeko Gabriel T. Medical Simulation a Tool yet untapped in most developing nations in Africa. Int J Comput Appl. 2014;97(5):1–4.

5. Maglio S, Tamirat S, Tesfaye M et al. Toward the design of a tailored training course for birth assistance: an Ethiopian experience. Pan African Medical Journal. 2024;47. https:// www.panafrican-med-journal.com/content/article/47/32/ full

6. Campain NJ, Kailavasan M, Chalwe M et al. An Evaluation of the Role of Simulation Training for Teaching Surgical Skills in Sub-Saharan Africa. World J Surg. 2018;42(4):923–9. https://onlinelibrary.wiley.com/doi/ https://doi.org/10.1007/s00268-017-4261-7

Quanquaye (ቋንቋዬ) Voice to text translation AI-Assisted EMR Data Entry Using the Medispeak Framework

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Abstract

Introduction: In Ethiopia, manual data entry in Health Management Information Systems (HMIS) often leads to inefficiencies, errors, and inequities, particularly for health workers with limited typing skills or disabilities. This voice-enabled system integrated with the Bahmni EMR, leverages OpenAI's Whisper API and GPT-3.5 to streamline data entry and enhance patient data management.

Objective: To design, implement, and evaluate an AI-assisted voice-enabled electronic medical record (EMR) data entry system, quanquaye (ቋንቋዬ) AI, integrated with the Bahmni EMR to improve patient data management in Ethiopia.

Method: Agiel software development methods with user acceptance evaluation with 30 health workers, 5 data managers, and 2 HMIS staffs at Harar regional health bureaus. quanquaye (ቋንቋዬ) AI-powered voice assistance tool using OpenAI's Whisper API for speech-to-text transcription and GPT-3.5 for form filling, integrated with Bahmni EMR to streamline data entry.

Results: Users acceptance evaluation results indicate 50% reduction in data entry time, 60% reduction in errors, and 85% user satisfaction.

Conclusions: quanquaye (ቋንቋዬ) AI significantly enhances data management efficiency and equity, offering a scalable model for low-resource settings. Policy integration and capacity building are critical for sustainability.

Key words: Speech to text, Artificial Intelligence, Medspeak, quanquaye (ቋንቋዬ)

Introduction

In Ethiopia, the effective utilization of Health Management Information Systems (HMIS) is fundamental for improving health service outcomes through evidence-based interventions. However, various challenges inhibit the optimal performance of such systems, particularly the fragmented nature of electronic platforms like eCHIS, DHIS2, and Electronic Medical Records (EMR). These systemic issues contribute to incomplete and inaccurate patient data, compromising health service delivery throughout the country (Zerfu et al., 2025; Adane et al., 2021). A notable aspect of the problem is associated with manual data entry, as health workers are burdened by time-consuming processes that are not only prone to errors but also create barriers for health workers, especially those with disabilities or limited typing skills (Dassah et al., 2022;, Ganle et al., 2020). This highlights the inequities present in health data collection efforts as reported by the World Health Organization (WHO) (Shiferaw et al., 2017).

The Ethiopian Ministry of Health's Health Sector Transformation Plan (HSTP) recognizes the critical need to enhance HMIS functionality and promote equitable health service delivery. The initiative focuses on integrating innovative technologies such as Artificial Intelligence (AI) to streamline data entry processes. One promising solution is the Medispeak framework, which incorporates voice assistance to facilitate data input. This integration employs OpenAI's Whisper API for speech-to-text transcription, coupled with GPT-3.5 for structured form completion. Such advancements aim to alleviate some barriers linked to manual data entry and improve data quality (Zerfu et al., 2025; , Shama et al., 2021). The implementation of quanquaye (ቋንቋዬ) AI in the Harar and Somali regions represents a strategic approach to increasing the efficiency and accuracy of patient data management while reinforcing adherence to gender-disaggregated data collection.

The objectives of the research study is

- To assess the impact of *quanquaye* (ቋንቋዬ) AI on the completeness and accuracy of patient data.
- To determine the extent to which *quanquaye* (ቋንቋዬ) AI reduces data entry time and errors.
- To evaluate the effectiveness of *quanquaye* (ቋንቋዬ) AI in promoting equity in patient data collection

Methods

This study used a mixed-methods design to develop and evaluate Quanquaye (ቋንቋዬ), an AI-assisted voice-enabled EMR integrated with the Bahmni platform. Agile software development enabled iterative refinement with stakeholder input, while a quasi-experimental pre-post evaluation assessed its impact on data management. Quantitative measures and qualitative feedback ensured both practical system development and rigorous real-world assessment, consistent with health informatics recommendations (Kebede et al., 2020).

The study population included health workers, data managers, and HMIS staff from public health facilities under the Harar regional health bureau. Participants (n=37: 30 health workers, 5 data managers, 2 HMIS staff) were purposively sampled to capture diverse EMR experience, typing proficiency, and potential barriers such as disabilities. This approach ensured representation of key user groups relevant to usability and equity evaluation. The sample size was guided by power analysis (moderate effect size, 80% power, α=0.05) and usability research standards suggesting 30–50 participants are adequate for pilot testing and thematic saturation. While sufficient for this feasibility study, larger-scale validation is recommended.

The development process, guided by the Medspeak framework, followed four agile phases: (1) requirements analysis through

stakeholder workshops, (2) prototyping with voice-to-text integration, (3) implementation using Python (Whisper API, GPT-3.5) and React.js, and (4) iterative testing with bi-weekly feedback. The system was built to reduce inefficiencies and improve accessibility by enabling local dialect voice commands and ensuring full compatibility with Bahmni EMR.

A pre-post quasi-experimental design was used, with participants first completing manual EMR entry (baseline) and then using Quanquaye (ቋንቋዬ) after a one-day training. They applied the system in routine workflows for two weeks. Primary outcomes were:

- **Data entry time:** Average minutes per patient record, measured via system timers across 10 standardized cases.
- **Error rates:** Proportion of discrepancies against a gold-standard script, assessed by blinded reviewers in 100 randomly selected records.
- **User satisfaction and equity:** Measured with an adapted System Usability Scale (SUS) plus items on voice recognition and accessibility, and explored further through semi-structured interviews with 15 participants.

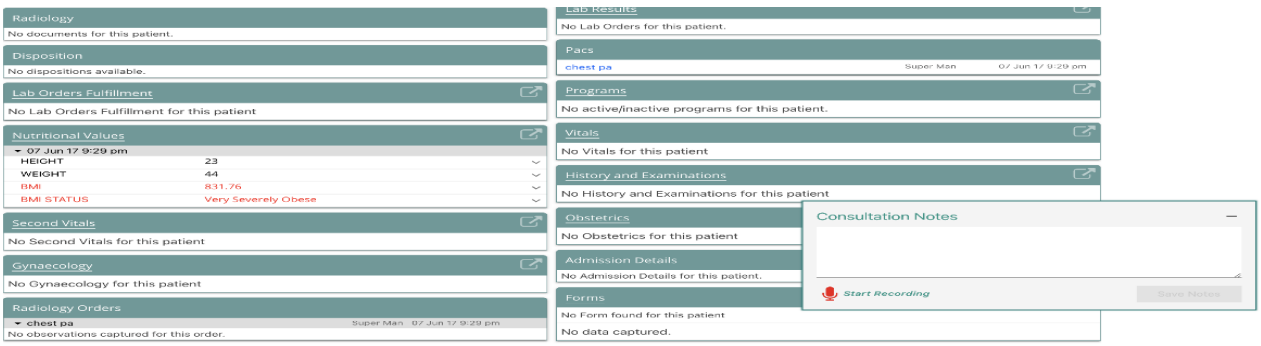
Data collection ensured anonymity, with quantitative responses analyzed using descriptive statistics (means, standard deviations, paired t-tests for pre-post comparisons) in R programming, and qualitative data thematically coded using NVivo software to identify recurring patterns.

Results

The implementation of Quanquaye (ቋንቋዬ), integrated with the Bahmni EMR platform, demonstrated significant improvements in patient data management during the user acceptance evaluation, involving 30 health workers, 5 data managers, and 2 HMIS staff, yielded robust quantitative and qualitative outcomes. Quantitative results from the adapted System Usability Scale (SUS) questionnaire showed a 50% reduction in data entry time compared to manual methods, with an average of 1.5 minutes per patient record using Quanquaye (ቋንቋዬ) AI versus 3 minutes manually. Error rates decreased by 60%, with discrepancies in only 8 out of 100 randomly selected records compared to 20 errors in manual entries. User satisfaction was high, with 85% of participants rating Quanquaye (ቋንቋዬ) AI as “very effective” or “extremely effective” for streamlining workflows. Qualitative feedback from semi-structured interviews highlighted enhanced accessibility, particularly for users with limited typing skills or disabilities, and reduced cognitive load due to intuitive voice commands. Iterative refinements, such as enhanced voice recognition for local dialects, further improved transcription accuracy and user experience, confirming Quanquaye (ቋንቋዬ) AI’s efficacy in addressing efficiency and equity challenges in low-resource settings.

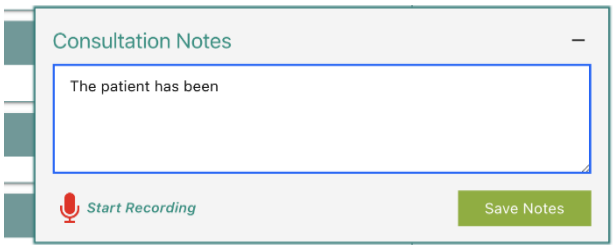
Features of the developed system

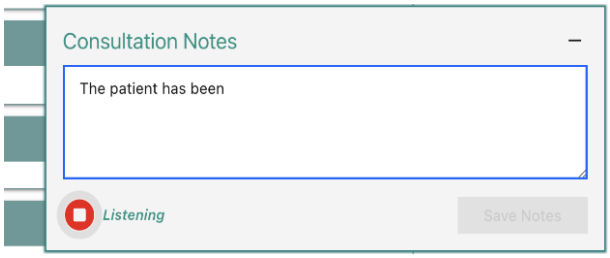
Once the doctor clicks on the button, the consultation box with the speech-to-text converter opens as seen below



The doctor can drag and move the consultation box.

We can observe that the “save notes” button is deactivated after the box is open. This is due to the fact that the box contains no notes. The physician can now select “start recording.”





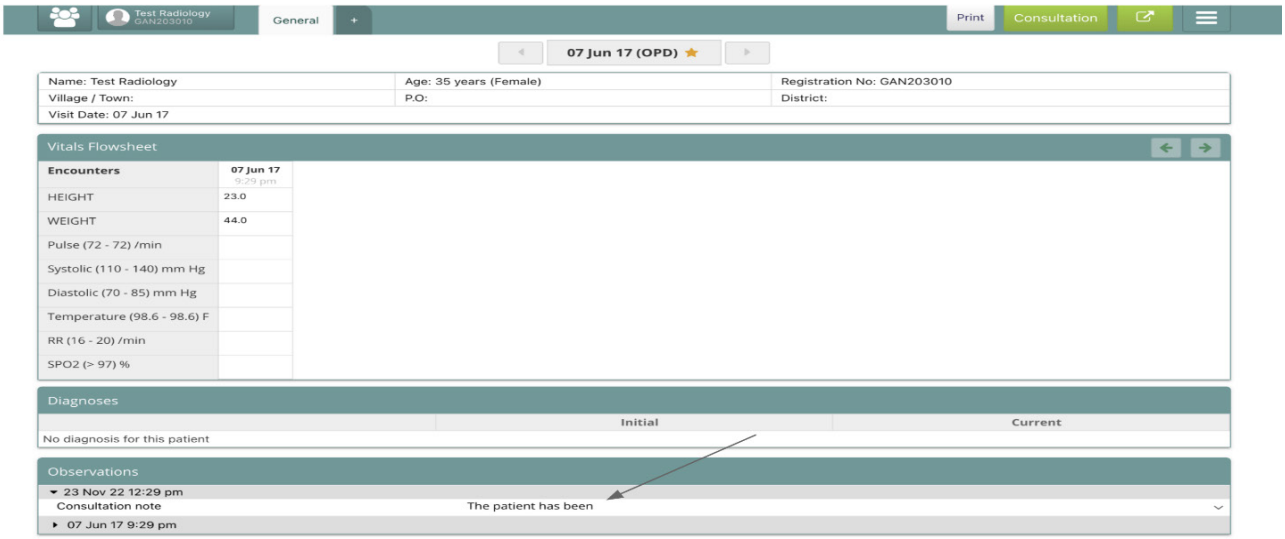
The doctor can begin talking to take notes as soon as they select “Start Recording.” Keep in mind that the doctor must click the stop button before the save button becomes active. Additionally, the ability to update notes while they are being listened to has been disabled.

In the screenshot above, we can see that the save notes has been enabled after the recording has been stopped.

Note: Doctor can also use keyboard to type in this box without using voice as the primary means

Saving the notes

Once the notes are saved, the doctor can verify in the following places at present:



Discussion

The evaluation of Quanquaye (ቋንቋዬ) AI demonstrates its transformative potential in addressing longstanding challenges in Ethiopia’s Health Management Information Systems (HMIS). By integrating OpenAI’s Whisper API and GPT-3.5 with the Bahmni EMR, Quanquaye (ቋንቋዬ) AI achieved a 50% reduction in data entry time and a 60% decrease in errors, aligning with prior studies on AI-driven health data solutions (Zerfu et al., 2025; Shama et al., 2021). These results suggest that voice-enabled systems can significantly enhance efficiency, particularly in low-resource settings were manual data entry burdens health workers. The 85% user satisfaction rate underscores Quanquaye (ቋንቋዬ) AI’s usability and accessibility, especially for health workers with limited typing skills or

disabilities, addressing equity gaps noted in the literature (Dassah et al., 2022; WHO, 2017). However, challenges such as variable dialect recognition highlight the need for ongoing system refinement. Quanquaye (ቋንቋዬ) AI's success indicates a scalable model for low-resource settings, but sustained adoption requires policy integration and capacity building to ensure infrastructure and training support.

References

1. Adane, A., Adege, T., Ahmed, M., Anteneh, H., Ayalew, E., Berhanu, D., … & Janson, A. (2021). Routine health management information system data in ethiopia: consistency, trends, and challenges. Global Health Action, 14(1). https://doi.org/10.1080/16549716.2020.1868961
2. Bright, T. and Kuper, H. (2018). A systematic review of access to general healthcare services for people with disabilities in low- and middle-income countries. International Journal of Environmental Research and Public Health, 15(9), 1879. https://doi.org/10.3390/ijerph15091879
3. Dassah, E., Aldersey, H., McColl, M., & Davison, C. (2022). Health care providers' and persons with disabilities' recommendations for improving access to primary health care services in rural northern ghana: a qualitative study. Plos One, 17(9), e0274163. https://doi.org/10.1371/journal.pone.0274163
4. Ganle, J., Baatiema, L., Quansah, R., & Danso-Appiah, A. (2020). Barriers facing persons with disability in accessing sexual and reproductive health services in sub-saharan africa: a systematic review. Plos One, 15(10), e0238585. https://doi.org/10.1371/journal.pone.0238585
5. Kebede, M., Adeba, E., & Cheme, M. (2020). Evaluation of quality and use of health management information system in primary health care units of east wollega zone, oromia regional state, ethiopia:. BMC Medical Informatics and Decision Making, 20(1). https://doi.org/10.1186/s12911-020-01148-4
6. Shama, A., Roba, H., Abaerei, A., Gebremeskel, T., & Baraki, N. (2021). Assessment of quality of routine health information system data and associated factors among departments in public health facilities of harari region, ethiopia. BMC Medical Informatics and Decision Making, 21(1). https://doi.org/10.1186/s12911-021-01651-2
7. Shiferaw, A., Zegeye, D., Assefa, S., & Yenit, M. (2017). Routine health information system utilization and factors associated thereof among health workers at government health institutions in east gojjam zone, northwest ethiopia. BMC Medical Informatics and Decision Making, 17(1). https://doi.org/10.1186/s12911-017-0509-2
8. World Health Organization. Global Strategy for Health Information Systems. Geneva: WHO, 2020.
9. Zerfu, T., Genye, T., & Tareke, A. (2025). Quality of routine health and nutrition data in ethiopia: a systematic review. Plos One, 20(3), e0316498. https://doi.org/10.1371/journal.pone.0316498

Predictors of Spontaneous Abortion Among Women Attending Public Hospitals of East Ethiopia, A Case-Control Study.

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Abstract

Introduction: Spontaneous abortion is one of the most common complications of early pregnancy, occurring in 15-20% of pregnant women. Every year, an estimated 23 million miscarriages occur worldwide, resulting in 44 pregnancy losses every minute. Consistent findings show that spontaneous abortion has a negative impact on current and consecutive pregnancies. It also has an enormous economic impact. When all of these factors are combined with the idiopathic nature of the problem, identifying predictors of spontaneous abortion will have a significant impact on preventing the problem. However, no studies have been conducted in Ethiopia on this topic.

Objective: this study aimed to assess the predictors of spontaneous abortion among women attending referral and specialized public hospitals in Eastern Ethiopia.

Methods: An institutional-based unmatched case-control study design was used. Three hundred seventy-one (371) cases and three hundred seventy-one (371) controls were studied. The study was conducted Sep 15, 2022, to Nov 15, 2022. The data were collected by using an interviewer-administered structured questionnaire. The collected data were entered into Epi data version 4.6 and then exported to SPSS window version 25 for analysis. Bivariate and multivariable analyses were used to determine the associations between each independent variable and the outcome variable. All the variables with a P value ≤ 0.25 in the bivariate analysis were included in the final model of multivariable analysis to control for possible confounders. A P value <0.05 was considered to indicate a statistically significant association.

Result: Spontaneous abortion was significantly associated with several factors: intended pregnancy reduced the odds by 56% (AOR = 0.443; 95% CI: 0.279–0.703), and folate intake during pregnancy lowered the odds by 93% (AOR = 0.067; 95% CI: 0.042–0.106). In contrast, coffee consumption increased the odds nearly fourfold (AOR = 3.699; 95% CI: 2.341–5.846), stressful life events raised the odds over sevenfold (AOR = 7.550; 95% CI: 3.932–14.496), and a history of spontaneous abortion was associated with nearly nine-fold higher odds (AOR = 8.860; 95% CI: 3.197–24.604).

Conclusion: This study provides evidence that several predictors are independently associated with spontaneous abortion. Importantly, many of these factors can be modified or prevented through appropriate awareness and education among reproductive-age women. By addressing these risk factors, the incidence of spontaneous abortion can be reduced.

Keywords: Spontaneous abortion, Case-control, early trimester bleeding, miscarriage, pregnancy loss

Background

Spontaneous abortion is generally defined as the loss of an intrauterine pregnancy before it reaches viability. The gestational age or fetal weight can be used to determine viability limits (1). Miscarriage is defined by the World Health Organization as the expulsion of a fetus (embryo) weighing less than 500 g and corresponding to approximately 22 weeks gestation (2). However, in Ethiopia, it is defined as pregnancy termination occurs before 28 weeks after the last normal menstrual period or when the fetal weight is less than 1000 g/m. suppose that the Gestational age (GA) is uncertain (3).

Every year, an estimated 23 million miscarriages occur worldwide, resulting in 44 pregnancy losses every minute. Miscarriage occurs in 15.3% of all recognized pregnancies (95% CI: 12.5%–18.7%) (1). Spontaneous abortion has emerged as a serious global reproductive health concern, with negative consequences for physical and mental health as well as increased economic strain (4, 5). The incidence of spontaneous abortion in developed nations such as the United States of America is approximately 15.7%, and in China, it is 5%; in India approximately 4.7% of pregnancies end up as spontaneous abortion (SAB). However, no data can be retrieved from Ethiopia about this problem.

Consistent findings have shown that spontaneous abortion has a negative impact on current and consecutive pregnancies. It also has an enormous economic impact. Furthermore, it increases the risk of consecutive maternal ischemic heart disease by 1.6-fold (11, 12). There have also been reports of significantly higher rates of perinatal mortality and low birth-weight infants. According to a study conducted in Japan, recurrent pregnancy loss was linked to an increased risk of placental adhesions and uterine infection (13). Miscarriage is expected to cost the United Kingdom £471 million annually in short-term economic costs alone (1).

The Ministry of Health of Ethiopia recommends timely and safe management of spontaneous abortion as part of its broader reproductive health strategy. Guidelines emphasize early diagnosis, access to appropriate care—including medication and surgical options—and integration with family planning and counseling services. Health providers are trained to offer respectful, evidence-based care aligned with WHO standards, aiming to reduce complications and improve maternal outcomes.

Although several studies have been published on the risk factors for spontaneous abortion, it is difficult to extrapolate the causes to all women around the world due to differences in lifestyle, behavior, and environmental circumstances. Therefore, a regionalized survey of likely causes is required (14). Moreover, according to the suggestion of different studies, it is critical to explore the risk factors for spontaneous abortion because risk factor modification is the only preventative measure for spontaneous abortion (5), and lowering all of these risk factors to low-risk levels could prevent 25.2% of miscarriages. Modifying risk factors before and during pregnancy could prevent 14.7% and 12.5%, respectively, of miscarriages (15). Therefore, identifying these factors is crucial for the early prevention of spontaneous abortion and for preventing complications that can arise from this problem. However, no study conducted in Ethiopia has investigated the predictors of spontaneous abortion. Therefore, this study aimed to determine the predictors of spontaneous abortion among women attending referral and specialized public hospitals in East Ethiopia from Sep 15, 2022, to Nov 15, 2022. As a result, this study is novel nationally in terms of investigating the topic.

Methods

Study Design: A facility-based unmatched case-control study design was used.

Study population

Cases: The mothers who had spontaneous abortions and who attended the gynecologic outpatient department of the three public hospitals during the study period.

Controls: Pregnant mothers who were beyond 20 weeks gestation, who had no history of vaginal bleeding during the current pregnancy, and who attended the antenatal clinics of the three public hospitals during the study period.

Selection of cases and controls

Cases: women who experienced spontaneous abortion (the loss of pregnancy naturally before twenty weeks of gestation).

Controls: pregnant mothers who were more than 20 weeks of gestational age and who had no history of vaginal bleeding before mid-pregnancy.

Exclusion criteria

Cases: if the bleeding was due to an attempt made by a woman to terminate a pregnancy, mothers with unknown gestational age, were excluded.

Controls: pregnant mothers with current or history of bleeding, if the gestational age was unknown.

Sample Size Determination

The sample size was determined by using the double population proportion exposure difference formula for the predictors of spontaneous abortion. The sample size was calculated by using Epi Info 7 Software: with the following assumptions

Power: 80% statistical power, Confidence Level: 95%, α=0.05, Cases-to-Control Ratio: a 1:1 ratio of cases to controls, Exposure Proportions: Cases: 25% of participants had exposure. Controls: 16% of participants had exposure.

These proportions were derived from a previous study conducted in Japan, focusing on the variable of 'previous history of one spontaneous abortion' (16). Therefore, based on the previously provided information, the sample size was computed as 674, after 10% nonresponse rate added the final sample size was found to be 741.4 (371 cases and 371 controls).

Sampling Procedure

In east Ethiopia, there are two specialized hospitals and one referral public hospital. This research included all these hospitals (selected based on the availability of gynecologic outpatient departments). Study subjects from each hospital (exclusively for cases and controls) were chosen via proportional allocation of the determined sample size for each hospital based on the average two-month client flow. Two-month average client flow in the gynecology outpatient department (to proportionally allocate a sample size of 371 cases) and in the antenatal care unit (to proportionally allocate a sample size of 371 controls)

Cases: were selected from the gynecologic outpatient department and gynecologic ward of each hospital by using consecutive sampling techniques until the desired sample for each hospital was met.

Controls were selected from the antenatal clinic by using a systematic random sampling technique. To obtain the total population (N), a one-year antenatal care unit client flow was taken from all hospitals, and then the average client flow for two (2) months was computed. To obtain the sampling interval (K), the total population (average two-month client flow), which is (N), was divided by the determined sample size, which is (371). Then, every K^{th} (3) of controls was selected from according to their entrances to the antenatal clinic.

The equation to calculate the proportional allocation of sample size, $n_i = \frac{N_i * n}{N}$

n_i = sample size for each hospital

N_i= two-month average client flow for each hospital

n= determined sample size

N= two-month average client flow for all hospitals

K= 329+405+355= 1089/371= 3

Data collection methods

Data collection instrument

An interviewer-administered structured questionnaire was used.

Data Processing and Analysis

After data collection, the data were coded, cleaned, and entered into Epi data statistical software version 4.6 and then exported to SPSS window version 25 for analysis. The odds ratio (OR) and 95% confidence interval (CI) were estimated to identify predictors of spontaneous abortion via multivariate analysis via binary logistic regression. A P value <0.05 indicated a statistically significant association.

RESULTS AND DISCUSSION

This study revealed that the odds of spontaneous abortion were 3.7 times [AOR=3.699, 95% CI: (2.341, 5.846)] greater among women who drank coffee regularly during the pre-pregnancy and current pregnancy periods than among women who did not drink. A case-control study conducted in Nepal also revealed that the odds of spontaneous abortion were reduced by 64% [AOR=0.34, 95% CI (0.2–0.63)] among those who did not drink coffee (17). A possible explanation could be that caffeine can cross the placental barrier and affect fetal cell development. It may increase the risk of miscarriage (18).

The results of the current study also revealed that the odds of spontaneous abortion were 7.5 times [AOR=7.55, 95% CI: (3.932, 14.496)] greater among women who experienced severe stressful life events during their current pregnancy than among women who did not experience stress. This finding is in line with a study conducted in China, which reported that the odds of early trimester vaginal bleeding increased two (2)-fold [AOR=2.22, 95% CI (1.56-3.16)] among women who experienced stressful life events (19). A possible explanation for this can be that stress can have a direct effect on the hypothalamic-pituitary-adrenal axis, which is responsible for the production of stress hormones such as catecholamines, adrenocorticotropin, and glucocorticoids. These hormones can impact the maternal basement membrane in various ways, including reducing uterine blood flow and causing oxidative stress and hemorrhaging due to stress (20). However, a contrary result was found in a study conducted in Nepal; according to this study, the odds of spontaneous abortion were 10 times [AOR=10, 95% CI (1.06-96.96)] greater among women who did not experience an emotional disturbance (17). Moreover, no association [ARR=1.14 95% CI (0.74-1,76)] was found between stress and SA according to another cohort study conducted in China (21).

Additionally, the current study showed that the odds of spontaneous abortion were 8.9 times [AOR=8.86, 95% CI: (3.197, 24.604)] greater among women who had a previous history of spontaneous abortion than among those who did not. This finding is consistent with a study conducted in Iran, which reported that the odds of SA were 3.4 times (AOR=3.43, 95% CI (2.03-5.79)) greater among women who had previously undergone spontaneous abortion (22).

According to the current study, women who reported that their pregnancy was intended for pregnancy were 56% [AOR=0.443, 95% CI: (0.279, 0.703)] less likely to have a spontaneous abortion than women who had an unintended pregnancy. This finding is consistent with a

study conducted in Nepal, which showed that having a planned pregnancy reduces the odds of spontaneous abortion by 90% [AOR=0.1, 95% CI (0.04-0.22)] (17). However, a study conducted in Brazil also indicated that there was a statistically significant association between SAB and the use of morning-after pills for the prevention of current pregnancy (23).

In this study, compared with women who did not consume folate, women who consumed folic acid before or during their current pregnancy had a 93% [AOR=0.067, 95% CI: (0.042, 0.106)] reduced risk of having SAB. Similarly, a cohort study conducted in the United States of America revealed that a greater intake of folic acid was associated with a reduced risk [ARR=0.8, 95% CI (0.71-0.9)] of spontaneous abortion. A study from China also reported that folic acid intake during pregnancy and pre-pregnancy periods were found to be protective factor [AOR=0.7, 95% CI (0.54-0.9)] against spontaneous abortion.

Table 1. Predictors of spontaneous abortion among mothers attending specialized and referral public hospitals in East Ethiopia, 2022 (n=742).

Variables	Cases	Controls	COR (95% CI)	AOR (95% CI)
Maternal Education	No formal education	94	62	1	1
	Primary	136	118	0.76 (0.507, 1.139)	0.733 (0.405, 1.325)
	Secondary	95	140	0.45 (0.296, 0.677) **	0.543 (0.292, 1.013)
	More than secondary	46	51	0.595 (0.357, 0.992)	0.658 (0.310, 1.396)
Coffee consumption	Yes	218	76	5.53 (3.992, 7.662) **	3.699 (2.341, 5.846) **
	No	153	295	1	1
Smoker partner	Yes	110	66	1.95 (1.377, 2.756) **	1.388 (0.836, 2.305)
	No	261	305	1	1
History of stillbirth	Yes	20	10	2.06 (0.949, 4.457)	2.707 (0.971, 7.550)
	No	351	361	1	1
History of spontaneous abortion	Yes	67	6	13.4 (5.736, 31.336) **	8.869 (3.197, 24.60) **
	No	304	365	1	1
Folate Intake	Yes	87	322	0.047 (0.032, 0.068) **	0.067 (0.042, 0.106) **
	No	284	49	1	1
Severe Stress	Yes	139	18	11.75 (6.99, 19.727) **	7.55 (3.93, 14.496) **
	No	232	353	1	1
Antibiotic intake	Yes	143	162	0.809 (0.604, 1.085)	0.640 (0.406, 1.008)
	No	228	209	1	1
Heavy material lifting	Yes	221	247	0.74 (0.548, 0.998)	0.766 (0.488, 1.202)
	No	150	124	1	1

Conclusion and Recommendation

This study provides evidence that several predictors are independently associated with spontaneous abortion. Spontaneous abortion was less likely among women with intended pregnancies (56% lower odds) and those who took folate during pregnancy (93% lower odds). In contrast, coffee consumption increased the odds nearly fourfold, stressful life events raised the odds over sevenfold, and a history of spontaneous abortion was linked to nearly nine-fold higher odds. Importantly, many of these factors can be modified or prevented through appropriate awareness and education among reproductive-age women. By addressing these risk factors, the incidence of spontaneous abortion can be reduced.

References

1. Quenby S, Gallos ID, Dhillon-Smith RK, Podesek M, Stephenson MD, Fisher J, et al. Miscarriage matters: the epidemiological, physical, psychological, and economic costs of early pregnancy loss. The Lancet. 2021;397(10285):1658-67.
2. WHO. Manual of the international statistical classification of diseases, injuries, and causes of death : based on the recommendations of the ninth revision conference, 1975, and adopted by the Twenty-ninth World Health Assembly, 1975 revision. [Available from: https://apps.who.int/iris/handle/10665/40492.
3. Ethiopia M. Management protocol on selected obstetrics topics for hospitals. Addis Ababa2020.
4. Tsikouras P, Deftereou T, Anthoulaki X, Bothou A, Chalkidou A, Gaitatzi F, et al. Abortions in first trimester pregnancy, management, treatment. Induced Abortion and Spontaneous Early Pregnancy Loss-Focus on Management: IntechOpen; 2019.
5. MacWilliams K, Hughes J, Aston M, Field S, Moffatt FW. Understanding the experience of miscarriage in the emergency department. Journal of Emergency Nursing. 2016;42(6):504-12.
6. Xu Q, Chan Y, Feng Y, Zhu B, Yang B, Zhu S, et al. Factors associated with fetal karyotype in spontaneous abortion: a case-case study. BMC Pregnancy and Childbirth. 2022;22(1):320.
7. Eldabae EE, Taha N, Khalifa MA, Gamal A. Risk Factors Associated with Spontaneous Abortion at Woman's Health Hospital Assiut University. Assiut Scientific Nursing Journal. 2019;7(18):105-13.
8. Zakira S, Hardianto G. Risk factors associated with spontaneous abortion in Dr. Soetomo General Hospital Surabaya: a case-control study. Jurnal Kebidanan Midwiferia. 2021;7(1):65-80.
9. Adel LM, Farajallah S, Al-Shanableh Z, Issa F, Al-Ani D, Muttappallymyalil J, et al. Determinants of spontaneous abortion: A hospital based case control study in Ajman, UAE. GMJ. 2015;4(S2):s24-s35.
10. Muanda FT, Sheehy O, Bérard A. Use of antibiotics during pregnancy and risk of spontaneous abortion. Cmaj. 2017;189(17):E625-E33.
11. Lykke JA, Dideriksen KL, Lidegaard Ø, Langhoff-Roos J. First-trimester vaginal bleeding and complications later in pregnancy. Obstetrics and gynecology. 2010;115(5):935-44.
14. Oliveira MTS, Oliveira CNT, Marques LM, Souza CL, Oliveira MV. Factors associated with spontaneous abortion: a systematic review. Revista Brasileira de Saúde Materno Infantil. 2020;20:361-72.

Community-Based Delivery of Life-saving Maternal and Newborn Health Interventions in Vulnerable Communities of Ethiopia: Feasibility, Acceptability, and Effectiveness

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Abstract

Introduction: In Ethiopia, women in remote agrarian and pastoralist areas face significant barriers to accessing timely, quality maternal and newborn health (MNH) services. High rates of home births, limited facility access, and supply gaps contribute to preventable deaths. This study assessed the fidelity, feasibility, acceptability, reach, and safety of delivering an integrated MNH intervention package through trained community health volunteers—Village Health Leaders (VHLs).

Methods: A mixed-methods implementation research design was employed in selected agrarian and pastoralist woredas. Trained VHLs delivered a home-based MNH package that included misoprostol for postpartum hemorrhage prevention, chlorhexidine for umbilical cord care, iron-folic acid for anemia prevention, and postpartum family planning counseling and services. Routine program monitoring data were triangulated with qualitative insights from interviews and focus groups involving mothers, health workers, and community leaders.

Results: The intervention reached over 3,800 pregnant women, with high uptake of key MNH services. Among women delivering at home, over 90% used misoprostol correctly, and most applied chlorhexidine. VHLs adhered to protocols, conducted timely referrals, and engaged communities effectively. Their cultural competence and strong community trust contributed to high intervention acceptability. Challenges included supply shortages, lack of formal recognition for VHLs, and weak referral feedback systems. Nonetheless, the intervention improved access, equity, and continuity of care—without reducing facility delivery rates.

Conclusions: Community-based delivery of essential MNH services by VHLs is feasible, acceptable, and safe in underserved agrarian and pastoralist settings. The model strengthens primary health care by bridging access gaps and extending the continuum of care. To sustain and scale this approach, investments are needed in supervision and supply chains. These findings support integrating trained community volunteers into national MNH strategies to reduce preventable maternal and newborn mortality.

Keywords: community-based service delivery, implementation research, maternal and newborn health, misoprostol, Village Health Leader

Introduction

Despite substantial investments in maternal and newborn health (MNH), facility-based care uptake remains low in Ethiopia, where nearly half of the four million annual births occur at home under unsafe conditions. Vulnerable groups in remote agrarian and pastoralist areas face systemic, socio-cultural, and logistical barriers limiting timely access to quality care [1]. Many hemorrhage-related maternal deaths happen outside well-resourced facilities lacking skilled obstetric care [2]. National efforts to improve facility delivery have yet to fully reach these populations.

Community-based platforms offer promising solutions. Evidence from low- and middle-income countries (LMICs) shows community health workers (CHWs), when well trained and supported, effectively deliver essential MNH services and supplies [3]. Specifically, community delivery of misoprostol for postpartum hemorrhage (PPH), iron-folic acid (IFA) for anemia, chlorhexidine for cord care, and progestin-only pills (POPs) for postpartum family planning has shown promising results in LMICs [4, 5].

However, scaling community-based MNH interventions remains uneven due to policy hesitations, supervision gaps, and concerns about misuse [6]. To address these challenges, JSI and Amref Health Africa, partnering with the Ministry of Health and regional bureaus, have been conducting implementation research since November 2022. The study assessed the fidelity, feasibility, acceptability, and safety of community-based delivery of MNH interventions.

Methods

Intervention Description

Since April 2022, JSI and Amref Health Africa have been implementing the Improve Primary Health Care Service Delivery (IPHCSD) project. Starting December 2023, the project introduced home-based MNH interventions—facility birth promotion, education on birth preparedness, and distribution of IFA, misoprostol, chlorhexidine, and POP—across seven health centers and 38 vulnerable communities (8 agrarian, 30 pastoral), reaching 210,787 people in Chifra (Afar), Degahabur (Somali), and Seka Chekorsa (Oromia).

Through consultations, stakeholders agreed on a home-visit-based package to be delivered by Village Health Leaders (VHLs), who support Health Extension Workers (HEWs) in delivering RMNCH services. Introduced by the MOH in 2020, VHLs are trusted, community-selected volunteers (mostly young women with ≥Grade 6 education), acting as liaisons between households and health posts.

VHLs identify and enroll pregnant women, conduct three targeted home visits during pregnancy and postpartum, and ensure delivery of essential interventions and counseling on birth preparedness and complication readiness. A total of 187 VHLs (78 agrarian, 109 pastoral) were trained and equipped with start-up kits, including misoprostol, chlorhexidine, POP, IFA, counseling tools, and data collection materials. In pastoral areas, VHLs also received clean birth kits (e.g., towel, cape, cord blade).

The project developed tools. Essential MNH commodities were secured through the health system.

Design and sampling methods

This mixed-methods research combines a quantitative cohort study (conducted from December 2023 to June 2025) with a qualitative inquiry (carried out in February 2025). The quantitative component enrolled pregnant women who were followed at home by VHLs from early pregnancy through the first postpartum week.

The qualitative component used a phenomenological approach among purposively selected participants across agrarian and pastoral settings. Participants include: postpartum women, VHLs, and program managers (e.g., HEWs, PHCU directors, woreda experts).

Data collection and analysis

VHLs collected longitudinal data during home visits—from early pregnancy through postpartum. Information includes MNH intervention uptake and maternal conditions. In agrarian areas, VHLs used smartphones with a DHIS2 Tracker app for real-time data entry. In pastoral areas, data were collected on paper and digitized later by HEWs at health posts.

Qualitative data were collected using semi-structured discussion guides tailored to each respondent category. Trained researchers conducted and audio-recorded sessions in natural settings, after with consent from participants. Transcripts were produced verbatim and analyzed using ATLAS.ti.

Results

Qualitative respondent characteristics

The study included 90 individual interview participants—45 each from agrarian and pastoral communities—comprising 14 VHLs, 17 HEWs, 31 postpartum mothers (both home and facility deliveries), 10 husbands, 3 mothers-in-law, and 15 supervisors (project coordinators, HEW supervisors, health center directors, and woreda health office experts). In addition, 14 FGDs were conducted: nine in agrarian and five in pastoralist settings. Each FGD involved 4 to 12 VHLs and explored community-level perceptions of the intervention and its impact on MNH service delivery and care-seeking behaviors.

Implementation Fidelity

Home Visits and Service Delivery: VHLs were actively engaged in MNH care through regular home visits and promoting birth preparedness, safe delivery, and newborn care. They provided practical support, such as misoprostol instruction and hygiene promotion during home deliveries.

Use of Job Aids: VHLs effectively applied MNH guidelines using job aids, visual materials, and mobile apps for visit scheduling and reporting—showing high procedural compliance.

Operational Challenges: Despite their dedication, VHLs and HEWs faced major challenges: competing duties, supply shortages, limited supervision, and geographic barriers like long distances and dispersed, nomadic populations, which made identifying and reaching pregnant women difficult.

> *"We are currently experiencing a shortage of misoprostol… it is a significant concern."* – VHL, IDI, Pastoral.

Reach and Safety

Program Reach: The program demonstrated strong reach by VHLs, who surmounted physical and infrastructural challenges to identify and engage pregnant women through regular home visits, collaboration with community members, and leveraging local knowledge to ensure no one was missed for timely care and essential medications.

Between March 2023 and June 2025, 3,844 pregnant women (2,439 agrarian, 1,405 pastoral) were enrolled—representing 48% of expected pregnancies across 38 kebeles (75% agrarian, 30% pastoral). Of these, 1,591 agrarian (65%) and 1,248 pastoral (89%) women received a first antepartum home visit; 1,330 (55%) and 895 (65%) received a second; and 1,429 (59%) and 745 (53%) received a third postpartum visit, respectively. During these visits, most women received misoprostol and chlorhexidine, though

only one-third received postpartum progestin-only pills from VHLs.

Among 2,174 women who gave birth during the intervention, facility delivery rates were 38% in agrarian and 31% in pastoral areas. Of those who delivered at home, 92% used misoprostol—89% agrarian, 97% pastoralist—and most applied chlorhexidine to the umbilical cord (77% agrarian, 89% pastoral).

Qualitative respondents reported that geographical isolation, inadequate infrastructure, and unreliable ambulance services severely restricted women's access to facility-based care, often leading to unplanned home deliveries. They emphasized the critical role of community-based services, particularly those provided by VHLs, in addressing access barriers in remote areas.

Safety of Interventions: No maternal or newborn deaths or misoprostol misuse were reported. While minor side effects were noted, they didn't affect adherence.

> *"The medication caused a burning sensation… but I also emphasized the importance of continuing."* – Husband, IDI, Agrarian.

Community members, especially mothers, expressed gratitude for the interventions provided by VHLs, including life-saving medicines. The distribution of iron supplements and misoprostol has led to notable improvements in maternal well-being:

> *"Mothers are happy with the medications; many now ask for these pills themselves and report that they experienced less bleeding and abdominal cramping (Malla) after taking the misoprostol"*—VHL, FGD, Agrarian.

Feasibility and acceptability

Community acceptance and trust: VHLs are well-accepted and trusted by the community, which has also embraced the community-based delivery of MNH services. The culturally sensitive strategy has further strengthened engagement and trust, ensuring effective implementation.

> *The services provided by the VHLs were extremely helpful. Their advice to give birth at a health facility was invaluable, contributing to the health of both me and my newborn.* —Mother, IDI, Pastoral

The services delivered by VHLs were widely accepted and appreciated across communities, with many noting this was the first time such care was available at their doorstep. VHLs are seen as accessible, caring, and deeply embedded in community life, which has enhanced service uptake and compliance.

> *"We all knew the benefits of the intervention, and no one had any reason to object."* —Mother, IDI, Pastoral.

Community members, including women and families, hold a positive view of both the interventions and the role of VHLs. Through consistent awareness efforts, VHLs have built strong trust and rapport, strengthening the link between pregnant women and health facilities.

> *"Family members and the broader community strongly support women in accessing modern healthcare. There is widespread awareness about its benefits, leading to full acceptance and support."* —Mother, IDI, Pastoral.

A VHL from pastoral areas reflected on community trust:

> *"The community sees that I play a positive role supporting women, and they trust me because I always tell the truth. I explain the services clearly and share hopes for better comprehensive care."* — VHL, IDI, Pastoral.

Culture influence: Cultural and religious beliefs continued to shape some attitudes toward MNH interventions, particularly family planning. In some communities, religious doctrines discouraged contraceptive use, while gender dynamics influenced provider preference, with many women favoring female VHLs for comfort and privacy.

> *"Many women… prefer being served by female VHLs."* – Mother, IDI, Agrarian

> *"Female VHLs are more effective… women are more comfortable confiding in other women."* – Husband, IDI, Agrarian

A key informant from the community noted some initial opposition from community members, including religious leaders, over family planning kits included in the packages.

> *"Some religions… consider family planning forbidden..."* – Mother-in-law, IDI, Agrarian

Discussion

This implementation research provides strong evidence that delivering life-saving MNH interventions through trained VHLs is both feasible and acceptable in underserved agrarian and pastoralist areas. VHLs delivered an integrated MNH package—including misoprostol, chlorhexidine, IFA, and postpartum contraceptives—with high adherence to protocols and strong community uptake. The model addressed barriers to facility-based care and offers a promising strategy for advancing health equity and strengthening PHC linkages [4]. This aligns with evidence from other LMICs where CHWs delivered similar interventions when adequately trained and supervised [7, 8].

Trust in VHLs was critical. Seen as accessible, culturally competent, and embedded in the community, VHLs facilitated high acceptance of doorstep MNH services. These findings are consistent with global and national evidence that trusted CHWs improve uptake of health interventions [3].

This approach reached women typically excluded from formal systems, addressing inequities in MNH service access. In hard-to-reach areas, over 90% of home births involved misoprostol use, and most women used chlorhexidine for umbilical care [4].

The package was effective and safe. Participants reported improved preparedness, fewer complications, and safer deliveries. Routine monitoring found no serious adverse events or misuse, echoing prior studies showing that community-level distribution of misoprostol and chlorhexidine is safe and does not discourage facility births [4]. Minor side effects did not hinder use. Household support, particularly from spouses, enhanced intervention success, reinforcing the role of family dynamics in maternal health behaviors.

In conclusion, this implementation research shows that delivering essential MNH care through trained VHLs is feasible and well-accepted in hard-to-reach agrarian and pastoralist settings. To sustain and scale this approach, investments are needed in supervision and supply chains.

References

1. Ethiopian Public Health Institute (EPHI) [Ethiopia], ICF. Ethiopia Mini Demographic and Health Survey 2019: Final Report. Rockville, Maryland, USA: EPHI and ICF; 2021.
2. Lancet. WOMAN: reducing maternal deaths with tranexamic acid. Lancet. 2017;389(10084):2081. doi: 10.1016/s0140-6736(17)31111-x.
3. Scott K, Beckham SW, Gross M, Pariyo G, Rao KD, Cometto G, et al. What do we know about community-based health worker programs? A systematic review of existing reviews on community health workers. Human resources for health. 2018;16(1):39.
4. Tiruneh GT, Yakob B, Ayele WM, Yigzaw M, Roro MA, Medhanyi AA, et al. Effect of community-based distribution of misoprostol on facility delivery: a scoping review. BMC Pregnancy and Childbirth. 2019;19(1):1-11.
5. Solo J, Festin M. Provider bias in family planning services: a review of its meaning and manifestations. Global Health: Science and Practice. 2019;7(3):371-85.
6. Sibley LM, Spangler SA, Barry D, Tesfaye S, Desta BF, Gobezayehu AG. A regional comparison of distribution strategies and women's awareness, receipt, and use of misoprostol to prevent postpartum hemorrhage in rural Amhara and Oromiya regions of Ethiopia. Journal of midwifery & women's health. 2014;59(s1):S73-S82.
7. Kayentao K, Ghosh R, Guindo L, Whidden C, Treleaven E, Chiu C, et al. Effect of community health worker home visits on antenatal care and institutional delivery: an analysis of secondary outcomes from a cluster randomised trial in Mali. BMJ global health. 2023;8(3).
8. Kok MC, Dieleman M, Taegtmeyer M, Broerse JE, Kane SS, Ormel H, et al. Which intervention design factors influence performance of community health workers in low-and middle-income countries? A systematic review. Health policy and planning. 2015;30(9):1207-27.

Evaluation of Quality PMTCT of HIV Service Provision and its Determinants: The Case of Health Facility Readiness and Mothers' Perspectives

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Abstract

Background: Prevention of Mother-To-Child Transmission of HIV (PMTCT) is a comprehensive intervention designed to reduce vertical HIV transmission, which accounts for over 90% of pediatric AIDS cases. Despite the improvements observed, challenges remain in service integration, client satisfaction, and facility readiness. Evidence on PMTCT service quality is essential for clinicians and policymakers. This study aimed to evaluate the effectiveness of PMTCT services in public health facilities in Northwest Ethiopia.

Methods: A cross-sectional study was conducted from June 1 to July 17, 2022, across nine public health facilities in Gondar city, involving 334 mothers. Service quality was assessed using the Structure-Process-Outcome framework. Approximately 135 counseling sessions were observed. Data were analyzed using SPSS 26. Binary and multiple logistic regression analyses identified factors associated with mothers' satisfaction, with P-values <0.25 and <0.05 considered significant, respectively.

Results: The overall performance of the health facilities was 74.09% (95% CI: 72.19–76.01%). Output quality was rated good in 88.89% of cases, while input and process quality were 60.40% and 72.97%, respectively. Overall, 67.09% of women reported satisfaction with the services. Factors positively associated with satisfaction included sufficient counseling time (AOR=2.83; 95% CI:1.72–3.97) and convenient opening hours (AOR=4.27; 95% CI:2.09–6.67). Conversely, lower satisfaction was observed among women aged 15–24 years (AOR=0.31; 95% CI:0.06–0.79), formally educated mothers (AOR=0.59; 95% CI:0.35–0.67), those traveling over one hour to the facility (AOR=0.71; 95% CI:0.55–0.93), and those experiencing waiting times exceeding 30 minutes (AOR=0.23; 95% CI:0.11–0.37).

Conclusion: The quality of PMTCT service provision and mothers' satisfaction were low. Reducing waiting time, punctuality of service providers, adequate counselling, and availability of basic resources can boost mothers' satisfaction

Keywords: Determinants, Evaluation, Health facility readiness, Quality, PMTCT, Satisfaction

Introduction

More than 90% of HIV infections in newborns result from mother-to-child transmission (MTCT), occurring during pregnancy, childbirth, or breastfeeding. Infants born to HIV-positive mothers, known as exposed infants, are at risk of infection [1–3]. Africa bears the highest burden, with over two-thirds of new infections globally; Ethiopia, with an HIV prevalence ranging from <0.1% to 4.8% across regions, is among 21 high-burden countries [4,5]. In 2016, ART coverage was 59% for adults and 35% for children [6]. Improving healthcare quality is essential to reduce MTCT and achieve Universal Health Coverage (UHC) [6,7].

Quality healthcare—defined by the Institute of Medicine as services that increase the likelihood of desired outcomes consistent with professional knowledge—is crucial for safe, effective, patient-centred, timely, and equitable care [6]. In Ethiopia, quality also emphasizes efficiency and accessibility for all [1,4].

Sub-Saharan African women face high HIV risk due to limited STD screening, inadequate PMTCT knowledge, male partner non-participation, and poor infant feeding practices [8,9]. Challenges include insufficiently trained staff, weak leadership, inadequate infrastructure, and poor service delivery [2,3]. Studies from Ethiopia indicate low PMTCT service quality, limited follow-up, and gaps in facility readiness [21–24]. Evaluating both facility readiness and provider commitment is critical to ensuring high-quality PMTCT services. Using the Donabedian framework, this study assesses service quality, facility readiness, and associated factors among pregnant mothers in Gondar city public health facilities [5,7].

Methods

This institutional cross-sectional study was conducted in Gondar City's public health facilities between June 1 and July 17, 2022, including eight health centers and one comprehensive specialized hospital. Gondar, located 748 km northwest of Addis Ababa, had a population of 207,044 in 2007 [CSA]. All facilities provide maternal and child health services, including PMTCT, while the referral hospital serves over ten million people in the city and nearby catchments.

The source population comprised pregnant women attending ANC and PMTCT services. Eligible participants were women receiving PMTCT services who voluntarily consented; those experiencing severe pain or with less than six months of follow-up were excluded. Using a single population proportion formula with an estimated PMTCT service quality of 74.7%, 95% confidence, 5% margin of error, and 15% non-response rate, a minimum sample of 334 mothers was determined. Participants were selected via systematic sampling with proportional allocation per facility.

Data were collected using structured, pre-tested questionnaires and standardized facility readiness checklists, translated to Amharic and back to English. Inputs (47 indicators), processes (43 indicators), and outputs (13 indicators) were assessed based on national PMTCT guidelines, UNAIDS, and FHI standards. Exit interviews measured mothers' satisfaction on a five-point Likert scale; responses were dichotomized into "satisfied" and "not satisfied." Non-participant observations of 135 counseling sessions evaluated adherence to guidelines. Facility readiness was assessed through resource inventories, including personnel, logistics, and PMTCT materials.

Three BSc midwives and two supervisors collected data following two days of intensive training. Pre-testing at Debark Hospital ensured clarity and consistency. Data were coded in EPI Data 4.6 and analyzed in SPSS 26. Binary and multiple logistic regression identified factors associated with satisfaction, using a p-value ≤ 0.25 for variable selection and a p-value < 0.05 for significance. Multicollinearity was checked using VIF (mean 1.69), and model fit was assessed via the Hosmer-Lemeshow test. The Donabedian framework guided the assessment of input, process, and output dimensions to evaluate the overall quality of PMTCT services.

Results

A total of 334 pregnant women participated in the study, achieving a 100% response rate. Participants' ages ranged from 15 to 50 years (mean 29.33 ± 5.97). Nearly half (47%) attained secondary or higher education, 83% were urban dwellers, 39% were housewives, 87% were married, 79% were Orthodox Christians, 27% were primigravida, and 79% were of Amhara ethnicity.

Using the Donabedian framework, the quality of PMTCT services was assessed across nine facilities (eight health centers and one specialized hospital). Input service quality was low at 60.40%, with gaps in cleanliness, ventilation, Dried Blood Spot kits, and IEC materials. Only three facilities (33.34%) met all input criteria. Process service quality scored 72.97%, with good performance in physical examinations, history taking, and ARV adherence review. However, low scores were observed for welcoming patients (22.2%), cervical cancer screening (44.45%), substance abuse screening (33.34%), opening hours, and adherence to service standards. Output quality scored highest at 88.89%, with five facilities (55.56%) meeting the full criteria. Overall, PMTCT service quality across all dimensions was 74.09%.

A total of 135 PMTCT counselling sessions were observed to assess provider adherence, excluding the first and last three sessions to reduce Hawthorne effects.

Multivariable logistic regression identified several factors significantly associated with maternal satisfaction. Women aged 15–24 years had 69% lower odds of satisfaction compared to those aged 35–50 years (AOR = 0.31; 95% CI: 0.06–0.79). Women with secondary or higher education had 41% lower odds compared to illiterate women (AOR=0.59; 95% CI:0.35–0.67). Arrival within 30 minutes reduced dissatisfaction by 29% (AOR=0.71; 95% CI:0.55–0.93), whereas waiting more than 30 minutes decreased satisfaction by 77% (AOR=0.23; 95% CI:0.11–0.37). Adequate counseling increased satisfaction 2.83-fold (AOR=2.83; 95% CI:1.72–3.97), and convenient clinic hours increased it 4.27-fold (AOR=4.27; 95% CI:2.09–6.67).

Discussion

This study evaluated the quality of PMTCT services and determinants of maternal satisfaction among 334 women in Gondar city public health facilities using the Donabedian framework [1–4]. Overall, PMTCT service quality was good (74.09%), though input and process dimensions had notable gaps affecting service delivery [5]. About 67.08% of women reported satisfaction, lower than prior studies in other Ethiopian cities, possibly due to increased awareness and higher expectations of service quality [6–9].

Multivariable analysis identified several factors associated with maternal satisfaction. Younger women (15–24 years) had 69% lower odds of satisfaction compared to older women, potentially reflecting lower ANC and ART utilization, reduced awareness of PMTCT benefits, and sensitivity to healthcare worker attitudes, waiting times, and service costs [10–13]. Educated women (secondary or higher) were 41% less likely to be satisfied, possibly due

to higher expectations or perceived knowledge gaps in counselling engagement [9, 14–16].

Service-related factors also significantly influenced satisfaction. Women who waited longer than 30 minutes had 77% lower odds of satisfaction. In contrast, those with adequate counselling were nearly three times more satisfied, underscoring the importance of personalized health education and communication [8, 10, 15,16]. Arrival time and clinic opening hours also affected satisfaction: women arriving earlier and those attending facilities with convenient hours reported higher satisfaction [1,5,11,16]. These findings align with prior studies linking timely service provision, reduced waiting times, and effective counselling to improved patient satisfaction.

The results emphasize that while PMTCT service output may be high, gaps in inputs, process quality, accessibility, and patient-centered care substantially affect satisfaction. Addressing these factors—especially waiting times, counselling adequacy, and service hours—can enhance maternal engagement and PMTCT outcomes [5, 8].

Conclusions

This study reveals that the quality of PMTCT services in Gondar city public health facilities falls below national guideline expectations, with only just over two-thirds of women expressing satisfaction. Key determinants of satisfaction include women's age, educational status, waiting time, counselling adequacy, arrival time, and facility opening hours. To enhance service quality, facilities should adopt a patient-centered approach that tailors counselling and information to women's needs, optimizes processes to reduce waiting times, extends operating hours, and ensures sufficient counselling time. Additionally, improving facility resources, maintaining clean and well-equipped counselling rooms, integrating PMTCT with other maternal and child health services, and providing continuous gender-sensitive and client-centered training for healthcare providers are essential. Emphasizing cultural competency, effective communication, and awareness of socioeconomic determinants will help meet the diverse needs of women, ultimately improving satisfaction and PMTCT outcomes.

Ethical approval and consent to participate

The School of Nursing's ethical review committee provided ethical review on behalf of the University of Gondar College of Medicine and Health Sciences with Reg. No. SoN/CHNU/72/10/22.

Reference

1. Organization WH. Global health sector strategy on HIV 2016-2021. Towards ending AIDS. Global health sector strategy on HIV 2016-2021 Towards ending AIDS2016.
2. Ababa A. Competency Based National Comprehensive PMTCT/MNCH Training Participant's Manual. 2017.
3. Trivedi S, Kariya P, Shah V, Mody S, Patel P, Desai K. Does maternal HIV status affect infant growth?: a hospital based follow up study. National Journal of Medical Research. 2012;2(04):512-7.
4. Ethiopia FMoH. National consolidated guidelines for comprehensive HIV prevention, care and treatment. Federal Ministry of Health Addis Ababa, Ethiopia; 2018.
5. Farhoudi B, Ghalekhani N, Afsar Kazerooni P, Namdari Tabar H, Tayeri K, Gouya MM, et al. Cascade of care in people living with HIV in Iran in 2019; how far to reach UNAIDS/WHO targets. AIDS care. 2022;34(5):590-6.
6. UNAIDS W. Global AIDS monitoring. Geneva: UNAIDS. 2017.
7. Organization WH. Fact sheets on Quality health services. 2020.
8. Albritton E, Edmunds M, Thomas V, Petersen D, Ferry G, Brach C, Bergofsky L. Engaging Stakeholders to Improve the Quality of Children's Health Care. Agency for Healthcare Research and Quality, July. 2014.
9. Cottrell E, Whitlock E, Kato E, Uhl S, Belinson S, Chang C, et al. Defining the benefits of stakeholder engagement in systematic reviews. 2014.

10. Halbesleben JR, Whitman MV. Evaluating survey quality in health services research: a decision framework for assessing nonresponse bias. Health Services Research. 2013;48(3):913-30.

11. Plsek P. Institute of Medicine. Crossing the Quality Chasm: A New Health System for the 21st Century. Washington, DC National Academies Pr. 2001.

12. Hagaman AK, Singh K, Abate M, Alemu H, Kefale AB, Bitewulign B, et al. The impacts of quality improvement on maternal and newborn health: preliminary findings from a health system integrated intervention in four Ethiopian regions. BMC health services research. 2020;20(1):1-12.

13. Health EFMo. HEALTH & HEALTH-RELATED I N D I C A T O R S: https://www.moh.gov.et/site/sites/default/files/2021-10/Health%20and%20health%20related%20indicators%20_2013%20EFY.pdf. 2020/2021.

14. Health FDRoEMo. ETHIOPIAN NATIONAL HEALTH CARE QUALITY STRATEGY Transforming the Quality of Health Care in Ethiopia 2016-2020.

15. Magadi MA. Understanding the gender disparity in HIV infection across countries in sub-Saharan Africa: evidence from the Demographic and Health Surveys. Sociology of health & illness. 2011;33(4):522-39.

16. Yah CS, Tambo E. Why is mother to child transmission (MTCT) of HIV a continual threat to new-borns in sub-Saharan Africa (SSA). Journal of infection and public health. 2019;12(2):213-23.

17. Goga AE, Dinh T-H, Essajee S, Chirinda W, Larsen A, Mogashoa M, et al. What will it take for the Global Plan priority countries in Sub-Saharan Africa to eliminate mother-to-child transmission of HIV? BMC infectious diseases. 2019;19(1):1-13.

Ethiopia's Primary Health Care Efficiency to achieving Universal Health Coverage: A scoping review of studies

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Abstract

Introduction: Ethiopia is committed to meeting Sustainable Development Goal 3 (SDG 3), aimed at ensuring health and well-being. This can't be achieved without universal health coverage (UHC) and efficient health systems anchored on Primary Health Care (PHC). Despite doubled health spending over recent decades, rising costs, resource misallocation, and operational inefficiencies impede UHC necessitating an assessment of efficiency.

Objective: This study evaluates Ethiopia's health system efficiency in achieving SDG 3 by synthesizing evidence on health facility performance, identifying efficiency drivers, and proposing improvements.

Methods: A scoping review of 15 peer-reviewed studies and 2 reports on Ethiopia's health system efficiency were conducted. The focus was on public health centers, posts, and primary hospitals. Metrics included technical efficiency (TE) scores, input-output ratios, and inefficiency determinants. A meta-analysis pooled facility performance data.

Results: Efficiency varied, with TE scores from 0.54 among health posts to 0.83 among health centers indicating potential output increases of 17–46% without additional inputs. As one of these studies indicated inefficient facilities could save 26–54% of costs (56–187 million birr). Efficiency was enhanced by in-service training, experienced managers, and urban settings, but hindered by conflicts, rural locations, resource misallocation, stockouts, and overstaffing. Regional disparities were stark, with health posts underperforming and conflict-affected areas like Tigray and parts of Oromia showing sharp declines in efficiency.

Conclusion: Ethiopia's health system has faced considerable operational inefficiencies, resource misallocation, and structural challenges, limiting progress towards SDG3 targets. Targeted interventions - proper resource allocation, improving staff competency, and conflict mitigation mechanisms could enhance efficiency and redirect savings to policy priorities. Capacity-building in low-efficiency facilities is critical.

Keywords: Health system efficiency, Sustainable Development Goal 3, Primary Health Care

Introduction

Ethiopia has made remarkable strides in expanding healthcare access over the past two decades with improved health outcomes. Furthermore, the country has been committed to meeting the SDG-3 goals by 2030, which could be attained through UHC that can be catalyzed by adequate and sustained financing as well as improved efficiency [1,2]. Efficiency is one of the top priorities of the health sector development and investment plan (HSDIP) and as a strategic thought leadership, it is considered as a top priority by the top leadership of MOH. However, achieving efficiency—maximizing health outcomes with limited resources—remains a pivotal goal amid ongoing constraints like funding shortages, workforce gaps, and infrastructural hurdles. Ethiopia's healthcare systems face dual challenges: insufficient resources and operational inefficiencies, which affect the delivery of high-quality services [3,4].

Ethiopia has significantly increased primary health care (PHC) expenditure, doubled in the past three decades. PHC facilities, which consume the largest share of health expenditure, face shortages of human, capital, and financial resources, underscoring the need for more efficient resource utilization. Though total PHC expenditure increased over time, PHC spending from total health expenditure (THE) has declined slightly over the last three NHAs from 86% in 2013/14 to 78% in 2019/20. Improving health system efficiency is a key strategic direction as stated in the different health sector strategic plans that emphasize on better resource allocation, optimizing resource use and minimizing waste. (5,6,7) While the health reforms in Ethiopia prioritize efficient resource allocation, there is a notable gap in research on the efficiency of the primary health care system. This study assesses Ethiopia's health system efficiency in achieving SDG 3 by analyzing health facility performance, identifying key drivers, and proposing actionable improvements.

Methods

We did a scoping review of 15 peer-reviewed studies and 2 grey literatures on Ethiopia's health system efficiency, primarily analyzed using Data Envelopment Analysis (DEA) and stochastic frontier analysis (SFA) methods. Metrics included both allocative efficiency (AE) and technical efficiency (TE) scores, return to scale, input-output ratios, and in[e]efficiency determinants. Furthermore, meta-analysis of pooled TE scores were conducted.

Results and discussion

Studies in Ethiopia showed mixed results - most studies reported that the health systems fall short of maximizing outputs—given its inputs, others reported existence of improved efficiency over time. For example, a DEA of 34 health centers in East Wollega Zone, found an average technical efficiency (TE) of 0.47—meaning most centers could halve inputs without losing service levels and only one tenth hits full efficiency. (8) A 2020 study in Northwest Ethiopia found over half of public hospitals achieved 100% TE in maternal health services, aided by experienced managers and nearby facilities, but inefficiencies in resource allocation persist. (9) According to this study, inefficient hospitals could reduce input use by 3.6–9.8% while increasing outputs by 11.7–13.9%. A Harvard study by Mann and Berman, 2020 flagged overstaffed administration and underused facilities. (10) While in Tigray, war slashed functionality to 9.7% of health centers by 2022 amplifying waste. (11)

Mann and Breman also estimated the potential financial savings for the inefficient PHC facilities to become as efficient as the frontier. According to their analysis, the potential financial gain for efficient production is equivalent to 54% of their spending on studied primary hospitals or 187 million birr (US$9.05 million). For health centers, this is a potential financial gain equivalent to 26% of studied health centers or 56 million birr (US$2.71 million). Both hospitals and health

centers could have saved their finances from indirect costs and human resource costs. (12) Similarly, in Jimma Zone, 88 % of health posts and 65% of health centers were scale inefficient, implying room for improvement in resource allocation. (13) Another study from Southwestern region showed that only 21.2% of studied health facilities were technically efficient with a mean TE score of 0.6 (± 0.3), indicating that health posts could increase their service volume by 40% with no change made to the inputs they received. (14) In 2007/08, a TE analysis conducted in the Tigray region found that only 25% of the 60 sampled health posts were efficient. (15) Another studies in Oromia found that only 50% of the studied health centers and less than 6% of the studied health posts were technically efficient. Lamsgen et al reported that only 59.3% of the health centers were technically efficient although the mean TE score of the health centers was 0.899 ± 0.156. (16)

Pooling all these studies, the data revealed that Ethiopia health facilities especially health posts and health centers are working below their scale of operation *and* are technically inefficient highlighting the potential for improved outputs without additional inputs by 17-46%.

Factors associated with health systems efficiency

Ethiopia's healthcare system efficiency is shaped by a complex interplay of structural, financial, and human resource factors. Positive contributors include in-service training, experienced managers, and urban locations, boost TE by enhancing staff skills and improving resource access. Conversely, challenges such as conflict, rural and hard-to-reach settings, large catchment populations, proximity to competing facilities, long waiting times, staff motivation, and misaligned resources - excess staff or beds - negatively impact TE, mainly due to disrupted services, overstretched resources, or lower demand influenced by user perceptions.

Resource misallocation manifested by geographic disparities and overinvestment in urban hospitals and specialized care driving up long-term costs, while rural areas remain underserved. Inefficient supply chain management lead to stockouts of essential medicines alongside overstocking of unneeded ones. Political and bureaucratic decisions exacerbate these issues, diverting funds toward excessive administrative costs rather than direct patient care. Human resource mismatches with an oversupply of certain professions and shortages of critical personnel, compounded by technological and infrastructure gaps such as high-tech equipment deployed in areas lacking trained operators.

These findings reveal regional differences, likely tied to variations in health system performance, population demand, and resource availability. Contextual factors like conflict and infrastructure play roles in driving these disparities. External factors, including urban-rural divides, also influence outcomes, urging policymakers to integrate these realities into health intervention strategies. The variability across regions and facility types underscores the need for tailored interventions to optimize resource use. This study has limitations: Lack of evidence from regions like Afar, Somali, Benishangul Gumuz, and Gambella on both allocative and technical efficiency preclude us from understanding of the phenomenon and generalizability of findings.

Conclusion and recommendation

Ethiopia's health system has demonstrated remarkable progress in expanding PHC access through initiatives like the Health Extension Program (HEP) and increased spending, which doubled as a share of total expenditure from 1995 to 2022. However, persistent operational inefficiencies, resource misallocation, and structural challenges such as overstaffing, stockouts, underutilized facilities, and regional disparities exacerbated by shocks – conflicts, disease outbreaks and natural disaster –

that continue to undermine the system's effectiveness and sustainability and impeded UHC and quality service delivery. This scoping review also attest that many facilities operate below optimal efficiency, with average technical efficiency scores ranging from 0.54 to 0.83 across facilities, indicating substantial potential for output gains (17–46%) without additional inputs.

Overall, Ethiopia's health system efficiency remains suboptimal, ranked low globally, but with strategic interventions, it holds the potential to redirect savings toward equitable, high-quality service delivery. While policy frameworks, the Health Sector Transformation Plan (HSTP) and National Health Financing Strategy, emphasize resource optimization, mixed results from available evidence show the need for targeted interventions. To enhance efficiency and align with SDG 3, the following actionable recommendations are proposed, drawing on evidence from efficiency studies and emerging trends.

Prioritize capacity building: Invest on in-service training and professional development for health workers, mainly in rural and vulnerable areas, to boost technical efficiency. Institutions with well thought leadership have shown higher performance, so targeted programs could reduce inefficiencies while increasing outputs. Facilities with lower efficiency scores should be prioritized for improvement.

Address resource misallocation and disparities: Implement tailored resource allocation strategies to balance urban overinvestment with rural underservice, focusing on preventive care balancing specialized care. Policymakers should be based on timely and quality evidence to identify factors for inefficiencies and redirect savings.

Integrate digital health interventions: Accelerate digitization of health record systems, reduce waiting times, and minimize stockouts.

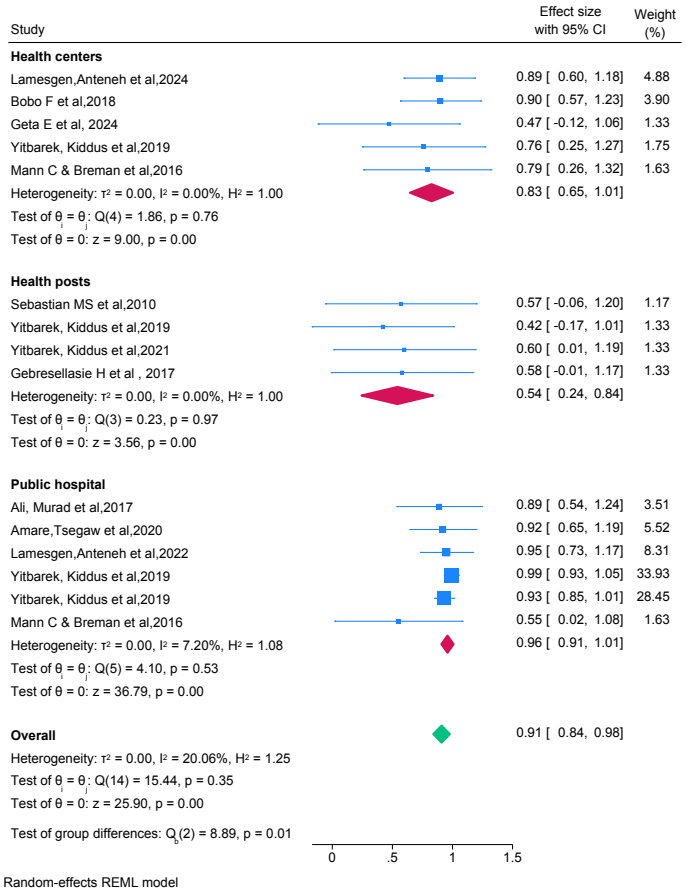

Fig. 1. meta-analysis of available studies, 2025

Mitigate external factors and build resilience: Develop risk-sensitive strategies to restore functionality in shock-affected regions where efficiency has plummeted.

Monitor and evaluate progress: Establish a *national efficiency analysis framework* to pool efficiency data across regions and facility types.

Further research: We recommend further representative research focusing on both allocative and technical efficiency of health care systems

References:

1.Gaspar V, Amaglobeli MD, Garcia-Escribano MM, Prady D, Soto M. Fiscal policy and development: Human, social, and physical investments for the SDGs. International Monetary Fund; 2019.

2. Swanson RC, Atun R, Best A, Betigeri A, de Campos F, Chunharas S, et al. Strengthening health systems in low-income countries by enhancing organizational capacities and improving institutions. Global Health. 2015;11:5

3. Hanson K, Brikci N, Erlangga D, Alebachew A, De Allegri M, Balabanova D, et al. The Lancet Global Health Commission on financing primary health care: putting people at the centre. Lancet Glob Health. 2022;10: e715–72

4. Croke K. The origins of Ethiopia's primary health care expansion: the politics of state building and health system strengthening. Health Policy Plan. 2020; 35:1318

5. Woldie M, Yitbarek K, Dinsa G. Resource Mobilisation and allocation for primary health care: lessons from the Ethiopian health system. Lancet Global Health Commission on Financing Primary Health Care. 2022.

6. Geta ET, Terefa DR, Shama AT, Desisa AE, Hailu WB, Olani W, et al. Technical efficiency and its determinants in health service delivery of public health centers in East Wollega Zone, Oromia Regional State, Ethiopia: Two-stage data envelope analysis. BMC Health Serv Res. 2024; 24:980.

7. Mann C, Berman P. Measuring Technical Efficiency of Primary Health Care Providers: An Analysis from Ethiopia. In: World Scientific Series in Global Health Economics and Public Policy. 2020. https://doi.org/10.1142/9789811212413_0009.

8. Gesesew H, Berhane K, Siraj ES, Siraj D, Gebregziabher M, Gebre YG, et al. The impact of war on the health system of the Tigray region in Ethiopia: an assessment. BMJ Glob Health. 2021;6.

9. Yitbarek K, Abraham G, Adamu A, Tsega G, Berhane M, Hurlburt S, et al. Technical efficiency of neonatal health services in primary health care facilities of Southwest Ethiopia: a two-stage data envelopment analysis. Health Econ Rev. 2019;9:27.

10. Berman P, Mann C, Ricculli M-L. Can Ethiopia finance the continued development of its primary health care system if external resources decline? Health Syst Reform. 2018;4:227

11. Sebastian MS, Lemma H. Efficiency of the health extension programme in Tigray, Ethiopia: A data envelopment analysis. BMC Int Health Hum Rights. 2010. https://doi.org/10.1186/1472-698X-10-16.

12. Berman P, Mann C, Ricculli M-L. Can Ethiopia finance the continued development of its primary health care system if external resources decline? Health Syst Reform. 2018;4:227

13. Gebresilassie YH, Nyatanga P. Efficiency of the Ethiopian health extension program: an application of data envelopment analysis. Eurasian Journal of Business and Economics. 2017; 10:99–126.

14. Bobo FT, Woldie M, Wordofa MA, Tsega G, Agago TA, Wolde-Michael K, et al. Technical efficiency of public health centers in three districts in Ethiopia: Two-stage data envelopment analysis. BMC Res Notes. 2018. https://doi.org/10.1186/s13104-018-3580-6.

15. Yitbarek K, Abraham G, Berhane M, Hurlburt S, Mann C, Adamu A, et al. Significant inefficiency in running community health systems: The case of health posts in Southwest Ethiopia. PLoS One. 2021.https://doi.org/10.1371/journal.pone.0246559.

16. Lamesgen A, Mengist B, Mazengia EM, Endalew B. Level of technical efficiency and associated factors among health centers in East Gojjam Zone, Northwest Ethiopia: an application of the data envelopment analysis. BMC Health Serv Res. 2024. https://doi.org/10.1186/s12913-024-10843-1.

From Access to Agency: Innovating Youth Health Services in Ethiopia through Digital and Community-Based Model

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Abstract

Background: Adolescent girls and young women (AGYW) in Ethiopia face persistent barriers to accessing quality sexual and reproductive health (SRH) services, including limited information, stigma, and lake of youth-responsive care. This study aimed to evaluate the effectiveness of digital versus paper-based counselling model within an integrated reproductive, maternal and new-born, and child health (RMNCH) intervention aimed at supporting improvements in health outcomes among married AGYW.

Method: A mixed-methods approach was employed, including client exit interviews with 302 AGYW, key informant interviews with 20 Health Extension Workers (HEWs), and secondary analysis of service delivery data from DHIS2. Quantitative data were analysed using descriptive statistics and chi-square tests, while qualitative data were thematically analysed.

Results: Findings revealed that the digital counselling model significantly improved client engagement, contraceptive knowledge, and decision-making confidence compared to the paper-based model. Clients receiving a digital counselling were more likely to answer "yes" to all four questions on the Method Information Index Plus (MII+) scale (93% vs. 76%, $p<0.002$) and showed higher family planning methods uptakes. HEWs reported enhanced efficiency, reduced counselling time, and improved data accuracy when using the digital tool. Despite digital literacy challenges, HEWs were able to confidently engage with the guide's multimedia features and had good comprehension of the digital content.

Conclusion: Integrating digital counselling tools into community-based SRH programs can substantially improve service quality and youth empowerment. A hybrid model may be optimal in settings with limited digital infrastructure. These findings support the scale-up of digital innovations to advance reproductive health outcomes for AGYW in Ethiopia.

Keywords: adolescent reproductive health, digital counselling, Smart Start, youth agency, Ethiopia

Background

In Ethiopia, adolescent girls and young women (AGYW) continue to face persistent barriers to accessing quality, and responsive sexual and reproductive health (SRH) services[1,2]. These challenges stem from limited access to accurate information, entrenched social stigma, and health system capacity gaps in youth-quality and responsive care. Overcoming these barriers requires innovative approaches that move beyond conventional healthcare delivery models to meet the unique needs of young people.

Digital and community-based innovations are emerging as promising strategies to bridge health system gaps and support youth-responsive service delivery[3]. By integrating technology with community resources, these models aim to improve service accessibility, efficiency, and responsiveness. Digital health solutions offer personalized and confidential care, while community-based approaches provide culturally relevant and trusted support[4,5]. When integrated, community-based digital service delivery innovations hold significant potential to address the structural and functional limitations inherent in conventional health systems, such as poor accessibility and limited responsiveness to youth needs[6]. Despite their potential, implementation of digital and community-based models is particularly challenging due to limited digital readiness, fragmented service integration, and inequitable access. Addressing these issues requires ongoing adaptation and refinement to ensure these models effectively serve diverse populations of AY.

Since 2016, PSI and its partners—funded by Gates Foundation and the Children's Investment Fund Foundation (CIFF)—have used Human-Centered Design (HCD) to develop youth-focused interventions under the Adolescents 360 (A360) project in Ethiopia. The flagship initiative, 'Smart Start', combines aspirational messaging with SRH counseling and has increased voluntary contraceptive uptake among married adolescent girls [7.8.] To expand support beyond contraception for AGYW, A360 introduced Smart Pathways in 2024—a maternal, new-born, and child health (MNCH) component designed to support married AGYW during the preconception and pregnancy stages of the RMNCH continuum. Trained community mobilizers, including members of the Women's Development Army (WDA) and HEWs, engage girls within their communities and connect them to appropriate services, ensuring continuity of care and timely access to health services. This study presents findings from a mixed-methods evaluation of the digital and paper-based counselling models used in Smart Start initiatives. It examines client satisfaction, provider experience, and overall service performance. Anchored in Ethiopia's health system and PSI's adaptive implementation approach, the study provides insights into how digital community-based service delivery innovations can improve service delivery consistency and effectiveness, leading to enhanced RMNCH outcomes for AGYW.

Method:

mixed-methods study was conducted from January to February 2025 to evaluate client and provider experiences with the Smart Start digitized counselling tool and assess quality of care. The target sample for client exit interviews, calculated using a single-proportion formula (95% confidence, the prevalence of "good counselling" using the Method Information Index, 68% prior prevalence, 5% margin of error), was 335. After data cleaning and assessment of questionnaire completeness, 302 fully completed interviews were available for analysis, excluding 33 records with incomplete Method Information Index items or missing key demographic/service variables. The final analytic sample provides an estimated margin of error of ±5.3 percentage points at the 95% confidence level.

A multi-stage sampling strategy selected 43 health posts across 24 intervention districts in three regions, stratified by counselling modality (digital vs. paper) and region. Married adolescent girls and young women (AGYW) aged 15–24 seeking sexual and reproductive health services were recruited proportionally on the day of service; 188 received paper-based counselling and 114 received digital counselling. In addition, 20 key informant interviews were conducted with health extension workers experienced in either counselling modality. Participants were excluded if they were unmarried, outside the age range, sought non-SRH services, or if providers had less than three months of facility experience.

Routine service data were extracted from the national DHIS2 platform to examine trends in service utilization and complement client and provider perspectives. This triangulated approach provided a comprehensive understanding of counselling effectiveness, client knowledge, and provider experience.

Ethical approval was obtained from the Ethiopian Midwives Association Institutional Review Board (EMwA-IRB-SOP/007/10-24) with annual renewals.

Results

Most participants (71%) were aged 20–24, with limited formal education, 93% of participants were not enrolled in any formal education at the time of survey. Its multimedia features improved understanding and partner communication, offering a more impactful experience than the paper-based model, which focused on goal-setting and maternal health. Digital counselling improved awareness of side effects (85% vs. 73%), preparedness to manage them (89% vs. 79%), and confidence in switching methods. It also enhanced financial literacy and goal setting, with higher scores in financial counselling (46% vs. 32%) and storytelling (37% vs. 19%). While both formats equally supported knowledge of pregnancy spacing (61%) and Smart Start (80%).

Table1: Client engagement with counselling content: paper-based vs. digital Smart Start approaches

Contents	Paper based	Digital	P value
Which on the tool did you find to be client engagement			
Knowledge of Smart Start	80%	80%	0.001
Knowledge of contraceptive methods	91%	92%	0.036
Confident to discuss about contraceptives	88%	95%	0.001
Confident to make contraceptive decisions	93%	97%	0.019
Confident to discuss with husband	90%	95%	0.03
Less anxious about methods	60%	61%	0.001
Aware of side effects	73%	85%	0.001
Prepared to handle side effects	79%	89%	0.001
Which on the tool did you find to be the most interesting			
How to avoid or delay or space pregnancy	61%	61%	<0.001
Financial counselling	32%	46%	0.005
Cost of raising children	13%	8%	0.372
How to reach my goals	10%	15%	0.347
Setting goals	14%	18%	0.008
Settings saving goals	13%	18%	0.060
Calculating income/ savings for goals	29%	32%	0.715
The story of the three families	19%	37%	0.001
Income and expenses	2%	5%	0.001

CEI and facility level service data (Jan–Jun 2025) showed comparable overall performance between the digital and paper-based Smart Start counselling approaches, with notable differences in method mix and service uptake. Counselling outcomes indicated similar levels of implant use (18%) across both models. Service utilization was also generally higher in facilities implementing the digital counselling approach, including skilled birth attendance (52% vs.48%), immediate postpartum family planning (IPPFP) uptake (51% vs. 49%), and overall family planning uptake (56 vs. 44).

Table 2: Counselling outcomes and service utilization by counselling modality (digital vs. paper-based Smart Start).

A. **Counselling outcomes (method mix)**	**Digital (%)**	**Paper-based (%)**
Implant use	18	18
Pill uptake	20	7
Injectable use	50	64
B. **Service utilization**		
Skilled birth attendance	52.1	47.9
IPPFP uptake	51.4	48.6
Family planning uptake	56	44

The digital Smart Start counselling model consistently delivers all elements of high-quality counseling compared to the paper-based approach. A higher percentage of clients who received the digital counselling vs. the paper-based counselling service said that they had been informed about other methods of contraception, possible side effects, what to do if they experienced side effects, and the possibility of switching. Of those two were statistically significant differences on the individual scale items and there was also a significant difference on the composite MII+ metric. ($p<0.002$)

Table 3: Informed choice vs counselling approaches

Questions	Paper based	Digital	P value
Other methods of contraception	98%	99%	0.743
Possible side effects or problems that you might experience when using the method	84%	93%	0.003
Told what to do if you experience any side effects or problems	79%	93%	<0.001
Told about the possibility of switching to another method if the method	93%	94%	0.289
MII+ (all items)	76%	93%	0.002

Health providers consistently described the Smart Start digital guide as an effective and user-friendly tool for delivering age-specific SRH counselling. It supported structured discussions on contraceptive options, side effects, and the socio-economic benefits of family planning. The integration of multimedia—especially visuals and videos—enhanced client comprehension and reduced counselling time. As one participant from Oromia noted, *"there has been positive changes from the past when we teach using a digital cancelling model rather than orally."* The guide's clarity and relevance boosted client engagement and service uptake. A provider shared, *"even without verbal explanation, clients grasp the concepts through the guide's visuals,"* while another emphasized, *"it enhances our effectiveness by over 90%."*

Acceptability among HEWs was high due to the guide's comprehensive content and interactive features. It improved workflow, facilitated referrals, and supported individualized counselling. *"The digital guide simplified our work and reduced effort. We now link clients directly to health centres and submit reports easily,"* said

a participant from Sidama. Its adaptability and youth focus were key strengths. *"It's perfectly acceptable,"* affirmed another from Oromia. However, digital literacy varied, with some HEWs requiring additional support to fully utilize the tool.

Discussion

This study offers compelling evidence that integrating digital counseling approach into community-based reproductive health programs can greatly enhance service quality, increase engagement, and improve outcomes for AGYW in Ethiopia. The digital counselling model outperformed the traditional paper-based model across multiple dimensions, including client satisfaction, contraceptive knowledge, decision-making confidence, and service uptake.

The findings of this study are consistent with global evidence highlighting the transformative impact of digital health interventions on reproductive health outcomes. A study by Jennings et al. (2019) found that digital decision-support tools in Tanzania improved providers' adherence to counseling protocols and strengthened clients' understanding, particularly among youth and first-time users[9]. Similarly, a randomized trial in Kenya by Harrington et al. (2021) found that digital health education significantly increased contraceptive uptake and reduced misconceptions among adolescent girls[10].

The multimedia features of the digital counselling model such as videos and interactive visual proved especially effective in engaging clients, building trust, and simplifying complex information. Digital counseling resulted in 93% of clients meeting all Method Information Index Plus (MII+) criteria, compared to 76% with paper-based counseling ($p < 0.002$), reflecting a higher quality of informed choice. These results align with a study from India, where digital storytelling and visual aids enhanced contraceptive counseling outcomes and improved client recall[11].

Moreover, the digital model offered operational advantages for HEWs, including shorter counseling time, improved data accuracy, and more efficient reporting. These benefits are consistent with findings from a study in Uganda, where digital job aids enhanced provider efficiency and reduced documentation errors[12]. However, challenges related to digital literacy and device usability were observed, highlighting the importance of ongoing training and technical support.

Importantly, the digital counselling approach also demonstrated potential to promote gender-equitable communication and encourage shared decision-making. Clients reported greater confidence in discussing family planning with their partners, a key factor in sustaining contraceptive use. This finding aligns with evidence from Nigeria, where digital interventions that incorporated partner engagement improved couple communication and contraceptive continuation[13].

While digital counseling showed clear strength, broader coverage and improved client experience, the paper-based model still added value in goal-setting and maternal health education in specific contexts, especially in settings where digital tools were not practical or available. A hybrid approach may be most effective. Scaling digital tools will require addressing infrastructure gaps, device access, and data privacy. Overall, this study highlights the potential of digital innovations to strengthen provider capacity, empower youth, and improve reproductive health outcomes.

Conclusion and recommendations

Integrating digital counseling tools into community-based reproductive health programs can greatly enhance service delivery for adolescent girls and young women in Ethiopia. The digital counselling model enhanced client engagement, informed choice, and service uptake, while also improving provider efficiency. To maximize impact, future scale-up efforts

must address infrastructure limitations, ensure equitable access to digital tools, and uphold data privacy standards. Overall, digital tools offer a scalable and effective pathway to strengthen youth agency and reproductive health outcomes.

Reference

1. Zepro, N.B., Ali, N.T., Tarr, N. *et al.* Sexual and reproductive health services use among adolescents in pastoralist settings, northeastern Ethiopia. *BMC Health Serv Res* 23, 677 (2023). https://doi.org/10.1186/s12913-023-09616-z
2. Sidamo NB, Abebe Kerbo A, Gidebo KD and Wado YD (2024) A policy brief: improving access and utilization of adolescent sexual and reproductive health services in Southern Ethiopia. *Front. Public Health* 12:1364058. doi: 10.3389/fpubh.2024.1364058
1. Ahmed, M.M.; Okesanya, O.J.; Olaleke, N.O.; Adigun, O.A.; Adebayo, U.O.; Oso, T.A.; Eshun, G.;Lucero-Prisno, D.E., III. Integrating Digital Health Innovations to Achieve Universal Health Coverage: Promoting Health Outcomes and Quality Through Global Public Health Equity. Healthcare 2025, 13, 1060. https://doi.org/10.3390/healthcare13091060
1. Ferretti, A., Hubbs, S. & Vayena, E. Global youth perspectives on digital health promotion: a scoping review. *BMC Digit Health* 1, 25 (2023). https://doi.org/10.1186/s44247-023-00025-0
2. Poduval, S., Arnold, L., Carta, E. *et al.* Do community-based digital health inclusion programs contribute to tackling health inequalities in disadvantaged population groups? a qualitative study of experiences of a city-wide program in the North of England. *BMC Public Health 25*, 275 (2025). https://doi.org/10.1186/s12889-025-21418-y
3. Bakibinga, P., Kamande, E., Omuya, M., Ziraba, A. K., & Kyobutungi, C. (2020). Challenges and prospects for implementation of community health volunteers' digital health solutions in Kenya: A qualitative study. *BMC Health Services Research, 20*(1), 660. https://doi.org/10.1186/s12913-020-05711-7
4. Spratt, S., RamaRao, S., & Solo, J. (2020). *Empowering married adolescents: Integrating aspirational messaging with SRH counseling*. New York: Population Council.
5. Wilson, K., Kebede, S., & Alemu, H. (2022). *Improving contraceptive uptake among adolescent girls through behavior change interventions in Ethiopia*. *Global Health: Science and Practice*, 10(4), 556–567.
6. Jennings, L., George, A. S., Jacobs, T., Blanchet, N. J., Singh, K., & Lund, C. (2019). *Use of digital decision-support tools to improve provider performance and client outcomes in reproductive health: Evidence from Tanzania*. *Global Health: Science and Practice, 7*(3), 500–514. https://doi.org/10.9745/GHSP-D-19-00123
7. Harrington, E. K., Drake, A. L., Matemo, D., Ronen, K., Osoti, A. O., JohnStewart, G., Kinuthia, J., & Unger, J. A. (2019). *An mHealth SMS intervention on postpartum contraceptive use among women and couples in Kenya: A randomized controlled trial*. *American Journal of Public Health, 109*(6), 934–941. https://doi.org/10.2105/AJPH.2019.305051
8. RamaRao, S., Lacuesta, M., Costello, M., & McCarraher, D. R. (2020). *Digital storytelling and visual aids to improve contraceptive counseling outcomes: Evidence from India*. *Global Health: Science and Practice, 8*(1), 45–56. https://doi.org/10.9745/GHSP-D-19-00429
9. L'Engle, K., Vahdat, H., Ndakidemi, E., Lasway, C., & Zan, T. (2018). *Evaluating feasibility, reach, and potential impact of digital job aids for family planning in Uganda*. *Global Health: Science and Practice, 6*(2), 348–360. https://doi.org/10.9745/GHSP-D-17-00367
10. Austad, K., Agboola, F., Johnson, E., & Adeyemi, O. (2022). *Partner engagement in digital reproductive health interventions: Impact on couple communication and contraceptive continuation in Nigeria*. *Journal of Global Health, 12*, 04014. https://doi.org/10.7189/jogh.12.04014

Implementing community referral vouchers to promote MCH care in Afar and Benishangul Gumuz Regions, Ethiopia

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Abstracts:

Background: Maternal and child mortality remain urgent public health issues in Ethiopia, contributing to 3.6% of global maternal deaths and experiencing under-five mortality of 55 per 1,000 live births. Over half (525) of the under-five deaths occur in the neonatal period and are largely preventable with timely access to care. In resource-limited regions such as Afar and Benishangul-Gumuz, multi-dimensional barriers, including low awareness, weak referral systems, and limited transportation, critical limit care-seeking.

Objective: To assess the contribution of community level referral system in improving maternal and child health service uptake in Afar and Benishangul-Gumuz regions.

Methods: A longitudinal facility and community linked interventional study was conducted across 36 health facilities in 12 woredas. Data from 34 months (Sept 2021–June 2024) were extracted from referral logbooks, facility registers, and monthly reports. The intervention involved training health workers and community agents to implement a color-coded voucher system linking community-identified cases to timely care. Data were analyzed using SPSS v25.

Results: Baseline data revealed no use of referral vouchers in the two regions. In the first-year post-intervention, uptake was minimal due to early-stage implementation. By the second year, the referral vouchers use increased significantly across all four types, antenatal care, delivery care, PNC and sick young infant treatment. However, challenges persisted, particularly in feedback documentation, follow-up and health workers turnover. As a result of increment in the community referrals by using the referral vouchers, MNCH service utilization indicators, including ANC, skilled delivery, and treatment of sick young infants, showed improvements over the two-year post-intervention period.

Conclusion: The community referral voucher system enhanced MNH service uptake by facilitating early identification and linkage to care. For sustained impact, interventions in referral feedback, provider training, transport, and enhancing follow-up and monitoring system are essential. The findings also hold promise as a scalable strategy for improving health outcomes in underserved settings.

Key words: Referral voucher, MCH, Afar, Benishangul Gumuz, Ethiopia

Introduction

Maternal and child mortality remain critical issues in Ethiopia, which contributes to 3.6% of global maternal deaths and experiences high under-five mortality rates, 55 per 1,000 live births, with over half (52%) occurring in the neonatal period. Many of these deaths are preventable with timely access to care. However, significant barriers, such as limited awareness, poor health-seeking behavior, transportation issues, and weak referral mechanisms, delay care-seeking, particularly in resource-limited regions like Afar and Benishangul-Gumuz (1)

A well-functioning referral system is essential to reduce these delays and ensure continuity of care (2-4). While the Ethiopian Ministry of Health has prioritized referral strengthening through policy initiatives, implementation remains weak at the community level in the two regions (5).

A 2021 rapid assessment by Emory University Ethiopia and UNICEF identified key gaps, including the absence of referral slips at a community level, weak feedback mechanisms, and uncoordinated referral processes.

In response, Emory University Ethiopia, in collaboration with UNICEF, the Ministry of Health, and regional health bureaus, through the fund from Korean International Cooperation Agency (KOICA), introduced a color-coded Community Referral Voucher (RV) system in 18 woredas (11 in Benishangul-Gumuz and 7 in Afar). This intervention aimed to bridge the gap between community level health development teams and healthcare facilities, ensuring timely and appropriate care for pregnant women, mothers, and sick young infants. The referral voucher system comprises four color-coded referral slips: “Blue” for early antenatal care for pregnant women identified in the community, “Green” for postnatal care follow-up for recently discharged mothers and newborns, “Yellow” for postnatal care for mothers who delivered at home and “Red” for urgent referral for sick young infants with danger signs. Each referral voucher includes a detachable feedback section, allowing the receiving facility to confirm referral completion back to the referring member of the community health development team, such as Women Development Army (WDA) members or Quality Improvement (QI) teams.

Training was provided to health workers, HEWs, community representatives, and WDAs leaders, who were selected on referral documentation and communication. The health workers were midwives and nurses working at MCH units. For the community representatives, those members of the community quality improvement team were selected purposefully and involved. The WDAs played a key role by identifying cases at the community level and initiating referrals using the vouchers. Health posts and health centers recorded referrals, provided necessary services, and returned feedback to the original source, creating a two-way referral loop.

Objective: To assess the contribution of the community referral voucher system in improving maternal and child health service uptake in Afar and Benishangul-Gumz regions.

Methods

Study setting and interventions: The endline evaluation study was conducted in randomly selected twelve woredas across Afar and Benishangul-Gumuz regions of Ethiopia, where Emory University, in partnership with UNICEF and regional health bureaus, implemented the Referral Voucher (RV) system.

Study design: A facility-community linked longitudinal interventional study was conducted. Quantitative data were extracted from 36 health facilities (10 health centers and 26 health posts) randomly selected from the intervention facilities.

Population: The target population included all pregnant women, postnatal mothers and sick infants recorded in MNCH, iCCM service registers and the prepared referral voucher recording logbooks.

Data collection and analysis: Data were collected using a structured tool adapted from the iCCM form D and extracted from routine facility registers, referral logbooks, and monthly reports. Data were cleaned, verified for completeness and accuracy, and analyzed using SPSS Version 25.

Ethical considerations: Ethical approval was obtained from the Afar and Benishangul-Gumuz Regional Health Bureau IRBs. Data confidentiality was maintained, and all identifiers were removed during analysis.

Results

Trends in Referral Voucher Utilization

One year (Sep 2021-Aug 2022) retrospective baseline data before intervention show no RVs use. The initial uptake during the first year (Sep 2022–Aug 2023) was minimal, as implementation was still in early stages. In the second year (Sep 2023 – Jun 2024, there was a marked increase in voucher usage across all four types: blue (antenatal care), green (referral of health center deliveries to health post to complete PNC), yellow (home deliveries linked to health facilities for postnatal checkup), and red (sick infants' treatment). This upward trend indicated increased integration of the RV system into routine service delivery.

Despite these gains, consistent challenges emerged around follow-up and feedback. In all years, the proportion of vouchers with complete feedback remained low. This was most evident for green vouchers related to postnatal care, suggesting weak linkages between health centers and health posts. Notably, red referral voucher usage (for sick infants) declined in the third year, pointing to possible issues in community-level identification, referral behavior or maybe disease epidemiology which need further explanation by additional data.

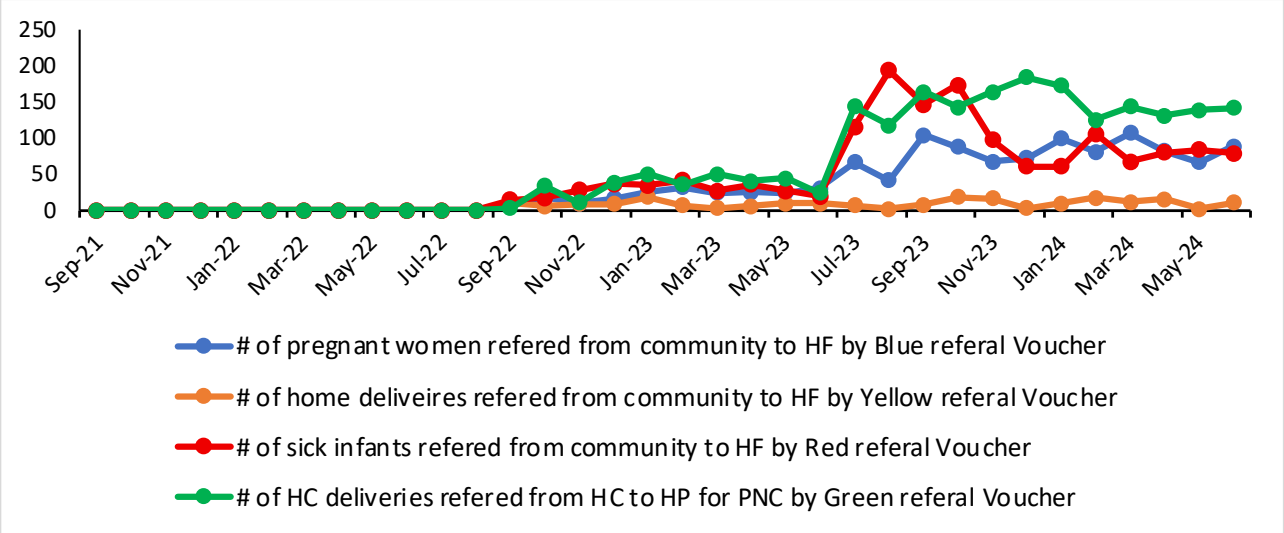
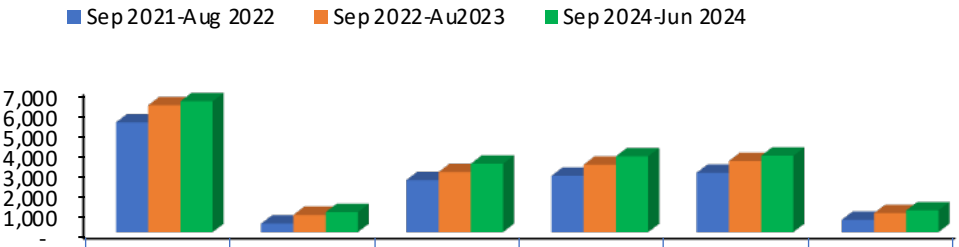


Figure 1: Trends in referral voucher utilization (#of service users linked by using REVs), in study facilities in Afar and Benishangul Gumuz Regions, Ethiopia, Sept 2021-June 2024.

MNCH service utilization trends

Service utilization (coverage) trends related to the RV indicators, antenatal care (ANC), skilled delivery (SD), postnatal care (PNC), and treatment of sick under-five (U5) treatment, showed modest but steady increases over the two-year period, corresponding with increased implementation of the RV program across health facilities in the two regions. These incremental gains suggest the referral vouchers played a supportive role in improving early identification and linkage to care. Hence, the RVs can be a useful tool with additional demand-side and supply-side interventions to maximize service uptake.



	ANC1	Early ANC (<12weeks)	ANC4+	Facility delivery	PNC1	Early PNC (<48hrs
Sep 2021-Aug 2022	5,361	417	2,542	2,747	2,901	603
Sep 2022-Au2023	6,202	840	2,936	3,298	3,472	925
Sep 2024-Jun 2024	6,398	975	3,343	3,708	3,731	1,065

Figure 2: Trends in maternal Health care coverage as a result of referral voucher in study facilities in Afar and Benishangul Gumuz Regions, Ethiopia, Sept 2021-June 2024.

Discussions

The implementation of community referral vouchers (RVs) in Afar and Benishangul-Gumuz has demonstrated a promising role in enhancing maternal, neonatal, and child health (MNCH) service uptake. The significant upward trend in voucher utilization, especially in year two, underscores growing community engagement and integration into routine care. This finding is in alignment with global findings on demand-side financing improving health access (6).

Overall, improvements in ANC, skilled delivery, PNC and U5 treatment coverage suggest RVs enhance early care-seeking behavior, particularly when integrated with broader health system strengthening strategies (7). These findings reaffirm RV systems' potential in remote regions, contingent on improved follow-up and community-level engagement (8)

Conclusions and recommendations:

The community-based referral vouchers in Afar and Benishangul-Gumuz improved maternal, neonatal, and child health service uptake, particularly for ANC and skilled delivery. However, slight gaps were observed in follow-up, feedback mechanism and provider engagement. To sustain the impact of referral vouchers, key actions include strengthening referral feedback systems, enhancing community awareness, training frontline providers, improving transport logistics, and integrating referral voucher monitoring into routine health information systems. These interventions are essential to ensure timely, coordinated, and equitable access to MNCH services in remote region

References

1. EPHI, FMOH, ICF. Ethiopia Mini Demographic and Health Survey 2019. Addis Ababa, Ethiopia: EPHI/FMoH/ICF, 2021
2. Mengist, B., Semahegn, A., Yibabie Damtie,t al. Barriers to proper maternal referral system in selected health facilities in Eastern Ethiopia: a qualitative study. BMC Health Services Research, 2024;(376);PP1–12. Available at: https://doi.org/10.1186/s12913-024-10825-3
3. Kitila, S.B., Tesema, A.A., Bekele, G., Olika, A.K., Terfa, Y.B., Sinkie, S.O. & Olika, A.K. Average Time Spent in Referral Process and its Determinants Among Clients of Maternal and Child Health Service in 2 Districts of Jimma Zone, Ethiopia. SAGE Open Medicine, 2022(23743735221086757): pp. 1–11. Available at: https://doi.org/10.1177/23743735221086757
4. Sharew, B.M., Semahegn, A., Worku, N.K., Yibabie Damtie, S. & Tura, A.K. (2025). Appropriateness of maternal referral system and its associated factors in Eastern Ethiopia: a facility-based cross-sectional study. Frontiers in Global Women's Health, 2025;6(1473191): pp. 1–12. Available at: https://doi.org/10.3389/fgwh.2025.1473191
5. The Federal Democratic Republic of Ethiopia Ministry of Health (FDRE-MOH). Reproductive Health Strategy 2021-2025. Addis Ababa, Ethiopia: FDRE-MOH, 2021.
6. Bellows, N.M., Bellows, B.W. and Warren, C. (2011). Systematic review: the use of vouchers for reproductive health services in developing countries. Tropical Medicine & International Health, 16(1), pp.84–96.
7. Mebratie, A.D., Sparrow, R., Alemu, G., Bedi, A.S. (2015). Service quality and perceptions in primary health care facilities in Ethiopia. International Journal for Quality in Health Care, 27(5):369–376.
8. Obare, F., Warren, C., Njuki, R., Abuya, T., Bellows, B. and Askew, I. (2014). Community-level impact of the reproductive health vouchers program on service utilization in Kenya. Health Policy and Planning, 28(2), pp.165–17

Information Revolution Implementation in Pastoralist Woredas: Current Status, Barriers, and Enablers in the Case of Afar Region, Ethiopia.

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Abstract

Background: The health information system (HIS) is one of the key building blocks within the healthcare system, linking actors, organizations, and resources. In Ethiopia, efforts to strengthen HIS through initiatives like the Information Revolution (IR) aimed to enhance data quality and use. However, challenges persisted, particularly at the woreda and facility levels, where data quality and use remained low.

Objective: This study assessed the status of IR implementation and explored the barriers and enabling factors at selected woredas of the Afar Region.

Methods: A mixed-methods study design was employed from May 15–30, 2024, covering four woredas (three rural, one urban). Quantitative data from all public facilities (one hospital, 12 health centers, 37 health posts, and four woreda health offices) were collected using the IR tool, adapted from PRISM, and analyzed in STATA v14. Qualitative data from 25 key informant interviews and observations were thematically analyzed.

Results: All facilities were at the emerging stage of Ethiopia's IR implementation, with overall low scores (15.4%–17.2%). Domain-specific performance was also poor, including infrastructure (14.5%–20.8%), data quality (19.2%–27.4%), and administrative data use (9.1%–13.1%). Barriers included high staff turnover, low digital literacy, heavy workloads, and shortages of functional computers, trained HIS staff, storage, and manuals. Common issues included unreliable electricity, poor internet connectivity, and outdated devices. Enablers included strong policy support, political will, staff motivation, and mentorship programs.

Conclusion: IR implementation in Afar's pastoralist settings remains low, with major gaps in infrastructure, data quality, and data use across all health system levels. Progress toward a "model" status will require targeted investments in reliable infrastructure, capacity building for HIS personnel, strong leadership commitment, and sustained mentorship to strengthen a culture of data use.

Keywords: Information Revolution, pastoralist woreda, Afar Region, Ethiopia.

Introduction

The Health Information System (HIS) is one of the World Health Organization's (WHO) building blocks for health systems and is fundamental for collecting, managing, and utilizing health data to support evidence-based decision-making, improve service delivery, and enhance health outcomes [1]. In Ethiopia, strengthening HIS is a key component of the Information Revolution (IR), a flagship initiative under the Health Sector Transformation Plan II (HSTP-II)[2]. The IR aims to build robust digital infrastructure, promote a culture of data use, and guide health facilities in progressing from the *Emerging to the Demonstration* stage, thereby enabling the provision of evidence-based care[3].

Despite these firm national commitments and strategies, the implementation of HIS remains irregular across regions, particularly in pastoralist and hard-to-reach areas, such as the Afar Region. Geographic isolation, cultural diversity, limited infrastructure, and low data use capacity pose significant challenges that undermine data quality and utilization in these settings[4]. Moreover, while digital health tools, such as mobile reporting and dashboards, have demonstrated potential, their scale-up is constrained by weak governance structures and environmental unpredictability [5].

Existing literature suggests a limited understanding of how the Information Revolution (IR) is implemented in pastoralist contexts, where unique features and infrastructural factors shape progress and directly influence the ability to improve data quality and foster a sustainable culture of data use [2, 6]. Therefore, this study focuses on assessing the current status of IR implementation in selected woredas of Afar and exploring the key barriers and facilitators influencing the performance of the Health Information System, in line with national IR guidelines.

Methods

Study Setting, design, and period: This study was conducted in Ethiopia's Afar Region, which has 50 woredas (42 rural, eight urban). Four woredas—three rural and one urban—were randomly selected, and all public health facilities and woreda health offices within them were included. Using a mixed-methods, cross-sectional design (May 15–30, 2024), the study quantitatively assessed Health Information System (HIS) performance and qualitatively explored barriers, enablers, and contextual factors.

Sampling: The quantitative component involved a complete census of one hospital, twelve health centers (HCs), forty-one health posts (HPs), and four woreda health offices (WorHOs). For the qualitative part, twenty-five key informants who are actively involved in health data management were purposively selected. Ethical approval for the study was obtained from the Institutional Review Board (IRB) of the University of Gondar. Informed consent was obtained from all interview participants after a clear explanation of the study's purpose, procedures, and confidentiality assurances.

Data Collection: Quantitative data were collected using the standardized IR tool adapted from PRISM to assess infrastructure, data quality, and data use. Qualitative data included semi-structured interviews conducted in either Amharic or Afar, depending on participants' preference (audio-recorded and transcribed), along with non-participant observations using checklists to capture contextual factors.

Data Analysis: Quantitative data were analyzed using STATA version 14 to assess HIS performance across infrastructure (30%), data quality (30%), and data use (40%). For the qualitative data, we applied thematic analysis informed by the IR framework, whereby codes and themes were primarily developed inductively from the data and then interpreted in light of the framework, rather than using a structured

framework analysis matrix. Triangulation was also applied to enhance the robustness of the findings.

Operational Definitions: Facilities were categorized based on their performance scores as Emerging (<65%), Candidate (65–90%), Model (>90%), representing high-performing facilities, and Digital Model, which denotes the highest maturity level characterized by innovation and digital transformation [8].

Results and Discussion

The study assessed 12 HCs, 37 HPs, and four WorHOs (4 HPs excluded as non-functional). Key informant interviews with 25 stakeholders provided insights into barriers and opportunities.

Infrastructure and Inputs

Basic HIS infrastructure was severely lacking—standard shelving, card rooms, DHIS2 computers, and HIS manuals were often absent. Infrastructure scores were low: 14.5% at HPs, 18.6% at HCs, and 20.8% at WorHOs. Common issues included unreliable power, poor internet, and outdated equipment. Human capacity was also weak, with most facilities lacking trained HIS staff, and challenges like high turnover, low digital literacy, and heavy workloads. Sustaining HIS functionality requires addressing these gaps through targeted training and workload management [2, 9, 10].

Data Quality

Data quality level was low with average scores: 27.4% at HPs, 20.6% at HCs, and 19.2% at WorHOs. Poor use of LQAS and RDQA methods, along with late, incomplete, and inconsistent reporting, reflected weak supervision, verification, and feedback systems[8].

Data Use Practice

The administrative data use practice was low across all assessed facilities, with data use scores of 9.1% for HPs, 9.2% for HCs, and 13.1% for WorHOs. Challenges included weak governance structures, lack of dedicated budgets, poor functionality of Performance Monitoring Teams (PMTs), and low prioritization of data's value.

Overall HIS Performance

All facilities scored at the "emerging" level on Ethiopia's IR status, with low composite scores—Semera Logiya (26.5%), Chifra (18.35%), Telalak (19%), and Mille (7.4%). HIS scores were also low: 15.7% at HPs, 15.4% at HCs, and 17.2% at WorHOs (Figure 1). An "emerging" score reflects poor data quality and limited data use, with the lowest scores indicating severe HIS capacity gaps. These findings highlight a wide gap between national IR targets and ground realities, especially in rural areas, echoing challenges seen elsewhere in Ethiopia, such as weak infrastructure, high staff turnover, and low digital literacy[11].

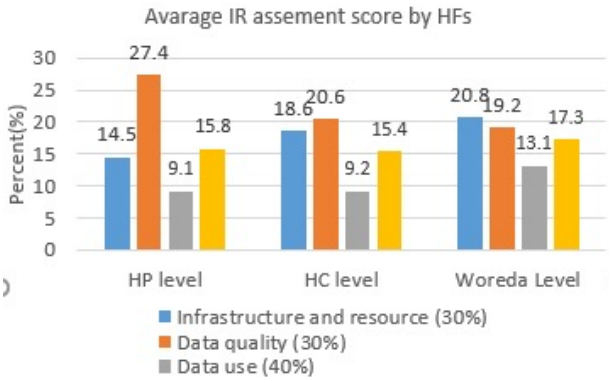

Figure 1: Average IR assessment score by Facility type in selected woredas of the Afar region, 2024

Barriers

The study identified major barriers to HIS implementation, including inadequate infrastructure—such as unstandardized medical record units, a lack of recording tools, unreliable electricity/internet, device shortages, and the absence of offline-capable tools. Critical human resource gaps included a shortage of trained staff, high turnover, low digital literacy, and heavy workloads. Weak data management, characterized by incomplete/inconsistent reporting, as well as limited quality oversight, further compromised performance. Governance issues—low HIS prioritization, weak leadership,

limited budgets, geographic isolation, and poor infrastructure—added to the challenges.

Enabler's

The study also identified several enablers of HIS performance, including strong policy support for digital health, political commitment to strengthening HIS, and the availability of mentorship programs. Motivated staff with a willingness to learn digital skills are driving efforts to improve data quality and use. Ongoing mentorship programs provide continuous guidance and skill development, creating a solid foundation for enhancing HIS performance in these challenging settings.

Conclusion and recommendation

IR implementation in Afar remains low and requires urgent intervention, with major gaps in infrastructure, data quality, and data use. Facilities lack basic HIS resources—recording tools, electricity, and trained personnel—while high turnover, low digital literacy, and heavy workloads further limit performance. Weak governance, inadequate supervision, and limited budgets exacerbate these challenges.

However, opportunities exist through strong policy support, political commitment, and mentorship programs. Key interventions should focus on:

- **Infrastructure & Tools:** Standardized medical record units, DHIS2-compatible computers, reliable electricity (including solar), internet, and offline-capable tools.
- **Capacity Building:** Context-specific training on HIS, IR, ESV-ICD11, digital literacy, and data use.
- **Mentorship & Coaching:** Institutionalize mentorship with regular supervision, skills transfer, and performance monitoring.
- **Data Quality & Use:** Implement LQAS and RDQA, enhance feedback, and revitalize PMTs.
- **Accountability Framework:** Define roles, performance targets, and reporting linked to leadership appraisals.
- **Leadership Engagement:** Secure HIS budgets, integrate HIS priorities into plans, and reinforce governance and accountability.

References

1. Biru, A., et al., *Pathways to improve health information systems in Ethiopia: current maturity status and implications.* Health Research Policy and Systems, 2022. 20(1): p. 78.
2. Ministry of Health, *Health Sector Transformation Plan II - HSTP II 2020/21-2024/25 (2013 EFY - 2017 EFY).* 01 Jan 2021.
3. Knittel, B., et al., *Early effects of information revolution interventions on health information system performance in Ethiopia.* Global Health: Science and Practice, 2024. 12(6).
4. Yadav, S., *Digital pathways to excellence for bridging gaps and building competencies.* Holistic approaches to teacher development: Leadership, pedagogical practices, and cognitive insights: Leadership, pedagogical practices, and cognitive insights, 2025. 287.
5. mHealth Initiative, G., *Monitoring and Evaluating Digital Health Interventions.* 2016.
6. Akhlaq, A., et al., *Barriers and facilitators to health information exchange in low-and middle-income country settings: a systematic review.* Health policy and planning, 2016. 31(9): p. 1310-1325.
7. Csa, I., *Central statistical agency (CSA)[Ethiopia] and ICF.* Ethiopia Demographic and Health Survey, Addis Ababa, Ethiopia, and Calverton, Maryland, USA, 2016. 1(1).
8. MoH, *INFORMATION REVOLUTION IMPLEMENTATION GUIDELINE*. 2021-2025.
9. Mehl, G., et al., *WHO SMART guidelines: optimising country-level use of guideline recommendations in the digital age.* The Lancet Digital Health, 2021. 3(4): p. e213-e216.
10. Kumar, M. and D. Gotz, *System Design Barriers to HIS Data Use in Low and Middle-Income Countries: A Literature Review.* Weekly Epidemiological Record, 2014. 89(40): p. 429.
11. Tilahun, B., 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 Research Policy and Systems, 2021. 19(1): p. 141.

Evaluation of Perioperative Safety and Quality Strategies in Ethiopian Hospitals

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Abstract

Access to safe, affordable, and timely surgical care remains a critical challenge in low- and middle-income countries (LMICs), with Ethiopia facing significant gaps in perioperative safety and quality improvement (QI) practices. This mixed-methods study evaluates perioperative safety protocols and QI strategies across 24 high-volume Ethiopian hospitals, assessing adherence to international standards, identifying systemic challenges, and exploring best practices.

A cross-sectional design was employed using structured checklists, direct observations, and interviews adapted from WHO and World Federation of Anesthesiologists tools, refined via a Delphi consensus. Key findings show high compliance with anesthesia assessments (92%) and informed consent (100%) but reveal significant gaps in protocol use and postoperative care. Quality structures exist in 91.6% of hospitals, but only 54% had functional SaLT committees.

Findings indicate a need for enhanced checklist use, stronger QI mechanisms, and improved workforce training. Recommendations include digital surgical registries, clinical audits, and standardized protocols to align with global surgery goals.

Keywords: Perioperative safety, surgical quality improvement, WHO checklist, LMICs, Ethiopia

Introduction

Access to safe, timely, and affordable surgical care remains a major challenge in low- and middle-income countries (LMICs), where 9 out of 10 people lack access to essential surgery. This is compounded by a shortage of trained anesthesia providers, weak adherence to safety protocols, and limited quality improvement (QI) systems.

While high-income countries have adopted tools like the WHO Surgical Safety Checklist (SSC) and enhanced recovery protocols, their implementation in LMICs, including Ethiopia, remains inconsistent. Barriers such as limited workforce capacity, inadequate infrastructure, and poor protocol adoption persist.

In Ethiopia, perioperative safety efforts are hindered by staff shortages, inconsistent use of checklists, and lack of critical supplies. However, promising developments such as digital surgical registries and clinical audits are emerging.

Objective

This study aimed to assess the level of perioperative safety protocol implementation and quality improvement practices across high-volume surgical hospitals in Ethiopia to inform health policy and surgical system improvements.

Methods

A cross-sectional study was conducted in 24 high-volume surgical hospitals selected by the Ethiopian Ministry of Health. These included tertiary, referral, general, and primary hospitals across 10 regions and 2 city administrations. Data were collected between November and December 2024.

Facilities were purposively selected based on surgical case volume. Data collection tools—adapted from WHO and World Federation of Anesthesiologists standards—underwent two rounds of Delphi review, reaching 94.4% consensus, and were digitized for uniform use. A pretest was conducted in Addis Ababa prior to rollout.

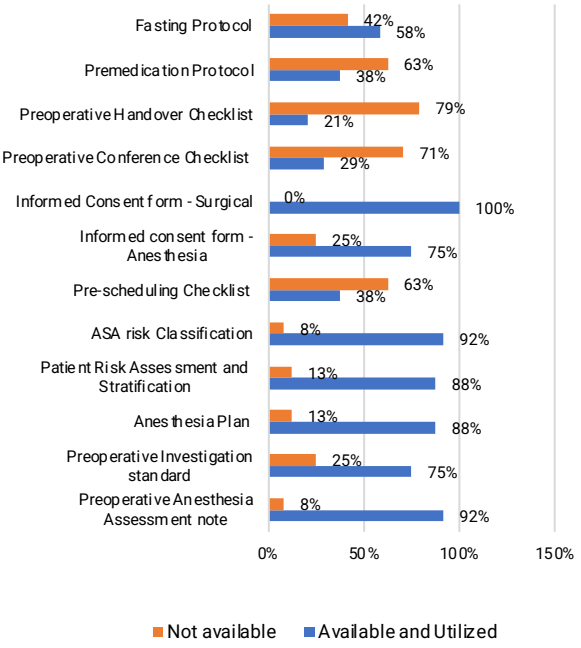
Data were gathered through structured checklists, observations, and interviews by multidisciplinary teams from the Ministry and regional health bureaus, all trained in the methodology. Analysis involved descriptive statistics and qualitative synthesis using Excel.

Exposure variables included surgical protocols, checklists, clinical audits, and organizational structure. Outcome variables were patient safety, quality improvement, and data management practices. Ethical approval was obtained from the Ethiopian Association of Anesthetists.

Results and Discussion

Section 1.1: Protocol Utilization and Patient Safety Practice

Most facilities had key protocols in place, including preoperative anesthesia assessments (92%), ASA classifications (92%), anesthesia plans (88%), and informed consent (100%). However, critical checklists, such as pre-scheduling, premedication, and fasting protocols, were missing in over 40% of hospitals, with preoperative handover and conference checklists absent in over 70%.



Section 1.2: Protocol Utilization – Part 2

The WHO Surgical Safety Checklist and anesthesia logbooks were used in all facilities (100%), with most also employing operating schedules (79%) and anesthesia prep checklists (67%). However, key tools were often missing: patient prep and OR readiness checklists were absent in over half of hospitals, while intraoperative nursing, anesthesia machine tests, and adverse event tracking tools were unavailable in 42–58%. Postoperatively, 46% lacked handover checklists, 33% had no infection surveillance, and 50% lacked incident reporting systems.

Section 1.3: Preoperative Practice

An assessment of 24 hospitals in Ethiopia revealed variable capacity regarding recommended standards for safe surgical systems and infrastructure. All of the facilities had surgical referral clinics while only 79% had established anesthesia clinics. Standard pre-operative anesthesia checklist was available in 88% of the institutions and 71% were effectively using WHO safe surgery checklist.

Section 1.4: Intraoperative Practice

In the evaluation of intraoperative safety measures practice, 92% of the institutions had adherence to utilization of WHO SSC in real time. Half (50%) of the health facilities were utilizing checklist to evaluate whether the operating room was ready or not. Significant number (83%) of the institutions had a designated room to prepare patient for OR and 100% of them had appropriate anesthesia management documentation.

Section 2: Quality Improvement Practice

The overall compliance rate with WHO surgical and anesthesia quality improvement standards across 24 high-volume health facilities is 80.77%. Data management and quality and performance monitoring and improvement has adherence rate of 80.56% and 81.25%.

Section 2.1: Structure and Process

Out of the 24 health facilities observed on our study 91.6% had organizational structure based on the hospital tier level and had assigned operating room manager to control their service. Thirteen (54%) had SaLT committee and only 50% were functional at the time of data collection. Majority (70.8%) use key performance indicators (KPI) to evaluate their service. Apart from 4 of the facilities all had regular clinical audit sessions and 70.8% had readily available guidelines, protocols and standard of practice (SOP) documents.

Section 2.2: Data Management

The assessment of data management and quality practices revealed positive findings across several key indicators. Regular backlog updating (83.33%), availability of operating room/surgical site infection registers (83.33%), and clinical format availability (95.83%) demonstrated high compliance rates. Furthermore, routine backlog analysis and action (70.83%), training of qualified data owners on key performance indicators (KPIs) (75%), regular data quality assessment (91.67%), KPI data verification (75%), data utilization for decision-making (75%), and maintenance of complete medical records (75%) exhibited satisfactory performance. However, areas requiring improvement were identified, including routine backlog analysis and action, training of data owners, KPI data verification, data utilization for decision-making, and maintenance of complete medical records, where compliance rates ranged from 70.83% to 75%.

Section 2.3: Performance Monitoring

The assessment of performance monitoring and improvement practices revealed room for enhancement in certain areas. While the inclusion of efficiency and safety indicators (87.50%) and appropriate antibiotic prophylaxis (87.50%) demonstrated satisfactory compliance, the review of surgical key performance indicators (KPIs) by the performance monitoring team (PMT) (75.00%) and the presence of a designated quality improvement team (75.00%) showed relatively lower adherence rates. These findings highlight the need for strengthening the systematic review of surgical KPIs by the PMT and ensuring the establishment of dedicated quality improvement teams to drive continuous performance monitoring and improvement efforts effectively.

Section 2.4: Qualitative Findings (best practices + challenges)

Qualitative analysis from 24 hospitals identified both enabling practices and persistent barriers in surgical safety and quality.

Best Practices

Two major enablers stood out:

1. Standardized Protocols: Facilities that institutionalized SOPs and consistently used the WHO Surgical Safety Checklist reported better coordination and patient safety.

"Our practice of utilizing SOPs, protocols, and checklists is institutionalized." — Tibebe Ghion Specialized Hospital

2. Quality Monitoring: Hospitals conducting regular audits and outcome reviews demonstrated stronger quality improvement efforts.

"Monthly clinical audit is regularly conducted at our hospital." — Dil-Chora Referral Hospital

Challenges

Despite progress, several challenges were noted:

1. Weak Governance and Implementation Gaps: Many hospitals lacked functional SaLT committees or failed to implement existing SOPs.

"We have SOPs—but they are not implemented." — Jimma Medical Center

2. Substandard PACU Services:

Poor postoperative care, limited equipment, and lack of trained staff compromised patient recovery.

3. Supply and Equipment Shortages: Inconsistent access to oxygen, gowns, and monitors hindered safe surgeries.

Recommendations

- Standardize use of WHO SSC across all facilities.
- Establish functional SaLT committees.
- Provide training on checklist utilization and incident reporting.
- Integrate routine clinical audits into QI processes.

References

1. Meara, J.G., et al. (2015). Global Surgery 2030: evidence and solutions for achieving health, welfare, and economic development. Lancet, 386(9993), 569–624.
2. Alkire, B.C., et al. (2015). Global access to surgical care: a modelling study. Lancet Global Health, 3(6), e316–e323.
3. World Health Organization. (2009). WHO Surgical Safety Checklist. Geneva: WHO.
4. Holmaas, G., et al. (2022). Strengthening anesthesia workforce in Ethiopia: progress and challenges. Anesthesia & Analgesia.
5. Hunter, B., et al. (2021). Checklist compliance and perceptions in low-resource surgical settings. BMJ Global Health, 6(7).
6. Kifle, Y., et al. (2021). Implementation of a digital surgical registry in Ethiopia: experience from a multicenter pilot. Journal of Global Surgery, 9(2), 45–52.
7. Steelman, V.M., et al. (2013). Perioperative patient safety concerns: priorities for improvement. AORN Journal, 97(1), 99–110.
8. Nijkamp, D., et al. (2021). Perioperative adverse events in sub-Saharan Africa: a systematic review. World Journal of Surgery, 45(5), 1104–1113.
9. Oliveira, T.C., et al. (2011). Medication errors in surgical patients. Brazilian Journal of Anesthesiology, 61(2), 144–151.
10. Chappy, S.L., et al. (2006). Disruptions in the perioperative environment. AORN Journal, 84(3), 401–417.

Uncontrolled Hypertension among Adult Hypertensive Patients in Addis Ababa Public Hospitals

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Abstract

Introduction: In 2019, 77% of women and 82% of men with hypertension had uncontrolled hypertension worldwide. Uncontrolled hypertension can cause stroke, myocardial infarction, heart failure, renal failure, dementia, blindness, and death. However, there is lack of evidence in the extent of uncontrolled hypertension in the study area using the new protocol.

Objectives: The overall objective was to assess the prevalence and associated factors of uncontrolled hypertension among adult hypertensive patients at public hospitals of Addis Ababa.

Methods: A cross-sectional study was conducted on 408 hypertensive patients selected using systematic sampling from April 12 to May 12, 2024. We used a structured questionnaire, patient chart and took physical measurements. Data were entered into Epi-data and analyzed using statistical package for social science version 25. A logistic regression was used to identify factors associated with uncontrolled hypertension at a P-value < 0.05 with a 95% confidence interval.

Results: The prevalence of uncontrolled hypertension among hypertensive patients at public hospitals of Addis Ababa was 66.2% (95% CI: 61.6%, 70.8%). Age ≥ 60 years (AOR=2.88, 95% CI: 1.37, 6.04), the presence of comorbidities (AOR=2.21, 95% CI: 1.23, 3.96), being overweight (AOR=2.25, 95% CI: 1.20, 4.24), non-adherence to antihypertensive medication (AOR=5.21, 95% CI: 2.76, 9.83), non-adherence to a low-salt diet and dietary approaches (AOR= 2.74, 95% CI: 1.35, 5.53), taking three or more antihypertensive medications (AOR= 3.10, 95% CI: 1.16, 8.25), and non-adherence to physical exercise (AOR=2.84, 95% CI 1.49, 5.39) were the significant factors.

Conclusion: Uncontrolled hypertension was very high in public hospitals of Addis Ababa, Ethiopia. Key factors for uncontrolled hypertension were non-adherence, use of multiple medications, physical inactivity, and low adherence to low salt and dietary approaches. Patient education, promoting lifestyle changes, and leveraging digital health tools, like mobile apps, for real-time support and adherence tracking are recommended.

Keywords: Uncontrolled hypertension, prevalence, hypertensive patients, public hospitals, Ethiopia

Introduction

Cardiovascular disease (CVD) is the leading cause of death globally, responsible for 17.3 million deaths annually, with hypertension as a primary risk factor for nearly half of all CVD-related morbidity and mortality (1). Globally In 2019 only 23% of women and 18% of men on hypertension therapy effectively controlled their blood pressure (2). The magnitude of uncontrolled hypertension varied from 54.9% at Tikur Anbessa Hospital to 73.8% at Zewditu Memorial Hospital (3, 4). Most studies on uncontrolled hypertension in Ethiopia utilized the outdated 2003 guidelines (5). There is lack of study based on updated 2014 guidelines for the management of hypertension (6). Studies on uncontrolled hypertension have shown significant disparities and only a few factors were consistently identified across studies, and nearly half did not evaluate patients' knowledge of hypertension self-care. Without assessing the knowledge status of patients, it will be difficult to fully understand patient-side factors for uncontrolled hypertension.

Objective: The overall objective was to assess the prevalence and associated factors of uncontrolled hypertension among adult hypertensive patients in public hospitals in Addis Ababa.

Methods

The study was conducted at selected public hospitals in Addis Ababa from April 12 to May 12, 2024. We employed a hospital-based cross-sectional study design. The sample size was calculated based on the following assumptions: 80% power, 37.9% proportion of non-adherence to physical exercise in exposed individuals, and 24.2% in unexposed individuals, a 95% confidence interval, and a 1:1 ratio of unexposed to exposed individuals (7) and the final sample size was 425 participants. The study participants were chosen using systematic random sampling methods and data collected using structured questionnaire, patient charts review and measurement of current blood pressure, height, and weight were taken on the day of data collection. The collected data were coded and entered into Epi-data version 3.1.and analyzed using SPSS version 25**.** The results of the analysis are presented in the form of text and summary statistics. For categorical variables, frequencies, percentages, and figures were used. To identify the factors that were associated with uncontrolled hypertension, logistic regression was carried out with a p-value < 0.05 at 95% confidence interval.

Result and discussion

Prevalence of uncontrolled hypertension

The prevalence of uncontrolled hypertension among adult hypertensive patients in public hospitals in Addis Ababa was 66.2% (95% CI = 61.61%, 70.79%). This prevalence is consistent with findings from a study conducted in six Latin American countries (62.4%)(8). However, this prevalence is lower than that reported in the Peru (94.7%)(9), and Morocco (73%)(10). The study was limited to a single facility, which could lead to overestimation. This study is higher than studies done in Russia (47.8%) Botswana (55%) (11), and Tanzania (37.2%)(12). This may be due to the differences in socioeconomic status, which leads to the individuals were unable to access healthcare facilities (13).

Factors associated with uncontrolled hypertension

In this study, hypertensive patients aged sixty years and older were 2.88 times more likely to develop uncontrolled hypertension than those aged younger than sixty years (AOR = 2.88). This finding is similar to that of an Iranian study (14), a study conducted in three Mekelle hospitals (15), and a study at Jimma University (16). This could be because as people age increased, their blood vessels lose elasticity, resulting in peripheral vascular resistance and uncontrolled hypertension (16). In this study, hypertensive patients with comorbidities were 2.21 times

more likely to have uncontrolled hypertension than those who were not diagnosed with comorbidities. This finding is consistent with the findings of a study conducted at Tigrai (17). A possible explanation could be that many chronic diseases can cause secondary hypertension, making it difficult to control hypertension while also treating other illnesses (17).

Overweight hypertensive patients were 2.25 times more likely to develop uncontrolled hypertension than normal-weight patients (AOR = 2.25, 95% CI: 1.20, 4.24). This finding is consistent with a Moroccan study (10), and study from Tigray (17). This could be explained by the fact that being overweight increases afterload and peripheral vascular resistance, which leads to increased triglyceride and cholesterol levels, decreased high-density lipoprotein (HDL) levels, and uncontrolled hypertension(16).

Hypertensive patients who did not adhere to their antihypertensive medications were 5.21 times more likely to have uncontrolled hypertension compared to their counterparts (AOR = 5.21, 95% CI: 2.76, 9.83). This study is line with the findings from studies done in Asmara (72.8%) (18), and, Afghanistan (47.9%)(19). Those who did not adhere to a low-salt diet or DASH diet were approximately three times more likely to develop uncontrolled hypertension than those who did adhere to a low-salt or DASH diet (AOR = 2.74, 95% CI: 1.35, 5.53). This finding is consistent with studies done in Northwest Ethiopia (20), and three Mekelle Hospitals (15). This similarity could be explained by the fact that salt reduces the natural sodium balance in the body, causing fluid retention and, as a result, increasing the pressure exerted by the blood vessel walls, leading to uncontrolled hypertension(21).

Hypertensive patients who were taking three or more antihypertensive medications were 3.1 times more likely to develop uncontrolled hypertension than those who were taking one or two antihypertensive medications (AOR = 3.10, 95% CI: 1.16, 8.25). This finding is in line with studies conducted in Thailand (22), and Ghana (23). This consistency could be due to the possibility that those who took three or more antihypertensive medications increase pill burden and cost, which reduce adherence. Poor adherence contributes significantly to uncontrolled hypertension (24).

Those who did not adhere to physical exercise were 2.84 times more likely to have uncontrolled hypertension than those who did (AOR = 2.84, 95% CI: 1.49, 5.39). This finding is consistent with studies performed at Tigray (17) and Nekemte (25). These are because of regular physical activity helps to strengthen the heart, allowing it to pump more blood with less effort, a reduction in systemic vascular resistance. Furthermore, exercise lowers blood pressure by decreasing body weight and increasing renal function (25).

Limitations of the study

This study has limitations. The study might have a social desirability and recall bias. As the study used a cross-sectional study design, it is difficult to relate the temporal relationship and has a short duration of study.

Conclusion and recommendation

The study revealed that a high prevalence of uncontrolled hypertension among hypertensive patients in Addis Ababa public hospitals, with non-adherence to antihypertensive medications as a key predictor. Other contributing factors include use of multiple medications, physical inactivity, and low adherence to low-salt and DASH diets. Prioritizing targeted interventions to improve antihypertensive medication adherence, including structured follow-ups, enhanced patient education on adherence benefits. Advocacy on multidisciplinary care models, patient-centered approaches and policy initiatives help to reduce this menace.

Reference

1. Zhou D, Xi B, Zhao M, Wang L, Veeranki SP. Uncontrolled hypertension increases risk of all-cause and cardiovascular disease mortality in US adults: the NHANES III Linked Mortality Study. Scientific reports. 2018;8(1):1-7.

2. Zhou B, Carrillo-Larco RM, Danaei G, Riley LM, Paciorek CJ, Stevens GA, et al. Worldwide trends in hypertension prevalence and progress in treatment and control from 1990 to 2019: a pooled analysis of 1201 population-representative studies with 104 million participants. The Lancet. 2021;398(10304):957-80.

3. Horsa BA, Tadesse Y, Engidawork E. Assessment of hypertension control and factors associated with the control among hypertensive patients attending at Zewditu Memorial Hospital: a cross sectional study. BMC research notes. 2019;12(1):152.

4. ALEMAYEHU M, Abebe S, Yadeta D, Alemayehu B. Ambulatory Blood Pressure Control Pattern in Hypertensive Patients at Tikur Anbesa Specialized Hospital: A Cross Sectional Study. 2021.

5. Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL, Jr., et al. Seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. Hypertension (Dallas, Tex : 1979). 2003;42(6):1206-52.

6. James PA, Oparil S, Carter BL, Cushman WC, Dennison-Himmelfarb C, Handler J, et al. 2014 evidence-based guideline for the management of high blood pressure in adults: report from the panel members appointed to the Eighth Joint National Committee (JNC 8). Jama. 2014;311(5):507-20.

7. Fekadu G, Adamu A, Gebre M, Gamachu B, Bekele F, Abadiga M, et al. Magnitude and determinants of uncontrolled blood pressure among adult hypertensive patients on follow-up at Nekemte Referral Hospital, Western Ethiopia. Integrated blood pressure control. 2020:49-61.

8. Lamelas P, Diaz R, Orlandini A, Avezum A, Oliveira G, Mattos A, et al. Prevalence, awareness, treatment and control of hypertension in rural and urban communities in Latin American countries. Journal of hypertension. 2019;37(9):1813-21.

9. Carrillo-Larco RM, Bernabe-Ortiz A, Villarreal-Zegarra D. Short-term trends in the prevalence, awareness, treatment, and control of arterial hypertension in Peru. 2021.

10. Essayagh T, Essayagh M, El Rhaffouli A, Khouchoua M, Bukassa Kazadi G, Khattabi A, et al. Prevalence of uncontrolled blood pressure in Meknes, Morocco, and its associated risk factors in 2017. PloS one. 2019;14(8):e0220710.

11. Gala P, Moshokgo V, Seth B, Ramasuana K, Kazadi E, M'Buse R, et al. Medication Errors and Blood Pressure Control Among Patients Managed for Hypertension in Public Ambulatory Care Clinics in Botswana. Journal of the American Heart Association. 2020;9(2):e013766.

12. Galson SW, Stanifer JW, Hertz JT, Temu G, Thielman N, Gafaar T, et al. The burden of hypertension in the emergency department and linkage to care: A prospective cohort study in Tanzania. PloS one. 2019;14(1):e0211287.

13. Antignac M, Diop IB, Macquart de Terline D, Kramoh KE, Balde DM, Dzudie A, et al. Socioeconomic status and hypertension control in sub-Saharan Africa: the Multination EIGHT study (Evaluation of Hypertension in Sub-Saharan Africa). Hypertension. 2018;71(4):577-84.

14. Katibeh M, Moghaddam A, Yaseri M, Neupane D, Kallestrup P, Ahmadieh H. Hypertension and associated factors in the Islamic Republic of Iran: a population-based study. Eastern Mediterranean health journal = La revue de sante de la Mediterranee orientale = al-Majallah al-sihhiyah li-sharq al-mutawassit. 2020;26(3):304-14.

15. Aberhe W, Mariye T, Bahrey D, Zereabruk K, Hailay A, Mebrahtom G, et al. Prevalence and factors associated with uncontrolled hypertension among adult hypertensive patients on follow-up at Northern Ethiopia, 2019: cross-sectional study. The Pan African medical journal. 2020;36:187.

16. Tesfaye B, Haile D, Lake B, Belachew T, Tesfaye T, Abera H. Uncontrolled hypertension and associated factors among adult hypertensive patients on follow-up at Jimma University Teaching and Specialized Hospital: cross-sectional study. Research Reports in Clinical Cardiology. 2017;8:21.

17. Gebremichael GB, Berhe KK, Zemichael TM. Uncontrolled hypertension and associated factors among adult hypertensive patients in Ayder comprehensive specialized hospital, Tigray, Ethiopia, 2018. BMC cardiovascular disorders. 2019;19(1):121.

18. Mebrahtu G, M MM, Okoth Achila O. Antihypertensive Medication Adherence and Associated Factors: A Cross-Sectional Analysis of Patients Attending a National Referral Hospital in Asmara, Eritrea. 2021;15:2619-32.

19. Stanikzai MH, Wafa MH. Predictors of non-adherence to antihypertensive medications: A cross-sectional study from a regional hospital in Afghanistan. 2023;18(12):e0295246.

20. Abegaz TM, Abdela OA. Magnitude and determinants of uncontrolled blood pressure among hypertensive patients in Ethiopia: hospital-based observational study. 2018;16(2):1173.

21. Animut Y, Assefa AT, Lemma DG. Blood pressure control status and associated factors among adult hypertensive patients on outpatient follow-up at University of Gondar Referral Hospital, northwest Ethiopia: a retrospective follow-up study. Integrated blood pressure control. 2018;11:37-46.

22. Sakboonyarat B, Rangsin R, Kantiwong A, Mungthin M. Prevalence and associated factors of uncontrolled hypertension among hypertensive patients: a nation-wide survey in Thailand. BMC research notes. 2019;12(1):380.

23. Sarfo FS, Mobula LM, Burnham G, Ansong D, Plange-Rhule J, Sarfo-Kantanka O, et al. Factors associated with uncontrolled blood pressure among Ghanaians: Evidence from a multicenter hospital-based study. PloS one. 2018;13(3):e0193494.

24. Kinfe DG, Berhe G. Blood Pressure Control, Left Ventricular Hypertrophy and Treatment Practice Among Hypertensive Patients in Ethiopia. 2020;13:903-16.

25. Fekadu G, Adamu A, Gebre M. Magnitude and Determinants of Uncontrolled Blood Pressure Among Adult Hypertensive Patients on Follow-Up at Nekemte Referral Hospital, Western Ethiopia. 2020;13:49-61.

Assessment of Operational Challenges for Pharmaceutical Manufacturing Industries in Ethiopia

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Abstract

Background: The Ethiopian pharmaceutical manufacturing industry is a vital pillar of the nation's healthcare system and economic development, playing a key role ensuring access to essential medicines while reducing dependency on costly imports. However, despite its importance, this critical sector operates far below its potential, constrained by systemic and operational challenges that limit its capacity to meet national demand and ensure sustainable growth.

Objective: This study was conducted to comprehensively assess operational challenges confronting the Ethiopian pharmaceutical manufacturing industry and to propose evidence-based strategies aimed at enhancing capacity utilization and overall competitiveness.

Methods: Institution-based cross-sectional study was performed from January to June/2024, involving 256 employees from various pharmaceutical industries and related government agencies. A systematic sampling technique was employed, and data were collected via pretested, self-administered structured questionnaire. The collected data were analyzed using SPSS version 23, with binary logistic regression used to estimate the association between variables and capacity utilization. A significant level was set at p-value of <0.05.

Result: The study achieved 92.1% response rate. Central finding reveals that capacity utilization among local pharmaceutical manufacturers is alarmingly low: 78.9% of firms operating at less than 30% of their installed capacity. The study identified several factors significantly associated with low capacity utilization, including reliance on imported raw materials (AOR = 0.02), internal operational inefficiencies (AOR = 0.05), inadequate infrastructure (AOR = 0.039), and shortage of skilled labor (AOR = 0.028). In contrast, collaborative engagement with local manufacturers (AOR = 3.02) and confidence in government initiatives (AOR = 2.82) were found to be positively associated with improved capacity utilization.

Conclusion: Ethiopian pharmaceutical industries are functioning at a sub-optimal level due to a combination of factors, including limited access to foreign exchange, dependency on raw material imports, and critical shortages of skilled labor. To improve capacity and contribute more effectively to public health, these challenges must be addressed through supportive regulatory frameworks, strategic investments, and enhanced collaboration among all stakeholders. The positive role of industry-wide cooperation and confidence in government support highlights crucial pathway for future growth.

Keywords: Local Manufacturers, Pharmaceutical, Capacity, Ethiopia

Introduction:

Over two billion people globally lack access to essential medicines, highlighting the vital role of local pharmaceutical production (LPP). LPP ensures reliable, affordable medicine supplies, especially for remote populations, while reducing dependence on international suppliers and strengthening resilience against global supply chain disruptions(1).

Africa, home to 17% of the world's population, produces only 3% of global pharmaceuticals and imports over 80% of its medical needs—a critical vulnerability exposed during health crises(2). Ethiopia's pharmaceutical sector is vital for both healthcare and economic growth, aiming to reduce costly import dependence through local production, as outlined in its Health Sector Development Plan (HSDIP-2024).

Despite its potential, Ethiopia's pharmaceutical sector struggles with regulatory delays, financial constraints, import dependency, outdated technology, and inefficiencies – all reducing productivity and increasing costs(3). This study examines these challenges to bridge the gap between policy goals and real-world performance, providing actionable solutions to boost local production and strengthen healthcare and economic outcomes.

Objective: To assess the operational challenges faced by the Ethiopian pharmaceutical manufacturing industry and propose strategies to enhance its capacity utilization and competitiveness.

Methods: The study employed an institution-based cross-sectional design and was carried out across various pharmaceutical manufacturing firms in Ethiopia from January to June 2024. The study population was composed of all employees, managers, and key stakeholders within the Ethiopian pharmaceutical manufacturing sector, including representatives from regulatory bodies such as the MoH, EPSS, and EFDA

A sample size of 278 was determined using Cochran's formula, with an estimated unknown proportion of the population set at 0.5, a margin of error of 0.05, and a 95% confidence level. To ensure a representative sample across different stakeholders, a stratified random sampling technique was used. The employees and managers on the front lines of manufacturing provided a ground-level perspective to capture the lived experiences and perceptions of the workforce. Data were collected using a pretested, structured, self-administered questionnaire. The questionnaire included variables designed to measure regulatory barriers, financial constraints, supply chain issues, technological deficiencies, and operational inefficiencies. Data were double-entered and verified by two reviewers to ensure accuracy. For analysis, the data were coded, entered into Epi Info version 7.2.4, and then exported to SPSS version 23. Descriptive statistics were used to summarize the data, while inferential statistics, specifically bivariate and binary logistic regression analysis, were employed to determine the association between independent variables and the dependent variable of capacity utilization. Predictor variables were selected for the multivariate model at an alpha level of 0.05. The goodness of fit of the final model was checked using the Hosmer-Lemshow test, resulting in a chi-square of 3.79 and a p-value of 0.81, which indicated a good fit. Statistical significance for associations was declared at a p-value of <0.05.

Results and Discussion:

The study reveals alarming underutilization in Ethiopia's pharmaceutical sector, with 78.9% of firms operating below 30% production capacity and none exceeding 50%. This chronic underperformance stems primarily from near-total import dependence (95.7% of firms rely on foreign raw materials), making companies 98% less likely to achieve optimal capacity compared to those using local inputs.

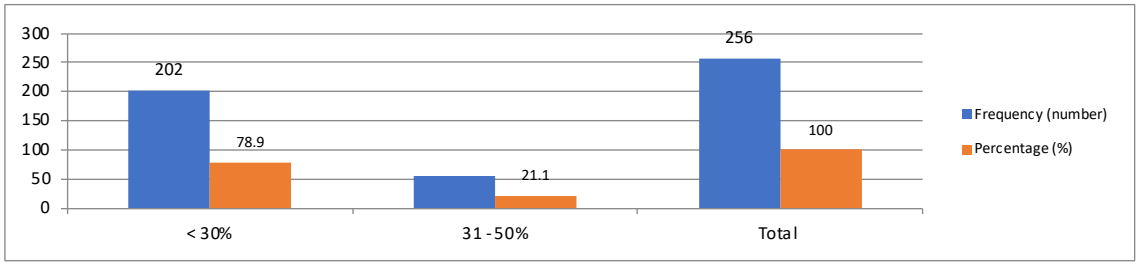

Figure 1: Local pharmaceutical manufacturers' capacity utilization in Ethiopia; August 2024

A critical compounding factor is universal foreign exchange shortages (reported by 100% of respondents) caused by restrictive monetary policies, which directly contradict national industrial development goals. These interconnected challenges - import reliance, forex constraints, and policy misalignment - create a self-reinforcing cycle of low productivity that undermines both healthcare security and economic potential. The findings expose an urgent need for coordinated policy reforms to reconcile macroeconomic stability measures with industrial development objectives in this strategic sector(4).

Table 1: Factors Associated with the Low Capacity Utilization for Local Pharmaceutical Manufacturing Industries in Ethiopia, August 2024

Variables	Capacity Utilization		COR (95% C.I.)	AOR (95% C.I.)
	< 30%	≥ 30%		
Raw Material Source				
In house and local	9(3.5%)	2(0.8%)	1	1
Imported	193(75.4%)	52(20.3%)	0.03(0.001, 0.081) **	0.02(0.003, 0.037)**
Firm's Operational Efficiency				
Agree	49(19.1%)	15(5.9%)	1	1
Disagree	153(59.8%)	39 (15.2%)	0.02(0.001, 0.032) **	0.05(0.001, 0.071) **
Adequate for Local Infrastructure				
Yes	66(25.8%)	20(7.8%)	1	1
No	136(53.1%)	34(13.3)	0.04(0.002, 0.069) **	0.039(0.002, 0.063) **
Skilled Labor and Experts				
Yes	98(38.3%)	26(10.2%)	1	1
No	104(40.6%)	28(10.9%)	0.03(0.007, 0.082) **	0.028(0.001, 0.049) **
Collaboratively Working with Local Pharmaceutical Manufacturers				
Yes	181(70.7%)	51(19.9%)	1	1
No	21(8.2%)	3(1.2%)	3.09(1.01, 10.78) **	3.02(1.31, 6.98) **
Trust on a governmental support, initiatives and strategic plan for local manufacturers				
Yes	145(56.6%)	50(19.5%)	1	1
No	57(22.4%)	14(5.5%)	2.90(1.98, 9.23) **	2.82(1.23, 6.38) **

The study reveals three critical barriers limiting Ethiopia's pharmaceutical manufacturing capacity. First, a severe skills shortage affects 68.8% of firms, making them 97.2% less likely to achieve full production capacity. This workforce crisis extends beyond training gaps to include brain drain and inadequate knowledge transfer systems. Second, operational challenges plague 84.3% of manufacturers, reducing their capacity utilization by 95%, primarily due to poor inventory management and outdated processes. Infrastructure deficiencies (reported by 73.4% of firms) further compound these issues, worsening resource accessibility by 96.1%. While technology adoption showed no significant correlation with capacity problems - suggesting recent improvements in this area - its potential benefits appear overshadowed by more pressing systemic constraints like forex shortages and workforce gaps. These findings underscore the need for comprehensive interventions addressing human capital development, operational modernization, and infrastructure upgrades simultaneously to unlock the sector's potential(5).

Despite the formidable challenges, the study also identified crucial enablers for the industry's growth. The most powerful findings were the positive associations between capacity utilization and collaboration among local manufacturers (AOR=3.02) and trust in government initiatives (AOR=2.82). These results are not merely encouraging but represent the most viable pathways for future growth. Collaboration among firms, for instance, can lead to pooled procurement; a strategy that 84.0% of respondents believed would be effective for overcoming raw material acquisition challenges. The fact that trust in government initiatives is a significant factor indicates that, despite a history of restrictive policies (40.6% of respondents found them to be so), there is still a reservoir of goodwill and a belief that supportive policies and incentive packages can work. This highlights a critical psychological and political variable that must be leveraged. The solution, therefore, is not solely a set of technical fixes but also a call for a new paradigm of public-private partnership and a fundamental rebuilding of confidence.

Conclusions and Recommendations

The study highlights that Ethiopian local pharmaceutical manufacturers are operating below their capacity, with an average utilization below 30%. Key factors contributing to this low capacity utilization include limited access to foreign exchange, reliance on imported raw materials, a shortage of skilled labor, and significant operational challenges. Addressing these issues through improved infrastructure, better supply chain management, investment in modern technologies, and supportive regulatory frameworks could enhance their capacity utilization. Collaboration with local manufacturers and trust in government initiatives also play a crucial role in improving production capacity

Reference:

1. Building the case for investment in local pharmaceutical production in Africa: A comprehensive framework for investment policymakers. Policy Rev.
2. The case for investment: Insights from five African manufacturers on local manufacturing of diagnostic tools [Internet]. [cited 2025 Aug 13]. Available from: https://www.path.org/our-impact/articles/investment-insights-local-manufacturing-diagnostic/
3. Marew T, Richmond FJ, Belete A, Gebre-Mariam T. Trends and Challenges in Access to Essential Medicines in Ethiopia and the Contributions of Local Pharmaceutical Production. Ethiop J Health Sci. 2022 Sep;32(5):1027–42.
4. Launch of Ethiopian National Strategy and Plan of Action for Pharmaceutical Manufacturing Development and Improving Access 14 July 2015 [Internet]. [cited 2025 Aug 13]. Available from: https://cdn.who.int/media/docs/default-source/medicines/local-production/ethiopian_national_strategy.pdf?sfvrsn=89b37c7e_1

5. Suleman S, Woliyi A, Woldemichael K, Tushune K, Duchateau L, Degroote A, et al. Pharmaceutical Regulatory Framework in Ethiopia: A Critical Evaluation of Its Legal Basis and Implementation. Ethiop J Health Sci. 2016 May 16;26(3):259.

6. Moosivand A, Rajabzadeh Ghatari A, Rasekh HR. Supply Chain Challenges in Pharmaceutical Manufacturing Companies: Using Qualitative System Dynamics Methodology. Iran J Pharm Res IJPR. 2019;18:1103–16.

7. Tannoury M, Attieh Z. The Influence of Emerging Markets on the Pharmaceutical Industry. Curr Ther Res Clin Exp. 2017;86:19–22.

8. Yenet A, Nibret G, Tegegne BA. Challenges to the Availability and Affordability of Essential Medicines in African Countries: A Scoping Review. Clin Outcomes Res CEOR. 2023;15:443–58.

9. Pandey N, de Coninck H, Sagar AD. Beyond technology transfer: Innovation cooperation to advance sustainable development in developing countries. WIREs Energy Environ. 2022;11:e422.

10. Bilal AI, Bititci US, Fenta TG. Challenges and the Way Forward in Demand-Forecasting Practices within the Ethiopian Public Pharmaceutical Supply Chain. Pharmacy. 2024; 12:86.

11. Talele D, Talele C, Shinde Y, Shaha A. GOOD MANUFACTURING PRACTICES AND COMPLIANCE REQUIREMENTS IN DRUG FORMULATION AND MANAGEMENT. 2023.

12. Jones GH, Carrier MA, Silver RT, Kantarjian H. Strategies that delay or prevent the timely availability of affordable generic drugs in the United States. Blood. 2016; 127:1398–402.

13. Kaplan W, Laing R. Local Production of Pharmaceuticals: Industrial Policy and Access to Medicines An Overview of Key Concepts, Issues and Opportunities for Future Research. 2005;

14. Gurgula O. Strategic Patenting by Pharmaceutical Companies – Should Competition Law Intervene? Iic Int Rev Ind Prop Copyr Law. 2020; 51:1062.

15. Salah A, Çağlar D, Zoubi K. The Impact of Production and Operations Management Practices in Improving Organizational Performance: The Mediating Role of Supply Chain Integration. Sustainability. 2023;15:15140.

16. Tamvada JP, Narula S, Audretsch D, Puppala H, Kumar A. Adopting new technology is a distant dream? The risks of implementing Industry 4.0 in emerging economy SMEs. Technol Forecast Soc Change. 2022;185:122088.

17. Haeussler C, Assmus A. Bridging the gap between invention and innovation: Increasing success rates in publicly and industry-funded clinical trials. Res Policy. 2021;50:104155.

Impact of the Information Revolution on Antenatal Care Quality in Oromia and Gambella, Ethiopia

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Abstract

Background

High-quality antenatal cares (ANC) is essential for maternal health. Health Information Systems (HIS) interventions are believed to enhance ANC quality by improving data use and service delivery. This study assessed the impact of HIS interventions on ANC quality in Ethiopia.

Methods: A comparative cross-sectional survey was conducted from October 15–25, 2023, among 840 mothers attending health facilities (HFs) with Health Information System (HIS) interventions. Facilities were classified as "model" (≥90%) or "candidate" (65–90%) based on 2015 EFY performance scores. Data were collected using a structured questionnaire adapted from the Demographic and Health Surveys (DHS) on socio-demographic characteristics and antenatal care (ANC) service utilization using SurveyCTO among women who had given birth within the 12 months preceding the survey. Good-quality ANC was defined as receipt of all eight essential components, assessed as a binary outcome (1 = all received; 0 = fewer than eight). The components include: BP measurement, blood and urine tests, iron supplements, tetanus injection, nutrition counseling, birth preparedness, and danger sign awareness. A two-stage sampling technique was used. Data were analyzed using SPSS v25. Bivariable and multivariate logistic regression identified predictors of ANC quality, with adjusted odds ratios and 95% confidence intervals used to assess statistical significance.

Results: Overall, 54% of mothers received all eight ANC components (95% CI: 50.6–57.4%). Nearly all (97.4%) had at least one ANC visit, and 66.8% attended four or more. Early initiation (within four months) occurred in 61.7% of cases. The most delivered components were TT immunization (95.0%), BP measurement (92.5%), and iron supplementation (90.6%). The intervention showed a strong impact: mothers at model facilities were over nine times more likely to receive good-quality ANC (AOR = 9.23; 95% CI: 5.65–15.1), with 77.4% receiving all eight components compared to just 22.8% at candidate facilities. Married women also had higher odds of receiving good-quality ANC (AOR = 8.16; 95% CI: 1.62–41.2).

Conclusion: Model health facilities demonstrated better ANC quality. Our findings underscore the importance of strengthening HIS interventions and sustaining model facility status to improve ANC quality. Future efforts should prioritize continuous quality improvement and strategies to boost service uptake

Keywords: Antenatal Care, Information revolution, Health Information Systems, Quality Improvement, Ethiopia

Background

In 2020, 95% of maternal deaths occurred in low-income countries, with sub-Saharan Africa facing the highest burden (536 deaths per 100,000 births) (1). While 88% of pregnant women globally attend at least one ANC visit, only 69% complete the recommended four visits—dropping to 58.5% in sub-Saharan Africa, with disparities by wealth and region (2,3) Quality ANC is vital for detecting complications and improving outcomes, highlighting the need for consistent monitoring to ensure care standards outcomes (4)

WHO recognizes HMIS as vital for health systems (5), with quality data driving informed decision-making in healthcare (6,7)but poor quality of these data hinders use. To address concerns about data quality in Malawi, the Ministry of Health and National Statistical Office conducted a data quality assessment (DQA. HIS improves ANC through better data management (8)Sri Lanka, and at exploring its use for developing recommendations for improving quality of care (QoC Since 2008, Ethiopia has enhanced HMIS via standardization and the Information Revolution program, overcoming resource challenges to enable health outcomes through data-driven decisions (9,10).

Objective

To assess the impact of Information Revolution (IR) implementation status on the quality of ANC in model versus candidate health facilities

Methods

Setting Area, design and sample size

A comparative cross-sectional study involving 840 recent mothers in Oromia and Gambella assessed the quality of ANC across 12 health centers and 24 kebeles, categorized by Information Revolution (IR) performance status (model, candidate, or mixed). Using a two-stage sampling approach, the sample size was calculated to detect a 10% difference in quality ANC service utilization across IR categories. The dependent variable was ANC quality, defined by receipt of all eight essential components, while independent variables included demographic, household, maternal characteristics, and proximity to health centers. Data were collected using a structured questionnaire adapted from the DHS and administered by trained data collectors through face-to-face interviews with mothers who had received ANC services via SurveyCTO. and analyzed in SPSS using bivariable and multivariate logistic regression were employed to assess the association between the outcome variable and multiple predictor variables with statistical significance set at $p<0.05$. Ethical approval was obtained from Jimma University, with verbal consent from participants, confidentiality assured, and support letters secured from Regional Health Bureaus.

Results and Discussion

Result

Participant Demographics and Socioeconomic Profile

A total of 840 women were selected through two-stage sampling across 24 kebeles 560 from Oromia and 280 from Gambella with equal representation from candidate, model, and mixed facilities; most were aged 20–34 years, nearly all were married (98%), about 29% had no formal education, and agriculture was the primary occupation for 72% of mothers and 84% of their partners.

Utilization of ANC Service

Nearly all women (97.4%) attended at least one antenatal care (ANC) visit with a skilled provider, while 66.8% completed four or more visits, and 61.7% initiated ANC within the first four months of pregnancy. The majority received services at health centers (87.9%).

Components of ANC

Most women received key ANC services, including TT vaccination (95%), blood pressure checks (92.5%), IFA supplements (90.6%), and blood tests (89%). However, urine testing and danger sign counseling reached only 85%, indicating areas for improvement

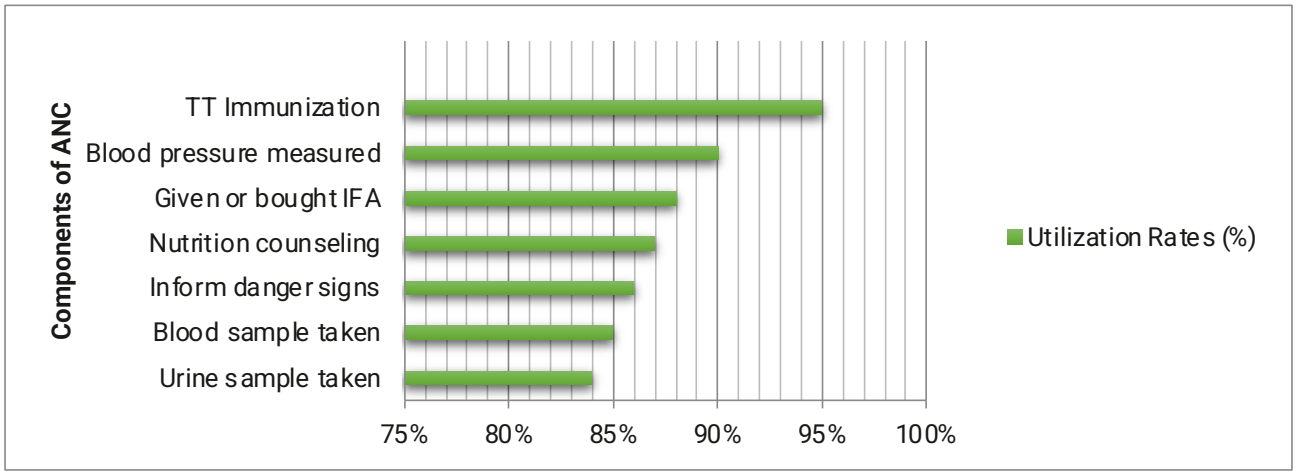

Fig.1 Proportion of Pregnant Women Receiving Essential ANC Components, Effect of IR Implementation Performance status of HCs on Quality of ANC, Ethiopia, October, 2023.

Quality ANC and Its Determinants

A study of 840 women found that only 54% received all eight essential components of AN), with substantial disparities in service quality across facility types. Coverage was highest at model health centers (77.4%), followed by mixed (60.9%) and candidate centers (22.8%), reflecting a 3.4-fold difference between model and candidate facilities. Women served at model (AOR: 9.23) and mixed (AOR: 3.89) centers had significantly higher odds of receiving quality ANC. Key factors associated with improved ANC quality included being married (AOR: 8.16), having a planned pregnancy, higher household wealth (rich vs. medium: AOR: 0.54), and proximity to health facilities (+5.7% odds per kilometer). Additionally, women engaged in farming had better ANC outcomes than those unemployed (AOR: 1.58).

Table 1: Information Revolution Assessment Status of Health Facilities and Quality of ANC, Ethiopia, October 2023

Quality of ANC Services	Model		Combination of Model & Candidates *		Candidate	Total		
	#	%	#	%	#	%	#	%
Poor Quality	63	23	106	39	207	77	376	45.97
Good Quality	216	77	165	61	61	23	442	54.03
Total	279	100	271	100	268	100	818	100.00

NB *Combination of Model & Candidates Selected based on quarterly scores, the facilities were modeled for two quarters and a candidate for the remaining two

Discussion

The study demonstrates a strong positive association between Implementation Readiness (IR) and ANC quality, highlighting how improved data use and system strengthening contribute to better maternal health outcomes. Overall, 54.0% of women received good-quality ANC—substantially higher than DHS estimates from Pakistan 41.4% (11), Nepal 21% (12)no studies have been conducted recently in Nepal. Therefore, we analyzed the sociodemographic correlates of the frequency and quality of antenatal care among Nepalese women from the nationally representative data of 2016. Methods: We analyzed data obtained from the Nepal Demography Health Survey (2016, sub-Saharan Africa (10.4%) and East Africa (11.6%) (13,14)data reporting in the SSA region focused primarily on four visits, and evidence on the timing and adequacy of ANC based on the current recommendation was limited. Hence, this study aimed at assessing the level of timely and adequate ANC visits and their determinants in the 18 Sub-Saharan African countries with the most recent DHS report (2016–2021 , and Ethiopia 22.5% in DHS 2016 and 43% in Mini EDHS (15,16). It also exceeded findings from regional studies in Sidama 41.2% (17),, Addis Ababa 33.3% (18), Hosanna 31.5% (19) increases the chance of using a skilled attendant at birth, and contributes to good health through the life cycle. Inadequate care during this time breaks a critical link in the continuum of care and affects both women and babies. Therefore, the main aim of this study was to determine the quality of ANC in Hadiya Zone, Southern Ethiopia. Method. A longitudinal facility-based study design was conducted among 1123 mothers whose gestational age of less than 16 weeks was identified and followed until birth and 40 days after birth to detect whether they gained the acceptable standard of quality of ANC from July 2017 to June 2018. A structured, predefined, and pretested observation check list and Likert scales were employed to obtain the necessary information after getting both written and verbal consent from the concerned bodies and study participants. Data was entered into Epi Info version 3.5 and transferred to STATA Version 14 software and cleaned by reviewing frequency tables, logical errors, and checking outliers. Generalized estimating equation (GEE, and Harar (24%) (20), likely due to CBMP interventions such as data quality training, mentorship, and performance reviews. However, ANC quality in our study was lower than in Tamil Nadu 98.6% (21), Mexico 74.1% (22)number of antenatal care visits and key processes of care. Methods In a cross-sectional, retrospective study we used data from the Mexican National Health and Nutrition Survey (ENSANUT, and Pakistan 61% (23), possibly due to differences in IR implementation, study design, timing, and recall bias. Additionally, married women were more likely to receive quality ANC than unmarried women, reflecting social and systemic barriers that affect service uptake (24–26)but millions of women in developing countries do not receive it. DATA SOURCES: A range of electronic databases was searched for studies conducted in developing countries and published between 1990 and 2006. English-language publications were searched using relevant keywords, and reference lists were hand-searched. REVIEW METHODS: A systematic review was carried out and both quantitative and qualitative studies were included. RESULTS: Twenty-eight papers were included in the review. Studies most commonly identified the following factors affecting antenatal care uptake: maternal education, husband's education, marital status, availability, cost, household income, women's employment, media exposure and having a history of obstetric complications. Cultural beliefs and ideas about pregnancy also had an influence on antenatal care use. Parity had a statistically significant negative effect on adequate attendance. Whilst women of higher parity tend to use antenatal care less, there is interaction with women's age and religion. Only one study examined the effect of the quality of antenatal services on utilization. None identified an association between the utilization

of such services and satisfaction with them. CONCLUSION: More qualitative research is required to explore the effect of women's satisfaction, autonomy and gender role in the decision-making process. Adequate utilization of antenatal care cannot be achieved merely by establishing health centres; women's overall (social, political and economic.

In summary, the findings affirm that strengthening IR and targeted health system interventions can significantly improve ANC quality, though persistent disparities call for inclusive and context-specific strategies**.**

Conclusion & Recommendations

HIS implementation improves ANC quality, especially in model facilities. To enhance maternal care, it is recommended to upgrade low-performing centers, strengthen service monitoring, expand ANC education, and pursue further HIS research

References

1. WHO. Trends in maternal mortality 2000 to 2020: estimates by WHO, UNICEF, UNFPA, World Bank Group and UNDESA/Population Division. WHO, Geneva. Geneva: World Health Organization; 2023. 12 p.
2. UNICEF. Atenatal care [Internet]. New York. 2024 [cited 2024 Aug 10]. Available from: https://data.unicef.org/topic/maternal-health/antenatal-care/
3. Tessema ZT, Teshale AB, Tesema GA, Tamirat KS. Determinants of completing recommended antenatal care utilization in sub-Saharan from 2006 to 2018: evidence from 36 countries using Demographic and Health Surveys. BMC Pregnancy Childbirth. 2021;21(1):192.
4. Belay A, Astatkie T, Abebaw S, Gebreamanule B, Enbeyle W. Prevalence and factors affecting the utilization of antenatal care in rural areas of Southwestern Ethiopia. BMC Pregnancy Childbirth. 2022;22(1):1–8.
5. WHO. Monitoring the Building Blocks of Health Systems : a Handbook of Indicators and Their Measurement Strategies. World Health Organization. Geneva: World Health Organization; 2010. 110 p.
6. O'Hagan R, Marx MA, Finnegan KE, Naphini P, Ng'ambi K, Laija K, et al. National assessment of data quality and associated systems-level factors in Malawi. Glob Heal Sci Pract. 2017;5(3):367–81.
7. WHO (World Health Organization). Data quality review, Module 1 Framework and metrics. Vol. NLM classi, WHO Press. 2017. 1–8 p.
8. Lazzerini M, Senanayake H, Mohamed R, Kaluarachchi A, Fernando R, Sakalasuriya A, et al. Implementation of an individual patient prospective database of hospital births in Sri Lanka and its use for improving quality of care. BMJ Open. 2019 Feb;9(2):e023706.
9. Ethiopian Ministry of Health. Health Information System Strategic Plan: 2020/21-2024/25. Addis Ababa:Ethiopia; 2021.
10. Ethiopian Ministry of Health. HMIS Indicators Reference Guide 2021. Addis Ababa:Ethiopia; 2021.
11. Asim M, Hameed W, Saleem S. Do empowered women receive better quality antenatal care in Pakistan? An analysis of demographic and health survey data. PLoS One. 2022;17(1 January):1–13.
12. Adhikari M, Chalise B, Bista B, Pandey AR, Upadhyaya DP. Sociodemographic correlates of antenatal care visits in Nepal: Results from Nepal Demographic and Health Survey 2016. BMC Pregnancy Childbirth. 2020;20(1):1–10.
13. Habte A, Tamene A, Melis T. Compliance towards WHO recommendations on antenatal care for a positive pregnancy experience: Timeliness and adequacy of antenatal care visit in Sub-Saharan African countries: Evidence from the most recent standard Demographic Health Survey data. PLoS One. 2024 Jan 25;19(1):e0294981.
14. Raru TB, Mamo Ayana G, Bahiru N, Deressa A, Alemu A, Birhanu A, et al. Quality of antenatal care and associated factors among pregnant women in East Africa using Demographic and Health Surveys: A multilevel analysis. Women's Heal. 2022;18.
15. Negash WD, Fetene SM, Shewarega ES, Fentie EA, Asmamaw DB, Teklu RE, et al. Multilevel analysis of quality of antenatal care and associated factors among pregnant women in Ethiopia : a community based cross- sectional study. BMJ Open. 2022;12:e063426(7).
16. Negero MG, Sibbritt D, Dawson A. Women's utilisation of quality antenatal care, intrapartum care and postnatal care services in Ethiopia: a population-based study using the demographic and health survey data. BMC Public Health. 2023;23(1):1174.

17. Zenebu Yimam1, Lioul Berhanu1, Mulawshum Zewdu1, Abebaw Ayele1, Addis Zikargie2, Tilahun Mequanint1, Wubhareg Dellie2, Tamirat Abebe1, Tasew Tadesse2, Sebsibe Tariku2, Hailu Gebisa1, Jemal Idris1, Roman Oumer1, Abdulbasit Hamza1 BA. Quality of Maternal Screening and Counseling in Primary Health Care Units in Ethiopia. Ethiop Heal Care Qual Bull FMOH. 2019;1(May):127.

18. Hailu GA, Weret ZS, Adasho ZA, Eshete BM. Quality of antenatal care and associated factors in public health centers in Addis Ababa, Ethiopia, a cross-sectional study. PLoS One. 2022;17(6 June):1–12.

19. Berehe TT, Modibia LM. Assessment of Quality of Antenatal Care Services and Its Determinant Factors in Public Health Facilities of Hossana Town, Hadiya Zone, Southern Ethiopia: A Longitudinal Study. Adv Public Heal. 2020;2020.

20. Tekelehaymanot G. Assessment of Quality of Antenatal Care Service Provision and Associated Factor at Governmental Health Facilities of Harar Town, Eastern Ethiopia, 2017. J Gen Pract. 2018;06(04).

21. Sugunadevi G. Quality of antenatal care services at subcentres: an infrastructure, process and outcome evaluation in a district in Tamil Nadu. Int J Community Med Public Heal. 2017;4(11):4071–7.

22. Heredia-Pi I, Servan-Mori E, Darney BG, Reyes-Morales H, Lozano R. Mesurer le caractère adéquat des soins prénataux: Une étude transversale nationale au Mexique. Bull World Health Organ. 2016;94(6):452–61.

23. Sommer Albert J, Younas A, Victor G. Quality of Antenatal Care Services in a Developing Country: A Cross-Sectional Survey. Creat Nurs. 2020 Feb;26(1):e25–34.

24. Simkhada B, Teijlingen ER van, Porter M, Simkhada P. Factors affecting the utilization of antenatal care in developing countries: systematic review of the literature. J Adv Nurs. 2008 Feb;61(3):244–60.

25. Mpoy CW, Katembo BM, Ndomba MM, Mishika PL, Missumba WK, Mukuku O, et al. Determinants of Utilization and Quality of Antenatal Care Services in Lubumbashi, in the Democratic Republic of the Congo. Glob J Medical, Pharm Biomed Updat. 2022;17(April):2.

26. Negash WD, Fetene SM, Shewarega ES, Fentie EA, Asmamaw DB, Teklu RE, et al. Multilevel analysis of quality of antenatal care and associated factors among pregnant women in Ethiopia : a community based cross- sectional study. BMJ Open. 2022;12:e063426.

Effects of Malaria RDT Policy Change on P*f* Case Trends: Insights from Ethiopia's HMIS Data

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Abstract

Malaria remains a major public health concern in Ethiopia, with recent years showing a sharp resurgence in cases and mortality. One emerging challenge is the growing prevalence of HRP2/3 gene deletions, which undermine the accuracy of HRP2-based rapid diagnostic tests (RDTs). In response, the Ministry of Health introduced non-HRP2 (LDH-based) RDTs, with nationwide rollout beginning in April 2024.

Data from 3,818 health posts meeting reporting and case threshold criteria were analyzed to compare confirmed *Pf* case numbers, test positivity rates (TPR), and *Pf*-to-*Pv* ratios across pre- and post-rollout periods. Results showed a 14% increase in the average monthly number of confirmed *Pf* cases post-rollout (from 14,493 to 16,480), with the TPR rising from 37.8% to 48%. While the overall *Pf:Pv* ratio declined from 3.0 to 2.4, stratified analysis revealed divergent trends: in high HRP2/3 deletion prevalence areas, the ratio slightly increased (2.89 to 2.96), likely reflecting improved *Pf* detection. In contrast, areas with low or undocumented prevalence showed a marked decrease (3.11 to 2.11), potentially indicating a rising burden of Pv or shifts in transmission dynamics.

Although findings support the positive diagnostic impact of non-HRP2 RDTs, the analysis is limited by potential confounding from concurrent interventions and overall malaria resurgence. To address these limitations, future studies should consider quasi-experimental designs, such as interrupted time series or difference-in-differences analyses, to better isolate the effect of diagnostic policy changes. Continued investment in diagnostic quality assurance and targeted malaria control strategies remains essential for sustaining progress toward elimination.

Keywords: HRP2/3 gene deletion, non-HRP2 RDTs, Ethiopia

Introduction

Malaria remains a major public health concern in Ethiopia, with 69% of the population at risk and recent data pointing to a resurgence. Confirmed cases rose from 1.6 million in 2021/22 to over 10.2 million in 2024, with reported deaths increasing from 180 to 1,343 in the same period (1,2). While previous control efforts, including LLINs, IRS, and prompt treatment, yielded progress, recent challenges such as Anopheles stephensi expansion, conflict, climate variability, and HRP2/3 gene deletions have reversed gains (2).

Accurate diagnosis is critical for malaria control. HRP2-based rapid diagnostic tests (RDTs), widely used at health posts, have become increasingly unreliable in areas with high HRP2/3 deletion prevalence, leading to false-negative results (3–5). Ethiopia is among the countries where HRP2/3 deletions have exceeded the 5% WHO threshold for diagnostic policy revision (5–7). In response, the Ministry of Health began rolling out non-HRP2 RDTs (pLDH-based) in 2023, initially through pilots and later at scale, starting April 2024 (8,9).

This study analyzes HMIS data to examine trends in Plasmodium falciparum detection before and after the diagnostic shift. It hypothesizes that Pf case numbers, test positivity rate (TPR), and the Pf-to-Pv ratio increased, especially in areas with known high HRP2/3 deletion prevalence.

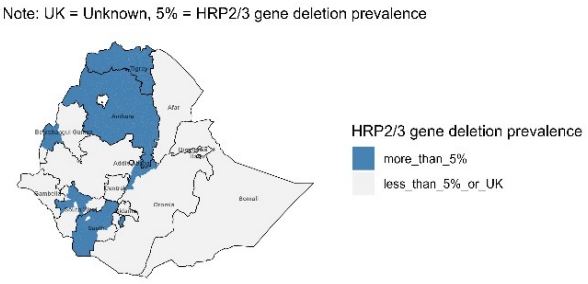

Figure 1: Selected HFs by HRP2/3 Gene Deletion Prevalence (7)

General Objective

To assess trends in Plasmodium falciparum case detection before and after the rollout of non-HRP2 RDTs in Ethiopia, using health post-level HMIS data from January 2023 to June 2025.

Specific Objectives

Compare the pf case detection trend before and after the introduction of non-HRP2 RDTs.

To analyze changes in the Pf-to-Pv case ratio during the study period.

Evaluate shifts in test positivity rate (TPR) across the study period.

Methods

A retrospective observational study using routine HMIS data, analyzing trends in Plasmodium falciparum case detection before and after the national diagnostic policy change (non-HRP2 RDT rollout in April 2024) was conducted. The study covered January 2023 to June 2025 and included key indicators such as testing volume, positivity rates, and species-specific diagnoses.

Health posts were eligible if they reported data for at least two-thirds of the study months, both in the pre- and post-period, and had ≥15 confirmed cases in both pre-rollout (Jan 2023–Mar 2024) and post-rollout (Apr 2024–Jun 2025) periods. A total of 3,818 HPs (out of 17756 HPs reported during the study period) met the criteria, accounting for 74% of all reported cases.

Data were cleaned and harmonized, including standardizing geographic identifiers and facility types. Descriptive analyses were conducted using R (v4.5.1) to compare trends between the two periods.

Results and Discussion

Between January 2023 and June 2025, the selected health posts conducted over 5.3 million malaria tests, with 45% testing positive. Among confirmed cases, 1.08 million (45%) were due to *Pf*.

Trends in Confirmed Pf Cases

The monthly average of *Plasmodium falciparum* cases rose from 14,493 before the nationwide rollout of non-HRP2 RDTs (Jan 2023–Mar 2024) to 16,480 after (Apr 2024–Jun 2025), marking a 14% increase. This rise may reflect improved detection of HRP2/3 gene-deleted strains using LDH-based kits, intensified case finding following the June 2024 Targeted Cluster Initiative, or broader epidemiological changes.

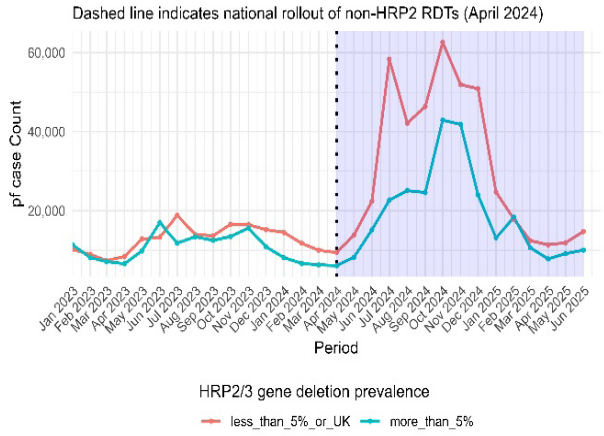

Figure 2: Monthly pf case count trend across the selected HFs from Jan 2023-June 2025

Pf Case Detection in High HRP2/3 Deletion Areas

Overall, the average monthly confirmed *Plasmodium falciparum* cases increased by 14%, rising from 14,493 before the non-HRP2 RDT rollout to 16,480 afterward. In districts with documented high HRP2/3 gene deletion prevalence—namely Amhara and Tigray regions, and East Shewa, Assosa, Kefa, Bench Sheko, Gedeo, South Omo, Gamo, Gofa, and Wolayita zones—the average monthly Pf cases rose by 10% (from 6,668 to 7,322). Meanwhile, districts with lower or undocumented deletion prevalence experienced a 17% increase (from 7,825 to 9,158). These differences may reflect a national malaria resurgence and the lack of comprehensive HRP2/3 deletion data across the country, making comparisons between regions uneven.

Pf-to-Pv Case Ratio

While the overall Pf-to-Pv ratio declined from 3.1:1 to 2.4:1 following the rollout of non-HRP2 RDTs, stratified analysis revealed diverging trends across areas with differing HRP2/3 gene deletion prevalence. In high-prevalence areas, the Pf:Pv ratio increased slightly from 2.89 to 2.96, likely reflecting improved detection of P. falciparum cases due to the replacement of HRP2-based RDTs, which are known to miss infections in settings with HRP2/3 deletions. This supports the hypothesis that the diagnostic shift enhanced Pf case confirmation in these high-risk zones.

In contrast, areas with low or undocumented gene deletion prevalence experienced a substantial decline in the ratio from 3.11 to 2.11, suggesting a relative increase in P. vivax burden. This may be linked to biological relapse patterns, suboptimal provision or adherence to primaquine-based radical cure, or evolving species dynamics in local transmission.

These findings highlight the importance of tailoring diagnostic and treatment strategies based on local epidemiological contexts. They also reinforce the value of disaggregated analysis in informing targeted malaria control and elimination efforts.

Test Positivity Rate (TPR)

Following the rollout of non-HRP2 RDTs, the Pf TPR increased from 37.8% to 48% in the selected health posts. This suggests a potential improvement in Pf case detection, likely due to the ability of non-HRP2 RDTs to identify infections previously missed by HRP2-based tests, particularly those with HRP2/3 gene deletions.

In areas with *high HRP2/3 gene deletion prevalence*, TPR increased by 8.3 percentage points (from 37.3% to 45.6%), supporting the expected benefit of switching to non-HRP2 diagnostics in these settings. Interestingly, areas with *low or undocumented deletion prevalence* also saw a larger increase (from 38.2% to 49.2%), which may reflect either previously undocumented deletions or other factors influencing case detection.

While the overall TPR increase may also be partially influenced by broader factors such as intensified surveillance through the Targeted Cluster Initiative, an expanded community-level outreach testing by Health Extension Workers in some areas, increasing access and case identification in previously under-tested populations or a general resurgence in malaria transmission during the study period, the pattern remains consistent with improved diagnostic sensitivity from the non-HRP2 RDTs.

These findings are consistent with the hypothesis that the rollout of non-HRP2 RDTs may have contributed to improved identification of P. falciparum cases, particularly in areas affected by HRP2/3 deletions; however, other factors, including increases in overall malaria cases, intensified surveillance through the Targeted Cluster Initiative, and other contextual confounders, cannot be excluded

Conclusion and Recommendations

Analysis of HMIS data from January 2023 to June 2025 suggests that the rollout of non-HRP2 RDTs likely contributed to improved *Plasmodium falciparum* case detection in Ethiopia. The 14% increase in average monthly confirmed *Pf* cases and the rise in TPR from 37.8% to 48%, particularly in high HRP2/3 deletion areas, point to improved diagnostic performance. Trends such as rising *Pf:Pv* ratios in these areas further support this interpretation.

Nonetheless, other factors like malaria resurgence and the implementation of the Targeted Cluster Initiative Approach also influenced these patterns. To strengthen future evidence and maximize program impact, the following actions are recommended:

- Implement regular quality assurance for non-HRP2 RDTs to ensure diagnostic reliability.
- Continue scaling up community-based testing and treatment through health extension workers.
- Promote rigorous operational research, such as difference-in-differences and other quasi-experimental designs, to better isolate the impact of diagnostic shifts from other programmatic or epidemiological influences.

References

1. Ethiopian Public Health Institute. 2024 National Incidence Management System (IMS) report. Addis Ababa: EPHI; 2024.

2. Federal Ministry of Health. National Malaria Elimination Strategic Plan (2024/25–2026/27). Addis Ababa: FMoH; 2024.

3. World Health Organization. Malaria rapid diagnostic test performance: results of WHO product testing of malaria RDTs, round 8 (2016–2018). Geneva: WHO; 2018.

4. Gamboa D, Ho MF, Bendezu J, Torres K, Chiodoni PL, Barnwell J, et al. A large proportion of Plasmodium falciparum isolates in the Amazon region of Peru lack pfhrp2 and pfhrp3: implications for malaria rapid diagnostic tests. PLoS One. 2010;5:e8091.

5. World Health Organization. World malaria report 2024: addressing inequity in the global malaria response. Geneva: WHO; 2024.

6. World Health Organization. False-negative RDT results and Plasmodium falciparum histidine-rich protein 2/3 gene deletions. Geneva: WHO; 2019. Available from: https://iris.who.int/handle/10665/258972.

7. World Health Organization. Malaria threats map. Geneva: WHO; 2024. Available from: https://tinyurl.com/yydnj5vw [Internet]. Available from: https://tinyurl.com/yydnj5vw

8. Federal Ministry of Health. National malaria guidelines. 5th ed. Addis Ababa: FMoH; August 2022.

9. Roll Back Malaria Partnership. Ethiopia malaria presentation. Available from: https://endmalaria.org/sites/default/files/Ethiopia%20Presentation.pptx.pdf.

Strengthening Ethiopia's National Blood System: A Comprehensive Assessment Using the WHO Blood System Self-Assessment Tool

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Abstract

Introduction: Blood transfusion is essential for treating severe anemia, trauma, surgery, and maternal hemorrhage. A safe, sufficient, and sustainable blood supply is critical to achieving universal health coverage. Ethiopia has committed to enhancing its blood system, yet significant challenges persist.

Objective: To assess Ethiopia's national blood system using WHO's Blood System Self-Assessment Tool, identify strengths and gaps across six strategic objectives, and develop a prioritized intervention roadmap.

Methods: The World Health Organization Blood System Self-Assessment (BSS) Tool was used to assess six strategic objectives. Data were collected through qualitative stakeholder group discussions, policy documents review, and consensus scoring of each indicator using the BSS tool's color-coded framework.

Results: Ethiopia achieved commendable progress with 99.8% voluntary non-remunerated blood donations. However, critical gaps identified include absence of legally binding national blood policy, limited EBTBS authority, lack of sustainable funding mechanism, no regulatory framework for blood , low component production rates, absence of centralized data systems, and Weak stakeholder engagement. Assessment revealed moderate performance in governance and blood services with significant weaknesses in regulatory controls and surveillance systems.

Conclusion: While Ethiopia demonstrates strong foundation in voluntary blood donation and government commitment, systematic gaps across governance, regulatory oversight, operational efficiency, and surveillance require urgent intervention. Priority actions include developing legally binding National Blood Policy, establishing comprehensive regulatory framework, transforming EBTBS into integrated National Blood Transfusion Service, and promotion of appropriate clinical use and patient blood management practices to achieve universal health coverage goals. Strengthening these foundational elements is essential to build a safe, sustainable, and equitable national blood system for Ethiopia.

Keywords: Blood system, health system strengthening, universal health coverage, WHO BSS Tool

Introduction

Blood transfusion is essential for treating severe anemia, trauma, maternal hemorrhage, and blood disorders. The World Health Organization (WHO) advocates robust, well-coordinated blood systems to ensure safe, available, and equitable access to blood products.

Blood system deficiencies directly impact public health, especially in low- and middle-income countries where postpartum hemorrhage and severe anemia are common. Ethiopia has committed to enhancing its blood system through Ethiopian Blood and Tissue Bank Service (EBTBS) under the Federal Ministry of Health, with ambitious targets in transformation and strategic plans.

Despite stated objectives and progress, significant challenges persist within Ethiopia's blood service system. While achieving high rates of voluntary donations, collection volumes remain low against national demand. Further challenges include weak regulatory frameworks, suboptimal stock management, persistent gaps in access to quality-assured blood products, and outdated infrastructure in certain regions.

To systematically address these multifaceted challenges, Ethiopia implemented the WHO Blood System Self-Assessment (BSS) Tool to analyze and assess the blood system through a stepwise questionnaire identifying strengths and challenges across six strategic objectives outlined in the WHO Action Framework.

Objective

The objective was to assess Ethiopia's blood system using the WHO BSS Tool, identify strengths and gaps across six strategic objectives, and develop an evidence-based roadmap aligned with Health Sector Development and Investment plan (HSDIP) priorities for universal health coverage.

Methods

The implementation of the BSS tool in Ethiopia was a collaborative effort coordinated by EBTBS , WHO and partnership of USAID Quality Healthcare Activity. The overall national blood system assessment exercise employed a mixed-methods design, comprising a quantitative hospital demand-based estimation survey and a qualitative self-assessment using the WHO Blood System Self-Assessment (BSS) Tool. However, this article reports exclusively on the BSS assessment component. The results from the hospital demand estimation survey will be presented separately.

The BSS assessment used a qualitative approach, involving structured multi-stakeholder discussions, document reviews, and consensus scoring of system performance based on the WHO BSS tool questionnaire.

The BSS Tool is structured around six strategic objectives from the WHO Action Framework to advance universal access to safe, effective, and quality-assured blood products (2020–2023). These are: (1) establishing an appropriately structured, well-coordinated, and sustainably resourced national blood system; (2) implementing an appropriate national framework of regulatory controls, national standards, and quality assessment programs; (3) ensuring functioning and efficiently managed blood services, including donor mobilization, blood collection, testing, processing, storage, and distribution; (4) implementing patient blood management to optimize clinical transfusion practices and minimize unnecessary transfusions; (5) establishing effective surveillance, hemovigilance, and pharmacovigilance systems supported by comprehensive data systems; and (6) fostering partnerships, collaboration, and innovation to strengthen the blood system.

The BSS tool consists of a structured questionnaire and set of worksheets guiding participants to assess performance in each

of these six areas. During the assessment, participants reviewed national policy documents and operational data, discussed each question in facilitated group sessions, and scored the current status of each component through consensus. Notes from these discussions were recorded and later analyzed thematically to identify key strengths, gaps, and priority areas for system strengthening.

Data Collection and Analysis Activities:

Data were collected through three multi-stakeholder workshops with representatives from blood banks, Regional Health Bureaus, the Ministry of Health, hospitals, regulatory authorities, and development partners. Using the WHO Blood System Self-Assessment (BSS) Tool, responses were scored under its six strategic objectives with a color-coded framework (Red, Amber, Green) to indicate critical gaps, moderate issues, and strengths. Stakeholder discussion notes were thematically analyzed, and priorities were determined by group consensus.

Results

The assessment identified key strengths and gaps, presented below under the six WHO strategic objectives.

National Blood System Structure and Coordination: EBTBS operates under the Federal Ministry of Health structure with designated coordination responsibilities and strong government leadership support for blood system strengthening. Voluntary non-remunerated blood donations accounted for 99.8% (n = 423,295 units collected nationally in EFY 2017), demonstrating strong community engagement and donor mobilization. However, EBTBS lacks sufficient legislative authority to enforce standardization across regional blood banks. Financial sustainability emerged as a critical concern, with heavy reliance on external donors (56.3%) compared to government contributions (43.7%). Emergency preparedness mechanisms showed considerable weaknesses, with blood reserve capacity falling significantly short of expected levels and incomplete integration with national disaster management systems.

Regulatory Framework and Quality Standards: Blood services operate under general health regulations with established quality standards and institutional oversight mechanisms. National guidelines, SOPs, and a basic quality management system have been developed, and the National Blood Center achieved African Society for Blood Transfusion (AfSBT) Level 2 certification in 2019 as evidence of meeting international quality standards. However, no independent national regulatory framework exists under EFDA specifically for blood services. Lack of mandatory licensing for blood establishments has resulted in inconsistent oversight and variable quality standards across regions. Quality assessment programs showed limited implementation, with gaps in accreditation processes and low participation in External Quality Assessment schemes.

Blood Services Efficiency: The blood system achieved very high rates of voluntary donation through established donor recruitment programs. However, total collection remained well below the WHO target of at least 10 donations per 1,000 population, with the 2017 EFY total of 423,295 units amounting to only about 3.9 donations per 1,000 population. Poor demand and supply estimation and weak transport infrastructure frequently led to shortages despite available donations. A significant concern was the very low blood component production from whole blood, falling below international minimum standards and creating a major gap in the availability of plasma-derived medicinal products for fractionation.

Patient Blood Management and Appropriate Use: National Appropriate Clinical Use of Blood (ACUB) guidelines provide a framework for clinical decision-making and have established transfusion medicine protocols across

healthcare facilities. However, adherence remained inconsistent, leading to considerable variation in transfusion practices. Hospital transfusion committees showed significant dysfunction, with many facilities operating without active committees or lacking the authority, resources, or expertise to function effectively. Healthcare worker competency in transfusion medicine proved inadequate due to insufficient training infrastructure.

Surveillance and Data Collection Systems: Hemovigilance systems operate through facility-based monitoring with established reporting mechanisms and manual record systems. However, fundamental weaknesses were identified in hemovigilance system structure, coverage, and effectiveness. Most facilities relied on manual systems or basic electronic records lacking integration capabilities, severely limiting real-time monitoring capacity. No centralized donor and blood data management system existed, nor any national inventory/ stock management system for real-time blood stock monitoring.

Stakeholder Partnerships and Collaboration: The blood system has established active partnerships with religious organizations, schools, and community donor clubs, as well as collaboration with government agencies, development partners, and civil society organizations through established communication channels. However, the system lacks a structured stakeholder management framework, resulting in fragmented engagement and weak coordination. Stakeholder involvement remains largely ad hoc, with no formal strategy outlining roles, responsibilities, or engagement mechanisms. Critical gaps also exist in linking stakeholder engagement to national emergency preparedness efforts.

Discussion

The assessment findings reveal that Ethiopia's blood system faces systemic challenges that extend beyond individual operational gaps. The absence of a legally binding national blood policy and regulatory framework has contributed to fragmentation, variable quality standards, and limited enforcement capacity, undermining progress achieved through government commitment and donor support. According to the WHO Blood System Self-Assessment (BSS) Tool, a robust national system should be anchored in legal frameworks, sustainable financing, and a centralized governance structure—elements that remain underdeveloped in the Ethiopian context.

The system's heavy reliance on external funding threatens sustainability and constrains long-term planning, while weak integration of blood services within the broader health system limits coordinated resource mobilization and emergency preparedness. Reliance on manual and non-integrated data systems hinders real-time stock visibility and evidence-based decision-making, which WHO identifies as essential for an effective blood system. Addressing these gaps will require high-level political action to institutionalize governance, secure sustainable financing, and embed blood services within health system strengthening efforts as part of Ethiopia's universal health coverage agenda.

Conclusion

This national blood system assessment revealed a complex landscape of strengths and persistent gaps across the six WHO strategic objectives. Ethiopia has achieved notable progress, including strong government commitment, integration of blood services into the national health strategy, and very high rates of voluntary non-remunerated blood donations. However, the assessment also highlighted critical systemic challenges, including the absence of a binding national policy and regulatory framework, overreliance on external funding, weak emergency preparedness, and fragmented data and information systems. Addressing these foundational weaknesses is essential to ensure the safety, sustainability, and resilience of the blood supply as part of Ethiopia's universal health coverage agenda.

Recommendations

Based on the assessment findings, several strategic actions are recommended to strengthen Ethiopia's national blood system. First, the establishment of a legally binding national blood policy and legislative framework is critical to formalize the mandate of the Ethiopian Blood and Tissue Bank Service (EBTBS), ensure coherent national coordination, and secure sustainable domestic financing to reduce dependence on external donors. In parallel, a dedicated regulatory system for blood services should be developed under EFDA, with mandatory licensing, registration, and regular accreditation of blood establishments, supported by strengthened quality management systems and broader participation in External Quality Assessment schemes.

Efforts should also focus on improving blood collection and component production through enhanced demand forecasting, strengthened coordination and transport infrastructure, and scaling up component preparation to meet international standards and improve Clinical transfusion practices by revitalizing hospital transfusion committees, enforcing ACUB guidelines adherence, and expanding training in transfusion medicine for health workers. In addition, modernization of data and hemovigilance systems is essential, including the development of a national integrated digital blood information system, establishment of real-time inventory and stock management platforms, and strengthening of facility-based hemovigilance. Finally, building structured partnerships and linking blood services with national emergency preparedness and disaster response systems will be crucial to enhance system resilience and coordinated stakeholder engagement.

References

- World Health Organization. (2023). Guidance to identify barriers in blood services using the blood system self-assessment (BSS) tool.
- Ministry of Health-Ethiopia. (2021). Health Sector Transformation Plan II (HSTP II) 2020/21–2024/25.
- Ethiopian Blood and Tissue Bank Service. (2023). Blood and Tissue Bank Service Medium Term Development and Investment Plan 2016 - 2018 EFY.

Impact of Targeted Cluster Initiative on Malaria Surge in Ethiopia: A Comparative HMIS Analysis

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Abstract

In response to a national resurgence of malaria in Ethiopia, the Ministry of Health launched the Targeted Cluster Initiative in late June 2024, aiming to curb the rising cases in high-burden and conflict-affected districts. The initiative prioritized political advocacy, community empowerment, multisectoral coordination, and strong leadership engagement to reinforce malaria control across 222 targeted districts. This study assessed its impact using routine health management information system (HMIS) data from January 2024 to June 2025, divided into pre-implementation, implementation, and post-implementation phases. Reports from 2035 facilities were included, based on consistent reporting (at least two-thirds of the months in each phase) and a minimum malaria case threshold (≥6 confirmed *Plasmodium falciparum* cases or positive tests). Trends across the three phases showed significant improvements in malaria indicators following implementation: confirmed cases declined by 21%, incidence rates dropped by 23%, admission rates fell by 35%, and malaria CFR declined by 24%. The test positivity rate also decreased from 43% to 37%, while the proportion of cases detected at health posts rose by 76% (from 7.6% to 13.4%), indicating stronger community-level engagement. These results suggest that the Targeted Cluster Initiative contributed to reversing the malaria upsurge, supported by effective program coordination and leadership engagement. As implementation coincided with the major transmission season, seasonal effects could not be fully controlled and should be considered when interpreting findings. Sustained community involvement, robust diagnostic quality, and follow-up studies accounting for confounders will be critical to consolidating these gains and guiding future efforts.

Keywords: malaria resurgence, Targeted Cluster Initiative, HMIS, Ethiopia

Introduction

Malaria has resurged in Ethiopia since 2020 due to various biological, environmental, climatic, socio-political, and programmatic factors, doubling cases by 2022 and increasing high-risk districts from 68 to 89 (1,2).

To address this, the Ministry of Health launched the Targeted Cluster Initiative approach in June 2024, a six-month intervention, targeting 222 high-burden districts that together accounted for 76% of the national malaria burden. These were organized into nine clusters based on disease burden, accessibility, and conflict context (3).

Aligned with Ethiopia's Health Sector Plan, the initiative aims to expand equitable health care coverage, strengthen primary care, and improve outbreak response. However, despite being a key measure to curb the malaria resurgence in Ethiopia, the Targeted Cluster Initiative has yet to be formally evaluated. This study analyzes routine HMIS data to assess its impact, hypothesizing that the initiative contributed to reductions in confirmed cases, incidence, admissions, and deaths, as well as improvements in community-level service delivery.

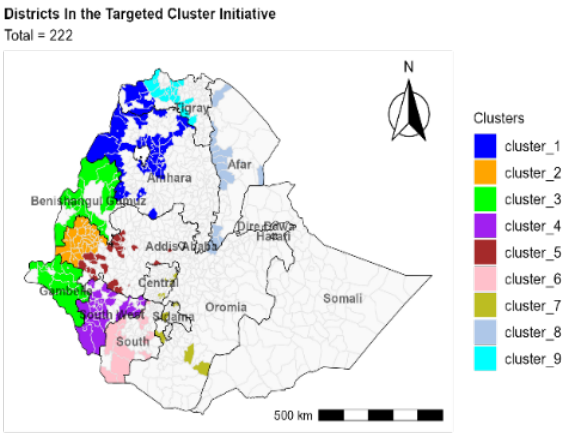

Figure 1: Geographic Coverage of the Targeted Cluster Initiative

General Objective

To evaluate the impact of the Targeted Cluster Initiative on malaria burden in targeted districts by comparing key malaria indicators before and after its implementation (Jan to June 2024 & Jan to June 2025).

Specific Objectives

- To examine trends in confirmed malaria cases over the study period.
- To compare malaria incidence rates between the pre-implementation (Jan-June 2024) and post-implementation (Jan–June 2025) phases.
- To assess changes in test positivity rates (TPR) between the two periods.
- To assess trends in malaria-attributable admissions and deaths before and after the Targeted Cluster Initiative.
- Analyze the contribution of health posts to malaria case detection before and after the Targeted Cluster Initiative approach.

Methods

A retrospective observational study was conducted using HMIS data from 222 districts targeted by the Targeted Cluster Initiative, covering January 2024 to June 2025 (six months pre-, during, and post-implementation). Reports were submitted by 5,820 facilities; those with ≥two-thirds monthly reports and ≥six confirmed *Pf* cases or positive tests per period were included. Overall, 2,035 facilities (35%) met criteria, accounting for ~80% of confirmed cases. Data were cleaned by standardizing geographic identifiers, harmonizing data elements, and checking anomalies. Descriptive analyses assessed trends in cases, test positivity rate, incidence, admissions, deaths, and Health Post contributions, using R version 4.5.1.

Note: All rates are expressed relative to their relevant denominators: TPR per suspected malaria tests, admission rate per total population, CFR per confirmed malaria cases, incidence per 1,000 population, and health post contribution per total reported malaria cases.

Results and Discussion

Trend in Confirmed Malaria Cases:

Between January 2024 and June 2025, 4.49 million confirmed malaria cases were reported from the selected HPs in the 222 districts. Cases rose by 84% during implementation (2.27 million) from a pre-implementation baseline of 1.23 million, then declined by 21.4% post-implementation (974,783). Monthly trends showed a decline in early 2024, rising during the minor transmission season (Apr–Jun) and peaking at 425,195 in Oct 2024 amid the major season and the Targeted Cluster Initiative. Cases fell to 312,243 by Dec and continued declining post-implementation, reaching 144,135 in May 2025 before a slight rebound in June. While the increase during implementation may reflect strengthened detection through reactivated health posts and HEW outreach, it coincided with the major transmission season, making it difficult to fully separate program effects from seasonal patterns.

Malaria Incidence Rate:

Incidence was 67.6 per 1,000 pre-implementation, rose to 123.1 during implementation, and declined to 51.8 post-implementation, a 23% reduction from baseline. Monthly incidence declined early in 2024, then rose during the minor transmission season (Apr–Jun). During the Targeted Cluster Initiative (Jul–Dec), incidence peaked at 23.9 in October amid the major season. Post-implementation, incidence steadily declined to 8.2 in May 2025, with a slight rebound to 9.4 in June (Figure 2).

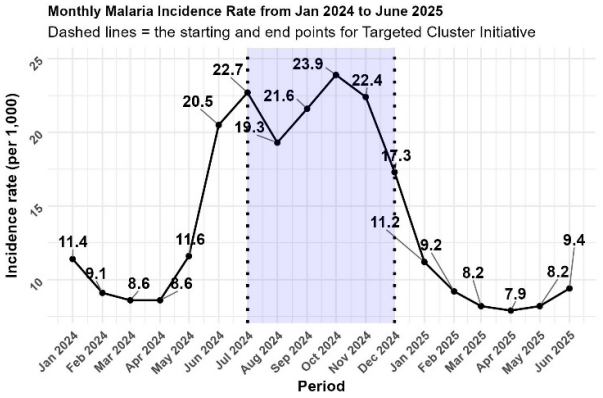

Figure 2: Monthly malaria incidence rate per 1,000 population in 222 high-risk districts, January 2024 to June 2025

Test Positivity Rate (TPR)

The average TPR was 43% pre-implementation, rose to 49% during the Targeted Cluster Initiative, and then declined to 37% post-implementation. Monthly TPR trends declined until March 2024, then rose through the minor transmission season (April–June) and peaked during the Targeted Cluster Initiative (July–December 2024), which overlapped with the major transmission season. Post-implementation, TPR fell from 38.6 in January 2025 to 31.8 in March, with a slight rise from April to June aligned with the minor transmission season. The increase during implementation may reflect both intensified testing and seasonal transmission, while the post-implementation decline could be influenced by expanded testing of non-malarial fevers and the shift to LDH-based RDTs.

Malaria-Related Admission Rate

Malaria-related admissions averaged 57 per 100,000 population in the pre-implementation period, rose to 65 during implementation, and then declined to 37 post-implementations: a 35% reduction. This decline is likely due to improved outpatient care and earlier detection of cases.

Case Fatality Rate (CFR)

Case fatality rates dropped from 0.021 in the pre-implementation period to 0.016 post-implementation, representing a 24% decrease. The lowest CFR (0.01) was recorded during the implementation phase, possibly reflecting enhanced case management. These trends indicate improved quality and timeliness of malaria treatment, contributing to reduced severity and mortality.

Contribution of Health Posts:

The proportion of confirmed malaria cases reported from the sampled health posts (HPs) increased substantially across the study periods. In the pre-implementation period, HPs contributed to 7.6% of total cases, rising to 14.5% during the implementation period and 13.4% in the post-implementation period. This marks a 76% increase in HP contribution from the pre- to post-implementation period. The upward trend likely reflects the impact of intensified stakeholder mobilization and engagement driven by the Targeted Cluster Initiative approach, which helped reactivate health posts and strengthen their role in malaria service delivery.

Table 1: Summary of key findings.

Indicator	Pre -implementation	During implementation	Post-implementation	% Change
Confirmed Cases	1,239,668	2,276,434	974,783	↓ 21.4%
Incidence Rate (per 1,000)	67.6	123.1	51.8	↓ 23.4%
TPR	43%	49%	37%	↓ 14%
Admission Rate (per 100,000)	57	65	37	↓ 35%
CFR	0.021	0.01	0.016	↓ 24%
HP Contribution to Case Detection	7.6%	14.5%	13.4%	↑ 76%

Notes: The implementation period refers to July–December 2024; Percent changes are relative to the pre-implementation period; HP = Health Post.

Conclusion and Recommendation

The Targeted Cluster Initiative had a measurable impact in the districts targeted by the initiative, with increased case detection during implementation followed by notable declines in incidence, admissions, and mortality post-implementation. Strengthened community-level services through health posts, supported by effective program coordination and leadership engagement, were key to these improvements. One limitation of this study, however, is that given the overlap of analysis periods with both the major and minor malaria transmission seasons, part of the observed trends may reflect seasonal variation rather than program effects alone. To sustain and build on these gains, it is recommended to:

- Sustain and expand community-based interventions with ongoing support to health posts.
- Ensure diagnostic quality through regular quality assurance of malaria tests.
- Conduct follow-up studies that control for seasonality and other confounding factors to assess long-term impacts.

Maintain high-level leadership engagement and enhance coordination across partners and administrative levels

References

1. Federal Ministry of Health. National Malaria Elimination Strategic Plan (2024/25–2026/27). Addis Ababa: FMoH; 2024.

2. Federal Ministry of Health. Health Sector Medium-Term Development and Investment Plan (HSDIP), 2016–2018 EFY (2023/24–2025/26). Addis Ababa: FMoH; 2023.

3. Federal Ministry of Health, MOVBDPD. Targeted Cluster Approach and Strategic Advocacy to Curb the Malaria Surge in High-Burden and Conflict-Affected Areas: A Coordinated Effort Led by the State Minister of Health (Program and Health Services Wing). Addis Ababa: FMoH; 2024.

Enhancing Health Facility Data Quality in Ethiopia: Leveraging DHIS2 to Address Immunization Data Challenges

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Abstract

Introduction: High-quality health facility data is vital for guiding public health programs, yet persistent gaps in completeness, consistency, and accuracy undermine decision-making. In Ethiopia, monthly immunization reports provide critical insights but are often weakened by missing values, outliers, and inconsistencies. This study explores how District Health Information System 2 (DHIS2) can be leveraged to strengthen data quality at the facility level, thereby improving the reliability of immunization monitoring.

Objective: To assess immunization data quality in Ethiopian health facilities using DHIS2 and introduce strategies to detect and correct anomalies, ensuring more accurate reporting and decision-making for immunization services.

Method: A review of over 21,000 health facility records was conducted for DTP1, DTP3, and MCV1 indicators spanning 2018–2024(2010-2017E.C.). Data quality assessments focused on detecting outliers, identifying missing values, and resolving internal inconsistencies. Customized Excel workbooks were developed for each region to flag issues. These flagged records were reviewed collaboratively by the Ministry of Health Expanded Program on Immunization (MoH EPI) team and health facilities to confirm or correct anomalies.

Result: Findings revealed substantial data quality issues: 75% of facilities reported missing entries, 45% had extreme outliers, and 23% showed inconsistencies between vaccine doses. Regional disparities were evident, with Oromia and Amhara recording the highest data anomalies, while Addis Ababa, Harari, and Dire Dawa demonstrated improvements over time. Conflict-affected and pastoralist regions such as Somali, Afar, and Benishangul-Gumuz continued to face persistent challenges in data completeness. Encouragingly, several high-burden regions showed progressive improvement, suggesting that targeted interventions can reduce errors and strengthen accountability.

Conclusion and Recommendations

Analyzing immunization data at the facility and monthly levels reveals gaps often hidden in aggregated reports, highlighting the importance of granular monitoring. To strengthen data reliability, structured and automated quality checks should be integrated into DHIS2 to detect anomalies early and support timely corrective action. Equally important is prioritizing facility-level analysis before national aggregation, strengthening support in conflict-affected and pastoralist areas, and ensuring targeted feedback and corrective action plans for facilities with recurring data issues. Building local capacity in data entry, validation, and DHIS2 use, alongside institutionalizing routine data quality monitoring, will help sustain improvements and enhance trust in Ethiopia's immunization data.

Introduction

Monthly health facility reports offer timely and cost-effective insights into public health decision-making. Yet, their value is often diminished by persistent data quality challenges. This study examines how the DHIS2 platform can be leveraged to enhance data quality at the facility level by identifying outliers, missing values, and inconsistencies ultimately improving the reliability of routine immunization data in Ethiopia to better inform service providers and decision-makers.

Methodology

Data Source:

Over 21,000 health facility records were reviewed for DTP1, DTP3, and MCV1 indicators spanning the period from January 2018 to December 2024(2018 to 2024G.C or 2010-2016 E.C)

Data Quality Assessment

Outlier Detection: Five distinct methods (listed in the right table) were applied to identify outliers in monthly health facility data, capturing various dimensions of data variability and potential anomalies.

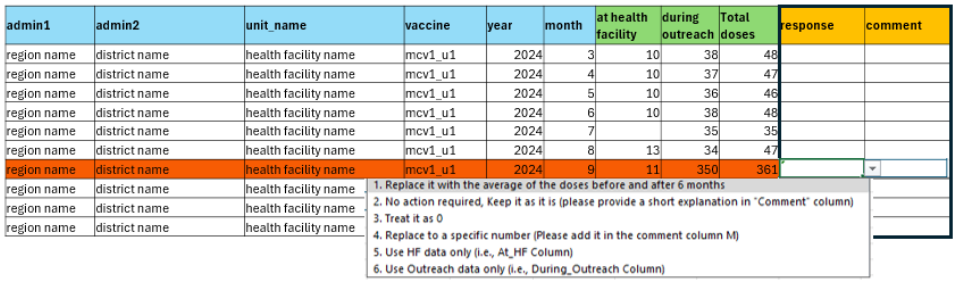
Number	Method	Description	Threshold for Outliers
1	Standard Deviation (SD) Approach	Measures the extent of variance or dispersion from the mean.	More than 2 SD from the mean
2	Mean Absolute Deviation (MAD) Method	Measures the average distance of each number from the mean, less affected by extremes.	More than 2 MAD from the mean
3	Median Absolute Deviation (Median AD) Technique	Measures the distance of each number from the median, more robust against extremes.	More than 8 Median AD from the median
4	Lowess Regression (Locally Weighted Smoothing)	Draws a smooth curve through data points to observe overall trends.	Deviation from Lowess curve more than 2 times the standard error
5	Absolute Difference from the Mean Method	Measures the direct difference of each number from the mean.	More than 100 doses higher or lower than the mean

Missing values and inconsistency: We also assessed missing data and internal inconsistencies in the number of vaccine doses reported within the same month.

Data Quality Improvement

To support data quality improvement, customized excel workbook were developed for each administrative region (admin1). These workbooks included monthly health facility data and flagged potential outliers, missing values, and inconsistencies.

MoH EPI team reviewed flagged records in coordination with health facilities to determine whether the values were accurate or required correction based on documented explanations.



admin1	admin2	unit_name	vaccine	year	month	at health facility	during outreach	Total doses	response	comment
region name	district name	health facility name	mcv1_u1	2024	3	10	38	48		
region name	district name	health facility name	mcv1_u1	2024	4	10	37	47		
region name	district name	health facility name	mcv1_u1	2024	5	10	36	46		
region name	district name	health facility name	mcv1_u1	2024	6	10	38	48		
region name	district name	health facility name	mcv1_u1	2024	7		35	35		
region name	district name	health facility name	mcv1_u1	2024	8	13	34	47		
region name	district name	health facility name	mcv1_u1	2024	9	11	350	361		
region name	district name	health facility name								
region name	district name	health facility name								
region name	district name	health facility name								

1. Replace it with the average of the doses before and after 6 months
2. No action required, Keep it as it is (please provide a short explanation in "Comment" column)
3. Treat it as 0
4. Replace to a specific number (Please add it in the comment column M)
5. Use HF data only (i.e., At_HF Column)
6. Use Outreach data only (i.e., During_Outreach Column)

Outliers

Admin 2	Health Facility Name	Vaccine	Year	Month	Value
Dollo Zone	Ilanle Health Center	mcv1_u1	2,013	6	13
Dollo Zone	Ilanle Health Center	mcv1_u1	2,013	7	10
Dollo Zone	Ilanle Health Center	mcv1_u1	2,013	8	14
Dollo Zone	Ilanle Health Center	mcv1_u1	2,013	9	8
Dollo Zone	Ilanle Health Center	mcv1_u1	2,013	10	10
Dollo Zone	Ilanle Health Center	mcv1_u1	2,013	11	4,465
Dollo Zone	Ilanle Health Center	mcv1_u1	2,013	12	12
Dollo Zone	Ilanle Health Center	mcv1_u1	2,014	1	9
Dollo Zone	Ilanle Health Center	mcv1_u1	2,014	2	10
Dollo Zone	Ilanle Health Center	mcv1_u1	2,014	3	11
Dollo Zone	Ilanle Health Center	mcv1_u1	2,014	4	13

Missing data

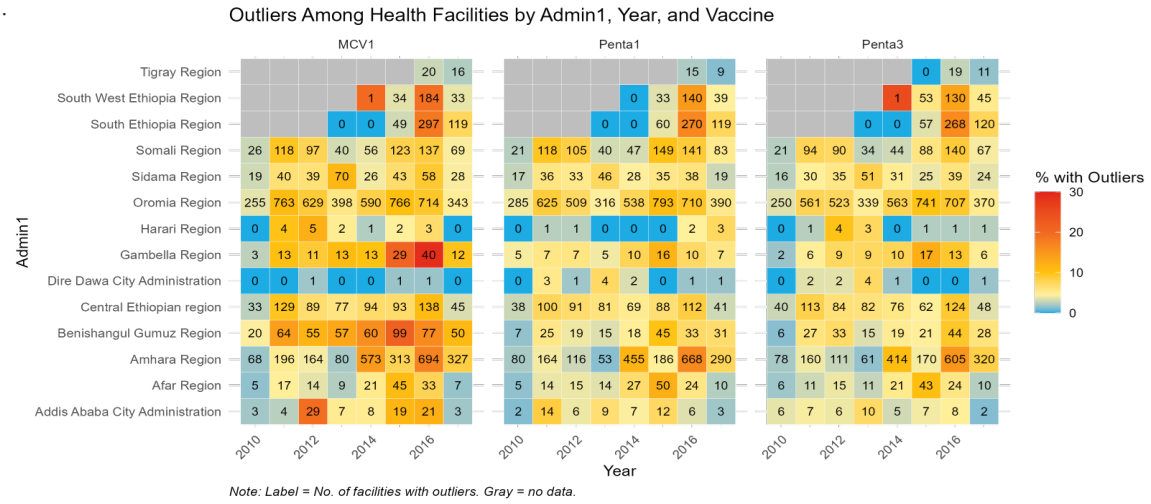
Implausible relationships between related indicators

Admin2	Health Facility	Year	Month	Penta1	Penta3
East Hararge Zone	Biftu Oda Health Post	2,016	7	24	2,424
Central Gondar Zone	Tsadikan Health Post	2,010	10	12	1,012
Shebelle Zone	dabaldag Health Post	2,011	9	12	1,012
South Omo Zone	Dizishsh Health Post	2,016	5	16	716
Dollo Zone	Galhamur Health center	2,016	9	23	521
East Gurage Zone	Butajira General Hospital	2,014	4	0	337

Result

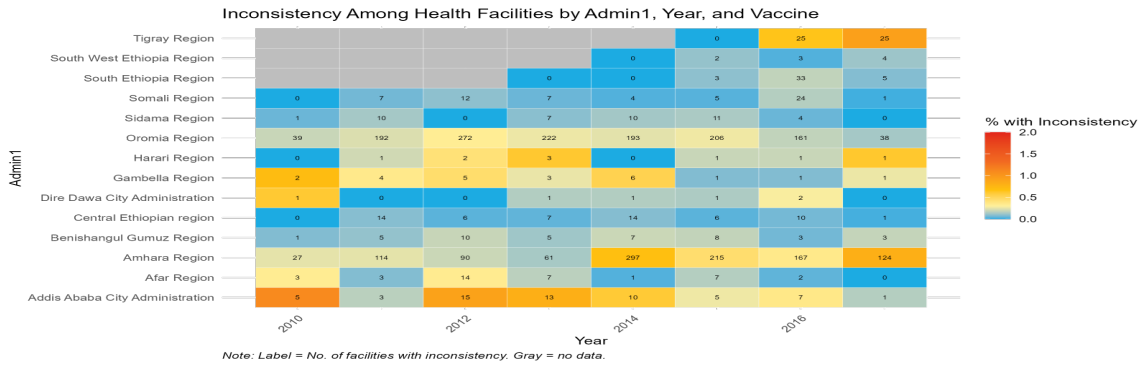
In Ethiopia, monthly vaccination data from more than 21,000 health facilities between 2018 and 2024 revealed substantial data quality issues. Across the period, 75% of facilities had missing entries, 45% reported extreme outliers, and 23% showed inconsistencies between related vaccine doses. Such gaps and anomalies—often masked in aggregated national statistics—highlight the critical importance of facility-level analysis to guide accurate monitoring and decision-making.

The same dataset revealed pronounced regional and temporal disparities in data inconsistencies. High-burden areas such as Oromia and Amhara repeatedly recorded large counts, in some years surpassing 200 health facilities, while regions like Harari and Afar consistently reported very low numbers. Encouragingly, Oromia and several others demonstrated notable declines over time, suggesting that targeted interventions are having a positive effect. Heatmap analyses conducted from 2018 to 2024 G.C (2010–2016 E.C), focusing on key vaccination coverage indicators such as MCV1 and Pentavalent3, reveal persistent regional disparities. A considerable number of health facilities reported high levels of missing data, outliers, and inconsistencies. These challenges have been especially evident in recent years across conflict-affected regions like Amhara and Oromia, as well as in pastoralist areas including Somali, Afar, Gambella, and Benishangul-Gumuz—where data completeness and reliability continue to hinder effective monitoring. Conversely, regions such as Addis Ababa, Harari, and Dire Dawa have shown notable declines in data gaps and made commendable progress over the decade



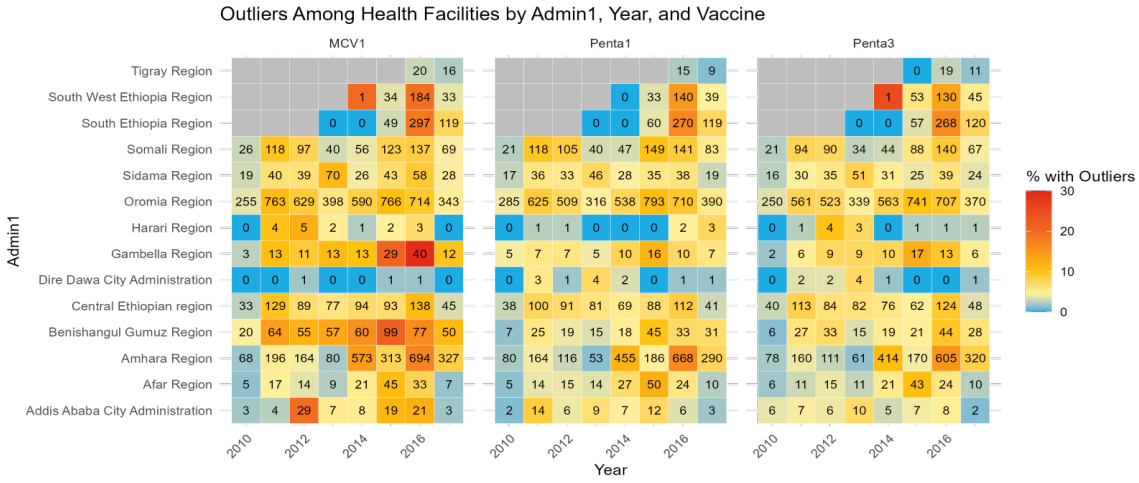
Note: Label = No. of facilities with outliers. Gray = no data.

Number and % of health facilities with inconsistency data by region in Ethiopia



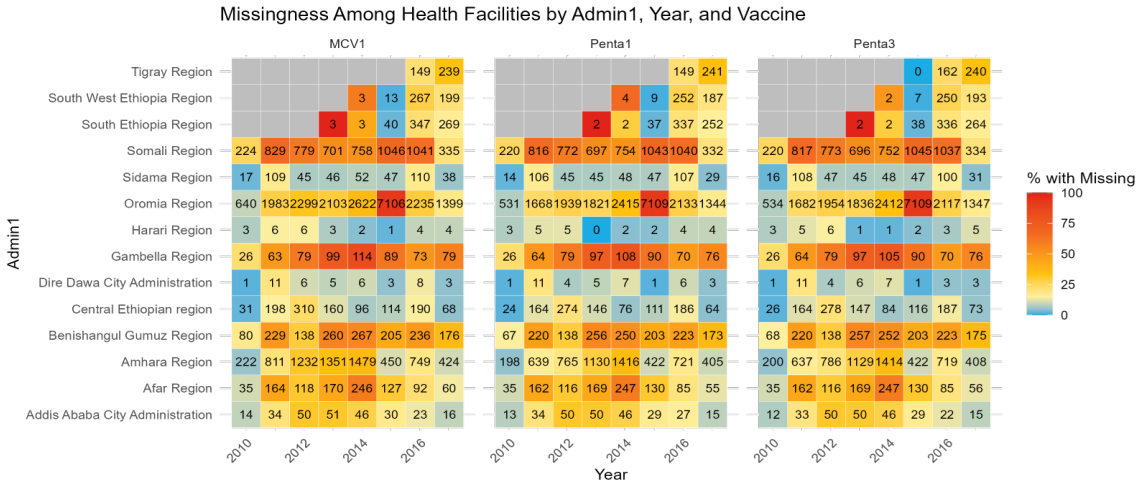
Note: Label = No. of facilities with inconsistency. Gray = no data.

Number and % of health facilities with possible outliers by region and year in Ethiopia



Note: Label = No. of facilities with outliers. Gray = no data.

Number and % of health facilities with missing data by region and year in Ethiopia



Note: Label = No. of facilities with missing values. Gray = no data.

Conclusion

This project demonstrated that traditional statistical approaches for routine data quality assessment often produce divergent insights when compared to a facility-specific tracking method. By analyzing data at the facility and monthly levels, we uncovered a range of issues, such as outliers, missing values, and internal inconsistencies, that are often masked in aggregated data. These findings emphasize the importance of granular assessments before data aggregation to ensure accuracy and reliability. Integrating structured, automated data quality checks directly into DHIS2 can support more timely correction and feedback loops to inform service providers and decision makers for service delivery and program planning.

Recommendation

- **Integrate automated data quality checks** into DHIS2 to show outliers, missing values, and inconsistencies at the facility level.
- **Prioritize facility-level analysis** before data aggregation to ensure reliability and avoid masking local data challenges.
- **Strengthen regional support systems**, particularly in conflict-affected and pastoralist areas, to address persistent disparities in data quality.
- **Provide targeted feedback and corrective action plans** to facilities with recurring data gaps and anomalies.
- **Build local capacity through training** on data entry, validation, and use of DHIS2 tools to promote accountability and ownership.
- **Institutionalize routine data quality monitoring** to sustain improvements and support timely decision-making in immunization services

References

1. Ministry of Health, Ethiopia. *National Data Quality Strategy: Ensuring Quality Data for Quality Decisions in the Health Sector*. Addis Ababa: MoH; 2019.
2. Ministry of Health, Ethiopia. *National Expanded Program on Immunization (EPI) Comprehensive Multi-Year Plan 2021–2025*. Addis Ababa: MoH; 2021.
3. Ministry of Health, Ethiopia. *Health Sector Transformation Plan II (HSTP-II), 2020/21–2024/25*. Addis Ababa: MoH; 2020.
4. UNICEF. *Immunization Data: Evidence for Action—A Call to Strengthen Immunization Data Quality and Use*. New York: UNICEF; 2016.
5. UNICEF and World Health Organization. *Immunization Agenda 2030: A Global Strategy to Leave No One Behind*. Geneva/New York: UNICEF & WHO; 2020.
6. World Health Organization. *Immunization in Practice: A Practical Guide for Health Staff*. 2015 Update. Geneva: WHO; 2015.
7. World Health Organization. *Data Quality Review: A Toolkit for Facility Data Quality Assessment*. Geneva: WHO; 2017.
8. World Health Organization. *Monitoring the Building Blocks of Health Systems: A Handbook of Indicators and Their Measurement Strategies*. Geneva: WHO; 2010

Powering Health for All: What the Grand Ethiopian Renaissance Dam (GERD) Means for Ethiopia's Health System

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Abstract

The Grand Ethiopian Renaissance Dam (GERD), Africa's largest hydropower project, represents national sovereignty and addresses severe energy poverty that limits essential health services. Although contributing about 87% of the Nile's waters, roughly 60 million Ethiopians (55%) lack electricity; only half of health facilities have regular and uninterrupted power supply, which hampers safe childbirth, neonatal intensive care, diagnostics, and the vaccine cold chain (11–13). This review combines national policies (Health Policy 2024; Health Sector Development and Investment Plan (HSDIP) 2023–2026), the SDG-3 Acceleration Plan, peer-reviewed articles, and partner reports (WHO, UNICEF, Africa CDC, World Bank, Ministry of Water and Energy/ Ethiopian Electric Power MoWE/EEP) to evaluate how GERD-powered electricity can improve maternal and child health (MCH), immunization, and primary healthcare (PHC), and support Ethiopia's national, continental, and global commitments.

Evidence shows that stable electricity increases skilled birth attendance, reduces maternal complications, improves neonatal survival, and stabilizes vaccine potency through reliable cold chains and digital monitoring (1,3,6,9,15). Electrified primary health care (PHC) expands service hours, strengthens infection prevention, enables digital health solutions, and supports workforce retention, especially in rural and pastoralist areas (1–3,6,7). GERD is therefore a strategic health investment: it can reduce preventable deaths, sustain immunization systems, and accelerate Universal Health Coverage (UHC) and SDG-3, while advancing the Abuja Declaration, the Lusaka Agenda, and the Africa CDC Addis Declaration on Immunization (4–9).

Keywords: GERD; Ethiopia; Electricity; Maternal and Newborn Health; Immunization; Primary Health Care

1. Introduction

GERD is more than a power plant; it stands as a powerful symbol of Ethiopia's sovereignty, unity, and resilience. Unlike many large-scale projects, it was largely financed through the contributions of ordinary citizens, including bond purchases, salary deductions, and community fundraising, demonstrating national ownership and sacrifice. Its realization was further strengthened by determined leadership that safeguarded Ethiopia's right to harness its natural resources (13,16). With 5,150 MW of installed capacity and a vast reservoir, GERD promises reliable energy and multi-sector benefits (tourism, irrigation, fisheries, regional trade), spurring broad-based development (13,16). Yet Ethiopia has long faced energy inequity: approximately 60 million people (55%) remain without electricity, compared to near-universal access in Egypt, over 85% in Kenya, and more than 75% in Rwanda, highlighting the stark disparities in energy coverage across the continent [11,13]. Household air pollution causes substantial mortality in the region, including around 68,000 deaths in Ethiopia (2019) (11,13,14). Health services reflect this gap; only 50% of facilities report reliable power, limiting safe delivery, Neonatal Intensive Care Unit (NICU) care, diagnostics, blood safety, and the vaccine cold chain (12). GERD can address these systematic challenges by providing stable, renewable electricity to Ethiopian health facilities at all levels, from rural health posts and health centers to district hospitals and referral institutions. Reliable power will enable continuity of essential services such as safe deliveries, emergency surgery, diagnostics, blood banking, and the vaccine cold chain, which are currently compromised in many facilities due to unreliable or absent electricity. At the same time, energy-enabled economic growth will expand fiscal space, allowing government health budgets to grow and households to afford and utilize services more equitably. In this way, GERD strengthens both the supply and demand sides of Ethiopia's health system, ensuring that improved infrastructure translates into better service coverage, quality, and outcomes (1,3,13). Aligned with the revised Ethiopian Health Policy (2024) and HSDIP (2023–2026), electricity is fundamental to quality, equity, and access—powering theaters and ICUs, enabling digital health and data systems, and maintaining vaccine potency, especially in rural, pastoralist, and conflict-affected areas (1–3).

2. Methods and Materials

A narrative review of secondary sources was conducted: Ethiopia's revised Health Policy (2024), HSDIP (2023–2026), the SDG-3 Acceleration Plan (2025), national service statistics, and peer-reviewed articles indexed in PubMed on energy access and health service delivery. The evidence was then triangulated with global and regional partner reports (WHO, UNICEF, Africa CDC, World Bank) and energy-sector documents (Ministry of Water and Energy; Ethiopian Electric Power) (1–4,6–10,11,13–16). Evidence was synthesized across four domains: MCH and neonatal care, immunization/cold chain, and PHC systems, to assess plausible health gains from GERD-enabled electrification and alignment with national, continental, and global commitments.

3. Results and Discussion

3.1 Maternal and Child Health and Neonatal Care

Ethiopia reduced maternal mortality from 950 to 195 per 100,000 live births (2000 to 2023), with parallel declines in under-five deaths; however, rural, pastoralist and conflict affected areas remain disproportionately affected (17). Reliable power is essential for EmONC and NICU readiness: without electricity, facilities cannot ensure safe C-sections, anesthesia, sterilization, blood refrigeration, or neonatal respiratory support. HSDIP aims to increase skilled birth attendance from 50% to 78% by 2026; achieving this requires dependable electricity for lighting, sterilization, suction,

monitoring, oxygen, incubators, and warmers (1,6). Evidence consistently links electrified facilities to higher-skilled attendance, fewer complications, and improved neonatal survival; GERD can support 24/7 functionality, reduce preventable maternal/neonatal deaths, and accelerate SDG-3/UHC gains (1,3,6).

3.2 Immunization and the Cold Chain

Full immunization remains ~44%, well below the 95% SDG target, with pronounced gaps in Afar and Somali (often <30%) (3,9,15). Cold-chain failure due to power interruptions degrades potency and increases wastage. HSDIP targets Penta3 61%80% and measles ~90% by 2026; this requires uninterrupted refrigeration and temperature monitoring (1,3,9). GERD can stabilize power for ~18,200 health posts and ~3,800 health centers and other health facilities, enabling continuous cold storage, automated temperature logging, and timely stock and supply chain management through systems such as DHIS2, eCHIS, Dagu, mbrana, eAPTS, and the current ERP platforms of EPSS (1,3,9,15). Research from WHO/UNICEF/Gavi links continuous power to higher coverage, lower wastage, and safer vaccines; thus GERD-backed electrification should translate into improved coverage and child survival (9,15).

3.3 Primary Health Care, Equity, and System Readiness

PHC is the backbone of Ethiopia's strategy; community-based, decentralized, and equity-oriented (1,2). Electricity enhances PHC readiness by extending service hours, enabling diagnostics (microscopy, rapid tests), powering sterilization and WASH, and supporting digital tools that connect peripheral units to referral hospitals (eCHIS/DHIS2/telehealth). However, findings from the Ethiopia Service Provision Assessment (ESPA 2021–2022) reveal persistent gaps in readiness, substantial proportion of primary health care facilities lacking reliable electricity, essential equipment, and basic amenities, which continue to undermine the quality and equity of service delivery across rural and pastoralist regions (12). Electrification also helps attract and retain the workforce in rural posts and strengthens emergency preparedness (1,2,6,7). By closing urban–rural service gaps, GERD-driven power directly promotes UHC and Ethiopia's continental and global commitments (SDG-3; Abuja; Lusaka Agenda; Africa CDC Addis Declaration), while ensuring health financing results in real service availability and quality (4–9).

3.4 Policy Alignment and Strategic Leverage

Electricity supports the health policy's pillars of quality, equity, and access, as well as the HSDIP's focus on MCH, immunization, safety, and innovation (1,2). It also enhances the efficiency of public spending envisioned under the Abuja Declaration by reducing equipment idling and commodity loss caused by power failures (5,6). Lastly, electrification provides the necessary platform for PHC revitalization under the Lusaka Agenda and universal access to immunization under the Africa CDC Addis Declaration (7–9).

4. Conclusion and Recommendations

GERD is a strategic health investment beyond an energy project. By ensuring stable electricity across the healthcare system, from health posts to hospitals, Ethiopia can reduce preventable maternal and neonatal deaths, maintain vaccine potency and coverage, extend PHC hours and readiness, and reduce urban–rural disparities. We recommend: (i) accelerating facility electrification and establishing redundant source (grid plus solar backup where needed); (ii) prioritizing maternity theaters, blood banks, NICUs, and cold-chain points for immediate power stability; (iii) expanding digital monitoring (eCHIS/DHIS2 with remote cold-chain sensors and strengthening health commodity and logistics management platforms such as DAGU, eAPTS, mbrana, and the ERP systems of EPSS); and (iv) aligning energy deployment with HSDIP targets and SDG-3/UHC milestones

to maximize health investment benefits (1–4,6–9,12,13,15,16). As electricity from GERD reaches every woreda, the potential is clear: safer births, effective vaccines, stronger PHC, and a significant step toward UHC and SDG-3 for all Ethiopians.

5. References

1. Federal Ministry of Health. Health Sector Medium-Term Development and Investment Plan (HSDIP) 2023–2026. Addis Ababa: MoH, 2023.
2. Federal Ministry of Health. Ethiopian Health Policy (Revised 2024). Addis Ababa: MoH, 2024.
3. Federal Ministry of Health, AMREF Health Africa & Partners. Extended Summary: SDG-3 Acceleration Plan for Ethiopia. Draft, August 2025.
4. United Nations. Sustainable Development Goal 3: Ensure Healthy Lives and Promote Well-Being for All at All Ages. New York: UN, 2015.
5. African Union. Abuja Declaration on HIV/AIDS, Tuberculosis and Other Related Infectious Diseases. AU, 2001.
6. World Health Organization. Tracking Universal Health Coverage: Global Monitoring Report. WHO/World Bank, 2023.
7. African Union & Partners. The Lusaka Agenda: Reimagining Primary Health Care in Africa. AU, 2023.
8. Africa Centres for Disease Control and Prevention (Africa CDC). Addis Declaration on Immunization. AU, 2017.
9. United Nations Children's Fund (UNICEF) & World Health Organization (WHO). State of the World's Vaccines and Immunization. Geneva, 2022.
10. World Bank. Ethiopia Health Financing and Systems Assessment. Washington, DC: World Bank, 2021.
11. Ethiopian Public Health Institute (EPHI). Burden of disease attributable to household air pollution in East Africa. Addis Ababa: EPHI, 2020.
12. Federal Ministry of Health & Ethiopian Public Health Institute. Ethiopia Service Provision Assessment 2021–2022 (ESPA). Addis Ababa: MoH, 2022.
13. World Bank. Tracking SDG7: The Energy Progress Report. Washington, DC: World Bank, 2018.
14. World Health Organization. Household air pollution and health fact sheet. Geneva: WHO, 2021.
15. World Health Organization, United Nations Children's Fund, & Gavi, the Vaccine Alliance. State of the World's Vaccines and Immunization. Geneva: WHO, 2022.
16. Ethiopian Electric Power (EEP). (2022). Grand Ethiopian Renaissance Dam (GERD) project update. Addis Ababa: EEP. Top of FormBottom of Form
17. World Health Organization (WHO), United Nations Children's Fund (UNICEF), United Nations Population Fund (UNFPA), World Bank Group, & United Nations Department of Economic and Social Affairs (UNDESA), Population Division. Trends in Maternal Mortality: 2000 to 2023 – Estimates by WHO, UNICEF, UNFPA, World Bank Group and UNDESA/Population Division. Geneva: WHO, 2025.

Does Comprehensive Health Post improve access to equitable essential health services in Ethiopia? A comparative cross-sectional study

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Abstract

Introduction: In Ethiopia, health posts are the lowest health infrastructure of the primary healthcare system. Over the past three decades, the county invested in over 17000 health posts and increased access for essential health services. Since 2020, the role and scope of practice of health posts redefined to optimize health extension program. But no empirical evidence found on readiness, access and utilization essential health services using the new arrangements. Therefore, this study assessed the readiness and effect of comprehensive health posts (CHPs) by comparing maternal, child health and outpatient service uptake against basic health posts and health center in remote inaccessible location of twelve regional states of Ethiopia.

Methods: A comparative cross-sectional study targeted all CHPs registered in routine HMIS database. In addition, we enrolled catchment HCs and BHPs from the same woreda. We collected the data between December 2024- February 2025 to demonstrate readiness and effects of CHP on improving maternal health, child health and outpatient service use in twelve regional states of Ethiopia. Services availability and volume of service data were captured for 48 months (2022- 2025) from routine reports.

Results: The response rate for CHPs were 91% (142/155) and one fifth (21.8%) of the assessed CHPs were in pastoralist area. The average distance of the CHPs from the supervising health center was 19.8 kilometers. Among service intended to be offered universally in CHPs, the highest availability was for malaria, under-5, and non-delivery obstetric care; the lowest was for neglected tropical diseases (NTDs).

Conclusions: CHPs address inaccessibility of outpatient, antepartum, intrapartum and postpartum care, communicable diseases managements. While non-communicable diseases care and support need improvement. Government of Ethiopian, partners and stakeholders should work towards achieving the goal of Health Extension Program Optimization (HEPO) roadmap targets.

Keywords: Comprehensive Health Posts, Health Extension Program, Access, Ethiopia

Introduction

In Ethiopia, health posts represent the most basic level of health infrastructure within the primary healthcare system. Over the past three decades, the county has invested in over 17000 health posts and increased access to basic health services. Each health post is staffed by health extension workers and serves from 3000 to 5000 people in a kebele or village [1]. Health Posts are a key component of the Health Extension Program (HEP) and remain a vital part of the system with the aims to improve access to health promotion, disease prevention and curative care for selected health conditions, especially in rural areas. Despite the gains, the national health system was challenged in reducing the high level maternal and neonatal mortalities due to poor quality of health care, low capacity of health workforce and poor facility infrastructure to offer standard service for the citizens [2].

The government developed and endorsed fifteen years (2020 - 2035) Health Extension Program Optimization (HEPO) roadmap. The implementation of this strategic plan repositioned HEP to be optimized in the health sector [3]. These strategic shift demands to adapt with epidemiological, and demographic changes as well as enhancing responsiveness of the community health program to demand of beneficiaries. The health extension program restructuring activity starts with categorization of health posts into three service delivery points: namely, basic health post, CHP and Health Extension Program Unit in health centers and primary hospitals [4].

According to the Ethiopian Service Standards, a CHP is a health facility within the primary health care system that provides health promotion, disease preventive, curative and rehabilitative services for outpatients supplemented with basic laboratory and pharmacy services to underserved communities. A trained multi-disciplinary health workforce including a public health officer, a midwife, a nurse, a laboratory technician, a pharmacy technician, and two level four health extension workers should be deployed in a typical CHP. Therefore, the restructuring intervention of community health facilities would improve access to, and quality for essential health services particularly in the rural area of Ethiopia. However, there were limited evidence on effects of CHPs in addressing inaccessibility and quality of essential health services in Ethiopia. Therefor this study aims to assess the effect of CHPs by comparing maternal, child health and outpatient service uptake against basic health posts and health center in remote inaccessible location of twelve regional states of Ethiopia.

Methods

Study Setting

Based on the fifteen years (2020 – 2035) HEPO roadmap community health facility restructuring criteria, there would be 12,470 (74%) as basic health posts (BHPs), 1,873 (11%) as CHPs, and 2,555 (15%) as HEP unit within health center or primary hospital. However, at the end of fourth year (2024) of HEPO roadmap implementation there are 155 functional CHPs in twelve of thirteen regional states. The study took place in Afar, Amhara, Oromia, Benishangul Gumuz, Gambella, Sidama, Central Ethiopia, Southwest Ethiopia, South Ethiopia, Somali, Harar and Dire Dawa between December 2024 and February 2025 (Fig 1).

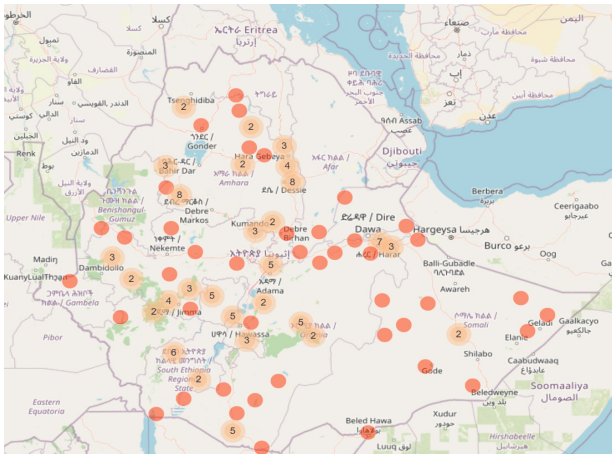

Fig 1: Distribution of functional CHPs by region in Ethiopia, February 2025

Study design and sampling methods.

This comparative cross-sectional study targeted all CHPs registered in routine HMIS database. In addition, catchment HCs and BHPs were enrolled from the same woreda. Data were collected from two sources. First the primary data were collected from health posts and secondary data were extracted from routine health information system database (DHIS2 database).

Data collection and analysis

Primary data were collected using structured digitally enabled questionnaires from 142 CHPs on availability and readiness of services. Forty-eight months (2022- 2025) service data were extracted from routine health information system database for 105 basic health posts, 142 CHPs and 46 health centers. The secondary data includes data on service utilization for selected indicators such as maternal health, child health, and outpatient services. Data completeness was checked on daily bases and Data analysis was done using R statistical software. The results were presented using graphs and frequency tables. Comparison of volume of services provided at basic health posts, comprehensive health posts and health centers were done.

Results

Characteristics of Comprehensive Health Posts

In this study CHPs were censused and matched with basic health posts and health centers in twelve regionals sites found in 58 zones and 119 woredas in Ethiopia. The response rate for CHPs were 91% (142/155) and one fifth (21.8%) of the assessed CHPs were in pastoralist area. Most CHPs 123 (86.6%) were in rural setting, while 19 (13.4%) were located in urban settings. In addition to the CHPs, the assessment was done in 105 BHPs and 46 health centers.

Table 1: Number of BHPs, CHPs and health centers assessed for service availability and readiness, February 2025

S.N.	Region	Number BHPs assessed	Number CHPs assessed	Number of HCs
1	Afar	12	2	6
2	Amhara	22	42	11
3	Benshangul Gumuz		1	
4	Central Ethiopia		2	
5	Dire Dawa		2	
6	Gambella		2	
7	Oromia	22	52	11
8	Harari		2	
9	Sidama	31	7	16
10	Somali	20	19	12
11	South Ethiopia		9	
12	Southwest Ethiopia		2	
	Total	105	142	46

Service availability in comprehensive health posts.

The average distance of a CHP from the supervising health center was 19.8 kilometers. The majority 119 (83.8%) of CHPs were located below 30 kilometers. Among services intended to be offered universally in all health facilities, service availability ranged from 12% (dengue treatment) to 97% (antenatal care). The highest availability of infectious disease management was for malaria, under-5, and the lowest was for neglected tropical diseases (NTDs). Among services intended to only be offered at CHPs but not at basic health posts, availability ranged from 18% (heart attack/AMI) to 78% (HIV testing). The highest availability was for infectious disease treatment (STI diagnosis and treatment), and obstetric services (ANC HIV testing, delivery, BEmONC) and the lowest was for non-communicable diseases (NCDs) and intra-uterine contraceptive devices (IUDs) (Fig 2.).

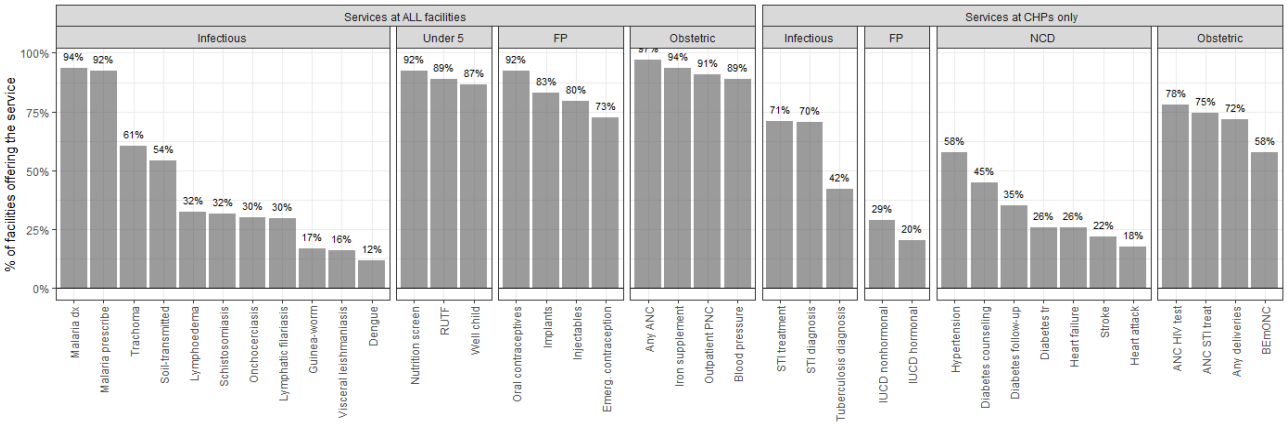

Fig 2. Health Services Offered in targeted health facilities, February 2025

Service readiness of comprehensive health posts

Service readiness assessment showed that most CHPs 106 (75%) were bridging the gap between BHP and health centers, providing access to obstetrics services not available at BHPs. However, most CHPs that provide obstetric service were without the addition of laboratory, pharmacy, and staff quarters that are required per standards that are needed to ensure the highest quality of care. Only 9 (6%) had the full set of intended CHP design requirements. One in five, 27 CHPs (20%) were functionally still as basic health posts.

Fig. 3 Service readiness of health facilities, February 2025

Comparison of service volumes offered at BHPs, CPHs and HCs

In four years (2022- 2025), the average outpatient service volume showed an increase by 180 per year after upgrading BHPs to CHPs. These results showed the number of outpatient visits have tripled in CHPs and approaching health center volumes in facilities served for more than 12 months. In addition, skilled delivery services increased by 50% in CHPs after starting services. Furthermore, malaria tests in CHPs significantly grow over two years and reach service volume offered in health centers (Fig. 3) this implies that CHP have taken on the additional volumes as effectively as health centers.

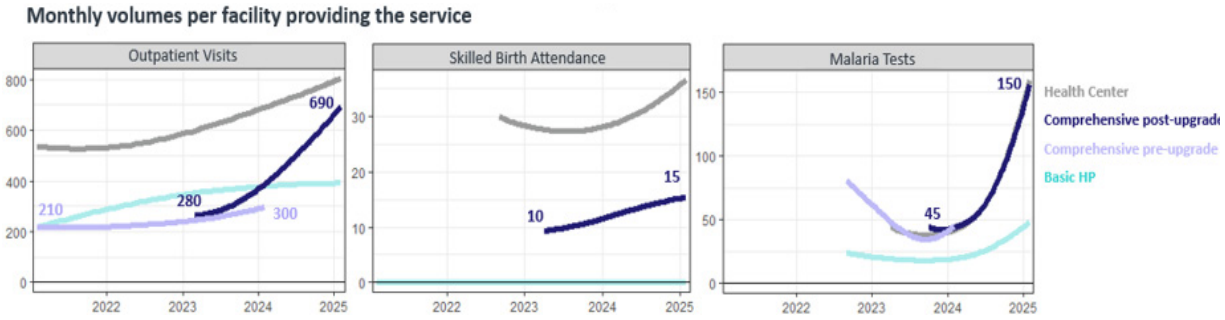

Fig. 4: Monthly service volume per facility providing the service.

Conclusions and recommendation

This readiness assessment indicates that that most CHPs are improved, particularly in their capacity to provide obstetric care. CHPs contributes to increased volume of essential health services. CHP address inaccessibility of outpatient, obstetric care such as skilled delivery, and management of communicable diseases. However, services for non-communicable diseases requires improvement. The government of Ethiopia, partners and all relevant stakeholders should work towards achieving the HEPO roadmap targets.

References

1. Ayehu T, Tiruneh GT, Tesfaye C, Belete M, Fesseha N, Semahegn A, Tadesse H, Mirkuzie AH, Aklilu Y, Zenebe M, Yasin M. Facility readiness and experience of women and health care providers in receiving and delivering obstetric care in comprehensive health posts in Ethiopia: a mixed method study. BMC Health Services Research. 2025 Feb 25;25(1):303.
2. Usman AK, Wolka E, Tadesse Y, Tariku A, Yeshidinber A, Teklu AM, Senturia K, Gezahegn W, Litch JA, Every Preemie–SCALE Ethiopia Implementation Research Collaboration Group Gidey Hagos Hailu Tedros Jebessa Solomie Kahsay Amaha Kuti Kemal A. Levine Gillian A. Robb-McCord Judith Tesfahun Alemu Tuamay Berhe Dessalegn. Health system readiness to support facilities for care of preterm, low birth weight, and sick newborns in Ethiopia: a qualitative assessment. BMC health services research. 2019 Nov 21;19(1):860.
3. MOH. Realizing universal health coverage through primary health care: A roadmap for optimizing the Ethiopian health extension program 2020–2035. Addis Ababa, Ethiopia: Ministry of Health, Ethiopia; 2020.
4. Assefa Y, Hill PS, Gilks CF, Admassu M, Tesfaye D, Van Damme W. Primary health care contributions to universal health coverage, Ethiopia. Bull World Health Organ. 2020 Dec 1;98(12):894-905A. doi: 10.2471/BLT.19.248328. Epub 2020 Sep 28

Overnutrition and its associated factors among women of reproductive age group in Metropolitan regions of Ethiopia

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Abstract

Background: Globally, overweight and obesity cause approximately 4.0 million deaths and 120 million disability-adjusted life years. Overweight and obesity are also increasing in developing countries due to the development of their economies, the decrease in physical activity, and the shift to higher energy and fat dense diets. In Ethiopia, some studies found that overweight and obesity were common among reproductive age group women. Despite Ethiopia's rising obesity prevalence, there is no evidence of reproductive-age overweight in the country's metropolitan areas. Therefore, this study aimed to determine the prevalence of overweight/obesity and its predictors among women of reproductive age in Ethiopia's metropolitan regions.

Methods: The study was based on secondary data analysis of the EDHS 2016 data. A total weighted sample of 810 reproductive age women was included. A multilevel mixed-effect binary logistic regression model was fitted to identify the significant factors of overweight/obesity. Statistical significance was determined using Adjusted Odds Ratio (AOR) with 95% confidence interval.

Results: The overall prevalence of overnutrition was observed to be 33.24 % (30.08, 36.57) where 31.48 % and 32.5% had overweight and obesity, respectively. Women's age 25-34 (AOR = 2.2; 95% CI: 1.39, 3.47), and 35-49 (AOR = 4.62; 95% CI: 2.79, 7.64), secondary and above educational level (AOR = 1.77; 95% CI: 1.12, 3.28), number of alive children: 1-3 (AOR = 1.68; 95% CI: 1.05, 2.68), 4 and above (AOR = 1.97; 95% CI: 1.32, 4.22), and living in Addis Ababa (AOR =2.68; 95% CI: 1.46, 4.74) were associated with over nutrition.

Conclusion: The prevalence of overnutrition in the Metropolitan regions of Ethiopia is still optimally high. Women's age, education level, number of living children and living in Addis Ababa had increased the odds of overweight and obesity. Thus, regular physical activity, reducing high fat/high-energy foods, and walking part of the way to work instead of taking a taxi are all recommended.

Keywords: Ethiopia, Factors, Multilevel, overnutrition

Background

The issue of overweight/obesity affects both developed and developing countries worldwide [1, 2]. The overweight/obese population is at a significant risk of developing non-communicable diseases such as hypertension, coronary heart disease, type 2 diabetes, joint and muscular disorders, respiratory problems, and cancer [1, 3, 4]. In addition to affecting women's health, overweight and obesity also affect their children's health [5]. Obese and overweight women are more likely to experience pregnancy complications such as gestational diabetes, gestational hypertension, preeclampsia and postpartum hemorrhage, as well as surgical site infection and low birth weight as well as congenital malformations, preterm birth, large babies for their gestational age, and perinatal deaths[5, 6].

Globally, overweight and obesity cause approximately 4.0 million deaths and 120 million disability-adjusted life years [7]. According to systematic reviews and meta-analyses, overweight/obesity among women worldwide ranges from 29.8% to 38.0% [1]. Overweight and obesity are also increasing in developing countries due to the development of their economies, the decrease in physical activity, and the shift to higher energy and fat dense diets [2, 8]. The prevalence of overweight and obesity among women of reproductive age group was 57.4% in Uganda, 66.7% in Nigeria, 74.1% in Tanzania, and 87% in South Africa, respectively [9]. In Ethiopia, some studies found that overweight and obesity were common among reproductive age group women, with 56.2% reported in the south[10], 26.7% in Dessie town [11], 36.4% in Hawassa [12] and 20.6% in Addis Ababa [13].

As far as overweight and obesity are concerned, the following predictors can be identified: being female [9, 12, 14], older age [9, 12, 15, 16], married [9, 11, 15, 17], Having a higher wealth index [11, 12, 14, 18], eating snack[11], Consumption of sweets, meat, and eggs on a regular basis [12], Water sources with improved accessibility [13], access to improved toilets [15],higher education [15, 16, 18], not working[16], Utilization of hormonal contraception [16], and urban in residence [15, 17] were factors associated with an increased risk overweight and obesity. While overweight and obesity are widespread problems among women of reproductive age in Ethiopia, little research has been conducted to identify national determinants of overweight/obesity. As a result, this study will assist health practitioners and policymakers in identifying, implementing, and evaluating evidence-based interventions for the problem. It will also benefit the community by providing insight into the risk factors of overweight/obesity and encouraging people to avoid these risk factors in the future.

Methods

Study Settings and Data Source

The study was a cross-sectional assessment of data from Ethiopian Demographic and Health Surveys (EDHSs) conducted from January 18, 2016, to June 27, 2016, across the country which is the fourth comprehensive survey [19]. Regions (Addis Ababa, Dire Dawa, and Harari) were included in this study. These regions were selected because they are Metropolitan. The data for these regions were gained from the official database of the EDHS program, www.measuredhs.com after authorization was granted via online request by explaining the purpose of our study. We extracted dependent and independent variables from the woman record (IR file). DHS is a nationally representative household survey conducted by face-to-face interviews on a wide range of populations. Study participants were selected using a two-stage stratified sampling technique. Enumeration Areas (EAs) were randomly selected in the first stage, while households were selected in the second stage[20]. Because households are not selected uniformly, weighting was performed prior to analysis of the DHS dataset to ensure that the sample data was representative. Women's individual weight (v005) is calculated

by multiplying the inverse of their individual response rate with household weight (hv005). Before analysis, individual sample weights were generated by dividing (v005) by 1,000,000 to ap proximate the number of cases [21, 22]. After exclusion of underweight, pregnant mothers, and postpartum women, a total weighted sample of 810 reproductive- age women was included from three Metropolitan regions in this study.

Ethical approval and consent to participate

The study does not involve participants to provide information. Consent to participants is not applicable since the data is secondary and is available in the public domain. All the methods were conducted according to the Helsinki declarations. More details regarding EDHS data and ethical standards are available online at (http://www.dhsprogram.com). The study is not experimental study. Further explanation of how the DHS uses data and its ethical standards can be found at: http://goo.gl/ny8T6X.

Study variables

Outcome variable

The outcome variable for this study was overnutrition which was estimated by body mass index (BMI), which is dichotomized as normal and overweight/ obesity. Individuals are found to have normal BMI when their BMI is from 18.5 to 24.9kg/m2. Those individuals with a BMI of ≥25kg/m2 were overweight and those with BMI ≥30kg/m2 were obese[23].

Independent variables

Individual level variables: Age of respondents, educational status of respondents, and occupation of respondents, wealth index, media exposure, parity, current marital status, contraceptive use, and religion were included.

Community level variables: Community level variables included region and some were derived from the individual level data of all community members in the primary sampling unit (PSU), which includes the community level poverty, community level education, and community level media exposure.

Data analysis

Data analysis was performed using Stata version 16 with four models: null, individual factors (Model I), community factors (Model II), and both factors (Model III). Model fit was assessed using ICC, MOR, and deviance (-2LLR), with Model III showing the best fit. Variables with p-values under 0.2 in bivariable analysis were included in multivariable analysis. Factors of overnutrition were identified using adjusted odds ratios, 95% confidence intervals, and p-values below 0.05 in the final model.

Results

Socio-demographic characteristics

Individual level factors

About 40.59% of the women were aged between 15-24 years. Regarding their educational level, 400 (49.39%) respondents were reported with secondary and above education. Among the participants, 433 (53.46%) had no children. About 61.61% of the respondents were married and 522 (64.48%) of participants had work. With regard to their economic status, 13 (1.64%) women were from the poor wealth quintiles and 792 (97.77%) were from the rich wealth quintiles. Moreover, 763 (41.2%) respondents had media exposure. In addition, 571 (70.46%) participants were Orthodox Christian.

Community level factors

Of the study participants, 546 (67.43%) reproductive age women were from communities with high proportion of community level education. Majority (70.24%) of participants had community media exposure. Moreover, 727 (89.82%) participants were from Addis Ababa (Table 2).

Overall, the prevalence of overnutrition among reproductive age women in Metropolitan regions of Ethiopia was 33.24 % (95% CI: 30.08, 36.57) where 31.48 % and 32.5% had overweight and obesity, respectively (Fig 1).

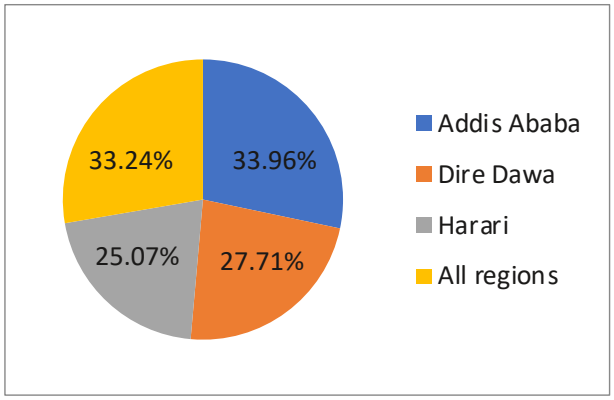

Fig 1: Prevalence of overnutrition among reproductive age women in Metropolitan regions of Ethiopia, 2016 EDHS data

Factors associated with over nutrition (overweight/obesity)

In terms of individual level factors, the study showed that women aged 25 to 34 and 35 to 49 were more likely to be overweight/obese (AOR = 2.2; 95% CI: 1.39, 3.47), (AOR = 4.62; 95% CI: 2.79, 7.64) compared to 15 to 24 aged women respectively. The study found that women with a secondary and above educational level were 1.77 times more likely to be overweight/obese (AOR = 1.77; 95% CI: 1.12, 3.28) than those who had no formal education. Women who had 1-3 children had 1.68 (AOR = 1.68; 95% CI: 1.05, 2.68) higher odds of being overweight/obese and 4 and above children had 1.97 (AOR = 1.97; 95% CI: 1.32, 4.22) higher odds of being overweight, compared to no child. The risk of overweight/obesity was 2.68 times higher in reproductive age women lives in Addis Ababa region as compared to children in the Harari region (AOR = 2.68; 95% CI: 1.46, 4.74).

Discussion

The overall prevalence of being overweight was 33.24% (95% CI: 30.08, 36.57) which is high. This finding is higher than studies conducted in Gondar town, Northwest Ethiopia 9.1 %[24], Ethiopia 35.9 % [25], and Uganda 21.6%[26]. This variance may be due to a number of variables, including societal socioeconomic issues and differences in sample size. Furthermore, variations in the study population and methodological approaches may be to

The odds of overweight/obesity among women aged 25–34, and 35–49 years was higher compared with women with age group of 15–24 years. This implies that the likelihood of gaining excess weight rises with age. It is similar to findings from many other research studies [27-31]. It could be due to changes in body composition, including an increase in body fat and hormonal changes due to aging, which are accompanied by less active lifestyles, increasing the risk of overweight and obesity among older women[32].

The odds of overweight/obesity among women with secondary and higher education were higher than women with no education. This finding is in line with the finding in study conducted Ethiopia [33]. This is not expected because people who are educated are expected to get more information on the effect and methods of overweight and obesity from different sources than those who are not educated. Nevertheless, consistent findings have been reported in other low and middle-income countries [34, 35]. One explanation could be that those with a higher educational level live in urban areas where overweight and obesity are more prevalent than among those without education [36]. Additionally, women with higher educational levels are more likely to have higher wealth status, which is a significant factor for overweight and obesity[37]. In addition, because people with higher levels of education tend to live in urban areas, their occupations might result in higher body weights than those who live in rural areas [36, 38].

In comparison to a woman who had no children, women who had 1-3 children and women who had 4 and above children were 1.68 and nearly 2 times more likely, respectively, to be overweight. This is in line with the study conducted in

Maldives [39]. A possible explanation might be that successive pregnancies lead to cumulative excess weight gain during each subsequent pregnancy period as well as during the postpartum period, as reported in several studies [40-42]. A previous study reported parity as an independent predictor for subsequent maternal weight gain[39].

Respondents in Addis Ababa had higher odds of being overweight or obese compared to those in Harari, likely due to sociodemographic and socioeconomic differences. Addis Ababa is entirely urban, while Dire Dawa and Harari include rural areas, where residents have a lower risk of overweight and obesity, as shown in previous studies[25, 33].The study used a mixed-effect multilevel model but couldn't establish causality due to its cross-sectional design. Self-reported data, limited triangulation, and small sample size may introduce bias and limit generalizability.

Conclusion

According to this study, the prevalence of overweight and obesity among reproductive age group women is increasing in Ethiopia. Age of respondents, educational status of mothers, parity, and region were significant factors for overweight and obesity. Overweight and obesity are major issues for women, especially in metropolitan areas, regardless of education. This raises concern as they increase vulnerability to non-communicable diseases like hypertension and cardiovascular conditions. Thus, context-based interventions need to be designed on the prevention and control methods of overweight and obesity giving especial emphasis to those regions. Additionally, it is advised to Walking part of the way to work instead of taking a taxi, reducing high-fat/high-energy foods, and engage in regular physical activity.

References

1. Ng M, Fleming T, Robinson M, Thomson B, Graetz N, Margono C, Mullany EC, Biryukov S, Abbafati C, Abera SF: Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: a systematic analysis for the Global Burden of Disease Study 2013. The lancet 2014, 384(9945):766-781.
2. Organization WH: World Health Organization Obesity and Overweight. In.; 2021.
3. Cefalu WT, Bray GA, Home PD, Garvey WT, Klein S, Pi-Sunyer FX, Hu FB, Raz I, Van Gaal L, Wolfe BM: Advances in the science, treatment, and prevention of the disease of obesity: reflections from a diabetes care editors' expert forum. Diabetes care 2015, 38(8):1567-1582.
4. Ziraba AK, Fotso JC, Ochako R: Overweight and obesity in urban Africa: a problem of the rich or the poor? BMC public health 2009, 9(1):1-9.
5. Marchi J, Berg M, Dencker A, Olander E, Begley C: Risks associated with obesity in pregnancy, for the mother and baby: a systematic review of reviews. Obesity Reviews 2015, 16(8):621-638.
6. Kulie T, Slattengren A, Redmer J, Counts H, Eglash A, Schrager S: Obesity and women's health: an evidence-based review. The Journal of the American Board of Family Medicine 2011, 24(1):75-85.
7. Ferreira CM, Reis NDd, Castro AdO, Höfelmann DA, Kodaira K, Silva MT, Galvao TF: Prevalence of childhood obesity in Brazil: systematic review and meta-analysis. Jornal de pediatria 2021, 97:490-499.
8. Subramanian S, Perkins JM, Özaltin E, Davey Smith G: Weight of nations: a socioeconomic analysis of women in low-to middle-income countries. The American journal of clinical nutrition 2011, 93(2):413-421.
9. Ajayi IO, Adebamowo C, Adami H-O, Dalal S, Diamond MB, Bajunirwe F, Guwatudde D, Njelekela M, Nankya-Mutyoba J, Chiwanga FS: Urban–rural and geographic differences in overweight and obesity in four sub-Saharan African adult populations: a multi-country cross-sectional study. BMC Public Health 2016, 16(1):1-13.
10. Yohannes M: Prevalence of overweight and obesity among office-based urban civil servants in southern nations, nationalities and peoples' region, Ethiopia. Ethiop Med J 2019, 57(16):391-399.
11. Dagne S, Gelaw YA, Abebe Z, Wassie MM: Factors associated with overweight and obesity among adults in northeast Ethiopia: a cross-sectional study. Diabetes, metabolic syndrome and obesity: targets and therapy 2019:391-399.
12. Regassa B, Mosisa G, Biru B, Fekadu G: Prevalence and Factors Associated with Overweight and Obesity among Adults in the Selected Towns of Western Ethiopia: A Community Based Cross-Sectional Study. J Obes Overweig 2021, 7(1):104.
13. Tebekaw Y, Teller C, Colón-Ramos U: The burden of underweight and overweight among women in Addis Ababa, Ethiopia. BMC public health 2014, 14(1):1-11.

14. Shayo GA, Mugusi FM: Prevalence of obesity and associated risk factors among adults in Kinondoni municipal district, Dar es Salaam Tanzania. BMC public health 2011, 11(1):1-7.

15. Delbiso T, Guha-Sapir D: Health at the borders: multilevel analysis of women's malnutrition determinants in Ethiopia: Tefera Darge Delbiso. The European Journal of Public Health 2016, 26(suppl_1):ckw170. 023.

16. Mkuu RS, Epnere K, Chowdhury MAB: Peer reviewed: prevalence and predictors of overweight and obesity among Kenyan women. Preventing Chronic Disease 2018, 15.

17. Janghorbani M, Amini M, Willett WC, Gouya MM, Delavari A, Alikhani S, Mahdavi A: First nationwide survey of prevalence of overweight, underweight, and abdominal obesity in Iranian adults. Obesity 2007, 15(11):2797-2808.

18. Abrha S, Shiferaw S, Ahmed KY: Overweight and obesity and its socio-demographic correlates among urban Ethiopian women: evidence from the 2011 EDHS. BMC Public Health 2016, 16:1-7.

19. Abate MG, Tareke AA: Individual and community level associates of contraceptive use in Ethiopia: a multilevel mixed effects analysis. Archives of Public Health 2019, 77(1):1-12.

20. Corsi DJ, Neuman M, Finlay JE, Subramanian S: Demographic and health surveys: a profile. International journal of epidemiology 2012, 41(6):1602-1613.

21. Croft TN, Marshall AM, Allen CK, Arnold F, Assaf S, Balian S: Guide to DHS statistics. Rockville: ICF 2018, 645.

22. Eshete T, Kumera G, Bazezew Y, Mihretie A, Marie T: Determinants of inadequate minimum dietary diversity among children aged 6–23 months in Ethiopia: secondary data analysis from Ethiopian Demographic and Health Survey 2016. Agriculture & Food Security 2018, 7(1):1-8.

23. Organization WH: Obesity and overweight. 2018 Available from: https://www. who. int/en/news-room/fact-sheets/detail/obesity-and-overweight. Accessed 2019, 2:26.

24. Ali MS, Kassahun CW, Wubneh CA: Overnutrition and associated factors: A comparative cross-sectional study between government and private primary school students in Gondar Town, Northwest Ethiopia. Journal of Nutrition and Metabolism 2020, 2020.

25. Mengesha Kassie A, Beletew Abate B, Wudu Kassaw M: Education and prevalence of overweight and obesity among reproductive age group women in Ethiopia: analysis of the 2016 Ethiopian demographic and health survey data. BMC Public Health 2020, 20(1):1-11.

26. Sserwanja Q, Mukunya D, Kawuki J, Mutisya LM, Musaba MW, Arinda IK, Kagwisagye M, Ziaei S: Over-nutrition and associated factors among 20 to 49-year-old women in Uganda: evidence from the 2016 Uganda demographic health survey. Pan African Medical Journal 2021, 39(1).

27. Doku DT, Neupane S: Double burden of malnutrition: increasing overweight and obesity and stall underweight trends among Ghanaian women. BMC public health 2015, 15(1):1-9.

28. Ford ND, Patel SA, Narayan KV: Obesity in low-and middle-income countries: burden, drivers, and emerging challenges. Annual review of public health 2017, 38:145-164.

29. Corsi DJ, Kyu HH, Subramanian S: Socioeconomic and geographic patterning of under-and overnutrition among women in Bangladesh. The Journal of nutrition 2011, 141(4):631-638.

30. Kamal SM, Hassan CH, Alam GM: Dual burden of underweight and overweight among women in Bangladesh: patterns, prevalence, and sociodemographic correlates. Journal of health, population, and nutrition 2015, 33(1):92.

31. Hasan M, Sutradhar I, Shahabuddin A, Sarker M: Double burden of malnutrition among Bangladeshi women: a literature review. Cureus 2017, 9(12).

32. Han T, Tajar A, Lean M: Obesity and weight management in the elderly. British medical bulletin 2011, 97(1):169-196.

33. Yeshaw Y, Kebede SA, Liyew AM, Tesema GA, Agegnehu CD, Teshale AB, Alem AZ: Determinants of overweight/obesity among reproductive age group women in Ethiopia: multilevel analysis of Ethiopian demographic and health survey. BMJ open 2020, 10(3):e034963.

34. Benkeser R, Biritwum R, Hill A: Prevalence of overweight and obesity and perception of healthy and desirable body size in urban, Ghanaian women. Ghana medical journal 2012, 46(2):66-75.

35. Diendéré J, Kaboré J, Somé JW, Tougri G, Zeba AN, Tinto H: Prevalence and factors associated with overweight and obesity among rural and urban women in Burkina Faso. The Pan African Medical Journal 2019, 34.

36. Sengupta A, Angeli F, Syamala TS, Dagnelie PC, Van Schayck C: Overweight and obesity prevalence among Indian women by place of residence and socio-economic status: contrasting patterns from 'underweight states' and 'overweight states' of India. Social science & medicine 2015, 138:161-169.

37. Bishwajit G: Household wealth status and overweight and obesity among adult women in B angladesh and N epal. Obesity science & practice 2017, 3(2):185-192.

38. Goryakin Y, Suhrcke M: Economic development, urbanization, technological change and overweight: what do we learn from 244 Demographic and Health Surveys? Economics & Human Biology 2014, 14:109-127.

39. Hill B, Bergmeier H, McPhie S, Fuller-Tyszkiewicz M, Teede H, Forster D, Spiliotis B, Hills AP, Skouteris H: Is parity a risk factor for excessive weight gain during pregnancy and postpartum weight retention? A systematic review and meta-analysis. Obesity reviews 2017, 18(7):755-764.

40. Mamun AA, Kinarivala M, O'Callaghan MJ, Williams GM, Najman JM, Callaway LK: Associations of excess weight gain during pregnancy with long-term maternal overweight and obesity: evidence from 21 y postpartum follow-up. The American journal of clinical nutrition 2010, 91(5):1336-1341.

41. Voerman E, Santos S, Patro Golab B, Amiano P, Ballester F, Barros H, Bergström A, Charles M-A, Chatzi L, Chevrier C: Maternal body mass index, gestational weight gain, and the risk of overweight and obesity across childhood: An individual participant data meta-analysis. PLoS medicine 2019, 16(2):e1002744.

42. Gunderson EP: Childbearing and obesity in women: weight before, during, and after pregnancy. Obstetrics and Gynecology Clinics 2009, 36(2):317-332.

Assessment of Capacity for Surveillance, Preparedness, and Response to Strengthen Public Health Emergencies in Healthcare Facilities, Ethiopia.

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Abstract

Introduction: Health facilities are the gateway of various unusual and emerging diseases, as well as public health emergencies, and Healthcare facilities at all levels of the system play a central role in the delivery of health services. However, comprehensive information on the capacity of healthcare facilities for surveillance, preparedness, and response at all system levels is lacking in Ethiopia. This study aims to bridge this gap and generate evidence to improve the Public Health Emergency Management PHEM system.

Methods: A health facility-based cross-sectional study design was employed to assess 197 public and private health facilities in five regions and two administrative cities. Data were collected from July 1–30, 2022, through interviews using the World Health Organization Health System building block, such as health facility infrastructure, facility-level PHEM workforce, facility-level PHEM leadership and coordination, facility-level PHEM health information system, risk communication and community engagement, facility-level PHEM level finance, logistics, and supply, supplemented with observation and document reviews. Data analysis was performed using SPSS Version 26, and findings were triangulated with findings from after-action reviews and sentinel site reports.

Results: There were significant variations and gaps among facilities. Key infrastructure challenges include limited internet connectivity (46.7%), inadequate phone access (35.5%), unreliable electricity supply (6%), and the absence of isolation centers (51.2%). (87.8%) lack of dedicated surveillance officers (53.3%), lack of training in PHEM, and absence of RRT (17%) and (54%) non-functional. While 88% facilities have internal communication mechanisms and 84% have external communication mechanisms for emergencies, and only 34% have prepositioned emergency supplies.

Conclusion: The study shows major gaps in the surveillance, preparedness, and response capacity at health facilities. The findings underscore the need for further improvement. Sustained and concerted efforts and more investments in human resources, diagnostics, supplies, and infrastructure, including periodic supportive supervision.

Keywords: Health, Preparedness, Response, Emergency, Ethiopia

Introduction

Globally, public health events (PHEs) are increasing from time to time. Preparedness for PHEs at each level of the health system is becoming more crucial than ever(1, 2). Public health emergencies (PHEs), like pandemics, disasters, and other catastrophic events, pose significant threats to the ability of health facilities to maintain operational capabilities and provide essential and basic health services to the public. Some causes of routine health services disruption due to PHE include overwhelmed health services due to increased demand, shortage of health workers due to fear, sickness, or death, diversion of essential medical supplies to response, and damage to facilities(3, 4). Health facilities are the gateway for index cases for potential natural and manmade disasters. The public health system is continually challenged by recurrent and unexpected disease outbreaks and is facing the challenges of managing health consequences of natural and human-made disasters, emergencies, crises, and conflicts. Health facilities are at the frontline to encounter reportable cases as patients usually visit health facilities to seek health care services. The COVID-19 pandemic has tested healthcare facilities and exposed vulnerabilities in healthcare emergency preparedness on a scale unprecedented in recent history (2, 5). The main purpose of this study was to identify the current public health emergency management (PHEM) practices at health facilities in terms of preparedness, surveillance, and response.

Methods and Materials

Study setting: Ethiopia had a federal administrative system with 12 administrative regions and two city administrations at the time of this study.

Study design, sample size, and selection criteria Descriptive cross-sectional design was used, and a multi-stage sampling technique was employed to select regions and health facilities. Regions were categorized into agrarian regions, pastoralists, and city administrations based on climate conditions and livelihoods. Three regions from agrarian and two regions from pastoralist were selected randomly, and two regions from urban were selected purposively. Then, after discussion with the selected Regional Health Bureaus and Regional Public Health institutes, the lead hospitals were selected, and the catchment health facilities of the lead hospitals, including private and NGO health facilities, were selected for the data collection. The study was conducted from July 1–30, 2022.

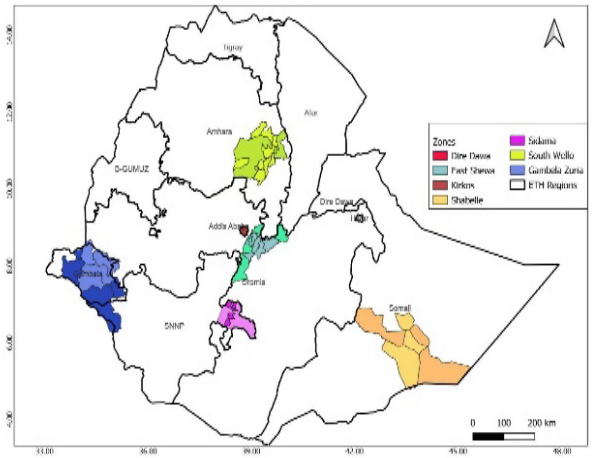

Figure 1: Map of sampled zones for the assessment of PHEM at HF in Ethiopia, July 2022

Data collection tool. The standard questionnaire was adapted from the WHO's hospital safety index evaluation(**6)** and customized using the WHO health system building blocks.

Data quality assurance.

The ODK data collection kit was to collect data, and a minimum first degree of health professional who has data collection experience were selected and trained on data collection, and data was monitored daily.

Data Analysis. First Data was exported to an Excel data sheet to clean, and variables for analysis were identified. The closed-ended questionnaire and the checklist were analysed quantitatively using SPSS version 26. To complement the reports, after-action reviews from 2019 to 2022 and periodic/sentinel site reports were used. The WHO health systems

building blocks were used to summarize the findings. **Results and Discussion**. In this study 197 public, private and NGO health facilities (3 specialized hospitals, 9 general hospitals, 13 primary hospitals, 18 private hospitals, 113 health centers, 39 private clinics, and 2 NGO health facility) from the 5 regional states and 2 city administrations out of which 50 of the health facilities were from the Amhara region, 43 from Oromia, 29 from Gambella, 24 from Dire Dawa, 22 from Sidama, 20 from Addis Ababa, and 9 from Somali region were included in the study. Infrastructure at health facilities. The findings of this study revealed that access to tertiary health services declines as one moves along the health sector tier system from higher to lower (from referral hospitals to primary healthcare), affecting public health emergency management at the nearest facility.

According to this study findings 11.1% of general hospitals, 38.5% of primary hospitals, 56.6% of health centers, and 56.4% of private clinics do not have cable internet connection and 15.4% of primary hospitals, 47.8% of health centers and 35.9% of private clinics do not have phone access whereas 9.7% of health centers and 2.6% of private clinics do not access to electricity.

Additionally, only 36% of health centers have isolation rooms for unusual case observation and management. Isolation rooms are present in 100% of referral institutions, but only 13% and 14% of private hospitals and clinics, respectively. Additionally, this study demonstrated that lower-level healthcare facilities and some referral healthcare facilities lacked the necessary triage of patients with respiratory symptoms. Additionally, (82%) of the lower-level healthcare facilities and (47%) of the referral healthcare facilities lacked a physical barrier to keep patients and healthcare professionals apart during the patient review. 29% referral hospitals and 76% lower lower-level medical facilities lacked patient isolation spaces. Health workforce at health facilities. This study showed that (33%) of specialized, 44% of general, and 69% of primary hospitals, 89% of health centers, 100% of private hospitals and clinics, do not have a designated surveillance officer. Nearly half (53%) of health professionals employed in health facilities participating in PHEM have not obtained PHEM basic training. From this, 78% of general hospitals, 46% of primary hospitals, 78% of private hospitals, and 38% of health centers and 87% of Private clinics' surveillance officers/PHEM focal persons have not received basic training. AAR reports indicated that training on the outbreak investigation not given for all responders before the occurrence of the outbreak.

Finance, logistics, and supply at health facilities. In this study, 34% of assessed health facilities have a prepositioned PHE stock or supply. 44% percent of general hospitals,77% primary hospitals, and 63% health centers have no supply. The AAR indicated that there was a budget and logistic supply shortage at the facility level, and there was also a shortage of operational costs. Among lower-level facilities, all had medicine, but one health facility lacked medicine, and most health facilities had inadequate PPE supplies. Health information systems, guidelines, and other documents at health facilities. Concerning this, 29 % of healthcare facilities do not have a mechanism for gathering, packaging, and transporting specimens during public health emergencies. This study showed that 46% health facilities have no PHEM guideline, 16% have no IPC manual and 19% have no case definitions of priority diseases posted at IPDs and the reviewed report from sentinel sites showed majority (77%) of the facilities use DHIS-2 for monthly reporting and (64%) use one or combined mechanism like Email, telegram to report surveillance reports to the next higher level and 44% of general hospitals, 92% of primary hospitals, 65% of health centers, private and NGO facilities do not have Emergency Preparedness and Response Plans (EPRPs). There was an identified gap in DHSI2 utilization on smartphones. This could affect the report's completeness as well as its timeliness. Service delivery at health facilities. According to study

findings, only 43% of the health facilities have an essential health service continuity plan. Nearly half (49%) of assessed health facilities lack of triage system for managing public emergencies and disasters, while 98% of facilities have established a system for referral, transfer, and reception of patients during emergencies.

Leadership and coordination at health facilities. Regarding this, 22% of general hospitals, 83% of private hospitals, and 15% of health centers had no established functional RRTs. Among those 86% general hospitals, 77% of primary hospitals, and 79% of health centers have no regularly scheduled meeting. Of the seven AARs reviewed indicate two AARs established an RRT team prior to the outbreak. This study shows that 82.4%) respondents said their HCFs were poor in terms of general reparation.

Risk communication and community engagement at health facilities. In terms of risk communication and community engagement initiatives, out of the 197 types of health facilities, 88% had internal communication mechanisms during emergencies, about 84% had external communication mechanisms during emergencies, 31% had assigned focal person for risk communicating with the public and media, about 81% had feedback mechanisms with the next higher levels, about 56% had mechanisms for community engagement for public health emergencies, and about 40% had a resource mobilization mechanism from community for public health emergencies. According to findings of some AAR/IAR, there is massive workforce mobilization and management via engagement of volunteers and training using various platforms, like mobile-based and online training modality.

Conclusions and recommendations

Health facilities play a crucial role in public health emergency management, as they are the first to encounter emergencies. However, there are significant gaps in enabling health facilities to detect, notify, and respond to emergencies. To address these gaps, improving health infrastructure, assigning dedicated PHEM officers, training healthcare workers on PHEs, advocating, strengthening electronic reporting systems, job aids, tools, and enhancing policies on health facility attention to public health emergencies are recommended. These findings helped in designing the PHEM ta health facility initiative focused on strengthening the Health **system.** Health facilities play a crucial role in public health emergency management, as they are the first to encounter emergencies. However, there are significant gaps in enabling health facilities to detect, notify, and respond to emergencies. To address these gaps, improving health infrastructure, assigning dedicated PHEM officers, training healthcare workers on PHEs, advocating, strengthening electronic reporting systems, job aids, tools, and enhancing policies on health facility attention to public health emergencies are recommended. This funding helped in designing the PHEM at health facility initiative, focused on strengthening the Health system

References

1. Organization WH. WHO guidance on preparing for national response to health emergencies and disasters. WHO guidance on preparing for national response to health emergencies and disasters2021.

2. Herstein JJ, Schwedhelm MM, Vasa A, Biddinger PD, Hewlett AL. Emergency preparedness: What is the future? Antimicrobial Stewardship & Healthcare Epidemiology. 2021;1(1):e29.

3. Organization WH. Health service continuity planning for public health emergencies: a handbook for health facilities: interim version for field testing. Health service continuity planning for public health emergencies: a handbook for health facilities: interim version for field testing2021.

4. Organization WH. Health emergency and disaster risk management framework. 2019. Reference Source. 2022.

5. Blumenthal D, Fowler EJ, Abrams M, Collins SR. Covid-19—implications for the health care system. Mass Medical Soc; 2020. p. 1483-8.

6. Organization WH. Hospital safety index: Guide for evaluators: PAHO; 2019.

Regional inequalities in Zero dose children remain wide in Ethiopia: a finding from community-based surveys from 2011-2022

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Abstract

Background: Zero-dose prevalence is defined as the proportion of children who did not receive a single dose of Pentavalent vaccines. Measuring, and monitoring inequalities of zero-dose children across socio-demographic variables is essential to craft focused interventions and ensuring no one has left behind. Therefore, this study aimed to examine the trend and inequalities of zero-dose children over the years in Ethiopia.

Methods: The study has utilized data from Ethiopian demographic and health surveys (EDHS) conducted in 2011, 2016, 2019 and the national health equity survey conducted in 2022. A total of 6819 children aged 12-23 months were included in this study. Data management and analysis was computed using stata17 software. Descriptive statistics including proportions, ratio, absolute differences, table and graph were used to describe the study variables. Zero dose children inequalities across socio-economic factors were explained using concentration index (CIX).

Results: The burden of zero dose children has declined from 37%, [95% CI, 32%-41%] in 2011 to 25%, [95% CI, 22%-28%] in 2022. However, significant inequality has observed across regions, wealth, and residence. Nearly two third of children (65%) in Afar region and nearly half of children (48%) in Somali region were zero dose in 2022; while Addis Ababa city and Amhara region had only 11% and 15% burden of zero dose children during the same year respectively. The disparity in zero dose children across regions persisted from 2011-2022.

Conclusions: The magnitude of zero dose children has declined in Ethiopia, however significant inequalities continued across regions and other socio-demographic variables. Strengthening health care facilities in pastoral and conflict affected areas would be helpful to reach more eligible children.

Keywords: vaccination, zero dose children, inequality, Ethiopia

Introduction

Immunization is one of the proven effective strategies to prevent child morbidity and mortality attributable to vaccine preventable diseases [1]. However, children all over the world are not equally benefited from vaccination. In 2023, about 21 million children were zero doses (missed penta1) or partially vaccinated; of which the great majorities (60%) live in ten countries consisting of Ethiopia, Nigeria, India, Afghanistan, Democratic Republic of Congo, Sudan, Yemen, Angola, Indonesia, and Pakistan[2, 3]. Zero dose children are defined as the proportion of children who did not receive a single dose of DPT/Pentavalent vaccines[4]. Cognizant of the existing inequalities within and between countries, state leaders have called the international community to "leave no one behind" on the sustainable development goals summit (SDGs)[5], and the international agenda for immunization 2030 (IA2030) envisioned to see a world where everyone, everywhere, at any age has fully benefited from vaccines for health and wellbeing[4]. However, there were inequalities in vaccination indicators within and between countries[3, 6]. The Ethiopian government has shown its political commitment for ensuring universal access to health care including routine child immunization services. The government's effort in tandem with the efforts of international partners working on immunization has significantly improved access to immunization services in Ethiopia[7, 8]. As a result, Ethiopia's immunization coverage has steadily increased. However, Ethiopia is still among the ten countries contributing about 80% of zero dose children in African WHO region and among five countries contributing 50% of global zero dose children[9]. According to a UNICEF report in 2023, Ethiopia had 1.1 million zero dose children which is the second highest number of zero dose children in the continent next to Nigeria[6]. The previous research works on zero dose children in Ethiopia were not nationally representative and had focused on single year point estimates which did not allow examining the course of disparities in zero-dose children across socio-demographic variables over the years [10-12]. Therefore, this study is aimed to examine the trend and disparities of zero dose children across socio-demographic variables from 2011-2022.

Methods and Materials

Study Design, Population and Data sources

Repeated cross sectional study design was employed to determine the level of zero dose children and its inequalities across socio-demographic variables among 12-23 months aged children from 2011-2022 in Ethiopia. The study has utilized data from the last three rounds of Ethiopian Demography and Health Surveys (EDHS) which were conducted in 2011, 2016 and 2019, and the National Health Equity Survey (NHES 2022) conducted in 2022. The EDHS data were obtained from the measure DHS program website upon online request on https://dhsprogram.com/Data/terms-of-use.cfm[13] and the national health equity survey data is obtained from EPHI[14].

Sample size, and sampling technique

A total of 6819 children aged 12-23 months were included in this study. Two stage stratified cluster sampling technique was employed to recruit study participants in both the EDHS and national health equity survey. The details of the sample size, sampling technique and data collection procedures are explained in each EDHS report[15-17].

Data Management and Analysis

The children level data (KR file) from the last three rounds of EDHS datasets were appended to a single dataset using STATA 17 software. Variables were re-coded, generated, and/or dropped to make the dataset ready for analysis.

Vaccination status of children was determined-for each vaccine antigen using either of vaccination card, mother's report or health

facility records. Children who have not received penta1 were labeled as zero dose children and coded as"0" while those who have received penta1 were re-coded as "1". Due to the complexity and hierarchical nature of the EDHS and the national health equity survey datasets; weighting variables were used for adjustment during the analysis. Inequalities of zero dose children across regions and other socio-demographic variables were presented using absolute differences, ratios, and concentration index (CIX).

Ethics statement

The research protocol was ethically approved by Ethiopian Public Health Institute Institutional Review Board (EPHI-IRB) on 20/09/2023 with protocol number EPHI-IRB-518-2023. This study utilized data from archived sample survey, as result consent to participate in the study is not directly obtained from participants.

Results and Discussion

The burden of zero-dose children has declined from 37%, 95% CI [32%-41%] in 2011 to 25%, 95% CI [22%-28%] in 2022. Its average annual rate of reduction was 3.4% from 2011-2022. However, from 2019-2022, the burden of zero dose children has bounced upward with a 2% annual increment; specifically, the burden in urban areas has soared with 22% average annual rate of increment from 2019-2022, while it declined by 2% annually in rural areas during the same years. This backsliding trend of zero dose children will deter Ethiopia from achieving the agreed global target of reducing the burden of zero dose children by 50% in 2030 from the 2020 baseline[18]. The disruption of health systems due to armed conflicts, road blockades, security concerns for outreach immunization services and the COVID 19 pandemic might have contributed for the upsurge in zero dose children in the last two surveys. On top of the high national burden of zero dose children, there were a wide disparity across sub-national settings and other socio-demographic variables including residence, and wealth which is consistent with findings of previous studies in Ethiopia and other low and middle income countries[14, 19-21]. Children from rural areas bear the highest burden of zero dose children from 2011-2022. In 2011, about 39% and 20% of children were zero doses among rural and urban children respectively; in 2022, 28% and 18% of children from rural and urban areas were zero doses respectively. The burden of zero dose children has also significant disparity across household wealth in which children from poorest households were disproportionately zero doses compared to the counterparts. In 2011, nearly half (45%) of 12-23 months aged children from the poorest households were zero doses, whereas only 16% of children from the richest households were zero dose children. The observed gross inequality in zero-dose children across wealth was further examined using concentration index (CIX). The CIX value of zero dose children across wealth has negative values which prove that poorest households bear the highest burden of zero dose children. The table below (table1) summarizes the trend and inequalities of zero dose children across wealth in Ethiopia.

The trend and burden of zero dose children is heterogeneous across regions of Ethiopia. In 2011, about seven out of ten children (72%) were zero doses in Afar region which was nearly twice as high as the national burden of zero dose children, while only 5% of children in Addis Ababa city were zero-dose children in the same year.

Table1: **Trend and inequalities of zero-dose children across wealth from 2011-2022 in Ethiopia**

Indicators	Year	National zero dose magnitude	Magnitude across Wealth (%)		Equity indicators across wealth		
			Poorest (Q1)	Richest (Q5)	Difference (Q1-Q5)	Ratio (Q1/Q5)	CIX, [95% CI]
Zero-dose children	2011	37[32-41]	45	16	29	2.8	-0.20[-0.25 - -0.15]
	2016	27[23-31]	38	14	24	2.7	-0.19[-0.23- -0.14]
	2019	24[19-29]	41	5	36	8.1	-0.26[-0.32- -0.20]
	2022	25[22-28]	35	17	18	2	-0.13[-0.17- -0.08]

There was a 67%-point difference in magnitude of zero dose children between Afar region and Addis Ababa city in 2011. In 2022, the burden of zero dose children has declined to 65% in Afar region, while it rose to 11% in Addis Ababa city. Regions consisting of Gambella, Amhara, Oromia and Somali had significantly reduced their percentage of zero dose children during this period. In contrast, Tigray, Harari, SNNP*, Dire-dawa, and Addis Ababa saw an increase in zero dose children in 2022 compared to the 2011 levels. The table below (table2) illustrates the regional distribution of zero dose children from 2011-2022.

Conclusion and Recommendation

Zero dose children have significantly declined over the years in Ethiopia. However, significant inequalities observed across regions where pastoral and conflict affected regions bore the highest burden. Enhancing vaccination program activities with a special focus to pastoral and conflict affected regions is helpful to mitigate the existing inequality and high burden of zero dose children.

Table2: **Trend of zero dose children across regions of Ethiopia from 2011-2022**

Regions	Burden of Zero dose children across years, N (%)			
	2011	2016	2019	2022
Tigray	13(7%)	18(8)	5(5)	84(40)
Afar	132(72%)	102(54)	65(54)	84(65)
Amhara	66(33)	36(18)	18(16)	31(15)
Oromia	141(49)	105(34)	39(27)	57(39)
Somali	82(59)	83(38)	49(56)	31(48)
Benishangul Gumuz	41(28)	28(28)	10(11)	12(29)
SNNP*	66(26)	52(23)	37(27)	142(34)
Gambella	51(30)	49(28)	27(24)	16(22)
Harari	26(26)	23(21)	24(37)	33(33)
Addis Ababa	5(5)	3(3)	2(4)	8(11)
Dire-dawa	12(11)	3(2)	5(5)	11(25)
National	635(37)	503(27)	281(24)	509(25)
Lowest burden region	Addis Ababa	Dire-dawa	Addis Ababa	Addis Ababa
Highest burden region	Afar	Afar	Somali	Afar
Absolute difference	67	52	52	54
Mean absolute difference from mean(MADM)	18	12	15	13
Relative difference (%)	49	44	63	52

References

1. I., Lassi, Z.S., et a*Essential interventions for child health.* Reproductive Health, 2014. 11(1): p. S4.

2. UNICEF and WHO, *Progresses and Challenges with Achieving Universal Immunization Coverage (WUENIC 2021): available at http://www.data.unicef.org/child-health/immunization*. 2021.

3. WHO, *Immunization coverage key facts, available at https://www.who.int/news-room/fact-sheets/detail/immunization-coverage*. 2024.

4. Immunization Agenda 2030 (IA2030), *A global strategy to leave no one behind*. 2021.

5. Hosseinpoor, A.R., N. Bergen, and V. Magar, *Monitoring inequality: an emerging priority for health post-2015.* 2015, SciELO Public Health. p. 591-591A.

6. UNICEF Eastern and Southern Africa, *New UNICEF report shows 12.7 million children in Africa missed out on one or more vaccinations over three years*. 2023.

7. Ministry of Health (MOH) Ethiopia, *Comprhensive Multi-year Plan.* 2021-2025.

8. Ministry of Health (MOH) Ethiopia, *Routine Immunization catch-up vaccination guideline* 2022.

9. Mboussou, F., et al., *Status of Routine Immunization Coverage in the World Health Organization African Region Three Years into the COVID-19 Pandemic.* Vaccines (Basel), 2024. 12(2).

10. Shiferie, F., et al., *Decomposition Analysis of Socioeconomic Inequalities in Vaccination Dropout in Remote and Underserved Settings in Ethiopia.* The American Journal of Tropical Medicine and Hygiene, 2024. 111(1): p. 196-204.

11. Biks, G.A., et al., *High prevalence of zero-dose children in underserved and special setting populations in Ethiopia using a generalize estimating equation and concentration index analysis.* BMC Public Health, 2024. 24(1): p. 592.

12. Tamir, T.T., et al., *Prevalence, spatial variation and determinants of zero-dose children in Ethiopia: Spatial and multilevel analyses.* Public Health, 2024. 236: p. 365-372.

13. The DHS Program, *Available datasets. Available: https://dhsprogram.com/data/available-datasets.cfm [Accessed April 2024].* 2024.

14. Ethiopian Public Health Institute (EPHI) and Ministry of Health (MoH) Ethiopia, *National Health Equity Survey 2022/23: Key Findings. Addis Ababa, Ethiopia: EPHI.* . 2023.

15. Central Statistical Agency/Ethiopia and ICF International, *Ethiopia Demographic and Health Survey 2011*. 2012, Central Statistical Agency/Ethiopia and ICF International: Addis Ababa, Ethiopia.

16. Central statistical agency and The DHS program, *Ethiopian health and demographic health survey report.* 2016.

17. Central statistical agency and The DHS program, *Ethiopian Health and demographic survey report.* 2019.

18. World Health Assembly, *Implementing Immunization Agenda 2030: A framework for action through Planning, Monitoring, Evaluation, Ownership,Accountability, Communications, and Advocacy*. 2020.

19. Bianca, O.C.-P., et al., *Ethnic disparities in immunisation: analyses of zero-dose prevalence in 64 countries.* BMJ Global Health, 2022. 7(5): p. e008833.

20. Sato, R., *Zero-Dose, Under-Immunized, and Dropout Children in Nigeria: The Trend and Its Contributing Factors over Time.* Vaccines (Basel), 2023. 11(1).

21. Shiferie, F., et al., *Spatial distribution of zero-dose children in Ethiopia: evidence for a targeted intervention from a large-scale cross-sectional evaluation survey.* Frontiers in Pediatrics,2024.12:p.1337922.

Section Two: Best Practice Articles

Jabez Remedy: A Digital Procurement Platform Empowering Pharmacies and Health Centers

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1. Introduction

Ethiopia has introduced an electronic government procurement (e-GP) system to enhance transparency, accountability, and efficiency in public sector procurement. The e-GP system ensures competitive bidding, reduces corruption, and improves contract management for government institutions. While this is a major step forward, challenges remain in the private pharmaceutical supply chain, where procurement is still highly fragmented, manual, and non-transparent.

Pharmacies and health centers often face stockouts, which forces them to turn patients away and undermines public trust in pharmacists as essential health professionals. Instead of being seen as trusted providers of care, pharmacists risk being viewed only as merchants when they cannot supply essential medicines. These gaps highlight the need for a complementary solution in the private sector that builds on the principles of e-GP while addressing the unique realities of medicine distribution.

Jabez Remedy was developed to respond to this challenge. It is a digital procurement platform that connects pharmacies, health centers, and wholesalers in real-time, ensuring product visibility, transparent pricing, and simplified procurement. The platform aligns with national priorities—including the Ministry of Health's multi-vendor sourcing strategy and the HSDIP focus on digital health, pharmaceutical supply, and private sector engagement—while adapting e-GP principles to strengthen the pharmaceutical value chain.

2. Objective

The overall objective is to strengthen Ethiopia's pharmaceutical supply chain through a transparent, digital multi-vendor procurement platform.

Specific objectives include:

- Improving access to real-time stock and pricing information
- Enabling decentralized, multi-supplier procurement
- Supporting pharmacists and health centers to deliver timely patient care
- Reducing stockouts and dependency on a single supplier
- Preparing for future AI-driven forecasting to estimate procurement needs

3. Method

The design of Jabez Remedy is informed by the procurement cycle of e-GP systems, customized for pharmaceutical transactions. The platform is currently in pilot testing with selected pharmacies and wholesalers in Ethiopia. Its key functional features include:

- **Purchase requisition** – Pharmacies and health centers can generate digital requisitions for required medicines, replacing manual or paper-based processes.
- **Order management** – Requisitions are converted into orders, placed directly with verified wholesalers, with visibility of stock availability, pricing, and delivery lead times.
- **Contract management** – Digital invoices and order confirmations serve as binding contracts between buyers and suppliers. Future versions will expand into framework agreements and financing contracts (e.g., "receive now, pay later").
- **Supplier management** – Verified wholesalers manage their own stock and pricing on the platform, ensuring transparency and decentralized procurement.
- **AI assistant** – Integrated into the system to guide users step-by-step, making the transition from traditional to digital procurement seamless and accessible.
- **Scalability** – Beyond pharmacies, the platform is designed to serve clinics, hospitals, and other health facilities, and in the long term will connect wholesalers with importers for a more integrated supply chain.

By mirroring the logic of e-GP while tailoring it to the private health sector, Jabez Remedy reduces fragmentation, increases efficiency, and ensures health facilities can reliably access the medicines their patients need.

4. Results / Outputs

The platform is in early pilot testing. Initial feedback indicates improved efficiency in sourcing products and enhanced decision-making from real-time visibility of stock and pricing. Wholesalers have responded positively to the decentralized model. Key outputs include

- Successful onboarding of pharmacies and wholesalers
- Streamlined procurement with automated invoicing
- Improved product availability visibility
- Early implementation of an AI assistant to help users adapt
- Plans to introduce a 'receive now, pay later' service for financial flexibility
- Commitment to offering free access for nonprofit health organizations

5. Conclusion and Way Forward

Jabez Remedy represents an innovative step toward building a resilient, decentralized pharmaceutical supply system. By digitizing procurement, enhancing market transparency, and leveraging AI for both guidance and forecasting, the platform supports Ethiopia's goal of ensuring consistent access to essential medicines.

We welcome collaboration with MOH, EFDA, RHBs, and health partners who share this vision. By scaling this platform, we can jointly build a pharmaceutical system that works better for everyone—from supplier to health worker to patient.

PEN-Plus Implementation in Ethiopia: A Best Practice in Decentralizing Severe Chronic NCD Care Closer to Community

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1. Introduction

Non-Communicable Diseases (NCDs) is the leading cause of death in Ethiopia with an estimated rate of 554 (95% UI: 502-605) per 100K population every hour an estimated of 25 Ethiopians are dying of NCDs [1]. In 2016, NCDs accounted for 39% of all deaths and 34% of disability-adjusted life years in Ethiopia, where they are also common and, on the rise, [2, 3]. Ethiopia has a pooled prevalence of 21% for hypertension (HTN) [4] and 5% for diabetes mellitus [5]. The PEN-Plus integrated care delivery strategy designed to empower primary hospitals in provision of high standards of care for patients with severe chronic NCDs. It complements the WHO's PEN strategy and aims to decentralize specialized care [6]. Ethiopia endorsed PEN-Plus in 2022 during the WHO AFRO conference in Lome, Togo, marking a commitment to SDG 3—reducing premature mortality from NCDs by one-third and the country's commitment to achieving Universal Health Coverage which aims to ensure healthy lives and promote well-being for all at all ages [3]. The PEN-Plus improves access to quality care by reducing the burden on specialized hospitals by empowering mid-level providers to manage severe chronic NCD cases and strengthening the referral system. It is implemented with standardized treatment protocols, trained staff, and essential equipment to improve patient outcomes. Through establishing cohort registries, standardizing care protocols, and encouraging continuity of care, PEN-PLUS aims to improve equity for marginalized rural communities while lowering morbidity, disability, and premature mortality. It offers a sustainable and scalable strategy that helps nations achieve universal health coverage in the end.

2. Statement of the Problem and Rationale

As the WHO PEN initiative continues to expand in low- and middle-income countries as a platform for prevention and management of less common & more severe NCDs; gaps remain in the care of childhood onset severe chronic NCDs [7]. The presence of limited access to quality and integrated outpatient services for severe chronic NCDs, such as Type 1 Diabetes, Rheumatic heart disease, Congenital Heart Disease and severe Asthma and Sickle Cell (not applicable for Ethiopia) complemented by less accessible specialized care of these severe disease conditions due to lack of trained personnel, comprehensive guidelines, & unavailability of diagnostic tools and supplies. In addition to this, the affected population resides in the rural and underserved community that is far from the specialized care contributing to poor patient outcome and early death. Hence, the PEN-Plus program invests on the improving the mid-level providers capacity in managing the severe chronic NCDs effectively, equipping the health facility of essential medical equipment & supplies that contribute to resilient health system and responds to the increasing burden of NCDs [8].

3. Methods or Approach

The intervention included training of mid-level providers on severe chronic NCDs (didactics, clinical attachment, and hands on training point of care (POC) machines and mentorship), establish PEN-Plus clinics, and availing essential medical equipment and supplies. The implementation started in 2022 at Addis Zemen and Muketuri primary hospitals found in Amhara and Oromia regions respectively by Mathiwos Wondu-YeEthiopia Cancer Society/ MWECS, in collaboration with Ministry of Health, Regional Health Bureau, and other key stakeholders through the support from NCDI Poverty Network. Additionally, the PEN-Plus in implementation in Ethiopia is guided by a protocol with clear objectives and integrates the packages of peer and psychosocial support into the PEN-Plus clinic addressing the young and financially dependent people affected by the disease.

3.1 Statistical Analysis

Data were entered, cleaned, and analyzed using R statistical software (version 4.4.3). Descriptive statistics were used to summarize baseline and follow-up outcomes. The McNemar's test was applied to assess changes in paired categorical variables (dichotomized) between baseline and follow-up status change. For variables with more than two categories, the Bowker's test was used to evaluate outcome change for patient. To assess the assumption of normality for continuous HbA1c values, the Shapiro–Wilk test along with visual inspection of Q-Q plots applied. As the difference scores between baseline and most recent HbA1c values did not follow a normal distribution (Shapiro–Wilk $p < 0.05$), the Wilcoxon signed-rank test was used instead of the paired t-test to evaluate whether there was a statistically significant change in HbA1c over time.

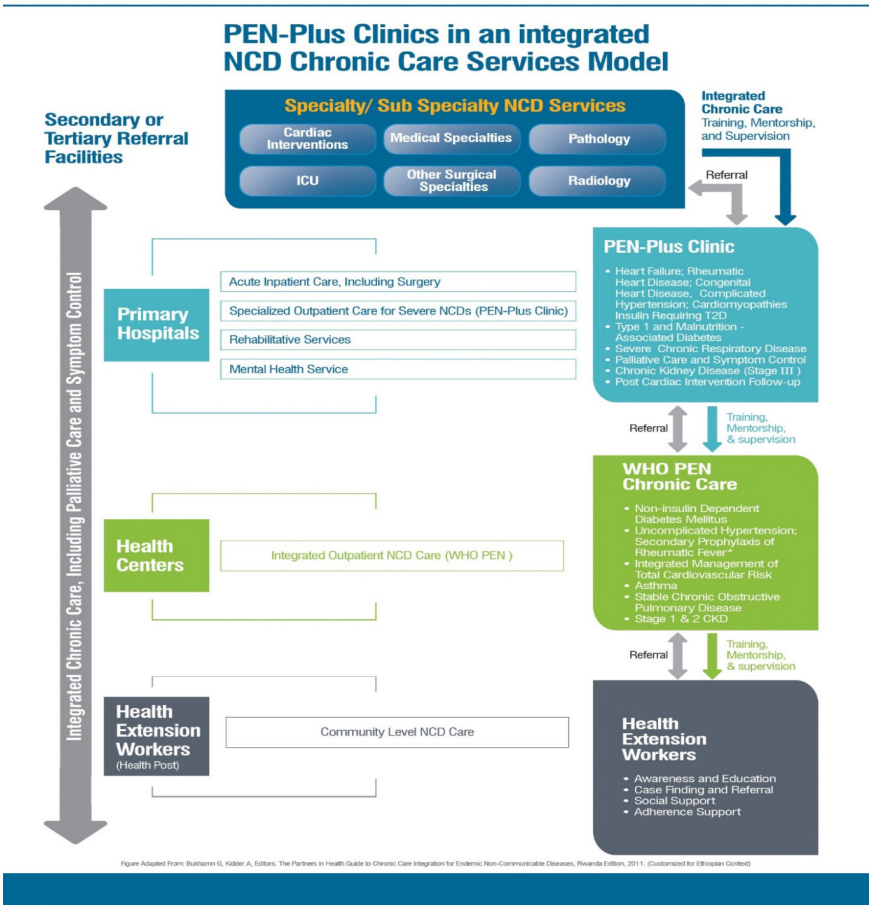

Figure 1 Overview of the PEN-Plus Clinical Model

4. Result or Relevant Change

4.1 Enrollment of severe chronic NCD cases

The program enrolled 691 patients as of June 2025, with majority being Type 1 Diabetes (55.7%), followed by Rheumatic Heart Disease (16.4%) and Insulin requiring Type 2 Diabetes (13.3%). Other conditions like severe hypertension, other cardiac conditions and chronic respiratory diseases consists smaller proportions.

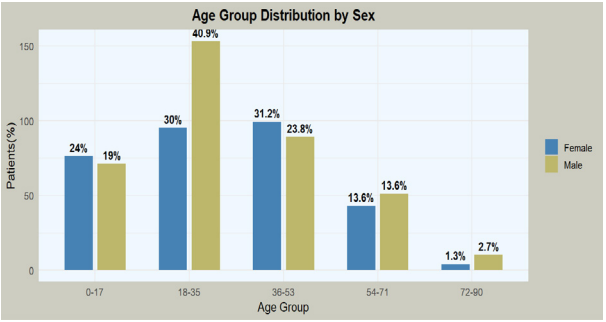

Figure 2 Enrolled patients by Age and sex, June 2025.

Table 1 Enrollment proportion of PEN-Plus conditions, June 2025

Row Labels	# of Patients by Diagnosis Type	(%)
Type 1 Diabetes	385	55.72
RHD	113	16.35
Type 2 Diabetes	92	13.31
HTN	26	3.76
Other Cardiac Conditions	25	3.62
Cardiomyopathy	20	2.89
CRD-Asthma	19	2.75
CHD	6	0.87
HF	5	0.72
Grand Total	691	100%

4.2 Patient Outcome status of Severe NCD cases

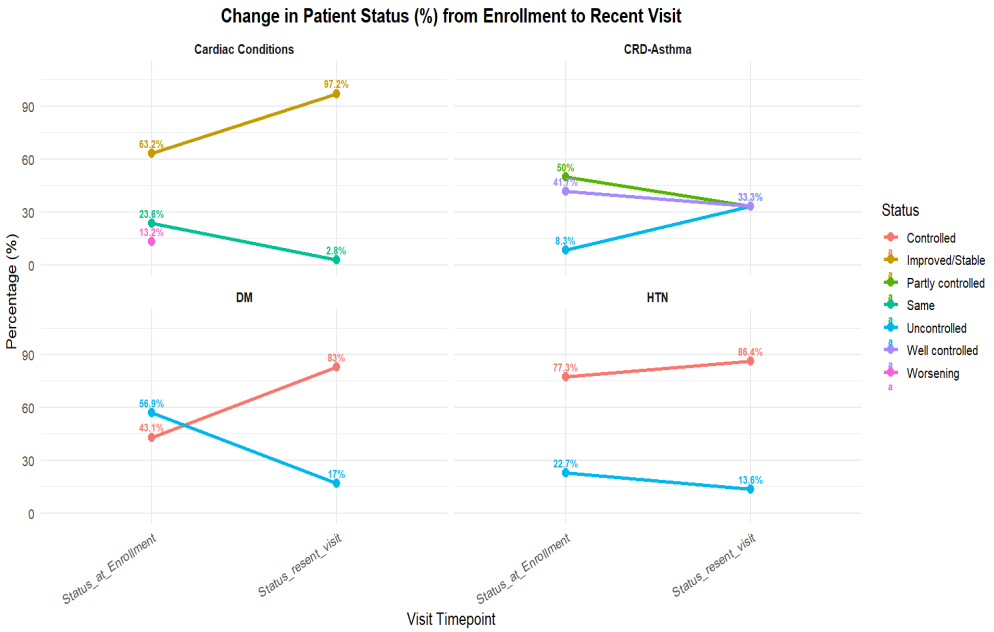

Figure 3 Patient Outcome change at initial to recent visit, June 2025

```
> bowker_test(tab)
For Cardiac Conditions
$ChiSq
[1] 36
$df
[1] 3
$p.value
[1] 7.488377e-08
> > mcnemar.test(tab)
For DM Conditions
data:  tab
McNemar's chi-squared = 102.78, df = 1, p-value < 2.2e-16
```

Both Bowker's test of symmetry (χ^2=36, df=3, p<0.001) and McNemar's test (χ^2=102.8, df=1, p<0.001) indicated significant changes in patient outcomes when compared to baseline, demonstrating a systematic shift in disease control status over the follow-up period.

Figure 4 Results from Bowker's test and McNemar's test showing significant changes in patient outcomes for both cardiac and DM (diabetes mellitus) conditions.

As shown in Figure 3 and Figure 4, there is a positive shift in patient outcome status from enrollment to the most recent visit across all major disease conditions. For Diabetes Mellitus (DM), the proportion of patients with *controlled* status increased significantly from 43% to 83%, while *uncontrolled* cases dropped from 56.9% to 17%. Similarly, in severe Hypertension (HTN), controlled cases improved from 77.3% to 86.4%, and uncontrolled cases declined. Cardiac conditions showed a notable increase in patients who were *improved* (from 61.3% to 82.4%). In CRD-Asthma, the percentage of *well-controlled* patients increased (from 8.3% to 33.3%), with a corresponding reduction in those with *same* or *worsening* status. Overall, these trends reflect substantial improvements in disease control and patient outcomes through the PEN-Plus implementation.

4.3 Patient Outcome status of Severe NCD cases

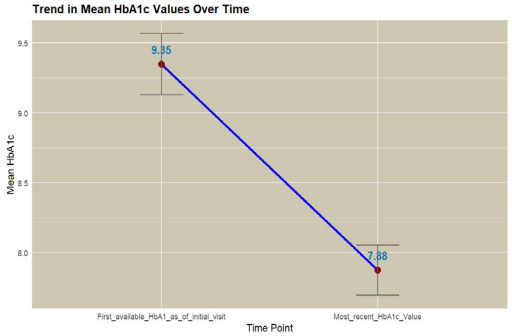

Figure 5 Mean HbA1c Values at Initial and Most Recent Visits, June 2025

In line with the control status of patients, over the period, a notable improvement in glycemic control over time is shown (figure 5). From the active 288 Type 1 Diabetes patients who received laboratory investigation of HbA1c at initial and recent visit, the mean HbA1c value decreased from 9.35 at baseline to 7.88 at the recent measurement, indicating an overall improvement in glycemic control over time. Initially, 84.4% patients had HbA1c levels above the recommended threshold of 7%, whereas this number declined to 63.9% patient at the most recent follow-up. The Shapiro–Wilk test showed that the distribution of HbA1c differences was not normal (W=0.972, p<0.001). Therefore, a Wilcoxon signed-rank test was used to assess the change between baseline and most recent HbA1c values. The results indicated a significant reduction in HbA1c over time (V=3311.5, p<0.001), with a median decrease of 1.2 percentage points, suggesting improved glycemic control among patients enrolled in PEN-PLUS care.

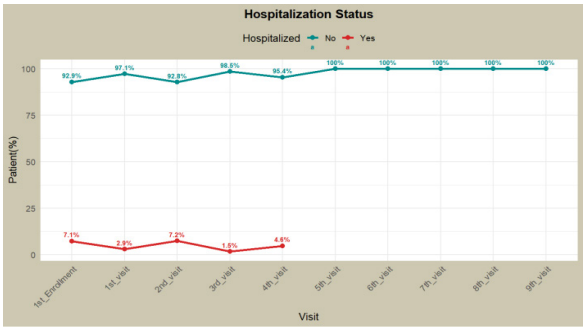

Figure 6 Patient Hospitalization at initial to recent visit, June 2025

For the analysis of the hospitalization (figure 5), those who have 9th follow up, the data shows that the introduction of the PEN-Plus service has reduced the hospitalization rate at post-enrolment to be less than one percent evidenced by a lower proportion of clients admitted at their fourth visit (4.6%) compared to the baseline (7.1%) regardless of their diagnosis.

4.4 Echocardiography test

The Mid-level providers were trained on POC Echocardiography with close mentorship from cardiologists and the portable Echo Machine

(kosmos) was procured for the PEN-Plus clinic to serve not only the patients of the clinic but the whole hospital when needed. Excluding the repeat/follow up tests for the cardiac patients where 21.6% of the diagnosis was changed to the correct one. The echocardiography tests performed were validated by a cardiologist, showing high accuracy (over 95%) and strong consistency between the findings of the mid-level provider and the cardiologist.

5. Lessons Learned

The PEN-Plus achieved significant successes by addressing critical gaps through comprehensive capacity building of mid-level providers with both practical and didactic training, (POC) echocardiography skills and supplemented by clinical mentorship. Programs promoted adherence and addressed socioeconomic barriers, including financial aid and support for school reintegration. The packages of social and psychological care is integrated into a PEN-Plus clinic to address the needs of the patients which brought a positive change to the outcome of patient status (>82% of the patients being in care).

Challenges included limited resource, interruption of supply for essential medicines and commodities.

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 and is planned for scale-up. It is a best practice due to its decentralized and integrated model with proven outcomes of severe chronic NCDs.

6. Recommendations

It is highly recommended to prioritize and build upon the already developed National Operational Plan to support the step-wise scale-up of the PEN-Plus strategy. Investing in mid-level provider capacity building, ensuring the availability of diagnostic tools and medicine and implement strong mentorship are the core areas for success often supplemented by community engagement, psychosocial support, and local partnerships which are critical for success and sustainability of the program. Social support schemes should consider a diverse array of support to meet the needs of patients and families, and it should be integrated into service packages to inform long-term policy planning, estimation of resources, and plan for program evaluation. A sustainability strategy needs to be in place to minimize dependence and increase productivity.

7. Reference

1. Burden of non-communicable diseases (NCD) in Ethiopia. National Data Management Center for health (NDMC) at the Ethiopian Public Health Institute (EPHI). 2023;1.
2. Tesfay FH, Zorbas C, Alston L, Backholer K, Bowe SJ, Bennett CM. Prevalence of chronic non-communicable diseases in Ethiopia: a systematic review and meta-analysis of evidence. Front Public Heal. 2022;10.
3. Girum T, Mesfin D, Bedewi J, Shewangizaw M. The Burden of Noncommunicable diseases in Ethiopia, 2000–2016: analysis of evidence from global burden of Disease Study 2016 and Global Health estimates 2016. Int J Chronic Dis. 2020;2020:1–10.
4. Tesfay FH, Backholer K, Zorbas C, Bowe SJ, Alston L, Bennett CM. The magnitude of NCD risk factors in Ethiopia: Meta-Analysis and systematic review of evidence. Int J Environ Res Public Health. 2022;19(9).
5. Tesfaye B, Alebel A, Gebrie A, Zegeye A, Tesema Leshargie C, Ferede A et al. Diabetes Mellitus and its Association with Hypertension in Ethiopia: a systematic review and Meta-analysis. Diabetes Res Clin Pract. 2019;156.
6. "Non-communicable diseases." World Health Organization ,https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases
7. Jeet, G., Mukherji, A., Thakur, J. S., & Prinja, S. (2023). Implementation of the WHO Package of Essential Non communicable (PEN) Disease Interventions in Low-Resource Settings: A Systematic Review. PLOS Global Public Health, 3(7).
8. Burden of non-communicable diseases in Ethiopia – National Data Management Center for Health." National Data Management Center for Health, 6 October 2020, https://ndmc.ephi.gov.et/burden-of-non-communicable-diseases-ncd-in-ethiopia/.

Integrating SNOMED CT with Local Drug Terminologies: A Best Practice from Medrafa's Digital Pharmacy Pilot in Ethiopia

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Introduction

Medication related harm remains a significant global health challenge, affecting approximately 5% of patients worldwide, with higher prevalence (about 7%) in low- and middle-income countries (LMICs) [1]. In Ethiopia, studies have reported medication error rates ranging from 28% to over 90% of prescriptions, with errors contributing to substantial morbidity, mortality, and healthcare costs [2,3]. These errors are often linked to illegible handwritten prescriptions, incomplete documentation, inconsistent drug naming, and lack of standardized prescribing practices [4,5].

The World Health Organization recommends implementing electronic prescribing (e-prescription) systems with standardized clinical terminologies to improve safety, efficiency, and interoperability [6]. SNOMED CT is the leading international standard for coding medical concepts, including medications, but its international core often omits Ethiopian-specific brand names and compounded formulations [7].

To address this gap, Medrafa Technologies developed and piloted RxHub, an e-prescription and pharmacy management platform built on the HL7 FHIR standard, integrating SNOMED CT with Ethiopia's local drug nomenclature. Through systematic terminology mapping, over 93% of Ethiopia's local medication codes were successfully matched to SNOMED CT concepts, enabling standardized, interoperable, and clear electronic prescriptions.

The pilot implementation in Addis Ababa involved over 30 pharmacies, processing more than 50,000 medications with 99.99998% system uptime and 88% user satisfaction. This initiative aligns with Ethiopia's Health Sector Transformation Plan II (HSTP-II) and Digital Health Blueprint, providing a scalable model for improving medication safety and interoperability in LMIC contexts [8,9].

Methods

The project began with a desk-based mapping of 1,183 Ethiopian drug codes from Medrafa's inventory and prescription systems against the September 2023 SNOMED CT International Edition [10]. Automated string-matching algorithms and synonym dictionaries generated candidate mappings, which were then validated manually by licensed Ethiopian pharmacists and clinical informatics specialists.

Mapped drug concepts were imported into a HAPI FHIR-based terminology server, with each medication encoded as a FHIR Medication resource using SNOMED CT identifiers. The RxHub RESTful API was developed to enable real-time, secure exchange of standardized prescriptions between prescribers and pharmacies [11].

Pharmacies participating in the pilot received training on digital prescription workflows, SNOMED CT coding, and inventory tracking. Security measures included OAuth2 authentication and end-to-end encryption to meet health data protection requirements [12].

Results

The mapping exercise achieved 93% coverage, with unmapped items primarily being local brands or compounded drugs absent in SNOMED CT. During the pilot, 98.9% of prescriptions were successfully processed end-to-end, with an average API response time of 220 milliseconds and 99.99998% system uptime.

Pharmacists reported reduced prescription ambiguity, faster dispensing times, and improved inventory reconciliation. Structured surveys indicated 88% overall satisfaction and an average usability rating of 4.2/5. The standardization of drug names also supported improved prescription completeness and reduced potential for dispensing errors, consistent with global findings on SNOMED-enabled e-prescribing [13].

Conclusion

This project demonstrates that integrating SNOMED CT with Ethiopia's local drug terminology is technically feasible, highly compatible, and beneficial for medication safety. Success factors included early involvement of pharmacists in terminology validation, use of open interoperability standards (FHIR), and continuous user support during rollout.

However, challenges remain:

- **Unmapped local medicines** require a national SNOMED CT extension.
- **Digital literacy gaps** among healthcare workers necessitate ongoing training.
- **Connectivity limitations** in rural areas may affect real-time prescription exchange.

Despite these challenges, the pilot significantly improved prescription accuracy, standardization, and interoperability, setting a precedent for broader adoption across Ethiopia and other LMICs.

Recommendations

- ✓ Develop a SNOMED CT national extension to include Ethiopian-specific brands and compounded medicines.
- ✓ Mandate standards-based prescribing in national eHealth policies and procurement guidelines.
- ✓ Expand RxHub integration to clinics, hospitals, insurers, and regulatory systems for full-cycle interoperability.
- ✓ Institutionalize capacity-building on SNOMED CT, FHIR, and e-prescribing for pharmacists, prescribers, and IT teams.
- ✓ Update the National Health Data Dictionary to incorporate standardized, mapped drug codes.
- ✓ Leverage this model for other LMICs aiming to improve prescription safety through global–local terminology integration.

References

1. World Health Organization. Medication safety in polypharmacy: Technical report. Geneva: WHO; 2019.
2. Mohammed T, Mahmud S, Gintamo B, Mekuria ZN, Gizaw Z. Medication administration errors and associated factors among nurses in Addis Ababa federal hospitals, Ethiopia. *BMJ Open*. 2022;12:e066531.
3. Endalamaw A, Tefera M, Eshetie S, et al. Medication prescribing errors and associated factors in Ethiopia: A systematic review and meta-analysis. *Drug Healthc Patient Saf*. 2020;12:205–216.
4. Abiye AA, Assefa A. Completeness and legibility of handwritten prescriptions at an Ethiopian general hospital. *Int J Curr Res Acad Rev*. 2019;7(8):8–15.
5. Angamo MT, Wabe NT, Raju NJ. Assessment of prescription completeness and drug use pattern in Southwest Ethiopia using WHO indicators. *J Appl Pharm Sci*. 2011;1(7):62–6.
6. World Health Organization. Technical specifications for ePrescribing: Standards and terminology guidance. Geneva: WHO; 2021.
7. SNOMED International. SNOMED CT: The global language of healthcare. London: SNOMED International; 2023.
8. Ministry of Health Ethiopia. Health Sector Transformation Plan II (2021–2025). Addis Ababa: MoH; 2021.
9. Ministry of Health Ethiopia. Digital Health Blueprint. Addis Ababa: MoH; 2021.
10. National Library of Medicine (US). SNOMED CT International Edition September 2023. Bethesda, MD: NLM; 2023.
11. HL7 International. FHIR R5 Specification. 2023.
12. El-Sappagh S, Ali F, Hendawi A, et al. Mobile health monitoring-and-treatment system based on integration of SSN ontology and HL7 FHIR. *BMC Med Inform Decis Mak*. 2019;19(1):66.
13. Chen C, Borycki E, Kushniruk A. The impact of electronic prescribing systems on prescription completeness. *BMC Med Inform Decis Mak*. 2022;22:90.

USAID Community HIV/AIDS Care and Treatment Activity

Project HOPE People-to-People Health Foundation Inc. Addis Ababa, Ethiopia

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Background

HIV remains a major global public health issue, having claimed almost 44.1 million lives so far. Ethiopia has made a significant effort in reducing HIV incidence, AIDS related mortality and overall epidemic control. However, there remains a gap in achieving the three-95 targets in HIV case finding, treatment and viral suppression. The USAID Community HIV Care and Treatment (CHCT) activity aims to accelerate and sustain HIV epidemic control in Ethiopia through delivery of high-impact and integrated community-based HIV services, improving the capacity of local community structures and strengthening data systems and data use. CHCT has been implemented across all PEPFAR-supported regions of the country including Addis Ababa, Amhara, Oromia, Tigray, Sidama, Southwest Ethiopia Peoples' Region (SWEPR), Soth Ethiopia, Central Ethiopia, and Gambella Regions. CHCT has so far engaged three international partner organizations, sixteen local implementing partners (LIPs) and eight regional PLHIV networks. CHCT is implemented in close collaboration with the Ministry of Health, Regional Health Bureaus (RHBs), ART health facilities (HFs), and PLHIV associations and their networks.

Project HOPE's role has evolved over the years from direct service delivery to provision of technical assistance (TA) to LIPs who have transitioned to receiving direct funding from USAID to implement Family focused HIV Prevention, Care and Treatment Activities. CHCT activity resumed direct service delivery activities in post-conflict Tigray Region with a yearlong halt that resumed in October 2023. Community HIV/AIDS prevention, treatment and care services are delivered in Mekelle, Adigrat, Shire, Adwa, Mehoni and Maichew towns through three sub-recipient LIPs -Mothers and Children Multisectoral Development Organization (MCMDO), Tigray Youth Association (TYA) and Tigray-Network of Ethiopian Positives (TNEP+).

Objective: Accelerate and sustain HIV epidemic control in Ethiopia through delivery of high-impact community-based HIV services.

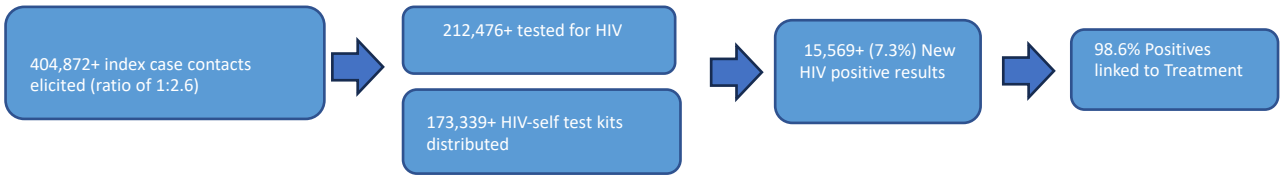
Intermediate Results/Outcomes

- Strengthened community health and support systems for service delivery
- Improved organizational and technical capacity of community structures
- Strengthened data collection and use for learning and program improvement

Approach: CHCT implements a package of standardized community-based services to reach target groups using a hub and spoke model with ART HFs serving as hubs and community service delivery points as spokes. Community service delivery points are staffed with health professionals who closely work and supervise PLHIV volunteers from the associations. For technical assistance scope, the model is stepwise, comprehensive, progressive and participatory to ensure they are tailored to the needs of the TA recipients.

Community-Based Index Case Contacts Testing (ICT)

CHCT delivers **community-based** *ICT* services to sexual contacts and family members of index cases, Orphans and Vulnerable Children (OVC) and their caregivers through HIV self-test kit distribution, conventional testing at home, community or HFs and linked them to HFs for care and treatment.

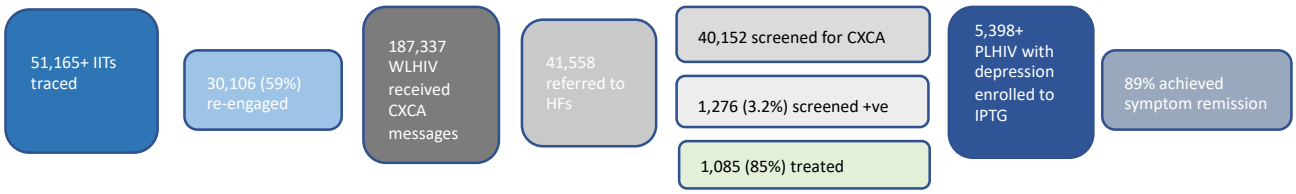


Community-Based Differentiated ART Service Delivery Models (C-DSDM)

Project HOPE supported the adoption, piloting, and scale up of various C-DSDM, namely the Health Extension Professional-managed Community ART Refill Group model (HEP_CAG) and the Peer-led Community-based ART Distribution model (PCAD). Recently, CHCT is piloting implementation of the Adolescent and Youth Community DSD model (AY-CDSDM) to improve treatment outcomes among adolescents and youth living with HIV (AYLHIV). There are 38,377+ PLHIVs ever enrolled to C-DSDM.

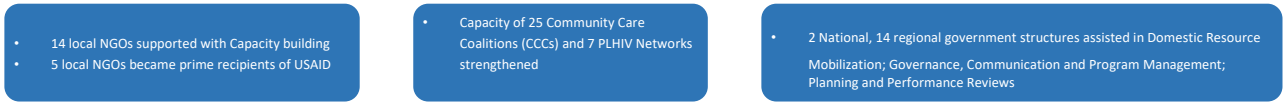
HIV case management

CHCT provides a standardized package of community-based case management services to PLHIVs including the tracing of interruption-in-treatment cases (IITs) and re-engage them to clinical care, and providing community based enhanced adherence counseling (cEAC) to those with unsuppressed viral load (VL). CHCT also introduced and scaled-up novel interventions that address evolving needs of PLHIV to its community-based package including integrated NCD services, demand creation and referral for Cervical Cancer Screening and treatment, first line support to survivors of sexual violence, and mental health and psychosocial support services (MHPSS) such as Group Inter-Personal Psychotherapy (IPT-G) services for depression. Moreover, based on the lessons learned during the pilot implementation, NCD-HIV integration has been scaled up to all community-based service delivery points (cSDPs) nationally by MOH, RHBs and LIPs.



Capacity Strengthening

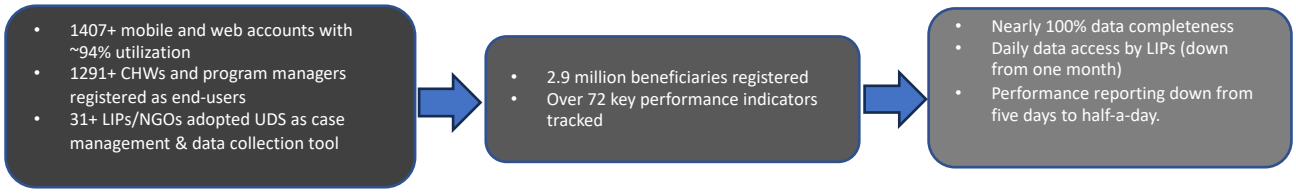
CHCT provides capacity building support to government structures, civil society organizations, PLHIV Associations and faith-based organizations (FBOs). This support focuses on three integrated and reinforcing components: individual/workforce, organizational, and systems, i.e. improving knowledge and practice of evidence-based core competencies and developing properly functioning systems for HIV/AIDS service delivery.



CHCT developed and utilized different tools including organizational and technical capacity assessment (OTCA), institutional and technical capacity assessment (ITCA), technical assistance and needs assessment (TANA) and technical assistance transition readiness assessment (TA-TRA).

Unified Data System (UDS): supporting the national electronic Community Health Information System (eCHIS)

Project HOPE developed a unified data system (UDS) - an innovative digital health solution aimed at standardizing HIV service delivery and real-time data collection, analysis, visualization, and reporting procedures across all PEPFAR-supported community HIV programs. Frontline community health workers (CHWs) utilize it for case management and client-level data gathering electronically. UDS dashboards are regularly used by partner organizations for planning, monitoring activities, reviewing performance, checking data quality, and making data-informed decisions. Project HOPE also developed and pilot-tested four HIV modules that are integrated into the national eCHIS.



Quality Assurance and Improvement

In CHCT, we apply a continuous quality improvement (CQI) method which follows scientific procedures to identify quality gaps, analyze root causes, implement change ideas, and measure performance to evaluate whether we meet or exceed quality standards. So far, 118+ Quality Improvement Teams (QITs) composed of PLHIVs, healthcare providers, and team leaders were established at sub national unit (SNU) level. Over 119+ QI projects were implemented, of which 90 (75.6%) showed an improvement in real-time data entry, HIV positive case identification, tracing and re-engagement of interruption-in-treatment cases to clinical care.

Lessons Learned

- Decentralized service delivery approaches helped to reach communities near to their home and created access to high impact and innovative services for high risk and under service communities.
- Community-based services make a significant contribution to accelerated progress towards the three 95 targets.
- A targeted and tailored technical assistance approach has progressively improved the capacity of community-based organizations and health system structures.

Recommendation

- Improved ownership of the community-based interventions by health system structures at the various levels is critical to sustain the gains.
- Strengthening the health extension program will ensure sustainability of many of the high impact community-based HIV services.
- Integrated monitoring practices should be strengthened to ensure the quality and continuity of community-based HIV services.

Enhancing TB Detection in Ethiopia: Results from the Oromia TB Catch-Up Campaign

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Background and challenges to implementation:

Tuberculosis (TB) remains a significant global health challenge, particularly in Ethiopia. The COVID-19 pandemic disrupted TB control efforts, likely contributing to increased undetected cases. To address this, a one-month intensive TB Catch-Up Campaign was implemented in Oromia, Ethiopia, utilizing multiple strategies to enhance case detection among high-risk and vulnerable populations.

Intervention or response:

The campaign covered 44 zones and 298 woredas in Oromia, targeting contacts of confirmed TB cases, diabetes (DM) patients, healthcare workers (HCWs), and Key Affected Populations (KAPs) such as prisoners, internally displaced persons (IDPs), and miners. The campaign ran from April 1 to April 30, 2024, and employed three tailored interventions:

Intervention 1: Retrospective Contact Tracing

Health Extension Workers (HEWs) conducted house-to-house visits to map contacts of confirmed TB, drug-resistant TB (DRTB), and leprosy cases. Health professionals then performed community-based screenings, collecting sputum samples for lab testing. TB preventive treatment (TPT) was also provided to eligible contacts.

Intervention 2: Screening of High-Risk Groups

DM patients and HCWs were screened at health facilities, with sputum samples collected and sent to laboratories for testing.

Intervention 3: Screening of Key Affected Populations (KAPs)

Individuals in congregate settings (prisoners, IDPs, miners) were screened at designated sites, with sputum samples transported to labs for diagnosis.

Results/Impact: 1

- 187,951 individuals screened
- 57,064 presumptive TB cases identified
- 38,181 tested via GeneXpert and 18,883 via AFB microscopy
- 5,907 TB cases and 13 rifampicin-resistant (RR) TB cases detected
- 377 leprosy cases identified
- 8,388 individuals received TB preventive treatment (TPT)

Conclusions:

The TB Catch-Up Campaign in Oromia, Ethiopia, demonstrated success in enhancing TB case detection through a multi-faceted approach, including contact tracing, high-risk group screening, and targeted interventions for vulnerable populations. The campaign not only identified thousands of TB and leprosy cases but also provided preventive treatment to at-risk individuals. These results highlight the importance of integrated, community-based screening strategies in high-burden settings

Summary:

The Oromia TB Catch-Up Campaign (April 2024) screened 1,187,951 individuals, identifying 57,064 presumptive TB cases. Testing (GeneXpert/AFB) confirmed 5,907 TB cases, 13 RR-TB cases, and 377 leprosy cases, while 8,388 received preventive treatment. Community-based and facility-led strategies proved effective in post-COVID TB case-finding, highlighting scalable approaches for high-burden settings

EPSS' Pioneering Digital Transformation: A Blueprint for Public Sector Logistics in Ethiopia

Ethiopian Pharmaceutical Supply Service (EPSS), Addis Ababa, Ethiopia

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Background: The Ethiopian Pharmaceutical Supply Service (EPSS) is a public health institution in Ethiopia. Its primary mission is to ensure that essential medicines and health supplies are delivered on time and fairly to over 22,000 public health facilities across the country, serving a population of 114 million people

EPSS managing total of over 3,114 employees, more than 400 vehicles, and 63+ warehouses. The organization oversaw a revolving drug fund and health programs that handled the procurement and distribution of pharmaceuticals valued at 44.91 billion and 42.95 billion, respectively (2014 EFY). To enhance its nationwide operations, EPSS introduced a comprehensive ERP system. Managing this large-scale initiative with 9.8 Million USD required the formation of two critical units: the ERP Project Office and a dedicated ERP Command Center. The Project Office was tasked with overseeing the system's implementation, ensuring seamless integration across procurement, inventory, and financial processes. Meanwhile, during the critical "Go-Live" phase, the Command Center was established under the Director-General's direct supervision to monitor supply chain operations in real time and provide daily updates to the central office and all 19 branches. This strategic initiative played a pivotal role in the system's successful nationwide rollout, significantly improving the efficiency of medicine and medical equipment procurement, storage, and distribution.

Before its digital transformation, EPSS faced immense operational challenges due to an outdated and fragmented technological landscape. The organization relied on more than 42 siloed legacy systems, resulting in a staggering lack of efficiency and data coherence. About 92% of supply chain processes and 90% of financial functions were managed manually. This fragmentation led to a lack of real-time visibility, delayed financial reporting, heightened donor compliance risks, and inefficient workflows with duplicated efforts and manual handoffs. A business process transformation study revealed that 42% of EPSS s 4,200 core business processes were non-value-adding.

To overcome these issues and align with international public health standards, EPSS embarked on an ambitious project to implement the first nationwide SAP S/4HANA ERP system in Ethiopia. The project's goal was to create a centralized, transparent, and auditable supply chain to enhance public health logistics. EPSS's successful implementation of the SAP S/4HANA ERP system is a best practice. This digital transformation addressed the fragmentation of over 42 legacy systems and automated 71% of core business processes, leading to significant financial gains and improved service delivery. The project's success is a model for public sector digital transformation in Africa.

Approach

The Ethiopian Pharmaceutical Supply Service (EPSS) successfully implemented the SAP S/4HANA ERP ((Enterprise Resource Planning)) system through a carefully structured and phased approach. Rather than treating it as a simple technology rollout, EPSS prioritized strong governance, strategic change management, and meticulous execution. This methodology not only ensured the project's success but also established a replicable model for digital transformation in the public sector.

A critical factor in the project's success was the establishment of a robust governance framework. EPSS formed two key units: the ERP Project Office, which equipped with 60 process champions, oversaw end-to-end implementation and business process integration, and the ERP Command Center, activated during the Go-Live phase under the leadership of Director General. The Command Center played a pivotal role by enabling real-time monitoring of supply chain operations and facilitating rapid issue resolution, ensuring a smooth nationwide rollout.

Before deploying the new system, EPSS recognized that technology alone would not address underlying inefficiencies. To lay a solid foundation, the organization conducted a comprehensive Business Process Transformation (BPT) study, which revealed that many existing processes were non-value-adding. EPSS then standardized optimized "To-Be" processes across all 19 sub-national hubs and the central hub, aligning them with global best practices. This step was crucial in transforming a previously fragmented and manual supply chain into an integrated and efficient system.

The implementation was guided by several key success factors. Strategic partnerships were essential, with funding provided by the Global Fund, the Ministry of Health, and EPSS's internal budget, while technical expertise came from Deloitte as the advisory partner and SEIDOR as the System Integrator. Change management was another critical pillar, with EPSS adopting the Prosci® methodology to drive user adoption and minimize resistance. Over 25 workshops were conducted, engaging more than 1,200 stakeholders from headquarters and regional offices to ensure the system met user needs and secured broad buy-in.

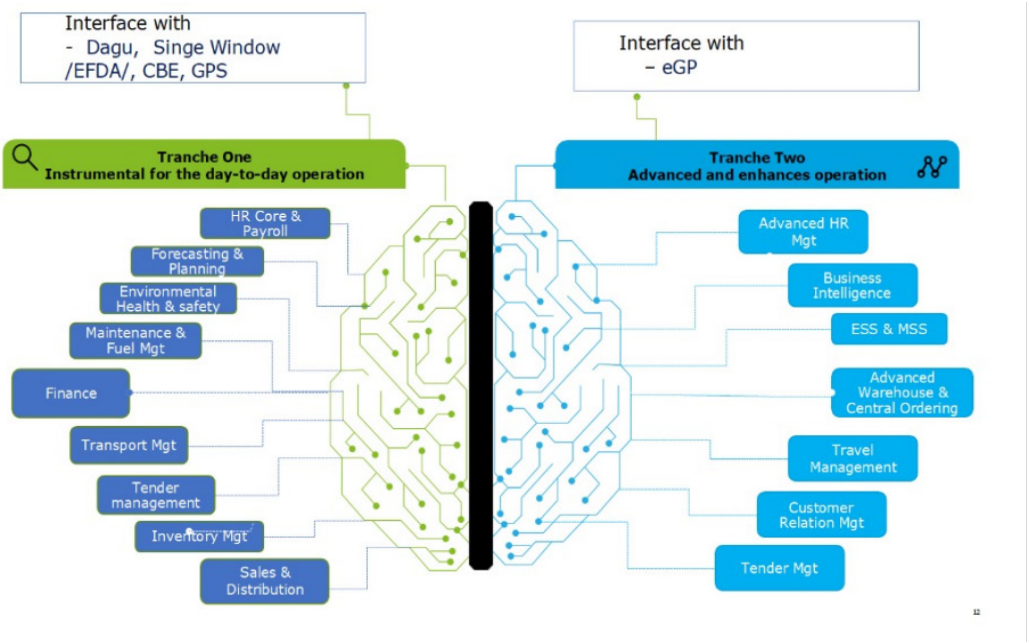

Figure-1: Overview of the 10 Basic and 10 Advanced Modules to be Implemented and Integrated with Internal and External Technology Solutions

To guarantee system reliability, EPSS adhered to rigorous testing protocols based on ISTQB standards, including risk-based, process-based, and user acceptance testing. This ensured seamless data migration from legacy systems and maintained data integrity. The SAP S/4HANA solution itself was tailored to EPSS's needs, incorporating modules for Finance, Funds Management, Materials Management, Warehouse Management, and Transportation Management. The implementation of a "Control Tower" model further enhanced real-time visibility and data-driven decision-making across the organization.

Result and the Impact

The implementation of the SAP S/4HANA ERP system at EPSS has led to a fundamental transformation of public health logistics in Ethiopia, producing profound and quantifiable improvements across all operational, financial, and service delivery metrics. This strategic change was necessitated by an outdated, manual, and fragmented technological landscape that included more than 42 siloed legacy systems. Prior to the implementation, a significant portion of core processes—92% of supply chain and 90% of financial functions—were managed manually. The most significant changes and their impacts are detailed below

The most significant changes and their impacts are detailed below:

- Operational Efficiencies: The ERP system has revolutionized business processes by automating 71% of all core functions. Manual reporting has been reduced by an astounding 80%, accelerating decision-making from weeks to hours. This includes the elimination of over 1,700 redundant operational steps.
- Financial Gains: The project has unlocked a significant $85 million in working capital, freeing up critical funds for reinvestment into public health initiatives. Furthermore, duplicate procurement has been reduced by 30%, leading to substantial savings and improved resource management.
- Enhanced Service Delivery and Measurable Impact: The new system's integrated process and data visibility have resulted in a direct and quantifiable improvement in key performance indicators (KPIs), as shown by the following before-and-after figures:
- Inventory Turnover: Improved from 1.4x to 2.2x per year.
- Stockout Rate: Reduced by 40% due to enhanced forecasting capabilities, ensuring more consistent availability of essential medicines.
- Forecasting Accuracy (RDF): Improved from 51% in 2022 to 60% in 2024.
- Pharmaceutical Wastage Rate: Decreased from 2.67% in 2022 to 0.72% in 2024.
- Procurement Lead Time: Decreased from 296.5 days in 2021 to 194 days in 2024.
- Customer Satisfaction: Increased from 67.8% in 2022 to 74% in 2024.
- Local Manufacturers' Percentage Share: Increased from 12.8% in 2021 to 42% in 2025.

The ERP system has enabled a "Control Tower" operational model that provides real-time visibility and enhanced data analytics. This has allowed for consolidated donor and public procurement reporting, significantly enhancing transparency and audit readiness. The transformation has turned the supply chain into a highly responsive, auditable, and transparent system for delivering critical health commodities.

Lessons Learned and Conclusion

The EPSS SAP S/4HANA implementation provides valuable lessons for public sector digital transformation. It demonstrated that a large-scale ERP project in a developing nation can be successful with strong leadership, strategic change management, and a robust governance framework. The project's success was not just a technological win but a testament to a comprehensive approach that addressed process, people, and policy aspects. The outcome has profoundly benefited the public health sector in Ethiopia by creating a highly responsive, efficient, and transparent supply chain. This initiative is considered a "Best Practice" because it is a proven, replicable model for other public institutions across Africa. A critical lesson learned from this experience is that the project's sustainability was directly tied to a forward-thinking design and a deep investment in people. The system was built with future scalability in mind, even exploring the potential for a National Center of Excellence in public ERP management. The most impact element was the focus on building human capacity. Over the project's three-year life, we trained and fully certified 60 process champions. Furthermore, we ensured successful adoption by training over 1,200 end-users. This investment in human capital is the strongest proof of the project's long-term viability, providing a solid foundation for future supply chain technology solutions. The support from the Ministry of Health and international partners like the Global Fund was critical to the project's success.

Recommendations

For other organizations intending to adopt this best practice, it is recommended to:

- Prioritize strong, visionary leadership and governance from the project's inception. the Director Genera; active involvement with his executive committee and management team was a key factor in the project's success.
- Invest in a comprehensive change management strategy and create a dedicated office and network of change agents to foster organizational buy-in.
- Conduct rigorous business process transformation studies to identify and eliminate non-value-adding activities before implementing new technology.
- Ensure extensive stakeholder engagement to align on processes and secure broad support.
- Adhere to stringent testing and quality assurance protocols to ensure the reliability and accuracy of the new system

From Gaps to Action: Strengthening Health Workforce Data Availability and Use Through National Health Workforce Accounts

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Background

Reliable health workforce (HWF) data is essential for effective health system planning and policy making. However, countries like Ethiopia have historically faced significant challenges due to weak, fragmented, and inconsistently collected data further compounded by weak information systems, limited technical capacity, and a lack of standardization. These issues have constrained the ability to effectively plan, allocate resources, and respond to critical workforce challenges such as shortages, maldistribution, and skill gaps. In response, World Health Organization (WHO) adopted resolution WHA69.19 in 2016, endorsing the National Health Workforce Accounts (NHWA) as a global tool to standardize HWF data collection, enhance interoperability, and monitor progress toward Universal Health Coverage (UHC) and the Sustainable Development Goals (SDGs). Anchored in the Global Strategy on Human Resources for Health: Workforce 2030, NHWA promotes integrated, evidence-based workforce planning and policy making. Ethiopia began implementing NHWA in 2018/19 with WHO support, taking key steps such as securing government buy-in, appointing a national focal point, adopting a multi-sectoral approach, and strengthening HWF data collection and analysis. Institutionalizing NHWA in Ethiopia has strengthened HWF data availability, quality, and use enhancing strategic planning and contributing to a more resilient health system aligned with UHC and SDG goals.

Objective

To strengthen Ethiopia's HWF information system by institutionalizing NHWA to improve the availability, quality, and use of data for evidence-based policy and planning.

Phased Approach to NHWA Implementation

Using the *NHWA Implementation Guide,* Ethiopia successfully followed the three key phases of NHWA implementation: Conceptualization, Operationalization, and Process Revision along with the eight recommended steps, resulting in a structured, effective, and sustainable system for HWF data management. The process began with securing governmental buy-in, which was critical to establishing the necessary processes and structures to enforce NHWA implementation. This was followed by the establishment of a multi-sectoral governing structure comprising key stakeholders including Ministry of Health, Ministry of Education, Ministry of Finance, Civil Service Commission, development partners responsible for data sharing, supervising and coordinating the implementation of NHWA processes. Stakeholder meetings were conducted primarily virtually, and when held in person, they were organized at minimal cost.

During the Conceptualization phase, conducted a thorough scoping of national resources and data requirements, assessing existing HWF information systems and identifying gaps. The Operationalization phase involved the effective compilation, analysis, validation, exchange, and dissemination of HWF data ensuring the data was reliable, timely, and actionable. Finally, the Process Revision and Sustainability phase included periodic reviews of each step to ensure the system remained efficient and effective. These reviews supported the continuous

Implementation of NHWA in Ethiopia has improved the availability, consistency and quality of HWF data overtime through regular reporting on four modules and 29 core indicators of NHWA Handbook. Since 2018/19, annual country profile reports have supported evidence-based planning and policy making in the HWF.

Relevant Changes

Leaving No Source Untouched: One of the most valuable lessons in NHWA implementation was the successful collection of comprehensive HWF data from diverse sources using a standardized tool. This ensured data consistency, accuracy, and completeness, addressing previous issues of fragmentation. Data was gathered from national and sub-national health authorities, educational institutions, the private sector, NGOs, and other sectors, and was categorized by gender, profession, geography, tier, and employment type—supporting better analysis, planning, and evidence-based decision-making.

Putting NHWA into Action: National Health Workforce Accounts (NHWA) is a system developed by WHO to support countries in collecting, analyzing, and using standardized health workforce data for evidence-based decision-making. Through NHWA handbook, NHWA Implementation Manual and global online platform, It provides a structured approach to monitoring health workforce availability, distribution, education, and regulation, enabling countries to strengthen health systems and advance toward Universal Health Coverage UHC and the SDGs.

NHWA implementation in Ethiopia followed three key phases including: conceptualization, operationalization, and sustainability, each carried out through specific steps including:

- Establishment and maintenance of National Multisectoral Technical working group which meets every quarter and members were represented from MOH, Ministry of Education, Ministry of Finance, Civil service Commissions, Private sector federation, partners and other stakeholders.
- Through high level discussion, secured government buy-in,
- Mapping available data sources,
- Addressing legal frameworks for data sharing among stakeholders, and
- Compiling, analyzing, validating, and disseminating data. The process in Ethiopia was led by a national focal point designated by the Ministry of Health.

Received Global Recognition: Ethiopia received international recognition for its progress in implementing the NHWA. According to the globally developed NHWA Summary Scorecard, Ethiopia achieved an impressive data availability score of 77%, significantly surpassing the global average of 45%. In addition to this performance milestone, Ethiopia was formally acknowledged and appreciated for its outstanding contribution and commitment to the implementation of NHWA.

Policy Development and Strategic Planning: NHWA data has been instrumental in supporting the development and monitoring of key national initiatives and informing evidence-based health workforce policies. It enabled to identify workforce gaps, supported planning for equitable distribution and prioritized training and recruitment efforts.

Evidence-based Health Workforce Policies and Strategies. These include the Health Sector Development and Investment Plan (HSDIP), Human Resources for Health Strategic Investment Plan (HRHSIP), Primary Health Care (PHC) Investment Plan, Nursing and Midwifery Roadmaps, the Investment Charter, and frameworks for motivation, incentives, and risk allowances.

Strengthened Governance, Data Systems, and Stakeholder Engagement: NHWA has enhanced governance mechanisms, integrated diverse data sources, and promoted a culture of data use serving as a key driver of evidence-based HWF development. It has also facilitated multi-sectoral dialogue and stakeholder engagement, including with the private sector, and supported advocacy for more equitable geographic distribution of the HWF.

Improved Data Collection, Analysis and Use

Health Workforce Stock: Available data triangulated from different sources show that Ethiopia had about 492,181 HWF of which 325,226 (66.1%) are health professionals of various occupational groups and 166,955 (33.9%) are admin and support staff as of 2025. Of the total health professionals, about 73,136 are practicing in the private, Non-Governmental Organizations and other sectors. However, the overall contribution of the private sector to HWF employment is about 22.5%.

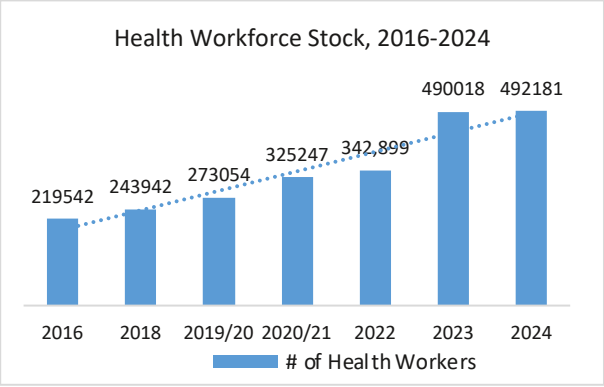

Figure 1 Trends of Health Workforce

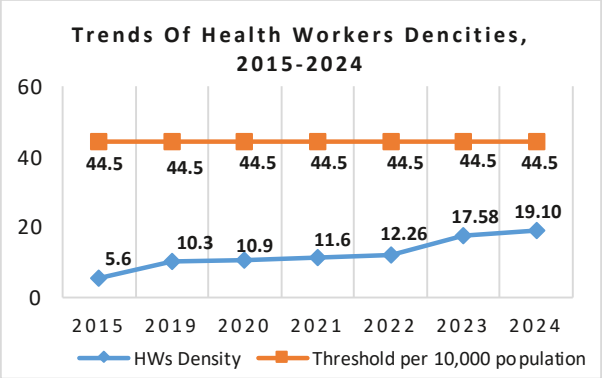

Figure 2 Trends of Densities of Health Workers

Health Workforce Density and Composition: Amongst the total health professionals, 33.0% were nurses, 14.6% health extension workers, 4.0% general practitioners, 6.9% health officers and 2.6% medical specialist among others. The current stock translates into HWF density (doctors, nurses, midwives, health officers, dentists and pharmacists) of 19.1 per 10,000 population - about 42.40% of the threshold of 45 per 10,000 population which is deemed necessary for progressive realization of UHC and the SDGs. It is also threefold increase over the 2015 density of 5.6 per 10,000.

Health Workforce Distribution by Gender: As of 2024, 54.6% of the health sector workforce are women and 45.4% are men, representing a 23.6 percentage point increase in female representation since 2009, when women accounted for only 31%. The vast majority of health extension workers (94.9%) are females. Thus, health extension workers are the leading occupational group with the highest proportion of females, followed by midwives with 64.6%. All other health occupational groups are dominated by males.

Proportion of Health Professionals

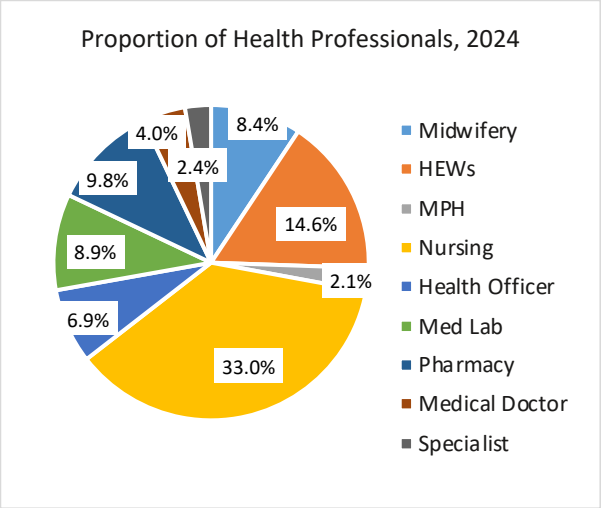

Figure 3 Proportion of Health Professions, 2024

More data are now available, including regional distribution patterns, distribution by tier system, and information on other sectors including pre-service education.

Lesson Learnt

- Successful NHWA implementation in Ethiopia has shown that strong government commitment and political will are essential for institutionalization and sustainability.
- Effective governance, multi-sectoral coordination, and stakeholder engagement ensure ownership and broad support.
- Partnership and collaboration played a critical role in the successful implementation of NHWA, fostering shared ownership, resource sharing, and coordinated action across sectors.
- Capacity building at all levels, along with standardization and integration of data systems, improves data quality and efficiency.
- When consistently used, NHWA data informs impactful policies and investment decisions.
- Regular reporting promotes accountability and alignment with national and global goals.
- Sustainable resource mobilization remains a key challenge for long-term stakeholder engagement.
- Limited engagement from development partners affects broader support and collaboration.
- Some data gaps persist, including distribution by age group, vacancy rates and application-to-training capacity.

Expanding CEmONC access through Clinical Midwife Specialists in rural Ethiopia: Best practices and key lessons

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Introduction

The maternal mortality ratio in Ethiopia has declined from 871 per 100,000 live births in 2000 to 412 per 100,000 live births in 2016 (EDHS, 2016). The UN Interagency Maternal Mortality Ratio estimate for 2020 puts the maternal mortality ratio of Ethiopia at 267/100,000 live births (UN IGME, 2020), showing good progress in the reduction of maternal mortality, though this is still far from the SDG target of 70. Contributing factors include geographic barriers, a shortage of skilled healthcare providers, and low rates of facility-based deliveries (EDHS, 2019; WHO, 2023).

To address this, the Ethiopian Midwives Association (EMwA), in collaboration with UNFPA and the Federal Ministry of Health, launched a targeted intervention to strengthen the capacity of Clinical Midwife Specialists (CMS). Clinical Midwifery Specialists (CMSs) are highly experienced midwives who have received advanced education and training to provide CEmONC services. However, due to management-related challenges, many did not get the opportunity to practice the full scope of their training. They are often selected for their ability to deliver expert care in complex or high-risk maternity cases and for their commitment to evidence-based maternal and newborn health practices. The training aims to refresh and strengthen their advanced clinical competencies, ensuring they remain well-prepared to deliver high-quality maternal, newborn, and child health services. Through refresher training in advanced surgical skills, CMS are now better equipped to deliver Comprehensive Emergency Obstetric and Neonatal Care (CEmONC) in hard-to-reach areas (UNFPA Ethiopia, 2023; EMwA, 2024). This initiative aims to:

- Increase access to life-saving CEmONC services (e.g., cesarean sections, hemorrhage management).
- Reduce maternal and neonatal mortality in underserved regions.
- Document scalable strategies for national replication.

Implementation

1. Provision of Refresher Training on advanced surgical skills

The MSc Clinical Midwifery Specialist program is offered in more than seven higher education institutions across Ethiopia. However, many graduates have not been able to practice in clinical settings due to the absence of formal job grading, evaluation frameworks, and professional licensing. Following the development of job grading and evaluation and allowing professional licensing, the Ethiopian Midwives Association (EMwA), in collaboration the Ministry of Health (MoH), and regional health bureaus and with financial support of UNFPA implemented a structured one-month refresher training program for Clinical Midwife Specialists, designed to strengthen their capacity to provide Comprehensive Emergency Obstetric and Neonatal Care (CEmONC) in underserved areas.

The training curriculum was developed collaboratively by the MoH, selected universities, and professional associations, ensuring alignment with national clinical guidelines and international best practices. The program adopted different Teaching/learning methods Interactive lecture, Group discussion and exercise, Video shows, Case studies, simulation-based learning, hands-on supervised clinical practice.

Each participant received training and mentorship from experienced Obstetrician and gynecologist and Senior practicing MSc Clinical Midwife/Integrated Emergency surgical officer to ensure competency acquisition and confidence in performing high-risk procedures. Core competencies included performing emergency cesarean sections and peripartum hysterectomies, managing intraoperative complications and injuries, conducting operative vaginal deliveries, performing Obstetric Ultrasound and interpreting sonographic images, and managing conditions such as ectopic pregnancies, tubo-ovarian torsion and abscesses, and gestational trophoblastic disease.

Training sessions were conducted at strategically selected hospitals with high patient caseloads and prior experience in clinical training, including Debre Markos and Debre Tabor Comprehensive Specialized Hospitals in Amhara, Axum St. Mary Hospital and Suhul Referral Hospital in Tigray, Adama Hospital Medical College in Oromia, and Arba Minch General Hospital in Southern Ethiopia. Implementation required substantial resource allocation, including surgical equipment, simulation models, sonography machines, standardized checklists, and dedicated clinical mentors, as well as coordination across regional health bureaus for trainee deployment and follow-up.

To date, over 80 Clinical Midwife Specialists from Amhara, Tigray, Benishangul Gumuz, Southern Ethiopia, South West Ethiopia, Harari, Sidama, and Central Ethiopia have completed the program. By combining structured competency-based training with hands-on mentorship, this initiative demonstrates a scalable and replicable model for strengthening CEmONC services in Ethiopia.

Deployment and Service Delivery:

Following the refresher CEmONC training and licensure, Regional Health Bureaus deployed Clinical Midwife Specialists (CMS) to Comprehensive Emergency Obstetric and Neonatal Care (CEmONC) facilities at the Primary Health Care Unit (PHCU) level to strengthen service delivery in underserved areas.

Key outcomes

Out of 5,176 total cesarean sections (CS) done in eight facilities, 1,967 (38%) of them were performed by Clinical Midwife Specialists. The decision-to-incision time ranged from 15 to 30 minutes in most facilities, reflecting variability in emergency response efficiency. Post-operative hospital stays averaged 2–3 days. Out of 1,967 cesarean sections performed by Clinical Midwife Specialists, no maternal deaths were recorded. In addition, the Clinical Midwife Specialists successfully managed 1,023 maternal complications and 269 neonatal complications.

The findings underscored that Clinical Midwife Specialists significantly strengthened emergency cesarean sections coverage by independently performing cesarean sections and managing acute complications, such as hemorrhage and eclampsia. Their patient-centered care, characterized by empathy, reassurance, and psychological support, promoted higher facility-based delivery rates and garnered heightened trust from the community.

Indicators	Responses								Total
	Gewade HC	Chencha Hospital	Bambasi HC	Debre Markos Hospital	Debre Tabor Hospital	Dr. Tsegaye Hospital	Abi adi Hospital	Adigrat Hospital	
Number of cesarean sections performed in the health facility in 2025	50	210	99	2221	1458	50	361	727	5176
Total number of cesarean sections performed by Clinical midwife specialists	50	127	62	790	297	30	240	371	1967
Average time (in minutes) from decision to perform cesarean section to actual delivery	30	23	30	15	30	30	30	30	218
Average length of stay post-cesarean section in days	3	3	3	2	3	2	3	2	21
Number of maternal complications managed by Clinical midwife specialists	77	60	26	42	70	15	51	682	1023
Number of neonatal complications managed by Clinical midwife specialists	13	12	22	19	40	8	63	92	269
Total maternal deaths occurring during or after cesarean sections performed by Clinical Midwife Specialists between 2022 and 2024	0	0	0	0	0	0	0	0	0

Outcomes:

Proficiency in Critical Interventions and Professional Maturity

Clinical Midwife Specialists (CMS) play a crucial role in enhancing maternal and neonatal outcomes, especially in areas with limited resources. Their advanced skills in managing critical interventions such as cesarean sections, postpartum hemorrhage, eclampsia, and high-risk pregnancies have proven to be lifesaving. Through quick decision-making and teamwork, they provide timely and effective care, earning the trust of patients and colleagues alike.

Compassion and continuum of care

Clinical Midwife Specialists are also known for their compassionate, patient-centered approach, offering emotional support and clear communication during high-stress situations. Their empathetic care builds trust and reduces patient anxiety, particularly during emergency procedures like cesarean sections.

"He showed me the ultrasound and tried to keep me stress-free… I can't describe how peaceful he made me feel", emphasizing how empathy alleviated anxiety during a high-stakes decision for a cesarean section. (A 31-year-old, Para three women, Chencha Primary Hospital, South Ethiopia Region)

Contribution to Reduced Mortality and Increased Service Utilization

Clinical midwife specialists (CMS) have profoundly transformed maternal and neonatal healthcare by bridging critical gaps in resource-limited settings. Their contributions have led to reduced maternal and neonatal mortality and increased use of facility-based services. In many areas, they perform 80–90% of cesarean deliveries, fill gaps left by physician shortages, and serve as trusted healthcare providers.

"Clinical midwife specialists have made significant contributions to improving the delivery of CEmONC services… enabling timely interventions in life-threatening cases" (P21). *(A 28-year-old Male,* Obstetrician and gynecologist*,* Abiy Addi General Hospital*)*

Strengthened Multidisciplinary Coordination

In addition to clinical care, CMS strengthens health systems through mentorship, leadership, and community engagement. They collaborate with multidisciplinary teams to enhance efficiency in emergency response and reduce referral delays. Their efforts extend beyond hospitals organizing labor wards, mentoring junior staff, and educating communities.

*"My leadership also goes beyond this hospital. I provided mentorship services to nearby health centers… to decrease unnecessary referrals***"** (A 30 years old Male, Clinical midwife Specialist, Debre Tabor Compressive Specialize Hospital, Amhara Region)

Investing in clinical midwifery is recognized as a sustainable strategy for expanding access, ensuring equity, and achieving national and global maternal health goals.

"Investing in clinical midwifery training is a sustainable strategy for improving maternal and child health outcomes in underserved regions." (A 40-year-old Male, Maternal and child health case team leader, Benishangul Gumuz*).*

What Works Well

Deployment: More clinical midwife specialists were trained and strategically assigned to health facilities lacking obstetricians, ensuring critical maternal and newborn care services reached the underserved communities.

Life-saving skills: Clinical Midwife Specialists (CMS) demonstrate competencies to perform cesarean sections, manage eclampsia, postpartum hemorrhage, and neonatal asphyxia, often working in areas without obstetricians.

Improve Quality of Care: Clinical Midwife Specialists delivered compassionate, client-centered care that built community confidence, empowering more women to choose safe, facility-based deliveries and improving maternal and newborn outcomes.

Improved outcomes: Clinical Midwife Specialists performed cesarean sections with no maternal deaths recorded, significantly contributing to reductions in maternal and newborn mortality

Bridging gaps: They ensure 24/7 access to emergency obstetric care in underserved areas

Lessons Learned

Clinical midwifery specialists have gained vital experience in collaboration, confidence, and preparedness within CEmONC settings. Advanced training empowers them to manage emergencies and perform cesarean sections in underserved areas where obstetricians are limited. One specialist shared,

"I no longer fear complications… I can manage any emergencies and even perform a cesarean section" (Male, 33, Bambasi Health Center).

Their ability to provide critical care in rural facilities shows how their presence can reduce maternal and neonatal deaths. Another midwife added,

"Serving in rural areas isn't just a professional duty; it's a meaningful way to address healthcare gaps" (Male, 33, Gewada HC).

Challenges of Implementation

Clinical Midwife Specialists face unclear job roles and limited formal recognition, weak integration into national health policies, and a lack of benefit packages, including unpaid overtime and risk allowances, and poor infrastructure hinders their full potential. These factors drive many highly trained specialists to leave for better-paying positions, threatening the sustainability of critical maternal and newborn care services and wasting significant investment in their training.

Conclusion and Recommendations

Conclusion: Clinical Midwife Specialists have proven indispensable in reducing maternal and neonatal mortality in rural Ethiopia by performing cesarean sections and managing emergencies independently. Their compassionate, skilled care has increased facility-based deliveries and community trust.

Recommendations: Formalizing Clinical Midwife Specialists' roles and scope of practice, establishing structured deployment and career pathways, providing consistent incentives and resources, and integrating midwife-led CEmONC into national health policies are vital to sustaining these skilled professionals and delivering lifesaving maternal care to Ethiopia's most remote and underserved communities.

References

1. Central Statistical Agency (CSA) [Ethiopia] and ICF. 2017. 2016 Ethiopia Demographic and Health Survey Key Findings. Addis Ababa, Ethiopia, and Rockville, Maryland, USA. CSA and ICF.
2. World Health Organization. Trends in maternal mortality 2000 to 2020: estimates by WHO, UNICEF, UNFPA, World Bank Group and UNDESA/population division [Internet]. Geneva: World Health Organization; 2023
3. UNFPA Ethiopia. (2023). UNFPA and EMwA Empower Clinical Midwives in Emergency Obstetric Care.
4. UNFPA, Pathways to Equality: Saving Lives and Advancing Rights for all in Ethiopia Annual Report, 2023
5. Ethiopian Midwives Association (EMwA). (2024). Annual Report: Strengthening Midwifery Capacity in Humanitarian and Rural Settings. Addis Ababa: EMwA.

Evolution of Ethiopia's National Health Policy: An evidence-based, context-driven, participatory approach to policy change

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Introduction

Ethiopia's 1993 National Health Policy established a primary health care (PHC)-oriented system that expanded service coverage and improved outcomes—life expectancy rose from 49 years in 1995 to around 67 years by 2023[1]. Rapid population growth, a rising burden of non-communicable diseases (NCDs) and injuries, emerging health threats, and persistent gaps in service quality and financing exposed limitations in the 1993 policy. A comprehensive revision was needed to respond to contemporary challenges, uphold the constitutional right to health and align with global health-related Sustainable Development Goals and universal health coverage (UHC) targets (2). After an extensive review process, Ethiopia's Council of Ministers approved a revised national health policy in April 2024. This article summarizes how the policy was developed, the key shifts in its content, outputs of the review process and lessons for policy makers.

Methods

A retrospective policy analysis was undertaken using official documents: the 1993 and 2024 national health policies, the Ministry of Health (MoH) report on the policy development process, and a comparative analysis by Feyissa *et al.* 2025 [2]. These documents were reviewed against established frameworks for health policy analysis. We applied Walt and Gilson's model, which examines policy context, actors, process and content [3]; this framework is widely used in health policy analysis [4]. We also drew on methodological guidance from Walt *et al.* (2008) on conducting health policy analysis in dynamic settings [5]. The Health Policy Analysis Reader (Gilson *et al.*, 2018) informed our understanding of politics and power in policy change [6]. Data on the development process, differences between policies, outputs and lessons were synthesized narratively.

Results

Policy development process. The policy revision began in 2015 (Tahsas 2007 E.C.) Senior experts drafted a framework and first draft in an initial seminar, and a follow-up workshop produced the first English draft. The initial seminar involved eighteen senior experts drawn from the Ministry of Health, universities and partner institutions, and a second workshop with over seventy professionals from multiple sectors drafted the policy using government guidance and lessons from the health extension program [7,8] and WHO frameworks [8]. This draft was translated into Amharic, refined by a technical committee and reviewed by senior leadership, with crosschecks against the then ongoing five-year health sector plan, Health Sector Transformation Plan (HSTP I, 2015/16–2019/20) (9). Inputs from professional associations, universities, the private sector, non-governmental

organizations, civil society and community forums were compiled and reviewed. The joint steering and management committees refined successive drafts. Additional forums solicited input from professional associations, university representatives, private sector stakeholders, non-governmental organizations and community groups, generating detailed recommendations that were compiled for further revision. Leadership changes and the COVID-19 pandemic interrupted progress, but a reconstituted technical committee resumed work in 2019 and completed broad stakeholder consultations and legal review. Technical support from the World Health Organization assisted with evidence appraisal and translation. The Council of Ministers endorsed the policy in April 2024.

Key shifts in the 2024 policy. The 2024 policy marks a decisive shift toward rights-based, inclusive and resilient health systems [2]. It affirms health as a constitutional right and adopts the principle of "no one left behind". Priorities expand beyond communicable diseases and maternal and child health to include NCDs, mental health, disability, injuries, climate resilience, emergencies and One Health approaches. Service delivery moves from basic PHC to an integrated, peoplecentered model that embeds quality and safety systems, expands tertiary care, recognizes traditional medicine and promotes digital health, including telemedicine. Financing reforms introduce community-based and social health insurance, pooled funds and private sector engagement to reduce dependence on donors and out-of-pocket payments. Governance is reinforced through clearer roles for federal, regional and local authorities, results-based management, stronger regulation and the creation of a National Health Advisory Council. Research and innovation are institutionalized through health policy and systems research, national research agendas and support for telemedicine, artificial intelligence and e-health. Cross-government platforms and Health formalize multisectoral action in All Policies mechanisms that involve civil society and the private sector. Together, these changes align Ethiopia's health system with UHC and Sustainable Development Goal commitments.

Outputs of the review process. The main output is the revised National Health Policy, which incorporates the shifts described above and includes implementation arrangements and monitoring and evaluation frameworks that define roles, indicators, reporting schedules, and priority programs. Strengthened institutional capacity for evidence use and learning systems is a second output: the Ministry's Policy, Strategy and Research Lead Executive Office has been enhanced to coordinate evidence-based policy, and a National Health Policy Advisory Council has been established to provide multisectoral advice and accountability. The policy introduces a national health research priority-setting process, creates an integrated repository for researchers and institutions, and embeds evidence generation and use into policy and practice. Programmatic directions include expanding NCD prevention, integrating mental health into PHC, strengthening emergency preparedness and One Health surveillance. It is expected that the revised policy will enhance the operational capacity of the health sector and strengthen legal frameworks to implement social health insurance and digital health initiatives; long-term outcomes include improved governance through institutionalized multi-sectoral platforms, enhanced evidence-based decision-making, and more resilient health systems.

Discussion and lessons learned

Ethiopia's experience underscores that inclusive participation, rigorous evidence appraisal and adaptive leadership can drive policy transformation in alow-income context. Broad engagement across government, professional associations, civil society, private sector and communities build legitimacy and relevance. WHO's technical support through its country office and regional networks strengthened

national capacity for evidence appraisal and helped synthesize global and local evidence. Nevertheless, the process faced challenges, including limited internet access that excluded some participants, leadership transitions, and the COVID-19 pandemic, all of which delayed progress. Innovative approaches were required to bridge the digital divide and maintain momentum despite leadership changes.

Systematic review of data, alignment with UHC, One Health principles and lessons from other countries guided design. Applying explicit policy analysis frameworks kept attention on context, actors, process and content [3,5], which helped ensure a comprehensive analysis. However, we acknowledge that such frameworks simplify complex realities, a limitation we considered in interpreting results. Regular reviews by MoH executives and the joint steering committee refined drafts; adaptive management enabled work to resume after interruptions. The 2024 policy blends continuity with innovation by sustaining PHC and equity principles while introducing rights-based framing, digital health, research and innovation, and formal multi-sectoral governance. By defining clear roles, indicators and research mandates, and by institutionalizing structures for evidence-informed decision-making and national knowledge management, the policy embeds accountability and fosters a culture of learning. Its success will depend on sustained leadership, coordination and investment.

Conclusion and recommendations

Ethiopia's revision of its national health policy demonstrates that a participatory, evidence-based, context-driven process can yield a forward-looking agenda for health system transformation. The 2024 policy steers the country toward a rights-based, peoplecentered, resilient system aligned with UHC and Sustainable Development Goals. Other low- and middle-income countries seeking similar reforms can draw lessons from Ethiopia's experience: Key recommendations include:

- Institutionalize structured policy review manuals. Adopt clear guides reflecting all stages of the policy cycle to ensure timely and systematic reviews.
- Invest in robust situational analyses and inclusive stakeholder mapping. Comprehensive situation analyses and stakeholder mapping are essential for accurate agenda setting and for ensuring that marginalized voices inform the process.
- Apply comprehensive analytical frameworks and rigorous evidence appraisal. Use the policy analysis triangle, stakeholder analysis and multiple-streams models, and undertake option appraisal—including cost-effectiveness modelling—to develop evidence-informed policy alternatives.
- Develop clear implementation and financing plans. Pair policy design with detailed plans that address legal frameworks, financing (e.g., community and social health insurance, and innovative taxes), accountability, and contingency provisions.
- Embed monitoring, evaluation and research governance. Establish national health research priority-setting, evidence networks and digital repositories; embed monitoring and evaluation frameworks to enable continuous learning and adaptation.

Secure high-level political commitment and inclusive engagement. Maintain political support through leadership changes, align reforms with constitutional rights and national strategies, and engage stakeholders at all levels, especially marginalized groups.

Following these steps and maintaining partnerships with institutions such as the WHO to strengthen capacity for evidence appraisal can help countries replicate Ethiopia's achievements and ensure that health policies remain living documents responsive to changing contexts.

References

1. Federal Ministry of Health (Ethiopia). National Health Policy of Ethiopia. Addis Ababa; 2024. (English translation of revised health policy).
2. Feyissa YM, Ketema KG, Nambiar B, Gemta EA, Ali M, Tsegaye A. From equity to rightsbased health systems: Ethiopia's policy shift toward UHC and resilience – a comparative analysis of the 1993 and 2024 national health policies. Bulletin World Health Organ. 2025 (forthcoming).
3. Walt G, Gilson L. Reforming the health sector in developing countries: the central role of policy analysis. Health Policy Plan. 1994;9(4):353–370.
4. Zahidie A, Iqbal M, Asif S. Building on the Health Policy Analysis Triangle: Elucidation of the Elements. Pak J Med Sci. 2023;39(6). doi:10.12669/pjms.39.6.7056
5. Walt G, Shiffman J, Schneider H, Murray SF, Brugha R, Gilson L. "Doing" health policy analysis: methodological and conceptual reflections and challenges. Health Policy Plan. 2008;23(5):308–317.
6. Gilson L, Orgill M, Shroff ZC (eds). A Health Policy Analysis Reader: The Politics of Policy Change in Low and MiddleIncome Countries. Geneva: World Health Organization (Alliance for Health Policy and Systems Research); 2018.
7. Ministry of Health (Ethiopia). Realizing Universal Health Coverage through Primary Health Care: A Roadmap for Optimizing the Ethiopian Health Extension Program, 2020–2035. Addis Ababa: MoH; 2020
8. Federal Ministry of Health (Ethiopia). Report on the Development of Ethiopia's Revised National Health Policy. Addis Ababa; 2023. (Translation of policy development process document).
9. Federal Ministry of Health [Ethiopia]. Health Sector Transformation Plan (HSTP) 2015/16–2019/20 (2008–2012 EFY). Addis Ababa: FMoH; 2015.

Breaking Barriers: Integrating Family Planning, Immunization, and Nutrition Services into Rural Ethiopia's MCH Systems

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Abstract

Background: Ethiopia has prioritized integrating reproductive, maternal, newborn, child, and adolescent health and nutrition (RMNCAH-N) services with family planning, immunization, and nutrition to improve health outcomes and achieve universal health coverage. While integration promises efficiency and improved service quality, it faces challenges such as fragmented health systems, sociocultural barriers, and inadequate infrastructure.

Method: This qualitative case study explored barriers and enablers of service integration in agrarian and pastoralist regions of Ethiopia. Data were collected between December 2024 and January 2025 from ten primary healthcare units in Kedida, Lume, and Amibara districts through 7 focus group discussions, 18 in-depth interviews, and 10 key informant interviews with 91 participants. Guided by the Consolidated Framework for Implementation Research (CFIR), data were thematically analyzed.

Result: Findings revealed both opportunities and constraints. Enablers included time savings, reduced facility visits, community demand, and the involvement of local leaders. However, barriers spanned across domains: heavy provider workloads, inadequate infrastructure, staff shortages, cultural and religious norms restricting women's decision-making, lack of youth-friendly services, and limited collaboration among providers. Additional challenges included language barriers, poor supportive supervision, and insufficient training and resources. Despite these obstacles, the study highlighted the importance of community engagement, male involvement, leadership commitment, and provider motivation in sustaining integration.

Conclusion and recommendations: The study concludes that addressing infrastructural gaps, expanding youth-friendly and culturally sensitive services, strengthening supervision, and ensuring adequate staffing with performance incentives are essential for improving integrated service delivery. Community awareness campaigns and digital monitoring tools are also critical for enhancing sustainability. These strategies can strengthen health system responsiveness, particularly for vulnerable populations in rural and pastoralist regions, thereby advancing equitable access to high-quality RMNCAH-N services.

I. Introduction

Ethiopia prioritizes integrating reproductive, maternal, newborn, child, and adolescent health and nutrition (RMNCAH-N) with family planning (FP), immunization, and nutrition to improve health outcomes and advance universal health coverage (1,2). Integrated care enhances efficiency and service quality but faces barriers like fragmented health systems, inadequate training, and sociocultural factors (1,2). Success depends on community engagement, government commitment, and models like Ethiopia's Health Extension Program (4).

Despite progress, maternal mortality persists (5). Studies show FP integration with immunization and nutrition boosts contraceptive use (6,9), yet gaps remain—contraceptives are often unavailable in immunization units (7,9). Ethiopia's 2021 guidelines promote integration across HIV, maternity, and abortion care (8). This study examines barriers and enablers in agrarian and pastoral regions to strengthen service delivery for vulnerable populations.

II. Objective

To explore the barriers and enablers to integrating FP, immunization, and nutrition services with RMNCAH-N services in pastoralist and agrarian regions of Ethiopia, and describe how these factors inform implementation strategies for improved service delivery

III. Methods

This qualitative case study was conducted in ten primary healthcare units (PHCUs) across three regions: Kedida (Central Ethiopia), Lume (Oromia), and Amibara (Afar). Data collection took place between December 2024 and January 2025. The study employed a purposive sampling strategy to select 32 officials, 10 health workers, and 49 clients, ensuring diverse perspectives on service integration. Data were collected through 7 focus group discussions (FGDs), 18 in-depth interviews (IDIs), and 10 key informant interviews (KIIs). The Consolidated Framework for Implementation Research (CFIR) guided the study design, data collection, and analysis. Data were transcribed verbatim, coded using OpenCode software, and analyzed thematically to identify barriers and enablers across CFIR's five domains: innovation, outer setting, inner setting, individuals, and process.

IV. Results and discussion

The study identified barriers and enablers across five domains of the Consolidated Framework for Implementation Research (CFIR).

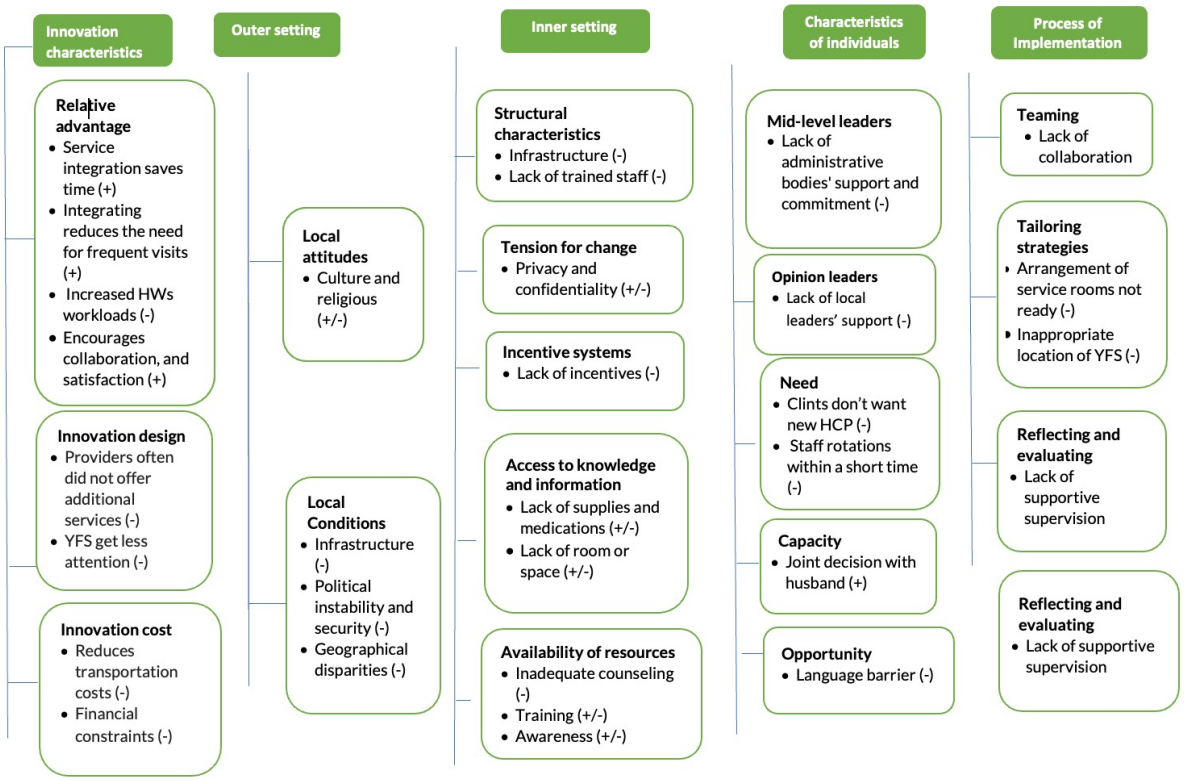
Innovation Domain: Clients valued the time savings and reduced transportation costs from integrated services, but women struggled to balance healthcare visits with household duties. Providers reported increased workloads and compromised service quality. Youth-friendly services were underprioritized, and clients faced barriers when seeking services like FP at immunization units.

Outer Setting Domain: Cultural and religious norms, particularly male dominance in decision-making, hindered family planning service utilization. In Afar, men often controlled decisions about FP and maternal health. Poor infrastructure, long distances, and political instability further limited access, especially in rural and pastoralist areas. Some clients preferred female providers due to cultural or religious reasons.

Inner Setting Domain: Inadequate infrastructure, such as lack of rooms, electricity, and water, hindered integration. Staff shortages and high turnover rates worsened the challenges. The lack of performance-based payments and inadequate salaries demotivated healthcare workers, while insufficient training and lack of SBCC materials limited effective service delivery.

Individuals Domain: Administrative support and community leaders, such as kebele administrators, were crucial for successful integration. Joint decision-making between husbands and wives, especially for FP, was essential. Language barriers also affected accessibility, with clients emphasizing the need for providers fluent in local languages.

Process Domain: Lack of collaboration among providers, such as midwives and nurses, hindered integration. Youth-friendly services were often located in areas that compromised privacy, discouraging young people from seeking care. The absence of regular supportive supervision and feedback mechanisms limited sustainability, highlighting the need for continuous monitoring and evaluation.



V. Conclusion and Recommendations

The study identified key enablers and barriers to integrating family planning, immunization, and nutrition services with RMNCH-N services across pastoralist and agrarian settings in Ethiopia. Enablers included time savings, reduced facility visits, and community demand, while barriers such as sociocultural norms, inadequate infrastructure, and provider workload hindered integration. Effective coordination, leadership engagement, and provider motivation were critical facilitators, but challenges like supply chain limitations and insufficient training impacted service quality.

To address these gaps, it is recommended to strengthen facility infrastructure, expand youth-friendly services, and ensure adequate staffing and performance-based incentives for healthcare workers. Additionally, community-based awareness campaigns, male involvement in decision-making, and the use of digital tools for monitoring and evaluation should be prioritized. These strategies will enhance service integration, improve access in rural and pastoralist areas, and ensure sustainable, high-quality RMNCH-N service delivery.

References

1. World Health Organization (WHO). (2020). Integrated health services: What and why? Geneva: WHO.

2. Federal Ministry of Health (FMOH). (2016). Health Sector Transformation Plan (HSTP). Addis Ababa: FMOH.

3. World Health Organization (WHO). (2022). Integrating health services: A practical guide. Geneva: WHO.

4. Assefa, Y., Gelaw, Y. A., Hill, P. S., Taye, B. W., & Van Damme, W. (2019). Community health extension program of Ethiopia, 2003–2018: Successes and challenges toward universal coverage for primary healthcare services. Globalization and Health, 15(1), 1-11.

5. WHO. (2023). Trends in maternal mortality 2000 to 2020: Estimates by WHO, UNICEF, UNFPA, World Bank Group, and UNDESA/Population Division.

6. Brhane, K., et al. (2022). The role of family planning counseling during maternal and child health services in postpartum modern contraceptive uptake in Ethiopia. PLOS Global Public Health.

7. Mickler, A. K., et al. (2021). Individual and facility-level factors associated with women's receipt of immediate postpartum family planning counseling in Ethiopia. BMC Pregnancy and Childbirth, 21(1).

8. Federal Ministry of Health (FMOH). (2021). Family Planning Service Integration National Implementation Guideline. Addis Ababa: FMOH.

9. Roro, M. A., et al. (2024). Integration of family planning into primary health care in Ethiopia: Results from national assessment. Reproductive Health, 21(1), 174.

10. Tadesse, A. W., et al. (2021). Analyzing efforts to synergize the global health agenda of universal health coverage, health security, and health promotion: A case-study from Ethiopia. Global Health, 17(1), 53.

Operative Delivery Task Shifting: Current Experience in Ethiopia

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Background

Task-shifting in healthcare, especially in surgical procedures like cesarean deliveries, has become an innovative strategy to address the critical shortage of surgical providers in Ethiopia. Training midlevel healthcare professionals to perform these procedures has greatly increased access to life-saving services for mothers and newborns, particularly in remote and underserved areas. A trend study summarizing DHS data up to 2019 shows the overall national rate rising to about 6% by 2019, with urban areas at 16% and rural regions at only 3%.

Objective:

This study assessed the outcomes of a structured, scope-based training program—Operative Delivery Skills and Surgical System Management (OSSYM)—designed to equip general practitioners with the essential skills to deliver the highest standard of care for mothers and neonates.

Methods or Approach:

A four-month structured training program, preceded by a two-week bridging course, was designed to strengthen operative delivery skills while emphasizing patient safety, teamwork, communication, and leadership. The initial bridging course covered basic surgical skills, maternal and neonatal resuscitation, and obstetric ultrasound. This was followed by a four-month onsite clinical training in teaching hospitals under the mentorship of obstetricians and gynecologists.

During the first four weeks, trainees mainly observed and assisted with cesarean sections. After this period, they were expected to independently perform at least 40 cesarean deliveries under three levels of supervision: direct, indirect, and distant. Progress was carefully tracked through weekly logbooks, monthly Objective Structured Assessment of Technical Skills (OSAT) evaluations, and records of independent cesarean sections, which together made up 80% of the total assessment. The remaining 20% was based on written exams, OSCEs, and practical performance tests. Besides surgical skill training, the program included monthly virtual (Zoom-based) sessions focused on patient safety, teamwork, communication, and leadership. These sessions aimed to build non-technical skills critical for safe surgical practice and effective team-based care. Overall, 70 general practitioners from 10 regions were trained across 26 general hospitals.

Ethical Considerations

The training program was implemented with strict adherence to ethical standards in medical education and clinical practice. All procedures were conducted in accredited teaching hospitals, with oversight by licensed obstetricians and gynecologists to ensure that patient care was not compromised

Results or Relevant Change:

Of the 70 trainees, 95.7% reached Level 3 competency, demonstrating successful completion of the program. Additionally, 96% of trainees met the expected number of independently performed cesarean deliveries. All those who reached the milestone also demonstrated competency in ultrasound skills, highlighting the integrated impact of the training approach.

Lessons Learned or Conclusion:

The OSSYM initiative has proven to be an effective model for task-shifting in operative delivery services in Ethiopia. Key success factors included a competency-based curriculum, robust supervision, and integration of leadership and communication skills. Challenges included variations in site-level mentorship quality and occasional shortages of case volumes for some trainees.

This experience reinforces the potential of structured task-shifting programs to address human resource shortages in maternal health care. It offers a scalable, evidence-informed model that can be adapted in similar low-resource contexts.

Recommendations:

- Scale up OSSYM to other underserved regions
- Standardize supervision protocols and site readiness assessments.
- Incorporate continuous mentorship and post-training follow-up.
- Expand the model to include other critical surgical procedures.
- Strengthen data systems for competency tracking and patient outcomes.

Celebrating Sustained Immunization Coverage Improvements in Ethiopia

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Introduction

Vaccines are among the most powerful and cost-effective public health tools, saving over 154 million lives globally in the past 50 years and delivering an estimated $54 in economic benefits for every dollar invested in childhood immunization. Ethiopia's experience reflects this global success, with the country steadily strengthening its immunization and disease surveillance systems despite significant natural and human-made challenges.

The 2024 WHO/UNICEF Estimates of National Immunization Coverage (WUENIC), released on July 15, 2025, show marked improvements across all antigens, underscoring both systemic progress and the collective efforts of health workers, partners, donors, and the Ministry of Health's leadership. While these achievements are cause for celebration, the data also highlight the need to sustain momentum and close remaining gaps to ensure every child in Ethiopia receives full vaccine protection.

Objective

The objective of this article is to narrate and celebrate the recent gains in immunization coverage in Ethiopia. We aim to analyze the WUENIC data to understand the extent of the progress and share these narrative details with readers of this article. Ultimately, this piece serves as a tribute to the dedicated individuals and organizations who made these results possible, while also serving as a call to action to continue the journey towards achieving national and global immunization targets.

Method or Scope of the Estimate

The data presented here are from the 2024 WHO/UNICEF Estimates of National Immunization Coverage (WUENIC), which provides the most comprehensive and up-to-date information on global immunization coverage. WUENIC data are generated through a collaborative process involving WHO and UNICEF immunization experts. They analyze country-specific data, including administrative reports and household surveys, and apply a standardized methodology to produce annual estimates. The scope of the estimate covers various antigens, with a particular focus on Penta1 and Penta3 coverage, the number of zero-dose children, and other key indicators like MCV1, MCV2, PCV3, and HPV. The indicators provide a consistent and comparable way to track immunization progress, identify missed communities, and monitor global targets, including those under the Immunization Agenda 2030 (IA2030) and the Sustainable Development Goals (SDGs).

Results: Coverage Levels and Gains

The WUENIC data for Ethiopia reveals remarkable progress. Penta1 coverage, a marker of access to routine immunization services, increased from 77% in 2023 to 81% in 2024. This is 8 percentage points higher than in 2019 (73%). The number of zero-dose children decreased significantly from 917,000 to 768,000, leaving 150,000 fewer zero-dose children in 2024. This moved Ethiopia from the 3rd to the 5th position globally in terms of zero-dose burden. Despite this improvement, Ethiopia accounted for 27.1% of zero-dose children in Eastern and Southern Africa (ESAR) and 5.4% globally.

Penta3 coverage, a key indicator of program performance, increased by 3 percentage points from 70% in 2023 to 73% in 2024, leaving 1.1 million children with incomplete protection. This coverage is 12 percentage points higher than in 2019 (61%). Ethiopia ranked number 5 out of 21 countries in ESAR for lowest Penta3 coverage and number 1 for the most un- and under-vaccinated children. This highlights that a large birth cohort can lead to a high number of unvaccinated children even with improving coverage rates.

Vaccine coverage, Ethiopia, 2000-2024

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
BCG	57	58	60	61	63	65	66	68	69*	71	72	74	70*	68	69*	70	72	73	71	69*	70*	73	73	79*	84*
DTP1	47	50	52	55	58	61	64	67	71	74	77	80	74	67	73	74	75	76	75	73	71	75	75	77*	81
DTP3	30	32	35	37	39	43	46	50	54	58	61	65	61	59	61	62	64	65	62	61	62	63	63	70*	73
Hib3								47	52	56	61	65	62	59	61	62	64	65	62	61	62	63	63	70*	73
HepB3								47	52	56	61	65	62	59	61	62	64	65	62	61	62	63	63	70*	73
PCV3												12	30	48	55	58	61	64	62	63	65	63	63	70*	73*
RotaC															57	60	64	67	63	63	62	63	63	68*	73*
POL3	48	51	53	56	58	61	61	63	65	67	68	70	69	68	68	75	67	67	65	64	64	63*	59	69*	73*
IPV1																		48	48	62	62	62	63	70*	73*
IPV2																									33*
MCV1	28	29	32	33	35	40	44	49	54	59	64	68*	62	55	54	56	57	59	54	56	57	60	62	68*	72*
MCV2																				35	41	41	52	53*	59*
HPVc																					24	22	25	29	58

Vaccine coverage (%)

0 60 70 80 90 100

Source: WHO/UNICEF Estimates of National Immunization Coverage, 2024 revision.
Note: Stock information available from 2003.
An asterisk (*) indicates where there was a vaccine stockout at the national or subnational level.

Improvements were also observed across other antigens:

- MCV1 coverage increased from 68% to 72%, though 1.1 million children still missed their first measles dose. This is a 16-percentage point increase from 2019 (56%).
- MCV2 coverage increased from 53% to 59%.
- Last dose coverage of HPV vaccination (HPVc) among girls impressively increased from 29% to 58%, due to improved program performance.
- In 2024, coverage of 9 vaccines increased compared to 2023 (BCG, Penta1, Penta3, IPV1, MCV1, MCV2, PCV3, POL3, and ROTAC).

Despite these gains, it's important to note that no single vaccine in the schedule achieved the 90% coverage target in 2024. Vaccine coverage ranged from 33% to 84%.

What Worked Well: Coverage and Strengths

As highlighted in the Catch-up and Big Catch-up Vaccination Intra-Action Review (IAR) Report–Ethiopia, as well as in the National Immunization Program Review reports and the Situational Analysis section of the ongoing work on the National Immunization Strategy 2026–2030, several factors have contributed to the success of immunization over time, witnessed by a record achievement of the first-dose Pentavalent coverage according to WUENIC which is highest record in its own trend observation. In addition, expert perspectives and experiences have been incorporated to better explain the gains reflected in WUENIC.

The unwavering commitment of frontline health workers was a key strength. Their dedication, often under difficult circumstances, was crucial in reaching remote and underserved populations. Strong support from implementing partners and donors provided essential resources, technical expertise, and logistical assistance. The visionary leadership of the Ministry of Health was instrumental in shaping immunization policies and coordinating efforts. This included the development of catch-up policies and guidelines, strengthening mobile and outreach services, and enhancing community engagement through standalone and integrated approaches to improve coverage and equity.

The integrated approach of incorporating immunization services into other primary healthcare initiatives also played a vital role. The increase in the number of children vaccinated with Penta1, Penta3, and MCV1 at a faster rate than the increase in the surviving infant population further highlights the effectiveness of these efforts. For example, in 2024, 500,000 more children were vaccinated with Penta1 and 700,000 more with Penta3 compared to 2019, while the surviving infant population increased by 300,000. For vaccine coverage to increase, the number of children vaccinated must grow at a faster rate than the population itself.

What Did Not Work Well: Challenges

Despite the progress, significant challenges remain. Data quality continues to be a key concern in monitoring the immunization program, while natural and man-made factors—further hinder access to vaccination. The high Penta-MCV drop-out rates imply poor retention and ability to provide a full course of vaccines. Reaching the remaining zero-dose children in certain communities is also persistent challenges. For instance, in 2024, Ethiopia ranked first in the ESAR region for the number of zero-dose and unvaccinated children, despite its improved coverage. This demonstrates that while percentage coverage has improved, the absolute number of children needing vaccination remains a significant concern, partly due to a large and growing birth cohort. Ethiopia's Penta1 and Penta3 coverage rates in 2024 (81% and 73% respectively) were also lower than the global and ESAR averages. The

logistical complexities of maintaining the cold chain and ensuring a steady vaccine supply pose ongoing difficulties. This highlights the need to further strengthen the immunization system and the need for greater resilience.

What Has Been Learned in the Process

The journey provided valuable lessons. The resilience and adaptability of the health system in the face of crises have also proven to be a critical asset. These lessons will be vital as we continue to refine our strategies and push towards universal immunization coverage. The challenge of a growing population means that simply maintaining current coverage is not enough; to achieve targets like the IA2030 goal of reducing zero-dose children by half, more children must be vaccinated each year. The IA2030 goal requires Ethiopia to vaccinate approximately 2.15% more children with Penta1 each year to reach the target. This will require substantial increases in immunization program and health system capacity.

Conclusion

The remarkable improvements in Ethiopia's immunization coverage, as highlighted by the 2024 WUENIC data, are a source of great pride and a clear indicator of a strengthened health system. While we celebrate the decrease in the number of zero-dose children and the increase in Penta1 and Penta3 coverage, we must also be realistic about the work ahead. We have learned a lot, but the journey to reach national and global immunization targets is far from over. Let this moment of celebration be a reaffirmation of our commitment. With continued dedication, collaboration, and visionary leadership, we can ensure that every child in Ethiopia can be vaccinated and lead a healthy life. The Immunization Agenda 2030 aims to leave no one behind, and Ethiopia has made a commendable step in that direction, though much work remains to be done.

Gender-based violence service provision in the primary health care system in Ethiopia

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Background

In the current climate of multiple concurrent crises, national health systems are struggling to cope with cuts in funding, increasingly privatized healthcare and widening health inequities. In this regard, governments play an important role as critical actors in the provision of scaled and sustained health programs. One important approach to strengthening health systems is through addressing gender inequalities within health programs and policies. Gender integration involves identifying and addressing gender inequalities across the whole process of strategic planning, project design, implementation, and monitoring and evaluation. However, despite global commitments to gender integration [1,2], a substantial gap remains between intention and implementation. Current practices that seek to integrate gender largely focus on the technical aspects of "what to do" but lack practical insights on "how to do it" – particularly drawing from existing experiential evidence on promising approaches that have been scaled and sustained in diverse contexts and across different levels of the health system.

Fifty-one potential case studies were submitted to Regional Promising Practices (RPP) Consortium or sourced from the desk review in 2024, with 18 from Africa, 19 from Southeast Asia and 14 from South Asia. Seven programs were selected across the three regions, for in-depth data collection based on regional representation, program diversity, levels of gender integration and government involvement, and long-term sustainability. Programs were located in the Philippines, Timor Leste, India, Nepal**,** Ethiopia and Niger.

Ethiopia, despite economic growth, women and girls continue to face significant socioeconomic challenges linked to harmful gender norms, roles and stereotypes that extend beyond socioeconomic and political arenas, severely impacting the health of women and girls [3]. Gender based violence (GBV) may take many different forms, including threats of violence, sexual assault and harmful traditional practices. Yet only 23 per cent of women aged 15-49 years who had ever experienced physical or sexual violence have sought support 10 per cent have faced sexual violence in their lifetime, and 7 per cent reported experiencing sexual violence in the previous 12 months. [4]. The prevalence of female genital mutilation (FGM) among girls aged 0–14 years was estimated at 16 per cent [4]. Further, the prevalence of GBV often increases during public emergencies, including armed conflict, climate disasters, financial crises and disease outbreaks.

Over 1,300 incidents of rape have been reported and an estimated 40–50 per cent of women and girls in the Tigray, Amhara, Afar and Oromia regions of Ethiopia have been subjected to GBV since the start of the 2020 conflict. The looting and destruction of health facilities in the regions has impeded access to care for GBV survivors [5].

In Ethiopia, the impact of GBV on women and girls contributes to higher healthcare costs while reducing productivity and income. Further, persistent GBV may perpetuate intergenerational violence, which can hinder efforts to reduce poverty and improve healthcare access and gender equality [3, 6].

To tackle institutionalized gender inequalities, including GBV, gender mainstreaming has been recognized as a major global strategy for the promotion of gender equality [7]. In Ethiopia, the Ministry of Health (MoH) has mainstreamed gender at various programmatic and institutional levels and has a dedicated structure for gender mainstreaming. The 2013 National Gender Mainstreaming Manual for Health revised in 2021 was a breakthrough to strengthen the GBV service in primary health care (PHC). Since 2017, MoH has actively worked with development partners to address gaps and improve GBV services in PHC through the provision of comprehensive clinical services, training of health workers and establishing a referral system to connect survivors with additional support services, such as legal and psychosocial services [8].

Objective/aim: The study set out to analyze and document the policy relevant factors that led to improvements in gender equality in Primary Health Care (PHC), particularly the gender mainstreaming manual and GBV service provision.

Methodology/Approach

Desk review: gathered information to map the gender mainstreaming practices and initiatives undertaken by the Ethiopian MOH, particularly focusing on the primary health care system. Forty-five documents were reviewed, including empirical studies, project reports, policy papers, strategy documents, and regulations. *policy dialogue:* a policy dialogue was held with stakeholders from MoH and its agencies, and other key stakeholders including UN agencies, NGOs, health professionals' associations.

In-depth, semi-structured interviews: A total of 19 interview were undertaken (directors and experts from MoH, hospitals, UN agencies, NGOs and health professional association)

Data Analysis: All transcripts analyzed line-by-line by coding themes according to the framework of contextual factors, catalysts, mechanisms that sustained change, and achievements. Key actors involved in driving and sustaining change were especially noted.

Validation of the study findings: A validation workshop with respondents and key stakeholders was organized October. 20, 2023 after which the analysis was further refined based on inputs.

Ethical Clearance: Ethical approval was sought from the Institutional Review Board of the Ethiopian Public Health Institute (EPHI-IRB), which was granted in Protocol No. EPHI-IRB-503-2023.

Result/ Lessons on the politics of change

- **Policy reforms:** MoH banned the medicalization of FGM in all public and private medical facilities in the country. MoH issued circular exempting fees for GBV services to all regions. However, while this has been implemented at one-stop centers, application at the PHC level is less consistent. In 2024, advocacy was carried out in two regions with higher magnitude of FGM (Somali and Afar) resulted in declaration for banning severe form of FGM.
- **Health service Delivery Improvement:** Out of 3,826 PHC facilities, 819 health centers provide multidisciplinary health response service to GBV survivors in 2022. The national coverage for facility readiness for health response to GBV survivors showed an increasing trend from 3.5 per cent in 2020 to 21.0 percent in 2022 and 37 percent in 2025 for primary healthcare, and from 7.5 percent in 2020

to 23.0 percent in 2022 and to 25 percent in 2025 for One Stop Center (OSC) at hospital level. In 2022 OSC provided care to 5,337 female and 147 male survivors of GBV. Recent data for the period of 2024/25 (EFY 2017) showed 49,119 GBV survivors (Male: 36,783, Female: 12,336) received health care for all type of GBV (physical, sexual and emotional) at PHC and OSCs among whom 30,194 survivors (22,771 female and 7,423 male) received health care for mixed physical and sexual violence. Compared to previous years, GBV data collection is increasingly reportable.

- **Healthcare Providers Capacity Development**: MoH has rolled out training and awareness raising for healthcare workers, and managers on gender mainstreaming and GBV, helping to raise the capacity of health workers in terms of their ability to respond to GBV.
- **Data and Reporting system development for GBV**: Confidential registries developed and operational at all one-stop centers and PHC facilities that provide GBV services. Sex-disaggregation was formally introduced into the national health management information system in April 2021, and routine data collected through three indicators:
    - Number of health facilities ready to provide comprehensive health response to GBV (administrative report)
    - Number of GBV survivors who received healthcare services (disaggregated by age, sex and disability) (DHIS2 report)
    - Number of leadership positions held by women at health facility level (DHIS2 report)
- **Multisectoral collaboration**: Multisectoral responses are coordinated through the National Coordination Body on Violence Against Women and Girls, co-convened by Ministry of Justice and Ministry of Women and Social Affairs (MoWSA), and include counselling and psychological support, legal aid, police, shelter, medical and rehabilitation services.
- **Advocacy and community awareness**: Public messaging has been directed through social and mass media, while community mobilization activities have been conducted by HEWs to address prevailing negative attitudes, beliefs and biases towards GBV survivors.

What contextual factors facilitated the integration of GBV services in PHC?

International and regional conventions and declaration that Ethiopia ratified and endorsed; National policies and legislations; Institutional structures and champions: The MoWSA, The Women and Social Affairs Inclusive Implementation Executive Office (WSAI-EO); Civil society engagement, and Women's political representation.

What catalyzed GBV service provision in PHC?

The multidisciplinary approach to GBV in PHC gained attention in 2017, drawing on prior work on violence against children, particularly in tertiary care. Leveraging work addressing violence against children. Experience-sharing programs on GBV in other countries; establishment of a multisectoral coordinating body, and key evidence on GBV services in PHC.

What mechanisms allowed changes to be sustained over time?

Institutionalization and governance structures through the Gender mainstreaming and women's empowerment technical working group; the Women and Social Affairs Structures Forum; the biannual Gender in Health Forum and the Women's Forum.

Furthermore, leadership and support, technical and financial support from development

partners, information-sharing mechanisms and accountability, and accessibility of PHC services for GBV survivors

What were the missed opportunities and challenges?

- Need to expand service to include other forms of gendered violence
- Inadequate funding
- Limited accountability mechanisms
- Deep-rooted harmful sociocultural norms
- Effects of conflict on service expansion

Conclusion

The gender mainstreaming manual was a pioneering effort, which has led to numerous reforms in the Ethiopian health system, including the integration of GBV into PHC. A favorable policy context, strong leadership and partnerships with development partners have allowed MoH, along with WSAI-EO, to gradually improve the services offered. MoH is committed to maintaining the momentum that has been generated to expand access to GBV services.

Important gains have been realized in terms of making PHC services more responsive to women's specific needs, based on a foundation of institutionalizing gender mainstreaming across the health sector that rests on a strong architecture of legal obligations, organizational structures and reporting and budgeting processes, as well as the individual actions of a number of champions working within the system. It is important to keep the dynamics of this initiative to further sustain the integration of gender as cross-cutting dimension.

References

Full case report is published and can be accessed https://www.genderhealthhub.org/wp-content/uploads/2023/12/Ethiopia_GBV-PHC_Final-Case-Study-Summary.pdf

[1] Resolution 6/30, Integrating the human rights of women throughout the United Nations system, Human Rights Council. Dec. 2007.

[2] Beijing Declaration, United Nations resolution approved in 1995 on gender equality and women's rights

[3] Beyene, A.S., Chojenta, C.L. & Loxton, D.J. 2021. Consequences of gender-based violence on female high school students in eastern Ethiopia. African Journal of Reproductive Health, 25(4): 22-33. https://doi.org/10.29063/ajrh2021/ v25i4.3.

[4] Central Statistical Agency (CSA) Ethiopia & ICF. 2016. Ethiopia Demographic and Health Survey 2016. Addis Ababa, Ethiopia, and Rockville, Maryland, USA: CSA and ICF.

[5] iMMAP. 2022. Gender-based violence in Ethiopia crisis overview report [online]. https://reliefweb.int/report/ethiopia/ gender-based-violence-ethiopia-crisis-overview-report-august-2022#:~:text=EXECUTIVE%20SUMMARY%20This%20 crisis%20overview.

[6] USAID/Ethiopia. 2019. Gender -Based Violence Landscape Analysis - Amhara case study [online]. https://www.igwg. org/wp-content/uploads/2019/05/IGWG-Plenary-EnCompass.pdf.

[7] United Nations. 1996. Report of the 4th World Conference on Women, Beijing, 4–15 September 1995. New York, United Nations.

[8] Stones, E., & Heran, A.T. 2022. Increasing Accessibility of Post-Gender-Based Violence Services through Primary Health Care in Ethiopia: Technical Brief. Rockville, MD: EnCompass, LLC.

A Journey to Zero Missed Opportunities: Enhancing Cervical Cancer Screening at Jenela Health Center, Harar town

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Introduction

Cervical cancer remains one of Ethiopia's most pressing public health threats, claiming the lives of countless women every year despite being largely preventable through early detection. Recognizing this, the Ethiopian government has made a clear commitment to expanding screening coverage and strengthening health systems to combat this silent killer. Yet, at the frontline of service delivery, progress is uneven.

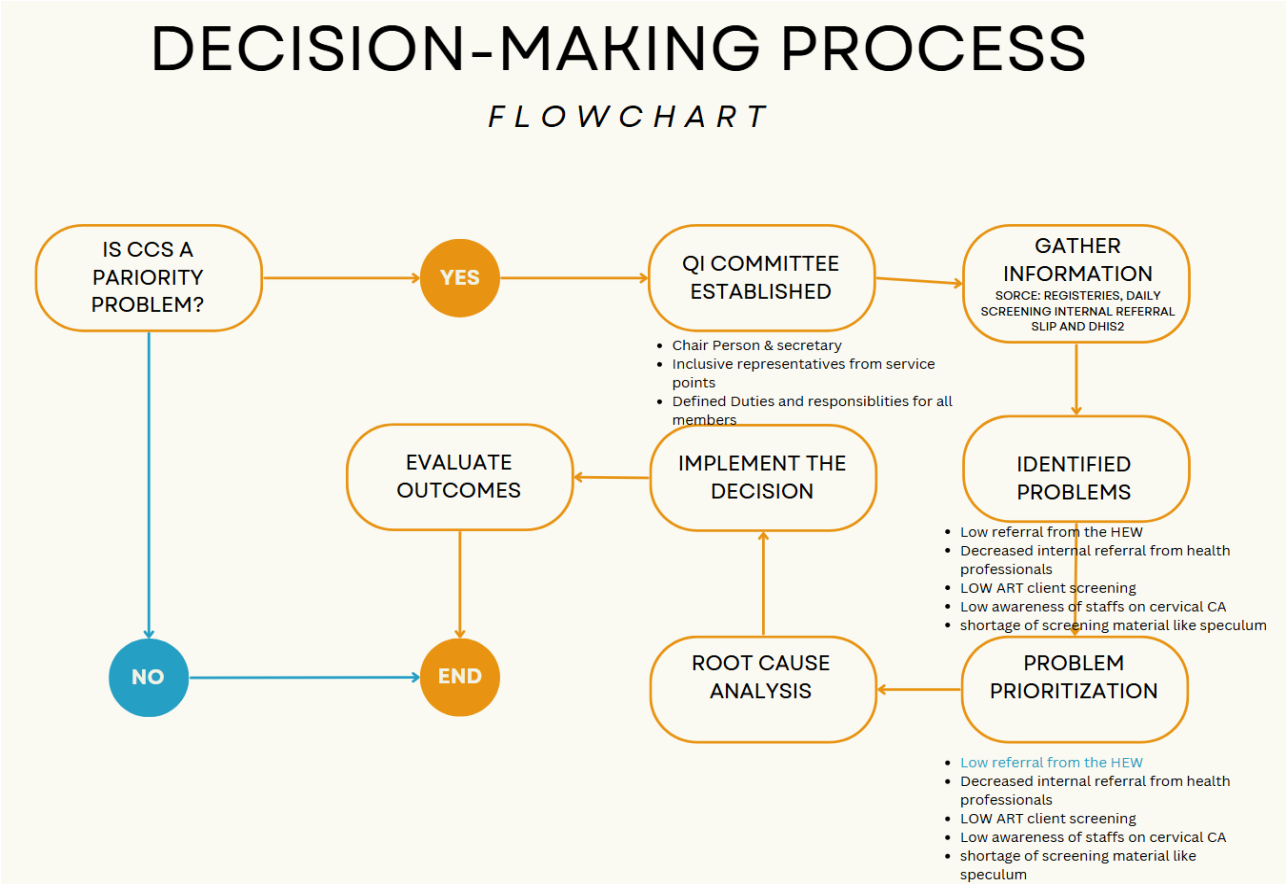
In Jenela Health Center, nestled within the vibrant communities of the Harari Region, the reality of this burden came into sharp focus. In July 2017 E.C., only 5 women had been screened out of 39 eligible that month; just 12% coverage. On paper, it looked like a statistic. But in truth, it represented 34 missed opportunities; 34 women left vulnerable to a disease that could have been detected early, and potentially prevented.

This low coverage was a clear indication that a new, more comprehensive approach was urgently needed. Guided by this commitment, supported by Haramaya University under the Capacity Building and Mentorship Program (CBMP), in partnership with the Regional Health Bureau, the center committed to strengthening data quality, promoting evidence-based decision-making, engaging the community, and improving service delivery. The aim was to increase screening coverage from 12% to 100% by the end of October 2016 E.C., ensuring every eligible woman was reached.

Methods

Determined to identify and address the underlying issues, the facility's Quality Improvement (QI) team, with technical guidance from Haramaya University through the CBMP, conducted an in-depth problem analysis using a fishbone diagram. This analysis revealed that the challenge went far beyond the low numbers and was rooted in multiple systemic gaps:

- Although 39 eligible women visited the health facility during the reporting period, only 5 were screened. This reflects not only low community awareness but also missed opportunities within the facility itself. Once women reached the health center, healthcare providers did not consistently counsel, refer, or integrate cervical cancer screening into routine services, leading to preventable missed opportunities.
- Infrastructure limitations, including a cramped screening room that lacked privacy and discouraged women from participating.
- Human resource constraints, with insufficient trained providers to deliver screenings consistently and confidently. This indicates the gap in service integration and provider practice it shows health professionals did not consistently screen or refer eligible women already present at the facility. The key issue is therefore a *missed opportunity at the point of care*, rather than staff shortage.
- To reduce missed opportunities for cervical cancer screening by ensuring that every eligible woman visiting the facility is identified, counseled, and screened during her visit, while strengthening data recording and real-time reporting systems to track progress and address service gaps.



Intervention approaches

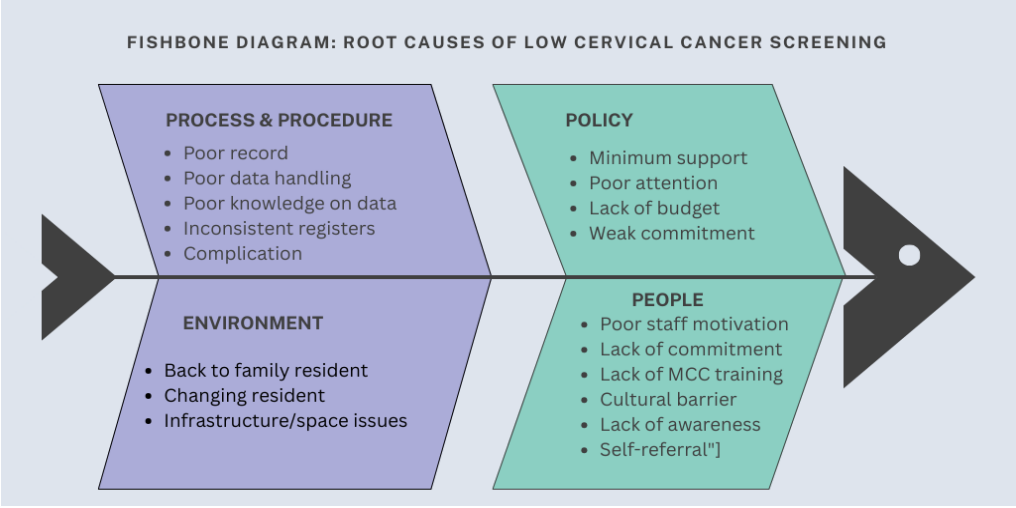
The team realized the problems demanded a systemic solution; one that integrated data use, community engagement, capacity building, and stakeholder collaboration at every level. Given that the team, in collaboration with Haramaya University's CBMP, prepared a wide-ranging intervention packages that aligned with national cervical cancer prevention goals and Ethiopia's broader health transformation agenda, aiming to bring lasting change to Jenela Health Center and the women it serves.

Interventions were:

- Collaborative Planning and Problem Analysis: Joint planning sessions with staff and HEWs to identify barriers and develop a shared, actionable plan.
- Infrastructure & Service Expansion: Sufficient screening and triage rooms to improve privacy and client comfort.
- Capacity Building: Training for staff from MCH, OPD, CAC, and HEWs on screening guidelines, documentation, and counseling; experience-sharing visits to high-performing facilities.
- Community Outreach: 13-day household visits by HEWs and facility-based health education sessions to address misconceptions.
- Data Management: Daily Telegram-based reporting for real-time monitoring; improved DHIS2 entry and recordkeeping.
- Motivation & Recognition: Performance-based incentives, including palm tops and mobile airtime, for high-performing staff.

Relevant Changes

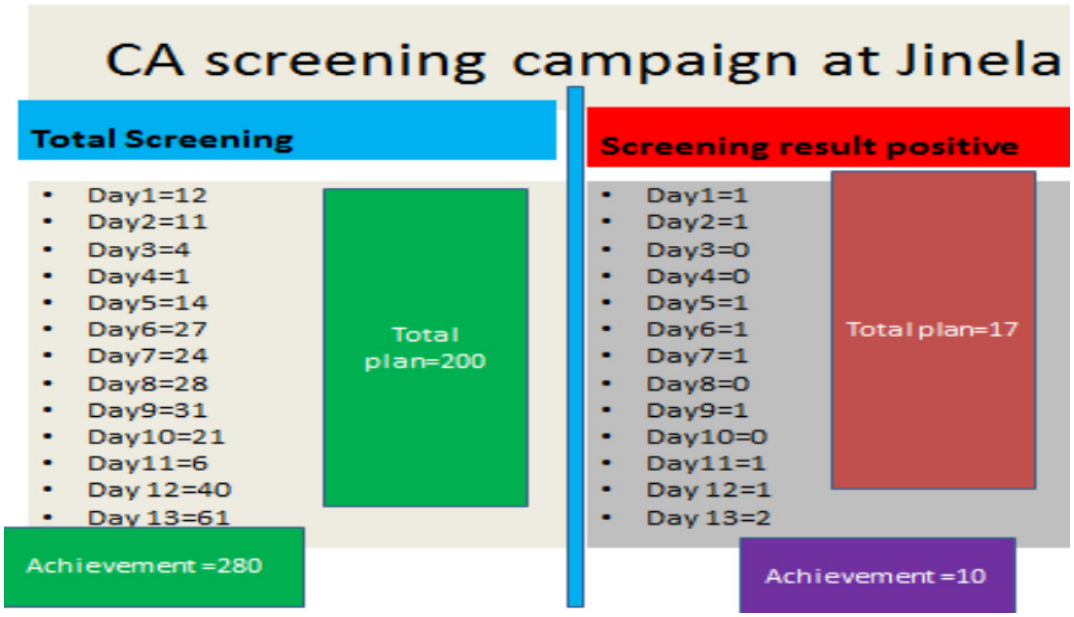
The impact of these combined efforts was both immediate and profound, transforming cervical cancer screening from an underutilized service into a source of community pride and hope.

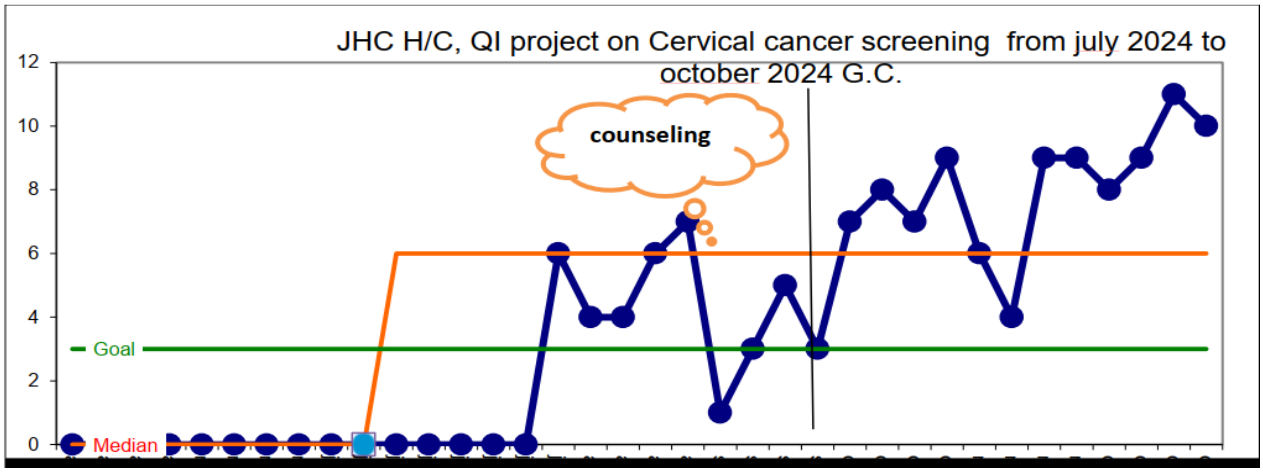


Within 13 days:

- Coverage: Screening rose from 12% to 100% of the monthly target 280 women screened. The peak day recorded 61 screenings.
- Early Detection: Twelve women (4.3%) were identified with cervical lesions and linked to treatment.

- Community Engagement Impact: Of screened women, 71 were referred directly by HEWs; others learned of the service through OPD, MCH, and other service units.
- Staff Motivation: Five staff members were formally recognized for exceptional performance.
- Data Use: Daily reporting fostered accountability, allowing rapid adjustments and steady service growth, shown in a run chart.





A run chart showed daily screenings rising from sporadic to sustained delivery, reflecting the impact of clear planning, community engagement, and motivated staff.

Challenges along the Way: Despite notable successes, the team faced fluctuating community turnout, limited resources, staff fatigue, and persistent data management gaps.

Lessons Learned

- Community engagement is non-negotiable: HEWs' trusted relationships and door-to-door outreach significantly increased uptake.
- Performance incentives matter: Recognition and rewards boosted morale and sustained effort.
- Experience sharing fosters innovation: Visits to high-performing sites provided practical ideas and solutions adaptable to local conditions.
- Robust data systems are essential: Real-time reporting ensured timely gap identification and action.

Conclusion and Recommendations

Jenela Health Center's response to low cervical cancer screening evolved into a model of collaborative, data-driven quality improvement. Through staff capacity building, infrastructure upgrades, intensive community outreach, and a culture of recognition, the team reached hundreds of women in days, energized the workforce, and demonstrated that even resource-limited settings can achieve sustained impact.

This experience provides a blueprint for other facilities: integrate outreach, staff incentives, and data monitoring; ensure private screening spaces; build provider skills; and strengthen partnerships with universities, health bureaus, and communities. Adapting this approach to other health services can rapidly improve coverage and quality, ensuring timely, dignified care for all.

Strengthening RMNCH Commodity Supply Chain Management through Supportive Supervision in Ethiopia: A Best Practice

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Introduction

Ethiopia has made commendable progress in advancing reproductive, maternal, neonatal, and child health (RMNCH) over the past two decades, underpinned by robust policy reforms and investments in primary healthcare. Maternal and child mortality rates have steadily declined, with the maternal mortality ratio falling from 399 per 100,000 live births in 2015 to 267 in 2020, and under-five mortality decreasing from 165 per 1,000 live births in 2000 to 67 in 2020.[1] Despite these national achievements, substantial disparities remain at the point of service delivery, particularly in rural and hard-to-reach areas. [2]

One of the critical barriers to consistent RMNCH outcomes is the fragile and fragmented last-mile supply chain. Frequent stockouts of life-saving commodities, poor inventory control, and limited logistics capacity continue to disrupt service delivery. These challenges are further evidenced by the low rate of postpartum contraceptive provision only 11% of women received a modern contraceptive within 48 hours of childbirth in health facilities in 2021/22. [3] Neonatal mortality, which has stagnated at 29 deaths per 1,000 live births over the past decade, remains a significant contributor to under-five mortality.[2]

In response to these systemic gaps, the Clinton Health Access Initiative (CHAI), introduced a supportive supervision intervention aimed at strengthening RMNCH supply chain management. Unlike conventional audit-based supervision, this approach emphasizes capacity building, real-time mentorship, and collaborative problem-solving at facility and district levels. Since its launch in November 2023, four supervision rounds have been implemented across targeted public health facilities, focusing on ensuring the availability of essential RMNCH commodities and improving logistics performance.[4]

This intervention seeks to institutionalize a data-driven, responsive supervision model that reinforces accountability and enables timely decision-making across the supply chain. Ultimately, the goal is to improve the availability of RMNCH commodities, enhance service quality, and reduce preventable maternal and child deaths through a resilient and equitable supply system.

Methods

Approach and Intervention

A structured supportive supervision (SS) model was implemented. This model emphasized real-time data collection, on-site mentorship, and collaborative action planning. In contrast to traditional audit-based approaches, the intervention prioritized capacity building and local problem-solving. Key components included systematic supervision visits, facility-based coaching, and follow-up planning based on observed gaps and root cause analysis.

Setting and Implementation

The supportive supervision was conducted in four national rounds between November 2023 and April 2025, covering an expanding cohort of public health facilities in each round. Facilities included health posts, health centers, and hospitals (primary, general, and tertiary) located across all regions and city administrations. Site selection was guided by proximity (within 100 km) to CHAI-supported oxygen plants, which functioned as distribution hubs.

To ensure coverage of facilities in conflict-affected areas, CHAI, in collaboration with the respective RHB/ZHD, provides ongoing orientation to supervisory teams from the RHB and ZHD, who are assigned to oversee and provide technical support to health facilities in these areas.

Digitized checklists were deployed via Survey CTO to capture real-time data on RMNCH commodities. The product list included 9 family planning, 11 maternal health, and 12 child health commodities. Data were cleaned and analyzed using Microsoft Excel, employing descriptive statistics with disaggregation by region, facility type, and hospital level.

Key Actors and Collaboration

The intervention was led by the CHAI in close partnership with MOH, RHBs, ZHDs, WoHOs, and health facility staff. Implementation teams comprised CHAI technical experts, regional and district health personnel, and frontline healthcare workers, including pharmacists, supply chain experts, and clinicians.

Results

Across the four rounds of SS, a total of 191, 448, 349, and 618 public health facilities were visited during SS1, SS2, SS3, and SS4, respectively. SS1 was conducted in eight regional states and one city administration, while SS2 through SS4 expanded to include all twelve regions and two city administrations, thereby achieving nationwide coverage of Ethiopia's public health system (Table 1).

Table 1: Distribution of health facilities visited across four rounds of supportive supervision, by facility type and level

Round	Total HFs	Health Posts	Health Centers	Hospitals
SS1	191	57	85	49
SS2	448	135	204	109
SS3	349	–	231	118
SS4	618	265	237	116

Pharmaceutical Supply Management Practices

Four rounds of supportive supervision demonstrated progressive improvements in RMNCH commodity supply management across health facilities. Key areas of progress included product availability, inventory accuracy, and adherence to standard operating procedures.

Availability of Facility-Specific Medicine Lists increased from 67.9% in Round 1 (SS1) to 89.8% in Round 4 (SS4), while Standard Treatment Guideline availability improved from 31.3% to 82.4%. The inclusion of RMNCH products in FSMLs rose from 25.4% to 76.2%. Demand-based quantification practices showed marginal improvement, rising from 51.5% to 56.1% (Table 2).

Table 2: Availability of FSML, 2021 STG, and Inclusion of RMNCH Products Across Supportive Supervision Rounds

Round	FSML Availability	Inclusion of All RMNCH Products in FSML	STG (2021) Availability
SS1(n=134)	67.9%	25.4%	31.3%
SS2 (n=313)	-	31.3%	43.5%
SS3 (n=349)	77.7%	52.2%	65.1%
SS4 (n=353)	89.8%	76.2%	82.4%

Procurement lead times from facility request for RMNCH commodities to delivery by EPSS or WoHO remained unchanged at 20–21 days, indicating ongoing inefficiencies. However, the availability of key logistics management information system tools increased significantly: bin card availability rose from 78.0% to 98.6%, and Report and Requisition Forms from 87.0% to 98.6%. Despite this, routine bin card updating remained inadequate, especially in lower-level facilities.

Storage conditions also improved. The proportion of facilities meeting at least 80% of national storage standards increased from 27.8% to 70.3% (Table 3).

Table 3: - Pharmaceutical Supply Management Practice across Supportive Supervision Rounds

Indicator	SS1 (n=134)	SS2 (n=313)	SS3 (n=349)	SS4 (n=353)
Average Lead Time (days)	20.7	19.6	21.1	20.4
Facilities Meeting ≥80% Storage Standard (%)	27.8	41.0	58.0	70.3
Bin Card Availability (%)	78.0	93.3	96.4	98.6
RRF Availability (%)	87.0	98.1	98.3	98.6
IFRR Availability (%)	68.0	86.3	91.4	94.8

Supportive supervision of the supply chain by higher administrative levels (RHBs, MoH partners) covered 67% of facilities in SS1, 46% in SS2, 70.5% in SS3, and 83% in SS4 per quarter. Follow-up on identified action points improved, with full implementation increasing from 11.2% in SS1 to 33.0% in SS4, and non-implementation decreasing from 35.8% to 8.0%.

RMNCH Commodity Availability

Family Planning Commodities

Day-of-visit availability of family planning commodities was consistently higher in hospitals compared to health centers across all rounds of supportive supervision (SS), with national average availability approaching 90% in managing facilities. Medroxyprogesterone Acetate, intrauterine contraceptive devices (IUCDs), and Implanon, demonstrated consistent improvements in availability across the rounds. Postpartum IUCD (PPIUCD) availability increased between SS1 and SS4.

Maternal Health Commodities

Availability of maternal health commodities improved markedly from 76.6% in SS1 to 83.4% in SS4. Hospitals consistently reported the highest availability, followed by health centers. Key commodities such as oxytocin, magnesium sulfate, and ferrous sulphate with folic acid were consistently available across facilities. However, unavailability of carbetocin injection and misoprostol 25 mcg were frequently reported throughout the supervision rounds.

Child Health Commodities

Availability of child health commodities increased from 76.0% in SS1 to 84.2% in SS3, with a minor decrease to 82.8% in SS4. Amoxicillin dispersible tablets (DT) demonstrated consistent improvements in availability across the rounds.

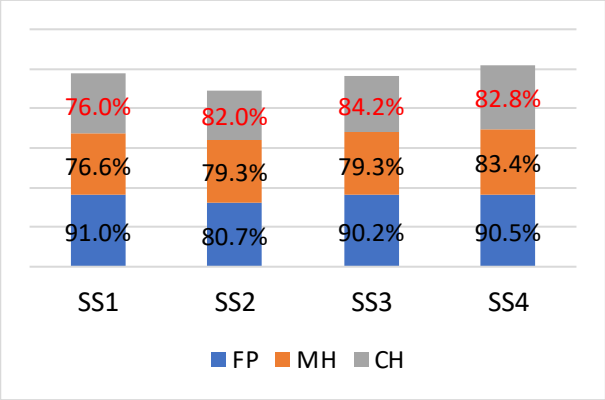

Figure 1. Trends in Availability of Family Planning (FP), Maternal Health (MH), and Child Health (CH) Commodities Across Four Rounds of SS

Lessons Learned

While the first round SS included only a few high-volume facilities, the later rounds showed clear improvements in supply chain performance and availability of RMNCH commodities. Continuous monitoring, intersectoral collaboration, and targeted capacity building emerged as critical enablers of a resilient health system. Sustained, integrated efforts are necessary to ensure reliable access to RMNCH commodities.

What Worked Well

Supervision in health facilities, combined with tailored on-site support, brought noticeable improvements. Using real-time data with quick feedback also helped speed up progress. Coordination with Regional, Zonal, and Woreda health structures facilitated scale-up. Higher-tier hospitals outperformed in storage and commodity management. Follow-up raised action point completion from 11.2% to 33%, enhancing accountability.

What Did Not Work

Challenges persisted, including frequent stock-outs, irregular resupply, and distribution of near-expiry products. Data quality gaps and weak coordination disrupted replenishment. Limited uptake of products such as Carbetocine, Misoprostol 25mcg, and PPIUCDs contributed to expiry and inventory inefficiencies.

Benefits to the Target Population

Improved RMNCH commodity availability translated into better access to life-saving interventions for mothers, newborns, and children. Strengthened supply chains accelerated progress toward Universal Health Coverage and the SDGs, reducing preventable maternal and child deaths.

Conclusion

The four CHAI-supported supervision rounds showed tangible gains in RMNCH supply chain performance. Although SS1 covered a smaller number of high-volume facilities, consistent supervision from SS2 to SS4 led to incremental improvements, with more facilities showing progress in the later rounds. However, persistent systemic bottlenecks, especially in lower-level facilities, highlight the need for continued support, better coordination, and national scale-up to ensure equity and resilience across the health system.

References

1. United Nations Inter-Agency Group for Child Mortality Estimation (UN IGME). (2021). Levels & Trends in Child Mortality. Retrieved from UNICEF website.
2. United Nations Inter-Agency Group for Child Mortality Estimation (UN IGME). (2021). Levels & Trends in Child Mortality. Retrieved from UNICEF website.
3. Ministry of Health (2023). Health Sector Medium-Term Investment and Development Plan (HSMIDP). Addis Ababa, Ethiopia.
4. CHAI. (2024). *Health Facility Supportive Supervision Report: RMNCH Products, SS1-* SS4 Ethiopia.

Enhancing DHIS2 Data Utilization for Evidence-Based Decision-Making through Collaborative Quality Improvement Initiatives Across Ethiopian Regions

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Abstract

Introduction:

Despite the nationwide rollout of the District Health Information System 2 (DHIS2) in Ethiopia, significant disparities remain in its routine application for evidence-based decision-making across Regional Health Bureaus (RHBs). A baseline assessment conducted by HABTech Solutions in June 2024 across six regions; Central Ethiopia, Afar, Addis Ababa City Administration (AACAHB), Sidama, Harari, and Dire Dawa; which revealed limited use of DHIS2 analytical tools and outputs, with case team utilization rates ranging between 12% and 38%. This limited engagement has constrained evidence-based planning and weakened the effectiveness of health interventions. In response, a collaborative Quality Improvement (QI) initiative was launched, employing region-specific, context-sensitive strategies to address systemic barriers and strengthen the culture of data-driven decision-making.

Objective:

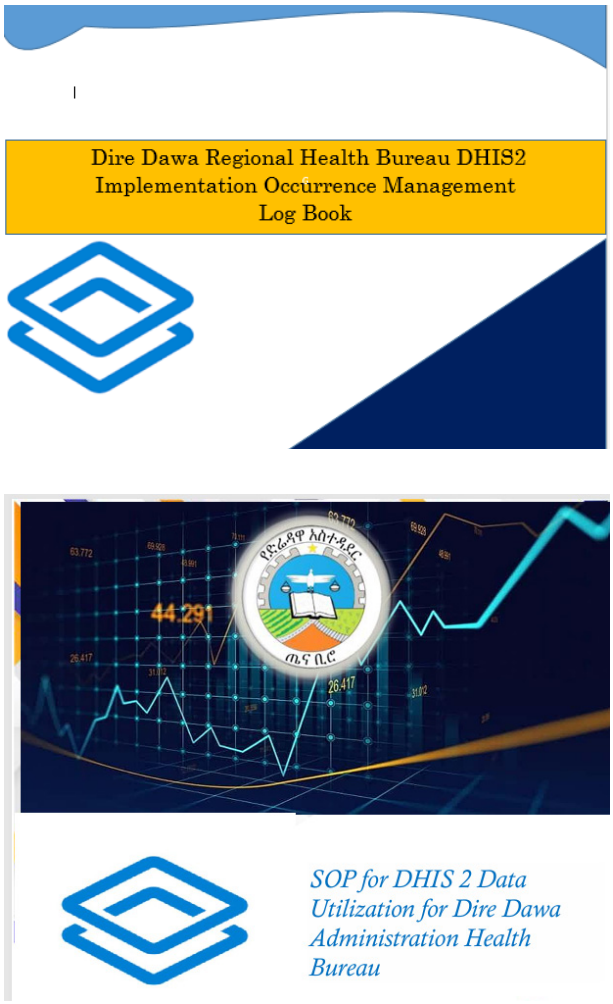
By June 2025, increase the routine use of DHIS2 data for evidence-based planning and decision-making to at least 85% among case teams in the health bureaus of AACAHB, Harari, Sidama, Central Ethiopia, Afar, and Dire Dawa.

Methods / Approach

A collaborative Quality Improvement (QI) model was used. The process began with a root cause analysis; this means looking deeply into the reasons behind low DHIS2 data use. Tools like fishbone diagrams (a visual way of mapping out problems and their possible causes) and the 'five why' technique (asking 'why' repeatedly to uncover the root of a problem) were applied to identify barriers. Using these insights, each region then developed and tested practical, context-specific solutions tailored to its own challenges:

- **Addis Ababa City Administration Health Bureau (AACAHB)** – Introduced continuous coaching and targeted training, strengthened awareness of indicators, data elements, and datasets, and provided orientation on new features introduced in DHIS2 version 40.
- **Dire Dawa & Harari** – Developed desktop reference materials and standard operating procedures (SOPs), created mentorship tools, and designed customized training packages to improve staff capacity and consistency in DHIS2 use.
- **Afar** – Established effective communication channels, issued DHIS2 access credentials to relevant staff, conducted regular training and mentorship sessions, disseminated short tutorial videos, institutionalized monthly performance analysis, and integrated data use as a formal performance indicator.
- **Central Ethiopia & Sidama** – Implemented regular follow-up using a standardized checklist, monitored change management progress, developed user-friendly dashboards, established continuous learning platforms, promoted advocacy through internal communication channels, and delivered tailored mentorship supported by structured feedback mechanisms.

These interventions were scaled across participating regions using the Training–Mentoring–Measuring–Recognizing (TMMR) approach, underpinned by strong leadership engagement, formalized performance recognition systems, and the institutionalization of robust data governance practices to ensure sustainability. The model emphasized efficient use of existing resources, making the interventions cost-effective and feasible for long-term adoption without requiring significant additional funding.



SOPs and DHIS2 implementation occurrence management logbook

Results:

By June 2025, all six participating regions demonstrated substantial progress in the routine use of DHIS2 data for decision-making. In Central Ethiopia, utilization among directorates rose from 38% to 66%, while the Addis Ababa City Administration Health Bureau (AACAHB) expanded its active case teams using DHIS2 from one to five. Sidama Region achieved a remarkable increase from 12% to 83% of case teams, and Afar Regional health bureau scaled use from one directorate to full coverage across all five directorates, achieving 100% uptake. Harari Regional health bureau improved utilization from 31% to 83% of case teams, and Dire Dawa City Administration health bureau increased from 25% to 70%.

These improvements were driven by a combination of enabling factors, including strong leadership engagement, consistent mentorship, development and deployment of reference tools and standard operating procedures (SOPs), establishment of structured feedback mechanisms, and the institutionalization of performance recognition systems that reinforced a culture of data-driven decision-making.

Run charts

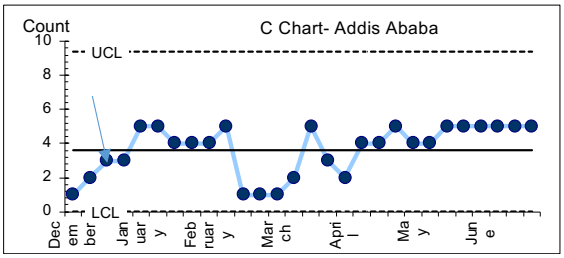
Lessons Learned / Conclusion

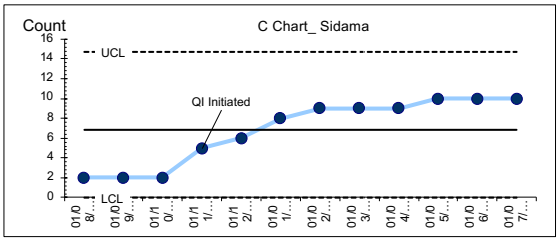
The QI collaborative approach effectively increased DHIS2 data utilization by embedding data-driven decision-making into institutional culture and strengthening local capacity. Flexibility to adapt interventions to regional contexts was crucial for success. Challenges such as initial resistance to change and variable staff capacity were mitigated through consistent mentoring and recognition of achievements. By leveraging existing resources efficiently and keeping costs low, the approach proved both sustainable and practical. This experience demonstrates that structured, collaborative QI interventions are not only scalable across regions but also replicable at the national level, offering a model for strengthening Ethiopia's health system more broadly.

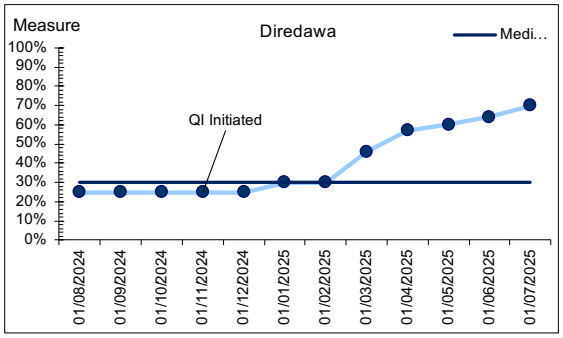
Recommendations

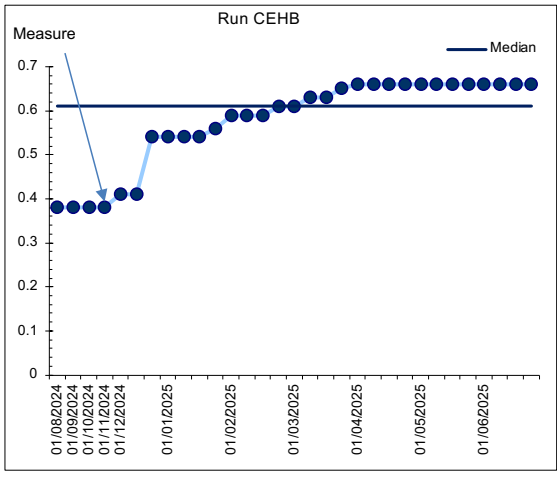
- Integrate QI collaborative approaches into national HIS strengthening plans.
- Maintain continuous capacity building through mentorship and refresher trainings.
- Institutionalize data use as a key performance metric in RHBs.

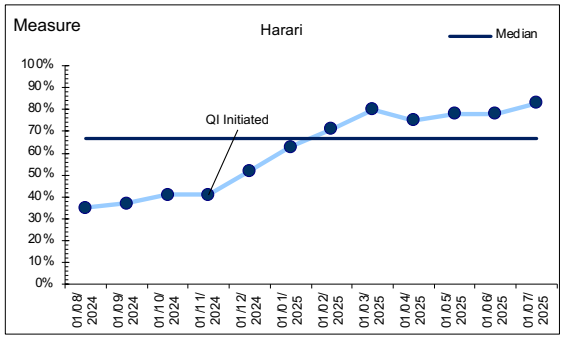
Replicate the TMMR approach in other regions to sustain and scale improvements











Reducing Irrational Drug Use in the Maternity Ward of Deder General Hospital, Oromia, Ethiopia

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Introduction

Irrational drug use remains a critical public health problem in Ethiopia, manifested in under prescribing, overprescribing, incorrect dosing, overprescribing, and excessive medication use. A recent study in eastern Ethiopia found that 44.5% of prescriptions contained at least one antibiotic, and 7.2% involved injections, both of which exceeded WHO standards [1]. Another study conducted in a conflict-affected area in 2025 reported even higher rates: 68% of prescriptions contained antibiotics, 58% involved injections, and overuse was observed in 75.8% of cases [2]. A 2024 meta-analysis indicated that 24% of prescriptions involved inappropriate antibiotic use, and 21% involved inappropriate injections [3].

At Deder General Hospital, a chart review conducted from August 22, 2024, to October 10, 2024, revealed 47% of unreasonable prescriptions in the maternity ward. This contributed to increased adverse drug reactions, antimicrobial resistance, prolonged hospital stays, and unnecessary healthcare costs. This high rate is primarily driven by three key problems:

- Inappropriate antibiotic selection—such as the use of broad-spectrum antibiotics (such as ceftriaxone) for uncomplicated simple infections, when narrower-spectrum antibiotics or no antibiotics at all are recommended.
- Non-adherence to national treatment standards—leading to the prescribing of medications that are not based on scientific evidence.
- Incomplete or unclear prescription documentation—compromising patient safety and continuity of care.

This pattern of illogical medication use directly impacts patient mothers, increasing the risk of adverse drug reactions, contributing to the development of antimicrobial resistance, prolonging hospital stays, and increasing direct and institutional healthcare costs—all without improving clinical outcomes

Aim: To reduce the rate of irrational drug prescriptions in the Maternity ward of Deder General Hospital from 47% to 0%, from October 11, 2024 to April 8, 2025.

Methods:

To drive sustainable improvement in prescribing practices, a multidisciplinary Quality Improvement (QI) team employed the Model for Improvement (MFI), executing four iterative Plan-Do-Study-Act (PDSA) cycles. The team utilized key QI tools to guide analysis and intervention design: a fishbone diagram to systematically identify root causes of suboptimal prescribing, and a driver diagram to map and prioritize change strategies aligned with overarching goals.

Prior to the intervention, prescribing practices were characterized by:

- Ad-hoc, non-standardized prescriber training;
- No routine distribution of essential drug lists;
- Infrequent and unstructured audits, delivered without feedback;
- Absence of formal interdisciplinary collaboration or case review.

Key Change Ideas Implemented:

- Structured In-Service Training for Prescribers: Regular, competency-based training sessions were introduced to standardize knowledge and reinforce best practices in rational prescribing.
- Weekly Distribution of Essential Drug Lists: Updated, context-specific essential drug lists were disseminated weekly to ensure prescribers had immediate access to current, evidence-based formulary guidance.
- Weekly Chart Audits with Written Feedback: Systematic audits of patient charts were conducted weekly, followed by individualized written feedback to prescribers — enabling timely reflection and course correction.

Focused Group Discussions (FGDs):

- Weekly FGDs brought together prescribers, pharmacists, nurses, and QI leads to:
  - ✓ Review audit findings and trends;
  - ✓ Share challenges and solutions in real time;
  - ✓ Reinforce learning and promote a culture of shared accountability.

Setting: Maternity ward, Deder General Hospital.

Implementation Period: October 2024 – April 2025.

Stakeholder Engagement: Physicians, pharmacists, nurses, hospital leadership, and the Health Service Quality Unit (HSQU) participated in planning, implementation, and monitoring.

Resources: Hospital training hall, prepared PowerPoints, audit tools, drug list printouts, meeting documentation.

Results

The Quality Improvement (QI) project at Deder General Hospital successfully reduced irrational drug use in the Maternity ward from 47% to 0% over a six-month period (October 11, 2024 – April 08, 2025) (Figure 1). This significant achievement was realized through a series of carefully implemented and continuously monitored interventions based on the PDSA (Plan-Do-Study-Act) cycle framework. The structured approach allowed the team to identify key problem areas such as: inappropriate antibiotic selection, non-adherence to guidelines, ad poor documentation), implement targeted strategies, and evaluate results at each stage. Throughout the project, weekly data collection and analysis enabled rapid course corrections and performance tracking, resulting in steady and sustained improvements. Each PDSA cycle was implemented over 6 weeks with reinforcement of the previous change idea. In PDSA Cycle 1, we launched in-service training

to build foundational understanding of rational prescribing. While we saw an encouraging initial drop in irrational drug use from a volatile baseline of 40–60% down to 40%-the gains quickly faded, rebounding to 55% by cycle's end. It became clear: *knowledge alone does not change behavior*. We needed to reinforce learning with practical, accessible tools leading us to introduce weekly essential drug lists in Cycle 2 (Figure 1).

Building on Cycle 1, the team introduced weekly distribution of essential drug lists to reinforce prescriber training and support real-time decision-making at the point of care. While irrational prescribing initially dropped to 35% in the second week, rates gradually climbed back to 50% by the cycle's end, indicating partial but unstable improvement. Feedback from prescribers revealed that access to drug lists helped, but without accountability or feedback on performance, adherence waned. This led the team to add *weekly chart audits with written feedback* as the next reinforcing change idea — creating a mechanism for continuous monitoring and individualized learning (Figure 1).

In PDSA Cycle 3, the team introduced interdisciplinary focused group discussions (FGDs) to promote shared learning, peer support, and collective problem-solving around prescribing practices. The run chart shows a noticeable decline in irrational drug use from 13% to 11%, with sustained stability over two consecutive weeks. Prescribers reported increased awareness and motivation due to open dialogue and real-time case reviews during FGDs. However, while engagement improved, isolated changes in individual behavior were still observed, suggesting that feedback mechanisms needed to be more personalized and timelier. This led the team to implement weekly chart audits with written feedback as the next key change idea in Cycle 4 (Figure 1).

PDSA Cycle 4 introduced weekly chart audits with written feedback, linking prescriber performance directly to individualized coaching and accountability. The run chart demonstrates a dramatic drop in irrational drug use to 0% starting from week 8 of the cycle, which was maintained through April 2025. Feedback from participants highlighted that receiving specific, actionable comments on their prescriptions reinforced learning and promoted ownership of quality improvement (Figure 1).

The combination of tools: training, essential drug lists, FGDs, and audit-feedback created a synergistic effect that transformed prescribing culture. This final cycle confirmed that structured, multi-layered interventions are essential for achieving and sustaining high-quality care.

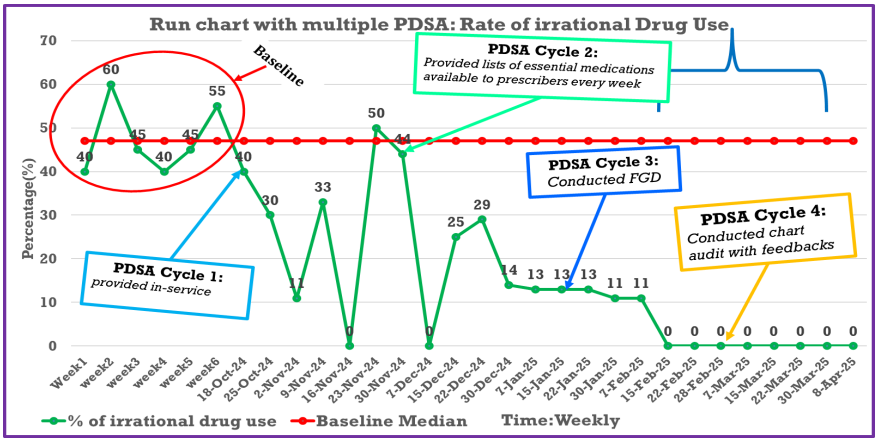

Figure 1: Run chart with multiple PDSA cycles to reduce irrational use of drugs at Deder from 47% to 0%, from October 11, 2024 to April 08, 2025

Beyond the primary outcome, the project also delivered favorable results in its balancing measures. The antibiotic usage in the ward dropped from **65% to 15% (figure 2)**.

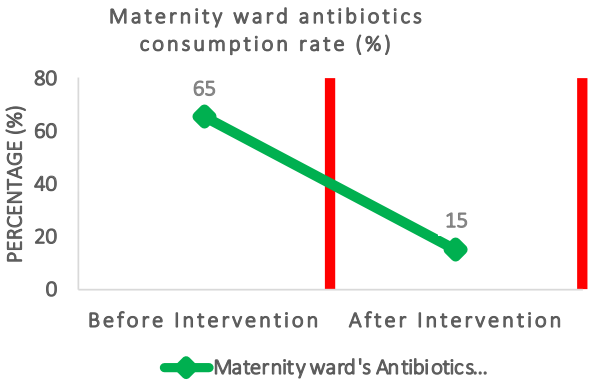

Figure 2: Shows that reduced irrational drug use led to a decreased Antibiotics Consumption Rate in the maternity ward of Deder General Hospital, April 2025

Prior to intervention, the consumption rates of ceftriaxone, cephalexin, amoxicillin, and metronidazole were 20%, 15%, 18%, and 12%, respectively. Following this intervention, these rates decreased significantly to 5%, 4%, 3%, and 3%, respectively, reflecting a sustained reduction in all antibiotics. This significant decrease confirms the success of this intervention in promoting appropriate antibiotic prescribing practices and reducing overuse in the maternity ward **(figure 3)**.

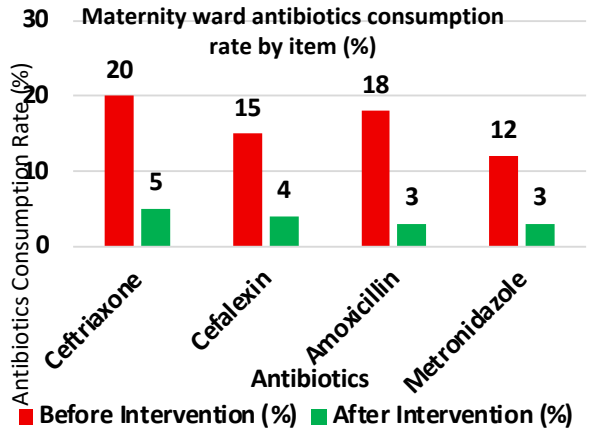

Figure 3: Antibiotics Consumption decreased by types in the maternity ward of Deder General Hospital, April 2025

Lessons Learned:

This Quality Improvement (QI) project highlighted several key lessons in addressing irrational drug use. First, multifaceted interventions —such as combining training, essential drug lists, stakeholder discussions, and audit feedback are more effective than isolated efforts, as they address both knowledge gaps and systemic barriers. Second, continuous monitoring and iterative improvements through PDSA cycles ensured sustained progress, demonstrating the value of adaptive strategies in healthcare quality initiatives. Third, interdisciplinary collaboration among physicians, pharmacists, and administrators was critical, as rational drug use requires coordinated efforts across departments. Finally, the project reinforced that data-driven decision-making, supported by tools like fishbone diagrams and run charts, is essential for identifying root causes and measuring impact. These insights can guide similar interventions in other healthcare settings to enhance prescribing practices and patient outcomes.

Strategies for Sustaining Quality Improvement Success

To ensure the sustainability and expansion of the Quality Improvement (QI) initiative's gains in reducing irrational drug use in the maternity ward, Deder General Hospital has developed the following strategies to promote rational drug use:

1. **Governance and Leadership (DTC Empowerment):**

- The Drugs and Therapeutics Committee (DTC) meet monthly to review audit data, prescribing patterns, and indicators of rational medication use.
- The results are communicated to physicians, and departmental performance reviews now incorporate rational prescribing measures.

2. **Policies and Regulations Enforcement**

- Standard Treatment Guidelines (STGs), the Essential Medicines List (EML), and the facility's Medication Formulary are applied to all prescribing activities.
- Physicians are consistently required to use generic names for medications, and the use of broad-spectrum antibiotics is now limited to justifiable uses.

3. **Priority Medication Monitoring**:

- High-use and high-risk medications, such as ceftriaxone, amoxicillin, metronidazole, and tramadol, are monitored on an ongoing monthly basis.
- Any deviations are analyzed, and corrective feedback is immediately provided to physicians.

4. **Ongoing Capacity Building:**

- Provide Regular (Bi-annual) capacity building training on rational prescribing, AMR, and pharmacovigilance for all clinical staff.
- Orientation modules for new staff to include rational drug use principles and antimicrobial stewardship

5. **Prescription Audit and Feedback:**

- Monthly Prescription audits in the maternity ward to continue, with prescriber-specific written feedback.
- Audit results to be reviewed quarterly at DTC meetings.

6. **Patient and Community Engagement**:

- Patients in the outpatient, inpatient, and pharmacy departments receive advice on the proper use of medications.
- Health education and awareness campaigns (HEC) effectively address the risks of self-medication, antibiotic misuse, and the importance of completing prescribed treatments.

Conclusion: This QI project shows that structured, data-driven, collaborative approaches can eliminate irrational drug use in resource-limited settings. The model is scalable to other wards and hospitals to improve patient safety, conserve resources, and enhance care efficiency.

REFERENCES:

1. Hailesilase, G.G., et al., *WHO/INRUD prescribing indicators with a focus on antibiotics utilization patterns at outpatient department of Adigrat general hospital, Tigrai, Ethiopia: a retrospective cross-sectional study.* Antimicrob Resist Infect Control, 2024. 13(1): p. 133.
2. Ahmed, M.A.A., et al., *Irrational medicine use and its associated factors in conflict-affected areas in Mali: a cross-sectional study.* Glob Health Action, 2025. 18(1): p. 2458935.
3. Teni, F.S., B.L. Wubishet, and D.K. Yimenu, *Systematic review and meta-analysis of medicine use studies in Ethiopia using the WHO patient care indicators with an emphasis on the availability of prescribed medicines.* BMJ open, 2022. 12(3): p. e054521.

Leadership and Governance Drives Health Information System Performance: The Case of University of Gondar Comprehensive Specialized Hospital

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1. Introduction

Despite ongoing efforts, the Health Information System (HIS) at the University of Gondar (UoG) Comprehensive Specialized Hospital remained weak, marked by poor data quality, limited information use, and low staff engagement. Key barriers included insufficient leadership support, unclear roles, weak teamwork, skill gaps, poor integration between HMIS and Quality units, and the absence of accountability mechanisms. Many academic and clinical staff also perceived HIS as peripheral to core duties, fueling resistance and low collaboration.

To address these systemic and behavioral gaps, the hospital working with the UoG Capacity Building and Mentorship Program (CBMP) conducted a comprehensive HIS/Information Revolution (IR) assessment. Findings were discussed with staff, leadership, and top university management, including the president, through structured engagement and management-by-walking-around approaches.

Based on the assessment, the hospital introduced a HIS accountability framework integrated into existing initiatives. The framework defined clear roles and responsibilities, established follow-up mechanisms, and was reinforced through leadership engagement, capacity building, structured mentorship, regular PMT meetings, task audits, and stronger integration with quality improvement. Additional strategies included designating a CBMP focal person and recognizing high-performing staff to build motivation and ownership. Implemented between October 2023 and December 2024, these measures aimed to transform HIS performance and embed accountability across the institution

2. Methods or Approach

We employed a mixed-methods pre-post study design to evaluate the effectiveness of the HIS accountability framework and its associated implementation strategies

Quantitative: Routinely collected data from the district health information system version 2 (DHIS2), hospital PMT reports, and HMIS task audits were used to measure changes in predefined HIS performance indicators. These included data quality (accuracy, completeness, timeliness), information-use scores, and selected service utilization indicators (e.g., outpatient attendance, emergency visits, surgical backlog, and neonatal outcomes). Performance trends were assessed by comparing baseline data (before October 2023) with follow-up data (up to December 2024).

Qualitative: To assess behavioral and organizational changes, we conducted structured observations, reflection sessions, and key informant discussions with HIS focal persons, clinical staff, and hospital leadership. These explored perceptions, attitudes, teamwork, motivation, and leadership engagement.

3. Results

3.1. Leadership support and engagement enhanced

Following the implementation of the HIS accountability framework, leadership engagement and support improved substantially across all levels. HIS became a strategic priority for university management, with active monitoring of hospital HIS activities and dedicated budget allocation for its implementation.

3.2. Behavioral change

After the intervention, staff showed notable improvement in attitude, knowledge, ownership, and appreciation of data value. Motivation, commitment, and teamwork improved across departments.

3.3. Improved HIS performance

- Data recording and reporting practices improved significantly, and data quality assurances were conducted regularly, with more than 85% of units conducting case team-level data quality verification.
- Average monthly report timeliness rose from 10% to 90% at the department (Outpatient, inpatient, emergency, laboratory, pharmacy, etc---) and 18% to 93% at the hospital level, while the hospital quarterly report completeness increased from 53% to 100% and has been sustained.
- Quarterly outpatient attendance rose from 49,942 to 68,759, and emergency visits doubled from 4,749 to 9,550. This growth is attributed to accurate recording and reporting, which enhanced service visibility.

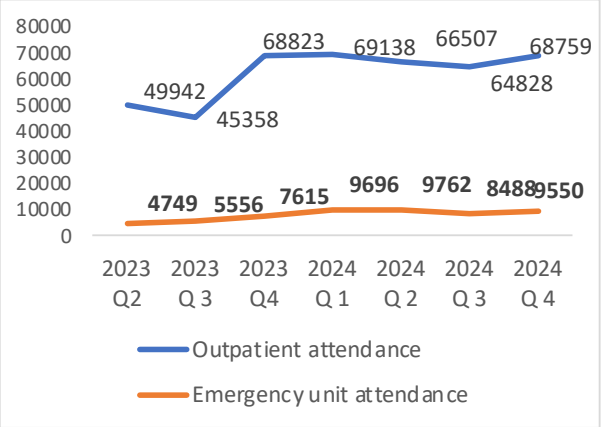

Figure 1: Outpatient and emergency attendant at UoG hospital before and after the implementation of the intervention. 2025.

- Before the intervention, no directorates held case team-level PMTs; after the intervention 75% did so regularly. The hospital PMT met monthly for 16 consecutive months on the 25th day of the month, addressing gaps through root cause analysis and improvement projects.
- Data use score improved: rising from 12% to 38% (target 40%).

3.4. Linking data with service improvement

The hospital PMT used routine PMT data for service improvement including initiating new services by integrating it with quality improvement project. The following were among the services improved by implementing the accountability framework:

❖ **Enhanced neonatal care**

- Neonatal mortality rate decreased from 13% to 7%

❖ **Improved surgical services**

- Average delay for elective surgical admission decreased from 380 to 124 days, and the average surgical cancellation rates decreased from 12% to 5%.

❖ **Improved emergency care**

- Proportion of clients stayed >24 hours with in emergency department reduced from 35% to 8% and the emergency mortality rate also declined from 1.5% to 0.97%.

3.5. Improved IR performance

With ongoing support, the hospital's IR performance improved from 63% to 93%, verified and recognized by Ethiopia's Ministry of Health as a model health facility.

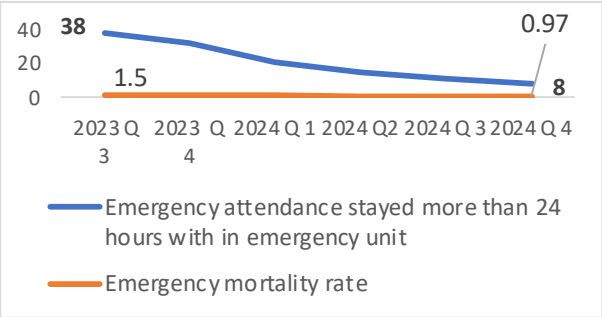

Figure 2: Improvements on emergency service on selected indicators at University of Gondar comprehensive specialized hospital, 2025.

3.6. Barriers and facilitators

Assigned new and committed leadership, University top management engagement, existing CBMP platform as a catalyst, and presence of adequate HIS workforce were the facilitators for the implementation of the intervention.

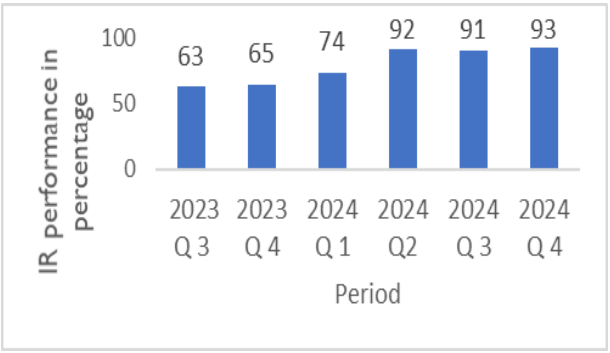

Figure 3:UoG comprehensive specialized hospital information revolution performance from 2023-24

Whereas, unclear roles and responsibilities, poor integration, staff resistance, and low motivation were the key barriers and addressed through stronger leadership engagement, clear accountability, integration with quality initiatives, regular PMT meetings and audits, capacity building, mentorship, and recognition of high performers.

4. Lessons learned

- **Leadership engagement:** Active hospital leadership fosters ownership, accountability, and data use, essential for effective HIS performance.
- **Driving HIS through accountability:** Implementing accountability alongside reward systems, with defined criteria, boosts motivation and strengthens HIS performance.
- **Improved data use, improved service outcomes:** Linking data use to service and clinical improvements motivates PMT members and functionality, and supports sustainability
- **Ensuring meaningful engagement of end users and stakeholders:** Active engagement of all HIS stakeholders in design, implementation, follow-up, and monitoring is essential to build ownership and ensure sustainability.

5. Recommendation

- The ministry of Health, with other stakeholders, should focus on ensuring leadership engagement and support for HIS performance beyond the word.
- A nationally endorsed framework and implementation guideline are vital for sustainable HIS accountability.
- HIS activities should be integrated into the routine performance appraisal system. Routine PMT activities must be formally linked with quality improvement initiatives

Improving Cervical Cancer and Breast Cancer Screening Outputs in Health Centers: Experience from Two Regions

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Introduction

Cervical cancer exemplifies healthcare inequity, as over 85% of the morbidity and mortality associated with it occurs among women of low socioeconomic status in developing countries. Sub-Saharan Africa bears the highest incidence and mortality rates for cervical cancer, with 19 out of the top 20 countries suffering the most significant burdens from this disease located in this region. In Ethiopia, cervical cancer is the second leading cause of cancer death among women, following breast cancer. In 2020 alone, there were 7,445 new cases and 5,338 deaths due to cervical cancer in Ethiopia.

Statement of the problem: The World Health Organization recommends cervical screening for women between the ages of 30 and 49 (2)more equitably, on the screening and treatment of cervical cancer. It includes some important shifts in WHO's recommended approaches to cervical screening, and includes a total of 23 recommendations and 7 good practice statements. 1. Among the 23 recommendations, 6 are identical for both the general population of women and for women living with HIV and 12 are different and specific for each population.2. Among the 7 good practice statements, 3 are identical for both the general population of women and for women living with HIV and 2 are different and specific for each population","edition":"Second edition","event-place":"Geneva","ISBN":"978-92-4-003082-4","language":"en","number-of-pages":"1","publisher":"World Health Organization","publisher-place":"Geneva","source":"K10plus ISBN","title":"WHO guideline for screening and treatment of cervical pre-cancer lesions for cervical cancer prevention","author":[{"literal":"World Health Organization"},{"literal":"Special Programme of Research, Development, and Research Training in Human Reproduction (World Health Organization. Achieving a high coverage of screening upwards of 70% is a more important determinant of the success of a screening program than frequent screening. In resource-limited settings, even once-in-a-lifetime screening at the age of 40 can reduce cervical incidence by a factor of 30%. PAP test linked with definitive treatment has prevented millions of women from cervical cancer in the developed countries. Due to limited availability of resources, a lack of infrastructure and difficulty in getting highly trained professionals, widespread implementation of PAP test dependent cervical cancer screening program has not been established in low and middle income countries such as India. Therefore, after availability of non-cytological tests such as visual inspection on acetic acid (VIA This underscores the need to maximize coverage to all eligible women to effectively capture and treat potential pre-cancerous lesions.

Despite the aforementioned evidence, screening coverage remains very low in most LMICs (5) practice, and barriers toward cervical cancer screening in Elmina, Southern Ghana Nancy Innocentia Ebu,1 Sylvia C Mupepi,2 Mate Peter Siakwa,1 Carolyn M Sampselle3 1University of Cape Coast, School of Nursing, Cape Coast, Ghana; 2Kirkhof College of Nursing, Grand Valley State University, Grand Rapids, MI, USA; 3School of Nursing, University of Michigan, Ann Arbor, MI, USA Aims: The aims of this study were: 1. The reality in Ethiopia is no different. A study found that the rate of cervical screening in Ethiopia is extremely low estimated to be around 2.9% (6)11,29]]}}}],"schema":"https://github.com/citation-style-language/schema/raw/master/csl-citation.json"} . Multiple barriers have been identified as causes for this unacceptably low rate including a lack of awareness and knowledge about risk factors, prevention methods, and women's unwillingness to be tested.

The theoretical foundation for this project is rooted in the notion that eligible women who visit health facilities for diverse reasons should not leave without being offered cervical screening and breast screening. Everyday hundreds of thousands of women who fit the profile for cervical screening come to health facilities. From regular outpatient units to family planning, from immunization for their kids to pediatric units, women from all walks of life flock to facilities in search of healthcare for themselves and their families. Through effective implementation of active intra-facility service integration, it is possible to capture more women than currently is possible. Passive client started cervical and breast screening programs fail to capitalize on the enormous potential made possible through active service integration.

Objectives

- To start cervical and breast screening services across 30 woredas and 67 health centers in Amhara and Oromia regions.
- To increase average weekly cervical screening outputs of 67 health centers from a baseline of 4 to 25 through intra-facility service linkage

Methods

Setting: The project was implemented in 67 health centers across 30 woredas in Amhara and Oromia regions and lasted from February 2025 to May 2025. The project was carried with the collaborative effort of Healthcare System Impact Syndicate Africa (ACSIS), Amhara and Oromia regional health bureaus, and respective zonal and woreda health bureaus.

Training Model: ACSIS used a training model that ensures situational fidelity. The training was given at Hub health centers (centers with OR Blocks) for Spoke health centers (small health centers with no CEMOC capacity) using expertise from Coach hospitals (large hospitals that support hubs and spokes). Case adequacy was assured by shunting eligible women from service units.

Providers were trained on the provision of cervical cancer screening and management enabling them to initiate screening services in their parent health centers.

After training and service initiation, the project focused on enhancing service output through two inter-related interventions. The first is the introduction of tools that help in the tracking and linking of eligible women from points of contact to the cervical unit.

Table 1: Number of trainees by training site

Training Site	Number of trainees
Dessie Comprehensive Specialized Hospital	8
Harbu Health Center	8
Debrebirhan Hospital	18
Asella Comprehensive Specialized Hospital	13
Dima Hospital	6
Sebeta Health Center	7
Laga Tafo Hospital	4
Sendafa Hospital	5
Total	69

These points of contact are family planning, regular adult outpatient units, immunization units, and sick childcare units. The second component of the intervention is the institution of weekly linkage audit where the improvement team audits the number of eligible women who visited each service unit, and the percentage of women sent for screening among the eligible. Regular learning sessions were also conducted to learn from and improve upon audit findings.

Community involvement was ensured with the involvement of health extension workers (HEWs) through performance-based payment scheme where each HEW was tasked with counseling and linking 50 women to be screened at their nearby screening center.

The intervention was initially piloted using improvement methodologies mainly repeated cycles of Plan-Do-Study-Cycles (PDSA) in a single health center, Guguftu health center in south Wollo and was then eventually scaled up to 67 health centers across Oromia and Amhara.

Results

After implementation, intervention adherence was assessed through weekly data collection and virtual learning sessions. Mentorship visits were also conducted by woreda non-communicable disease focal persons and cervical cancer screening unit professionals from the hospitals where the training took place.

In the pilot health center average weekly cervical screening numbers increased from 10 to 61 in 4 months. Positive screening increased from weekly average of 0 to 4. Breast screening numbers also increased from weekly average of 10 to 57 in the same period.

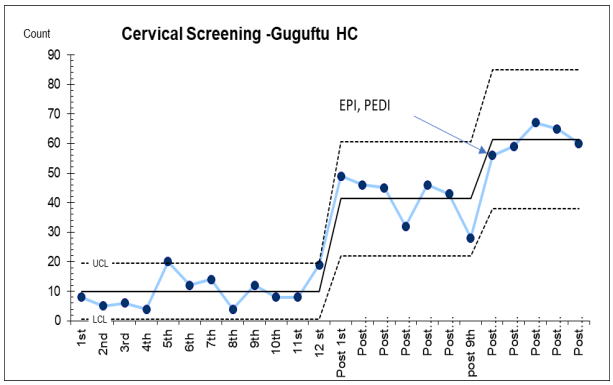

Figure 1, Trend in cervical and breast cancer screening, 2025

During the scale-up phase, cervical and breast screening service was started in 67 rural and remote health centers spanning 30 woredas across two regions, Oromia and Amhara, enabling them to provide basic screening services for previously underserved communities.

Two months after service initiation, the intra-facility service linkage model was introduced across all sites. After the introduction of the model service output for both breast and cervical cancer increased from a baseline of 4 to 20 per week.

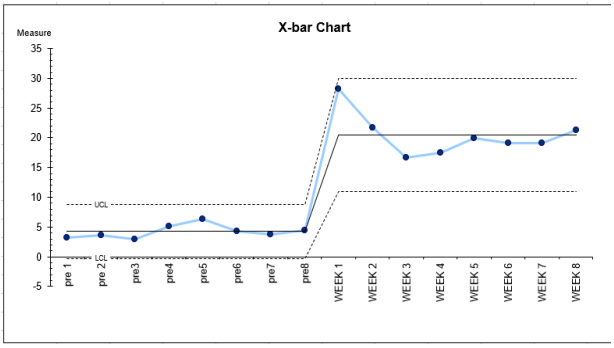

Figure 2: Trend in cervical cancer and breast cancer screening outcome, 2025

Conclusion

Increasing coverage for cervical screening along with breast screening is crucial to reduce the burden of harm due to these deadly cancers. ACSIS successfully implemented a comprehensive innovative training and service output increment model leading to better access and timeliness of screening services.

Lessons Learned

In the space of 3 months, 10,154 women were screened across reporting facilities with a 2 % positivity rate proving tangible benefit for the target population.

The collaborative effort of all concerned stakeholders was crucial for the success of the project especially zonal and woreda health offices.

A higher level of weekly performance couldn't be achieved mainly due to varying degree of adoption of the integration model by implementing institutions, underscoring the challenges of ensuring fidelity to interventions at front line care.

Earlier studies have shown 5-10% positivity rates. Relatively lower positivity rate can be explained by two key factors. The first is those studies were done among high-risk groups hence resulting in higher positivity rates. The second is lack of adequate work settings such as lack of proper illumination of the cervix and inexperience of providers. Future work needs to focus on increasing positivity rate by addressing these issues.

Zonal and woreda ownership is key to sustainability of the intervention. Regular mentorship and performance monitoring will ensure health facilities maintain service integration and screening outputs.

The project successfully proved that improving access to cervical screening services to remote health centers and instituting a model of active provider-initiated intra-facility service integration helps improve overall screening rate thereby leading to early detection & treatment. This is in line with the World Health Organization's goal of ending cervical cancer

As a global public health threat by the year 2030 with one of the pillars of the goal being screening 80% of eligible women by the aforementioned time period. We believe the project should be scaled up and implemented in a larger scale so that national screening averages move closer to the set 80% mark by 2030.

References

1. Jibat N, Ali R, Adissu W, Buruh G, Abdissa A, Goba GK, et al. Less known but greatly feared: Cervical cancer in Ethiopia community awareness. Heliyon. 2024 Mar 22;10(7): e28328.

2. World Health Organization, Special Program of Research, Development, and Research Training in Human Reproduction (World Health Organization). WHO guideline for screening and treatment of cervical pre-cancer lesions for cervical cancer prevention. Second edition. Geneva: World Health Organization; 2021. 1 p.

3. Banerjee D, Mittal S, Mandal R, Basu P. Screening technologies for cervical cancer: Overview. CytoJournal. 2022 Mar 29; 19:23.

4. Indicator Metadata Registry Details [Internet]. [cited 2024 Nov 29]. Available from: https://www.who.int/data/gho/indicator-metadata-registry/imr-details/3240

5. Ebu NI, Mupepi SC, Siakwa MP, Sampselle CM. Knowledge, practice, and barriers toward cervical cancer screening in Elmina, Southern Ghana. Int J Women's Health. 2014 Dec 24; 7:31–9.

6. Coverage of Cervical Cancer Screening in 57 Countries: Low Average Levels and Large Inequalities | PLOS Medicine [Internet]. [cited 2024 Nov 29]. Available from: https://journals.plos.org/plosmedicine/article?id=10.1371/journal.pmed.0050132

Kirkpatrick Level 3 and 4 Outcome and Impact of a Clinical Mentorship Program Following Operative Delivery Skill and Surgical Systems Management Training

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Abstract

Introduction

Mentorship programs are widely recognized as cost-effective and innovative strategies to address human resource challenges in healthcare. In the context of operative deliveries, clinical mentorship plays a crucial role in ensuring safe practice following focused training. To evaluate the impact and safety of a four-month Cesarean section (C/S) training program for general practitioners (GPs), we conducted a structured three-month follow-up mentorship initiative with supportive supervision.

Methods: A total of 70 GPs from 12 regions of Ethiopia were initially enrolled in the Operative Delivery and Surgical System Management (OSSYM) training program. Of these, 67 completed the full four-month training. Following graduation, the trained GPs were deployed to designated hub hospitals, each linked to their referral facilities. A national guideline–adapted mentorship framework was developed, with input from key stakeholders, including obstetricians, anesthetists, and scrub nurses. A one-week preparatory workshop helped define review areas and create checklists to assess OSSYM service delivery. Each trainee received monthly on-site mentorship for three months, during which mentors (obstetricians, IESO, anesthetist and scrub nurses) spent two days at the hub. Activities included chart reviews of operative deliveries, SPOUS (Structured Point-of-Care Obstetric Ultrasound), spontaneous vaginal deliveries (SVDs), and vacuum-assisted births. When feasible, mentors and mentees also conducted ultrasound exams and SVDs together.

Results: Over three mentorship rounds, the number of mentored facilities increased from 23 in the first round to 29 in the second, and 41 in the final round, demonstrating progressive service expansion. During the mentorship period, trainees collectively performed 451 Cesarean sections, 2,979 SVDs, and 17,722 SPOUS exams. Chart reviews across 93 mentorship visits identified 27 intra-operative complications, mostly uterine extension, all of which were successfully managed by OSSYM-trained General practitioners. Other findings included 10 neonatal deaths, 9 patient safety concerns, and 28 cases of poor documentation attributed to either a weak documentation culture or the absence of standardized formats. No maternal death events were recorded.

Conclusion: The three-month mentorship after OSSYM training helped GPs safely transition to independent operative delivery, improved skill retention, and expanded services. All complications were managed appropriately. Gaps in documentation and safety practices highlight the need for ongoing mentorship, standardized records, and continued post-training support.

Key words: SPOUS (structured point of care obstetrics ultrasound), OSSYM (Operative delivery skill and surgical systems management), Clinical Mentorship

Background

Mentorship programs are widely recognized as cost-effective and innovative strategies to address human resource challenges in healthcare (ref.). In the context of operative deliveries, clinical mentorship plays a crucial role in ensuring safe practice following focused training.

Accessible, qualified and responsive human resources for health (HRH) are critical determinants of a well-functioning health system and thus improving the health of populations. However, skill and competency gaps continue to present major problems among some healthcare professionals in Africa.(1) Centralized and off-site training programs are either ineffective or expensive. (2) A number of strategies have sought to tackle the problems arising from the scarcity of highly qualified HRH, in low and middle income countries. Among these initiatives are supportive supervision, provision of tools and aids, quality improvement methods, coaching and mentoring.(3) Mentoring is one of the innovative short-term solutions that have been in place in many healthcare institutions to tackle human resource-related challenges in low- and middle-income countries (LMICs).(4, 5)

Clinical mentoring is defined as "a system of practical training and consultation that fosters ongoing professional development" (pp.4). (6) Mentoring entails career support provided by an experienced, knowledgeable, skillful, empathetic and committed individual or a mentor to another less experienced individual or a mentee.(7) It involves a reciprocal relationship between the mentor and the mentee and hence improves the career outcomes of both. (7) Clinical mentoring is an approach for in-service training seeking to facilitate the dissemination of evidence-based practices. (8) It is aimed to increase the competence of health professionals and is seen as a part of continuous professional development.(9) Mentoring helps to establish an independent and productive service professional.(10) It also assists the mentee in establishing clear learning goals and professional relationships. (10) It stimulates the mentees to acquire both theoretical knowledge and practical skills and encourages the immediate application of the learning at work settings.(11)

To evaluate the outcome and safety of a four-month Cesarean section (C/S) training program for general practitioners (GPs), we conducted a structured three-month follow-up mentorship initiative with supportive supervision.

Objective

The key objectives of the mentorship were to assess the proficiency of GPs in performing operative delivery techniques (cesarean section, Structured Point of Care Ultrasound, delivery), to identify any gaps in knowledge or skills related to the management of complex obstetric cases, to provide targeted feedback to improve the skills and confidence of GPs in handling operative deliveries, to ensure that GPs are able to make sound clinical decisions regarding when to perform operative deliveries and thus ensure safe and quality procedures are being done by the GPs ensuring better maternal and neonatal outcome.

Methods

Study design; A total of 70 GPs from 12 regions of Ethiopia were initially enrolled in the Operative Delivery and Surgical System Management (OSSYM) training program. Of these, the 67 completed the full four-month training and were included in the mentorship program.

Study setting: Following graduation, the trained GPs were deployed to designated hub hospitals, each linked to their referral facilities.

Study period: The mentorship program took place for a duration of three consecutive months after the graduation of OSSYM trained general practitioners. The time period was months of February –April, 2025 G.C

Data collection: A national guideline–adapted mentorship framework was developed, with input from key stakeholders, including obstetricians, anesthetists, and scrub nurses. A one-week preparatory workshop helped define review areas and create checklists to assess OSSYM service delivery. Each trainee received monthly on-site mentorship for three months, during which mentors (obstetricians, IESO, anesthetist and scrub nurses) spent two days at the hub. Activities included chart reviews of operative deliveries, SPOUS (Structured Point-of-Care Obstetric Ultrasound), spontaneous vaginal deliveries (SVDs), and vacuum-assisted births. When feasible, mentors and mentees also conducted ultrasound exams and SVDs together.

Results and discussion

Over the three mentorship rounds, the number of mentored facilities increased from 23 in the first round to 29 in the second, and 41 in the final round, demonstrating progressive service expansion. In Tigray, which includes facilities such as Bizet, Nebelet, Ahsea, Guya, and Daerohafash, a total of 66 CS was conducted, with 624 SVDs vaginal deliveries attended and 1,795 SPOUS procedures performed. The Amhara region, encompassing Mekoy, Albuko, Enewari, Bulga, Wuchale, Bistima, Kutaber, Harbu, Lemi, and Seladingayhealth centers revealed 114 CS conducted, 923 SVDs attended, and 1,545 ultrasounds completed. The South region, which includes Koybe, Bulki, and Turmi facilities, recorded 90 CS, 200 SVDs, and 2,000 ultrasounds. In the Central region (Hadero and Lera facilities), there were 12 CS conducted, 80 SVDs attended, and 1,063 ultrasounds performed. The Afar region (Awash 7 health center) reported 22 CS, 60 SVDs, and 400 ultrasounds, while the BG region (Gilgel Beles) had 17 CS, 82 SVDs, and 600 ultrasounds procedures. In Oromia region 129 CS conducted, 1,000 SVDs attended, and 9,669 ultrasounds performed across Guna, Geda Tokuma, Yayu, Dimtu Hambala, Ogolcho, and Heban Arsi health centers. The Somali region had 1 CS conducted, 10 SVDs attended, and 650 ultrasounds performed. Overall, the total across all regions amounted to 451 CS, with 2,979 SVDs attended and a total of 17,722 SPOUS ultrasounds done.

Chart reviews across 93 mentorship visits identified 27 intra-operative complications, mostly uterine extension, all of which were successfully managed by OSSYM-trained General practitioners. Other findings included 10 neonatal deaths, 9 patient safety concerns, and 28 cases of poor documentation attributed to either a weak documentation culture or the absence of standardized formats. No maternal death events were recorded

Limitation of the study

The OSSYM mentorship program is the first program that is undertaken under OSSYM training, so there may be key take-home messages and lessons learnt for future similar programs. Since it is a new and is also implementation program, we couldn`t find comparative group. The other gap is since the health centers are far and remote it made difficult to cascade the mentorship timely. Also, qualitative data from all stakeholders should have included in the study.

Implication and scalability of the study

As a new program, we found promising outcomes from the 3 months period of mentorship. It may be a baseline and may be scaled-up for our remaining nationally built over 416 Operation blocks most of which service is not initiated. The MOH, regional health bureaus, zones and districts, NGOs, associations should work collectively to ensure those remaining sites have similar and better mentorship programs.

Cost effectiveness of the study

Although this might differ depending on the sites, over the three months mentorship, on average about 50,000 ETB per facility was used and about 2,000,000 ETB for the overall mentorship program.

Conclusion and recommendation

The three-month mentorship after OSSYM training helped GPs safely transition to independent operative delivery, improved skill retention, and expanded services. All complications were managed appropriately. Gaps in documentation and safety practices highlight the need for ongoing mentorship, standardized records, and continued post-training support

References

1.Bhutta ZA LZ, Mansoor N. Systematic Review on Human

Resources for Health Interventions to Improve Maternal health

Outcomes: Evidence from Developing Countries. World health organization (WHO). 2010.

2. Anatole M MH, Redditt V, et al. Nurse mentorship to improve the quality of health care delivery in rural Rwanda. Nurs Outlook. 2013;3:137–44.

3.Vasan A MD, Chaudhri S, Brown Epstein H-A, Lawn SD. Support and performance improvement for primary health care workers in low-and middle-income countries: a scoping review of intervention design and methods. . Health Policy Plan. 2017:437–52.

4.Green A dAV, Patten G, Davies MA, Ibeto M, Cox V. Clinical mentorship of nurse initiated antiretroviral therapy in Khayelitsha, South Africa: a quality of care assessment. PLoS One. 2014.

5.Manzi A MH, Hedt-Gauthier BL, et al. Clinical mentorship to improve pediatric quality of care at the health centers in rural Rwanda:a qualitative study of perceptions and acceptability of health care workers. BMC Health Serv Res. 2014;20(14):275.

6. WHO Recommendations for Clinical Mentoring to Support Scale-Up of HIV Care, antiretroViral Therapy and preVention in Resource-Constrained Settings. 2005.

7.Ghosh R RT. Career benefits associated with mentoring for mentors: a meta-analysis. J Vocat Behav. 2013;83:106-16.

8.Naikoba S SK, Mugabe P, et al. Improved HIV and TB knowledge and competence among mid-level providers in a cluster-randomized trial of one-on-one mentorship for task shifting. J Acquir Immune Defic Syndr. 2017;75(5):e120–e7.

9. Schwerdtle P MJ, Hall H. . A scoping review of mentorship of health personnel to improve the quality of health care in low and middle-income countries. Global Health. 2017;13:77.

10. Health RoKMo. Strengthening RH/HIV

Integration Services: National Mentorship Guidelines. Health RoKMo.2013.

11.Mekonnen Y HL, Asefa S, Kefale M. A study into the effectiveness of the midwives' mentorship for improving

maternal and new born health care programme in Ethiopia.

Strengthening Frontline Knowledge with Leap: The M-Learning Digital Platform for Health Literacy

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Introduction

Many developing countries, including Ethiopia, face a severe shortage of frontline health workers, which is particularly critical in rural and remote areas. According to a WHO report, the global shortfall of skilled health professionals is projected to reach 12.9 million by 2035 . Community Health Workers (CHWs) can fill this gap by providing basic health care and education to their communities. Evidence shows that CHWs can improve health outcomes in underserved communities . Building the capacity of community health workforce through training and empowerment strengthens the health system from the ground up.

The COVID-19 pandemic, first detected in Ethiopia in March 2020, severely disrupted health service delivery. Many Health Extension Workers (HEWs) lacked updated information on the virus. To address this, Amref Health Africa, in partnership with the Ministry of Health (MoH), launched the Leap mobile learning platform in May 2020 to train over 35,000 HEWs on COVID-19 prevention and response. Mobile learning (m-learning) platforms are emerging as effective tools for improving health literacy and training healthcare workers, particularly in remote and under-resourced areas. Studies have shown that structured m-learning programs lead to better learning outcomes and increased healthcare referrals . These digital platforms can enhance knowledge on various health topics, including mental health and healthy lifestyles .

To maintain essential care during the pandemic, a second training content on Reproductive, Maternal, Newborn, Child, Adolescent, and Youth Health and Nutrition (RMNCAYH-N) services was launched in February 2021, targeting 5,000 HEWs. In 2023, Amref introduced Adolescent and Youth Health (AYH) training in local languages to reach young people across multiple regions.

Building on this progress, the Leap platform was expanded in 2025 to train Community Health Leaders (CHLs), also known as Volunteer Health Leaders (VHLs). The training aims to enhance community engagement, strengthen referral systems, and promote health education.

The platform's low-tech, audio and SMS-based design makes it a scalable and cost-effective solution for remote areas with limited internet access.

Methods or Approach

Leap is the m-learning platform designed to strengthen health literacy and improve the capacity of frontline health workers and youths through Interactive Voice Response (IVR) and Short Message Service (SMS) technologies. The platform delivers short, focused training content tailored for practical health service deliver.

The learning content is developed by Subject Matter Experts and customized to address specific knowledge gaps and ground-level realities faced by frontline health workers. Once finalized, the content is converted into audio format in multiple local languages and recorded to ensure accessibility and comprehension, especially in low-literacy or linguistically diverse settings enabling learners to access training on basic mobile phones regardless of internet connectivity or digital literacy.

To reinforce learning, comprehension and reinforcement questions are sent via SMS after each topic. Learners must correctly respond to these questions to unlock subsequent topics, ensuring a sequential, mastery-based learning experience. Amref, in collaboration with the Ministry of Health (MoH), developed and delivered four trainings. To ensure training completion, strategies such as orientation sessions, regular review meetings, experience-sharing forums, digital monitoring, and learner recognition added. The trainings include:

- An Introductory COVID-19 prevention training covering topics on general information on COVID-19, coordination, psychosocial support and how to prevent spread of COVID-19.
- Essential services RMNCAYH-N training: covering topics on adolescent and youth health, family planning, maternal and newborn health, PMTCT (Prevention of Mother-to-Child Transmission) of HIV, child health, immunization services, nutrition and logistics and management
- Adolescent and Youth Health (AYH) training: covering topics sextual and reproductive health, family planning, demand creation and change agent.
- Community Health Leaders (CHLs) training: Covering RMNCAYH-N, communicable and non-communicable diseases, WASH (Water, Sanitation, and Hygiene), and CHL responsibilities

Key Implementers and Collaborators:

- Amref Health Africa – Lead implementer and technical coordinator
- Ministry of Health – Content development and quality assurance
- Funders – Swedish Postcode Foundation, Amref USA & Austria, Packard Foundation, EU delegates, Embassy of Kingdom of The Netherlands, Gates Foundation, Dutch Postcode Lottery

Result or Relevant Change:

To support Ethiopia's COVID-19 preparedness and response plan, the MoH and Amref launched the Leap mobile-based training platform in May 2020. By December 2021, 25,607 Health Extension Workers (HEWs) and supervisors were trained on COVID-19 prevention using mobile phones. HEWs appreciated the training for its timely, flexible, and practical nature, allowing them to learn at their own pace while avoiding in-person gatherings.

Maintaining Essential Services During COVID-19

When government attention shifted to COVID 19 response, essential health services were significantly disrupted. A study conducted in 2020 on the effect of COVID-19 on maternal and child mortality in 118 low and middle-income countries indicated that over a period of 6 months has predicted 253,500 and 12, 200 additional child maternal deaths,

respectively. This shows early sign of weak provision of essential services in low- and middle-income countries including Ethiopia . To address this problem Amref and MoH, developed a training content on RMNCAYH-N essential services during COVID-19, which reached 4,132 HEWs and supervisors from February to December 2021.

An assessment conducted in May 2021 at Sidama Zone (Hawassa City Administration and Luka Abaya District) indetified that HEWs became more confident, actively engaged in contact tracing, and community outreach. In Teletie and Geladelefia Kebeles, COVID-19 cases dropped significantly.

Adolescent and Youth Health (AYH) Training

Between 2023–2025, over 4,000 youth were enrolled in AYH training, with 3,055 completing in Afan Oromo and Amharic. The training improved awareness of SRH (Sexual and Reproductive Health), family planning, and STIs (Sexually Transmitted Infections), and empowered youth to challenge early marriage. As a result:

- Two girls in Moyale convinced their families to delay their marriages and returned to school.
- Club members showed observed behavioral changes, such as reduced substance use and focus on their education.
- At Wolayita Dimtu Health Center, youth-friendly service uptake rose from 3 to an average of 25 clients per day.
- Haymanot Sisay, age 15, from Serkalem Tadesse High School, Wagimra Zone, shared how the training changed her understanding of SRH, the effect of early marriage, and teenage pregnancy.

Community Health Leaders (CHLs) Training

I 2025, Community Health Leaders (CHL) training content was developed in collaboration with the MoH and training was started on March 2025. By July 28, 2025, a total of 611 participants across Amhara, Gambella, Afar, Somali, South Omo, and Oromia had completed the training. CHLs reported that the story-based mobile training content was both accessible and informative, making it easier to understand the topics. Many participants gained new knowledge or insights on essential topics such as preconception care, the importance of completing eight antenatal care (ANC) visits, and birth preparedness. In Afar region, CHLs particularly appreciated the family planning session, which emphasized mutual agreement between spouses, training content and stories aligning well with local cultural norms.

Lessons Learned

Leap mobile-based training platform has proven to be an effective, low-tech and scalable solution for training frontline health workers, adolescents, and CHLs especially in remote settings. Key success factors included:

- Audio-based delivery in local languages that accommodated learners with low literacy levels
- Storytelling formats and interactive SMS quizzes that improved learner engagement and retention
- A flexible, self-paced learning model that supported high uptake and course completion rates
- Strong government ownership and alignment with MoH priorities, which enabled rapid national scale-up across four training modules

Challenges encountered include:

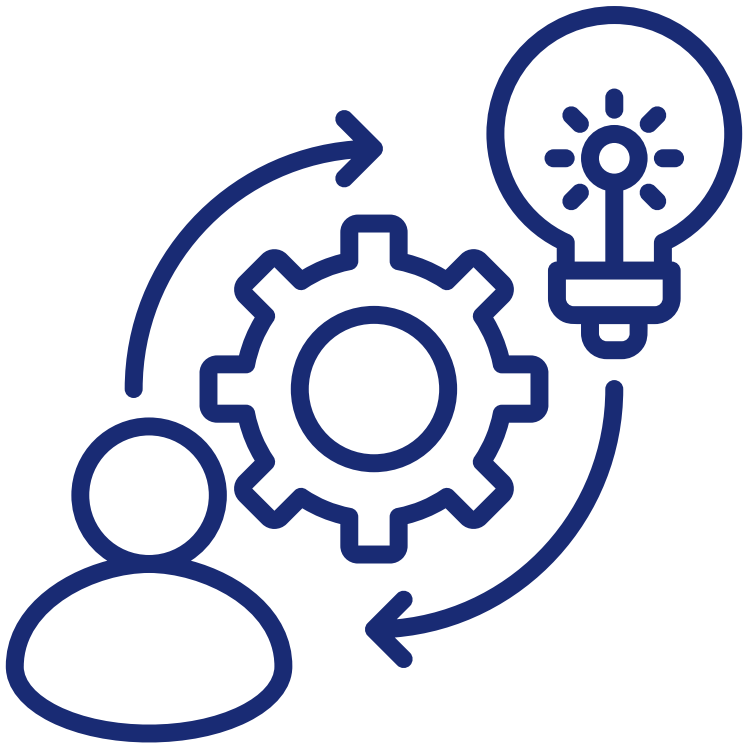
- SMS delays and server outages, which occasionally interrupted the learning process
- Connectivity limitations, especially in areas with weak mobile network infrastructure
- Limited digital troubleshooting capacity at the local level during early implementation phases

Recommendations

The Leap mobile-based training platform has demonstrated strong potential as a best practice model and can be scaled up to expand access to essential health information across communities—particularly to strengthen the capacity of Health Extension Workers (HEWs), Community Health Leaders (CHLs), adolescents, and youth. To sustain and expand its impact, the following actions are recommended:

- Strengthen Technical Infrastructure: Invest in more reliable SMS delivery systems and server infrastructure to reduce disruptions and ensure timely content delivery.
- Enhance Peer Support: Maintain and expand support mechanisms such as orientation sessions, peer-to-peer learning, and experience-sharing platforms to improve learner retention and course completion rates.
- Foster Multisectoral Collaboration: Engage additional sectors particularly education, youth affairs, and telecommunications to broaden the platform's reach, improve content relevance, and support integration into national capacity-building systems.
- Leverage for Emergencies: Institutionalize the Leap platform as a rapid response tool for health emergencies, enabling swift dissemination of preparedness training during disease outbreaks, natural disasters, and humanitarian crises.

Section Three: New Initiatives, programs or services



Reengineering the Patient Card – Transforming Data Quality at Ejere Health Center, Southwest Showa, Oromia region, Ethiopia

Jimma University Capacity Building program (JU-CBMP) team

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Background

Medical records management is a key part of the health information system, capturing patient information during healthcare encounters. A well-organized Medical Records (MRs) system is essential for delivering safe, efficient, and high-quality care, while also enhancing patient satisfaction (1). It supports evidence-based clinical and public health practices, informed decision-making, and serves as a reliable source for research and medico-legal purposes. It can be challenging to strike a balance between providing care and keeping accurate records in health systems with limited resources (2). This tension is particularly noticeable in rural health facilities, where there is a high patient volume but a lack of staff and infrastructure to support efficient recordkeeping (3).

Ejere Health Center, a busy rural facility found in Southwest Showa Zone, Oromia Region, has long faced the challenge of managing high patient flow with limited documentation tools. Although services were being delivered, data captured at the source, the patient card, was often incomplete or incorrect This resulted in underreporting of key indicators, especially OPD per capital, and a diminished ability to analyze performance or use data for decision-making.

Health workers frequently reported that MRs were not consistently updated, particularly when clients passed through multiple service points in a single visit. Important data such as diagnosis coding, treatments given, and follow-up appointments were either missed or inconsistently recorded. The ripple effect was clear: poor-quality data, reduced accountability, and weakened health system performance.

Digging Deeper: The Data Disconnect

Jimma University Capacity Building and Mentorship program (JU-CBMP's) analysis revealed that the root of the problem was not provider willingness; it was documentation tools and habits. The existing patient card lacked structured spaces for essential data elements such as ESV-ICD-11 codes, treatment summaries, or follow-up plans. Providers had no standardized format to follow, and the absence of peer review or ongoing mentoring led to varied practices across units. In this environment, maintaining accurate patient records was almost impossible; data would fall through the cracks between outpatient, lab, and pharmacy units.

The Turning Point: Redesigning the Patient Card with Purpose

With support from JU-CBMP, Ejere Health Center initiated a locally driven innovation aimed at improving

clinical documentation and service delivery. Recognizing the limitation of the existing patient card in capturing essential clinical and administrative information, the facility initiated the redesigning of patient card template to better reflect the practical needs of the day-to-day health care delivery. This innovation emerged from collaborative discussion involving frontline health workers, monitoring and evaluation (M&E) staff, and CBMP mentors. These stakeholders identified key gaps in the previous format such as lack of space for critical patient information, inconsistent documentation practices, and weak linkage between clinical care and data reporting. Guided by the principles of practicality, completeness, and accountability, the team co-designed a new template that is user friendly, aligned with routine clinical workflow and supports accurate and comprehensive documentation. The co designing process brought diverse teams, allowing them to contribute their perspectives and collaboratively develop effective, meaningful work. The redesigned patient card not only facilitates better patient management but also strengthens data quality for health information system.

The modified patient card includes:

- Provisional and final diagnosis (PHCD and HMIS Dx)
- Correctly coded ESV-ICD-11 diagnosis
- Advice and treatment provided
- Follow-up appointment dates
- Name and signature of the attending clinician

The goal was to create a simple but comprehensive tool that would standardize documentation, reduce data loss between service points, and strengthen the health center's ability to track service performance.

Knowledge Sharing and Culture Change

To support the rollout, CBMP facilitated peer-to-peer knowledge sharing sessions, where providers exchanged experiences on clinical documentation and data use. Alongside, awareness creation workshops on data quality were held, emphasizing the importance of content completeness and the long-term impact of accurate records.

The shift was not just technical; it was cultural. Providers began to understand that accurate data served not only administrators, but their own clinical decision-making, patient tracking, and professional credibility.

Results: From Paper Trail to Performance Gains

The intervention had a measurable impact. Over time, the number of outpatient visits recorded with correct ESV-ICD-11 codes increased significantly, improving both the quality and the quantity of reported data. Health center managers noted a rise in OPD per capita, reflecting more accurate data capture and improved patient follow-up.

Furthermore:

- Staff began to take shared responsibility in managing and maintaining individual patient folders.
- Efficiency improved, as records became more accessible and readable across units.
- A heightened awareness of data quality emerged among health workers and M&E teams.
- Accountability for clinical care and documentation was visibly strengthened.

These shifts not only improved the health center's internal reporting and analysis but also contributed to enhanced patient care continuity and facility-level performance.

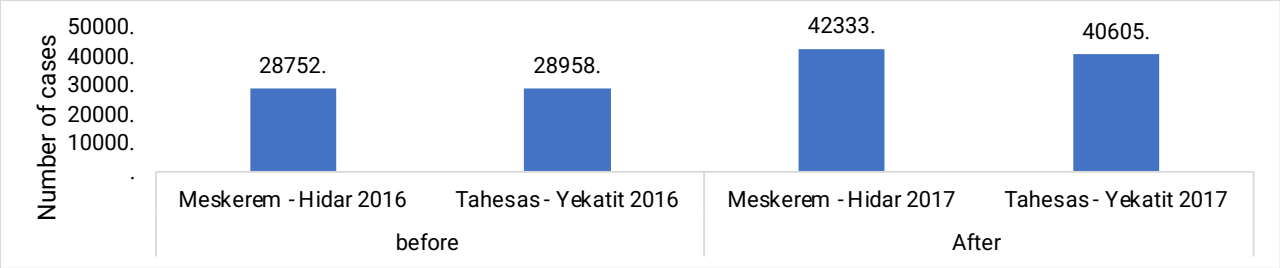

Fig. 1 Number of outpatients visit with correct record of ESV ICD-11 code, Ejere HC

Conclusion: A Simple Card with Transformative Power

The experience of Ejere Health Center shows that small, context-specific innovations can unlock significant gains in data quality and health service performance. By modifying a basic patient card and pairing it with capacity-building support and peer learning, the facility addressed long-standing gaps in documentation and accountability.

CBMP's role in mentoring, facilitating local solutions, and promoting a data-use culture was central to this transformation. The practice has since been recognized as a promising model for other health centers aiming to strengthen primary data sources, improve ESV-ICD-11 coding, and build a stronger foundation for data-informed decision-making.

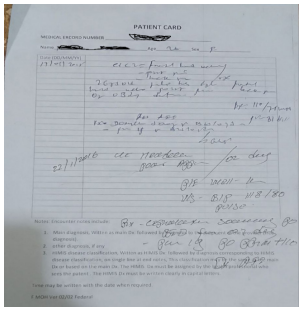

Photo (a) patient history sheet before intervention Ejere HC

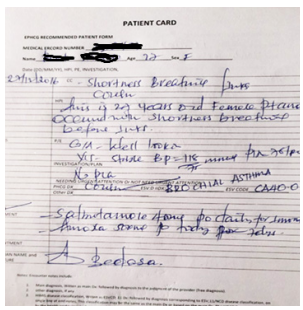

Photo (b) patient history sheet after intervention Ejere HC

References

1. Pirkle CM, Dumont A, Zunzunegui MV. Medical recordkeeping, essential but overlooked aspect of quality of care in resource-limited settings. Int J Qual Health Care. 2012 Dec;24(6):564-7. doi: 10.1093/intqhc/mzs034. Epub 2012 Jul 13. PMID: 22798693.

2. Siyam, A., Ir, P., York, D. *et al.* The burden of recording and reporting health data in primary health care facilities in five low- and lower-middle income countries. *BMC Health Serv Res* 21 (Suppl 1), 691 (2021). https://doi.org/10.1186/s12913-021-06652-5

3. Arsenault, C., Yakob, B., Tilahun, T. *et al.* Patient volume and quality of primary care in Ethiopia: findings from the routine health information system and the 2014 Service Provision Assessment survey. *BMC Health Serv Res* 21, 485 (2021). https://doi.org/10.1186/s12913-021-06524-y

Digital Transformation of Pharmaceutical and Medical Devices Monitoring and Evaluation in Ethiopia: Implementation of the ePMD-MES System

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Introduction

The legacy excel-sheet based system used by pharmaceutical and medical devices monitoring both before and after revision (1, 2) is not in a position to preclude a significant legacy burden. This is because it is characterized by protracted reporting cycles, critically high error rates, and vulnerability to data loss, which potentially is the potential cause of perpetuated public health risks through delayed insights into the vital information contained. The proposed electronic Pharmaceutical and Medical Devices Monitoring & Evaluation System (ePMD-MES) ePMD-MES represents a significant shift from the traditional Excel-based reporting system previously used for monitoring pharmaceutical indicators. While Excel offered a familiar interface, it relied heavily on manual data entry, formula management, and file consolidation, making the process slow (15-30 days), error-prone, and vulnerable to overwriting or inconsistent versions. This perpetuates critical public health risks from delayed insights into shortages and trends, erodes trust through unreliable data, and wastes funds due to obscured wastage from expired and overstocked inventory. By contrast, ePMD-MES automates almost the entire data flow, needing manual input only at the most detailed account levels. Proven at Wolaita Sodo University Hospital tracking 36 indicators (since there were only 36 indicators before the framework was revised which became 46 after revision), it slashed reporting time to under 24 hours, boosted accuracy to over 98%, and curtailed wastage. Although that pilot used an earlier framework, this renewed, expanded initiative—aligned with the pending national framework revision and featuring enhanced scope, functionalities, and integration—is essential to avoid missing these gains nationally and hindering efficient, equitable public health service scaling.

Objective

General: Fully digitize pharmaceutical and medical devises management monitoring and evaluation to improve efficiency, data precision, and real-time intervention and resource *optimization.*

Specific:

- Automate computation of all 46 PMD indicators.
- Cut reporting turnaround from 2 weeks to under 6 hours.
- Integrate seamlessly with DHIS2 and others to eliminate data silos.
- Increase data accuracy from ~68% to >98% for all 46 indicators" (validate by pilot).

Methods

- Target and Modality: Pilot implementation in four high-case-load hospitals, followed by phased national scaling through MOH infrastructure.
- Technology Platform:
  - » Frontend: Fully responsive, cross-platform interface with offline data entry capability on any device.
  - » Backend: API integrations with DHIS2, EPSA's eLMIS, and MEMIS
  - » Analytics: Automated scheduling, deadline tracking, data validity checks, and outlier detection
- Partnerships: Collaboration with Ethiopian Pharmaceutical Association, MOH, Tikur Anbessa Specialized Hospital, and JSI-Ethiopia (preliminary discussions ongoing)
- Sustainability: Deployment and hosting on MOH infrastructure to ensure long-term maintenance.
- Stakeholder Engagement: Engagement of over 120 pharmacists and biomedical engineers through targeted workshops.

Results / Outputs

Evidence from digital health literature and our pilot deployment of the electronic Pharmaceutical Monitoring and Evaluation System (ePMD-MES) demonstrate clear performance gains over manual reporting systems. When piloted at Wolaita Sodo University Hospital, the fully automated ePMD-MES system showed significant improvements across key performance areas. It greatly accelerated report timeliness, improved data accuracy, significantly reduced wastage rates, and enhanced decision-making capability—outcomes typically associated with comprehensive automation in healthcare monitoring systems.

Key Deliverables:

Real-time dashboards monitoring all 46 PMD indicators for continuous performance tracking

Automated, ARM-compliant PDF report generation for standardized documentation and compliance

Integrated mobile training modules aligned with Ministry of Health manuals to support capacity building and user adoption

Conclusion & Way Forward

ePMDMES modernizes Ethiopia's PMD M&E, replacing fragmented manual processes with a robust digital system. Piloting has demonstrated significant gains in data quality, reporting speed, and functionality—critical to advancing HSDIP's digital health agenda. Future efforts will build digital literacy through structured training modules.

Strategic Directions:

1. Roll out nationally to all 3,500+ facilities by 2027.
2. Integrate with the Ethiopian EHR for streamlined data flow.
3. Enhance capabilities to anticipate report timeliness risks and support proactive mitigation.

References

1. Federal Ministry of Health. Pharmaceutical and medical devices management monitoring and evaluation training course. Addis Ababa: Ministry of Health; 2024.
2. Federal Democratic Republic of Ethiopia, Ministry of Health. National pharmacy service, pharmaceuticals supply chain and medical equipment management monitoring and evaluation framework. Addis Ababa: Ministry of Health; 2019.

HIS Data Gebeta Initiative: Restructuring Health Information Systems Through the Wisdom of Ethiopian Tradition

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Introduction

The Haramaya University Capacity Building and Mentorship Program (CBMP) launched the Data Gebeta initiative in April 2025 at three health facilities in the Harar region, the Data Gebeta initiative reimagines Health Information Systems (HIS) by drawing inspiration from the Ethiopian Gebeta tradition a communal dining practice symbolizing unity, shared responsibility, and respect. This initiative aligns with the goals, objectives, and priorities of Ethiopia's Health Sector Development and Improvement Program (HSDIP), which emphasizes enhanced data quality, utilization, and system integration for evidence-based decision-making.

In the traditional Gebeta, participants of all ages and roles gather around a shared plate, with elders guiding and everyone contributing to meal preparation from preparing to providing inputs, reflecting harmony and accountability. Similarly, this initiative establishes a centralized hub that unifies HIS components such as performance monitoring, data quality assurance, logistics, and feedback into a single platform, promoting collaboration and visibility. This supports the HIS objective of strengthening HIS for accessible, high-quality data to inform health planning.

The initiative mirrors Gebeta's structured participation by assigning roles to HIS actors, including data clerks, health workers, partners, and regional officers, ensuring resource optimization, inclusivity and defined responsibilities. This fosters a cohesive, performance-oriented system where data is actively shared and utilized, addressing HSDIP priorities of stakeholder engagement and coordination. By tackling issues like fragmented data and lack of ownership, Accessibility, interoperability among data workers and departments, Data Gebeta creates an environment for meaningful data use, akin to the communal celebration of a Gebeta meal.

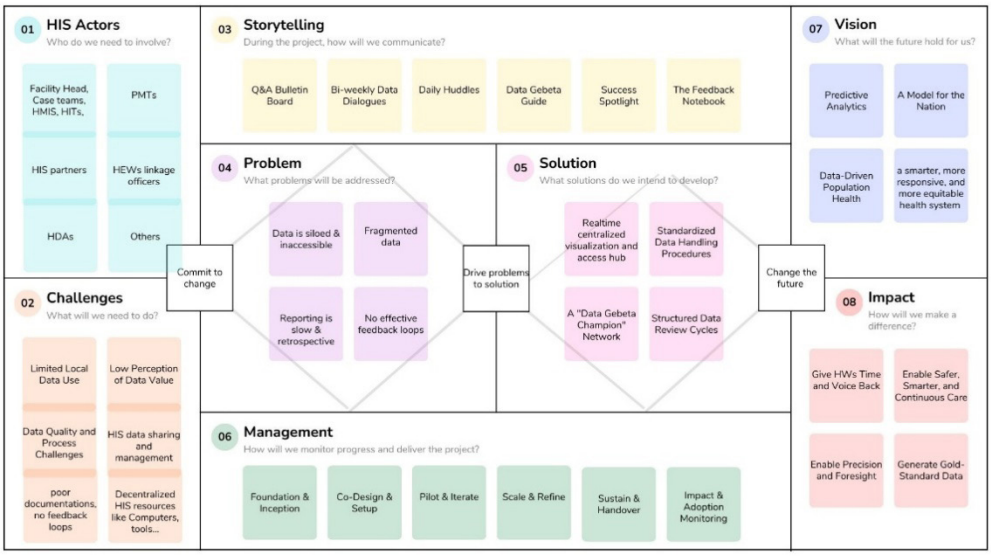

Fig1. Data gebeta center design thinking table brainstorming

All health information system (HIS) actors are accountable for their duties. Overall management of the center is led by the facility head, with the HMIS officer overseeing technical operations.

Rationale

The Data Gebeta Initiative was launched at Shenkor Health Center to directly tackle long-standing inefficiencies in its Health Information System (HIS). Before its introduction, key HIS actors functioned in isolation. This siloed approach resulted in inconsistent data, delayed or missing reports, fragmented data management, HIS communication barriers and data quality characterized by inaccuracies and incomplete records. These issues eroded trust among health workers and severely hampered timely, evidence-based decision-making. For instance, the HSDIP emphasized the need for better data integration and use, the absence of a cohesive platform hindered progress. The Data Gebeta Initiative was introduced to bridge these gaps by establishing a centralized hub where data could be harmonized, validated, and easily accessed enabling informed actions and strengthening overall health service delivery.

General Objective

To establish a centralized, inclusive, and culturally inspired Health Information System (HIS) framework that enhances data quality, utilization, and stakeholder collaboration in health facilities

Specific Objectives

1. To develop a unified Data Gebeta hub in CBMP facilities that integrates HIS components and fosters collaborative data sharing, inspired by the Gebeta tradition, to enhance data-driven decision-making.
2. Implement standardized processes for data collection, validation, and analysis within the Data Gebeta framework to improve data accuracy and utilization for decision-making.

3. Define and assign roles to HIS actors within the Data Gebeta structure to ensure inclusive participation and shared responsibility
4. Reduce instances of fragmented and inaccessible HIS data.

Method

The Data Gebeta is a culturally inspired initiative, piloted at Shenkor Health Center in the Harar region, designed to centralize and harmonize Health Information System (HIS) functions. This approach establishes a dedicated Data Gebeta hub to integrate key elements: HIS infrastructure, data quality assurance, and data utilization. The hub brings together Performance Monitoring Teams (PMTs), HMIS officers, Health Information Technicians (HITs), and data quality teams into a single, collaborative workspace.

This centralized hub serves as the primary location for all HIS-related work. The design designates the HMIS officer's office as the technical core of the hub, from which all HIS activities are coordinated, followed up on, and monitored.

Key methods include engaging stakeholders such as data clerks, health workers, facility heads, and regional HIS officers through **c**learly defined roles, orientation workshops, and ongoing training. A structured Data Gebeta monitoring framework was developed to track improvements in data accuracy, the quality and data use to measure reductions in fragmented data systems.

The initiative includes the development of a dedicated physical space, with conceptual zones aligned to the three HIS pillars. These zones include secure and open-access shelves, display boards, digital screens and areas for storing meeting minutes, documents, and reports. The layout encourages active collaboration, resembling a library where HIS workers can interact, access key information, and contribute to continuous performance reflection.

The Data Gebeta structural design has been developed and awareness creation workshop is provided to health facilities and guidance document is also shared. The bellow design illustrates the physical layout of the Data Gebeta**.**

Fig 2. The datagebeta center that integrate all actors HIS tasks in one place

Result

The Data Gebeta Initiative has yielded impactful results in the pilot health center, positioning the center as learning sites for others in the region. These centers were officially recognized by the Regional Health Bureau as "Data-Driven Model Facilities," having achieved over 90% performance in data quality and utilization a milestone never reached before. This success sparked high demand from neighboring facilities, with 10 cross-learning visits facilitated and 5% of CBMP-supported centers planning to adopt the Data Gebeta model

Figure 3. The data gebeta launching event at Shenkor HC.

The launch at Shenkor Health Center served as a catalyst, drawing strong interest from facility heads and regional leaders, who praised the model's potential for broader scale-up. Integration of the HIS workforce into a single, centralized space has improved access to reports, meeting minutes, and working documents, leading to better organization and continuity. The center also serves as a central HIS knowledge-sharing hub, where regular HIS activities are conducted as an integrated approach, and best practices and lessons learned from departments are displayed reinforcing accountability, teamwork, and a sustained culture of data-driven performance in the health system.

Conclusion and the Way Forward

The Data Gebeta Initiative has demonstrated that grounding modern health information system (HIS) reforms in Ethiopia's rich cultural traditions can create meaningful and sustainable impact. The initiative successfully created a centralized hub where all HIS-related activities are harmonized and used for real-time decision-making and performance improvement.

The implementation of Data Gebeta has led to stronger collaboration among health workers, improved data use practices, reduced reporting delays, and increased ownership of data-driven processes at the facility. The model has proven particularly effective in transforming fragmented HIS functions into integrated and action-oriented platforms.

Moving forward, we call upon all stakeholders Ministry of Health, regional leadership, academic institutions, and partners to recognize the strategic value of Data Gebeta and support its national expansion. With sustained investment, policy alignment, and local innovation, Data Gebeta can serve as a cornerstone for Ethiopia's journey toward a high-performing, data-driven health system.

Enhancing Oxygen Availability and Sustainability Through a National Hub-and-Spoke Delivery Model in Ethiopia

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Introduction

Medical oxygen is a life-saving essential medicine with no substitution. It is critical for the prevention and treatment of hypoxemia, a condition marked by low oxygen levels in the blood that can lead to severe organ dysfunction and death if untreated (WHO-UNICEF, n.d.). Ensuring equitable access to medical oxygen can prevent avoidable deaths from life-threatening conditions such as neonatal complications, pneumonia, and other respiratory illnesses.

Recognizing its indispensable role in clinical care and the broader public health, Ethiopia has undertaken substantial efforts to expand access to medical oxygen, enhance quality, and strengthen the overall oxygen ecosystem. The Ministry of Health (MOH), in collaboration with key stakeholders, has increased the number of operational oxygen plants from three in 2016 to 58 in 2025. This increase in production capacity marks significant progress in addressing the country's healthcare needs, especially for managing neonatal complications, pneumonia, and other respiratory illnesses. Moreover, MOH, in collaboration with Clinton Health Access Initiative (CHAI) and other partners, has developed supply chain management guidelines, sustainable plant administration frameworks, along with operational and training manuals and SOPs to support effective implementation.

Despite these achievements, findings from the national oxygen roadmap evaluation revealed that the assessed plants were operating at only 55% of their potential capacity (MOH, 2021). This underutilization was primarily due to inadequate plant management, shortages of spare parts, and a lack of skilled personnel for preventive and corrective maintenance. Furthermore, surplus oxygen production is often not efficiently utilized; hospitals with oxygen plants neither generated revenue from excess supply nor improved access to catchment health facilities. These inefficiencies are exacerbated by the absence of a structured distribution network linking production sites to catchment health facilities, as well as the lack of an integrated delivery and communication system.

To address these gaps, CHAI, in collaboration with MOH, has prioritized the implementation of a nationally coordinated hub and spoke oxygen distribution model. This approach aims to link production facilities with catchment health centers and hospitals through structured, cost-effective, and reliable supply chains, thereby improving access, optimizing resource utilization, and ensuring the sustainability of oxygen delivery across the health system. Moreover, the revenue generated from the sale of medical oxygen to catchment health facilities will help cover expenses for spare parts, maintenance, electricity, and training for experts.

General Objective: To improve access to medical oxygen and ensure the sustainability of its production and reliable distribution system. Specifically,

- To improve the availability, accessibility and affordability of medical oxygen in health facilities
- To establish a reliable, cost-effective, and efficient medical oxygen distribution network
- To strengthen the financial sustainability of medical oxygen plants.

Method: The hub and spoke model implementation targeted oxygen-producing hospitals (hubs) and their respective catchment health facilities (spokes) across all regions of Ethiopia. This initiative is being collaboratively implemented by the MOH, RHBs, CHAI, and health facilities. During the preparatory phase, CHAI and the MOH and its line structures identified and documented project intervention oxygen production centers and their corresponding catchment facilities. Data were collected from hubs and spoke facilities to guide mapping. Hub data included GPS location, production capacity, host facility consumption, monthly surplus, and number of potential spokes. Spoke data included GPS location, facility type/level, and average monthly oxygen demand.

Criteria for hub and spoke networking include hubs' production capacity, availability of surplus, proximity to the hub, road accessibility, travel time, and cost-effectiveness.

This mapping exercise informed the development of a comprehensive guiding document, which included detailed supply route maps and a master list of production hubs and spoke health facilities. Sustainable financing directives have also been developed and approved by the respective RHBs to guide the management and daily operations of the plants, including establishing standard pricing for medical oxygen. The hub and spoke model is being implemented to support these approved sustainable financing directives.

Moreover, as part of the program implementation, capacity-building interventions were provided across the selected health facilities. These activities include the provision of oxygen cylinders, quarterly supportive supervision, technical support, targeted trainings for clinicians, biomedical engineers/technicians, pharmacists, and health workforce leaders to strengthen operational readiness and adherence to standard operating procedures. The intervention initially commenced in 911 health facilities before being scaled to the national level under the leadership of the MOH, demonstrating strong political commitment to expanding access to medical oxygen.

Results/outputs: To strengthen sustainability, RHBs and their respective production centers have adopted sustainable financing directives to guide oxygen plant management and authorize the sale of surplus production to catchment facilities. To date, more than 878 spoke facilities have been mapped in association with both public and private oxygen plants. Under the hub-and-spoke implementation approach, 348 spoke facilities currently receive oxygen from public oxygen plants. Currently, the initiative is scaled up and led by the MOH, with all public medical oxygen production hubs and their respective spoke facilities identified and networked nationwide. To support the hub and spoke initiative, CHAI is supporting MOH in the development of a guideline named "hub and spoke model implementation guideline".

The hub and spoke model was anchored in a sustainability framework that linked oxygen distribution to the financial viability of production hubs. By selling surplus oxygen to catchment facilities, hub hospitals are generating revenue to fund the procurement of spare parts and accessories, facilitating regular preventive and corrective maintenance. This self-sustaining approach aims to minimize production interruptions, improve service quality, and

enhance patient satisfaction. To date, fourteen oxygen plants have begun generating income from oxygen sales, with eleven establishing dedicated bank accounts. In addition to their own consumption, these hospitals with oxygen plants generated 22,707,463 Ethiopian Birr by selling the surplus production to catchment health facilities.

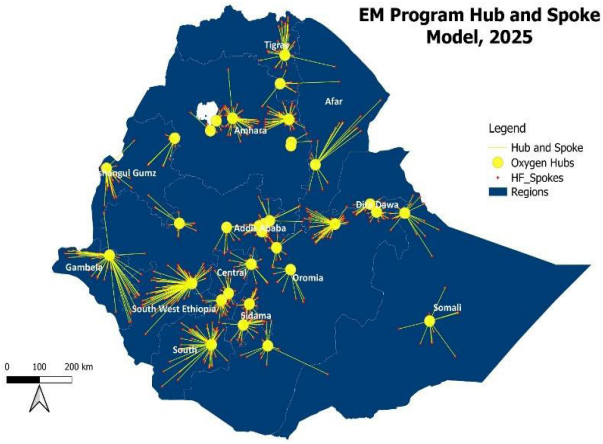

Figure 1 Hub and spoke networking model

Conclusion and the way forward: Based on comprehensive efforts to date, the hub and spoke model is emerging as a successful and sustainable pathway for the medical oxygen supply system. By systematically linking previously underutilized oxygen production hubs with hundreds of spokes, this initiative not only addresses critical gaps in access but also establishes a robust framework for financial sustainability. The revenue generated from the sale of surplus oxygen allows hubs to fund essential maintenance and procure spare parts, moving the system from a dependency model to a self-sustaining one. This strategic approach, which is considered for scale-up by the MOH, represents a significant step towards ensuring a reliable and cost-effective oxygen supply chain nationwide.

To fully realize this initiative, a concerted and unified effort from all stakeholders is essential. It requires health managers to champion this initiative through continued policy support and resource allocation. Healthcare leadership and professionals at different levels should be equipped with the necessary training and adhere to operational guidelines to ensure efficient utilization. Furthermore, the active participation of health facilities and all relevant stakeholders will be crucial for building a resilient and responsive health system.

References:

1. MOH.(2021).*Ethiopian_Medical_Oxygen_Roadmap_II*.
2. WHO-Unicef. (n.d.). *Technical specifications and guidance for oxygen therapy devices. Geneva: World Health Organization and the United Nations Children's Fund (UNICEF), 2019 (WHO medical device technical series). Licence: CC BY-NC-SA 3.0 IGO.* http://apps.who.int/bookorders.

Farm to Pharm: Strengthening Local Inputs through Cassava Starch Production

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Introduction

Starch which is extracted from cereal grains like wheat and corn, tubers such as potatoes, cassava, and arrowroot is a naturally occurring powder that serves as a vital material in a variety of industries, including pharmaceuticals, food and beverages, textiles, and cosmetics. (Oyalade, 2025)

The availability of inexpensive and high-quality starch found in cassava can be widely used as a filler material and bonding agent in the making of tablets, capsules, and powder formulations. (Adewole, 2024)

Starch derived from the cassava contains low amount of amylose in waxy cassava starch compared to other types of starch, which supports the various prime benefits including low gelatinization temperature, low retrogradation rates, higher swelling rate and produces comparably high viscosity paste, makes it preferable as an excipient for pharmaceutical applications. (Olagunju, 2024)

Locally the import dependent demand for starch has been increasing due to expanding industries; which creates a significant trade deficit and exposes industries to foreign market fluctuations. And recognizing the potential of locally available raw materials, recent initiatives have focused on developing Cassava cultivation and processing industries within the country.

This feasibility study assesses the technical, economic, environmental, and financial viability of establishing a cassava starch manufacturing plant in Ethiopia which aims to produce native, pre-gelatinized, and dextrin starch to meet rising domestic and regional demand in the pharmaceutical, food, and industrial sectors. And objectives are aligned with strategic goals:

- Enhancing food and pharmaceutical input security,
- Reducing import dependency,
- Creating rural employment and value addition opportunities, and
- Tapping into export markets (especially COMESA)

Objective

The main objective of the study is to conduct a full-fledged feasibility study to determine the viability of establishing a Cassavas Starch development as local industrial input manufacturing plant by critically evaluating market, technical, and financial viability.

Methodology

The study draws on integrated primary and secondary data, including:

- Field visits to cassava-growing regions
- Stakeholder consultations
- Comparative analysis of starch technologies
- Local and export market studies, and
- Engineering, financial, and environmental modeling across three volumes.

The analysis uses internationally accepted feasibility assessment tools, UNIDO'S COMFAR, while adhering to local regulatory and policy frameworks.

Expected Outcome

A. Technical and Operational Feasibility

Product Mix: The plant will produce three main products and the total investment cost of the project is estimated at Birr 657.69 million

- Native cassava starch
- Pre-gelatinized starch
- Dextrin (modified starch)

Annual Production Capacity (at full capacity):

- 8,600+ tons of native starch
- 1,200 tons of pre-gelatinized starch
- 4,800 tons of dextrin

Technology: Proven, scalable, and Good Manufacturing Practice (GMP)-compliant process lines, each with advanced controls for hygiene and quality. Native starch extraction includes wet milling, drying, and purification, while pre-gelatinized and dextrin starch are produced using extrusion and acid hydrolysis.

Inputs and Utilities:

- Primary raw material: cassava root (approx. 32,000 tons/year)
- Utilities: electricity, treated water, and process chemicals

Human Resources: 117 full time one shift operation staff with indirect employment in farming, logistics, and services.

B. Market Feasibility

Local Demand:

- Starch demand in Ethiopia is growing steadily and imports dominate the market, over 6,700 tons projected in 2025, which about 20% of it is pharmaceutical-grade starch.
- Only one local plant (Astuko) produces starch at a small scale (~30 tons/year), leaving a large supply gap.

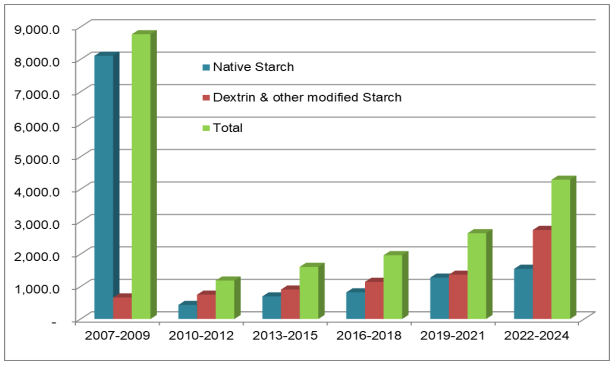

Figure 4: Local Import Trend of Starch with Three Years Interval Period (in Ton)

Export Potential:

- Regional demand, particularly in COMESA, is expanding. Member countries import over 110,000 tons/year of starch, mostly native and modified types.

- Ethiopia has favorable export positioning via AfCFTA and duty-free access to EU, China, and U.S. markets.

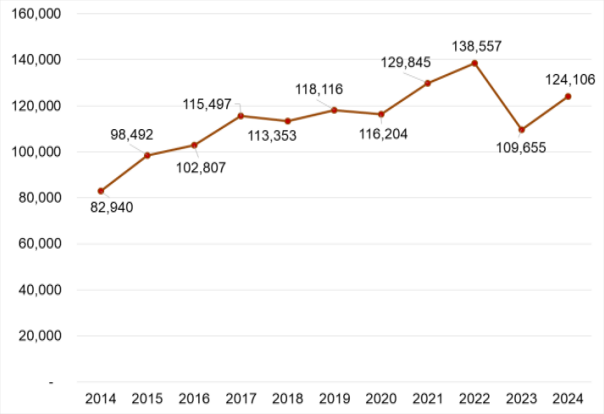

Figure 5: Imported Trend of Starch by COMESA Region (in Ton)

Competitive Advantage:

- Availability of low-cost raw materials,
- Government incentives
- Strategic proximity to port infrastructure and high-potential agro-climatic zones.

C. Environmental and Site Feasibility

Site: The feasibility study team conducted a comprehensive field visit. and also, the team employed a systematic and structured approach by developing a decision matrix. This matrix was designed to evaluate potential locations based on a comprehensive set of social, economic, and environmental parameters and Sodo (Wolaita Zone) selected as optimal site using multi-criteria analysis (access to raw materials, roads, energy, water, and workforce).

Land Use: ~15,000 m² required for facilities.

Environmental Compliance:

- Wastewater management systems and emission control plans proposed.
- Minimal ecological disruption anticipated.
- Positive environmental impact through import substitution and efficient land use.
- Sustainability Risks:
- Potential supply volatility due to climate change or pests.
- Solutions proposed include use of resilient cassava varieties, local sourcing models, and integrated pest management.

Economic and Financial Analysis

Key Highlights

- Total Investment Cost: Mid-to-high range of nine-digit local currency
- Investment Split: ~50% foreign currency; ~50% local
- Revenue (at full capacity): Upper mid-to-high nine-digit local currency/year
- Cost of Production: Moderate-to-high nine-digit local currency/year
- Internal Rate of Return (IRR): Strong double-digit rate (>50%)
- Payback Period: <4 years
- Break-even Point: ~25–30% capacity utilization
- NPV (Discounted @ 20%): Over 1 billion in local currency

Employment and Rural Development

- Direct employment: ~120 jobs
- Indirect employment: 1,000+ through supply chain (farmers, logistics)
- Contribution to rural industrialization, increased farmer income, and local economic diversification.
- Sensitivity Analysis: the project remains viable under stress scenarios:
- 20% increase in costs
- Delays in implementation
- Raw material price fluctuations
- This resilience enhances its attractiveness to financiers and development partners.

Policy Implications and Recommendations

Strategic Opportunities

- Subsidies & Incentives: Incentives for farmers and processors.
- Public-Private Partnerships (PPP): Enhance input supply by contract farming and out grower models.
- Infrastructure: Invest in rural feeder roads, power extension, and irrigation systems in cassava zones.
- Technology Transfer: Facilitate access to cGMP processing technologies and local adaptation of best practices.
- Regulatory Support: Expedite standards development for pharmaceutical-grade starch and streamline licensing.

Risks and Mitigation

- Climate Variability: Promote climate-smart agriculture and crop insurance
- Market Volatility: Stabilization funds; import substitution mandates
- Logistics & Infrastructure: Strategic investment in rural logistics corridors
- Supply Chain Gaps: Establish farmer cooperatives and structured aggregation systems

Alignment with National Development Goals

Homegrown Economic Reform (HGER): Supports import substitution and industrial development.

10-Year National Development Plan: Contributes to inclusive industrialization & rural transformation.

Health Sector Goals: Enhances local pharmaceutical input manufacturing for medicine security.

Conclusion and the way forward

Conclusion

The project is technically sound, financially viable, environmentally acceptable, and socially beneficial. With targeted public sector support and appropriate investor engagement, it can be a cornerstone agro-industrial project.

The way forward

- Secure investment
- Formalize raw material sourcing contracts,
- Finalize regulatory clearances and environmental licenses,
- Launch procurement and construction for commissioning within 12 months,
- Establish institutional coordination for implementation monitoring.

References

1. Phuk an, M. and Nongkhlaw, F.T., 2022. Starch: an overview of its conventional and unconventional sources, pharmaceutical and industrial applications. *Current Trends in Pharmaceutical Research*, *9*(1).
2. Reagan, K.R. and Jonans, T., 2024. Comparison of Starch from Locally Grown Food Crops as a Pharmaceutical Excipient: A Systematic Review.
3. Swinckels, J., 2007. Industrial starch chemistry. *Agro by Nature*, *1*(1), pp.1-56.
4. Oyelade, O. J., Adebowale, K. O., & Lawal, O. S. (2025). *Application of starch and starch derivatives in pharmaceutical formulation.*
5. Adewole, O. A., & Bamidele, F. A. (2024). *Advances of cassava starchbased composites in novel and conventional drug delivery systems: a stateoftheart review.*
6. Olagunju, A., & Aderibigbe, B. A. (2024). Advances of cassava starchbased composites in novel and conventional drug delivery systems.

From Policy to Impact: Progress in Implementing Ethiopia's New Catch-Up Vaccination Policy

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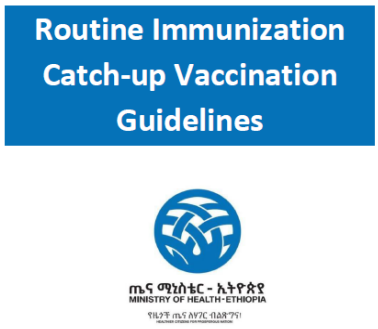
Background

A clearly defined catch-up vaccination policy and schedule is essential to any national immunization program and should operate continuously. Catch-up vaccination refers to the action of vaccinating an individual, who for whatever reason is missing or has not received doses of vaccines for which they are eligible, per the national immunization schedule. Its role is especially critical when emergencies disrupt routine services, as such interruptions can rapidly increase the number of susceptible individuals and trigger vaccine-preventable disease outbreaks.

Significance of the policy

In 2022, Ethiopia faced a drop-in immunization coverage, particularly in conflict-affected areas, Internally Displaced Person (IDP) settlements, pastoral, geographic hard to reach and drought-affected zones. WHO–UNICEF estimates showed Penta-1 coverage stagnating at 71% (2020) and 75% (2021–2022), leaving many children unprotected from vaccine-preventable diseases. Since 2021, measles outbreaks have occurred in 496 woredas, causing over 84,000 cases and 667 deaths, while 146 cVDPV2 cases have been reported since 2019, with an ongoing outbreak. In response, the Ministry of Health launched a catch-up vaccination policy targeting zero-dose and under-vaccinated children (for those aged less than five years), aiming to close immunity gaps caused by service disruptions due to multiple crises.



Catch-up vaccination policy implementation process

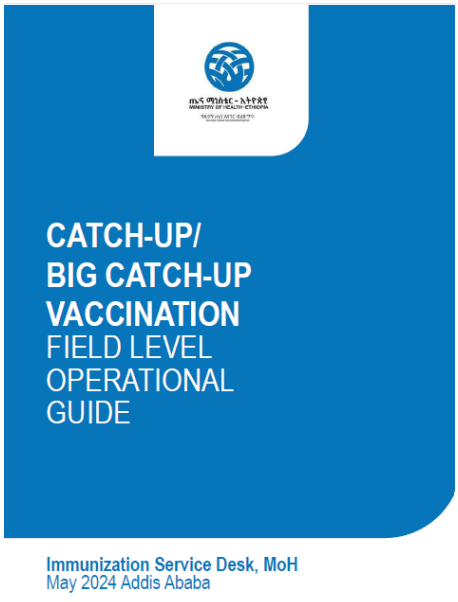
Implementation of the catch-up vaccination policy involved developing a training guide, conducting cascade trainings, and customizing recording and monitoring tools within existing systems and reporting through Google Sheets

Picture: High level advocacy on catch vaccination to regional state presidents

The program was bolstered by the global Big Catch-up initiative launched in 2023 following global immunization coverage drop due COVID19 pandemic effect, which led the MoH to prepare "Accelerated Big Catch-up Plan" in December 2023 to accelerate the catch-up vaccination. This plan aimed to vaccinate backlogs of zero dose and under-vaccinated children quickly, securing Gavi support for vaccines (Penta, MCV, IPV, Rota, and PCV) without co-financing requirements, and leveraging operational budgets and technical expertise.

BIG-Catch-up plan to reach zero-dose, and under-vaccinated children in Ethiopia

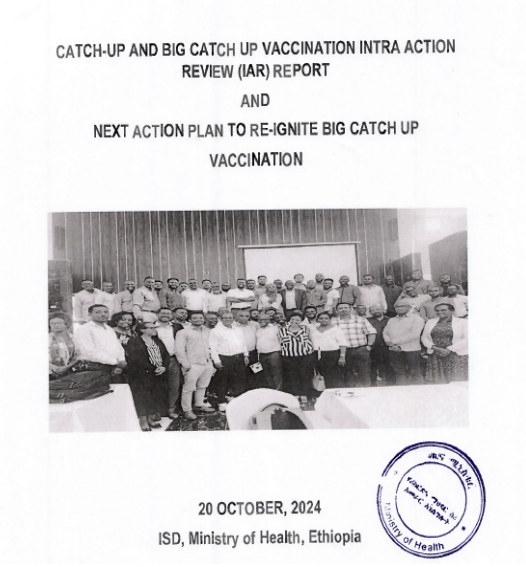
Using EDHS 2019 and a 2022 zero-dose evaluation survey, MoH initially estimated 3.9 million zero-dose children out of 17.5 million under-five children; during implementation and revised zero dose estimation recently in June 2025 using updated survey data and the re-estimated backlog zero dose children became 2.9 million.



Midway through implementation, challenges persisted in identifying and reaching zero-dose children, mobilizing communities, and monitoring progress. To address these, the MoH developed a practical Catch-up and Big Catch Up (BCU) Operational Guide outlining vaccine schedules, identification methods, recording and reporting procedures, service integration, community mobilization, and achievement validation, with more emphasis on timely vaccination.

Supportive supervision and mentorship were central to institutionalizing the policy, with regular oversight from MoH, regions, zones, woredas, and partners. The Rapid Community Survey (RCS) tool was deployed to validate kebele-level performance, providing quick, accurate, house to house data on vaccination coverage, socio-economic factors, and barriers informing actions to improve immunization services.

In October 2024, the MoH conducted an intra-action review to assess progress, identify good practices, and address gaps. Based on the findings, a re-ignition plan was developed with partners, cascaded to regions, and adapted for local implementation.



Implementation results, lessons, challenges and ways forward

Result

Since the launch of the catch-up vaccination policy, Ethiopia has identified and vaccinated more than 1.4 million zero-dose children as of July 2025. While some regions have performed well against their estimated zero-dose targets, this does not mean all zero-dose children have been reached, as new zero dose children continued to be identified. Overall, Ethiopia has addressed nearly 48% of zero dose children from the re-estimated zero-dose backlog target.

In addition, the catch-up vaccination effort has strengthened other essential health services, including Vitamin A supplementation, deworming, nutritional screening and management, and others.

Table 1: Catch-up vaccination performance by region as of July 2025

Region	Estimated Zero dose children (12-59 months)	# of Zero dose children vaccinated	Coverage (%)
Addis Ababa	9,150	839	9%
Afar	98,295	90,218	92%
Amhara	616,427	186,966	30%
Benishangul-G.	29,132	24,007	82%
Central Eth	168,234	40,877	24%
Dire Dawa	3,428	3,667	107%
Gambella	12,682	13,292	105%
Harari	6,723	1221	18%
Oromia	943,095	420,590	45%
Sidama	157,163	69,613	44%
Somali	376,474	354,974	94%
South Eth	201,870	74,804	37%
Southwest Eth	96,117	53,600	56%
Tigray	197,926	79,125	40%
Total	2,916,716	1,413,793	48%

Challenges

Catch-up vaccination has been implemented despite several challenges, some of the major ones listed below identified during intra action review and supportive supervision for consideration in future improvements:

- Persistent misconceptions about zero-dose children among lower-level health workers, with some claiming, "We don't have zero-dose children in our catchment area," often due to fear of accountability.
- Ongoing gaps in awareness of zero-dose definitions, catch-up vaccination schedules, approaches, and strategies is also needing attention.
- Low community awareness about catch-up vaccination for children over one year of age is a demand side barrier.
- Recording and reporting processes have not yet reached optimal levels.
- Funding gaps hinder the identification and vaccination of zero-dose and under-vaccinated children in hard-to-reach areas.
- Difficulties in distributing vaccines and supplies to hard-to-reach areas, such as conflict-affected or remote communities.
- Gaps in monitoring at lower levels, with supportive supervision and rapid community surveys being limited and insufficient.
- Discrepancies between survey-based estimates of zero-dose children and actual numbers found on the ground, which has affected implementation and prompted some regions to question the estimates.

Good practice

Despite challenges, the following good practices can be applied to other programs:

- A field operations guide was developed and shared with all stakeholders to ensure consistent catch-up implementation nationwide.
- Regular monitoring and review were conducted through virtual platforms, supportive supervision, and in-depth intra-action reviews.
- Orientation training was provided to the health workforce through integrated approaches.
- The MoH leadership designated catch-up vaccination as a flagship initiative and tracer indicator to monitor accessibility of other essential health services.
- Advocacy efforts targeted higher officials at national and subnational levels.
- Household level searches for zero-dose children helped identify and vaccinate large numbers of children.
- Catch-up activities were integrated with various service delivery opportunities.
- Spot messages were developed and broadcast via TV and radio.
- Humanitarian partners and CSOs were engaged to support implementation and distribute logistics to hard-to-reach areas.

Lessons learned

The following lessons are important for sustaining catch-up vaccination implementation:

- Any new policy requires intensive follow-up and time to be fully accepted, operationalized, and matured.
- Identifying and vaccinating zero-dose and under-vaccinated children is a resource intensive activity.
- Integrating catch-up vaccination with other campaigns and health services produces strong results with minimal additional resources.
- Periodic in-depth reviews and improvement actions are essential to fast-track implementation.
- Leadership engagement greatly facilitates resource mobilization and deployment.
- Re-estimating zero-dose children using new evidence enables better planning and helps save resources and effort.

Conclusions

Ethiopia's catch-up vaccination policy has made significant strides, vaccinating over 1.4 million zero-dose children nearly 48% of the re-estimated backlog while also strengthening routine immunization and other essential health services. Implementation faced notable challenges, including misconceptions about zero-dose children, funding and supply chain gaps, low community awareness, and inconsistencies in data and monitoring. Nevertheless, strong leadership, clear operational guidance, integrated service delivery, targeted advocacy, and community level outreach and mobile team vaccination have emerged as good practices to progress more. Sustaining progress will require continued resource mobilization, integration with broader health initiatives and primary health care services, robust monitoring, and periodic reassessment to refine strategies are very critical ensure every child is reached through routine and catch-up vaccination.

Alliance for Gender Awareness and Resourcefulness (AGAR) in Health information system and Digital Health

Ferehiwot Kassahun Miteku [1], Abebaw Gebeyehu Worku [1], Wubshet Denboba Midekssa [1]

[1] John Snow Institute - Ethiopian Data use partnership

Introduction:

Women are the largest stakeholders in health, they are primary caregivers, frontline health workers, and often the first to access health services for themselves and their families. Yet, their representation and involvement in health data management, particularly in decision-making platforms, remains disproportionately low. This disconnect undermines the inclusivity and effectiveness of Ethiopia's Health Information System (HIS) and Digital Health (DH) ecosystem. Despite their pivotal role in the health system, women's perspectives are often missing from the processes of data generation, interpretation, and use, resulting in a gender-blind evidence base for policy and planning. Addressing this gap is essential to realizing the goals of Ethiopia's Health Sector Development and Investment Plan (HSDIP), which emphasizes inclusive, equity-driven, and data-informed health system transformation.

Informed by a comprehensive gender analysis conducted jointly by the Ministry of Health (MOH), JSI's Data Use Partnership (DUP), and Digital Health Activity (DHA), Ethiopia developed its first-ever Gender Mainstreaming Strategy in HIS/DH (2023/24–2025/26). The analysis revealed critical gaps: a male-dominated HIS/DH workforce; limited integration of gender considerations in data tools and governance documents; insufficient gender-sensitive data use in performance monitoring; minimal female representation in data-driven decision-making forums, and lack of gender considerations in design, development and deployment of digital tools and systems. In response, the strategy established five key strategic objectives:

1. Ensure gender-transformative data management and decision-making;
2. Integrate gender in HIS/DH governance tools and policies;
3. Build a gender-balanced and competent HIS/DH workforce;
4. Strengthen partnership and collaboration for gender-responsive systems; and
5. Promote gender awareness and responsiveness in digital tool development and use.

It is within this strategic framework that the Alliance for Gender Awareness and Resourcefulness (AGAR) was designed and launched. AGAR represents an innovative initiative that operationalizes the national strategy through a dynamic model of women-centered capacity development. Grounded in behavior change theory and participatory learning, AGAR empowers women professionals across the HIS/DH spectrum to become Women Data Champions, leaders who are technically proficient, gender-aware, and positioned to drive change from within the health system. By embedding gender perspectives into the core of data governance, leadership, and use, AGAR is transforming the way Ethiopia's health system generates, interprets, and acts on health data, making it more inclusive, accountable, and aligned with HSDIP priorities.

Objectives:

AGAR aims to develop the technical capabilities, expertise, and leadership skills of the women health workforce within the health system on comprehensive data management, analysis, utilization, and gender integration in health data and health information systems that are needed to manage and use effective health information systems and data systems in a sustainable manner to contribute significantly to informed and timely decision making.

Specific Objectives

- Empower women professionals within the health system through tailored capacity-building initiatives that develop technical competence in data management, analysis, use, and leadership.
- Increase women's representation and participation in data governance platforms, including HIS management, performance review forums, and decision-making processes.
- Integrate gender perspectives into HIS/DH systems by promoting women's contributions to the design, revision, and utilization of gender-sensitive tools and data use practices.

Method:

AGAR employs a comprehensive, phased, and participatory implementation approach that is grounded in behavior change theory and systems-thinking. Designed as a national initiative to empower women and enhance gender integration in Ethiopia's HIS/DH, AGAR centers on capacity building, mentorship, and institutional transformation to empower women professionals as champions of data use.

AGAR is anchored in the Stages of Change Model, which acknowledges that behavioral change is a progressive journey. Women professionals often enter the program at different levels of readiness, from unawareness to active leadership. AGAR uses this model to tailor interventions according to each participant's stage:

- Precontemplation & Contemplation: Raising awareness of health system, HIS/DH, data and data use gaps, and key concepts of gender
- Preparation: Equipping women with foundational knowledge through structured training
- Action: Enabling women to apply data for performance review and gender-informed decision-making
- Maintenance: Sustaining leadership roles in HIS/DH through mentorship, coaching, and practice-based engagement

This stepwise model is reinforced through Behavior Change Communication (BCC) strategies that promote continuous learning, self-efficacy, and recognition. Through this dynamic approach, AGAR aims to institutionalize a culture of data use across the health system.

Implementation Approach: AGAR's implementation follows a phased rollout model, beginning at the Ministry of Health (MOH) and expanding to Regional Health Bureaus (RHBs). This allows for a structured foundation to be built at the federal level, followed by a deliberate scale-up informed by learnings and capacity from the initial phase. The core components of the implementation include:

- Tailored Training Modules on HIS/DH, data quality and analysis, gender in HIS, and leadership/governance
- Group and Virtual Mentorship to support professional growth and application of skills
- Learning-by-doing Assignments and QI Projects to reinforce practical application

- Graduation and Transition of women into a pool of Women Data Champions and future trainers

AGAR's approach ensures contextual relevance, technical rigor, and mentorship continuity, creating a strong and sustainable pool of gender-aware HIS/DH professionals.

Results:

The AGAR initiative has successfully demonstrated its transformative potential by equipping a cohort of women professionals at the MOH with the skills, confidence, and leadership in data management and to integrate gender perspectives into the HIS/DH. Launched as a pilot within the MOH, AGAR followed a phased approach and laid a strong foundation for scale-up to RHBs.

A key milestone was the creation of a pool of expert trainers and mentors from JSI/DUP, the MOH, and partner institutions. These experts were oriented on gender integration in HIS/DH, adult learning principles, and mentorship, ensuring the delivery of high-quality, context-sensitive training. Importantly, a pipeline of high-performing AGAR graduates is now transitioning into mentorship roles, reinforcing the program's sustainability.

The first cohort of 24 women professionals, selected through a competitive and inclusive process, underwent a six-month modular training covering HIS fundamentals, data quality and analysis, gender integration, and leadership in HIS/DH. Each module was complemented by group mentorship, virtual coaching, and on job assignments. This blended approach fostered strong peer learning, knowledge application, and confidence-building.

As part of their learning, participants developed and implemented quality improvement (QI) projects addressing real time health system-level challenges. The quantitative and qualitative data confirm AGAR's effectiveness:

- Knowledge Gains: Average summative assessment scores rose significantly across all modules—from 12.2 to 24 out of 25 reflecting near-expert mastery.
- Perceived Skill Transformation: "No skill" responses dropped from 16.7% to 0%, "Limited skill" dropped from 33.3% to 0%, "Advanced skill" rose from 10.8% to 39.1, and "Expert skill" surged from 0% to 52.2%.
- Participants reported significant increases in confidence, leadership readiness, and their ability to apply gender-sensitive perspectives in data collection, analysis, and decision-making processes. As one participant noted, *"Using the data analysis and gap identification skills I gained, I was able to design a quality improvement project to minimize the onset of malaria epidemics by identifying areas where cases are high and highly concentrated, and tailoring interventions to control the cases and prevent their migration to non-endemic areas."*

AGAR's successful implementation was driven by several key strategies: a tailored, modular training curriculum aligned with national HIS/DH priorities; a structured mentorship approach that blended group and virtual support; and a deliberate trainee selection process that prioritized motivation, diversity, and institutional alignment. The integration of practical quality improvement projects enabled immediate application of skills, while formal recognition and graduation reinforced visibility and momentum. Strong collaboration with the MOH and partners ensured institutional ownership and multisectoral engagement, critical factors that positioned AGAR as a scalable and sustainable initiative.

Conclusion & Way Forward

AGAR has demonstrated that advancing gender equity in Ethiopia's health information system is not only possible but essential for building a responsive, inclusive, and data-driven health sector. By empowering women professionals through targeted training, mentorship, and practical leadership opportunities, AGAR has contributed to closing the gender gap in HIS/DH and laid the groundwork for a stronger, more representative health workforce. The initiative has shown measurable improvements in knowledge, confidence, and the application of data use and decision-making across key MOH departments. The success of the pilot has garnered strong institutional support and positioned AGAR as a key contributor to the national Gender Mainstreaming Strategy in HIS/DH. Building on this momentum, AGAR is now in its preparation phase, laying the foundation for regional scale-up in the coming year .

Picture 1: AGAR women data champions graduation, June 28,2025 Addis Ababa, Ethiopia

References

1. Federal Ministry of Health, Health Sector Development and Investment plan 2023/24-2025/26. Addis Ababa, Ethiopia
2. Federal Ministry of Health (2016). Information Revolution Roadmap, Addis Ababa, Ethiopia
3. Federal Ministry of Health, Gender Mainstreaming Strategy for health information system and digital health, 2023/24-2025/26. Addis Ababa, Ethiopia
4. National Health information system Strategic plan (2020-2025)
5. Stages of Change theory: https://www.ncbi.nlm.nih.gov/books/NBK556005/
6. The Gates Foundation's Gender Equality Toolbox

First Integrated Diagnostic Service Center through Public-Private Partnership within the health sector in Ethiopia.

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Introduction

Despite improvements in access to basic health services, significant challenges remain in effectively curbing what is referred to as the 'triple burden': communicable, non-communicable diseases, and trauma and injury. Evidence suggests that the public expects a more comprehensive, quality, and affordable healthcare service. Besides, because of lack of some advanced diagnostic tests in the country many tests are referred abroad leading to individuals to financial hardships and draining the country's hard currency. To respond to this growing demand, the Ministry of Health (MOH) is seeking alternative viable modalities to provide such healthcare services. One of the strategic goals in the MOH's Health Sector Medium Term Development Investment Plan (HSDIP) is to enhance private sector involvement and health finance through the raising of private funds and creative financing models to support health sector infrastructure, manufacturing, and service delivery.

Accordingly, the MOH initiated the project, Integrated Diagnostic Service Center (IDSC) under a Public-Private Partnership (PPP) in partnership with the Ministry of Finance with St. Peters Specialized Comprehensive Hospital with the technical assistance and support of Clinton Health Access Initiative as transaction advisor with the initial funding from BMGF. The MOH announced the signing of the letter of intent between public and private parties in Ethiopia's first-ever IDSC under a Public-Private Partnership (PPP) agreement, in partnership with the Ministry of Finance, St. Peter Comprehensive Specialized Hospital, and private sector partners.

This ground-breaking project aims to improve access to top-notch laboratories, pathology and imaging services, boost diagnostic capacity, and ensure timely, and accurate diagnosis for patients in Addis Ababa and from across the country. It addresses longstanding challenges related to the limited availability, inconsistent quality, and delays in diagnostic services issues that have led to a high rate of referrals to non-public diagnostic providers and sometimes abroad. These referrals often expose patients to financial hardship and can result in delays or missed opportunities for essential healthcare. Comprehensive diagnostic testing and fast result delivery will be made possible by the Integrated Diagnostic Service Center which unifies pathology, radiology, and advanced laboratory services under a single, coordinated platform augmented by a sample referral system.

Objective: The primary objective of the project is to ensure availability and accessibility of quality but comprehensive diagnostic services (laboratory, pathology and imaging services) to the public through implementation of PPP.

Methodology (Project Structuring): The IDSC project is a national Diagnostic Services, which will be based in St. Peter Comprehensive Specialized Hospital with the model of DBFOMT (Design, Build, Finance, Operate Maintain, and Transfer). The project is intended to serve patients of the host hospital and those of the six federal hospitals who could not get diagnostic services because of different reasons using sample and specimen transport system for laboratory and pathology services and patient transport for imaging services.

The IDSC is positioned to change how patients in Ethiopia access critical diagnostic services. It is a unique collaboration known as a PPP uniting the MOH, St. Peter Specialized Comprehensive Hospital, global and local health diagnostic leaders such as Cerba Lancet Africa (CLA), International Clinical Laboratories (ICL), and Pioneer Diagnostic Center (PDC), along with banks, insurers, and other key partners.

PPP signatories: St. Peter's Specialized Comprehensive Hospital, and the winning private sector consortium have signed a formal agreement, which will lead to the creation of a special purpose vehicle to implement the IDSC.

MoH and Public hospitals on board: MOH, St. Peter Specialized Comprehensive hospital and the six Federal hospitals have already signed a tripartite referral agreement for the purpose of exclusively referring diagnostic tests unavailable in their facilities to the IDSC.

How it is funded: Private partners' investment will cover the total cost of the project, both capital as well as operational costs and will finance the cost from the revenue collected from users. The private operator will receive reimbursement from Addis Ababa Health Bureau and Ethiopian Health Insurance Service for community-based health insurance (CBHI) insured patients and collect out of pocket payment from non-insured public patients based on the regulated public user fee. The private operator will also collect payments from walk-in patients from the private sector and self-referred patients based on the agreed price. The capital investment of IDSC is estimated to be 2.7 million USD augmented with St Peter Comprehensive Hospital's in-kind contribution of diagnostic equipment valued at 2.9 million USD. The project period will be a total of 13 years (maximum of one year for setting up and preparation and twelve years for operation). The Financial Model analysis conducted by CHAI was validated by Expertise France, having experience in PPP appraisal and implementation. The MOH already demonstrated its commitment to de-risking the IDSC project through revenue and payment guarantee mechanisms to manage the payment delay and demand risk of public patients by communicating officially to Ministry of Finance.

Results/outputs: In October 2021 the PPP board, chaired by Ministry of Finance approved the IDSC Prefeasibility Study and registered the project as pipeline project for Ministry of Finance. In May 2022, the PPP board approved Diagnostic Feasibility Study to move forward with tendering and its outcome of the tender, award of the project to winning bidder held on December 2024. In July 2025, negotiation with the winning bidder was finalized and a letter of intent signed by Ministry of Finance, St Peter Hospital and the winning consortium members. This milestone marks the beginning of a long-term public-private partnership aimed at making quality diagnostic services more accessible, timely, and affordable—ultimately contributing to a healthier community.

The project is expected to accomplish the government's key goals in ensuring universal health coverage in the following ways:

- **Expand menu of tests:** Partnering with the private sector will expand the menu of test on offer by leveraging private sector resources and capabilities to fill service gaps or provide additional capacity.
- **Timeliness:** Partnering with the private sector can improve the availability of tests by ensuring a consistent supply of quality reagents and limit instrument downtime.

Private laboratories typically have shorter turnaround times for tests, and associated Laboratory Information Management Systems to ensure efficient and accurate transfer of laboratory results.

- **Cost effective:** Private partners can leverage more efficient labor forces and workflows, utilize increased purchasing power, and share knowledge and best practices to lower the cost per test.
- **Quality:** Private partners will improve the quality of diagnostic services through increased training, quality control testing, standardized reagent quality and adherence to accreditation and certification requirements with availability of a reliable testing services and an expanded menu in the public sector, more patients will use the service instead of sending samples outside the system. This will reinforce the national public health services.

Key Features of the initiative:

- The main characteristics of the initiative include Integrated Approach: specialized diagnostics, imaging, and laboratory services are provided under one roof.
- Cutting-Edge Technology: the launch of contemporary diagnostic tools that adhere to global standards.
- Capacity Building: Ongoing education and skill development for medical personnel.
- Better Access & Equity: Everyone may now access high-quality, reasonably priced diagnostic services.
- Sustainable Operations: Public and commercial partners working together to invest, share risks, and manage.

Challenges and lesson learnt: The project has proven to be a complex, multi-stakeholder undertaking involving public institutions across the health insurance system, six federal hospitals, MOH, and the Ministry of Finance. The successful tendering and procurement process and the milestone achieved underscore the importance of strong collaboration in navigating regulatory frameworks and aligning diverse institutional priorities.

- The country had limited technical experience in designing and executing PPP projects within the health sector, and a lack of experience among private sector actors in collaborating with public institutions on medium- to long-term initiatives.
- The project also struggled with complex stakeholder dynamics, requiring repeated engagement and awareness efforts. Planning issues such as inadequate resource allocation and poor stakeholder identification further complicated the progress. Regulatory gaps, including outdated user fee structures that failed to cover all diagnostic services, and recent macroeconomic policy shifts, added to the difficulties. Addressing these challenges required strong political commitment, institutional capacity building, stakeholder engagement, advocacy, and regulatory updates.

Conclusion and the way forward: The initiative is expected to bring better patient outcomes and more effective health system performance through improving availability, accessibility and affordability of quality and comprehensive diagnostic services to the public, which is crucial in early disease detection, enhanced clinical decision-making, and decreased diagnostic delays. The project will also bring significant savings for patients through availing affordable and quality diagnostic services, which would otherwise be paying high direct and indirect cost associated with non-public offering of diagnostic services. This program is a turning point in Ethiopia's health history and demonstrates the effectiveness of strategic alliances in addressing urgent healthcare issues and advancing UHC. For next steps, the winning bidders' consortia will establish project company as per the commercial code and will sign the PPP agreement with St Peter Hospital to launch the implementation of the project.

Integrating Health into the Productive SafetyNet Program (PSNP)

Project HOPE-The People-To-People Health Foundation Inc. (Project HOPE)

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Introduction

Productive SafetyNet Program (PSNP) is Ethiopian government's flagship food security program. Evolving through several phases, currently in its 5th phase, PSNP targets 8 million extremely poor rural households vulnerable to shocks and food insecurity. In this phase, a system of integrated social services is included with a specific output as "Linkage to Available Social Services (LASS)". This primarily aims to address the multidimensional needs of PSNP targeted households.

Building on existing efforts and with financial support of Gates Foundation, Project HOPE implements a three-year PSNP (November 2023- October 2026). The underlying assumption of the project is that the PSNP platform would present an entry point to help communities improve their utilization of Reproductive Maternal Newborn and Child Health (RMNCH) services. PSNP has established structures at Kebele and community level to manage the public work (PW) activities and other community engagement activities. These include development agents (DAs), Forman/woman, site managers, team leaders. Such community level agents and the PSNP platform such as public work sites and farmers training centers (FTCs) will be used as main strategy for community mobilization, referral and social and behavioral change communication (SBCC) activities of the project. The project will provide capacity building training for these actors to make them health oriented and equip them with basic community mobilization skills.

Goal

To contribute to the improvement of RMNCH outcomes among vulnerable population through the integration of minimum health service package in the PSNP platform.

Objectives

- Test the integration of minimum health service package into Ethiopia's flagship development platform (Productive Safety Net Program) to reach vulnerable and underserved sub-populations.
- Improve access and utilization of basic RMNCH services among PSNP beneficiaries
- Use implementation science to generate evidence to inform policies and practices as to how to provide health service packages and effectively reach underserved population groups through integration and collaboration with existing development platforms.

Method

This project is implemented in 10 districts across three regions: Afar (2), Amhara (5) and Tigray (3). By utilizing the PSNP platform as an entry point, the project aims to directly target the most vulnerable and underserved sub-populations and provides services directly. Women in reproductive age groups, children under the age of five years and adolescent girls are primarily targets of RMNCH service delivery while the general PSNP targeted community will be reached through SBCC activities.

The project adopts an innovative approach to test the integration of minimum RMNCH service packages into the existing PSNP platform and generate evidence data informed advocacy for integrated services. The project comprises two main components and details of activities under each are described in the next sections.

- **Strengthening linkages to RMNCH service delivery:** This component focuses on improving coordination and collaboration between health and social service providers within the PSNP framework. It will involve establishing robust referral mechanisms and coordination platforms to ensure a seamless integration of RMNCH services into existing PSNP infrastructure. Project HOPE will facilitate community level service delivery using a "Hub" and "Spoke" model and ensure bi-directional referral linkages between communities and facilities. Emphasis will be placed on supporting community level service delivery, building capacity among service providers and PSNP implementers, standardizing service packages, and optimizing resource sharing to maximize the impact of integrated service delivery.

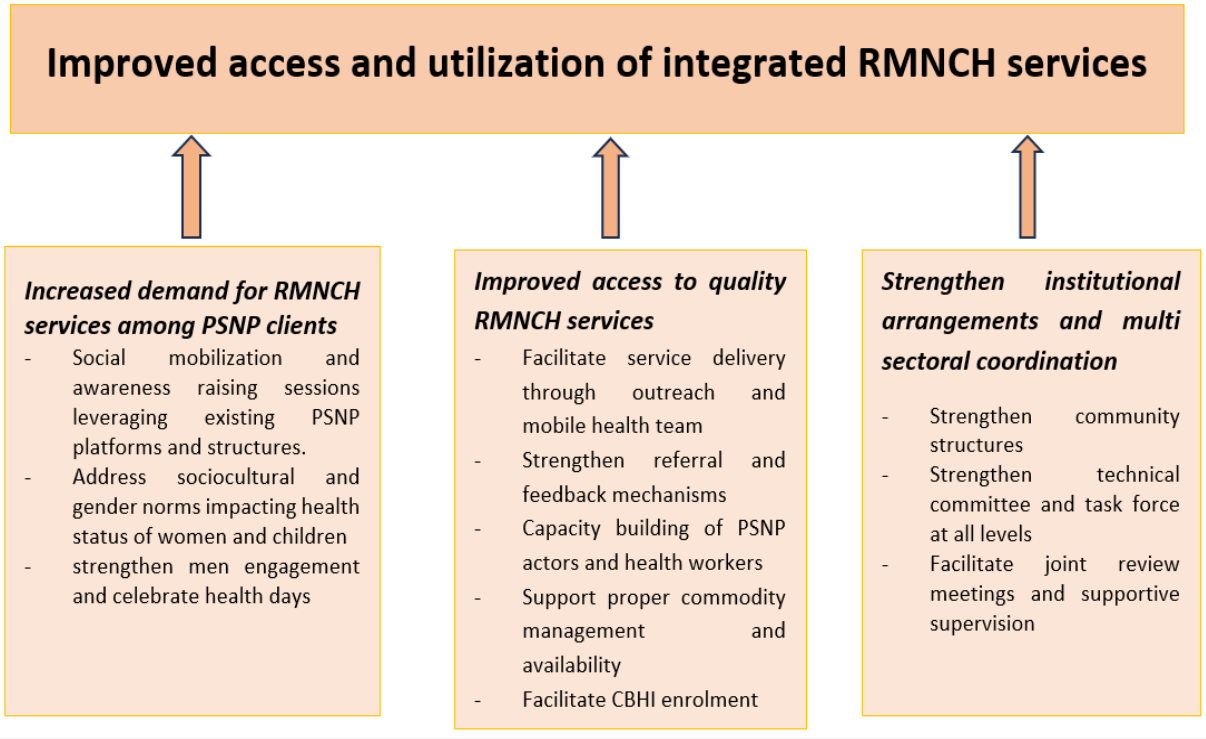

Figure 1 Intervention packages for integration of RMNCH into PSNP

- **Research to test integration:** Project HOPE will employ an implementation research approach, addressing scientific inquiries regarding implementation processes. Project HOPE will facilitate flexible, iterative, and cyclic inquiry by engaging independent groups of program implementers and researchers. The implementation research will be conducted over the same implementation period, focusing on monitoring real world execution of the model, with a particular emphasis on measuring impact, documenting implementation processes and understanding contextual factors influencing outcomes. It involves three rounds of evaluative quantitative assessments and five rounds of formative (qualitative) assessments during the three-year period (fig 2). The quantitative assessment (baseline, mid-term and endline evaluations) focuses on evaluating the extent to which the integration model has achieved its desired outcomes, with particular attention to address coverage and equity aspects. One formative assessment will be done with each quantitative assessment, and additional study will be conducted in between each of these.

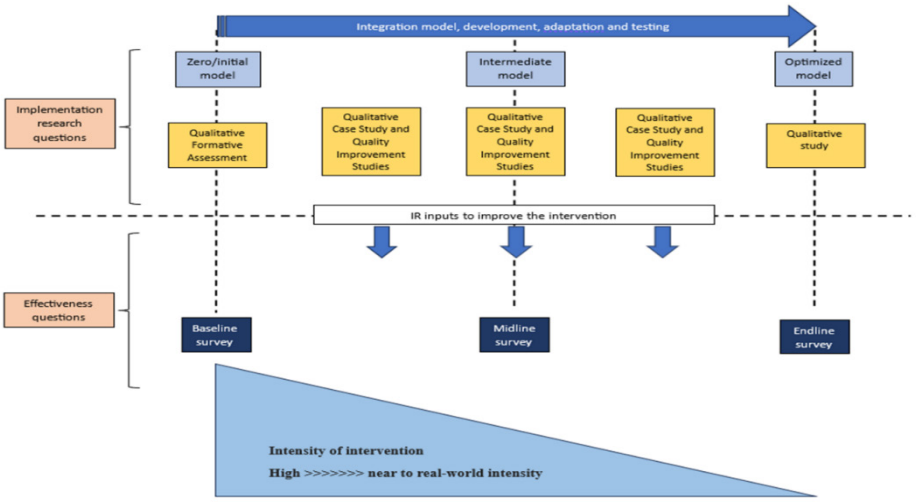

Figure 2 Schematic representation of the Effectiveness-Implementation Hybrid study

Result

The followings are major achievements of the project over the last year (July 2024-June 2025)

Increase demand for RMNCH services among PSNP beneficiaries

- Identified and trained 455 PSNP public work (PW) actors/ volunteer on basics of RMNCH and social mobilization skills before they engaged in the activities.
- Conducted SBCC activities such as health information and dissemination, social mobilization, and distribution of print medias and visibility materials for a total of 45,359 individuals, of whom 29,221 (64%) were female.
- Key messages delivered include: early ANC, immunization, institutional delivery, postnatal care after delivery, immediate breastfeeding after birth and exclusive breastfeeding, and health facility visit for sick child.

- Supported trained public work actors to regularly visit homes before and during the integrated outreach service delivery sessions and pass information on family planning, nutrition, immunizations, maternal health (ANC, PNC), and newborn and child health services offered at the outreach sites for the PSNP Beneficiaries. Accordingly, 15,820 home visits were made and 7,724 PSNP clients were linked to nearest health facilities.

Conduct outreach RMNCH service delivery in collaboration with hub health facilities

- Organized 862 integrated outreach activities in all targeted districts.
- About 83,261 medical consultations provided by a team of clinical nurses, health officers, and midwives, along with Health Extension Workers (HEWs) focused on sick child identification and treatment, immunization, malnutrition screening and referral, ANC, PNC, family planning and health education. Sixty-seven percent of the medical consultations provided focused on screening and referring cases of maternal and child malnutrition.

Multi sectorial coordination and collaboration

- Initiated close collaboration with existing national, regional, district and Kebele level coordination platforms which include the national Linkage to Available Social Services (LASS) technical committee, the Donor Working Group (DWG) led by World Bank (WB), food security task force and technical committee at region, district and Kebele level.
- Supported the revitalization of District and Kebele level food security taskforces as well as steering committees engaging key stakeholders.

Research and advocacy

- Conducted baseline survey and formative assessment
- Organized national regional and district level workshops to share key findings of the baseline assessment, present intervention packages and review the performance of the project.
- Conducted second round of qualitative (formative) assessment in selected six implementation districts to evaluate the project performance and integration strategies used

What are the facilitators and challenges identified/learned so far for effective implementation of the project?

Conclusion and way forward

The integration of RMNCH services into the PSNP represents a great opportunity to address the interconnected challenges of poverty and poor health outcomes at scale. Evidence from studies conducted and practical experience demonstrated that the integrated service delivery model is well accepted as a mechanism of improving health service access and utilization. Effective integration could be realized with stronger multi-sectorial coordination and strengthened systems for quality health service delivery. This will be realized through political commitment, financial investment, and sustained attention for institutional architecture, service delivery platforms, and information systems necessary to support integration.

Transforming Diagnostics in Ethiopia: The 2024–2029 National Strategic Plan for Accessible, Equitable, and Quality Diagnostic Services

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Introduction:

The National Diagnostics Service Strategic Plan (2024–2029) was developed by Ethiopia's Ministry of Health in recognition of the essential role diagnostics play in achieving Universal Health Coverage and ensuring quality healthcare services. Diagnostics, including laboratory, pathology, and imaging services, are foundational to accurate disease detection, patient management, and public health surveillance. Despite progress in expanding diagnostic access, challenges persist in quality, availability, equity, and integration of services across all health system levels. The plan aims to guide national efforts to strengthen diagnostic systems, standardize services, and address gaps in infrastructure, workforce capacity, and governance. The strategy aligns with Ethiopia's broader health sector transformation goals and global commitments such as the WHO Essential Diagnostics List and Sustainable Development Goals (SDGs).

Situational Analysis Result:

A comprehensive situation analysis revealed major gaps in the diagnostic landscape. Many facilities lack basic diagnostic capabilities, and access to advanced tests is limited to urban centers. Equipment is often outdated or non-functional due to poor maintenance systems. Human resource shortages, especially in radiology and pathology, significantly hinder service delivery. Quality assurance systems are weak, and most facilities are not accredited. Furthermore, there is fragmentation in service provision, poor integration between diagnostics and clinical care, and minimal use of digital health and Laboratory Information Management Systems (LIMS). Public-private partnerships remain underutilized, and data for planning and decision-making are scarce.

Development Process

The development of the National Diagnostics Services Strategic Plan was a comprehensive, inclusive, and evidence-driven process aimed at transforming diagnostic services across all levels of Ethiopia's healthcare system—primary, secondary, and tertiary facilities—in both urban and rural settings. Special emphasis was placed on underserved and remote areas where access to quality diagnostics remains critically limited. The strategy adopts a national implementation scope with phased interventions based on regional readiness, beginning with pilot projects in areas with foundational infrastructure.

A participatory approach was central to the strategy's formulation. The Ministry of Health (MOH), in collaboration with the Ethiopian Public Health Institute (EPHI), regional health bureaus, public and private health facility representatives, academic institutions, professional associations, and development partners, played an active role in shaping the strategy. Key structures such as the Technical Working Group (TWG) and National Advisory Committee (NAC) were established to oversee the technical and strategic direction of the plan.

The process was informed by a comprehensive diagnostic landscape assessment and desk reviews of global and national best practices. Multiple rounds of stakeholder consultations and validation workshops were conducted to identify service gaps, prioritize strategic interventions, and ensure alignment with national health goals. The strategy aligns closely with Ethiopia's Health Sector Development and Investment Plan (HSDIP), Universal Health Coverage (UHC) 2030 goals, and essential health service packages.

Sustainability considerations were embedded from the outset, focusing on health workforce capacity building, the integration of diagnostics into health financing reforms, and the adoption of digital health tools, such as Laboratory Information Management Systems (LIMS). Community and local health leaders were also involved during assessment and planning phases to ensure contextual relevance. The draft strategy was ultimately presented to and endorsed by the MOH executive management and broader stakeholders, ensuring strong political commitment and national ownership

Objectives:

The strategic plan is structured around four main objectives:

1. To improve equitable access to essential, high-quality diagnostic services at all levels of care.
2. To build a competent and motivated diagnostic workforce.
3. To strengthen diagnostic governance, regulation, and quality systems.
4. To enhance diagnostic service sustainability through innovative financing and partnerships.

Strategic Interventions:

To achieve these objectives, 15 key interventions were proposed. These include expanding and upgrading diagnostic infrastructure, implementing national quality assurance systems, developing a robust referral and sample transport network, introducing the national essential diagnostics list, integrating diagnostic services into the health management information system (HMIS), promoting digital diagnostics and artificial intelligence, strengthening regulatory and procurement systems, and leveraging public-private partnerships. Other interventions include improving equipment maintenance, enhancing workforce training, and ensuring equitable geographic distribution of services.

Sustainability

Ensuring the sustainability of Ethiopia's National Diagnostics Service Strategic Plan requires a multi-faceted approach that integrates financial, operational, technical, and governance dimensions. Financial sustainability will be achieved through diversified funding streams including increased domestic budget allocation, expansion of public-private partnerships, and integration with national health insurance schemes. Operational sustainability depends on strengthening supply chain systems, continuous workforce capacity building, and robust equipment maintenance programs. Technically, sustaining advancements will require ongoing investment in digital health infrastructure, including interoperable information systems that facilitate data-driven decision-making and remote diagnostics capabilities. Governance sustainability will be maintained by establishing clear leadership and coordination structures at national and regional levels, with regular monitoring, evaluation, and stakeholder engagement mechanisms to adapt to evolving health needs. Together, these efforts aim to build a resilient diagnostic system capable of delivering equitable, quality services well beyond the plan's five-year horizon.

Conclusion:

This strategic plan serves as a national blueprint to transform diagnostic services over the next five years. With a total estimated budget of USD 146 million, over 100 key activities have been costed and prioritized. Successful implementation will require strong coordination, political commitment, sustainable financing mechanisms, and active involvement of all stakeholders. The strategy envisions a diagnostic system that is accessible, integrated, quality-assured, and patient-centered—ultimately improving health outcomes and strengthening Ethiopia's overall health system resilience.

Reference:

Ministry of Health, Ethiopia. *National Diagnostics Service Strategic Plan 2024–2029*. Retrieved from https://www.moh.gov.et/sites/default/files/2025-05/Diagnostics_Service_Strategic_Plan.pdf

Optimizing Sever Pneumonia Management in Children Through Scale bCPAP technology in Low Resource Settings (OPT-bCPAP)

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Introduction: Pneumonia is a leading cause of morbidity and mortality especially among children in sub-Saharan[1] Africa. Ethiopia is among the 5 countries that account for half of the under-five pneumonia deaths. Majority of the deaths from pneumonia are however preventable with early diagnosis and appropriate management[2]. In children with pneumonia, hypoxemia is quite common and constitutes a major risk factor for death[3–5]. A cluster randomized trial in 12 hospitals in Ethiopia found that an improvised, low-cost bubble continuous positive airway pressure (CPAP) reduced treatment failure and mortality compared to the standard nasal oxygen in children 1-59 months [6]. Achieving the strategic initiative on quality Integrated management of new born and childhood illnesses under Ethiopia's Health Sector Transformation Plan II[7] is unlikely without access to innovative and low-cost interventions such as bCPAP.

Objectives: The aim of this project is to identify how a low-cost bCPAP system can be implemented at scale to reduce pneumonia mortality across a range of contexts. This will be done through context-appropriate implementation of bCPAP in Ethiopia alongside assessments of respiratory pathogen burden, antibiotic practice and guideline adherence.

Methods: We will use a type 1 hybrid effectiveness-implementation study design. Additionally, we will use an embedded mixed method approach incorporating both qualitative and quantitative approaches to evaluate key implementation outcomes. The study will be conducted in two major phases: (a) baseline and (b) implementation with a piloting period in between.

Study Sites

The implementation will take place across three African countries (Figure1) with South Africa as the coordinating centre:

- Ethiopia, (24 hospitals)
- Nigeria, (15 hospitals)
- Malawi. (1 hospital)

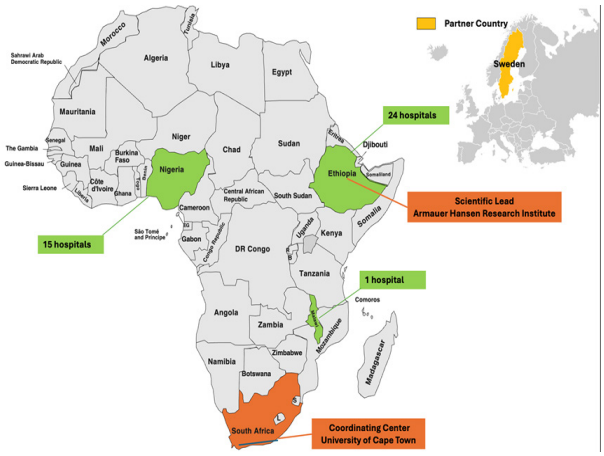

Figure 1. Map of countries for implementation of bCPAP among children with pneumonia

Bubble CPAP

We will use a bCPAP that is locally constructed and uses standard nasal oxygen prongs (Ventlab, Mocksville, NC, USA), tubing used for administration of intravenous fluids and a water-filled, transparent plastic bottle (Height: 18 cm, and diameter: 25 cm), graduated up to 10 cm (Figure 2). Gas flow will be provided by oxygen concentrators, pipped oxygen or with an oxygen cylinder.

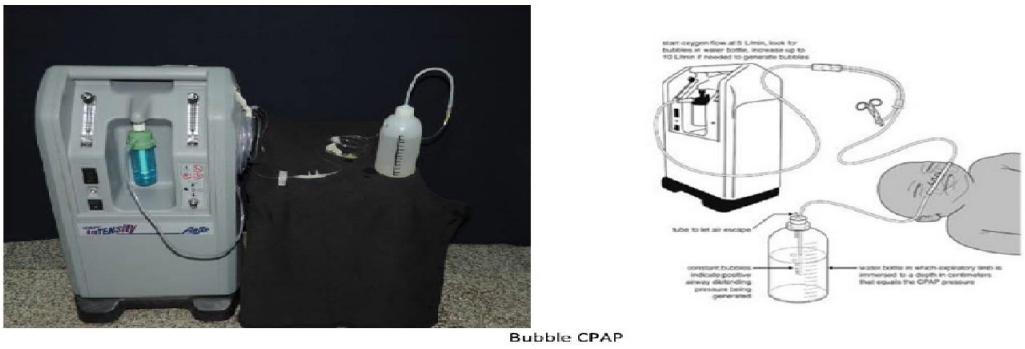

Figure 2. Locally constructed bubble CPAP, with an oxygen concentrator on the left side.

Study participants

Study participants will include children aged 1-59 months hospitalized with severe pneumonia. Health care providers, managers and policy makers and care givers will be study participants for the implementation study**.**

Effectiveness evaluation

The evaluation phase involves a 12-month baseline period, followed by 6-months of set-up and embedding the bCPAP intervention, and 18-months of implementation in the selected hospitals across Ethiopia. Throughout the evaluation period, we will collect clinical patient data for impact evaluation, quantitative monitoring data, and qualitative data on contextual implementation challenges and adaptations. All study hospitals will receive the bCPAP intervention, as described in Section 6, following the protocols refined during the formative project stage.

Using historical data from the sites and published data, we expect 8-11 children with severe pneumonia to be admitted each month in Ethiopia. This equates to an expected evaluation sample of 5184 children in Ethiopia.

Towards the end of the implementation, we will engage with stakeholders to develop a sustainability plan for the continued use of bCPAP therapy beyond the study period. This will include exploring funding mechanisms, integration into national health policies, and building local capacity for long-term maintenance and use

Results/outputs: The project is in the formative phase for the last one year. We have completed the following activities, site readiness assessment on 30 hospitals in collaboration with the child health department and selected 24 hospitals, we have conducted stakeholders meeting, Quantitative assessment of bCPAP acceptability, feasibility and appropriateness

Conclusion and the way forward: The study is expected to generate robust evidence on how to scale-up bCPAP in a safe, sustainable, and cost-effective manner through implementation in settings of very high disease burden (Nigeria, Ethiopia and Malawi)

Reference

1. Bender RG, Sirota SB, Swetschinski LR, et al. Global, regional, and national incidence and mortality burden of non-COVID-19 lower respiratory infections and aetiologies, 1990–2021: a systematic analysis from the Global Burden of Disease Study 2021. *Lancet Infect Dis*. 2024;24(9):974-1002. doi:10.1016/S1473-3099(24)00176-2

2. Uwemedimo OT, Lewis TP, Essien EA, et al. Distribution and determinants of pneumonia diagnosis using Integrated Management of Childhood Illness guidelines: A nationally representative study in Malawi. *BMJ Glob Health*. 2018;3(2). doi:10.1136/bmjgh-2017-000506

3. Lazzerini M, Sonego M, Pellegrin MC. Hypoxaemia as a mortality risk factor in acute lower respiratory infections in children in low and middle-income countries: Systematic review and meta-analysis. *PLoS One*. 2015;10(9). doi:10.1371/journal.pone.0136166

4. Graham H, Bakare AA, Ayede AI, et al. Hypoxaemia in hospitalised children and neonates: A prospective cohort study in Nigerian secondary-level hospitals. *EClinicalMedicine*. 2019;16:51-63. doi:10.1016/j.eclinm.2019.10.009

5. Subhi R, Adamson M, Campbell H, Weber M, Smith K, Duke T. The prevalence of hypoxaemia among ill children in developing countries: a systematic review. *Lancet Infect Dis*. 2009;9(4):219-227. doi:10.1016/S1473-3099(09)70071-4

6. Gebre M, Haile K, Duke T, et al. Effectiveness of bubble continuous positive airway pressure for treatment of children aged 1–59 months with severe pneumonia and hypoxaemia in Ethiopia: a pragmatic cluster-randomised controlled trial. *Lancet Glob Health*. 2024;12(5):e804-e814. doi:10.1016/S2214-109X(24)00032-9

7. *Health Sector Transformation Plan II*.; 2021.

Impact Health and Demographic Surveillance System (ImpactHDSS) Ethiopia initiative: a new source for standardized, timely, and reliable pooled mortality and population health data

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Introduction

The purpose of this article is to introduce and describe the *ImpactHDSS Ethiopia* initiative, launched in March 2024. Reliable and timely population health data are essential for effective health system planning, program design, and policymaking. In Ethiopia, prior investments in Health and Demographic Surveillance Systems (HDSSs) have demonstrated the value of longitudinal data for understanding mortality, fertility, causes of death, and health service utilization trends in defined populations(1, 2). Leveraging the strengths of HDSS can support Ethiopia's development of a national sample-based registration system (SRS).

The SRS is a nationally representative mechanism designed to collect continuous demographic data from a statistically selected sample of the population. It generates reliable estimates of vital events including birth rates, death rates, infant mortality, maternal mortality, and causes of death at both national and subnational levels, thereby informing policy decisions and guiding health interventions(3).

Ethiopia currently hosts 16 HDSS sites, operating under 16 universities across 10 regions and covering approximately 1% of the national population. However, these sites largely function in isolation, without standardized operational systems, resulting in inconsistent and poor-quality data. The absence of harmonized operations and standards has hindered integration of HDSS outputs into national data systems. Furthermore, the lack of national-level representation and weak coordination with the Ministry of Health (MoH) and other data users have constrained their potential as a robust source of national and subnational vital statistics for policy and planning.

To address these gaps and in response to growing demand for actionable population data on fertility, mortality, causes of death, and health service utilization the government of Ethiopia, with support from Vital Strategies, has launched a new initiative to leverage HDSS as an improved data source and lay the groundwork for an SRS. Funded by the Gates Foundation, this initiative builds on existing experience, revitalizes the HDSS network, integrates it into the broader Civil Registration and Vital Statistics (CRVS) strategy, and aligns it with government priorities through standardization, improved data quality, and strategic data use.

This three-year (2025-2027) project directly supports the goals and priorities articulated in Ethiopia's Health Sector Medium-Term Development and Investment Plan (HSDIP) for 2023/24–2025/26(4), and contributes to multiple strategic objectives. These are

- **Improving health system capacity, data quantity and data quality** through better data governance and analytics
- **Harnessing innovation for quality, equity, and safety**, by piloting scalable digital data tools and gender-responsive surveillance approaches
- **Enhancing community and primary health care ownership**, by engaging regional universities and local actors in sustained surveillance efforts.

By aligning HDSS-generated data with policy and programmatic decision-making needs and embedding gender and equity considerations, this initiative aims to institutionalize part of the evidence base for data-driven health sector development.

General Objective

To strengthen Ethiopia's HDSS sites as a core component of a sustainable, representative, and gender-responsive future SRS, supporting evidence-based decision-making and making strategic contributions to CRVS development

Specific Objectives

1. Standardize and harmonize HDSS operations
2. Enhance HDSS data quality, and representativeness
3. Strengthening mortality and disease surveillance
4. Integrate HDSS data into national health information and CRVS systems
5. Strengthen institutional and human capacity to implement HDSS standardized operations
6. Promote gender and equity-sensitive data systems
7. Foster data use for policy, planning, and research
8. Establish and contribute to the design and planning for a national SRS in partnership with other projects and initiatives

Target Population, Geographic Coverage

ImpactHDSS targets the population covered by Ethiopia's 16 existing HDSS sites, which collectively encompass over 1.4 million individuals across diverse geographic and socio-demographic settings. These sites span all major regions of Ethiopia and are affiliated with national universities, serving both urban and rural populations. The project is designed to be implemented in all HDSS sites across the country with established systems.

Participatory Development of the Theory of Change

Partners from the Ministry of Health (MoH), the Ethiopian Public Health Institute National Data Management Center (EPHI/NDMC), and HDSS sites agreed on a Theory of Change for leveraging HDSS to contribute to the national SRS. The model assumes growing government demand for reliable population data. Success hinges on strong collaboration across ministries and agencies, as well as integrated efforts by HDSS sites, MoH and EPHI/NDMC to improve data quality, timeliness, and use. Key actions include aligning data outputs with user needs, fostering data-use culture at national and regional levels, and building analytical capacity through structured trainings.

Partnership, Collaboration and Governance

The initiative is implemented through a strong multi-sectoral partnership led overall by MoH. The EPHI/NDMC leads technical aspects of the project, with full participation of the HDSS sites. HDSS will ensure scientific rigor and institutional continuity. Vital Strategies is the technical advisor responsible for coordination, capacity-building, logistical support, and limited funding for improved HDSS operations. A national

Steering Committee, a Management Oversight Committee and a Technical Working Group with representation from MoH, EPHI, universities, and key stakeholders ensures inclusive governance and effective oversight. Other collaborators and partners include Regional Health Bureaus and Regional Public Health Institutes, Ministry of Women and Social Affairs, Ethiopian Statistical Service, Immigration and Citizenship Services, Ministry of Education. Additional partners in SRS discussions and planning including the Bloomberg Philanthropies Data for Health Initiative, the Strengthening Ethiopia Survey and Analytics (SESA) project, and the Resolve to Saving Lives Initiative.

Strategic Alignment and Political Commitment

The project is strongly aligned with Ethiopia's national priorities as outlined in the HSDIP and the broader CRVS strategy. The MoH and EPHI have enshrined their commitment to the project's success through co-leadership, formal memoranda of understanding with universities, ImpactHDSS initiative, and dedicated staffing for support and coordination. The platform also enjoys support from parliamentarians, particularly through the Social and Health Affairs Committee, and is positioned to inform national reporting on Sustainable Development Goals (SDG).

Sustainability Strategy

ImpactHDSS has prioritized sustainability from the outset. This is being achieved by strengthening local capacity to maintain and improve HDSS operations, embedding project activities within the plans of the MoH, EPHI, and HDSS sites, and securing government budget support. A dedicated HDSS Network Secretariat, housed at EPHI, has been established to ensure national ownership and long-term operation. Sustainability is further reinforced by integrating HDSS data systems with routine health and civil registration platforms to reduce redundancy, and by promoting cost-efficiency through shared technologies, digital innovations, and capacity building at individual, institutional, and system levels.

Results from Year I Activities

During the first year of implementation, the project made significant progress through active engagement of stakeholders and partners. Key milestones were achieved in governance, standardization, capacity building, and early data use planning, laying a strong foundation for scale-up in subsequent years.

We have conducted a baseline/formative assessment to assess and explore existing systems, operations, tools and structures; to inform standardization and guide harmonization with the CRVS system's implementation of death and cause of death registration in a sample of 100 model woredas around the country.

1. Governance and Coordination Structures Established

- Official launching of the initiative in the presence of stakeholders and high-level delegate from MoH, followed by signing Memorandum of Understanding (MoU) among MoH, EPHI, and HDSS sites, formalizing collaboration and outlining roles and responsibilities
- Developed Terms of References for the MOC and TWG with gender consideration and representation from the MoH, EPHI/NDMC, partner universities, and other key stakeholders
- ImpactHDSS Project Director embedded within the MoH/SAEO and a Deputy Director within EPHI/NDMC

2. Standardization of HDSS Tools and Procedures

- Comprehensive formative assessment of all 16 HDSS sites completed complemented with desk reviews of existing practices and identification of gaps in knowledge, skills and practice.

3. Strategic alignment of the initiative with national systems

- ImpactHDSS initiative plan aligned to the MoH/SAEO 2017 EC plan, and the 2018-2018 EC plans of the SAEO and EPHI/NDMC
- Bi-annual performance reviews and supportive supervision plans for the HDSS
- Joint implementation planning has been conducted engaging primary stakeholders

4. Enabling Conditions for Harmonization

- Consensus reached to harmonize HDSS with CRVS model woreda Verbal Autopsy (VA) systems to generate more representative death and cause of death data
- Consultations were initiated with the Ethiopian Statistical Service to explore integration with national sampling frameworks
- Discussions with the Gates Foundation and other partners began to strengthen HDSS data systems, analytics for long-term SRS and CRVS integration.

These early achievements mark a critical step toward institutionalizing HDSS as a foundation for a sustainable, nationally representative SRS in Ethiopia. The strong half year performance sets the stage for successful implementation, deeper integration with CRVS systems, and a broader culture of evidence-informed decision-making across the health sector.

Conclusion and Way Forward

The successful launch of the initiative to standardize HDSS operations and revitalize Ethiopia's HDSS network marks a transformative moment in strengthening the country's population health data systems. By establishing standardized tools, improving data quality, and building strong institutional partnerships, we have laid the groundwork for a scalable, sustainable SRS that will reinforce Ethiopia's CRVS system.

We will standardize and strengthen operations across 16 HDSS sites to generate high-quality, representative, gender- and equity-sensitive data on births, deaths, causes of death, and health service utilization. These efforts will be fully aligned with the national SRS framework, integrated with the CRVS platform, and supported by digital innovations. Sustainable capacity building and embedding HDSS activities within government plans and budgets will ensure long-term continuity beyond the project lifecycle.

Our approaches are multi-sectoral partnership led by the MoH with technical leadership from EPHI/NDMC and active engagement of universities and regional health institutions; Evidence-based standardization of tools, methods, and indicators to ensure comparability and reliability; Lay the foundation for the integration of HDSS data in SRS, CRVS, and broader health information systems; Gender and equity mainstreaming in surveillance and analysis to address disparities and Adaptive management with regular performance reviews to maintain quality and relevance.

The initiative expects stakeholders to Provide leadership and align policies with national SRS/CRVS goals; Allocate resources and ensure operational rigor at national and subnational levels; Support implementation through technical expertise, financing, and capacity building and Facilitate community engagement and participation in data validation and use.

This initiative would offer stakeholders Reliable, timely, and standardized data to guide policy, planning, and program design; Strengthened accountability and evidence-based decision-making at all levels; Enhanced integration of CRVS and SRS systems; Institutional capacity development and sustainable operational models and Actionable insights to address health inequities affecting women, children, and vulnerable groups.

References

1. Debiso AT, Tefera K, Asseffa NA, Simachew Y, Atsibeha F, Belayneh F, et al. Cohort Profile: The Dale-Wonsho health and demographic surveillance system, Southern Ethiopia. International Journal of Epidemiology. 2024;53(1).

2. Afework MF, Gebregiorgis, S. H., Roro, M. A., Lemma, A. M., & Ahmed, S. Do Health and Demographic Surveillance Systems benefit local populations? Maternal care utilisation in Butajira HDSS, Ethiopia. . Glob Health Action. 2014;7(1).

3. Musa B, Were V, Amole T, Mahmud F, Ibrahim A, Haruna I, et al. Sampling Methodology for a Sample Registration System to Estimate Maternal Mortality Rates: Lessons from the Kano State Surveillance for Evidence and Policy, Kano State, Nigeria [version 1]. VeriXiv. 2025;2(127).

4. MoH. Health Sector Medium Term Development and Investment Plan (HSDIP) 2023/24-2025/26 2024.

Joint Supportive Supervision: An Initiative to Strengthen Ethiopia's Pharmaceutical Supply Chain Management and Pharmacy Service

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INTRODUCTION: Ethiopia, Africa's second most populous nation, has a decentralized healthcare system overseen by the Federal Ministry of Health (MoH). The Ethiopian Pharmaceuticals Supply Service (EPSS) is a crucial public institution responsible for ensuring the availability of quality-assured and affordable pharmaceuticals to public health facilities. The nation's commitment to improving healthcare is outlined in the Health Sector Transformation Plan II (HSTP II) and the Pharmaceuticals Supply Transformation Plan II (PSTP II), which both prioritize a robust and efficient pharmaceutical supply chain. The World Health Organization (WHO) advocates for regular, collaborative supportive supervision as a proven method for strengthening human resources and improving logistics systems in low- and middle-income countries. The 2nd Joint Supportive Supervision (JSS) report is an evidence-based tool for this purpose, particularly significant as it coincides with new initiatives such as the Committed Demand and Supply System, and the Multi-Vendor Strategic Sourcing through public-private partnership for the self-reliant supply system for future.

General Objective: The overarching goal of the 2nd JSS was to strengthen the national health supply system and ensure the consistent and equitable availability of essential medicines and health commodities at all levels of the supply chain.

Specific Objectives:

- To evaluate the availability of essential medicines, LMIS tools, and functional equipment across all levels of the supply chain.
- To assess the capacity, deployment, and training needs of the workforce involved in supply chain management.
- To examine the practices related to pharmaceutical quantification, budgeting, and the impact of healthcare financing reforms.
- To identify and analyze key supply chain management practices, including challenges and best practices observed during the supervision

Methods:

The Joint Supportive Supervision (JSS) initiative was a nationwide, multi-stakeholder assessment conducted from November 12 to December 12, 2024. It employed a cross-sectional design to provide a comprehensive snapshot of the national pharmaceutical supply chain. The target was all public health facilities and administrative bodies involved in the pharmaceutical supply chain within Ethiopia. The assessment covered all 12 regional states and 2 city administrations, ensuring a national-scale implementation. A purposive sampling method was used to select 157 public health facilities and administrative bodies, including health posts, health centers, primary hospitals, general hospitals, zonal health departments, and regional health bureaus.

The modality of implementation was a full-scale national assessment, and the initiative was a demonstration of strong political commitment from the EPSS in collaboration with MoH and

a testament to the country's dedication to improving public health infrastructure. The JSS was a prime example of partnership and collaboration, executed by a multi-disciplinary team of over 140 health supply chain experts from the MoH, EPSS, Regional Health Bureaus, and various implementing partners. This diverse team ensured a comprehensive and collaborative assessment.

The sustainability of the JSS initiative is tied to its dual role as a monitoring and capacity-building tool. The findings are intended to be a foundation for developing a long-term, evidence-based strategy to improve the supply chain. Furthermore, by identifying training needs and resource gaps, the JSS provides a roadmap for future capacity-building efforts that will be integrated into regular government and partner work plans. The assessment of key indicators allows for continuous monitoring and evaluation of progress. While community involvement was not a direct component of the data collection in this specific supervision, the initiative's ultimate goal is to improve the health outcomes of the 121 million people served by the Ethiopian health system.

Standardized supervision tools, including checklists, questionnaires, and interview guides, were developed, validated, and pre-tested to ensure data quality. Both quantitative and qualitative data were collected using a digital data collection platform (KOBO Toolbox) and through key informant interviews and focus group discussions. The data was then analyzed using SPSS and a thematic approach to provide both statistical findings and deeper insights.

Result:

The JSS provided a comprehensive overview of the pharmaceutical supply chain, identifying both strengths and weaknesses at different levels. At the health post level, there was varied availability of essential LMIS tools, with only 57.1% having Health Post Monthly Reporting and Requisition (HPMRR) forms and 21.4% having Vaccine Request Forms (VRF). The assessment also revealed a national average of 77.1% availability for tracer pharmaceuticals and 73.8% for functional equipment, with significant regional disparities.

For Service Delivery Points (Health Centers and Hospitals), the assessment found a high national compliance rate of 93.2% with healthcare financing reforms, though implementation was notably delayed in conflict-affected areas. Significant unpaid credits were observed in general hospitals, impacting the financial sustainability of the supply chain. The implementation of pharmacy services, such as Auditable Pharmacy Transactions and Services (APTS) and Drug Information Services (DIS), varied significantly, with specialized hospitals showing higher rates of implementation compared to health centers.

At the administrative level (RHBs, ZHDs, and WoHOs), challenges included insufficient budget for pharmaceuticals and a lack of coordinated capacity-building plans. At the EPSS Hubs, the JSS found gaps in financial management and auditing, with some hubs having substantial aging receivables. Challenges in Information and Communication Technology (ICT) were also identified, including a lack of licensed software, skill gaps among staff, and poor network connectivity.

Challenges:

- Significant gaps exist in the availability and use of essential reporting tools at lower levels of the health system.
- There is a need for more training on logistics systems like the Integrated Pharmaceutical Logistics System (IPLS) for health extension workers. High staff turnover and insufficient support were also identified.
- Unpaid credits in hospitals and a lack of adequate budget for pharmaceutical procurement threaten the sustainability of the supply chain.

- Significant variations were noted in training participation, implementation of pharmacy services, and budget reconciliation across different regions.
- A lack of high-level administrative support, limited staff awareness, and late budget allocation contribute to the failure of effective health commodity quantification.
- Some EPSS hubs reported insufficient technical support for their ERP/SAP systems, while others faced challenges with network connectivity and equipment shortages.

Facilitators: The JSS initiative itself serves as a key facilitator. The collaborative, multi-stakeholder approach brings together policymakers, implementers, and partners, which is crucial for a comprehensive assessment and the development of more effective and universally-supported solutions. The use of standardized digital tools like KOBO Toolbox facilitated consistent data collection and quality assurance.

Lessons Learnt:

The JSS highlighted that a collaborative, multi-stakeholder approach is crucial for identifying systemic issues within a complex supply chain that a single-entity supervision might miss. The findings demonstrate that effective governance is linked to stable leadership and clear guidelines, and that strengthening administrative support is essential for improving supply chain performance at all levels. The significant regional disparities underscore the need for targeted, context-specific interventions rather than a one-size-fits-all approach. Finally, the report shows that while data is being collected, there is a substantial gap in the utilization of monitoring and evaluation results for timely decision-making.

Recommendation:

The report recommends a multifaceted approach to address the identified challenges, including:

- Strengthening administrative support and governance at all levels of the health system.
- Improving financial planning and audit protocols to address unpaid credits and ensure timely budget allocation.
- Implementing targeted interventions to address regional disparities in training, LMIS tool utilization, and program implementation.
- Revitalizing the Integrated Pharmaceutical Logistics System (IPLS) to improve inventory management and reporting.
- Providing comprehensive training and support to staff to improve their skills in quantification, stock analysis, and data-driven decision-making.
- Enhancing coordination between health facilities and EPSS hubs to improve supply chain communication and efficiency.

Conclusion:

The 2nd JSS report provides a comprehensive overview of the strengths and weaknesses of Ethiopia's pharmaceutical supply chain and pharmacy services. Key challenges identified include inconsistencies in LMIS tool availability, gaps in human resource capacity, financial management issues, and significant regional disparities. These findings serve as a crucial starting point for informed action, with the ultimate goal of building a more resilient and equitable healthcare system for all citizens.

References

1. FMoH, H. S. T. P. (2015). Health Sector Transformation Plan II.
2. World Health Organization. (2008). Supportive supervision: A practical manual for strengthening supervision in health systems. Geneva: WHO.
3. World Health Organization. (2012). WHO guide for the development of supportive supervision tools for health programmes. Geneva: WHO.
4. JICA. (2014). Strengthening of integrated supportive supervision in developing countries. JICA.
5. World Health Organization. (2016). Supportive supervision for quality of care. Geneva: WHO.
6. World Health Organization. (2019). The benefits of supportive supervision. Geneva: WHO.
7. USAID. (2018). The role of supportive supervision in supply chain management. USAID.
8. World Bank. (2015). Improving health outcomes through supportive supervision. World Bank.
9. FMoH. (2019). National Pharmaceutical Logistics and Supply Chain Strategy. FMoH.
10. FMoH. (2020). Health Sector Strategic Plan. FMoH.
11. World Health Organization. (2017). Country Health System Profile: Ethiopia. WHO.
12. World Health Organization. (2010). Essential medicines for universal health coverage. WHO.
13. World Bank. (2018). The role of essential medicines in achieving universal health coverage. World Bank.
14. World Health Organization. (2019). Global report on pharmaceutical supply chain management. WHO.
15. FMoH. (2018). Ethiopia Pharmaceuticals Supply Chain Assessment. FMoH

Preliminary results of 'BabyChecker' use, AI that analysis ultrasound scan in Somali region Ethiopia.

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Abstract:

Background: Maternal mortality remains a major challenge in Ethiopia, where limited access to obstetric ultrasound in rural areas hampers early detection of pregnancy risks. To address this gap, Doctors with Africa CUAMM piloted BabyChecker, an artificial intelligence–based tool for point-of-care ultrasound.

Objective: To evaluate the usability and effectiveness of BabyChecker in strengthening ANC in a rural Ethiopian HCs.

Methods: The pilot began in October 2024 at Dharwanaje Health Center, Somali Region. Midwives received brief training and ongoing supervision. Data on ANC visits and scan outcomes were collected and compared with pre-pilot service data.

Results: From October 2024 to June 2025, 138 women were scanned, identifying 29 fetal mal-presentations and 25 low-lying placenta cases, with five referrals to higher-level care. Scan quality was high (83.8%), and BabyChecker was considered user-friendly. ANC attendance increased after its introduction, with monthly visits rising from 280 to 338.

Conclusion: BabyChecker is a practical and scalable tool for rural Ethiopia, enabling early risk detection and improved ANC uptake, with potential to reduce maternal and neonatal mortality.

Introduction:

Every day, about 700 women die from preventable causes related to pregnancy and childbirth. Maternal mortality is a global issue, with nearly 95% of deaths occurring in low - and middle-income countries (LMICs). The Ethiopian Health Sector Development Plan (HSDP) aims to reduce maternal mortality from 267 to 199 per 100,000 live births by 2026, and neonatal mortality from 26 to 21 per 1,000 live births. However, widening geographic inequities, infrastructural insufficiencies, and human resource shortages continue to hinder achievement of these goals. Challenges contributing to Ethiopia's high maternal mortality include: inequitable ANC service and luck of scalable ultrasound capacity especially in rural areas. Early obstetric ultrasound is recognized by WHO as a crucial component of routine ANC, enabling timely detection of pregnancy complications such as mal-presentation, placenta previa, and multiple gestations and encouraging use of skilled delivery services (1).

However, achieving this is a challenge in many developing countries such as Ethiopia and especially in more rural settings. To address this critical gap, an innovative solution has emerged: BabyChecker. BabyChecker is artificial intelligence device (AI) that analyzes obstetric ultrasound scans to identify potential risk factors in pregnancy. Scans can be easily acquired with a point-of-care ultrasound and by any frontline health worker within two minutes. A frontline healthcare worker, with no prior experience in ultrasound, can use BabyChecker after watching the 3 -minute tutorial video. The user is guided by the BabyChecker mobile application to perform a scan, which consists of standard sweeps across the abdomen. Once the sweeps are completed, AI analyses the scan and provides outputs for gestational age, fetal presentation and placenta localization, helping to identify potential risks to improve maternal and new-born health care and timely referrals from primary healthcare facilities (2).

BabyChecker was developed by Delft Imaging, with collaboration with various partners in 2012. The first version, launched in 2023, used AI to assess gestational age, fetal presentation and placenta location. Following a pilot with UNFPA Honduras, a second version was released in April 2024, featuring enhanced usability, support for multiple gestations, 2D fetal imaging, and multilingual options.

Figure 1. BabyChecker device and the standard sweeps to be made across the abdomen.

Doctors with Africa CUAMM, the first Italian international health organization, established in 1950 and active in Ethiopia since 1980 operates across nearly all regions of the country, working in close collaboration with local health authorities to strengthen health systems and improve sexual, reproductive, maternal, neonatal, child health and nutrition services.

CUAMM began operations in the Somali Region in 2020, implementing programs ranging from primary to tertiary health care, with a focus on supporting all pillars of the health system. In October 2024, as part of one of its projects funded by "Fondazione Elena", CUAMM piloted the use of BabyChecker at the Dharwanaje Health Center (HC) in Harewa Woreda, Fafan Zone.

General Objective:

The general objective of this study is to assess and understand the BabyChecker's usability, comparability and adoptability for the practical use in the clinical setting, and strengthening the antepartum care in the rural setting of Ethiopia.

Specific Objectives:

The specific Objective of this initiative is to ensure that the BabyChecker use is helping to achieve the following key outcomes related to prenatal service:

- Increase in the identification of pregnancy related risks such as risky placental localizations, fetal mal-presentation, multiple pregnancies and other risks detected outside of typical ANC indications;
- Increased number of ANC attendance and frequency of visits or contacts including earlier (first trimester) attendance;

Method

The pilot started in October 2024 after the device was delivered to the HC, targeting to reach all pregnant woman visiting for ANC and skilled birth attendance service. The implementation began in the same month after ensuring that all the midwifes working in the HC received the required orientation on the job, have seen the tutorial video and understood it.

In order to guarantee the correct usage of the new tool, monthly supervision and mentoring was conducted at Dharwanaje HC by a BabyChecker trained health officer. Additionally, after three months from the start of the pilot (January 2025), an expert Obstetrician-Gynecologist spent one week at Dharwanaje HC assist technically the midwives and ensure the provision of quality maternity care through the BabyChecker pilot.

A daily registration book was prepared by CUAMM, in collaboration with the Somali Regional State Health Bureau, and provided to the Health Facility's team. Data were collected on a monthly data collection tool for the BabyChecker scan while a ANC Matrix helped to measure the expected outcome of the service.

To ensure data quality and methodological rigor, all data collected on a monthly basis were independently verified by a third health professional who was not directly involved in the data collection process. Regular feedback was then provided to the primary data collectors to address any discrepancies or inconsistencies. In addition, performance data from the BabyChecker devices were automatically transmitted via internet connection to Delft Imaging on a monthly basis. These reports were subsequently shared with health professionals at the HC to cross-check and ensure consistency with the data collected on-site.

To enable consistent comparison, ANC data from the Health Facility for the 12 months preceding the pilot were collected.

Results and Outputs

Preliminary results show that:

- Since October 2024 to June 2025 a total of 138 women were scanned with the BabyChecker and out of these 29 fetal mal-presentations and 25 low laying placenta cases were identified, most of them during the first scan.
- Mothers were followed up and rescanned to confirm whether these conditions persist. Five cases referred to the nearby Karamara General Hospital in Jigjiga Town and 120 women were followed up in Dharwanje HC.

- Regarding usability, 83.8% of the scans performed until June 2025 were deemed to be of sufficient quality based on remote analysis. The combination of on-the-job training and instructional videos appears to have significantly contributed to the improvement in scan quality. BabyChecker is well-regarded for its user-friendliness and the reliability of its diagnostic output, which further supported its effective use in a primary health care setting.
- A comparison of the first six months of 2024 and 2025 showed that following the introduction of BabyChecker, overall ANC visits increased from 280 to 338 per month, first ANC contacts from 52 to 55, first-trimester visits from 24 to 26, and 7th–8th
- ANC contacts from 0 to 402, indicating improved attendance and follow-up care (Table 1)

#	Type of ANC contacts	Jan - Jun 2024 N. (monthly average)	Jan - Jun 2025 N. (monthly average)
1	Total ANC contacts	1681 (280)	2030 (338)
2	Total 1st ANC contacts	310 (52)	331 (55)
3	Total 1st ANC contacts in the first-trimester	147 (24)	158 (26)
4	Total 7th and 8th ANC contacts	0 (0)	402 (67)

Table 1. Comparison of ANC service utilization in Dharwanje HC, before and after BabyChecker introduction.

Conclusion and Way forward

Preliminary findings showed that the BabyChecker initiative demonstrated a highly practical, user-friendly, and adaptable solution for improving ultrasound screening in rural areas. Its simple design enables midwife in rural HC to accurately scan with minimal training.

The implementation also shows that BabyChecker can play a vital role in early identification of pregnancy-related risks, facilitating prompt referrals and timely interventions and may contribute to improved ANC compliance. Moving forward, expanding the use of BabyChecker to additional rural Health Centers is critical to achieving wider reach and impact. Consistent training and supervision will be key to sustaining high standards of use and overcoming operational challenges. BabyChecker has the potential to transform prenatal screening in underserved communities, saving lives and improving health equity.

References

(1) Ginsburg AS, Liddy Z, Alkan E, Matcheck K, May S. A survey of obstetric ultrasound uses and priorities for artificial intelligence-assisted obstetric ultrasound in low- and middle-income countries. Scientific Reports. 2025 Jan 31;15(1).

(2) 'BabyChecker: Artificial Intelligence for pregnancy screening with ultrasound', 2025.

SPECIAL BULLETIN

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The 27th Annual Review Meeting of the Health Sector